

NEW URBAN ENERGY



**Report
on Energy policy and
legal context (D4.1)
and on Financing and
ownership (D4.2)
Part 2: Full Report**

DELIVERABLES D4.1 AND D4.2

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22	SAS ATOS Worldgrid	ATOS	FR
23	Clicks and Links Ltd&L	C&L	UK
25	Grenoble-Alpes Métropole	METRO	FR
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PRE-AMBULE

The City-zen project brings together demonstration projects exploring different technologies all aiming at the same goal: the transition to a clean energy system within the urban context. It has been inspiring to study projects with such a broad and diverse background.

The research group Centre for Energy Research (*Centrum voor Energievraagstukken*) at the University of Amsterdam, in cooperation with DNV GL and La Métro has two tasks in the City-zen project: Analysing energy policies and the legal context of the demonstration projects (task WP4, 1.1) and studying financial barriers and the business models of the projects (task WP4, 1.2). As the subjects of the two studies appeared to be strongly interwoven, we published a preliminary report on the Energy policies and legal context in November 2016. In this report, we present the research of both the legal context and the financial conditions.

Most of the energy demonstration projects focus on technological innovations. Developing and demonstrating new sustainable projects naturally meets regulatory friction; laws and regulations are still directed towards the current system. Changing the regulatory framework is not straightforward, due to many unanswered questions and a lack of experience. The demonstration projects play an indispensable role in pushing and developing a new regulatory framework. The same holds true for developing new business models and financial scheme's: finding suitable and workable financial schemes is often complicated, because new projects require tailor made solutions, new partners and risk analyses. It is therefore important that besides the technical innovations the City-zen project also takes into account the political, legal and financial context.

Many people have contributed to this report: interviewees and reviewers, but also numerous persons consulted on specific issues. We wish to express our gratitude for sharing your time and expertise with us.

The report addresses a manifold of subjects and cases in the ongoing project City-zen. Hence we invite all contributors to send us up-dates on new developments and possible corrections on their case or subject. With these additions, we can publish a second, up-dated edition of the report at a later stage of the City-zen project.

As follow-up of this report, the CvE will conduct additional research for the City-zen project on the position of the 'Vulnerable end-user'. This study will be published in the autumn of 2018.

This report will be the last participation from University of Amsterdam, as the Center for Energy Research has transferred to Utrecht University in the autumn of 2017. The study on the 'Vulnerable end-user' will be conducted from its new quarters at Utrecht University.

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 Frits Otte (UvA)
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APPENDIX II

FOUT! BLADWIJZER NIET GEDEFINIEERD.

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<i>Amsterdam</i>	<i>Fout! Bladwijzer niet gedefinieerd.</i>
<i>Grenoble</i>	<i>Fout! Bladwijzer niet gedefinieerd.</i>

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CHAPTER 1 – INTRODUCTION CITY-ZEN & WP 4

1.1. THE CITY-ZEN PROJECT

City-zen is a EU-funded project that will demonstrate and develop, at the level of the urban environment, smart and sustainable energy systems and initiatives that improve energy efficiency and reduce GHG-emissions.

The objective of this report is to give an insight into the challenges demonstrators encounter in the field, and to formulate recommendations to improve the legal and financial context to facilitate an effective introduction of the demonstrated technologies as part of the road towards sustainable smart cities. Legal and financial challenges to these new technologies and financial schemes for optimal market penetration are studied.

1.2. WP4 – LEGAL AND FINANCIAL CHALLENGES

Legal and financial measures can both stimulate and impede the integration of technologies. Both in Grenoble and Amsterdam demonstration projects are developing new techniques, cooperation forms and financial strategies to give flesh and bones to the concept of sustainable urban development. These projects and the innovative technologies (WP2) will form the basis to the legal and financial analyses in this report. Legal and financial challenges experienced by the different demonstration projects are collected and studied. By assessing these, this paper aims to pave the path for facilitating sustainable developments and the integration of innovative technologies as part of the transition to a sustainable energy supply. Recommendations will be formulated in light of the European, national and local ambitions.

1.2.1. Relation to other Work Packages

The analyses of the challenges and resulting recommendations will form an important input to the catalogues of measures (WP4 Task2), which will be a catalogue on technical, financial, social and legal measures to stimulate the energy transition. In addition, the recommendations will be shared in the road shows with other European cities (WP9). Hence, we aim to encourage the interaction between on the one hand the technical innovations and on the other hand adapting the legal and financial frameworks to enable successful integration of new technologies.

1.2.2. European dimension

Besides country specific challenges, it is striking –but also expected- that a number of identified challenges in France and the Netherlands are very similar (improving energy efficiency in housing, increasing the number of connections to district heating, stimulating the involvement of citizens in local renewable energy production etc.). Overcoming these challenges often requires a local policy and a local approach that should be supported by the national and international laws and regulations. A number of challenges, however, are more universal and can be inspiring for other

European cities. The European legislation could address general principles that reinforce the local ambitions and actions.

1.3. METHODOLOGY

The analysis of challenges to the demonstration projects, started with exploring the business cases of the different demonstration projects and a round of interviews with key people involved in the development of these projects. During the interviews, we also received information about people that were able to tell us more about specific challenges and/ or similar projects that also deal, or have dealt, with these challenges.

During the project, the insights from the interviews have been supplemented with desk research, to further substantiate causes and impacts, and suggestions for overcoming the identified challenges.

The list of interviewed people is presented in **Fout! Verwijzingsbron niet gevonden..** The sources used in our desk research are presented in the Appendix I, the different business models canvasses of some of the demonstration projects can be found in Appendix III.

CHAPTER 2 – POLICY CONTEXT

2.1. CASCADING POLICIES

Climate change and sustainability targets have been formulated on both international, European, national and local levels. In recent agreement between the members of the United Nations, the Paris Climate change agreement, was formed and undersigned by EU Member States to avoid dangerous climate change and limit a global temperature increase to 2, preferably 1,5 degrees Celsius by drastically reducing our greenhouse gas emissions.

In its current policies, the EU has already adopted the goal of 80 to 95 % reduction in greenhouse gas emissions by 2050, compared to the level in 1990. These policies (directives) have been, and/or are being converted to national laws and regulations. Ultimately, (parts of) these policies are also interpreted and transferred into policy at the local level within Member States, in this case in Amsterdam and the Métropolitan area of Grenoble (La Métro).

Relating to the City-zen project, this chapter presents the relevant European, national and local frameworks that determine the relevant context for the City-zen demonstration projects in Amsterdam and Grenoble. Against this background, the next chapters will further address challenges concerning the realization of projects that improve a city's sustainability, as well as recommendations to overcome these challenges.

2.2. EU FRAMEWORK

2.2.1. Global Paris Agreement on climate change

On the 5th of October 2016, the EU formally ratified the global Paris Agreement on climate change, which aims at keeping global temperature rise well below 2°C and making efforts to limit it to 1.5°C (compared to pre-industrial levels). To this end, countries have an obligation to take measures to reduce their emissions.¹ The undersigning of this agreement has not yet led to a formalised policy (changes) in the European Union. On the 30th of November 2016 the Commission published its new legislative proposal 'Clean Energy for all Europeans', also called the 'Winter Package', including regulation aiming to implement the Paris Agreement in European legislation.²

¹ *Paris Agreement, UN 2015, articles 2, 3 and 4*

² *Commission proposes new rules for consumer centred clean energy transition. For more information and an overview of all proposals: <https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition>*

2.2.2. Current policy

As mentioned in the introduction of this chapter, current EU policies are aimed at reducing greenhouse gas emissions with 80 to 95% of 1990-levels, by the year 2050.³ Three important directives implementing EU's climate goals are:

- The Renewable Energy Sources (RES) directive from 2009⁴;
- The Energy Efficiency directive (EED) from 2012⁵, and
- The Energy Performance of Buildings directive (EPBD) from 2010⁶.

The RES directive sets ambitious mandatory goals for the member states to reach an overall 20 % share of renewable energy by 2020. The directive gives every state a specific goal, concerning the installed capacity of renewable energy, taking into account the resources and the financial capacity of each country. This means a commitment of 14 % RES in the Netherlands and 23% in France, by 2020.⁷ Within these countries, the national targets are transferred to lower governance levels to (i.e. by means of small-scale distributed generation) ensure a practical, hands-on development in (close) cooperation with local stakeholders in the provinces, regions and/ or cities in each country.

The remaining two directives (EED and EPBD) are touched upon in the remainder of this report, because of their specific relevance for energy use in the built environment.

2.2.3. Winter Package

On the 30th of November 2016 the European Commission published a new package of energy policies. The 'Winter Package' includes proposals on the electricity market, efficiency (of buildings), the support of renewable energy production and so on. Key objectives of the package are: 'putting energy efficiency first, achieving global leadership in renewable energies and providing a fair deal for consumers⁸'.

2.3. FRAMEWORK IN THE NETHERLANDS

This paragraph provides further insight into the Dutch national context for sustainable projects in cities, and highlights important aspects of the local framework in the city of Amsterdam.

³ *Energy Roadmap 2050, COM /2011/885*

⁴ *DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (OJEU 2009, L140/16)*

⁵ *DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC (OJEU 2012, L 315/1)*

⁶ *DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the energy performance of buildings (recast) (OJEU 2010, 153/13)*

⁷ *Annex I by the RES directive 2009/28/EC*

⁸ *COM(2016) 860: COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK, Clean Energy For All Europeans, COM(2016) 860, p. 3*

2.3.1. The national framework

Climate ambitions

The Dutch national climate goals are e.g. laid down in the Energy Agreement (Energieakkoord 2013).⁹ This is an agreement between a large group of stakeholders involving government bodies, companies and NGOs. The Netherlands aim to reduce final energy consumption by 1,5 % yearly, increase renewable energy production to 14 % in 2020 and create 15.000 new jobs in relation to this energy transition. The realization of these targets is largely transferred to market players, citizens and businesses, and lower governance levels within the country. Towards lower governments however, there are no legal obligations to achieve the climate objectives. The transferring or realization of responsibilities is largely arranged by means of numerous voluntary agreements, which are not enforceable.

Renewable energy target

The 14% renewable energy obligation/ target by 2020 for the Netherlands is partly transferred to the Dutch provinces. Only offshore wind is centrally planned, and the development of onshore wind power is based on a national target that is centrally coordinated and divided across the provinces: onshore wind parks larger than 100 MW are planned and developed within the provinces and are subject to this national coordination regulation¹⁰. The provinces themselves until now – individually determine the assessment of potential and actual development of other renewable energy sources in the Netherlands, with little coordination between them concerning the development towards overall targets.¹¹

2.3.2. Local framework Amsterdam

Amsterdam's sustainability agenda (Agenda Duurzaamheid), adopted in 2015, sets short term goals aiming for 20% reduction of energy use per citizen and 20% increase of renewable energy production, both in comparison to the 2013 rate, by 2020.

Climate goals for the next 25 years are formulated in the Amsterdam Structuurvisie 2040. These climate goals are driven by two important motivations:

- Operating in accordance with international and national climate goals to prevent a 1.5 to 2-degree temperature increase, and

⁹ *Energieakkoord voor duurzame groei, SER, september 2013, p. 11*

¹⁰ *More on the national coordination prescriptions for onshore wind parks larger than 100 MW is available on: http://www.rvo.nl/onderwerpen/duurzaam_ondernemen/duurzame-energie-opwekken/windenergie-op-land/wetten-en-regels*

¹¹ *This observation is supported by a recent publication of the Interprovinciaal Overleg (IPO), who requests an active cooperation of the national government with provinces, municipalities and water boards in developing energy neutral provinces by 2050 Interprovinciaal Overleg (IPO), Samen bouwen aan de toekomst van Nederland – Provinciaal aanbod voor de Nationale Omgevingsvisie (NOVI) (Interprovincial Consultation, Building on the future of the Netherlands together – Provincial offer for the National Environmental vision), page 10, and also: Rli, Rijk zonder CO2. Naar een duurzame energievoorziening in 2050, Rli, Den Haag, 2015, p. 6.*

- Creating economic growth by developing a sustainable city. The sustainability agenda formulates it as ‘...sustainability is the engine of society and the driver of the economy.’¹²

Amsterdam further promises to work towards a 40 % emission-reduction (against 1990) in 2025 and 75% in 2040. These intentions are not anchored in law; there is no legal obligation for municipalities regarding CO₂-emission reduction (also see paragraph 6.1.4)

To achieve these commitments Amsterdam made a set of focal points. Two important themes in relation to sustainable built environment and energy are:

- Finding alternative heating to gas, with a special focus on district heating, and
- Energy efficiency in the built environment¹³

These issues are addressed in several City-zen demonstration projects.

The measures taken by the national government and the City of Amsterdam to achieve the desired result in renewable production and energy efficiency, will be discussed in relation to the challenges described in this report.

2.4. FRAMEWORK IN FRANCE

This paragraph provides further insight into the French national context for sustainable projects in cities, and highlights important aspects of the local framework in the metropolitan area of Grenoble – La Métro.

2.4.1. National framework

Climate ambitions

France enacted its Energy Transition for Green Growth Act¹⁴ on August 17, 2015 following an initial presentation at the 2012 environmental conference and nation-wide public consultation in 2013. The Act lays out a roadmap for transforming France's energy model without hampering growth.

The Act requires producers and consumers of energy in all sectors – targeting spearhead domains like buildings, transportation, renewable energy production and waste recycling – to play their part in reducing greenhouse gas (GHG) emissions. It also includes provisions to put France back on the path to economic growth, which represents a real challenge given that this has always led to higher greenhouse gas emissions in the past. The Act sets out six objectives:

- 40% less greenhouse gas emissions in 2030 compared to 1990
- 30% less fossil fuel consumption in 2030 compared to 2012
- Increase the share of renewable energy sources to 32 % of the final energy consumption in 2030 and 40% of the electricity production
- Reduce final energy consumption by 50% in 2050 compared to 2012

¹² *Structuurvisie Amsterdam 2040, Economische sterk en duurzaam, 2011, p. 147 and Duurzaam Amsterdam, Agenda voor duurzame energie, schone lucht, een circulaire economie en een klimaatbestendige stad, 2015, p. 7*

¹³ *Structuurvisie Amsterdam 2040, Economische sterk en duurzaam, 2011, p. 149*

¹⁴ *LOI n° 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte, More information: <http://www.gouvernement.fr/en/energy-transition>*

- 50% less waste and landfill by 2025
- Diversify electricity production and reduce the share of nuclear power to 50% by 2025

The Act introduces a long-term national low carbon strategy (SNBC) for setting sector- and region-specific GHG-emissions reduction targets. This strategy will take shape in the form of five-year energy plans (PPEs) that will set out what needs to be done to achieve the Act's main objectives and with what financial incentives. The plans will add an element of flexibility to the highly difficult exercise of anticipating supply and demand trends, not to mention technological advances. It is composed by 212 articles that were the subject of 150 hours of debate in public, with 970 adopted amendments. The law and the action plans that accompany this strategy, enable France to contribute more effectively to the fight against climate change, and strengthen energy independence and improve the balancing of various supply sources. It has been translated into many national codes and laws (code of urbanism, code of energy, code of construction, code of public procurement, general code of local government, commercial code, etc.). In addition, the Act has been thought of as a direct operational toolbox, with:

- 18 concrete measures to mobilize citizens;
- 16 concrete measures to mobilize enterprises;
- 20 concrete measures to mobilize the territories;
- and 6 practical steps to act together.

2.4.2. Local framework Grenoble

Following the adoption of the law on the Territorial Organisation and on Métropolitan Areas (*MAPTAM*) on 27 January 2014¹⁵, Grenoble-Alpes Métropole (La Métro) has gained the status of Métropolis together with 14 other French metropolitan areas. By application of this law, La Métro is now in charge of an important number of new jurisdictions including energy transition, urban planning, water supply, roadways and economic development.

As part of these new responsibilities, La Métro is in charge of implementing the energy transition on its territory (e.g. energy saving and renewable energy production) and becomes (as of January 1st 2015) the Organising Authority of the Energy Distribution for gas, electricity, heating and cooling networks.

Additionally, La Métro has revised the objectives of its SEAP (Plan Air Énergie Climat, Deliberation of December 19, 2014) and laid down the following goals:

- By 2020: 35% reduction of greenhouse gas emissions compared to 2005;
30% reduction in energy consumption per capita;
20% of RES production in the territory by 2030:
50% reduction of greenhouse gas emissions;
40% reduction in energy consumption per capita;
30% of RES production in the territory.
- By 2050: 75% reduction of greenhouse gas emissions;
50% reduction of energy consumptions.

¹⁵ *LOI n° 2014-58 du 27 janvier 2014 de modernisation de l'action publique territoriale et d'affirmation des métropoles, article 52*

La Métro is in the process of developing a strategic roadmap to implement the energy transition, the construction of this strategic roadmap is based on two pillars:

- A planning component: energy action plan.
- An organizational component: set-up an adequate legal and organisational framework that will support the implementation of the energy transition roadmap and foster innovation.

Both pillars are strongly addressed by City-zen projects in Grenoble. This report will help La Métro to get insights on the existing legal, organisational and financial barriers and improve the quality of the road map and better enable the roll-out of sustainable solutions in the build environment.

2.5. A REFLECTION ON GOVERNANCE

2.5.1. The ideal situation

The energy transition has a profound impact on many aspects of modern society and such a complex and extensive endeavour necessitates a well-contemplated governance. In its ideal form, the governance is built up in its fundamental levels and the associated normative layers. A framework for a philosophical methodology, focused on urban sustainability, is given in the article of Han Vandevyvere.¹⁶ With reference to the so-called law-spheres of Herman Dooyeweerd, following nested approach will be instrumental for the energy transition.

- A high normative framework is shared at UN-level. The need for sustainability has indeed been recognised ever since the UN - Brundtland Report.
- A first step towards a more elaborated policy at UN-level is recently the Paris agreement with concrete targets on Sustainability, i.e. in energy supply.
- EU and national governments are to formulate the next level: a political vision on how to bring about a sustainable country, linked to national culture and societal views.
- Given this political vision, a policy can be formulated with more concrete targets and time frame.
- Legal and financial policy instruments (laws, regulations, subsidies, taxes) evolve from these policies.
- Within the thus created framework, technical innovations can be developed, leaning on research projects supported by subsidies. And mature technologies can rely on an enabling legal framework for their implementation.

Central thought in this approach is that any idea or concrete measure can only be meaningful within the framework of a higher sphere.

2.5.2. The present, observed situation

Many of the struggles we encountered in this research involve technical innovations that meet with unsupportive regulations and financial constructions. These regulations and constructions were often made protecting other interest than sustainability, either because their mere age, setting other priorities or because of a neglect in the scope of their effect.

¹⁶ Vandevyvere, H. (2011) *How to cut across the catch-all? A philosophical-cultural framework for assessing sustainability*, *Int. J. Innovation and Sustainable Development*, Vol. 5, No. 4, pp.403–424., 2010.

What we observe is an apparent vision on a sustainable world at high normative level. On a technical level, an army of motivated engineers is developing innovations contributing to sustainability. But in between, the policy, legal and financial frameworks are non-consistent, both to the normative world and to the technical world. Some of the City-zen projects can be an illustration to this observation.

2.6. CONCLUSION

On European level, goals for development of renewable energy, energy saving and energy efficiency have been developed, which are translated down into national goals. Within the Netherlands and France these national goals are transferred to lower governance levels. In the Netherlands, this is largely based on more voluntary agreements between stakeholders (e.g. the Energy Agreement), whereas in France responsibilities for important actors in the energy transition in cities are mandated to metropolitan areas by law, such as in the La Métro. The climate goals of both Amsterdam and Grenoble are more ambitious than the national targets.

The difference in national approaches between France and the Netherlands also seems to come across in the local setting within the involved cities/ regions: Amsterdam has set goals to guide and enable (bottom-up) sustainable development of the city, whereas La Métro takes on a role of implementing sustainable measures from a more top-down perspective.

In the Netherlands, a climate law is now under consideration, which could give local and/ or national governments stronger tools to enforce developments to enable (and speed up) energy transition within the country and its cities.

2.7. RECOMMENDATIONS

It takes time to develop a consistent framework (both legally, financially and technically) to direct the energy transition, complicated by the fact that these frameworks have continuously to serve the energy system. Yet, we recommend EU and national governments to pay more attention to the development of a consistent approach in the political view and policy vision that leads to a legal elaboration in the fields energy, taxation, building and urban planning in order to bridge the various levels of governance into one consistent sustainable structure.

In this approach, a new balance will have to be found between various interests, such as property rights versus the need to improve the energy performance of properties.

CHAPTER 3 – GENERAL CHALLENGES

In this chapter the more common (European) challenges that many of the demonstrators are confronted with, are discussed.

3.1. LOW ENERGY PRICES AND EMISSION COSTS

3.1.1. Introduction

Both the current wholesale market price for electricity, and the penalty costs for GHG emissions are very low. This is good news for consumers with respect to their energy bill. On the other hand, such price levels make it difficult to earn back (investment) costs for producers, suppliers and investors into renewable energy and energy efficiency, which can negatively impact upon (the speed of) their development.

If no other financial stimuli (e.g. subsidies/ penalties) are available, these low prices for renewable energy (making it less attractive as investment alternative), and relatively low production prices for conventional power (no financial incentive to divest in fossil-fuelled generation) slow down the development of on the one hand investments in more renewable energy production, and on the other hand low energy prices do not support energy efficiency measures.

3.1.2. Wholesale market price

Currently, wholesale power prices in the Netherlands are at a very low level (Day Ahead and Intraday prices in August – September 2017 between 25 and 50 EUR/ MWh).

Remunerations for power generators on the Dutch market are based on ‘Energy only’ (apart from the subsidies on renewable energy). This means that electrical energy is traded against the price of the lowest offering price for marginal generation. These offering prices are based upon the marginal production price of generators, which is predominantly based on the fuel price for offered generation. Currently, the fuel prices for both coal and gas (the predominant conventional generation technologies on the Dutch market) are very low. Coal is currently cheapest, and generally sets the wholesale market price in the Netherlands.

3.1.3. Ancillary services

Possible additional revenue streams can come from the provision of reserve power to the TSO. The current size of this market in the Netherlands is about 700 megawatts in total (for primary, secondary and tertiary reserves combined; different classes are associated with reserve power provision in different timeframes). This market can offer higher prices because of required (fast) response times, which not all (generation/ demand-side) assets can offer. However, it is more (inter)national and does not directly serve local flexibility needs. It does, however, involve remunerations for reserving capacity. On the other hand, reserving such capacity restricts opportunities to trade on the wholesale market.

3.1.4. Low CO₂-credit price

Ultimately, all the projects are aimed at a reduction/ elimination of emissions. When this is the goal, a proper return on investment is required to realize projects and related developments via market-based mechanisms. Currently, the value of CO₂-credits (the market-based tool for valuation of emissions) is very low. So low even, that a healthy business case for projects aimed at emission reduction is hardly available. If CO₂-emission pricing would have a significant impact upon the use of fossil fuels and thereby on wholesale power price formation, the (economic) feasibility of (local) renewable and energy efficiency measures would drastically improve, as reference prices of energy on the wholesale market would be much higher. Added (economic) value of these projects for the investor needs to come from other benefits than directly from the reduction of CO₂ and potentially other emissions.

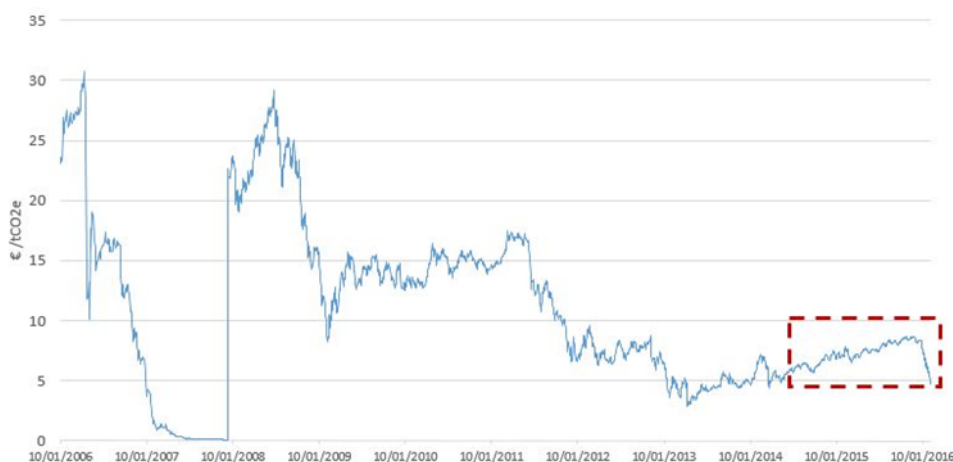


Figure 3-1 Evolution of ETS carbon price.
Source: sandbag.org.uk

3.1.5. Conclusion

Current low energy and emission prices are not in favour of driving sustainable development forward: remaining low wholesale prices from conventional energy sources, are not a big stimulus for energy efficiency measures and the absence of significant costs of GHG emissions do not give a big (price-based) push to invest in renewable energy technologies.

3.1.6. Recommendations

Low wholesale prices do not drive consumers to increased energy efficiency measures. Price differentiation concerning the source (renewable or not) of energy can be used to better incorporate climate impacts into pricing of energy. This can make consumers more aware of financial impacts of certain (environmentally unsustainable) consumptions and investment choices, thereby developing a more environmentally sustainable energy system. Reforms of GHG emissions pricing scheme(s) to better reflect environmental impacts are preferably implemented on a worldwide, or otherwise European scale.

Considering the ETS-system, the 2015 Paris Agreement may give a new push to adjustments in the ETS-scheme and thus may speed up sustainable developments, needed to fulfil it. Ultimately, increased credit prices will improve the earning models for development of sustainable and energy

efficiency solutions, because they drive up energy prices from the wholesale market, used as reference prices for investor's business case assessments.

3.2. CHALLENGE: ENERGY TAXATION

3.2.1. Introduction

Our research shows that the lack of a CO₂-price, either through taxes or ETS, is a major financial challenge in many of the projects. There are several ways to address this issue and in this challenge we will look at the tax system in both the Netherlands and France,

The energy price can have a large impact on how we invest in sustainable energy production and energy efficiency measures. Many of the interviewed stakeholders voiced that the uncertain development of energy prices has an impact on their projects. In the Netherlands, the wholesale price for electricity average at around EUR 0,04/kWh¹⁷, and the total electricity price for households is around EUR 0,20/kWh in 2017. The difference of EUR 0,16 is largely due to imposed taxes. In France, the end consumer price for electricity averaged at around EUR 0,17/kWh in the second half of 2016¹⁸. French wholesale electricity prices however (excluding VAT and network charges) were at between 0,03 and 0,07 kWh (price in colder months is higher due to large demand increase in these months; this results from the large share of electric heating in France) at that time, also indicating that a relatively large share of taxes is included in end consumer prices.

Government imposes these additional taxes, and the issue that was raised by many interviewed parties, especially in the Netherlands, is that the current taxation system we have, does not reflect the 'polluter pays principle'. I.e. there is no fair distribution of costs for climate policies. Many stakeholders voice that this creates uncertainty in times when all market players are aware of the major challenges that are lying ahead. Current household consumer prices therefore, do not help to create awareness and/ or a market incentive for household consumers to make choices in line with creating a more sustainable future.

In this paragraph we will further look into different aspects and impacts of the current systems in Europe, the Netherlands and France.

3.2.2. EU energy tax policies

In the 1990's the EU Commission tried to introduce a EU wide levy on emitting CO₂,¹⁹ the first energy tax. Unfortunately this intention was met with resistance by i.e. the UK²⁰ and it was not before 2003 that an Energy Taxation directive was published, which harmonized energy taxing throughout Europe.²¹

¹⁷ Average EPEX Spot price NL over april 2016 to April 2017, was 0.03682 EUR/kWh. [Apxgroup.com](http://www.apxgroup.com)

¹⁸ Source: http://ec.europa.eu/Eurstat/statistics-explained/index.php/Energy_price_statistics

¹⁹ COM (1992)226: Proposal for a council directive introducing a tax on carbon dioxide emissions and energy,

²⁰ S. Oberhür and M. Pallemarts, *The EU's Internal and External Climate Policies: an Historical Overview, in: The new climate policies of the European Union, VUBPRESS 2010,*

²¹ DIRECTIVE 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity

This directive sets minimum rates for energy product taxation. The objective of the directive is to improve the internal market by eliminating fiscal barriers to trade.²² Environmental protection must be integrated into the implementation of i.e. this directive. The directive explicitly allows member states to exempt or reduce taxation on energy from renewable sources, but does not obligate to do so.²³ The adoption of this directive was arduous and led to weak results. The directive is largely out-dated and based on a discussion that started in 1992.

In 2011 a new proposal was published²⁴, due to a lack of support the proposal was withdrawn in 2015. The proposal included tools to use energy taxation to support CO₂-reduction and renewable energy sources. According to the proposal, the current directive is out-dated and does not fit the new climate goals as laid down in the last energy package from 2009. The current directive, which is based on minimum levels of taxation, does not give the right incentives and leads to a higher tax burden on renewables than on fossil fuels.²⁵ The new proposal would have led to a tax based on both CO₂-emissions and energy content.²⁶ Critics say that the proposal would have relatively little impact because the new rules would only apply to parties/industries outside EU-ETS, and member states were free to set their own minimum rates.²⁷ Notwithstanding the mild impact, in 2015 there was no EU wide support for such rules yet.²⁸

Winter Package

In November last year the EU Commission published its Winter Package and announced that the EU will perform a REFIT evaluation of the EU energy taxation framework in order to remove fossil fuel subsidies.²⁹

The report from the Commission on Energy Prices and Costs in Europe shows that between 2008 and 2015 energy taxes and levies for households have been rising from 28 to 38%.³⁰

3.2.3. Netherlands

Not wanting to wait for European rules on energy taxation in the late 1990s, Dutch government introduced an energy tax in 1996: the *Regulating Energy Tax*, as part of the tax act. Goal was to give a financial incentive to reduce energy consumption by moving taxation from wages to environmental pollution.³¹ Taxes were levied on energy consumption. Consumption of renewables was exempted.³²

²² C. Barnard, *The substantive law of the EU, The four freedoms*, Oxford University Press 2013, p. 56

²³ article 15 of the directive

²⁴ Proposal for a COUNCIL DIRECTIVE amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity, COM(2011) 169 final, Brussels, 13.4.2011

²⁵ For an overview of the key arguments to replace the current directive; Proposal COM (2011)169, p. 3

²⁶ Article 15(1)(h), Proposal COM (2011)169

²⁷ *Belastingen op energieproducten, elektriciteit en CO₂, Gevolgen van herziening van de Energiebelastingrichtlijn voor Nederland*, Delft, juli 2011. Ecofys and CE Delft

²⁸ For a thorough analyses of the proposal and possible improvements of the directive read: *Reforming the EU Energy Tax Directive: Assessing the Options*, by Ian Parry Herman Vollebergh, CESIFO working paper no. 5749 category 10: Energy and climate economics February 2016

²⁹ COM(2016) 860, *Clean Energy For All Europeans*, p. 13

³⁰ COM(2016) 769, *Energy prices and costs in Europe*, p. 6

³¹ Dutch Parliament document: *Kamerstukken II 1994-95, 24250, 3*

This changed in 2004 because, according to the government, tax benefits were disappearing abroad without having a significant effect, due to the possibility to import green energy by buying guarantees of origin from either Norwegian waterpower or Dutch wind.³³ At the introduction of the energy tax, the objective was to compensate the extra levies by reducing income tax, to arrive at a budget neutral tax operation. At the time of implementation the energy tax accounted for 2,1 billion guilders (0,95 billion EUR),³⁴ today the state gets over 5 billion³⁵ and the energy tax has become one of the most important taxes in the Netherlands.

Tariffs

The energy tax is levied on every kWh of electricity and each m3 of gas that is delivered via a connection to an end-user.³⁶ The supplier is taxable³⁷, but will charge its customers to pay for these taxes. Only the last supplier is charged, not those that resell.³⁸

For electricity and gas various energy tax rates are levied, depending on the amount of energy consumed. Consumers with consumptions up to 10.000 kWh per year, pay the highest rate of 0,1013 EUR/kWh. Small consumers and businesses fall within that first category. Larger energy consumers with a consumption over 10.000 kWh drop to 0,049 and to 0,00053 EUR/kWh for a consumption of more than 10 million kWh (see figure 1.1 on energy tax tariffs). The latter category is often partaking in an energy efficiency program of the government and therefore not paying tax at all.³⁹

Gas prices are varying from 0,25 EUR for the first two categories to 0,012 EUR for large-scale consumption of more than 10 million m3 per year. This latter group again, is often exempt from tax, by participating in energy efficiency agreements with the national government.

Small vs. large consumers

As a result of the digressive tax system (see Figure 3-2) large consumers pay four times less tax than household consumers. Businesses consume around 80% of the overall electricity consumption, households the other 20%.⁴⁰ However, households paid in 2015 2,2 billion energy tax against 2,3

³² *Taxation on Electricity, rates by 2017 on belastingdienst.nl*

³³ *Dutch Parliament document: Kamerstukken II 2003-2004, 29210, 3, §7.6.*

³⁴ *Dutch Parliament document: Kamerstukken II 1994-95, 24250, 3, § 7.2*

³⁵ *CBS: Huishoudens betalen twee derde van de milieubelastingen, 10-8-2016 and CBS: Milieubelastingen brengen ruim 25 miljard € op, 14-8-2017*

³⁶ *Article 50 first led, Environmental Taxes Act includes the basic rule. Other activities that are also taxed are discribed in article 50, third led, a,b,c and d.*

³⁷ *Article 53 first led Environmental Taxes Act*

³⁸ *Article 50, fourth led Environmental Taxes Act.*

³⁹ *Article 66, first led Environmental taxes act, and Covenant Benchmarking Energy-Efficiency, resultaten en vrijstelling Energiebelasting, CE Delft june 2010 (Results on Exemptions on Energy Taks) Results show that covenant participants with an anual use above 10 million kWh (Meer jaren afspraken MJA) which get an Energy Taks exemption based on promised savings, do not realize the expected energy savings. They even performed worse than the performance that is expected if no stimulating policies are used.*

⁴⁰ *CBS stateline: Energieverbruik door bedrijven en huishoudens; nationale rekening: Households used around 715 PJ of the netto energy consumption, against 2.825 PJ consumed by businesses in 2013. This ratio of 20% and 80% has been stabel over the last decades.*

billion paid by the industry.⁴¹ In addition to the difference in levies, households pay relatively more network costs than large consumers, a higher commodity price, a higher margin to the retailer, higher additional levies (ODE) and only households pay VAT of 21%.

Belasting op elektriciteit

Jaar	0 t/m 10.000 kWh	10.001 t/m 50.000 kWh	50.001 t/m 10 miljoen kWh	meer dan 10 miljoen kWh particulier	meer dan 10 miljoen kWh zakelijk
2011	€ 0,1121	€ 0,0408	€ 0,0109	€ 0,0010	€ 0,0005
2012	€ 0,1140	€ 0,0415	€ 0,0111	€ 0,0010	€ 0,0005
2013	€ 0,1165	€ 0,0424	€ 0,0113	€ 0,0010	€ 0,0005
2014*	€ 0,1185	€ 0,0431	€ 0,0115	€ 0,0010	€ 0,0005
2015*	€ 0,1196	€ 0,0469	€ 0,0125	€ 0,0010	€ 0,0005
2016*	€ 0,1007	€ 0,04996	€ 0,01331	€ 0,00107	€ 0,00053
2017*	€ 0,1013	€ 0,04901	€ 0,01305	€ 0,00107	€ 0,00053

Figure 3-2 Taxes on electricity consumption in the Netherlands

Source: Belastingdienst.nl 2017-06-23

Tax reduction

For every connection to a location with a residential function, including offices, there is a tax reduction that is set every year. Since 2015 the reduction is being reduced each year, from 385 EUR in 2015 to 372 in 2017. The further development (if at all) of the reduction is uncertain at this point.⁴²

Exemptions

Besides a general reduction on the energy tax, there are other reductions/exceptions households could qualify for, like:⁴³

- Net metering (behind the meter settlement, “salderen”): Article 50 sixth led, says that no energy taxes will be levied on the consumption of electricity produced by the consumer through renewable energy sources. (zelfopwekvrijstelling)⁴⁴
- Cooperations that produce renewable energy can qualify for a tax reduction, if they comply with a number of conditions.⁴⁵

Both exemptions will be discussed more thoroughly in challenge 8.1 and 8.2

ODE

Since 2013 an additional levy is collected, called the Levy Sustainable Energy, *Opslag Duurzame Energie* (ODE).⁴⁶ Similar to the energy tax, this levy is also a digressive tax with a relatively high tariff

⁴¹ CBS: *Huishoudens betalen twee derde van de milieubelastingen, 2016: This includes the tax reduction.*

⁴² *Tariff Act 2001*

⁴³ *There are many exemptions and reductions on this tax. We will only discuss those exemptions that are most relevant to the demonstration projects.*

⁴⁴ *Net metering is officially not a tax reduction, but an administrative correction on the amount of kWh used, article 31C Electricity Act.*

⁴⁵ *Article 59a led 2 Environmental Tax Act.*

for small consumers and a low tariff for large consumers per kWh electricity and m3 gas, see Figure 3-3. Purpose of this levy is to finance the grand scheme called ‘Encouraging Sustainable Energy production’ (Stimulerend Duurzame Energieproductie; SDE+) The ODE will be raised every year, and the fee per unit will depend on the expected remunerations. The national government aims for a budget of 1.3 billion EUR in 2028. Depending on the amount of contributors the energy levy is estimated to raise from 8 EUR per year in 2013 to between 120 to over 300 EUR per year in 2028, for small end consumers.⁴⁷

Opslag duurzame energie op aardgas (normaal tarief)

Jaar	0 t/m 170.000 m ³ en blokverwarming	170.001 t/m 1 mln m ³	meer dan 1 mln t/m 10 mln m ³	meer dan 10 mln m ³
2013	€ 0,0023	€ 0,0009	€ 0,0003	€ 0,0002
2014	€ 0,0046	€ 0,0017	€ 0,0005	€ 0,0004
2015	€ 0,0074	€ 0,0028	€ 0,0008	€ 0,0006
2016	€ 0,0113	€ 0,0042	€ 0,0013	€ 0,0009
2017	€ 0,0159	€ 0,0074	€ 0,0027	€ 0,0013

Figure 3-3 Impact of ODE on natural gas prices in the Netherlands.
Source: Belastingdienst.nl

3.2.4. Powerful instrument: Objectives

Originally the energy tax is an environmental tax. When the *regulatory energy taxation act* was introduced in 1996 much emphasis was placed on cutting down carbon emissions. The tax exemption for energy from renewable sources was stopped in 2004, as it mainly leads to the import of Green certificates.⁴⁸

Today the government states that the emphasis is more on energy efficiency in general.⁴⁹ Increasing energy levies is often seen as an encouragement for consumers, companies and industries to become more energy-efficient by making energy-saving investments in homes and businesses more profitable.⁵⁰ A reflection of this changing ambition from supporting sustainable production towards general energy efficiency can be found in the fact that the distinction between energy from renewable sources and from fossil fuels is abolished. All energy use is taxed.

Counter argument is that the nature of a digressive tax only contributes to energy efficiency of small consumers, large consumers, however, are not encouraged to save energy. This is also confirmed by the low energy efficiency rates of large energy consumers in the Netherlands.⁵¹ In addition, the

⁴⁶ Stb. 2012, 673: Wet opslag duurzame energie

⁴⁷ Dutch Parliament documents: Kamerstukken II 2011/12, 33 115, 3 and Handelingen I 2012/13, 33115, 12, item 6

⁴⁸ Dutch Parliament document: Kamerstukken II 1994-95, 24250, 3

⁴⁹ Expressed in governmental statement about energy taxation on: www.rijksoverheid.nl/onderwerpen/milieubelastingen/energiebelasting dd. 07.07.2017

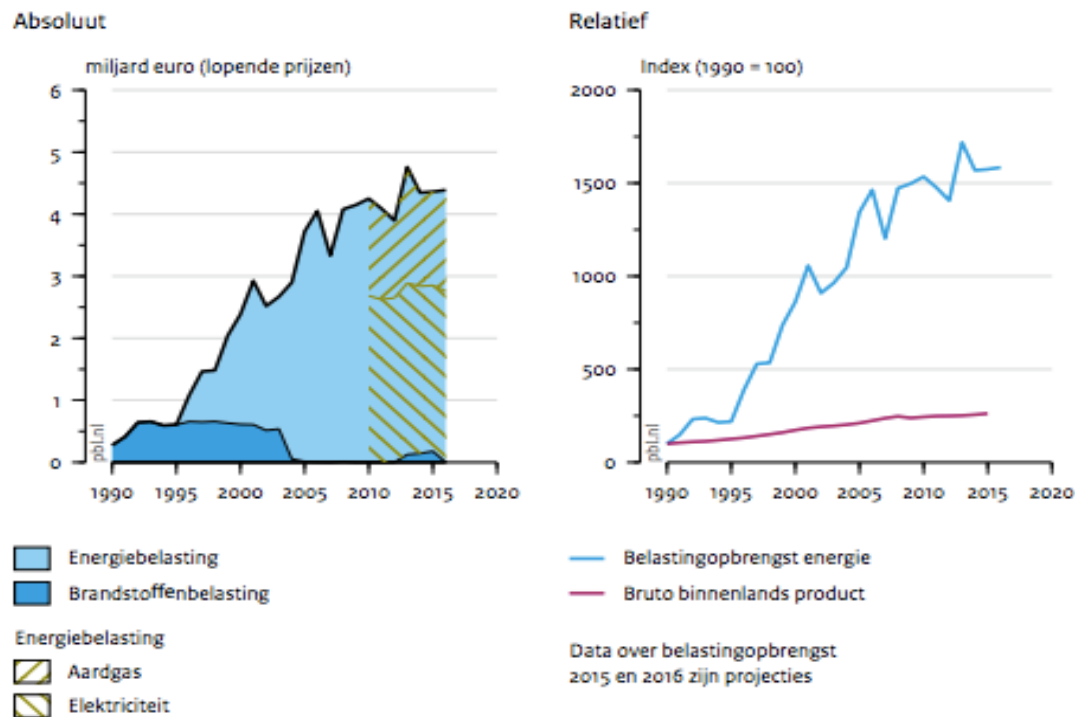
⁵⁰ Fiscale vergroening, Effecten en beoordeling van opties ten behoeve van het Belastingplan 2009, CE Delft p. 118

⁵¹ Voorlopige emissiecijfers industrie 2013-2016, Dutch Emission Authority and Letter from the minister of Economic Affairs, Kamerstukken II 2016/17, 30 196, 456: Minister threatens with obligations if the goals as laid down in the Energy Agreement 2013 are not reached.

energy efficiency agreements between the large industrial users and the government had so far not the desired effect.⁵²

Today's energy tax is largely seen as one of the main sources of income of the government and the *regulating* aspect has been retreated to the background over the last decade, see Figure 3-4—highlighting Dutch tax incomes from energy. Given the need to change to a fully sustainable energy system, this seems odd. The energy tax has been heavily debated the last couple of years, and several recommendations have been in favour of reinforcing the environmental regulatory aspect of the Energy tax. How to enforce this, is complex.

Belastingopbrengst energie



Bron: CBS; OESO; Financieel Jaarverslag van het Rijk 2014; Miljoenennota 2016; bewerking PBL

Figure 3-4 Illustrations of the absolute (left graph) and the relative (compared to GDP; right graph) evolution of energy tax revenues in the Netherlands
Source: PBL, 2016

Natural gas vs. electricity

Energy taxes are an important tool to achieve policy objectives. This can be illustrated by several examples. One such example is the discussion on the tax difference between natural gas and electricity. In 2015 more attention was given to the fact that there was a significantly higher tax on electricity, then on gas comparing by the amount of GJ that a kWh and an m3 stand for.⁵³ By

⁵² *Convenant Benchmarking Energie-efficiency: resultaten en vrijstellingen energiebelasting, CE Delft, juni 2010, p. 7-8*

⁵³ *Verschuiving van Energiebelasting, verkenning effecten, CE Delft, juni 2015, p. 3*

increasing the levies on natural gas, the government aims to encourage gas efficiency. Since gas is mostly used for heating (water) consumers will have a financial incentive to switch from natural gas to electric heating systems.⁵⁴

The adjustment did not only have an impact on the equal distribution of levies between energy sources, it also affected producers of renewable electricity. Small consumers using behind the meter settlement to deduct (see challenge 8.1) their production from their consumption, were suddenly calculating with a lower electricity price, directly affecting their business case.

Taking this ambition one step further would involve an energy tax not adjusted to the GJ per unit, but to the corresponding carbon emissions that are released.

3.2.5. CO₂-based taxes

Many of the parties in the Netherlands participating in the different projects voiced that the 'polluter pays-principle' is not sufficiently reflected in our tax system and this has a negative effect on many of the business cases; under the current framework and pricing scheme, significant investments in improved sustainability make hardly any economic sense because CO₂-emission reductions have little economic value. A CO₂-based tax would stimulate carbon emissions cuts. Adjusting the current energy tax system and introducing a CO₂-emission based tax is however complex.

First of all adjusting the current system in the Netherlands will have a large impact on all existing business cases in which energy plays an important role. As we will see later on in the report: the investments of small end users in solar panels heavily depend on the energy taxes. In addition, builders and housing associations are depending on the current energy prices to make sound business cases for retrofitting. Adjusting the tax level would have an impact on these business cases.

Secondly, the risk that a tax reduction on the consumption of green energy will lead to the import of relatively cheap green energy from other countries, like Norway, is still an issue today. A new tax system will have to address this challenge as well.

Endowed professor Volleberg (University of Tilburg and researcher at the Dutch Environmental Assessment Agency) suggests that a tax on the output/ production instead of the input/ consumption could contribute to implement the polluter pays principle in the energy tax system. A CO₂-tax could be in the form of a tax based on the sources that are used to produce energy, while reducing the tax on energy use. For a more extensive read on changing the energy tax system to a more polluter pays-based system we recommend the Report from the PBL, Green Tax Reform: Energy challenges for the Netherlands, by Vollebergh.⁵⁵

The new government announced in October 2017 to lay down a CO₂ tax which will be a minimum emission price (price floor) for energy producers.

In France, the newly elected government recently announced that it is planning to increase the carbon price floor by 40% by 2030, which brings the objective to 140 EUR/ton in 2030. This should, according to La Métro, support the development of renewable energy and be especially interesting

⁵⁴ *The question remains if the consumer is flexible, and wealthy, enough to adjust to this change. Families with a low income use a much higher percentage of their income on the energy bill (Energielastenbeschouwing, Nibud 2009). These consumers might not have the financial means or the possibility, renters, to invest in energy efficiency measures and new heating installations.*

⁵⁵ *PBL Netherlands Environmental Assessment Agency, Green Tax Reform: Energy challenges for the Netherlands, Herman Vollebergh, The Hague 2014.*

for La Métro because they will benefit developing biomass district heating networks that are currently not competitive compared to gas heating solutions due to current low gas prices. La Métro is indeed planning to expand the district heating system and they would like to increase the heat supply share from biomass sources.

3.2.6. Storage: One-sided tariffs and taxes

Both in France and the Netherlands the characteristics of the intermittent energy sources, like most renewables, are a challenge. Production of sustainable energy sources is not always in line with real-time demand for electricity. In order to have enough kWh available in times of low energy production and to save energy and relieve the network in times of high production, we will need to install large amounts of public or/and private storage capacity. In the Netherlands the owners of privately owned storage units -behind the household meter – are today confronted with double energy taxes. Energy taxes are only imposed on the final use. This results in paying double in case of electricity storage: both when charging the storage and when discharging and delivering electricity to the ‘real’ final user. It should be noted that the net metering (behind the meter settlement) solves this barrier for sustainable electricity produced behind the meter for small-end-users, see challenge 8.1.

Both large-scale storage (e.g. CAES-projects, pumped hydro power) and small-scale storage (batteries at home and electric vehicles) are thus under the current framework confronted with extra costs (taxes) which may be prohibitive for the development and application of storage technologies.⁵⁶

3.2.7. France

In France, there are several types of taxes and contributions on energy consumption, which are paid directly by end-users (large and small):

- Tax on Internal Energy Consumption (TICPE). Its level is defined by the law of finance depending on the nature of the energy (heating oil, diesel, gasoline). It is, for example, higher for gasoline than for diesel. A part of the TICPE is regionalised and modular: it makes it possible to participate in the financing of the budget of the regions when the latter wish to.
- Tax on Internal Natural Gas Consumption (TICGN). Its amount is directly integrated into the budget of the State and local authorities. Since January 2016, it incorporates the former gas solidarity tariff (CTSS) and biomethane contribution.
- Tax on Internal Coal Consumption (TICC). The amount was directly included in the State budget in 2016. However, since 2017 this tax is transferred to a specific account dedicated to energy transition.
- Taxes on Final Consumption of Electricity (TCFE). They replace local taxes on electricity. There are taxes on electricity consumption - a municipal tax and a departmental tax - that directly contribute to finance local authorities. In the case of La Métro, municipalities continue to collect the municipal tax even if “energy” jurisdictions have been transferred to La Métro since January 2015. It is important to point out that the overwhelming majority of these taxes contributes to the general budget of municipalities, and does not contribute to financing the energy transition.

⁵⁶ *Marktinzichting en Flexibiliteit, CE Delft and Centrum voor Energievraagstukken UvA; June 2016*

- Contribution to the Public Electricity Service (CSPE) is a levy that is levied on electricity consumption and is now paid directly to the state budget. The levy is used to finance the feed-in tariffs/costs for renewable energy, as well as the social tariff of electricity, which is a specific electricity tariff for low incomes households
- Value Added Tax (VAT). The Value Added Tax (VAT) applies to the totality of the energy price (incl. other taxes and contributions). Its rate is 20%. It is important to point out that the government strongly encourages the development of heat networks whose energy mix contains more than 50% of renewable energy. The energy sold by these networks benefits from a reduced VAT rate of 5.5%. It improves the competitiveness of heat produced from renewable sources like biomass and waste incineration, compared to standard solutions such as gas or electricity.

The graph below summarizes the impact of taxes and specific contributions on the price of one MWh of each type of energy carrier for the year 2016. The taxes and levies on electricity represent about 25% of the total price for small end users. Big consumers of electricity benefit from the degressive CSPE tariff: for enterprises consuming more than 7 GWh of electricity, the amount of the CSPE to be paid is limited to 0,5 % of the added value of the company.

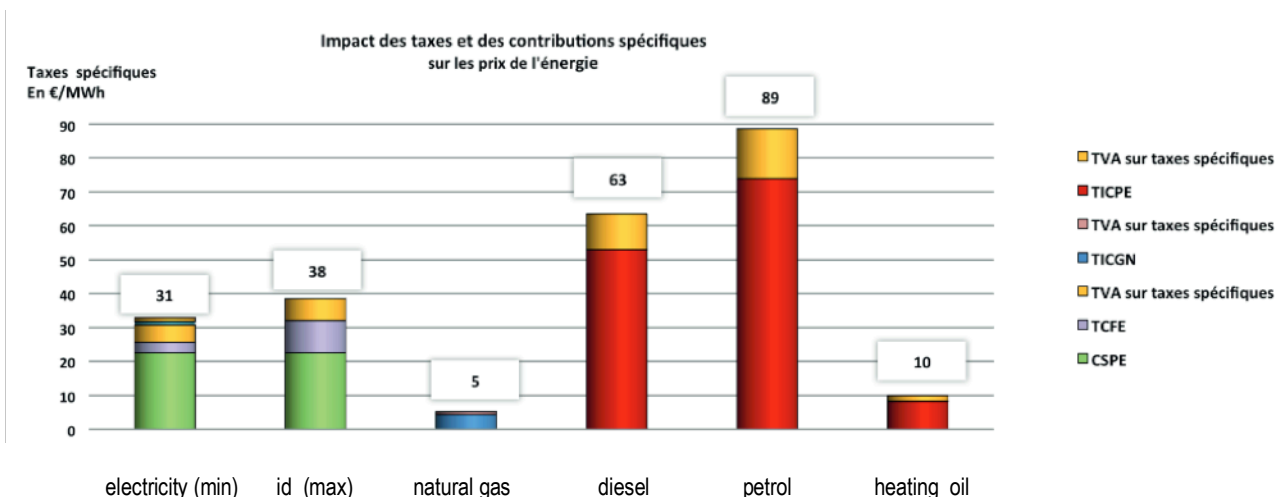


Figure 3-5 Impact of taxes and contributions on energy prices (EUR of taxes per MWh)
 Note: Because TCFE (electricity) is local and scalable; the graph represents the minimum and maximum tax rate for electricity.

Most of the taxed energy products are fuels, followed by diesel, electricity, heating oil and natural gas. The over-taxation of petroleum products in relation to other energies follows the polluter-pays principle, as the combustion of fuel products emits more CO₂ than natural gas or electricity generation in France, given the French energy mix.

In January 2014, the Finance Act introduced a share in internal consumption taxes that is proportional to CO₂-emissions from fossil products: the climate-energy contribution (CCE), which was implemented in 2016. The level of the climate-energy contribution in 2016 was 22 EUR/ton CO₂ and increased to 30,50 EUR/ton CO₂ in 2017. These levels are expected to meet the targets set by the Energy Transition Law for Green Growth, which are: 56 EUR/ton CO₂ in 2020, and 100 EUR/ton CO₂ by 2030. The newly elected government recently announced that it is willing to increase the CCE by

40% (i.e. 140 EUR/ton CO₂ by 2030). An increase of 1 EUR/ton CO₂ of this contribution represents an increase of 0.2 EUR/MWh for gas and 0.26 EUR/litre for diesel. The CEE does not apply to electricity because electricity generation is already subject to the European CO₂-quota trading system. The climate-energy contribution makes it possible to give a clear and long-term price signal to CO₂, which is essential for economic agents to anticipate and execute the most relevant economic decisions. For example, for La Métro, this tax is a real opportunity to make biomass district heating network competitive compared to gas. The bulk of the contribution-related revenue is used to finance the Employment Tax Credit (EICC).

3.2.8. Conclusion

Energy taxes and levies have a large impact on the energy price small end users pay, they make up a significant part of the final electricity and gas prices (up to 50% in the Netherlands). The most important levy in the Netherlands is the Energy Tax. Initially introduced as an environmental tax with a financial incentive for energy efficiency and renewable energy sources, today it is an important revenue for the national government that does not reflect the polluter-pays-principle, other than the recent adjustment on the tariffs for gas and electricity. The tax system does not stimulate energy efficiency improvements in the energy consumption of large-scale end users: these pay tariffs that are hardly affected by taxes, whereas household consumers pay much higher energy taxes.

In France there is solely an energy tax on consumption, not on production. All companies producing energy (being renewable or not) are subjected to the “standard” tax system of private companies (incomes taxes). The only exception is for individual photovoltaic electricity producers that benefit from a tax exemption if the energy system is inferior to 3kWp.

Additionally to the taxes and contributions listed above, electricity producers and consumers pay a contribution for the use of the electricity network (TURPE – Taxe pour l’Utilisation du Réseau Public de l’Electricité; grid fees). This tax directly finances investments in the electricity network (operation, maintenance and expansion). There is currently an important challenge to decrease the level of the TURP for energy system (production, storage or flexibility management) that are producing a service to the energy network and therefore contribute to reducing grid investments. This question is further addressed in challenge 8.3 on collective self-production of photovoltaic electricity.

3.2.9. Recommendations

We recommend that the Dutch government is clear on the policy objectives of the energy tax system. When taxes are used to impact the choices people make, transparency about what is included in these relatively high taxes is important for consumers to understand why they pay these costs, and give thought to how they could reduce them. If the objective is to support a sustainable and more energy efficient system, carbon emissions may be considered as the leading indicator in energy taxation of energy sources.

In France, we strongly recommend the government to increase the climate-energy contribution (CCE) to make renewable energy more competitive compared to fossil energy. It is also important to better consider the contribution of renewable energies and energy storage facilities to the grid operation, and to reduce grid access fees (TURP) when the solution developed has a positive impact by, for example, avoiding additional investments on the grid. Also increasing the taxes on gas would improve the business case of many of the projects in Grenoble.

3.2.10. France and the Netherlands

We see that the French and Dutch governments today voice the intention to make CO₂-emissions a leading factor in its tax system. A fairer distribution of taxes in both France and the Netherlands would support energy efficiency of large consumers.

CHAPTER 4 – GOVERNANCE

This chapter describes a number of challenges related to governance: The first challenge looks into the coordination between different governance levels, involved in developing a sustainable city. The second paragraph addresses the particular challenges of La Métro, Grenoble, in the coordination of the national owned DNO network and the local district heating network.

4.1. CHALLENGE: GOVERNANCE OF THE ENERGY TRANSITION: GRENOBLE AND AMSTERDAM

4.1.1. Introduction

Coordination between the various governance levels involved in decision-making to establish sustainable cities is a challenge, because there is no fixed framework available to effectively structure coordination between these levels regarding realization of national/ local ambitions. Each level has specific challenges.

4.1.2. European level

There are several challenges that will benefit most from a European approach/ solution. An example is CO₂-pricing, as discussed in previous paragraphs.

The challenge however, is to make all member states agree on impactful EU-wide measures. A single joint solution will thus always be a compromise between all these interests, very often reducing foreseen impacts of the original idea behind the measure.

Different approaches in countries

A first step in the governance discussion is answering the question whether the transition should be predominantly solved by 'the market', or by government. In the latter case, the governing body (bodies) involved, make the plans and solve most of the issues at play. When predominantly left to 'the market' however, government-(al bodies) determine the relevant frameworks in which companies and con-/prosumers develop the tools required to establish the transition, based on a trade-off between their foreseen costs and benefits. These approaches are different in the Netherlands (largely left to market with government setting boundaries and facilitating development), and France (transition largely directed by governing bodies, both at the level of energy production, but also increasingly in relation to legal obligations concerning energy efficiency).

In the Netherlands the national governments' objective is that the transition should be society/market driven. Leading document in the energy transition is the energy agreement (het energieakkoord), an agreement between many different parties like social organisations, governments, companies, and financial institutions. The responsibility for sustainable development is laid in the hands of all these different parties. Important is that the document involves voluntary agreements. The governments' role is to support sustainable development and create long-term consisting policies. So far we see that voluntary agreements often do not support sustainable

development sufficiently. The national government is therefore considering regulation within different fields.⁵⁷

In France and in Grenoble the course is more that the ‘metropolitan governance body’ develops and executes energy transition plans for the metropolitan area of Grenoble. They realise this in close cooperation with the energy companies. In contrast to the Netherlands where the citizen and companies are expected to engage in the transition, Grenoble uses more of a centrally governmentally controlled approach. In order to assure this role, La Métro is searching possibilities to exercise direct control in the local energy companies, or for example in financing solar production together with citizens. The advantage of such an approach is that there is a public authority that pushes and leads the transition and does not wait for market players to become active. A Risk of this approach might be that within regions and cities, the citizens and local companies feel less of a need to be actively involved in the transition process. This can reduce the development of innovative ideas and concepts that could give an important push to sustainable development, and the active involvement and awareness of citizens.

4.1.3. Decentralisation in The Netherlands

In the Netherlands the national government has been pushing the responsibility of the transition towards the local governments. This is understandable from a number of perspectives:

- a major share of future (renewable) energy supply will come from local, small-scale initiatives;
- decisions on land use predominantly play at the level of provinces and municipalities;
- integration issues, such as ‘not-in-my-backyard’ (NIMBY) discussions with local residents can be more effectively handled at the lower governance levels.

However, until now, a clear directive and mandate on energy transition is not given by national government. Provinces and municipalities can set other priorities than energy transition without any consequence. Also, local government may be in need for the proper knowledge to formulate a sound energy policy. Needless to say that it is not secured that the national ambitions will be achieved by the 12 provinces and 400+ municipalities.

Sub-optimisation.

Although more local decision-making and project development can ensure better fine-tuning with and between citizens, from a national perspective there is a significant risk of sub-optimal project development and use of resources. The first and foremost being (the risk of) overall sub-optimization due to the separate development and optimization of transition paths in provinces/regions and municipalities, and an apparent lack of a binding/ coordinating role from the national government.

Examples are found in the fact that the twelve Dutch provinces develop their own plans for becoming CO₂-neutral: some of the issues that play an important role in these developments might significantly benefit from a more nationally coordinated approach. This is already recognized and tackled with regard to the development of onshore wind power (national government and provinces

⁵⁷ *Several partners in the agreement have been threatened with legal obligations by the Ministry of Economic Affairs if they will not improve their commitment. Examples are the social housing associations, but also the energy intensive industry.*

have agreed on the division of national plans for onshore development⁵⁸ of wind parks larger than 100 MW⁵⁹), but for subjects like biomass projects and waste handling (including waste to energy) a more coordinated approach would also be beneficial, particularly because of limited resources available at the individual provinces.

Another example of such lack of coordination is that the economic frameworks for infrastructure investments in gas, electricity and heat are different, making it difficult to make fair comparison for – in this case – electric heating versus centralized (in the city/ region) heat production and provision. Investments and operational costs for centralized heat production and provision (e.g. a heat network) are generally divided over the number of (foreseen) connections, whereas investments and operational costs in the electric and gas grids (albeit gas will likely be phased out in residential areas in NL), are spread out regionally/nationally. Due to the different economies of scale, centralized heat production generally suffers from a comparatively bad business case.

4.1.4. Decentralisation in France

In France, energy policies are very centralized and mainly lead and decided by the state. However, since 2010 the role of the local authorities in implementing the energy transition is increasing significantly. In France, as a consequence of the Energy Transition Act, the national government focuses on fostering the development of Energy Positive Territories (TEPCV - Territoire à Energie Positive Pour la Croissance Verte) with the participation of more than 500 local authorities. The French government identified the metropolitan areas (Métropoles) as a key actor of the energy transition and therefore provided them with new jurisdictions and powers.

The Region, a new government layer

As such through the MAPTAM law, the 14 Métropoles that have been created in January 2015, are tackling the challenge of the energy transition:

- Both energy and urban planning are now part of the jurisdictions of the Métropoles, making more efficient the coordination of energy policies with urban planning documents
- The Métropoles have been designated as Organising Authority of the Energy reaffirming their role in the energy transition and especially in the control of the concessions of energy networks.

However to address these challenges, the Métropoles need to work out new governance schemes, that will improve the communication and cooperation between the different levels of the administration as well as with the key local stakeholders.

4.1.5. The end user

Remarkable is the difference in perspective in both countries on the role that end-users play in the energy transition. Whereas the overall Dutch assumption is that the end-user will need to play an active role and hardly any demands can be posed, the French partners look for legal tools to involve

⁵⁸ *An agreement between the national government and the provinces about the division of the 6.000 MW onshore capacity development target, was reached in 2013*

⁵⁹ *More on the national coordination prescriptions for onshore wind parks larger than 100 MW is available on: <http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/duurzame-energie-opwekken/windenergie-op-land/wetten-en-regels>*

and steer the end-user and so the energy transition into the desired direction. This different perspective is also reflected in many of the City-zen projects.

4.1.6. Local governance

Unclear role and responsibilities of the municipality

Both in France and in the Netherlands the municipalities are given a key role in orchestrating the energy transition.⁶⁰ Not only are municipalities in charge of planning, they also are the main contact for each of the parties involved. In addition, municipalities often have the financial means to support/subsidize initiatives/ measures.

Unfortunately the role of local governments in the Netherlands in the energy transition can be unclear. The Dutch national government could strengthen this role by giving local government legal obligations in the energy transition.

In France the metropolitans/municipalities have by law an official role in the transition.

Knowledge

Another challenge local governments are dealing with is a lack of knowledge within the local governments about the energy transition and the use of available tools. This is especially challenging for smaller communities and can result in poor planning and guidance.

Even the larger municipalities like Amsterdam are fumbling with these issues. An example is that an unclear role and responsibility of the municipality also leads to issues between city departments. Different bodies can have a different focus when it comes to developing a sustainable built environment. Some bodies may approve of certain projects because they principally address the issue of – for example – energy efficiency and renewable generation, whereas others may oppose to these projects based on pure financial, social or spatial planning argumentation. Between these different bodies, there is a different perception of what should be prioritized in the execution of their task: (municipal) sustainability goals, social or financial impacts, or spatial plans/ regulation.

Similar differences in priorities and ‘way of working’ regarding the development of sustainable energy projects can be found within (large) companies. Also in these entities, it is not always clear whether there is overall agreement on what the guiding principles are/ should be when it comes to project development where different parts of the company are involved.

An example is the Amsterdam municipalities’ sustainability departments’ ambition to make public (municipality owned) roofs available for private solar energy producers (citizens) with little or no suitable roof.⁶¹ In one of the City-zen projects inhabitants requested to use one of the city owned roofs. The specific department managing the estate was not willing to establish a building lease on the property. This resulted in a two-year delay and an agreement that was predominantly determined by the real estate department, deciding that the lease of the roof was restricted to the period that it would take to earn back the investment.

⁶⁰ *The role of the local government this will be further discussed in several challenges.*

⁶¹ *This year a new program was published by the municipality: Uitvoeringsprogramma SchaaSprong Zon 2016-2018: The aim is to go up from 13,3 MW in 2015 to 160 MW in 2020 providing 80.000 households with electricity. Question is if by 2020 this will still be sufficient to supply 80.000 households. Not taken into account are the growth of the households’ electric demand by further integration of electrified transportation and changing from natural gas based heating to electrical heating.*

This case illustrates the need for good internal harmonization within the municipal departments and that even well organized large municipalities with high ambitions are struggling with these issues. Political decisions must be translated into policies at any subject and where operational issues may conflict with a chosen policy, this friction is to be solved at a high level again. Disagreements between city departments on political ambitions is not only impeding renewable energy projects and the ambitions of the municipality, but even more importantly it leads to poor overall decision making and a lack of centralized and shared vision.

4.1.7. Conclusion

Both in the Netherlands⁶² and France⁶³, we currently see governments that choose to increasingly place the responsibilities for renewable energy development and sustainable heat supply at the level of lower – local – governance levels: provinces, regions and cities.

The differences in overall (national) approach and differences in focus, show that to provide effective measures for the implementation of sustainable measures in the built environment, it is important to recognise the fact that various governance levels are involved in the decision-making processes. From the perspective of citizens in any country, lower governance levels (i.e. national / provincial and municipal) increasingly tailor high-level regulation and ambitions to provisions that are / should be in tune with the local situation.

Local conditions and culture are crucial in developing effective policy frameworks for the energy transition throughout Europe. This means that there is no ‘one size fits all’-solution in terms of a fixed framework for coordination between the different governance levels. Rather, the different levels involved in decision-making anywhere in Europe, need to recognize the fact that all levels need to be involved. Albeit to different extents depending on the local conditions.

Saying this, the firm and transparent allocation of responsibilities between the governance levels is essential. Naturally, the means to execute the responsibilities are to be allocated also.

4.1.8. Recommendations

Given the described and potential drawbacks of the current approaches, we see a need for an overall stronger coordinating and monitoring role in the Netherlands, both at the central level as within the local governance levels. From this perspective, the ‘coordinator(s)’ can oversee the developments between and within the different levels and remediate inefficiencies, overlaps, and general sub-optimization with respect to the overall national (and ultimately European) goals. Care should be taken however, as more central monitoring may also ignore bottom up initiatives from within the regions or consumers. Installing coordinating or monitoring role(s) should be initiated by central players (i.e. the national government), and created in cooperation with local interests and initiatives.

In France a more facilitating role of the government could support citizens in taking more initiative and improve the focus on supporting citizen’s interest. Policy objectives of the local government and the interest of citizens may differ. By facilitating instead of participating, projects can be more tailor-made to the citizen’s interest.

⁶² *In the Netherlands: Ministerie van Economische Zaken, Energierapport – Transitie naar duurzaam (Dutch Ministry of Economic Affairs, Energy report – Transition to sustainability), page 29.*

⁶³ *In France : MAPTAM law that provides the new jurisdictions to local authorities and especially metropolises, and the Energy Transition Act that puts local authorities at the heart of energy transition.*

4.2. CHALLENGE: THE CONTROL OVER ENERGY NETWORKS IN GRENOBLE

4.2.1. Introduction

The role of electricity, gas and heat distribution networks appeared to be central to implement the energy transition. The transition of the current highly centralised energy system toward a decentralised energy system based on local renewable energy production implies an in depth evolution of the energy networks: decentralized architecture, integration of renewable energy, new usages and flexibility. In France, the vision is that these changes require a strong involvement of the local authorities to ensure integrated planning based on energy and climate objectives as well as on urban plans.

To meet these new challenges, Grenoble-Alpes Métropole (La Métro) as Energy Organising Authority⁶⁴ needs to improve its control and the coordination for the operation and the development of energy networks.

4.2.2. Local vs. national DNO

In France, gas and electricity distribution networks are mainly operated by national (and rarely local) DNOs⁶⁵. National DNOs benefit from a legal monopoly, and their relations with the local authorities have been very scarce in previous decades (partly to the lack of interest from local authorities). In the metropolitan area of the Grenoble, a local DNO (GEG) operates the city network of Grenoble, while all other networks in neighbouring municipalities are operated by national DNOs (ENEDIS for electricity and GRDF for gas). The advantage of the local DNO is that it is more easy to cooperate at the local scale. The national DSO has to comply with internal national policies and is therefore less flexible to adapt its actions to the specific local context.

The cooperation with the national DNO has been less successful and La Métro is experiencing more problems in cooperating with the national DNOs that have to comply with common rules at the national level and are therefore less flexible to adapt their practices to the local context. This has been impeding for carrying out their energy ambitions. To improve the control on the DNOs in the metropolitan area, La Métro is assessing the feasibility to select a new DNO that will be in charge of the networks that are now operated by ENEDIS and GRDF.

4.2.3. French national law and regulations

In French law, the monopoly of national and local DNOs is legally established. It implies that the concession can be delegated or renewed to the DNOs without formal competition. This monopoly is resulting from the combination of two laws:

- The energy code (Code de l'énergie) indicates that national and local DNOs have exclusive rights for the operation of the electricity and gas networks in their respective service areas

⁶⁴ *It means that Grenoble-Alpes Métropole is owner of electricity and gas distribution networks, and is therefore the authority in charge of organising the energy distribution. Grenoble-Alpes Métropole becomes the Organising Authority of the Energy Distribution for gas, electricity, heating and cooling networks in January 2015 as a result of the MAPTAM law (cf. §2.3)*

⁶⁵ *The Distribution system operator (DSO) is a natural or legal person responsible for operating, ensuring the maintenance and, if necessary, developing the distribution networks for electricity or gas in a given area. European Directive 2009/72/EC (OJEU 2009, L211,55) with regards to electricity and by the Directive 2009/73/EC (OJEU 2009, L211, 94) with regards to gas detail the tasks and duties of DSOs*

(respectively L111-52 and L111-53 in the Articles). As a consequence, the operation of these networks is reserved to a single economic operator (national or local DNO).

- The second text relates to the conditions for awarding public service delegation agreements (in French law, concessions for electricity and gas distribution networks are assimilated to public service delegation). Article L1411-12 of the general code of local government (Code général des collectivités territoriales) stipulates that the provisions defining and organizing the conditions for compulsory competitive tendering procedures do not apply to public service delegation when the law establishes a monopoly in favour of a company (Art. L141-11 to L-1411-11).

It follows that where a public service is subject to a legally constituted monopoly in favour of an operator, the French law provides an exception on the competitive tendering procedures.

4.2.4. Governance of the Grenoble heat network

Another challenge that Grenoble is confronted with involves the heat network. The existing heat network is currently operated by CCIAG (Compagnie de Chauffage Intercommunale de l'Agglomération de Grenoble) as part of a public service concession agreement. This 30 years agreement will end by July 2018.

The experience of Grenoble government learns that it is very difficult for the public authority to renegotiate future innovations and investments in the network. Given the financial structure of the agreement, the operator is disinclined to new investments near the end of the contract as these mean a loss to the operator.

Given that the current contract ends in 2018, there is a huge window of opportunity to optimise the heating-district network strategy and therefore La Métro studies how they can improve the new contract and avoid similar development barriers. In order to have command over the energy transition roadmap, La Métro developed a new way to operate the heat network.

Public interest defines following prerequisite conditions are to be fulfilled in the governance of a heat network:

- To ensure the quality of service and secure the supply of heat (with emphasis on periods of extreme cold)
- To support the national and local energy policies.
- To control the cost of service for end users, both on investments and operational costs.
- To strengthen environmental quality and innovation.
- To ensure control of the service by the local authority.
- To ensure transparency on operations, including sharing relevant data for energy planning.
- To enhance the end-users on governance level (user committee).

From July 2018, La Métro will split responsibilities for investments and for operation of the heat network. The daily operation will be tendered as a Public Service Delegation to a qualified company. La Métro will be responsible, as owner of the network, for investments in extension, improvement and innovation of the network and associated heat plants.

In this framework, La Métro decided to construct a new biomass unit including a combined heat and power plant (CHP) for the production of renewable heat and electricity. Also existing heat power plants in the network (i.e. La Poterne, Villeneuve, Vaucanson) are to be acquired by La Métro. These

investments will contribute to achieving the policy objectives in terms of production of renewable energy.

This setup also brings about the unbundling of production of heat and the distribution of heat.

Remaining questions to be answered at this moment observe the role of La Métro as retailer, third-party-access to the network and the establishment of a tariff for the heat are still absent. Third-party-access may increase the efficient supply of sustainable heat to the network, but may also affect the business case of the other suppliers, in this case the heat plants owned by La Métro. The tariff for the heat will exist of two components that are to be combined: the costs of investments by La Métro and the costs of operations under the Public Service Delegation. La Métro will have to balance its different interests in solving these questions. Finally, how is La Métro as regional authority to act as a monopolist retailer for the production and sale of heat to consumers?

4.2.5. Conclusion and Recommendations

The governance of the energy transition has been mandated by French national government to the Regions. This enables the Regions to optimise future energy planning in close co-operation with local parties (end-users, industry etc.), given the specific possibilities in the region.

However, the operators of the electricity, gas and heat networks have an important role to play in the energy transition as they are to adopt to new local investments and to support innovative developments in the regions. In this view, network operators should also be organised in such a way that it can adjust to local needs and context.

Three solutions to improve the cooperation with national DNOs can be further investigated:

- (1) transfer the operation of the network to a local network operator that will be capable of a sound reaction to the local policies;
- (2) reorganisation of the national DNOs into regional offices with the appropriate level of autonomy, or
- (3) modify the delegation contract with national DSO to adapt network development strategy and investment policies to local needs.

La Métro delegation contracts for all energy networks should therefore be reviewed to put the strategy of its operators in line with its energy transition roadmap.

CHAPTER 5 – DATA COLLECTION PROTECTION AND OWNERSHIP

5.1. DATA COLLECTION AND PROTECTION IN THE NETHERLANDS

5.1.1. Introduction

In 2017 the exchange of energy data is a necessity for essential systems in modern society. In this challenge we will discuss increase of energy consumption data of small end users through smart meters and the impact on data security and privacy.

The energy transition and the increasing need for accurate consumer data

Our energy data are taking an increasingly important role in transition to a sustainable energy system. The transition to an energy system that is based on large volumes of RES (Renewable Energy Sources) will have to find a way to adapt to resources that are much more unstable and unpredictable. To integrate sustainable sources with an intermittent output, the need for (near) real time flexibility increases. Collection and communication based on accurate data could be a tool to increase flexibility and facilitate the uptake of RES. Instead of only using large -power plants or -users to deliver this flexibility, improved data systems could also harvest the flexibility of small end users by supporting demand response of end-users. This will be further discussed in CHAPTER 9 – .

Smart grid and IT developments

IT-systems that enable these functions, are often referred to as “smart grids”.⁶⁶ The individual smart meters offer very detailed data on the consumption by end-users.

In recent demonstration projects such as the City-zen projects end2end smartification, virtual power plant and vehicle2grid , possibilities to use smart meter readings for demand response and grid stability are investigated.

New services are being developed to enhance the use of these data in the energy system for example by monitoring the system and to harvest the flexibility of end-users. New service providers, such as aggregators (companies combining the volumes of small end-users into optimised larger volumes), struggle with the present legislation, which forms a barrier to add value to the flexibility of an end-user (see also CHAPTER 9 –). As ‘business-as-usual’-solutions will fail, the energy transition needs a fresh approach on its use of IT.

The best illustration of the increased performance of IT-systems is in the development of “Big Data”. Experts see the use of different sources for a detailed prediction of energy use as a promising approach to securing stability in the electricity networks.⁶⁷

⁶⁶ *It should however be noted that smart grids are often approached from a technical point of view and little attention is given to legal, economical and social aspects. It is important to engage these aspects during the development of the energy network and the energy data systems.*

⁶⁷ *Presentation prof Osseyran at congres: “Schuivende Energiesystemen”, October 29, 2014*

5.1.2. Concerns around developments in IT and data businesses

On the other hand, concerns rise on the use of large data systems. Security breaches, whether caused by technology failure, human error or illicit activities, may lead to serious system failures and will violate privacy of many energy users. Cyber security can be improved with a new design of data collection, storage and use.

Directly linked to the developments in Information Technology (IT) are the developments in IT-companies. Not only energy companies invest in ‘smart meters’ and ‘smart thermostats’, but also companies active in data mining show interest (see Google, a data company developing Nest thermostats and other domotica)⁶⁸. Data on energy use give information on various aspects of consumer behaviour and can be made of value to companies collecting and trading information.

The information collected by information giants like Google, Facebook and Apple encompasses an important element of not only commercial but also political and societal power. As long as the functioning of the energy system is not safeguarded from the private interest vested in these companies, care should be taken with sensitive energy data.

We can conclude that the IT development can enable us to increase the uptake of sustainable energy sources, by monitoring the system and demand response. On the other hand it makes the functioning of our energy system increasingly dependent on IT and it poses a threat on our privacy when this information is shared with commercial parties.

5.1.3. Energy data system in the Netherlands

In the Netherlands the consumption data of small-end-users is regulated in national laws (energy- and consumer/data protection- laws), ministerial regulations and codes.. The last decade many alternations have been made, new registers have come in place and are currently developed and new security systems have been added. The resulting regulatory framework, especially the Information Code, is at the moment more a description of the procedures the sector developed over the last two decades, in stead of a set of rules based on the principles and directions given by the legislator. The current legal framework regulating personal energy data is very complex and almost impossible to understand for small end-users.

At this moment, only the data processes for administrative changes, such as consumer relocations and switches of retailer, and processes to make up the annual bill are described in detail⁶⁹. ‘Real time pricing’ on an hourly basis is recently introduced (January 1st, 2017)⁷⁰ and at this moment offered by a few niche players. Frequent readings (every 15 minutes) from smart meters are possible, but the description of the related data processes is far from transparent.

These findings are based on the public regulations and It should be noted that the detailed data process descriptions developed by NEDU and ESDN are only available to members of NEDU.

According to the Information Code, this fourth layer of regulations is developed by the DNOs in co-operation with the retailers, the BRPs and the measurement responsible parties (mostly affiliated

⁶⁸ *site NEST: article of general conditions NEST Privacybeleid website* (<https://nest.com/nl/legal/privacy-policy-for-nest-web-sites/>)

⁶⁹ *Information Code, chapters 3 and 5.*

⁷⁰ *Decree from the regulator (Autoriteit Consument en Markt) from October 27 2016 (nr ACM/DC/2016/206237) “Besluit tot wijziging van de voorwaarden als bedoeld in artikel 54, eerste lid, van de Elektriciteitswet 1998 en artikel 22, eerste lid, van de Gaswet inzake individuele slimme-meter-allocatie, gegevensverstrekking aan regionale netbeheerders en termijnen voor bulk-PV switch”.*

with a DNO); end-users and service providers are excluded by this list.⁷¹

5.1.4. The EU General Data Protection Regulation

The new EU General Data Protection Regulation, which will become effective in May 2018, includes a couple of basic principles that should be respected in relation to processing personal data. One of those principles is that processing of data should be adequate, *relevant and limited to what is necessary in relation to the purposes, for which they are processed*⁷² Another important principle is that collection happens *lawfully, fairly and in a transparent manner*⁷³, and data should be processed in a *secure* manner, including *protection* against loss of the data.⁷⁴

In relation to the collection of energy data, and the roll out of smart meters that can monitor real-time consumption we should ask what data is needed to fulfil the tasks of each party involved. If the end-user pays a fixed kWh tariff, there is no need to share the 15-minute meter readings with the supplier or DSO.⁷⁵ The question on what data is necessary in relation to the purpose is an important question that will continuously need to be asked in this rapidly growing and above all changing market.

To secure energy data of end users, the Dutch government decided after the administrative chaos that emerged after liberalisation of small end-users, to register data in a central register.⁷⁶ Centralised data banks can be efficient, but are also vulnerable for technical failure or criminal attack. The need to store all detailed energy data in central data banks should be reviewed. For instance, local storage of meter readings (in the smart meter itself) provides a high resilience, while the data stay available for third parties.

The central registers, managed by EDSN (Energy Data Service Netherlands), have proved to be weak in protection against (at least) human error. The numerous retailers, DNOs and BRPs have access to the data banks and all these authorised personnel can copy and distribute data to unauthorised partners. In recent history, a number of these incidents have drawn attention.⁷⁷ Measures to better secure the data are being taken by EDSN.⁷⁸ In an additional register, for each end-user, the given consents for sharing data will be stored. Each client will be made recognizable by means of an identification key, consisting of a partial bank account number or partial date of birth.

5.1.5. Conclusion and Recommendations

The new General Data Protection Regulation will provide the Member States and all parties affected by this regulation with guidance on how to handle personal data. In the Netherlands there have been incidents that have shown that improved protection of the energy data is needed. The national government has taken several actions - supporting central data registers and limitation on how data

⁷¹ *Information Cxode, article 9.1.1.*

⁷² *Article 5 led 1 sub c of the General Data Protection Regulation*

⁷³ *Article 5 led 1 sub a of the GDPR*

⁷⁴ *Article 5 led 1 sub f of the GDPR*

⁷⁵ *Code of conduct Smart meters §3*

⁷⁶ *Letter from the Minister of Economic Affairs to Parliament on Liberalising energiemarkten, nr 28 982 – 38 from March 23 2005*

⁷⁷ *Letter to Parliament on the theft of energy data from 2 million consumers, Oct 4th, 2016 (2016z16572)*

⁷⁸ *NEDU “Actieplan-Dataveiligheid”, 2017*

is shared - to improve the existing system. This, in turn, has resulted in many layers of regulations and players involved in securing these data and makes the handling of personal energy data opaque for small end users.

5.2. CHALLENGE: DATA OWNERSHIP IS CONFLICTING WITH USE FOR ENERGY PLANNING IN GRENOBLE

5.2.1. Different policy aims to be reconciled

The roll out and deployment of smart energy meters by 2020 will create opportunities to offer new services based on individual energy data. Services can be targeted to building owners and building managers, local authorities, private companies, research centres etc. However, collecting, processing and communication of energy data are governed by the laws on protection of consumer data and commercially sensitive information. To balance these two interests is challenging.

5.2.2. European legal framework on data protection

For purposes of assessing the legal provisions covering the implementation of smart metering, three different regulations have to be considered: Firstly, the European Convention on Human Rights, secondly the Third Legislative Energy Package of the European Union and finally, the General Data Protection Regulation⁷⁹. The General Data Protection Regulation will replace the Data Protection Directive, which was outdated and resulted in a patchwork of different rules in all member states. The regulation, which is directly binding and does not (cannot) need to be transposed into national laws, *seeks to harmonize* the protection personal data of natural persons in the EU. At the same time, the Regulation allows in numerous articles for member states to further specify provisions in national laws. The Regulation prevents the application of national laws whose content is inconsistent with the Regulation.

General Data protection Regulation

Article 5 of the General Data Protection Regulation (GDPR) stipulates that personal data must be processed fairly and lawfully, collected for specific and legitimate purposes and may not be further processed in a way incompatible with those purposes. In addition, data processing must be adequate, relevant, and not excessive in relation to the purposes for which the data are collected. Various purposes such as the improvement of energy efficiency, metering accuracy, customer information, grid stability, as well as timely billing, may demand data processing of detailed consumption data (beyond standard monthly readings). Data processing does not only have to comply with Article 5 but also with Article 6, which states that processing of personal data shall be lawful only if and to the extent that at least one of the following applies:

- (a) *the data subject has given consent to the processing of their personal data for one or more specific purposes;*
- (b) *processing is necessary for the performance of a contract to which the data subject is party or in order to take steps at the request of the data subject prior to entering into a contract;*
- (c) *processing is necessary for compliance with a legal obligation to which the controller is subject;*

⁷⁹ *Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data (OJEU 1995, L281) will be superseded by the General Data Protection Regulation (GDPR) (Regulation (EU) 2016/679, OJEU 2016, L119/1) . The Regulation was adopted in april 2016 and will become enforceable by May 2018.*

- (d) *processing is necessary in order to protect the vital interests of the data subject or of another natural person;*
- (e) *processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller;*
- (f) *processing is necessary for the purposes of the legitimate interests pursued by the controller or by a third party, except where such interests are overridden by the interests or fundamental rights and freedoms of the data subject which require protection of personal data, in particular where the data subject is a child.*

Transfer of data can only take place under one or more of these conditions.

In the remainder of the article the regulation allows the member states to introduce more specific provisions with regard to point c and e. *'by determining more precisely specific requirements for the processing and other measures to ensure lawful and fair processing including for other specific processing situations as provided for in Chapter IX'*⁸⁰

In addition the Regulation requires that processing of data as referred to in point c and e, is only allowed if there is a legal basis in EU law or in national legislation.

Types of data and their use

Privacy by design is very much encouraged by the EU commission in the rollout of smart metering.⁸¹ This approach can be guaranteed by a series of steps describing a bottom-up process from an exhaustive list of value-added services beyond standard meter reading, and even beyond the DSOs need for remote reading, that may be implemented by different energy actors.

Types of data may be classified based on the purpose for collecting it (billing, energy-efficient maintenance of the grid – forecasting and settlement -, offering tips to achieve energy savings, providing alarms of high consumption, etc.).

5.2.3. French legal context

Characterization of personal data

At the EU level, individual energy consumption data qualifies as personal data and, as such, concerns end-users. Each Member State can define more specific requirements than those discussed above on data processing that require consent of end-users to be performed. The requirements are different depending on the “status” of the organisation processing the data (DNO, energy retailer, local authorities, etc.). As well, Member States define, within the limits of the regulation, under which criteria aggregated data are no more considered confidential.⁸² This last point is essential in that sense that it determines which data is confidential and which data can be shared, for example with neighbours.

In France, if energy consumption data is not associated to a name and/or an address but only with a point of delivery (POD), than it should not be considered personal data provided that the POD cannot be associated to a name by a third party (i.e. other than retailer or DSO). For services that require information on the address of a user (such as comparison amongst neighbours), the address is coded

⁸⁰ Article 6 (2) General Data Protection Regulation

⁸¹ 2012/148/EU: Commission recommendation of 9 March 2012 on preparations for the roll-out of smart metering systems.

⁸² In the case of france, this level is defined by in the article 20 of the law n° 2000-108 of February 10th, 2000 as described below

with a number that only the DNO can recognize (i.e. the address cannot be deduced by the third party receiving the data) so that the triplet “POD - Load curve – Coded address” is not deemed confidential.

Aggregated data is defined very precisely in French law. Private data, so called commercially sensitive data (ICS), are described in article 20 of the law n° 2000-108 of February 10th, 2000 relative to the modernization and to the development of the public electricity service. The National statistics office (INSEE) describes at which point aggregated data is not considered confidential, that is when both of the following conditions are filled in:

- there are at least 3 clients, and
- no client represents more than 85% of the aggregated power.

Therefore, aggregation of electricity consumption data in a building is not considered confidential if there are at least 3 dwellings.

Legal processing of personal data

Each Member State has a different approach to the conditions in which DNO and energy suppliers (retailers) are allowed to treat personal data for the exercise of their duty. This is an essential point since unambiguous consent is difficult and timely to obtain from an end-user and may be revoked at any time thereby weakening the energy savings potential and economic viability of services offered.

In France, the Data protection agency (CNIL) is responsible for regulating how personal data may be processed. DNOs are allowed to treat individual metering data for improving consumption profiles they have on their consumers and for grid management purposes. Retailers must obtain the consent from users in order to be able to treat their data.

The CNIL made an announcement on smart metering in November 2012 that clearly restrains the collection and data processing of load curves from smart meters⁸³. The CNIL considers that:

- Collecting load curves at an interval of 10 min may lead to privacy issues since it reveals potentially consumer habits in the private sphere. ENEDIS, the largest French DNO, has therefore applied the precautionary principle in engaging not to collect load curves at a time interval below 30min. Since other DNOs smart metering systems depend on ENEDIS’s system, they must all comply with the same rule.
- Load curves may only be processed for three purposes: grid stability and development (DNO), introduction of tariffs tailored to consumption habits of users (retailers), offer complementary services such as refurbishment works (third parties).
- Load curves may only be collected:
 - By DNO when a default has been detected and localised on the distribution network, and not systematically.
 - By the retailers or third parties only with the consent of users. The DNO is in charge of collecting the consent of users upon a request by the retailers. Consent must be obtained individually for each service proposed by retailers or third parties and must be freely given.

⁸³ *Délibération n° 2012-404 du Data protection agency (CNIL) du 15 novembre 2012: portant recommandation relative aux traitements des données de consommation détaillées collectées par les compteurs communicants.*

- Data collected and treated should only be stored for the duration justified by the purpose of processing:
 - For the DNO: the time to resolve the problem on the grid
 - For the retailer: the time needed to simulate the adapted tariff structure
 - For third parties: the duration of the complementary service provided by the enterprise.

ENEDIS, the largest French DNO, has therefore applied the precautionary principle in engaging not to collect load curves at a time interval below 30min. Since other DNOs' smart metering systems depend on ENEDIS' system, they must all comply with the same rule.

Legal metering background and smart meter roll-out

Implementation of energy data related services is highly dependent of smart metering infrastructure deployment. In France, 300,000 smart meters for electricity (Linky) have been installed during the experimentation phase (2009-2015). The deployment phase started in 2015 for the municipalities delegated the national DSO (ENEDIS), 3 millions of smart meters for electricity will be installed by the end of 2016 and the total objective is to change 35 million meters by 2021. For smart meters for gas (Gaspar), 150,000 meters have already been installed in 2016, and the objective is to install 11 million meters by 2022. For the other municipalities whose DNO activities are either integrated within municipality services or externalized to a public-private entity (e.g. GEG), they have up to 2024 to complete the deployment of the smart meters.

5.2.4. Data and energy planning

Requirement of data by local authorities

La Métro wishes to receive the energy consumption data from the DNO. They claim to need the information on its network to develop its energy policies (energy data, information about existing network, investments plans, etc.). At present, only part of energy data requested by La Métro is shared by DNO. The situation has significantly improved since 2015 by the signing of several cooperation agreements with DNOs for the development of the energy transition roadmap, but more data related to the investments in energy networks has not been shared yet.

During the 5 to 10 previous years, many local authorities have been negotiating with DNOs to obtain detailed data on energy consumption and energy networks. For example, with the TRANSFORM project (FP7), Grand Lyon managed to obtain energy consumption data at 'block-level' that has been necessary to develop its transformation agenda⁸⁴. It took more than one year of negotiations to obtain the data and it has only been possible in the very specific context of the European R&D project including the DNO as a partner of the project together with the local authority (Grand Lyon). About 5 years later, the new law on energy transition made mandatory for DNO to provide local authorities with energy data at the block level (minimum 10 dwellings) by 2017⁸⁵. This new law enables small local authorities to make use of real consumption data and this leads to more adequate policy making. However, frontrunner local authorities are voicing that the data at block level is an important step forward but remains insufficient. They need more detailed information on energy networks (high voltage power house, electrical distribution substation, design of the middle and low voltage networks, etc.) to ensure a sound control of the concession as well as to ensure that

⁸⁴ <http://urbantransform.eu>

⁸⁵ Article 179, LOI n° 2015-992 (17 Août 2015)

investments will be done in an optimal way to tackle challenges of the energy transition (integration of RES and electrical vehicles, complementarily and inter-operability between energy networks, etc.). For these local authorities, having a higher control on and cooperation with the DNOs, is therefore an indispensable step forward for the implementation of energy transition.

In this context, La Métro assessed the legal possibility to use competitive procedures for the renewal of concession contracts of electricity and gas distribution networks, so as to implement its energy transition roadmap and to provide an efficient energy service as well to challenge existing network operators. For more information on this topic see challenge 4.2.

Legal development on energy data for local authorities

To enable local governments to plan and coordinate the energy transition, the law requires public system operators to communicate to them the consumption and production data they collect as part of their activity. In this sense, Energy Transition for Green Growth Act (law 2015-992 of 17 August 2015) introduced provisions in the Energy Code to ensure that electricity and gas distribution and transmission systems operators as well as district heating networks operators make available to local authorities some of the data they collect. Details on the application of this article have been published in particular in two specific decrees that:

- organize the provision of data necessary for the fulfilment of the tasks of local authorities for the design and implementation of territorial climate-air-energy action plans, in application of Article 179. One important point addressed by this decree is related to the communication of energy consumption and production data at the building scale when there are 10 or more residential delivery points⁸⁶.
- specify the conditions for the provision of energy consumption data, by the DSOs, to the owners or managers of residential or tertiary buildings who request them⁸⁷.

In line with the law on energy transition, the law for a Digital Republic⁸⁸ contributes to the sharing of energy data. First, the law creates the Public Data Service.⁸⁹ The data that will be made available within the framework of this public service are not yet known, but the public consultation held in November 2016, suggests that the data related to energy networks will very probably be included among the so-called "reference" data that will come under this public service. Secondly, the law imposes on public services concessionaires that they share with the local authorities - in a digital format - all data and databases collected or produced in connection with the operation of the public service of their data known as "general interest".⁹⁰ This will allow local authorities to obtain from the DNO more information regarding the energy distribution networks they operate. Finally, the Article 23 of the Law for a Digital Republic organizes the opening of detailed data on consumption and production of electricity and natural gas. It imposes an obligation on the electricity and gas network operators to process and make available to the public the data derived from the deployment of the communicating meters (Linky and Gaspar).

⁸⁶ Decree No. 2016-973 (18 July 2016) on the availability of data on the transport, distribution and production of electricity, natural gas and biomethane, petroleum products and heating and cooling.

⁸⁷ Decree No. 2016-447 (12 April 2016) on the provision of energy metering data to owners or building managers in application of Article 28.

⁸⁸ No. 2016-1321 of 7 October 2016.

⁸⁹ Article L321-4 of the Code on the relations of the administrations with the public.

⁹⁰ Article 53-1 of the ordonnance N°2016-65, 29 January 2016.

5.2.5. Conclusion

In its deliberation on the Public Energy Services, La Métro has decided to create a public service on energy data that aims to:

- Provide citizens with the opportunity to act on their energy consumption by developing adequate multi-energy interface
- Provide building owners or managers (municipalities, social housing corporations, etc.) with the opportunity to optimise the energy management of their buildings
- Provide La Métro with a better overview of energy consumption and production on its territory (energy atlas) as well as the opportunity to evaluate the performances and impacts of its energy policies.

To achieve this objective, La Métro is currently cooperating with ATOS and GEG as part of the City-zen project. The objective is to assess how the Vivacité platform⁹¹, a platform that is used to collect data (developed by GEG and ATOS), can be transferred to La Métro and expanded to the whole metropolitan area. It implies a cooperation with other DNOs (GRDF and ENEDIS), as well as to clearly define the functionalities that La Métro is willing to propose to citizens, buildings owners and municipalities as part as this new public energy data service.

5.2.6. Recommendations

La Métro is also assessing the feasibility to use this platform for energy planning purposes (energy atlas, dashboard to monitor the impact of energy policies, etc.). For this last point, it is according to La Métro necessary to go beyond the current legal framework. Discussions have already been engaged with CNIL (Data protection agency) and CRE (Energy Regulation Agency) to assess the feasibility to have a specific derogation to transfer monthly energy data (at building scale – i.e. 10 connection point) instead of annual data as planned in the Energy Transition Act (cf. previous paragraph).

⁹¹ *Vivacité plateforme is developed as part of Cityzen project (cf. Cityzen demonstrations project). This platform is a territorial energy monitoring system. It collects all energy consumption data made available through smart meters to offer inhabitants with a follow-up of their daily energy consumption. The information is displayed via a dedicated internet portal and comes together with specific advises on how to save energy.*

CHAPTER 6 – SUSTAINABILITY AND SPATIAL PLANNING

This chapter describes the challenges related to spatial planning.

6.1. CHALLENGE: SPATIAL PLANNING AND ENERGY TRANSITION IN THE NETHERLANDS

6.1.1. Introduction

This challenge focuses on the possibilities local governments in the Netherlands have, to spatially plan energy efficiency, production and infrastructure.⁹²

The local governments play a central role in the implementation and coordination of the energy transition. They are particularly equipped to fulfil this role, due to the instruments and powers available to them. Therefore local governments should have a clear overview of the instruments available to them to stimulate and enforce this sustainable energy transition. Unfortunately, this is not always the case; laws are plenty and instruments unclear. The new Environmental Act needs to bring salvation to this wide heard complaint. In this challenge we will look at the current instruments municipalities have and the new Environmental Act.

6.1.2. Laws and regulation

Spatial development strategy

The function of *Spatial Development Strategies* (Structuurvisie) for municipalities is to set out the outlines of policies. Besides the required general strategy, local governments have the possibility to develop a special *spatial development strategy* for energy, or *energy strategy*. This strategy could be a compass or roadmap to an energy neutral municipality. Today many municipalities are using this instrument to formulate their strategy and ambitions.

To make the public aware of the municipal energy strategy, is not the only reason to develop a strategy, also reinforcing the municipality's position with regard to communal 'land exploitation' is an important argument.⁹³ We will look at the instrument of exploitation below.

Land development plans

The most important legal instrument of local government is the *Land Development Plan* (Bestemmingsplan). This is a binding plan in which government can place direct binding rules on buildings, use of land, reuse, but also the energy system in the area, as far as planning falls under, what we call 'a good spatial planning'. This means that these plans give room for reserving land for energy production, sustainable energy production, or even more specific, wind or WKO (storage of heat and cold). The municipality will have the freedom to keep it more general or be more specific.

⁹² With a special thanks to my colleague Fons van der Linde, Amsterdam Centre for Energy, for his comments and input on this chapter.

⁹³ Fons van der Linden et al., *Ruimte voor een duurzame energievoorziening: Notitie bij de workshop energie en ruimte*, Centrum voor Energievraagstukken-UvA, september 2016, p. 18

Energy efficiency obligations are often qualitative obligations demanding a specific quality of the net, like smart grid, or the performance of buildings. The *Land Development Plan* does usually not allow qualitative demands, because it falls outside what is defined as ‘good spatial planning’.⁹⁴ Plans can neither include higher obligations than are laid down in Building Act (Bouwbesluit 2012), like demanding high energy efficiency in the form of an EPC (energy efficiency coefficient⁹⁵) in buildings or for an area.⁹⁶ This will be further elaborated on in challenge 7.1

Land exploitation agreement or plan

The municipality will conclude exploitation agreements with the different parties developing the area, for example with the network operator and the housing developer. In this agreement they lay down commitments on the costs made by the different parties. Such an agreement could also include conditions on the utility, including environmental conditions. These conditions will need to be in accordance with environmental law and the specific energy laws, like the Gas, Electricity and Heat laws. In case the municipality and the other party do not reach an agreement, the municipality can make, as part of the development of an area, an *Exploitation Plan* (Exploitatieplan). The legislator prefers parties to use an exploitation agreement.⁹⁷ The *Exploitation Plan* provides, among other things, the legal basis for the recovery of costs that are made to develop the area by the municipalities. This will often also include the costs made for developing an energy system. The law has a limitative list of costs that can be claimed.⁹⁸

Environmental Act

The new Environmental Act (Omgevingswet) is expected to enter into force in the beginning of 2021. The law brings together a number of laws, concerning the physical environment, and aims to make the current regulations easier and better. The concept of ‘good spatial planning’ is replaced for ‘the physical environment’ (*fysieke leefomgeving*), which is pointing to a much broader and integrated approach than only spatial planning. This is also reflected in the ‘aims’ like sustainable development, laid down in the new Environmental Act and the change of paradigm; going from primarily ‘protection’ to ‘protection and development of the physical environment’. Issues that before were not spatially relevant, like for example qualitative demands on the grid, like smart grids, under the new Act can be an aspect of spatial planning.

New instruments

The Environmental Act defines six new spatial development instruments. The following three will be discussed in relation to energy planning; *the Spatial Vision*, (Omgevingsvisie): similar to the existing strategy, *the spatial plan* (Omgevingsplan): will replace the land development plan and *the program* (Programma): new instrument.

⁹⁴ S. Pront-van Bommel, *Energie-efficiëntie en gebiedsontwikkeling*, BR 2012/153, p. 7

⁹⁵ Building Act article 5.2: EPC: *The measure of energy efficiency of a building is the EPC in the Netherlands. The EPC evaluates the energy efficiency of the building based on the building, installations and standard use of the building.*

⁹⁶ ABRvS 10 augustus 2011, JM 2011/112, m.nt. S. van Velsen en R. van Bommel.

⁹⁷ Dutch Parliament document: Kamerstukken II 2004/05 30218, 3, p. 11

⁹⁸ Article 6.2.4-6.2.5 Decree spatial planning (*Besluit Ruimtelijke Ordening*)

Vision

The *Spatial Vision* for the physical environment is a coherent strategic vision on the physical environment, which allows the local government to share their vision, challenges, choices and ambitions in relation to the development of the physical environment of the region. Energy is one topic that could, or should, be part of this integrated approach.

Plan

Municipalities will have to lay down their plans in relation to the physical environment in a *Plan* or *Municipal Regulations* (verordening). A *plan* can include rules and regulations that are directly affecting citizens and businesses. These are often laid down in *Environmental Values* (article 2.9), which reflect the ambitions, more precise; the standards that define the desired condition or quality of the physical environment. The administrative body has the assignment to comply or realize this goal. Article 2.9 in the new Environmental Act emphasises the permission to impose quality requirements. Consequently, these Environmental Values will bind the administrative body.

Program

The administrative body is obligated to monitor if the *Environmental Values* are achieved. If it shows that they do not comply with the values as laid down in the *Plan*, the administrative body will need to make a *Program*, which is a package of policy management measures, that will help them to reach their objectives. The administrative body is obligated to follow this *Program* until it has achieved the ambitions as laid down in the plan. In general a program is a standalone instrument, which can be used to practically implement the measures needed to fulfil the ambitions as laid down by the municipalities. An example would be the ambition to use residual heat in an area. A program can be used to carefully execute this ambition.

Even though ambitious goals could be formulated in a *plan*, the local government is still largely depending on other laws and regulations, providing a legal basis, to execute these ambitions. An example here is retrofitting owner-occupied housing; under the current building regulations the local government cannot enforce homeowners to upgrade the energy efficiency of their housing or connect to another heat source as long as there is no legal ground for such an obligation. This will also be discussed in challenge 7.1.

6.1.3. Remarkable changes

Ordering Provisions

In addition to letting go of the ‘good spatial planning’ scope and opening up for a wider range of interests, it has been argued that the new plan will also allow so called *Ordering Provisions* (gebodsbepaling).⁹⁹ That means that the administrative body can obligate citizens to carry out certain actions in relation to the physical environment, even if the citizen is ‘in-active’.

Groothuijse et al¹⁰⁰ have studied the possibility of *ordering provisions* in plans, and concluded that the impact of *ordering provisions* will most likely be limited. The right of property will often limit

⁹⁹ A.G.A. Nijmeijer, *Omgevingsplan: overgangsrecht, gebodsbepalingen en het verschuiven van de onderzoeksplicht*, TBR 2016/11 and A.G.A. Nijmeijer, *Gebodsbepalingen in het omgevingsplan: (veel) eenvoudiger gezegd dan gedaan*, TBR 2015/185 and F.A.G Groothuijse et al., *Gebodsbepalingen in het omgevingsplan (onderzoek in opdracht van het Ministerie van I&M) (2015) Utrecht University Repository*

¹⁰⁰ Groothuijse et al 2015

ordering in-active citizens to undertake certain activities. These types of obligation, in addition, need to meet the requirement of proportionality. To include *ordering provision* in a *Plan* on energy systems or energy efficiency measures seems challenging. The new law is unclear on this point and experience will be the best test to show the importance of this instrument.¹⁰¹

Connection to the grid

Another interesting change is the abolishment of the mandatory connection to the gas and electricity network.¹⁰² This opens up, from environmental law, the possibility to for example self-supporting energy houses, or neighbourhoods without a connection to a public network. Municipalities will get, according to the explanatory memorandum the possibility to regulate the connection to the energy systems in their *Spatial Plan*.¹⁰³

It should be noted that connection to the electricity - and gas network is also regulated in energy law, and these laws have only partly changed (proposal on changing obligation on new gas connections, further discussed in challenge 6.2). As long as the current energy laws are unchanged on this point, the legal possibilities for municipalities on this topic are limited.

Experiment provisions

The new Environmental Act does include an experiment provision, which allows derogations from the Electricity Act, Heat Act and the Environmental Act.¹⁰⁴

6.1.4. No climate obligation for municipalities

Dutch provinces and municipalities are announcing ambitious climate goals: *Amsterdam and Rotterdam free from natural gas in 2050, Province of Utrecht energy neutral in 2040, Groningen energy neutral 2035 and many more*. Even though climate ambitions are relatively easy to formulate, it is far more difficult to put in practice.

In a complex environment as the city, municipalities are faced with a wide range of interests that need to be safeguarded/protected. In balancing all these interests, climate goals can easily be forgotten or under pressure.

In spite of the new instruments that the new Environmental Act provides, the new regulations might also cause confusion. New instruments, like ordering provisions, are not always clearly explained and formulations in the law are often very wide and open; as a result, municipalities might be hesitating to use these new instruments. Obligating municipalities to integrate the energy transition, energy infrastructure and climate goals in spatial planning would prevent municipalities from making plans that will not contribute to the national objectives. The Council for Environment and Infrastructure recommends that the climate goals will be laid down in law.¹⁰⁵

¹⁰¹ In a letter from the minister of Infrastructure and Environment this topic was addressed, Dutch Parliament document: Kamerstukken II 2016/17, 33 962, 190, question nr. 12 and 44.

¹⁰² Article 6.10 Building Act 2012 will be repealed.

¹⁰³ Nota van Toelichting -Algemeen-Besluit Bouwwerken Leefomgeving-1 juli 2016, p. 28.

¹⁰⁴ There are no derogations from the Gas Act.

¹⁰⁵ Rli, Rijk zonder CO2. Naar een duurzame energievoorziening in 2050, Rli, Den Haag, 2015, p.8., and; Van der Linden, 2016, p. 9.

6.1.5. Conclusion

The new Environmental Act provides the municipality with improved instruments to plan the development of sustainable energy supply, infrastructure and energy efficiency. By letting go of the ‘good spatial planning’-principle and introducing the ‘physical environment’- principle, administrative bodies are allowed to set quality demands. Energy efficiency rules, like the quality of the energy infrastructure, now can be incorporated in spatial planning.

However, the question remains if there is enough expertise in municipalities to plan and facilitate this transition and whether they will know how to make ‘good’ use of these new instruments. The legislator does not always provide clear guidance on these new topics.

It should also be noted that the new Environmental Act does not force provinces or municipalities to formulate and execute local energy policies.

Finally, it should be stressed that the new law, does not sufficiently enough consider barriers experienced in other laws, like the Gas Act, Electricity Act, Heat Act, but also as we will see in challenge 7.1 in the Building Act.

6.1.6. Recommendations

The legislator could provide municipalities with clearer guidelines on the use of the new instruments.

According to the Dutch national government, municipalities play a central role in the energy transition. It is therefore necessary and appropriate to further anchor this role in legislation by making climate and the climate goals a mandatory element in the use of the municipalities’ instruments.

Today many municipalities are formulating goals and visions on climate, and especially energy use. To put flesh and bone to these ambitions, municipalities have several (new) instruments they could use (plan, program). We recommend that municipalities use these instruments to plan sustainable developments in good time, so they will get a clearer overview of the barriers ahead and the effort that is needed to comply with their, often high, ambitions.

Also, the new Environmental code, including the decrees, are providing the local government with more tools to design the local energy system, but unfortunately there are still barriers in other laws that are impeding these new powers. Contradictory legislation must be identified and harmonized.

6.2. CHALLENGE: PHASING OUT THE EXISTING GAS NETWORK IN THE NETHERLANDS

6.2.1. Introduction

In the Netherlands 80% of energy consumed in the city is used for space heating, and domestic hot water. In the Netherlands natural gas currently provides 93% of our heat demand.¹⁰⁶To comply with our climate commitments, the Netherlands will need to find sustainable heating sources and, as a result of this, the government has expressed to phase out, part of, the existing gas infrastructure.

This challenge will only address the issues for phasing out the gas network. Even though phasing out the current heating source will most likely run parallel with introducing (new) alternative heat sources, like district heating or all-electric alternatives, their particular legal challenges will be addressed in the next challenge.

¹⁰⁶ *Kamerstukken II 2016/17 34723, 3*

6.2.2. Laws and regulations

Connection of end-users to the grid

The current legal system is based on a nationwide gas grid.¹⁰⁷ The Gas Act regulates that all small end-users have the right to be connected to the grid. This is laid down in the obligation to connect every household to the grid that wishes to be connected to the grid (article 10, led 6 Gas Act). The Gas Act defines two exceptions to this rule: the household is placed in a so-called 'Heat District', or in a rural area where a gas network would be unprofitable (article 12b, section 1 Gas Act). *Heat Districts* are either existing built areas connected to district heating, or new areas, which fall under a *Heat-Plan* (Warmteplan) adopted by the municipality (article 6.10 section 3 Building Act). District heating legislation will be discussed in the next challenge. In June 2017 the Minister of Economic Affairs announced that article 10, led 6 Gas Act will be changed soon, to avoid that homeowners of new houses will demand a gas connection. Under the current framework such a demand can only be refused on two grounds. Firstly, the obligation to connect small end-users to the grid is regulated in the Building Act.¹⁰⁸ The Building Act maintains a connection distance of 40 meters to the grid. When the connecting distance is more than 40 meters, or the costs are higher than the equivalent of a connection at 40 meter, the grid operator is excused of his duty to connect the household requesting a connection.

Second, the Code Division Territory on Gas (Code Gebiedsindeling Gas), article 4.2, states that there is an exception to the obligation to connect, if the connection is part of a heat district, unless the end user was not connected to the heat system, in that case the obligation to connect is again applicable.¹⁰⁹ There is neither an obligation to connect households outside urban areas, if the length of the new network is longer than what would be acceptable.¹¹⁰ It can be concluded that the legal framework on the duty to connect is imprecise. In general, there will be an obligation for the network operator to connect, except in heat districts and sparsely populated areas.

In the new Environmental Act and the Decree Building and Living environment the obligatory connection to electricity, gas or heat will be abolished. Municipalities can include rules on the connection to both the electricity-, gas- and heating network in a Plan.¹¹¹ This means that houses do no longer have to have an electricity or gas (heat) connection.

Termination of the connection by the end-user

End-users can terminate their connection agreement with the network operator. Termination of the contract will typically be done by closing and sealing of the connection, and not by physically removing the connection. Removing gas lines is costly. If the termination of the connection agreement goes hand in hand with the switch to an alternative heat supply, for example the

¹⁰⁷ *This challenge is largely based on research done by the Amsterdam Centre for Energy (UvA) on District Heating in Amsterdam: Onderzoek naar gas- en warmtenetten, june 2016 by Sanne Akerboom, Fons Van der Linden, Frits Otte and Simone Pront, and the UCWOSL at Utrecht University.*

¹⁰⁸ *Article 6.10 Building Act 2012*

¹⁰⁹ *The District heating network operator has in view of the capacity of the heat source a limited number of connections he has to facilitate. Beyond this agreed number of connections, the operator of the district heating network is not obligated to connect new end-users. An end-user which is not connected to district heating can request the gas network operators to connect to the gas network.*

¹¹⁰ *What can be defined as 'acceptable' will be depending on the area.*

¹¹¹ *Nota van Toelichting Besluit Bouwwerken leefomgeving, p. 52*

connection to a district heating network or a heat pump, the question will rise whether the network operator will need to maintain the connection.

The termination of the connection in existing housing by the network operator is not regulated in the Gas Act and Codes, except from temporary shutting off the supply due to non-payment.

6.2.3. Retrofitting

Several demonstration projects, including City-zen retrofit projects, are experimenting with existing homes changing from natural gas heating to an alternative heat source. Examples of these projects are done by housing associations that are developing together with the building industry 'nearly-zero-energy-housing', which is a house with a zero net energy consumption.¹¹² Such a switch in heat source is today only possible with the consent of the homeowner, in this case the housing association, which is also asking for the consent of their tenants.

6.2.4. New housing

The obligation on the network operator to connect new built areas to the gas network has been a major political topic the last year.¹¹³ It was discussed in relation to the New Energy Act 'Current' (*STROOM*), which was rejected by the Senate in 2015, and the follow up shorter Act: *Wet voortgang energietransitie*, which led to so much disagreements that the execution is put on ice until the next government is installed. The discussion around abandoning the obligation for new buildings to connect to gas did not cease, especially after a report that showed that the coming 5 years around 150.000 new homes would be connected to the gas network.¹¹⁴ As a result of the on-going discussions and the report, the Minister felt pushed to change the law on this point. In January 2018 the parliament voted for a new legislative package that abandons the obligatory connection to gas for new housing. The new law forbids the connection of new buildings, unless it is the common interest, which can be that there is no (economically) feasible alternative.¹¹⁵

Where before municipalities could only avoid new gas connections by making a heat plan, they will now have the opportunity to choose other forms of infrastructure/(all-electric) heat sources as an alternative.

Phasing out existing gas networks will demand a more thorough considerations of all interests involved, according to the Ministry.¹¹⁶ This will be further discussed over the next couple of challenges.

6.2.5. Financial challenges of removing a gas network

Phasing out existing infrastructure creates a couple of major (financial) challenges.

¹¹² This means that the total amount of energy used on an annual basis is compensated by the total amount of energy produced.

¹¹³ *Energierapport: Transitie naar Duurzaam, Ministerie van Economische Zaken, januari 2016, p. 9*

¹¹⁴ *Onderzoek aardgasloze nieuwbouwwijken, Natuur & Milieu, mei 2017*

¹¹⁵ *Kmst I 2017-18, 34 627, nr. A: Wijziging van de elektriciteitswet 1998 en de Gaswet (Voortgang energietransitie), article 10 led 6 a Gas Act.*

¹¹⁶ *Kamerstukken II 2016/17 34 550 XIII, 55 and Kamerstukken II 2016/17 31 510, 66*

Economic lifetime of the gas network

The network operator emphasizes that the most cost optimal way to phase out a network is to start with the networks that are in need of renovation. A gas network has a recovery period of 50 years and given the long economic lifespan of the system, it is unavoidable that investments (replacement or renovation) in an existing gas network today, can result in infrastructure costs that will not be recovered before 2050. Avoiding such investments in existing, but also in new infrastructure, will minimize extra costs.

Avoiding double investments: role of the municipality

Municipalities are in charge of planning, housing associations and other homeowners are in charge of retrofitting, and the network operator is in charge of the grid. To prevent double investments, both in buildings and in infrastructure, it is very important that all these stakeholders work closely together and know at what time different construction works are needed and planned. The municipality, in charge of city planning should play a coordinating role here. They have the power and responsibility to carefully plan changes in our environment.

A good example of such clear planning and good cooperation of the local government, network operator, and building owners (housing associations and VVE's) is found in the Amsterdam Vision *To a City without Gas*¹¹⁷. The Amsterdam municipality is closely working together with the network operator and the housing associations to phase out networks and retrofit buildings, trying to align with natural renovation moments for all stakeholders involved. The next step will be to include these ambitions in a plan and develop programmes for each area (given that the existing regulatory barriers will be removed in the near future).

An example to illustrate the consequences of bad planning is found in the district Presikhaaf in Arnhem. Shortly after finishing renovation works on the network in this existing neighbourhood, the housing association decided that all houses would be renovated to all-electric/nearly zero energy housing. The investments that Alliander (DNO) did in this area will not be paid back by the households in that neighbourhood. Instead the remaining connected households (all other households connected to the Alliander network) will have to pay back this loss, which is estimated at 650.000 EUR.¹¹⁸

The same applies to an area where the heat supplier installs a heat system and homeowners apply for a derogation and install all electric solutions (see also challenge 6.3)

Fair distribution of costs

Finally, the process of disconnecting is challenging because this increases the financial pressure on the remaining connections. As a result of this trend, there will be fewer connections to the gas network. In the Netherlands the costs for the network are 'socialized', this means that all those connected, pay for the combined network costs. Since the number of connections will fall, the network costs will be divided over a lower number of connected users, consequently the connection costs can become unreasonably high for the remaining connected end-users. It is therefore desirable that the legislator designs a framework that allows phasing out the existing gas network and assures a fair distribution of the involved costs.

¹¹⁷ *Naar een stad zonder aardgas, Strategie voor de verduurzaming van de warmtevoorziening in de gebouwde omgeving, 7 november 2016.*

¹¹⁸ Nul op de Meter-plannen? Betrek de netbeheerder! Stroomversnelling, 21 april 2016

6.2.6. Coordination between housing and infrastructure

The coherence between infrastructure and buildings brings along many challenges: organisational, financial, legal and social.

The example above on avoiding ‘no regret’ investments already refers to the importance of cooperation between building and network owners. Many of the Dutch houses cannot be easily heated by all electric heat sources/solutions. This is often due to bad insulation of the building stock in many of the inner cities. District heating could be an alternative, but brings along large infrastructural challenges, which are again even more challenging in dense cities.¹¹⁹ Phasing out gas will only be possible if the houses that will be disconnected are ‘prepared’, meaning better insulated, for an alternative heat source, if not the new heating solution might not heat sufficiently.

Coordinating this transition is challenging because:

- Homeowners and grid owners might have different renovation plans: *when* and *how* the renovation is carried out
- Upgrading buildings, depends on the financial willingness and possibilities of the owner
- Coordinating building upgrades of a street or a whole neighbourhood, involves dealing with many individual homeowners. Retrofitting a street with social housing is, in that perspective, much easier than a street with individual homeowners¹²⁰
- There is no legal framework for coordinating changes on individual, street or neighbourhood level
- Not only the legal framework for phasing out existing gas networks does not exist, there is hardly any regulations on retrofitting existing housing either. This will be further discussed in challenge 7.1

6.2.7. Conclusion

It may be concluded that a large-scale transformation of the energy system is complex, especially when infrastructures as networks are concerned. In the Netherlands, the discussion has only started; legal and financial measures are not yet in place and will be explored in the years to come.

Under the current legal framework removing a gas network can only take place with the consent of all those that are connected. The obligation for network operators to connect new buildings to the network has been abolished in the proposal to change article 10 of the Gas Act, but only if this area is designated by the municipality for an alternative heating source.

In the transition to a sustainable energy system, Dutch municipalities get more and more responsibilities. An example is the recent proposed adjustment in the Gas Act, in which the municipality will get the authority to plan another/sustainable heat source. Expanding the responsibilities and competence of the local government is good news for municipalities that are keen on developing a sustainable municipality. However, they do not have any legal obligation to

¹¹⁹ *Leaving out that (future) sustainable district heating sources might not reach the same temperature as today's sources. Housing connected to district heating will, most probably, need to become energy efficient as well.*

¹²⁰ *In the Netherlands, the social housing associations have been selling parts of their housing stock over the last decades. Many social housing blocks today are partly rented and partly owner-occupied housing.*

support such a development, meaning; in all municipalities that do not actively prevent the roll out of new gas networks, new networks will be developed.

6.2.8. Recommendations

Given the limited time at hand, 33 years before the 2050-targets, an integrated approach on how to phase out existing gas networks is needed. This entails at least that each local government will plan the energy system together with the network operators and help building owners to contribute to optimal decision making and preventing double investments. Also an evaluation of all relevant laws involved is needed, especially the relation between infrastructure planning and building regulations.

Positive development is that the obligation to connect new buildings is abandoned and that the tendency regarding the current framework, to either choose for gas or district heating, is changing into a framework supporting also other heat sources.

At the same time the changes are still conservative. Given the ambitions laid down in the Paris Agreements and the goal to have a fossil fuel free environment, it is remarkable that municipalities are still given so much freedom to decide whether or not a new gas network will be rolled out. According to our findings a 'no natural gas, unless'-rule, would be more appropriate and hence demand of all municipalities to find alternative heating for new developed housing. The law could provide municipalities with a limited derogation of this obligation, if they can sufficiently justify that no other heat sources are (economically, physically, technically) available. This could also contribute to increase the awareness around future development on this topic and stimulate municipalities to find alternatives. The new built environment, which is much less complex than the existing built environment, would be a good learning opportunity to prepare municipalities to become more proactive on this topic.

The legislator will need to take into account that phasing out an existing gas network does not only include spatial planning measures, but also will have a direct effect on buildings and with that intervene with the homeowners' rights and wishes. We underline the statement of the Minister that phasing out existing gas infrastructure will demand thorough considerations of all interests *and laws* involved.

In summary, we recommend that the Dutch central government provides clearer guidance to municipalities, specifically when they are faced with the decision on how to deal with their natural gas infrastructure: More and clearer obligations related to phasing out of natural gas should be issued to guide their decision-making. This is especially important when it comes to considerations about new connections or overhauls of existing (parts of a) network(s).

6.3. CHALLENGE: EXPANDING THE DISTRICT HEATING NETWORK IN THE NETHERLANDS/AMSTERDAM

6.3.1. Introduction

In Amsterdam, like in most cities in the Netherlands, gas is the main energy source for heating. One of the measures of Amsterdam city to achieve its climate ambitions is to abolish all gas consumption by 2050.¹²¹ To provide citizens with an alternative, the city plans i.e. to expand the district heating

¹²¹ *Uitwerking samenwerkingsafspraken HA, AFW en Gemeente Amsterdam, mei 2016.*

network.¹²² The aim is to grow from the current +/- 62.000 connected households to 230.000 connections in 2040. That means that not only new housing, but also existing housing will need to be connected to district heating. Question is how the city can soundly manage the expansion of the district heating network in both new and existing areas and which legal instruments are available?

District heating can only be an alternative to gas heating, if the sources will become sustainable. Today the existing connections are heated with heat from waste incineration, and residual heat from coal and gas fired heat plants. The transition to sustainable heat, will most probably have an impact on the temperature of the heat delivered, since the temperature of many renewable sources is lower, and so the need to have better insulated buildings increases proportionally.¹²³

In the next paragraph we will look into the current regulations governing district heating.

6.3.2. Laws and regulations

District heating is regulated in the Building Act, Heat Act, and partly in the gas legislation. Both the Building Act and Heat Act are currently renewed. The Heat Act defines a distribution network for heat, or district heating as a *network system that transports warm water for heating and the warm water supply of buildings*.¹²⁴

6.3.3. Gas vs. district heating

The previous challenge discussed that the right to be connected to the gas network disappears when the area is or will get a heat network.¹²⁵ To determine whether or not there is a district heating network that fits this definition, there are three criteria:

- There is a *Heat-Plan*, drawn up by the municipality, as described in article 1.1, first led, of the Building Act.
- There is no gas installation in the building, article 9.2, led 10, Building Act or,
- It is designated as heat district in the annex to the Decree; which is essentially a list of older existing heat areas.

6.3.4. Heat Plan

The *Heat-Plan* is a decision from the city council on the construction of a district heating network in a given area. The plan should include: a defined area of the system, the number of connections and the degree of energy efficiency and environmental protection that is achieved in connecting to the district heating system.¹²⁶ Furthermore, the *Heat-Plan* should include an 'equivalence test' (or *gelijkwaardigheidstoets*), meaning that an equal alternative heat source should be tested against the particular district heating system on its degree of energy efficiency and the protection of the

¹²² *Agenda duurzaam, Gemeente Amsterdam, March 2015, p. 14.*

¹²³ *For a critical analysis on the role of district heating in enhancing a more sustainable heat supply: Toon Buiting, Hoe duurzaam is stadsverwarming? Energie+, nr. 1 March 2017*

¹²⁴ *Article 1 c, Heat Act (Warmtenet) and Gelijkwaardigheid in warmteplannen, H.M. Israels en W.P.C. Mans, NTvE, nr. 5/6 december 2014, p. 202*

¹²⁵ *Besluit Gebiedindeling Gas, January 2015 and Article 1 c, Heat Act*

¹²⁶ *Stb. 2013, 75, article 1 Building Act: Warmteplan*

environment.¹²⁷ The legislative historic points highlight the importance of a clear description of the performance of the system, to allow for a viable equivalence test (see also the next paragraph).¹²⁸

There is no obligation to make a *Heat-Plan*, but if municipalities would like to ensure that all new buildings will get a connection to the district heating system, such a plan is required.

Since the regulations around district heating and the obligation to connect households have undergone many changes and are still changing (new Heat Act, Environmental Act and proposed changes in the Gas and Electricity Act), a number of municipalities have gotten confused about which instrument to use for obligating end-users to connect to district heating. There are still municipalities using municipal laws, abolished in 2012, or even private agreements to oblige connection to the district heating network. To avoid that end-users in those areas might claim a connection to the gas network, municipalities are advised to make a *Heat-Plan*. Amsterdam published a draft of their first *Heat-Plan* before the summer of 2016.¹²⁹

6.3.5. The equivalence test

Households that prefer an alternative heating source can call upon the ‘equivalence’ article. The *Heat-Plan* needs to contain an ‘equivalence test’ that allows end-users to use another heat source than that laid down in the *Heat-Plan*. The alternative solution must at least be equal on:

- Energy efficiency, and
- Protection of the environment.

There are little guidelines for municipalities to formulate this equivalence test, except that it should contain these two elements and no other conditions can be imposed. The definition as laid down in law, gives the municipality the discretionary power to define the degree of energy efficiency and protection of the environment. In such a test, many factors can be taken into account: heat production and consumption, electricity production and consumption; on the building, in the area etc.¹³⁰ Depending on the factors that will be included in the definition, it will be more easy or difficult to get alternative solutions/sources qualified as ‘equivalent’.

The heat source will have an impact on the degree of protection of the environment and therefore it should, for example, be easier to find an alternative to heat coming from a fossil fuel based source, than from a geothermic source. The same counts for the energy efficiency of the system.

The obligation to connect to district heating and the scope of the derogation from this obligation will not only depend on the calculated factors (generation and consumption on- and around the building), but also on the heat source and efficiency of the district heating system.

The municipality has to decide how they weigh the importance of freedom of choice on one hand and the optimal CO₂-reduction on the other hand.

Question is if the equivalence test could also incorporate the advantages of using existing infrastructure and the downside of the impact of all electric solutions on the network. Such financial factors might fall outside the scope of efficiency and environment, but are relevant considerations in

¹²⁷ Article 1.3 section 3 Building Act

¹²⁸ Explanatory memorandum by article 1.3 section 3 Building Act 2012

¹²⁹ Warmteplan Centruemiland IJbrug, may 2016, Projectnummer 1235157

¹³⁰ H.M. Israels en W.P.C. Mans, *Gelijkwaardigheid in warmteplannen*, NTvE, nr. 5/6 december 2014, p. 202

the deployment of a sustainable and affordable energy infrastructure.¹³¹ Derogations have, after all, a negative impact on the business case of the district heating system.

Either way, a clear and well-formulated equivalence test at best could allow end-users to make a decision that contributes to all these aspects: CO₂-reduction, optimal use of existing infrastructure, efficiency, optimized use of the asset over its lifespan, bringing down average consumer costs and freedom of choice for end-users.

6.3.6. Existing housing

The city of Amsterdam has the ambition to grow from 62.000 district heating connections now to 230.00 connections in 2040. To comply with this ambition many existing houses need to get a connection to the/a district heating network.

So far, we have seen that only new buildings in a heat-district are obligated to connect to district heating.¹³² Connection to district heating of existing housing in a heat area is done voluntarily.¹³³ Under the current legal framework there are no legal obligations to connect existing housing to district heating and the obligation to connect to district heating in a *Heat-Plan* will only apply to new housing. To increase the number of connections in existing housing the municipality or heat distributor will need to convince people of connecting. This also applies to renovation projects.

Not only on a national level the use of district heating is stimulated: also in the European EPBD, national governments are encouraged to make use of district heating. Article 7 of the EPBD motivates member states to stimulate changing to high efficiency alternative heating in relation to buildings undergoing major renovations. An incentive in the form of a subsidy might help municipalities to convince people to change to district heating.

At the same time many of the sources used in large district heating systems are not necessarily fully sustainable, like heat from waste incineration, residual heat from coal-plants. Development of the district heating should go hand in hand with enhancing the sustainability of the sources. The sustainability of waste incineration and biomass are questionable and under debate in the Netherlands. In the future some of these sources (waste, residual heat from coal-plants) will also decrease, e.g. because of realizing the circular economy and phasing out fossil fuel based electricity plants. Amsterdam today is for a large part heated with heat from waste incineration.

If the sources cannot be changed to more sustainable alternatives the expansion of the district heating system can cause a similar 'lock in' as the gas network does today.

6.3.7. New laws

The draft of the new Decree of Building and Living Environment abandons the national rules on the connection of buildings on electricity-, gas- and heat infrastructure. Municipalities will get the freedom to organize the heat infrastructure in a *plan*¹³⁴.

¹³¹ *Phasing out the gas network, extending district heating networks and electricity networks should be assessed cohesively, Wetsvoorstel Herziening Warmtewet, MvT, p. 2*

¹³² *Article 6.10 Building act*

¹³³ *This leads to area's where there is both gas and heat infrastructure. Maintaining both infrastructures could be costly.*

¹³⁴ *Ontwerpbesluit Bouwerken Leefomgeving, Nota van Toelichting van 1 juli 2016, p.28 en Artikelgewijs, p. 51*

The *Heat-Plan*, the relatively new legal instrument, also disappeared in the draft of the new Decree. The 'equivalence test' will continue to exist, though the specific test for district heating is also abolished. What remains is the general test, article 4.7 of the Environmental Act, that will inquire if the alternative measure will reach and ensure the same level of safety, protection of health and the environment, and will be a practical/ usable solution. This is a much wider definition of 'equal' than the current test as laid down for district heating.

The draft of the new Heat Act, which was published this summer, neither regulates the connection of existing housing to district heating.¹³⁵ The proposed changes will however, change the obligation to connect to the gas network for new housing.

6.3.8. Financial challenges

District heating involves heavy and expensive infrastructure. Such a system only pays off if a large number of houses in the same area connect to the system. Similar financial challenges are experienced in the roll out of a cold-network (challenge 6.5). To individually convince homeowners to connect to district heating will probably not be financially feasible. The obligation to connect and a strict timeslot will be needed to make it financially feasible to roll out a district heating network in the existing built environment. Housing associations that own a larger number of houses in an area close to the district heating system might be an interesting first expansion possibility.

Another challenge in developing more district heating networks, is the division of costs. In principle, these should be equally shared among connected consumers, provided that the resulting costs for heat provision can withstand the 'equivalence test'. If the equivalence test shows that other, more environmentally sustainable and financially attractive (lower cost) options are available, people cannot be forced to accept a connection and the related costs.

Finally, a district heating system eventually will need to be 100 % sustainable, see the paragraph above. Question is if there will be sufficient sources for sustainable heat to supply so many connections. City-zen roadmap exercises in Amsterdam (9-12/10/2017) indicate that the heat and electricity needs are so high that energy efficiency will remain a fundamental and substantial pillar of the sustainable energy equation. This further increases the need of coordination between building interventions on the one hand (e.g. retrofit) and energy infrastructure interventions on the other hand.

6.3.9. Conclusion

Municipalities can, under the current framework, make a *Heat-Plan* and secure the connection of new buildings to the district heating network. Exception to this rule is the end-users that will find an alternative solution that can qualify as 'equivalent'. Municipalities have a discretionary power to fill in the two tests of (1) the environmental protection and (2) the energy-efficiency.

Municipalities are encouraged by EU regulation to use measures to stimulate the switch from gas to district heating. There are, however, no legal instruments for municipalities to oblige connection of existing housing to the district heating network under the current Dutch framework. Municipalities can try to convince people to voluntarily connect to the system.

The new Decree on Building and Living Environment, does abandon the *Heat-Plan*, and in doing so; the specific 'equality test' as laid down in the current Building Act. As a result, all provisions will fall

¹³⁵ Wetsvoorstel Herziening Warmtewet, Memorie van Toelichting van 17 augustus 2016.

under the more general equality definition of article 4.7 Environmental Act. This article might give municipalities an even larger degree of discretionary power.

6.3.10. Recommendations

Formulating a clear and well-functioning 'equivalence' definition is complex. Question is if the protection of both the environment, energy efficiency and the interests of end-users will be ensured by article 4.7. The national legislator could provide lower governments with guidelines on this topic.

More generally, again an integrated approach on switching from one heat source and infrastructure to another is missing. National government will need to provide a legal framework and guide local governments in this transition.

An evaluation of the (future) sustainable sources available is needed, before expanding and building a district heating system. Today's system in Amsterdam is based on relatively unsustainable sources which can not be qualified as CO₂-neutral. On the other hand as long as we have waste, burning waste is a relatively clean way to heat housing. The application of high temperature heat from waste incineration, will also be discussed in challenge 6.6

6.4. CHALLENGE: DENSIFYING EXISTING DISTRICT HEATING NETWORK IN GRENOBLE

6.4.1. Introduction

To implement the roadmap and extend the district heating network with the connection of 25.000 additional households, Grenoble-Alpes Métropole assesses the possibility to use the classification procedure. The classification of the heating network implies a mandatory connection to the district heating networks of both new housing and existing buildings (when an existing building is undertaking renovation works).¹³⁶

6.4.2. French national law and regulation

The heat networks classification procedure has been a legal instrument since 1980;¹³⁷ recently the law has been changed. Before, article 5 of the law No 80-531, enabled local authorities or groups of local authorities to apply for the classification of an existing- or new- heat network on its territory.¹³⁸ The regional prefect (representation of the national government at regional level) was responsible for final decision on the application of the classification procedure and a public inquiry was required before validation of the classification procedure.

Over the years, the classification procedure has proved to be extremely difficult to implement due to the complexity of administrative procedures. Between 1980 and 2010, only one French network was classified, the town of Fresnes in 2006, after five years of debate.

Due to the complexity of the procedure an adjustment is made. The Grenelle 2 law simplifies the classification procedure and facilitates its implementation by local authorities. The main changes introduced by the Grenelle 2 law are:

- The classification is now the responsibility of the municipality, not of the prefect.

¹³⁶ Articles L712-1 to L712-5 of the Code of energy

¹³⁷ Law No 80-531 of 15 July 1980 relating to energy savings and use heat distribution

¹³⁸ Article L.1413-1 of the general code of local authorities

- The public inquiry is not anymore mandatory.
- Introduction of heat metering obligations issued to each heat connection point.

Detailed rules related to the classification procedures have been published in the Decree No 2012-394 of 23 March 2012. Although the requirements to implement the classification procedure have been simplified, it remains an unpopular and complex procedure, and only one city¹³⁹ has classified its network since the publication of the decree in 2012.

6.4.3. Conditions and procedure

The network classification is a decision of the local authority, but it should request for validation of the national authority by providing detailed information on the technical and financial audit of the networks, outlooks of development of the network, as well as all the details on classification conditions (duration; identification of priority development areas; pricing, etc.).

To be eligible to the classification procedure, the law sets three major conditions¹⁴⁰. The network has to meet the followings conditions:

- The network must be powered by at least 50% of renewable or recovery energy (e.g. waste incineration).
- All heat delivery points (substation) are equipped with energy meters
- The network (production and distribution) is financially balanced

In addition, the local authority must obtain the opinion of the advisory commission on local public services, prior to the classification decision.¹⁴¹ It is also recommended to consult representatives of the users of the network, citizens, to involve them in the decision process.

Within the area covered by the district heating network, priority development areas have to be defined. Thus any new building or major renovation concerned by the conditions detailed in the next paragraph, have the obligation to be connected to the network. Priority development areas are not limited to undeveloped areas, but can also incorporate already existing urbanized areas, where connecting buildings that previously used other heating systems could densify the heating network.

6.4.4. Obligations and derogations of the classification procedure

Buildings subject to the obligation are:

- New building: if the demand for building permit was filed after the classification decision.
- Extension or elevation of an existing building: more than 150sqm or 30% of the existing surface.
- Renovation: improvement of the energy performance of an existing building in line with the thermal regulation for existing buildings¹⁴².
- Replacement of the heating system, if the power exceeds 30 kW (i.e. more than one dwelling).

¹³⁹ *Rillieux-la-Pape in December 2013*

¹⁴⁰ *Décret n° 2012-394, 23th of March 2012*

¹⁴¹ *Article L.1413-1 of the general code of local authorities*

¹⁴² *Articles R131-25 and R131-26 of the Construction and Housing Code*

Specific derogations allow building owners subjected to the classification obligation, not to connect their building if it meets the following conditions¹⁴³:

- It is supplied by local renewable energy for at least 50% of its heat demand.
- It presents technical requirements for the heat demand that are incompatible with those of the network (ex. temperature regime).
- It cannot be connected to the district heating network on time (considering the constraints of the building owners).
- It cannot benefit from the connecting fees stipulated in the classification procedure.

6.4.5. Classification procedure: mandatory connection to the grid

Pros of the classification procedure

For the local authority, the classification of the network has many advantages. Firstly it is a very effective energy-planning tool that allows the municipality to coordinate energy policies with the urban development plan, and, the territorial climate energy plan. Secondly, the development of heat networks requires high and long-term investments; the classification helps the local authority to ensure the economic balance of its district heating network. It also optimises overall investments in energy networks by avoiding competition between networks (i.e. to have gas and heat networks in parallel in the same street). Last but not least, since the classification procedure ensures a high density of buildings connected to the network, it benefits to the end-users by lowering the energy costs.

Cons of the classification procedure

However, the classification procedure is quite an unpopular measure as it is going against the liberty of choice of citizens, even if it is for a good reason. The classification procedure is directed primarily to private properties (condominiums) and can be perceived as interference of the local authority in the management of their property.

For those reasons, most of French local authorities prefer not to go for a classification procedure and to use other possibilities to support the connection to the heating network, such as:

- Obligation of the connection to heat network for new construction in urban operation on landsides owned by the municipality.
- Partnerships with social housing companies and public buildings.

6.4.6. Objectives of La Métro and energy roadmap for the district heating network

As part of the Task 2 of WP4, La Métro made a comparative analysis of several energy transition scenarios for 2030, including specific objectives for district heating networks. The scenario selected as part of La Métro Energy Roadmap, includes a maximisation of the thermal density of existing networks. It leads to a stabilization of the energy supplied by the main district heating network by connecting a large number of additional buildings (new and existing) to offset the decline in the heat needs of current customers (as a consequence of energy performance policies).¹⁴⁴

¹⁴³ Décret n° 2012-394, 23th of March 2012

¹⁴⁴ Cf. Grenoble Energy Roadmap (to be published in Dec. 2018 on Cityzen website)

Expanding and densifying the district heating network appears to be the best economic and environmental optimum for Grenoble because:

- It is an optimum regarding the “global cost” criteria (sum of operating costs and investment of all the actors of the territory for the supply of this scenario).
- This scenario of densification of the existing network in dense areas allows the best price for heat supply.
- It leads to a rate of renewable and recovery energies of 70%, and reduces the CO₂-content of heat from 150 kg / MWh to 60 Kg/ MWh by 2030.
- This scenario implies a reduction of the annual emission of greenhouse gases of 70 000 tons of CO₂.

Investments by 2030 for this scenario are estimated at 70 million EUR on renewable heat production systems and 86 million EUR for the development and densification of the network.

6.4.7. Conclusion and Recommendations

In order to achieve economic optimization, an increase in the thermal density of the district heating network is essential: in the immediate vicinity of the network, existing buildings using a different heating system should be converted and connected to the networks.

As a result of the present analysis on the classification procedure, La Métro has decided to classify the network as part of its energy transition roadmap. However, the classification procedure is only possible if the heating network remains a competitive heating mode compared to other energies, which requires controlling the cost of district heating while ensuring a level of investment allowing densification.

Next steps include specifying priority development areas over which connection to the district heating network will be mandatory (at the property section scale), fine-tuning connection rules and fees as well as specifying derogation clauses.

6.5. CHALLENGE: COMFORT-COOLING IN THE AMSTERDAM HOUTHAVENS

6.5.1. Introduction

AEB and Westpoort Warmte (WPW) developed a surface water regeneration plant and a district-cooling network in the Houthaven area. The goal is to chill new built homes, offices and schools during the summertime and avoid the use of traditional cooling sources, such as individual air conditioners.

The cooling is extracted from surface water of the IJ-river in Amsterdam, through an ATEs (Aquifer thermal energy storage). During the wintertime cold is stored in the ATEs, and distributed to the buildings during summer.

Today, the market for cold supply, compared to heat, is relatively small in the Netherlands.¹⁴⁵ A small part of the cold supply is delivered through a cold network. Amsterdam has the highest number of

¹⁴⁵ Nevertheless, individual air conditioners are successfully offered by all major DIY-stores.

networks, namely 25.¹⁴⁶ The comfort-cooling network is the first cooling network delivering sustainable cooling to households in Amsterdam.



Figure 6-1 Houthaven district

6.5.2. Obligatory connection

Together with builders, developers, network operators and other stakeholders the Amsterdam municipality agreed that the new to develop Houthaven area would be 100 % climate-neutral. The comfort-cooling network is an element in the ambition to develop a climate neutral neighbourhood.

Every house or lot that is sold is by contract obliged to have a connection to the district heating and the cold network. The obligation to purchase heat is a common obligation. This means that those households connected to district heating do not have the right to be connected to the gas network.¹⁴⁷ The obligation to connect to a cold network is not common.

The Heat Act objective is to protect the ‘captive’ end-user, mainly by regulating the heat tariffs. The Building Act regulates the obligation to connect to district heating and guarantees all households the freedom to provide an alternative equal solution, as discussed in paragraph 6.3.5 Unlike heating, which is governed by the Heat-Act and the Building Act, supplying cold alone is not regulated yet. In the proposal for the new Heat Act, cold tariffs are only regulated if the cold is ‘inseparably linked to the supply of heat’, like in a thermal energy storage system (mostly sub-soil). In the Netherlands other cold sources are not regulated because if the cold is not connected to the heat system it is not described as a primary need like heat and connection to such a system is assumed to be voluntary.¹⁴⁸

In this specific project the municipality decided that all households were obligated to connect to the cold system. Since cold is not regulated yet, the municipality treated - and continues to treat - cold as if it is heat. The obligation to connect to both district heating and the cold network was based on the municipal building code. In future the municipality will most likely use a heat plan, or under the new law an environmental plan¹⁴⁹, to plan the cold network. Since cold does not fall under the (new and

¹⁴⁶ *Evaluatie Warmtewet en toekomstig marktontwerp, Ecorys, in opdracht van het ministerie van Economische Zaken, Rotterdam, februari 2016, p. 36*

¹⁴⁷ *There is a derogation from the obligation to connect to the district-heating network.*

¹⁴⁸ *Explanatory memorandum to the revised Heat Act: Kamerstukken II 2016-17, 34723, 3*

¹⁴⁹ *Decree on Building and Living Environment, Nota van Toelichting algemeen, Ontwerpbesluit Bouwwerken Leefomgeving, 1 juli 2016, p. 41*

current) Heat Act, or the current Building Act, question remains what the legal basis is for the obligatory connection as exercised by the municipality.

The general principle in public law is that the municipality acts on the basis of legal power (principle of legality). The principle of legality demands that if a government intervention has a far-reaching impact that there is a legal basis for this intervention in a parliamentary Act (formele wet). An intervention has a far-reaching impact when *citizens are more or less obligated or forced to do or not do something*.¹⁵⁰ Laying down an obligation in a *communal* regulation might not be sufficient.¹⁵¹

The basis for communal regulations is based on article 147 and 149 of the Communal Act. It is also questionable if the mandatory connection to a cold network falls within the authority of the municipality.¹⁵²

The legal basis to lay down such obligations in a private land-lease agreement can also be discussed. Assuming that there is no public legal basis¹⁵³, this does not mean that the municipality can or cannot lay down this obligation in an individual lease agreement. The intention of the legislator is in this respect decisive.¹⁵⁴

The recent legal history shows that the legislator assumes that the connection to a cold network is voluntary and that the cold-consumer is not qualified as a captive-customer, as is the case with end-users connected to the district-heating network.¹⁵⁵ The legislator therefore does not provide a regulatory framework for this type of cold-consumers.

Given the current discussion regarding the new Heat Act, it could be concluded that the municipality obliging end-users to connect to a cold system and pay a yearly, unregulated, fee, is not in line with

¹⁵⁰ F.J. van Ommeren in *AB Klassiek, Standaarduitspraken bestuursrecht, onder redactie van T. Bakhuyzen et.al, Deventer: Wolters Kluwer 2016, p. 201-2016, p.54 and ECLI:NL:HR:1973:AD2208*

¹⁵¹ *An important premise of Heat Act is the effective legal protection of small consumers. As with the Electricity Act 1998 and the Gas Act, the Heat Act also contains rules that further elaborate on the prohibition of abuse of an economic dominant position contained in the Competition Act. Explanatory memorandum to the Heat Act: Kamerstukken II 2002-2003, 29048, 3*

¹⁵² *The scope of the authority to make communal regulations is limited to what is called in Dutch the 'housekeeping' of the municipality. That means that they can only regulate issues that fall within this domain. The scope of housekeeping is limited by the so-called 'low-limit', which addresses the limit between the public and the non-public sphere (private). The authority to regulate topics in communal regulations is also limited by the so-called 'upper-limit', which means that the municipality can only make rules to the extent to which higher governments allow the municipality to make agreements. In this particular case, the far-reaching consequence in the personal domain and on the other hand the legislator that regulates the heat tariffs to protect the bound end user in the Heat Act, are indications that this obligation does not fall within the governing authority of the municipality and the scope of article 147 and 149 Communal Act.*

Read for more information about the authority of the City Counsel, prof. mr. A.H.M. Dölle en prof. mr. D.J. Elzinga, Handboek van het Nederlandse gemeenterecht, Deventer: Wolters Kluwer, 2004, p. 171-187

¹⁵³ *If there is a public ground, and the municipality has been granted powers for the protection of certain interests, it is assumed to serve these interests in principle through public law (tweewegenleer) H.Ph. J.A.M Hennekens in AB Klassiek, Standaarduitspraken bestuursrecht, onder redactie van T. Bakhuyzen et.al, Wolters Kluwer Deventer 2016, p. 201-216*

¹⁵⁴ *Hennekens 2016, p. 201-2016*

¹⁵⁵ *Explanatory memorandum to the revised Heat Act: Kamerstukken II 2016/17, 34723, 3*

the intention of the national legislator. However, it must also be said that Amsterdam decided to connect all these houses even before the first Heat Act entered into force.

The comfort-cooling project triggers many questions in relation to the organisation and regulation of households connected to a cold network. Since this is the first project to supply households it also exposes the existing legal gap. The Amsterdam municipality is eager to explore how they can expand these types of cold networks in the new build environment and it is therefore strongly recommended that the legislator clarifies the position of cold networks.

6.5.3. Business case

Obliging all households to purchase cold makes a secure business case for WPW. This project was possible because of the annual fixed fees of 161 EUR per household, which covers the operational costs, and the connection fee of approximately 3.000 EUR per connection, which covers almost all the network and production costs.¹⁵⁶ AEB often includes a profit margin between 10 and 15 %. The total costs per household are relatively low when compared to costs for heating, whose annual fixed fees are ca 450 EUR. And there is a GJ price of ca 21 EUR for heat. Household use ca 20-25 GJ annually. The use of cold is approximately 2 GJ per year. Due to the low use there are no meters. The connection fee for a thermal energy storage system, delivering cold and heat, is similar to comfort cooling in combination with district heating (heat and cold together around 8.000 EUR).

In general, these types of projects need a large amount of connections¹⁵⁷ to cover the high infrastructural costs; such a network is – according to the developer – only possible in new built areas. So far, in the Houthavens over 600 households have been connected to the system and a total of 3.000 houses will be connected over the next couple of years. Costs are based on a fully developed system of 3.000 connections (for more information consult the business model canvas, Appendix III)

6.5.4. Energy efficiency

Avoiding the use of traditional cooling has a positive effect on the building's CO2 footprint. This is also reflected in the EPC¹⁵⁸. Systems such as this sustainable cooling network, with a connection to the building, will result in a lower EPC.¹⁵⁹

Since many households in the Netherlands do not use traditional coolers, it is difficult to establish how much CO2 reductions can be attributed to this system. Considering the increase of summer temperatures in the Netherlands and that new housing has a higher cold demand due to high insulation requirements, CO2 reductions, compared to traditional coolers should not be underestimated.

6.5.5. Challenges

Even though the project appears to have a successful business case and a well-functioning product, AEB and WPW are experiencing a restrictive attitude from stakeholders (builders, housing

¹⁵⁶ *There is no fee for the amount of cold used. Reason is that the source is plenty, and there are no additional costs if habitants use more.*

¹⁵⁷ *A business case can be made for comfort cooling with a minimum of 100 connecting households.*

¹⁵⁸ *Energy performance coefficient (EPC) is an index indicating the energetic efficiency of new buildings.*

¹⁵⁹ *Energieprestatienorm voor maatregelen op gebiedsniveau (EMG) Area measures can be included in the calculation of the energy performance of a building. Examples of such Area measures can be windmills, district heating or delivery of external cold. (NVN 7125)*

associations, municipalities) towards the further development of cooling networks. The Netherlands has no culture for using coolers, mainly because the cold demand in residential standard (poorly insulated) housing has always been low. Since comfort cooling is a new product, potential customers might not consider comfort cooling as long as it is not part of the obligatory heat package. Especially for the lower segment of the housing market the extra 3.000 EUR per connection weights heavily on the budget of for example social housing developers.

As already mentioned above, the success of such a project for the investor/developer depends strongly upon the amount of connections. It is not feasible to convince each potential customer of the net benefits of such a connection. Since the connection fee is still relatively high for low-income housing, WPW suggests that a (obligatory) rollout would be more appropriate in the high-end (residential) market.

6.5.6. Conclusion

Comfort cooling with surface water in the Houthaven project in Amsterdam is a relatively new sustainable solution to serve the cooling demand in houses. Connection costs are significant (3.000 EUR per connection), in contrast with the standard annual fee (161 EUR).

In the underlying project all households are obliged to connect. The developer of this system expresses that a voluntary connection would be unfeasible, because the infrastructure is relatively expensive and the projects economy depends on the certainty of a large number of connections.

The legal basis for mandatory connection of new housing is unclear.

The project in the Houthaven area has been an opportunity to evaluate the experiences of homeowners with comfort cooling. One result is that the Amsterdam municipality is evaluating increasing the amount of cooling connections in new built areas.

6.5.7. Recommendations

The current and also the new Heat Act do not regulate the cold-tariffs of these types of cooling systems and the Building Act does not regulate a mandatory connection for certain areas. Regulating this market is recommended. If the end-user is obliged to connect to the network, regulated prices are needed.

Obliging households to pay for a connection and a product is a strong instrument, known now for essential services like electricity and heat or gas. However, due to increasing insulation requirement and predicted increase of summer temperatures, the product could be very valuable and even necessary in making buildings more comfortable during summertime and preventing the use of polluting classical cooling units.

This product would certainly be interesting in other regions with at present already a higher cold demand.

6.6. CHALLENGE: DEVELOPMENT OF INNOVATIVE INSTALLATIONS IN AMSTERDAM -CASE OF THE BIO-REFINERY-

6.6.1. Introduction: Bio-refinery

In the new built area of Buiksloterham, a post-industrial site, Waternet, the public water company, will build a bio-refinery. This is a small-scale wastewater treatment plant at the central part of a New Sanitation System. This has been designed to maximize the recuperation of energy and nutrients

from the wastewater on a neighbourhood level, and to substitute a traditional centralized large-scale wastewater treatment plant.

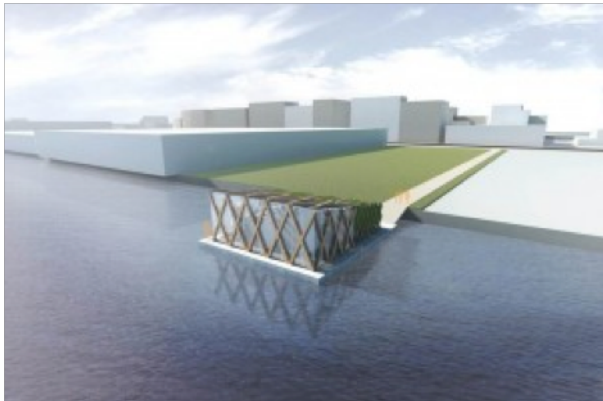


Figure 6-2 The Bio-refinery in Buiksloterham

6.6.2. Project

The plant will separate grey (water from showers, washing machines etc.) and black (faeces, urine, organic waste) -water; the latter is used to recover phosphate and biogas.

In traditional wastewater treatment, raw materials get lost. By separating the black water on site, valuable materials like phosphate, can be recovered.

Currently the grey wastewater stream will not be collected and treated locally yet, but the Buiksloterham system has the potential to do so in a later stage. For now, it will still be collected via a traditional sewer system. A local grey water treatment unit would facilitate the recycling of water and heat.

6.6.3. Challenges

The project has and is experiencing many challenges. The main challenges are:

- The project is new and involves essential elements of housing, namely the plumbing systems (and possible insulation and low temperature heating). Housing associations and local governments are reluctant to allow new housing to connect to such a new system, because of the high connection costs, the vacuum toilets and the fear that the system will have a negative impact on the value of the dwelling.
- The Netherlands struggle with a high surplus of phosphate from animal manure and in addition, produce a large amount of chemical fertilizers. Therefore the market for natural phosphate and nitrogen from sewage water in the Netherlands is economically not promising at the moment. On top of that, there are legal limitations that are discussed in paragraph 6.6.7.
- Supplying heat is a new activity for the public water company and it is uncertain if it should engage in a project that may compete with current heat suppliers of district heating.¹⁶⁰

¹⁶⁰ Suppliers of district heating: the public company AEB and the private company Nuon. In the north-west of Amsterdam these two companies co-operate in the joint venture 'Westpoort Warmte'.

- Many of the (financial) risks lie with Waternet

6.6.4. Project process

Finding common ground in the development of the bio-refinery has been a challenge for Waternet. The process is strongly marked by lack of knowledge and experience (even if the process is well-known), risk aversion and transaction costs. Initiating a new sewage system brings along many uncertain factors, like: will the bio-refinery technically perform to the expected standards? How do new houses connect to such a system? What impact will the system have on urban planning and the value of the connected houses?

These uncertainties were translated into several preconditions set by the Amsterdam municipality, like:

- Only a limited number of houses are allowed to connect to the system
- The plant would only recover black water. Low-temperature heat can be recovered from grey water, but the municipality chose to connect the houses to a planned district heating network.¹⁶¹
- The municipality is reluctant to provide the bio-refinery with a building lot. The result is that the refinery will be floating on the water and be movable, which is, in the end, a suitable solution for the plant according to Waternet.
- The bio-refinery can be disconnected for an undefined period if needed because of construction work or soil research in respect to soil pollution. These measures have already started.
- The housing association's main condition is that if the sanitation plant does not function well, all houses will be connected to a traditional system. Fortunately a traditional sewage system was already in place in this area. In addition, Waternet had to give of a guarantee on the system, including the system inside the apartments to the housing association.

Given all the conditions by the municipality and the housing association it can be concluded that almost all (commercial, technical and legal) risks lie with Waternet.

Despite of all the reservations, the Amsterdam municipality has the ambition to further integrate alternative, sustainable and also low temperature heat sources in especially the new built areas.

6.6.5. Business case general

Costs

Appendix II includes the business case of a comprehensive new sanitation system. Investment costs are substantially higher for a local sanitation bio-refinery, 21 million towards 14 million for a traditional system. On the other hand, the operating costs are much higher for a traditional system. Overall, this results in a lower total cost of ownership (TCO) for the new sanitation plant in comparison to a traditional plant. The total cost over an evaluation period of 50 years is around 62 MEUR for the new sanitation plant compared to 86 MEUR for a traditional plant; the cost savings on the TCO over this period thus amount to 27%.

Heat recovery has an important impact on the TCO of a local sanitation bio-refinery. The relatively high investment costs are earned back with the production and sales of heat.

¹⁶¹ For more information about the obligation to connect to district heating, read challenge 6.3

Benefits

The key resources included in the business model are: the recovery of heat, biogas and raw materials: phosphate. Other benefits like savings on drinking water and CO₂-emissions have not (yet) been included in the calculations.

6.6.6. Business case bio-refinery Buiksloterham

Low temperature heat vs. district heating

In the Buiksloterham bio-refinery the municipality does not allow heat recovery yet¹⁶², mainly because of two reasons:

- A high temperature district heating system was planned¹⁶³
- As already mentioned above, the municipality finds the risk too high and first wants to develop best practice experience.

Local government could decide to make room for this type of heating. A heat plan could allow for both: housing heated by (biogas and grey water from) a bio-refinery and district heating. Blocking the use of alternative heating could result in destroying the business case of the bio-refinery. A plan should take into account the environmental benefits of alternative sources. In relation to the climate targets, it is desirable that larger DH-networks allow for feed-in from alternative heat sources, if possible. This will allow the large-scale DH network foreseen in Amsterdam, to become really sustainable in the long term. It is likely that this will also involve increasing supply from lower temperature sustainable heat sources, especially in the new built, well insulated, houses.

The second argument of the municipality is that they first want to develop best practice experience before connecting households. The municipality is working on the development of suitable conditions for such a system. Buiksloterham might be a very adequate location for building up such experience, since there is a strong alternative heat source available, namely district heating, and a traditional sewage system.

CO₂-pricing/tax

The TCO based on a 50-year evaluation period does not include a CO₂-price. A higher energy price/tax will have a positive effect on the business case of the new sanitation plant. CO₂-emissions are expected to be 40% less with a new sanitation plant compared to a traditional plant: from 765 to 450 ton CO₂/year in an area with 1300 dwellings.¹⁶⁴

No direct financial benefits for customers

In Buiksloterham, the housing associations decide whether tenants will be connected to this system. For private homeowners¹⁶⁵, there are additional costs involved, in comparison to a traditional

¹⁶² *It is possible that this will change later on. The system is equipped to do so.*

¹⁶³ *At the time of planning the Buiksloterham area (2007-2009), the city had agreements with WpW to connect all households in the Northern area of Amsterdam. The obligation to connect was laid down in the Bouwverordening Amsterdam 2003 (City building code). Bestemmingsplan Buiksloterham, onderdeel III toelichting, van 16 december 2009.*

¹⁶⁴ *In Buiksloterham there will be 30 to 50% less connections.*

¹⁶⁵ *The housing associations also pay for the additional cost, though in this project the additional costs of the housing association are covered by the City-zen subsidy. The final users of the system -the renters- are not bearing these costs.*

system. These customers for example, will need to install vacuum toilets, which are more expensive. In addition, they will be more vulnerable to possible failure of a system, which is still in its early stages of development.

The sewage tariffs in Amsterdam are socialized, which means that all households will pay the same tariff, independent of the actual costs of the specific part of the system. In the future, when the teething troubles of the bio-refinery are over, the disadvantages for households connected to the bio-refinery toward those connected to a traditional system might need to be compensated to make such a new system more attractive than the traditional one. If the energy produced by the system can be recovered, the system will be financially more attractive for households than a traditional system and could compensate for the higher initial investment costs (toilets etc.).

The advantages that homeowners already are experiencing today are the benefits of saving drinking water. This is estimated to be around 30 % per household.¹⁶⁶

6.6.7. Legal barriers

The use of phosphates out of sewage water in agriculture is forbidden in the Netherlands, with the exception of phosphorus in the form of struvite, which is tolerated.¹⁶⁷ The ban is a result of both European (the sewage sludge directive)¹⁶⁸ and national legislation (Environmental management Act)¹⁶⁹, that wants to prevent soil contamination.¹⁷⁰

On both national and European level the value of these materials for our soil is studied and evaluations are made to see how these legal barriers could be overcome.

6.6.8. Conclusion

A persistent public water company that was willing to invest in an economically unattractive project makes the project possible. The project is financially interesting on paper, but – because of the lack of cooperation by other stakeholders – at this moment only possible if parties are willing to take various risks and losses.

Even though the willingness and the ambition to develop such a front-runner project is shared by all parties involved, priorities of the stakeholders can differ. Municipalities might focus on developing new housing, while tender projects, like the new sanitation, can slow down these ambitions.

Better cooperation, and transparency on these goals, could have limited these risks. In this specific project, better planning would also have improved the projects business case.

There are still many conditions for such projects to become undeniably financially attractive, but that are currently unaccounted of such as: no CO₂-price or tax, long-term interests insufficiently taken into account.

¹⁶⁶ *An average household with two people uses 93 m³ of water per year, which costs around 175,-EUR. Each two-person household, will save approximately 52,- EUR a year.*

¹⁶⁷ *Buyers take a certain risk to invest in a product that is not fully legalized yet.*

¹⁶⁸ *86 / 278 /EC: COUNCIL DIRECTIVE of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.*

¹⁶⁹ *Wet Milieubeheer. Stb. 1979, 442*

¹⁷⁰ *For an in-depth analysis; J. IJzerman et al., Perspectieven en knelpunten van zuiveringslib voor bodemkundig gebruik, STOWA 2014.*

6.6.9. **Recommendations**

Raw materials

A very clear legal challenge is the fact that specifically the phosphates, nitrogen and potassium from human sewage water cannot be re-used as fertilizer. This needs to be reconsidered from a realistic environmental and public health perspective, especially considering the asymmetric current build-up of phosphates and nitrates in our environment.¹⁷¹

Clear ambitions and priorities of parties involved

The local governments should be more pro-actively supporting front-runner projects if these projects prove to have important potential for solving local/global sustainability issues. They can do this by accepting certain risks, or helping / supporting to eliminate them.

Legal instruments

The municipality should exercise its legal powers. It is particularly the role of the local government to use the instruments available, see challenge 6.1 In case the municipality chooses to support a sustainable tender, the next step for municipalities is to incorporate their ambitions in a Plan. Especially in newly built areas it would be recommended to include such an installation in the Plan for this area, rather than adjusting the existing Plan through a permit procedure. Integrating goals and ambitions in an early stage in a Plan will allow all stakeholders to make the challenges of the project visible and to limit the project risks. Delaying this step will lead to unnecessary uncertainties and possibly a lack of physical space. (Local) governments, are the competent authority of spatial planning and have a key role in preventing such uncertainties.

Low temperature vs. district heating

Today (almost) only new build houses are connected to the district heating network. New houses are very well insulated and are very suitable for low temperature heat sources, like heat recovery from wastewater, while the available high temperature heat sources should preferably be reserved for areas with older buildings like the UNESCO protected city centre, where building insulation measures are difficult and/or expensive to apply and high temperatures for heating remain necessary.

Moreover in the future the available high temperature heat might become scarce, because today's district heating is largely based on waste burning and fossil fuels, and renewable high temperature sources might be limited. Further investigating the needs of different types of housing and possibilities of the different sources and the optimal deployment of these sources is needed, in particular taking into account the future reduced availability of high temperature heat. This requires city-wide energy planning.

CO₂

Finally and again, this project suffers from low CO₂-costs. The project's business case and chances of successful development could increase dramatically if more traditional and less-sustainable approaches and technologies, are faced with increasing costs to compensate for their environmental impact.

¹⁷¹ Rockström, et al. *Planetary boundaries:exploring the safe operating space for humanity. Ecology and Society* 14(2) 2009

6.7. CHALLENGE: MAKING OPTIMAL USE OF LOCAL RESOURCES IN AMSTERDAM

6.7.1. Introduction

Within the City-zen project there is a prominent place for both heat and cold projects, either by extracting it from existing pipelines or surface waters.

In this challenge we will look into the possibilities and challenges for cold- and heat-projects connected to pipelines.

The City-zen project has contributed to three different cold and heat projects connected to water and sewage pipes, only one project has been realized, the other two projects were terminated in earlier stages, both for different reasons.

6.7.2. Heating with sewage water

Waternet the public sewage and drinking water company in Amsterdam installed a new sewage pipeline in the business district of Amsterdam, *the Amsterdam Zuid-As*.¹⁷² A part of the pipeline was made ready to install, in a later stage, a heat exchanger. The objective was to extract heat from the pipeline and supply thermal energy storage (TES) systems on site with the extra heat.

Unfortunately Waternet could not find a customer for the heat. The reason that Waternet could not find a suitable customer is twofold: there is no real need for additional heat in most of the office buildings. The existing systems produce both heat and cold and the operators voiced that they have a relatively high cold demand¹⁷³, so the system had no need for additional heat. The second argument is that it might be perceived as too complex for the TES managers/operators to feed in additional heat to the system. They were insecure about how the extra heat would affect the TES. Even though the registration of extra heat to the system is relatively simple, the operators were reluctant in allowing this.

Despite the investments made to prepare for the installation of a heat exchanger, the project was cancelled. So far, no alternative customers or sites have been found. Finding a suitable location and customer depends both on the size of the pipeline, the presence of a TES close to the line and the needs and willingness of the customer in that specific location. In a context of still abundantly available low price fossil resources, it is challenging to find a customer and location that fits these criteria.

6.7.3. Cooling with drinking water: Schiphol

A similar project was developed at Schiphol Airport. Cold extracted from the raw untreated water supply system would be used to cool Schiphol. Initially Schiphol received the project positively, in a later stage many arguments were found to terminate the initiative.

The following challenges were identified:

- The cold delivered by Waternet was not as cold as from traditional coolers. A simple solution to overcome this temperature difference is to use additional coolers to chill the cold a couple of degrees extra.

¹⁷² This was running parallel with the construction of new offices.

¹⁷³ Office buildings have a higher cold demand than heat demand. In housing this is the opposite.

- Schiphol was not fully aware of their own capacity and the cold- demand. After an evaluation of the installed capacity and demand, Schiphol concluded that there was no need for additional cold.
- Schiphol has private contracts with many third parties, which it supplies with cold, like hotels etc. Buying in cold from Waternet might mean that some of these contracts needed to be renegotiated and possibly, installations needed to be adjusted.

During the project development the management team in charge of the project at Schiphol was changed. Where the first team was focusing on the positive sides of the project, the overall attitude of the new team was more cautious. The above arguments were profound enough for the new team at Schiphol to call off the project.

- The project never explored if there were substantial additional costs involved to reduce the difference in temperature of the cold delivered.
- For a long period the overall business case was unclear, including essential aspects like cold demand. As a result, the mutual expectations were ambiguous.
- The business model changed from a 30-year period to a 10-year period. As a result the focus shifted from the environmental aspects to the financial aspects. With a smaller timeframe the relatively high investments costs of a sustainable system had a negative impact on the business case. Using a 30-year timeframe the TCO of sustainable cooling would have had a much better outcome than the traditional, more polluting, coolers.

The fact that the new management of Schiphol had a different view of the project (particularly considering a much shorter payback period), appears to have been the main reason that this project was stopped. Also, it proved to be very difficult – or ultimately impossible – to fully align the views of the large amount of stakeholders that needed to be involved in this project.

6.7.4. Cooling with drinking water: Sanquin

After the project with Schiphol was terminated, Waternet looked at other potential customers along the pipeline and found Sanquin. Sanquin uses large amounts of cold in its pharmaceutical processes and needed to change out some of their traditional coolers, but was also very keen on reducing their CO₂-footprint. They proved to be a good partner for Waternet to develop this project. According to both parties, this is also due to the fact that both (non-commercial) parties were willing to be fully transparent about their respective business cases for this project. This helped to bring trust and understanding between the two parties involved.



Figure 6-3 Sanquin blood bank

During cold periods in winter, the temperature of drinking water drops. As a result households use more energy to heat up their water and the cold water in pipelines also chills the house in winter. From the viewpoint of energy saving, this is undesirable. This creates an abundance of cold energy that can be extracted and either used directly in Sanquin's pharmaceutical processes or stored in an underground storage facility (a so-called aquifer thermal energy storage: ATEs)

Because of the extraction of cold, the temperature of the drinking water will rise slightly and contribute in citizens using less energy on heating water.

In summer, no cold can be extracted, because of higher temperatures of the drinking water. Cold stored in the ATEs, is used in the summer months.

Successful elements in this project are:

- The project is a cooperation between two (non-profit) organizations/foundations that are mutually transparent about their respective business cases.
- A successful business case: The total cost of ownership is lower for this type of cooling than for traditional cooling. The projects involve large investment cost, but relatively low operational costs. This means that parties need to be willing to enter into a long-term agreement or commitment, to recover the investment.
- Geographically Sanquin had the right distance to the pipeline
- Both Waternet and Sanquin were keen on using a more sustainable cold source.

A challenge in the project is that water temperatures can vary. Waternet will have to guarantee a certain supply and can therefore most likely not connect other customers to the pipeline. Since both parties are non-profit organizations, the aim is to minimally make a break-even business case.

For a more extensive description of the business case, see the appendix: business model canvas Waternet-Sanquin.

6.7.5. Conclusion

Using heat or cold from drinking water pipelines is technically relatively simple, but geographically limited to costumers at little distance to the pipelines. Also, the pipeline should have a sufficient capacity to be able to extract cold or heat. Furthermore, most of the systems require a form of seasonal storage, like an ATEs to be able to bridge times that cold is available (in winter) to when cold is needed (in summer). This is a large-scale system and therefore a matching customer is needed, which would often result in supplying a larger customer or a group of smaller customers.

Looking at the three different projects, we can conclude that the success of a project depends largely on geographic factors and the willingness of the parties involved to explore new techniques, work with a transparent business case, engage in a long-term commitment and the involved parties' willingness to value (not necessarily in monetary value) a project's benefits in terms of sustainability.

Major success factor was that both parties were willing to openly discuss their costs, benefits and overall business case with each other. This allowed them to really develop a win-win project.

The open discussion about business cases was largely possible due to the fact that both parties are non-commercial parties with a primary obligation to serve society's best interests.

6.7.6. Recommendations

To strengthen the business case of sustainable cooling, using traditional (unsustainable) cooling should be made financially less attractive. Under the current conditions, this is not the case due to a lack of i.e. tax incentives and malfunctioning of the EU-ETS system.

Projects like the cooperation between Waternet and Sanquin should be used as a role model and a possibility for all water companies to develop this (new) product.

In order to have the market taking up such projects, at least transparency and completeness in business cases should be offered, total cost of ownership considered on the mid- or long term and trust between contracting partners secured. Public actors may, by setting examples to follow, help in establishing these new practices.

6.8. OVERALL CONCLUSION AND RECOMMENDATIONS CHAPTER 6

6.8.1. District heating: France and the Netherlands

Amsterdam has a natural gas network and is exploring the legal and financial possibilities to facilitate phasing out the gas network. The Netherlands has a nationwide gas network and end-users are largely depending on natural gas to heat up their homes. Because of this historic dependency on natural gas, the current legal framework is still impeding phasing out the network.

France with its more 'occasional' gas networks, on the other hand, does not have similar legal challenges. However, Grenoble does have another heating source challenge with replacing fuel oil-fired systems.

The common challenge is finding alternative heating. Both Amsterdam and Grenoble pin their hopes on district heating as one of the viable alternatives. Another challenge is how to enlarge the district heating network and at the same time ensure and facilitate other front-runner initiatives, like all electric solutions.

6.8.2. Heat plans

In Grenoble, La Métro evaluates using the *classification procedure*; a tool, which will enable Grenoble to oblige, in a defined area, new and renovated housing to connect to the district heating network. Derogation from the obligation is possible if the end-user provides a more energy-efficient heat solution.

A similar tool exists in the Netherlands. Municipalities can make a *heat plan* for a defined area and obligate all new buildings in that area to connect to district heating. In a similar vein as for Grenoble, a heat plan includes a derogation from this obligations; namely an alternative that is as efficient and environmentally friendly as the district heating network-option. The main difference between the French and Dutch tool seems to be the ability to also oblige buildings that are renovated to connect to the DH network. This is only possible with the French tool.

Both in Amsterdam and in Grenoble, the municipalities voice that too strict obligations on end-users, could have a negative effect on rolling out the district heating network. Another effect of too strict connection-policies is that it could impede other sustainable heating alternatives.

6.8.3. Sustainable heating

For Grenoble to be able to use the classification procedure the heat sources used will have to be powered by 50 % or more renewable sources or recovery heat. In Grenoble currently 60 % of heat comes from renewable sources, which are biogas and recovery heat from waste burning.

In Amsterdam the larger heating systems are based on waste incineration and residual heat from coal and a gas fired power plants.

To reach the climate ambitions of both cities, the heating networks will over time need to connect to 100%-sustainable heat sources. Both Amsterdam and Grenoble should carefully evaluate if these sources are available and prevent creating a new 'lock in' by expanding district heating.

6.8.4. Overall conclusion and recommendation chapter 6

In the Netherlands the role and responsibilities of local authorities in the energy transition are recently enhanced and strengthened in new legislation. One such example is the New Environmental Act and the Decree on Building and Living environment that will enter into force in 2019. The new act enlarges the freedom for the local authorities to make project tailored decisions, going away from the current more standardized and harmonized building regulations.

The increased flexibility and freedom of policy, allows municipalities to impact the energy transition on many levels and topics, such as infrastructure and sustainable energy production. At the same time there is a need for embedding this role and the climate goals further in legislation for two reasons. Firstly, active governments still lack some of the proper tools to execute their ambitious sustainable policy plans. Secondly, unwilling or incapable municipalities are not forced to adopt any policy regarding sustainability.

Downside of enlarging the local governments instruments and competences on so many levels is that the new tools can be experienced as unclear. Furthermore, a flexible system can also lead to legal uncertainty for both citizens and other market players. Lastly, the question of sufficient competence at the local government will need to be raised. The Dutch framework presumes and demands high competence of local governments in planning and governing the energy transition.

In Grenoble, La Métro also has a key role to play in the energy transition as well as on sustainable spatial planning as this is part of its jurisdiction since January 1st 2015. La Métro is currently working on its new local urban plan (PLUi) that aims at defining the rules for new buildings and retrofitting as well as new urbanized areas. In addition, an energy transition roadmap is developed. The main objectives of the energy roadmap will be laid down in the local urban plan, including setting-up energy performance objectives for new buildings, publication of priority development areas for the district heating networks and identification of the best location specific energy supply solutions in developing areas.

Furthermore, the municipality is studying how it can optimally use it's new accumulated legal tools to expand the district heating system.

Although innovative heating and cooling solutions come forward as both technically and economically feasible, they are often not taken up by the market. Reasons that can be identified are risk aversion and lack of proper knowledge and experience, lack of transparency and completeness of related business cases, preference for (very) short term investment horizons and lack of mutual trust in new business setups. Contraproductive or unclear legal settings may add to the problem. To break through these barriers and realise a real take up of innovations, solutions are needed that simultaneously address all of these bottlenecks in an integrative manner.

A proper CO₂-price would abolish the financial handicap sustainable setups have with regard to traditional, fossil fuel based solutions.

CHAPTER 7 – SUSTAINABLE HOUSING

In this chapter the challenges related to upgrading the energy efficiency and the use of sustainable energy sources are explored.

7.1. CHALLENGE: LEGAL CHALLENGES IN DEVELOPING A SUSTAINABLE HOUSING STOCK IN THE NETHERLANDS

Local government can have ambitions regarding upgrading the energy efficiency of the building stock, but to impose a sustainable transformation and renovation of existing housing in the Netherlands, is challenging.

7.1.1. Forbidden local ambitions

One of the City-zen renovation projects in Amsterdam concerns the transformation of a major office building into housing. The architect made an ambitious energy plan for the building, including renewable energy production on the building. Whether or not the sustainability goals in this project are met, is largely depending on the developer's wishes. The municipality lacks the legal instruments to obligate the developer to achieve a high-energy efficiency goal. The energy efficiency requirements for such projects, transformation –renovation- of an existing building, are significantly lower than the level required for new housing. In this project there are technically no constraints to renovate towards stricter requirements.

Renovations and transformations are a major opportunity to upgrade the energy efficiency of a building. In this challenge we will look at laws governing renovations and transformations. What energy efficiency demands are made on renovations, how do they differ from rules governing new buildings and which legal instruments do municipalities have to enforce energy efficiency measures on buildings?

7.1.2. Dutch laws and regulations

The Building Act 2012 regulates 'buildings', and includes a special paragraph on the energy efficiency of buildings. The Housing Act forms the basis for all building regulations. The Building Act determines three different levels of building:

- Existing housing; which is housing that is not being changed
- Rebuilding or renovation: defined as *fully or partly, changing or enlarging a building*¹⁷⁴
- New building: buildings that are going to be or are in the process of being built.

In this chapter, however, rebuilding will be defined as renovation, since this is the European term used in various directives.¹⁷⁵

¹⁷⁴ See article 1.12 led 1 Building Act 2012: and with this definition rebuilding is essentially equated with building (article 1 Housing Act)

Although the general rule in the Building Act is that both new buildings and renovation projects (or the part of the building that is renovated) fall under the requirements of new buildings,¹⁷⁶ in the energy efficiency paragraph most existing buildings will need to comply with the ‘legally acquired level’, except in case of major renovations.¹⁷⁷ That means that the general minimum level will be the quality that was required at the time of building or at the time of a renovation. This quality should not decrease.¹⁷⁸

As far as it concerns existing buildings that are not renovated, the building should be in accordance with the level of ‘existing building’. This is the lowest required level that a building should have in order to be allowed to ‘operate’ in its function.¹⁷⁹ Any obligations on existing housing which are renovated is restricted by article 4 of the Housing Act, which states that provisions regulating building, changing, enlarging only apply to the part of the building that is being ‘built’. Unchanged parts of the building cannot fall under the obligations.

The Building Act poses strict obligations on the energy efficiency of new housing, which is a direct implementation of the EPBD directive and will be further discussed in the next challenge. The Building Act obliges that all new housing in 2020 should be nearly zero energy housing. The measure of energy efficiency of buildings is translated in a so-called *energy performance coefficient* (EPC). In the Netherlands the EPC, since its introduction, has gradually gone down. By the end of 2020 it will be zero, which is comparable with nearly zero energy housing level.¹⁸⁰

Article 5.6 of the Building Act regulates the energy efficiency in relation to renovation.¹⁸¹ Which is also an implementation from the EPBD directive and regulates major renovations. In case of a major renovation, the Building Act provides solely extra requirements on the insulation value of the renovated part.¹⁸² In addition, the Building Act includes technical demands on the energy efficiency of the heating and cooling system, article 6.55.

¹⁷⁵ Article 2 section 10 EPBD

¹⁷⁶ *Nota van Toelichting, Dutch parliament document, Kamerstukken II 2010/11 32757, 10.1 verbouwen, see article 5.1 Building Act 2012*

¹⁷⁷ Article 1.1 Building Act 2012

¹⁷⁸ Article 5.6, states that the EPC demands laid down in article 5.2 are not applicable and for ventilation and insulation the legally required level is applicable, with one reservation on transformation a thermal resistance minimum of 1.3 m² •K/W, needs to be maintained.

¹⁷⁹ *Nota van toelichting article 1.12 Building Act, p. 23 and Transformatie en het bouwbesluit 2012, van het expertteam (kantoor-) transformatie, agentschap NL Ministerie van binnenlandse zaken en koninkrijksrelaties, november 2013*

¹⁸⁰ Article 5.2 and 5.1 Building Act: a EPC of 0.4 from 2015 to 0.0 by the end of 2020

¹⁸¹ Article 5.6 Building Act includes a couple of energy efficiency demands that are implementations of the EPBD directive: Article 4 and 7 of EPBD directive obliges minimum insulation requirements when changing out parts of the building envelope that have an important impact on the energy performance of the building like, floors, ceilings, windows etc. This means, for example, that one cannot replace single glass windows, with double glass windows. If the transformation relates to changing out an insulation layer extra minimum requirements are laid down. On extensions of the main building and dormer windows, the new building level is applicable on the insulation demands.

¹⁸² The directive does not specify in case of a major renovation, whether the energy performance of the whole building or just the part that is renovated needs to comply with the requirements.
<http://www.roadmap2050.eu/attachments/files/EnergySavings2020-FullReport.pdf>

The application of these rules results in a growing difference of energy performance requirements on new and existing housing. Today's requirements on new housing are, in the light of climate change, rapidly increasing. While existing housing is generally still governed by the building regulation at the time these buildings were built.

7.1.3. Housing Act

The importance of these provisions on energy efficiency in the Building Act need to be seen in relation to article 122 of the Housing Act. This article states that '*municipalities cannot perform legal acts under civil law regarding the topics that are regulated with regard to building and environmental law*'. If a municipality in a private agreement with the developer agrees to, for example, a higher EPC then mandatory by the Building Act, such a term is most likely to be void.¹⁸³

It is unclear if this also applies to voluntary commitments. Agreements made between parties based on equality, do not stand in the way of article 122. Since the municipality has often an intrinsic dominant position in respect to the other party, it is not easy to determine whether there is a voluntary commitment.¹⁸⁴

Today there are still local authorities that use private agreements to push developers in (re) developing housing with a higher energy performance than laid down in the Building Act. The enforcement of such agreements will be problematic and authorities are very much depending on the good intentions of the counterparty.

7.1.4. New Environmental law

As discussed in challenge 6.1 the new Environmental Act will bring some changes in relation to the current Building Act. The Decree Building Living Environment will replace the Building Act. There will be no remarkable changes in the energy efficiency chapters for both renovated and new buildings.¹⁸⁵ The limitation for municipalities to perform legal acts under civil law concerning building has so far also been part of the new legislative proposal and will continue to restrict the municipalities in demanding a higher energy performance of existing/ renovated buildings.¹⁸⁶

The most prominent difference between the Building Act and the new Decree is that municipalities will be allowed to demand a more ambitious energy performance in the form of a EPC for an area with new buildings, than the standard EPC as laid down in article 4.156 and 4.155.¹⁸⁷ The legislator did not include such an exception in the renovation chapter. The new proposal will improve the municipalities' instruments to impose higher energy efficiency demands on new buildings, but not on existing buildings.

¹⁸³ *A verdict from the Supreme Court shows that there is very little room for municipalities to make private agreements on this topic. HR 17 juni 2011, LJN: BQ1677*

¹⁸⁴ *M. Fokkema, Hoge Raad zet niet-duurzame relatie tussen artikel 122 woningwet en gebiedsontwikkeling verder onder druk, BR September 2011/9, p. 637*

¹⁸⁵ *Kamerstukken I 2015/16, 33118, C: Ontwerpbesluit Bouwwerken leefomgeving, p. 175.*

¹⁸⁶ *Article 23.6 Environmental Act*

¹⁸⁷ *Kamerstukken I 2015/16, 33118, C: Ontwerpbesluit Bouwwerken leefomgeving, p. 72*

7.1.5. Conclusion

The Building Act provides a high energy-performance level for new buildings. Renovation projects on the other hand, have to comply with a much lower standard. The current energy efficiency requirements set in the Building Act are not sufficient, especially in relation to major transformation projects, like the transformation of office towers to apartments. Bringing an existing building up to state of the art energy performance, is very complex and might be impossible both on technical and financial grounds. Fact remains that the difference between new building standard and the current renovation requirements vary widely and the current framework is limited in supporting to improve the energy performance of existing buildings.

The new Environmental Act and the Decree Building Living Environment do not change the demands on existing and renovated housing. Therefore municipalities cannot demand higher energy performance of a building than the requirements as already laid down in the current Building Act. However, the new Environmental Act will give municipalities the possibility to demand a higher EPC for new build areas. From 2020 all new buildings will need to be ‘nearly zero energy housing’ (referring to the aim that houses produce as much energy as they consume). This instrument will then, after 2020, only be used for developing housing that will go beyond zero; so called ‘plus housing’.

7.1.6. Recommendations

Improving existing housing is challenging, both on a technical, financial and legal level. Imposing changes on housing that will influence the financial situation of house owners (or renters, see challenge 7.7) is often experienced as undesirable. It can be disproportional, or as mentioned earlier, limited by the right of property, see challenge CHAPTER 6 – .

However, especially in relation to larger transformation projects higher legal demands or improved instruments for the municipality are desirable. An extension of article 122 Housing Act, or the new article 23.6 Environmental Act, to allow voluntary agreements between the municipality and a developer or buyer, proposed by professor Fokkema,¹⁸⁸ might be needed. This will provide municipalities with the possibility to legally enforce these agreements.

Another option would be to include a provision to enable local governments to impose higher energy performance demands on major renovation projects, like large transformation projects, than laid down in the Decree. Transformation projects have many similarities with new buildings, namely: there is no-one living in the building yet, most buildings are fully stripped and redone and new connections to energy systems will be installed. In the current housing market around big cities like Amsterdam; such stricter EPC demands are, given the current housing market, not expected to impede city development, except if there are technical barriers that would impede such demands. Enlarging the municipalities’ possibilities in relation to such projects would also be in line with legislation (Building Act 2003) before the financial crisis.¹⁸⁹ Therefore, with regard to energy efficiency of transformation projects, disregarding other building qualities/demands, and taking into account the current housing market, such demands could be feasible again and more appropriate. Besides from the existing insulation requirements the new Decree, in its current proposal, does not provide sufficient legal tools needed for local governments to actively improve the energy

¹⁸⁸ Fokkema 2011, p. 638

¹⁸⁹ Under the building act of 2003. See also *Transformatie Wijzer: van kantoor naar woonruimte. Perspectief, financiën en regelgeving*, Rotterdam: SBR, 2009.

performance of the existing housing stock, nor in allowing voluntary agreements and neither in creating a legal basis for challenging new city development in existing buildings, like in transformation projects.

7.2. CHALLENGE: UPGRADING THE EXISTING BUILDING STOCK

7.2.1. Introduction

By 2050 substantial increases in energy efficiency of the existing buildings stock must be realised In order to achieve this goal, huge investments are needed to retrofit the existing building stock. In this challenge we will look at the barriers impeding these investments for owner occupied housing. In the next challenge we will look into the legal and financial instruments available to improve the (rental) social housing sector.

In the Netherlands the premise is that homeowners pay for the retrofit themselves and that the government will assist with subsidies and cheap loans. Despite the various financial instruments, not enough houses are improved. What are the challenges involved in upgrading owner occupied housing?

We will discuss the regulation and financial schemes and close with the most important barriers.

7.2.2. Regulation relevant for retrofitting

In this chapter we will look at today's regulatory framework and see how this relates to the above described challenges.

EU building regulation

The European Directive on the Energy performance of Buildings (EPBD)¹⁹⁰ has been shortly discussed in chapter 2 and regulates the energy efficiency of buildings and regulates both new and existing buildings. Key elements in this directive are a common framework for the methodology for calculating the energy performance of a building, setting minimum energy performance requirements for both existing and new built buildings and a system for energy certification.¹⁹¹

New housing vs. existing housing

The EPBD includes high demands on new built housing. After 2018 and 2020 all public and private buildings respectively should be 'nearly zero energy' (with some exceptions). 'Nearly-zero energy housing' is: *a building that has a very high energy performance and requires a very low amount of energy which should be covered to a significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.*¹⁹²

Although the 'nearly-zero energy housing' article concerning new buildings does not mention very hard quantitative targets, the energy efficiency demands on existing housing, are even much less well defined. To improve existing housing, the directive lays down minimum energy performance obligations on specific renovations and major renovations. Major renovations are renovations where

¹⁹⁰ DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the energy performance of buildings (recast) (EPBD) (OJEU 2010, L153/13)

¹⁹¹ Article 1, EPBD

¹⁹² Article 2 section 2 EPBD

25 % of the building envelope undergoes renovation, or total cost of the renovation relating to the building envelope or technical building system is higher than 25% of the total value of the building.¹⁹³ There are also obligations on renovations in which elements of the building that form a part of the envelope that has a significant impact on the energy performance of the building, are traded off.¹⁹⁴

In case of a major renovation or a renovation of a significant element of the envelope, this need to be in accordance with the minimum energy requirements formulated in article 4, as far as this is technically, functionally and economically feasible.¹⁹⁵

To determine what this level of minimum energy requirements is, several factors need to be considered, such as the *cost-optimal level* (article 4 and 5). The *cost optimal level* is defined as the 'energy performance in kWh/m² that leads to the lowest costs during the buildings life cycle' (30 years for residential and 20 years for non-residential buildings).¹⁹⁶ Since the terminology is very generally formulated, Member States have the freedom to find a way to calculate this. Consequence is that the minimum energy requirements depend on a cost optimisation calculation that will be different in each Member State. This is on the one hand necessary to meet the different needs in each Member State, but on the other hand leads to diffused energy efficiency requirements for major renovations across the EU.

Even though the directive does not pose high-energy efficiency demands on existing housing, the directive explicitly sets minimum requirements, article 4 EPBD. Member States can impose higher demands as long as they are in accordance with the EC treaty.¹⁹⁷

Common aspects of national building codes

There are some Building code rules that apply in most (European) countries. The Inter-jurisdictional Regulatory Collaboration Committee (IRCC) found the following similarities¹⁹⁸

- Existing buildings, not under construction, are lawful if the building complies with the building code of the time the building was constructed
- This means that existing buildings will have to comply with the energy efficiency regulations of the time the building was constructed. A house from the 30's will need to comply with the energy efficiency regulations of the 30's.
- New codes only apply to alterations or additions on the building.
- Sometimes new codes apply to transformations of buildings, for example industry to housing.

¹⁹³ Article 2, section 10, and article 7 EPBD

¹⁹⁴ Article 7, EPBD

¹⁹⁵ Article 5, EPBD

¹⁹⁶ COM/2016/0464: Report from the commission to the European Parliament and the Council: Progress by Member States in reaching cost-optimal levels of minimum energy performance requirements

¹⁹⁷ article 5, of the EC Treaty

¹⁹⁸ Presentation by Bill Dodds IRCC, Oslo 20 may 2016: *Building Regulations for Existing Buildings; Innovations in building regulation and control for advancing sustainability in buildings (I) World SB 14 "Sustainable building: Results", 28-30 october 2014, Barcelona, Spain and Performance based Building Regulatory Systems: Principles and Experiences, edit. B.J. Beacham, IRCC report February 2010.*

Generally, countries regulate the energy efficiency of new buildings and set much lower demands on existing buildings. This conclusion is also in line with the European directive that only poses demands if it regards a major renovation. Regulation of existing buildings, especially in relation to energy efficiency, has been an important political topic in many countries. Translating energy efficiency targets for existing buildings into legislation has proven itself to be challenging, because buildings are about more than only energy efficiency. An example is that measures that could impact the energy efficiency could have an impact on the buildings climate, which has an impact on the users health. Changing existing buildings is also challenging because of the consequences for the building owners. There are many different types of buildings and many different types of owners, and they have varying needs and (financial) possibilities.

In the next paragraph we will look at examples of regulation that address different types of buildings and measures for existing buildings in Europe.

Energy performance regulation in the United Kingdom

In March 2015 the UK passed a law known as the Minimum Energy Efficiency Standard (MEES) that will oblige all private rented buildings, both domestic and non-domestic, to have a minimum energy efficiency label of E, by April 2018. The measure will be enforced not only with mutation, but also on the agreement renewal of existing leases after April 2018 and to all private rented homes by April 2020.¹⁹⁹ The legislation also includes provisions that will enable tenants to enforce energy efficiency measures by unwilling landlords.²⁰⁰

Reason to regulate this specific sector is to overcome the split incentive and inertia²⁰¹, which are the result of many issues. To begin, the specific sector has lower energy efficiency than other sectors; voluntary approaches, the existing regulation and subsidy programs often do not reach these properties/landlords.²⁰² Short tenancy lengths characterize private rented houses and tenants express to feel little ownership or responsibility towards the property.²⁰³ In addition, research showed that many of the landlords are not interested in investing in energy efficiency measures.²⁰⁴

Originally the policy ensured that there were no up-front installation costs and net costs for the landlord,²⁰⁵ because landlords could use Green Deal funding²⁰⁶ and tenants would pay back the investment through the energy bill. Since the Green Deal funding was terminated, this funding is not available any longer.²⁰⁷

¹⁹⁹ *Home energy efficiency and demand reduction, Report from the Committee on Energy and Climate change appointed by the house of commons, March 2016, chapter 2, § 12.*

²⁰⁰ *The Energy Efficiency (private Rented Property) (England and Wales) Regulation 2015*

²⁰¹ *Final Stage Impact Assessment for the Private Rented Sector Regulations by DECC, January 2015, p. 13*

²⁰² *DECC, March 2016, p. 7-9*

²⁰³ *DECC, March 2016, p. 9 and 11*

²⁰⁴ *Private Landlords Research, Energy Efficiency Partnership for Homes by Harris Interactive, in Final Stage Impact Assessment' DECC, March 2016, p. 13*

²⁰⁵ *Final Stage Impact Assessment for the Private Rented Sector Regulations, DECC, January 2015, p. 13*

²⁰⁶ *Green deal was a government policy that permitted loans for energy efficiency measures. The program was stopped in 2015. For more information see paragraph 7.2.6.*

²⁰⁷ *The non-domestic private rented property minimum, Guidance for landlords and enforcement authorities on the minimum level of energy efficiency required to let non-domestic property under the*

The regulations include many exceptions; the most relevant exception is that landlords only need to take all cost-effective measures. Cost effective is defined as measures that achieve an energy efficiency payback of seven years or less.²⁰⁸

Penalties for non-compliance vary from 5.000 pounds up to 150.000 pounds. The local authority has the power to impose these penalties.

The government announced that they are planning to raise the standard from E to D in 2025 and C in 2030. This allows landlords to already respond to these future changes.

Energy performance regulation in Scotland

In Scotland commercial, non-residential buildings over 1000 m² are regulated and owners are obliged from September 2016 to improve the energy performance when the property is sold or let.²⁰⁹ The Climate Change (Scotland) Act 2009 provides in section 63 for this regulation to be made. For buildings that do not comply with the minimum standard of the 2002 building regulations, or have not been improved via a Green Deal construction,²¹⁰ an energy action plan needs to be made. The action plan is a certificate containing a programme for the implementation of measures to improve the energy performance of the building and reduce emissions of greenhouse gases.²¹¹ Penalty for non-compliance is 1000 pounds.

Energy performance regulation in France

In France, the Energy Transition Act (Loi pour la Transition Energétique et la Croissance Verte) aims to drastically reduce national emissions of greenhouse gases (division by 4 by 2050 compared to 1990 levels) and final energy consumption (50% in 2050, 30% in 2030, relative to the level of 2012). The main lever towards this objective is the thermal renovation of existing buildings. The law sets the goal for all buildings to be renovated to the standards "low consumption building" (or equivalent) in 2050. So far, previous laws never made energy refurbishment mandatory. The only notable obligation (Law "Grenelle 2") was to carry out an energy audit for all condominiums of over 50 lots with a collective heating system. The Energy Transition act introduces the obligation for energy refurbishment and several decrees provide new instruments to meet the ambitious targets fixed by the law.

Many of the obligations on existing buildings are an implementation of the EPBD directive and apply only if renovation works are carried out.

The initial ambition of the Energy Transition Act was to go even further. In the final version, article 5 stipulated that all residential private buildings are refurbished by 2025 when the primary energy consumption exceeds 330 kWh of primary energy per square meter per year, this corresponds to all housing with an energy label F or G (30% of dwellings in France). In addition, the ambition was to

Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015, By the Department for Business, Energy and Industrial Strategy, p. 24

²⁰⁸ *Guidance, By the Department for Business UK, Energy and Industrial Strategy, p. 24*

²⁰⁹ *The Assessment of Energy Performance of Non-domestic Buildings (Scotland) Regulations 2016, part 1, provision 2*

²¹⁰ *For more information about the Green Deal construction see paragraph 7.2.6 and part 1, provision 2, sub 2 a and provision 3 under relevant building standard.*

²¹¹ *part 6, provision 6, The Assessment of Energy Performance of Non-domestic Buildings (Scotland) Regulations 2016*

further establish an energy renovation obligation for all dwellings with energy label ranging from C to E in case of a change of owner between 2030 and 2050. Unfortunately, the Constitutional Council revoked this article, not on the content, but on the form, finding that the article was not accurate enough and could harm laws on private property. A rewritten version of this article, which answers to the objections of the Constitutional Council, would greatly support the refurbishment of the existing building stock, but nothing is planned at this stage.

La Métro has decided to go further than the national obligations and make the energy retrofitting for all buildings that will ask for a statement of work or a building permit, mandatory. This obligation will be introduced in the local urbanism plan (PLU) that is currently under elaboration. La Métro will use the law “Grenelle II” that made possible to impose energy performance levels in the PLU.

Such extra obligations by the municipality on retrofit projects, are not allowed under Dutch law because of the limitations as earlier discussed in challenge 7.1.

Energy performance regulation in Netherlands

Homeowners

In the Netherlands there are no refurbishment obligations regarding the energy performance of owner occupied homes. In case of a renovation there are some energy efficiency obligations that are laid down in the Building Act. Most important and also the most ambitious requirements are those on major renovations. The minimum rules applicable on existing buildings have been discussed in challenge 7.1 There are no obligations that force homeowners to become active in improving the energy efficiency of their homes.

Social housing

The national energy review in 2016²¹² showed that the social housing sector are risking energy efficiency obligations due to not making the goals as laid down in both the voluntary Energy Agreement and the Covenant Energy Savings²¹³. The Minister voiced that because of the disappointing results, it is being considered to impose legal obligations on social housing. The department is currently working on a legislative proposal.

Offices

In March of this year the minister published an adjustment to the building Act, obliging all office buildings with a floor area of more than 100 m² to have a minimum energy label C by 2023. Monuments or temporary buildings are excluded, as are offices within a church, warehouse or in a building that is not heated.²¹⁴

Building owners will be obligated to take all measures that can be earned back in less than 10 years. A higher energy-index is allowed if all measures with a return time of 10 years are taken.²¹⁵

²¹² *Nationale EnergieVerkenning 2016, ECN, PBL, CBS and RVO*

²¹³ *Convenant energiebesparing huursektor, 2012 agreement between the rental sector and the Ministry of interior and kingdom relations: Article 1: In 2020 the social housing stock should have an average of label B (energy- index of 1,25)*

²¹⁴ *Article 5.11 sub 4 Building Act 2012, and article 2.2 Decree Energy performance of buildings*

²¹⁵ *Article 5.11 sub 5 Building Act 2012,*

The obligation on office buildings is based on the energy agreement from 2013.²¹⁶ Originally this is a voluntary agreement between many different parties. Reviews in 2015²¹⁷ and 2016 showed that the goals as laid down in this agreement, average label A in 2030, were not going to be met. Therefore the minister decided to make it a mandatory to comply with a minimum label C in 2023, and is considering a mandatory label A in 2030.

The energy performance obligations will lead to accelerated depreciation and impairment of the already "bad part" of the building stock. These are often offices that are characterized by poor location, low property value/standard and difficulties to rent out.²¹⁸ The question is which part of this "bad stock" is really affected by the legislation and which part would have been impaired without any measures.

7.2.3. Conclusion on the regulatory framework

The Dutch building regulations on existing housing do not put any mandatory demands on the energy efficiency level of existing housing, except when the house renovated. In France a proposal to set a mandatory minimum requirement on existing housing, resulting in an renovation obligation for all houses with a F and G label, was rejected by the constitutional counsel, because the obligation would interfere with the rights of property. However, La Métro assumes that French local governments can still proceed with higher demands. In the Netherlands enforcing households to improve their energy efficiency would need to have a legal basis in national law.

Simultaneously in different European countries, energy efficiency commitments are imposed on buildings that are commercially operated, such as buildings with office functions or rental homes.

Overall we conclude that current legal frameworks both in the Netherlands and in France do not actively contribute in stimulating energy efficiency upgrades of existing housing. Question remains if obliging homeowners would be the desirable tool to push this development, especially if one restricts/ eliminates the possibilities to use (possibly more economic) alternatives. Therefore these alternatives should remain a legal possibility if sufficient arguments for it can be brought forward.

7.2.4. Financial instruments to support Energy efficiency upgrades in the Netherlands

Not only legal obligations can support energy efficiency upgrades, also appropriate financial instruments (loans, subsidies) to support citizens to finance the upgrades are crucial.

In the Netherlands different subsidies are available to stimulate homeowners to invest in energy-efficiency measures and renewable energy production. An example of such a subsidy was the subsidy to take energy efficiency measures.²¹⁹ Homeowners that would invest in two or more energy efficiency measures could apply for this subsidy. By the end of April 2017 of the same year the subsidy was released the 60 million EUR that was available, was allocated. It can be concluded that these subsidies are very popular. In addition to national subsidies, there are many different municipalities subsidizing homeowners that wish to upgrade the energy efficiency of their dwelling.

²¹⁶ *Energieakkoord 2013*

²¹⁷ *Nationale energieverkenning 2015, ECN, PBL and CBS*

²¹⁸ *Verplicht energielabel voor kantoren, EIB, november 2016, p. 28-32*

²¹⁹ *Regeling van de Minister voor Wonen en Rijksdienst van 23 augustus 2016, nr. 2016-0000486646, houdende vaststelling van regels voor het verstrekken van subsidie aan individuele eigenaren-bewoners en VvE's in verband met het stimuleren van omvangrijke energiebesparende maatregelen in bestaande koopwoningen (Subsidieregeling energiebesparing eigen huis)*

To qualify for these types of subsidies the homeowner will, naturally, need to invest in energy efficiency measures, which often involve high upfront costs. The objective of the subsidy is to decrease the payback period of the investment. Other subsidies, like net metering and postal rose (discussed in challenges 8.1 and 8.2) have a similar objective.

A large group of homeowners do not have the financial means to cover these upfront costs. Therefore it is essential that 'affordable' and 'easy to understand' (energy efficiency) loans are available for homeowners to cover these upfront costs. In this paragraph the most important energy efficiency loans are discussed.

National Energy efficiency loan

The Dutch national government together with two banks initiated the Energy Saving Fund, *Nationaal Energiebespaarfonds*,²²⁰ and offers since 2014 low interest energy efficiency loans to both homeowners and homeowner-associations. The fund covers 300 million EUR and is a revolving fund. Homeowners can apply for a loan between 2.500 and 25.000 EUR to be used for a number of selected energy efficiency and renewable energy measures including installing solar panels, against an interest rate of 2,5 % with a payback period of 7, 10 or 15 years.

The applicant must go through a credit check in accordance with the *Standard for consumer credits*²²¹. Thus, households that used up their maximum loan capacity, or with a small income will often not qualify for such a loan, even though the monthly energy expenses are expected to go down and possibly compensate (at least partly) the monthly payment.

In addition to the above discussed credits, there are two special loans: 'The very energy efficient package' (maximum of 40.000 EUR) and the 'Zero on the meter' package (maximum of 50.000 EUR). These types of loan have a relatively short payback period (15 years) in relation to the amount of loan.

Many provinces and municipalities also offer sustainability loans under the same or similar conditions.

Extra allowance for mortgage for Energy efficient housing

Since 2013 new regulations make it possible for buyers to get extra financing on top of their maximum mortgage for energy efficiency measures. In the Netherlands a buyer can get a loan up to 101 % of the value of the property in 2017.²²² Furthermore, for each mortgagee, the maximum loan depends on the income. On top of this individual maximum loan capacity, the mortgagee can apply for an extra loan of 9.000 EUR if a house has A++ label or an EPC of 0,6 or better²²³. This loan is also available for financing the needed energy efficiency measures.

This loan is only available for households with an income of 33.000 EUR per year or more.²²⁴

The extra mortgage will help to increase the value of the high-energy efficient housing.

²²⁰ For more information see www.energiebespaarlening.nl

²²¹ *Gedragcode Consumptief Krediet: Code of conduct on lending capacity to private parties, guidelines for banks and other financial institutions that deal with consumer credits.*

²²² *The maximum mortgage has been declining from 105 % in 2013 to 101 % in 2017. Tijdelijke regeling hypotheckair krediet, article 5, led 1.*

²²³ *EPC (energy performance coefficient): A 0,6 EPC or better, for example 0,2, is a very energy efficient house.*

²²⁴ *Article 4, led 3, Tijdelijke regeling hypotheckair krediet.*

Energy efficiency measures

A similar extra mortgage is available for buyers that would like to upgrade the energy-efficiency of their newly bought house. They can get an extra mortgage of 9.000 EUR on top of the maximum mortgage that they have to invest in qualified *energy efficiency measures*.²²⁵ In this case, since extra energy efficiency measures are taken, the LTV norm is lifted from 101 % to 106 %. There are no label conditions to this extra mortgage.

Nearly zero energy housing

Instead of only implementing a number of energy efficiency measures, there is a mortgage of an extra 25.000 EUR for buyers that buy a nearly zero energy house (see the glossary for a definition).²²⁶

The mortgage can be used for buying a nearly zero energy house or to retrofit a house to nearly-zero energy level.²²⁷

The payback period of these loans will be, depending on the mortgage, often 30 years, which matches more the average payback periods for such deep retrofits.²²⁸ The extra mortgage will have to be paid off by a lower energy bill and a higher property value.

At the same time, the 'Stroomversnelling' programme, which is an information platform that provides support in deep renovations, shows that many 'to zero'-renovations are still very expensive and will not pay themselves back over a period of 30 years.

7.2.5. New Dutch experiments

City-Deal Overijssel.

A relatively new financial scheme/loan for upgrading energy efficiency is developed by the Province of Overijssel in a cooperation of local government, businesses and investors. They are developing a so-called house-subscription *woningabonnement* or *City-Deal*,²²⁹ which is a financial scheme for energy efficiency measures for owner occupied housing. After an experiment with 20 households, a pilot with 600 households has recently started.

The City Deal is a variant of on-bill financing, a financial product that is offered by retrofit companies that provide energy-efficiency improvements in and on the building, which are repaid by the homeowner on the monthly energy bill.²³⁰

The City Deal offers different types of packages. Varying from packages solely focused on energy efficiency measures connected to the house, to comfort packages, which will increase the living

²²⁵ For an overview of the energy efficiency measures see article 1 b Tijdelijke regeling hypothecair krediet

²²⁶ article 1 C, Tijdelijke regeling hypothecair krediet

²²⁷ article 4 led 3, Tijdelijke regeling hypothecair krediet. Unlike with additional energy efficiency measures, the total sum of the mortgage is not allowed to be over 101% of LTV.

²²⁸ Taking up such a high mortgage can be seen as a barrier in itself. The investments made in the home, need to pay off when selling.

²²⁹ City Deal Woningabonnement: Energiebesparen door de markt at www.rijksoverheid.nl: energiebesparing via abonnement or <http://www.woningabonnement.nl/>

²³⁰ M.A. Brown and Y. Wang, *Green Savings, How Policies and Markets Drive Energy Efficiency*, Energy recourses, Technology and Policy series, 2015, p. 75

comfort of the houses by installing double glass windows or changing out older household appliances, like kitchenware or the TV.²³¹

Aims and barriers

The City Deal Overijssel aims to overcome some of the barriers that are experienced by homeowners and the market. One of those barriers is that investing in energy efficiency measures is experienced as complex. There are several reasons for this:

- The market is new and there is limited knowledge about this market within the professional sector: contractors, installers etc. It is developing quickly and involves complex technical interventions. The complexity makes the customer highly dependent on the skills of experts. Selecting the right specialist is therefore a challenge.
- Homeowners find it challenging to find a 'trustworthy' contractor: does a contractor have sufficient knowledge and offer the right price?
- Finding suitable funding to finance the measures is complex: upfront costs on energy efficiency measures are often too high for owner occupied households.

The Deal should contribute to overcoming these barriers by:

- Covering the upfront cost
- Unburdening homeowners by delivering qualified contractors
- Developing the energy efficiency market, gathering experience
- Up-scaling the retrofit market.

Business case of the City deal

The potential market for retrofits is huge, most of our buildings need to be highly efficient by 2050, but the customers for such upgrades today are scarce. By developing a financing scheme that is attractive for homeowners, large investors are hoping to on the one hand enlarge the market, and on the other hand create interesting investment opportunities.

The retrofit market today is so fragmented that larger investors do not consider it to be interesting to invest in this market yet. For these investors a financing scheme like the City-deal is attractive because it introduces a middle man/ retrofit aggregator that can bundle these investments to a larger portfolios of e.g. minimum of 5 million EUR.

Long payback periods

These subscriptions can run over 20 years. This is 5 years more than the energy efficiency loans available through the national fund. The average investment for such a package per house is around 10.00 to 12.000 EUR with an expected return of 5 to 6 % for the investor. Given the low maximum investment per house, this loan is not fit for deep retrofits, of which the costs are today estimated around 65.000 per dwelling.

Customers will pay down this loan by monthly instalments. Moving to a new property will mean that the homeowner will pay back the instalments at once.

²³¹ For more information: www.woningabonnement.nl

The Dutch government is currently looking at changing the law and allowing building attached loans, see paragraph 7.2.4.

Energy efficiency

The deal is promoted as an energy efficiency deal, even though homeowners might reduce their energy consumption, the measures will not automatically pay themselves back by a lower energy bill. Homeowners are free to select what measures they want to take and in this scheme and this even includes measures like installing flat-screen TV or new kitchenware. The owner will have to pay the instalments, even if the energy savings are lower than expected. The City deal is neither meant as a tool to accomplish specific energy efficiency goals. The financing is independent of the energy efficiency outcome.

Trustworthiness

One of the essential ingredients of the City Deal is that it needs to be perceived as trustworthy. The active role of the local government in the project will help to increase the trustworthiness of the package.

Furthermore a quality label will be developed and will guarantee the level of work and financing offered.²³²

Evaluation of the City Deal

Experienced advantages of the City Deal are:

- A lower energy bill (if measures are selected carefully).
- Overcoming the high upfront cost barrier and making it possible to invest in multiple measures at once.
- Unburdening the homeowner by offering a full package.
- By making large portfolios of retrofits and introducing a middle man/ retrofit aggregator, larger investors will be able to make portfolios that have such a scale that large players like banks and pension funds will be interested to invest.
- Enlarging the market for retrofits

Also disadvantages of the City Deal are noted:

- Depending on the amount of the investment and the wishes of the customers, the subscription is 10, 15 or 20 years. When the owner wants to resell the property, the remaining instalments will have to be paid in one go before selling.
- Not all measures are earned back by energy savings. Especially the comfort measures, such as flat screen TV or better kitchenware will not have a large impact on the energy expenses of homeowners and will cause additional monthly costs.
- The owner will have to pay the instalments, even if the energy savings are lower than expected.

²³² Letter from the Minister of interior and kingdom relations, , dd. 28-02-2017

- Skewed risk distribution; in spite of guarantees, many risks are still borne by the homeowner, like changing energy prices, behaviour changes, miscalculation of the initial consumption vs. the consumption after installation and changing (tax) regulations.

7.2.6. Similar policy instrument in the UK: the Green Deal

Design of the Green Deal

In 2013 the UK introduced a similar financial scheme, *the Green Deal UK*,²³³ to improve the energy efficiency of the UK housing stock. In 2015 the Green Deal was cancelled, because of disappointing results.

The Green Deal scheme allowed households, landlords and businesses to take measures up to 10.000 pounds for the improvement of their buildings, with a payback period between 10 to 25 years.²³⁴

The Green Deal scheme conditions were as follows:

- For every house applying for Green deal financing, a Green deal assessment of the property was required. The assessment included a thorough evaluation of the energy efficiency of the house and of the homeowners' behaviour. Only such an assessment could qualify which measures would meet the Green Deal loan requirement.
- Golden Rule: The main condition was that the measures will needed to pay themselves back through a lower energy bill. In this way a 10.000-pound loan was only be possible with measures that lead to a reduction of more then 400 pounds yearly²³⁵ (with a payback period of 25 years)
- The loan was building (or meter) attached: *the debt is tied to the meter rather than the building owner*.²³⁶ This means that new tenants or homeowners were confronted with the liability for a debt they did not enter into from the beginning.²³⁷
- Only authorized Green Deal installers could install energy efficiency improvements under the financing scheme.

Furthermore, all homeowners taking energy efficiency measures, including those using green deal funding, could apply for a subsidy of the UK governments' Green Deal Home Improvement Fund (GDHIF). This subsidy was closed because of an overwhelming demand.

Stronger than in the Dutch scheme, the Green Deal's held the condition that the reduction on the energy bill would outweigh the expenses.²³⁸ In practice it showed that the savings that were calculated were often not achieved. The Green Deal loans had moreover a high interest rate of 8 to 10 %.²³⁹

²³³ *Energy Act 2011, chapter 16, part 1 chapter 1*

²³⁴ www.greendeal.co.uk

²³⁵ *This does not include an interest rate.*

²³⁶ *M.A. Brown and Y. Wang, Green Savings, How Policies and Markets Drive Energy Efficiency, Energy recourses, Technology and Policy series, 2015, p. 75*

²³⁷ *Green Deal energy efficiency scheme scrapped as Government pulls funding, the Telegraph, 23 June 2015*

²³⁸ <http://www.greendealinitiative.co.uk/>

²³⁹ *Green Deal Finance, Examining the Green Deal interest rate as a barrier to take-up, UK Green Building Council, January 2014, p. 7.*

The green deal resultantly had a number of problems:

- Green Deal finance had a relatively high interest rate.
- There was a lack of consumer protection in case of inheriting a Green Deal
- The assessment often overestimated the energy savings, which lead to measures that were not earned back on the energy bill.
- The Green Deal did not reduce energy poverty, because those people could not take up a loan or those who could were lending against a relatively high interest rate.²⁴⁰
- Penalty fee could be charged if the owner wanted to pay off the remaining instalments
- Impact of Green Deal finance on the value of the property is still unknown

Because of the disappointing results, the UK decided to stop the Green Deal. In December 2016 a review of the scheme was published. It concluded that the retrofit market and the Green Deal specific, are a *myriad of schemes, brands, certifications and organisations that work across energy efficiency and renewable energy sector* (and that) *give a confusing even bewildering picture for the consumer. Who can the consumer trust?*²⁴¹ These conclusions closely align with the identified barriers by our interviewees. The on-bill financing scheme, including certifications and selected companies and measures, in the UK did not eliminate these barriers in the UK.

The recommendation of the UK reviewers is that the UK government develops a quality mark for all energy efficiency and renewable energy measures.²⁴² The quality mark will be showing the competences of the contractors and quality of the measures. Question remains if the mark will show the customer anything about the financial consequences of the measure (assuming energy-conscious behaviour)?

Learning from the UK green deal

What can we learn from the Green deal?

- The most important lesson is that the measures taken should lead to real, actual, energy savings, unless clearly communicated otherwise. This is especially important in relation to low-income households. Not only do they have limited debt capacity, they will also benefit from a lower energy bill. Care should be taken to ensure that packaged offered to homeowners serve this objective. Facilitating and supporting packages that together with energy measures also provide loans for more luxurious measures (like providing loans for plasma TV's), might stand in the way of vital energy efficiency upgrades in a later stage, for example, when the neighbourhood will change heat infrastructure.
- Many of the loans available only address small adjustments: they offer sufficient budget for two measures. From a long-term perspective, we see that these measures not necessarily will lead to a nearly zero energy built environment, if only because these loans are, hardly ever, used to finance measures at the street or neighbourhood scale. Working towards

²⁴⁰ Letter to APPG for Excellence in the Built Environment Inquiry into Sustainable Construction and the Green Deal, by Engineering office Buro Happold, p. 2

²⁴¹ Each home counts, An Independent Review of Consumer Advice, Protection, Standards and Enforcement for Energy Efficiency and Renewable Energy, by P. Bonfield, requested by the Department for Business, Energy and Industrial Strategy and the Department for Communities and Local Government, 2016, p. 5

²⁴² Bonfield, 2016, p. 5

(nearly zero) should also be adapted to neighbourhood measures. The government could support this by developing financial schemes that can be used on street, neighbourhood or city- level.

- Moreover, the 2050 goals will not be realized by short term (<20 years) energy payback investments. Financial schemes will need to accommodate for longer investment horizons.
- Developing a quality mark might not be sufficient to guarantee the quality of the measures taken. A guarantee will in addition, need to prove that the measure is correctly installed and have the desired effect. Ex-post evaluation could prevent large deviation between the calculated- and actual- energy use.
- For on-bill financing to become attractive, it should be offered against a low interest rate.²⁴³
- Building attached loans might have an undesired impact on the value of the property and make a dwelling less attractive to sell.
- The Green Deal failures might also show us that earning back energy efficiency investments solely on the energy bill, under the current market conditions, is challenging. The value of such measures should first and foremost be reflected in the value of the property. The effect of building attached loans on the property value of the building is unknown.

7.2.7. **Building attached loans**

The long average payback periods and the average amount of years people occupy a home are conflicting. Developing investment schemes, like the City Deal Overijssel and the Green Deal UK, make these barriers more evident. The obligation to pay back the investment at once if the property is sold is experienced as a barrier and a risk for the owner and the funder. The same applies when the owner has taken up a loan and invested in energy efficiency measures and this investment is not reflected in the selling price of the property. At the same time this is true for many investments, like a new bathroom or kitchen.

Facilitating building-based funding can help boost energy efficiency investments and help homeowners to make long-term investments in their property.

Either way, the Dutch government is now looking at adjusting the law to make it possible for the owner to transfer the financial commitment of the subscription to the new owner.²⁴⁴ Under the current law this is not possible, because a loan is personal and not attached to the property or meter. Both European and national laws are impeding such financing schemes because of consumer protection rules like creditworthiness checks that will need to be carried out on the people taking over the loan ²⁴⁵ or, the freedom of consumers to decline to take over the loan.

Clarification of the possibilities is desirable, but it will be a challenge to find a good balance between consumer protections on the one hand and to stimulate a market that will allow retrofits paid by a

²⁴³ *Understanding the risks of the Green Deal, Smith School Working Paper, february 2012, p. 17 and 21.*

²⁴⁴ *Dutch Parliament document: Kamerstukken II 30 196, 485 and 540*

²⁴⁵ *DIRECTIVE 2008/48/EC of the European Parliament and of the Council of 23 April 2008 on credit agreements for consumers and repealing Council Directive 87/102/EEC (OJEU 2008, L33/66), article 8 and 14 and DIRECTIVE 2014/17/EU of the European Parliament and of the Council of 4 February 2014 on credit agreements for consumers relating to residential immovable property and amending Directives 2008/48/EC and 2013/36/EU and Regulation (EU) No 1093/2010 (OJEU 2014, L60/34), article 14,18 and 20, Dutch Civil Code book 7 article 66 and 122, Financial Supervision Act article 4:34*

monthly repayment schedule up to over 30 years, on the other hand. There are some aspects that should be carefully examined:

- What type of measures can be attributed to the building? Insulation measures are attached to the house and not removed when moving. The same often counts for kitchenware, although they not necessarily improve the energy efficiency of the building. Exchanging electrical appliances will often have a short-term effect. These appliances will only be energy efficient, until better equipment is available. Consequently, future buyers of the retrofitted home might not be interested in paying off an out-dated energy efficiency upgrade.
- After how many years can the financial obligation be given to the next owner? Is it fair that an owner, which had a contract for 20 years, will hand over such an obligation after 15 years? The solar panels that were installed might not be as productive as they were 10 years earlier, the same counts, in varying degrees, for the other measures. The depreciation of these packages should be studied.
- Not all packages are suitable to transfer to a new owner. A nearly-zero-energy renovation might be more eligible than a loan used for a couple measures.
- When a property has a debt, like such a subscription, it will naturally have an impact on the value of the property. It might be in the advantage of the owner to pay all the instalments before selling, to avoid a low(er) market price for the house itself.
- The financial supervision act also applies on today's City Deal agreements, which means that all homeowners will have to pass a creditworthiness assessment.²⁴⁶ The loan on the house will have an impact on the maximum mortgage a potential buyer can get.²⁴⁷

7.2.8. Conclusion on the financial schemes

Energy efficiency measures generally involve significant up-front investment costs. To cover these costs, several financial instruments are developed, like low interest-loans, energy efficiency mortgages, and possibly in the near future building-attached loans.

Subsidies are merely to lower the return time on the investment, because they are only available to homeowners that can cover the up-front costs.

Loans, and as a consequence of that subsidies, are not available to everyone because they will only be granted to homeowners that meet the minimum credit requirements.

Developing financial schemes for retrofitting owner occupied housing is challenging, because of all the different challenges that need to be addressed. There is an important disconnect between the size of projects at the local level, and the desired investment size and project risks targeted by large investment companies. While many of the loans just provide means to cover the upfront costs of these investments, only the City Deal Overijssel tries to offer a more all-round package that addresses multiple challenges. To overcome the split incentive between the current homeowner and the future homeowner, new forms of loans, like building-attached loans are looked into. Question is if this will stimulate the retrofit market, or that it will only complicate selling and buying a property.

²⁴⁶ *Article 4:34 Financial Supervision Act*

²⁴⁷ *Tussenrapportage Taskforce Financiering gebouw gebonden oplossingen, October 2015, Stroomversnelling*

The main condition is that the energy performance of a house is sufficiently valued and reflected in the market price of the property.

In challenge 7.3 the French financial schemes will be discussed.

7.2.9. Observed barriers

Discussing the legal and financial instruments available to stimulate energy efficiency upgrades in the build environment reveals many of the challenges that are encountered. Below we highlight some more important barriers that were discussed during the interviews.

General barrier: Lack of knowledge

Many of the interviewees voiced that the low interest in energy saving measures is not so much a financial challenge, but more due to an overall lack of knowledge about new technical solutions and financial possibilities. On the one hand there is no real convincing (regulatory or financial) push/incentive to implement energy efficiency measures, and on the other hand professionals are insufficiently informing their clients about the possibilities available. The lack of qualified contractors for retrofits was also noticed by one of the City-zen retrofit participants. As a result, the participant decided to become a contractor specialized in retrofitting. Although this is a positive development in terms of improving the overall knowledge base, it also is a sign of the fact that the lack of sufficient know-how in the relevant sector(s) – in this case the retrofitting branch – impedes kick-off (e.g. from an own profit-driven perspective) of the required change.

General barrier: Guarantees

Another challenge is found in the complexity of guarantees. Contractors can give customers a guarantee on improved energy performance after an investment is made. This is to provide customers with some certainty that targeted energy performance after an (often significant) investment in improvements, is met. The value of such a guarantee can however be unclear because of several reasons:

- Correct installation of the measure is difficult to verify
- In the building industry guarantees have a long duration, often longer than 15 years, an example is the guarantee on solar panels. Within these years, many changes can happen: What happens when a contractor goes bankrupt?
- What is guaranteed: Warranties often guarantee a certain minimum performance that is difficult to verify.
- Rebound effects: It is difficult to distinguish mal-installation from change of behaviour (e.g. homeowners taking longer showers or heating more spaces after investment in improved energy efficiency or renewable energy sources) if an increased energy consumption occurs.

General barrier: Fair distribution of benefits and Energy Poverty

The energy-saving measures that are taken in the Netherlands are attributable to the wealthier group of homeowners²⁴⁸, meaning that not all homeowners are reached, able or willing to invest in improving the sustainability of their house. Developing financial instruments that reach all

²⁴⁸ CE Delft, *Wie profiteert van het klimaatbeleid? Verdeling van subsidies en belastingkortingen tussen armere en rijkere huishoudens*, april 2017

homeowners is challenging. Low-income households have (hardly) no access to loans and as a consequence neither access to subsidies.

General barrier: individual vs. collective

The current approach in both the legal framework, which is also reflected in the financial instrument available, is that they are designed to address individuals. Energy efficiency regulations address one building, or one house, and financial instruments finance the upgrade of this single house or building.

As discussed in challenge 6.2 changing one energy system for another, will also involve many collective investments and decisions. Developing financial schemes that finance a retrofit on street or even neighbourhood level, is needed.

Currently, front-runner projects in the Netherlands are already confronted with these barriers. An example is the complexity of convincing an entire street to disconnect, voluntary, from gas and invest, voluntary, in upgrading their houses to nearly-zero-level.²⁴⁹ In Grenoble they are experimenting with financial schemes that can support especially low income households to also participate in upgrades on block level.

Legal barrier: No obligations to activate home-owners

It is not common in Europe to oblige homeowners by law to invest in their housing, unless there are health and safety issues. This means that under the current framework, unless the homeowner is (active) renovating, all inactive homeowners can stay inactive.

Today we prefer private homeowners to become active on a voluntary basis. Professional building owners, owners of rental housing or offices, are facing regulations that will force them to become active and actively invest in upgrading their buildings. Similar obligations on private households can be expected.

Financial barrier: Payback period and high upfront costs

Many measures to reduce energy consumption in the house, like insulation measures, changing to a more effective heat source or investing in sustainable energy production, can often be earned back on the energy bill, but require high upfront investments.

In case of deep retrofits to nearly-zero energy level this payback period can be substantially over 30 years. The long-term investments and the number of years people (are planning to) occupy the same place are conflicting and do not lead to optimal, or sensible (from a homeowners' perspective) long-term investments.

²⁴⁹ *In a street with almost exclusively social housing, the Housing association wanted to upgrade the entire street to nearly-zero-level. Unfortunately a couple of these houses were sold earlier to the former renters of the houses and these now homeowners did not have the financial means to participate in the project. This was unacceptable, not only because this would mean that a couple of houses would still need to be connected to the gas network in this street, which is not in line with the ambition to phase out and avoid maintenance costs, it was even more problematic because the owner occupied houses would devalue being in a street with solely renovated NOM houses. In this project the upgrade, which cost 75.000 EUR, was eventually paid by the municipality and they lease the 'façade' to the homeowners. Bijzondere NOM-leaseconstructie voor koopwoningen Westvoorne, Stroomversnelling, 20 september 2017*

Deep retrofits, aiming for nearly zero energy level, may therefore be considered too unattractive from the financial return point of view.²⁵⁰

Financial barrier: Deep retrofits are difficult to finance

Many of the available loans have a duration that is too short (maximum 25 years) for financing deep retrofits. Financial schemes with long term investment horizons (>30 years) are lacking.

Financial barrier: Market Scale

Large investors such as pension funds show interest to invest in long-term energy efficiency projects. However, there is a mismatch between project scale (often decentralised/ local projects) and project size desired by these investors.

The market for retrofitting is huge. The cases of individual homeowners however, are relatively (very) small scale from the perspective of large-scale investors, which are crucial parties in making widespread financing available through whatever scheme.

Large banks and pension funds typically prefer large-scale projects with low risk. This means projects with an investment volume with a minimum size of 5 - 10 million EUR, dealing with one party and preferably against a minimum return on investment of 10% within 5 to 10 years. If the investor, in addition, would like to invest in sustainable projects, the choices are limited. Particularly if one considers the fact that the Dutch government tries to establish the energy transition in the built environment from the bottom-up (typically involving decentralised, local projects with uncertain return on investment). This results in a disconnect between the size of projects at the local level, and the desired investment size and project risks targeted by large investment companies.

The view that legal requirements will have a positive effect on the scale and enhance professionalism. In order to attract large investors the market needs energy efficiency aggregators that will formalize and standardize upgrades.

Alternatively, larger investors also do not appear to be (very) pro-active in developing schemes that efficiently serve individual homeowners retrofitting interests, while fitting the investor's earning model at the same time. There is a lack of innovative capabilities to develop financing schemes that fit the chosen transition path (bottom-up) in the Netherlands.

Financial barrier: Living costs vs. mortgage costs

In practice this means that new built houses, with a mandatory 0,4 EPC and from 2020 an EPC of zero, potentially qualify for an extra 9.000 or 25.000 EUR mortgage²⁵¹. Depending on the heating system of the new house, a renovation to nearly zero energy can also be financially interesting. The average extra investment to make a 0,6 EPC (A++ label) dwelling into a nearly zero energy house is about 16.000 EUR.²⁵² Earning back the investment solely on the energy bill on an A++ label might be a challenge in itself. Investing in making housing energy neutral is mostly an increase of property

²⁵⁰ *Prices for upgrading existing housing to a nearly zero energy house, in case of terraced houses, are around 65.000 EUR. To make this financially interesting for private homeowners however, the price should not be more than 45.000 EUR. Source: Stroomversnelling, 4,5 miljoen woningen naar nul-op-de-meter.*

²⁵¹ *Given that the buyers are in compliance with the other conditions*

²⁵² *Nul op de meter- ervaring van vernieuwers in de woningbouw- In opdracht van het ministerie van Binnenlandse Zaken en Koninkrijksrelaties, RVO mei 2015*

value whereby the initial investment might not be earned back through a lower energy bill/ energy savings alone.

Because of the generally high mortgage adjustment fees, these mortgages are only interesting for buyers and not for current owners.²⁵³ Given that the bank does not need to do any creditworthiness assessments and the procedure could be standardized, banks could consider offering these mortgages to a very low adjustment fee or free of extra charges, because an increased mortgage sum already increases the banks interest incomes (assuming the interest rates on the entire mortgage are not changed) Another important downside to this mortgages is that none of the extra mortgages are available for households with an income under 33.000 EUR.

There are also some of advantages in using a mortgage instead of an energy efficiency loan from national or local funds:

- The property secures the loan,
- Banks already possess most of the information needed about their client, which saves on administrative costs,
- Longer payback period. Especially for deep retrofits the longer payback period on a mortgage compared to the maximum of 15 years on a regular credit, better matches the return time of the investment,
- All building related loans are with one lender.

7.2.10. Recommendations

In the face of current lack of legal retrofit obligations, there is a need to mobilize the huge available investment capital from large banks and pension funds for financing of smaller-sized, non-standard projects. Such alternatives should offer solutions for higher risk and lower payback rate involved, than generally desired by these parties. Government could help to develop ‘special purpose’ public-private entities in partnership with these commercial investors.

A second recommendation here is that, before considering legal obligations, the general public needs to be (made) more aware of all the financing options available for investments into improved sustainability of a home.

Thirdly, it is important that these funds (or alternatives) also need to be made available to low-income households.

Fourth, (available) financial schemes may be further innovated to accommodate the second point, and address the issue of the so-called split incentive between investor/ current owner and (future) user.

The energy savings could be taken into account in the creditworthiness assessment. For example, instead of looking at maximum loan capacity of the individual alone, the savings on energy expenses could be added to the amount of loan capacity the buyer has. Allowing this will need a careful assessment of which measure would lead to real energy savings.

Fifth, financial schemes should not only be targeted at the individual building owner, but also support neighbourhood upgrades.

²⁵³ As an example, Rabobank charges 1500 € for expanding/refinancing the extra mortgage.

Overall we see that the homeowner has a vulnerable position in this market, highly depending on the expertise of professionals. Making a bad investment can have a significant financial impact, especially on those that will be bound by long term financial obligations.

Many risk are to be taken by the homeowners of which they may not be aware. More tailored small-scale financial products (loans) with (partial) governmental guarantees (e.g. through public-private partnerships offering loans) to mitigate higher financial risk attached to these loans could improve the position of homeowners

Regulation and a well-developed guarantee system could also help to strengthen the position of the consumer and make the market more transparent. Again a homeowner that makes *real* energy-savings will have the financial means to pay back the loan.

Since the energy retrofit market is still new and developing rapidly, regulating mandatory retrofits on existing housing seems premature.

7.3. CHALLENGE: SCALING-UP THERMAL REFURBISHMENT OF THE PRIVATE HOUSING STOCK IN GRENOBLE: CASE STUDY MURMUR

7.3.1. Introduction

With the new Energy transition law and decrees, the French government aims to have the built environment completely renovated by 2050 as described in chapter 2. However, most of the energy experts agree that the changes are not sufficient to meet the objectives, because the number of dwellings directly affected by the obligations as aforementioned is limited. Actions developed by local authorities to foster the renovation of private building stock are therefore of high importance.

La Métro decided to focus its efforts on the condominiums (multi-families owned buildings) from 1945-1975 as they represent the biggest potential in terms of energy and consequently CO₂-savings. The major barrier for this topology of building is that renovation works depends on collective decision-making, which is proven to be a very long and complex processes (more than 70% of co-owners have to vote in favour of the works). Furthermore, and as in many other places, the building sector in La Métro is fragmented and not yet able to offer holistic solutions for deep renovation at acceptable cost and quality. The building process usually involves multiple separated disciplines, which leads to additional costs and risks of failure. The renovation market is principally supply driven and this can lead to a mismatch between the offered products and the end-user's needs. Many customers see high operating costs and poor environmental performance as an acceptable alternative to the time-consuming, disruptive and risky renovation process. Scaling-up thermal renovation works in this context remains one of the most important challenges in general, and of La Métro in particular..

From 2010-2014 however, La Métro has gained experience with the thermal renovation campaign "MurMur", that was one of the best schemes in France to support the refurbishment of the private building stock.

The City-zen project has given La Métro the opportunity to make an in-depth analysis of the results of this first campaign and improve the design of the new campaign MurMur2 (2016-2020) based on the lessons learnt and feedback of all parties involved.

7.3.2. Description of “MurMur” thermal insulation campaign

The Murmur campaign was proposing an incentive scheme and technical assistance for retrofitting private condominiums constructed between 1945 and 1975. Homeowners were given the choice between 3 different packages:

- Progressive thermal renovation (walls and gables insulation)
- Complete thermal renovation (insulation of roof, walls, ground floor and ventilation system as optional)
- Exemplary thermal renovation (complete renovation + improvement of ventilation system, replacement of windows)

To finance the renovation works a specific financial scheme has been set up. It combines financial assistance (paid by La Métro and its partners) and financial incentives. Financial incentives proposed to households are divided in two types:

- Block grants (10 to over 40% of net amount of the works) awarded to all co-owners. The amount depends on the extent of the works. The greater the volume of the works and the more ambitious the project, the higher the grant required and the more significant the energy savings were.
- Individual grants for low-income households, the combined aid can reach up to 80% of the total amount of the works.

These grants can be combined with the national aid (tax credit or EcoPrêt for interest free loans (EcoPrêt à taux zero)).

A specific one-stop shop has been created to provide homeowners with information on technical administrative and financial issues. Interested condominiums are guided through the process free of charge by professionals (ALEC and SOLIHA), including: independent and personal advices, financial simulations, mobilization of joint owners, technical assistance, monitoring of energy consumption after completion of the works, and more.

7.3.3. Financial analysis of MURMUR campaign

In total, 61 million EUR were invested in retrofitting works carried out within the framework of the first MurMur campaign. Given the large share of the workforce in these budgets (75%), it can already be estimated that the campaign has had an employment effect on the territory, at least in its fight against the current difficulties of the construction market.

On the revenue side, the experimental dimension of the scheme has enabled considerable public funds to be raised on this project: the 13.2 million EUR invested by local authorities made it possible to release nearly as many subsidies, mainly from the State and its agencies (ANAH²⁵⁴ and ADEME²⁵⁵). This fund raising implies the financial involvement of the three energy suppliers (GEG, CCIAG and EDF) via their legal obligations through the national mechanism of energy saving certificates. Beyond the local subsidies, the owners were able to benefit from tax credits and the zero interest eco-loans. The special support system (technical and administrative) for co-owners (2.6 million EUR) was also financed for almost 2/3 by public funds outside La Métro. This strong public intervention is particularly justified during the experimental phase, especially since the MurMur campaign is the first

²⁵⁴ ANAH : National Agency for Improvement of the Habitat

²⁵⁵ ADEME : Agency for the Environment and Energy Management

of its kind. Besides, it is important to point out that, even if the part of the public intervention remains very significant (25 million EUR in total), the Murmur campaign represents an important financial driver: for every EUR of public money, almost 2 EUR of private money have been invested in retrofitting works, which had a high impact on the local economy²⁵⁶

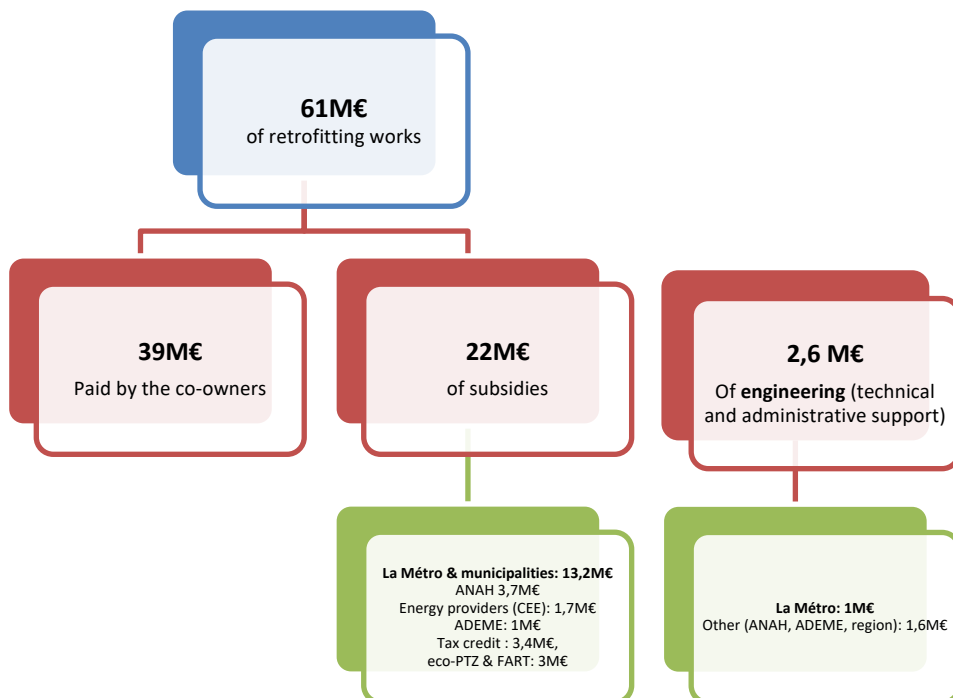


Figure 7-1 Overview of the financial scheme of MurMur campaign

7.3.4. A strong financial effort for co-owners

The average price of a complete renovation for a typical apartment block (+/- 40 apartments)²⁵⁷ is about 600.000 EUR. This leads to an average share of 14.500 EUR per co-owner. Obviously there are large differences between the packages chosen, a so-called progressive renovation is about 10.300 EUR per housing unit and an exemplary renovation has an average cost of 23.000 EUR. The homeowners will get a MurMur subsidy, which is around 3.000 EUR on the average costs of a renovation. This means that the homeowner, after deducting the subsidy, will have to find a way to finance around 11.500 EUR (14.500 -3.000= 11.500). This implies a strong financial commitment of households participating in the MurMur campaign.

In order to understand the procedure of this individual contribution, a survey has been carried out amongst the households involved in the MurMur campaign (about 380 respondents).

A majority of the participants faced difficulties to pay their outstanding remaining amount

The majority of co-owners participating in the MurMur campaign, faced difficulties to cover the individual high upfront costs. Given the high individual costs, this is not surprising. On the contrary, it

²⁵⁶ There are no exact figures about the amount of jobs created, but with an overall injection of € 61 million in the retrofitting industry, the expectation is that it had a high impact on the local economy.

²⁵⁷ The participating blocks varied in size, from 10 apartments to 200 apartments.

is rather remarkable to note that about one third of the participants of MurMur did not experience any challenges financing the large investment.

Families qualifying for subsidies did not receive the money until the conclusion of the project. As a result many households experienced that the advanced payment was the major barrier in this project.

Eco-PTZ (zero interest eco-loan): not as successful as expected

Part of the MURMUR campaign was to promote the use of low interest loans, the so-called “Eco-PTZ” (zero interest loan), which were presented as an interesting financing solution to cover the upfront investment of the individual homeowners (cf. § 3.16.4 for more information). The result of the survey underlines that it was difficult for co-owners to qualify for these loans, and only a small number of participants did get the eco-PTZ loan. 70% of the interviewed households heard about the loan, meaning that the instrument is well known. One quarter of households asked for Eco-PTZ, and 15% (over half of the applicants) were granted a loan (for an average amount of 13,000 EUR and a duration of 15 years). The main banks offering this loan are the Caisse d'Epargne, the Crédit Agricole and the Banque Populaire. The main argument for homeowners against using this loan is that the loan is experienced as complex.

10% of co-owners obtain a bank loan

Only 15% of respondents applied for a bank loan other than eco-PTZ and 10% obtained it, for an average of 13,000 EUR. The majority of participants financed the upgrade with a traditional “consumer loan”.²⁵⁸ Most of the participants that applied for a loan voiced that they faced little problems obtaining it. Nevertheless, there are some challenges experienced in relation to finding suitable finance for homeowners, which are linked to either the limited economic possibilities of some households or the challenges related to request individual loans for collective investment campaigns. This will be further addressed in the next challenge.

Specific individual aids (ANAH) to make retrofitting works affordable even for the poorest households

For the poorest homeowners (ex. a household of 4 persons with incomes below 29.000 EUR/year), the outstanding remaining amount is only 1.000 EUR due to significant individual aids delivered by the ANAH. For average income homeowners (up to 37.000 EUR/year), the amount of subsidies is less; homeowners pay an average of 3.000 EUR. For these low-income households, the financial support of the MurMur campaign is a crucial incentive, which makes retrofitting works affordable.

However, it is interesting to note that $\frac{3}{4}$ of the co-owners (homeowners earning more than 37.000 EUR a year or landlords) do not benefit from individual supplementary aid.

The limit for financial aid (ANAH) lies with an income of 37.000 EUR. Homeowners earning just over 37.000 EUR do not qualify for individual subsidies. This is a very strict limit and an abrupt “threshold”. Families earning only a little bit more than the limit do not benefit from any subsidies, but might earn too little to take up a loan. The MurMur campaign showed that this group in particular is experiencing difficulties to find an affordable loan.

²⁵⁸ The banks involved were: *Crédit Foncier, Crédit Mutuel, Caisse d'Epargne, Crédit Agricole and Banque Populaire.*

Delay in payment of the subsidies

As pointed out above another major challenge was the payout date of the subsidies. These delays in the payment of the subsidy generated financial difficulties for nearly half of the co-owners, resulting in:

- Families experiencing difficulties to pay for their living expenses.
- Some households were forced to take up a traditional loan to make the advance payment
- Participants voiced to experience a loss of faith in the reliability of the information or even in the MurMur campaign itself.

7.3.5. Conclusion

The results from the first campaign will be taken into account to strengthen the second MurMur campaign. The most important lesson learned from the first campaign is that for retrofitting to scale-up, simplification of the procedures, financing especially, is needed.

For the next campaign, the subsidy level will go down, due to an increase in participants and a lower budget.

7.3.6. Recommendations

Recommendations for the financial component:

- Revise the economic model of MurMur and adjust to the available budget, while maintaining financial support for average- and low- income households.
- Continue lobbying with both regional and national bodies to promote support to innovative thermal insulation campaigns
- Maintain an experimental dimension in order to broaden the funding base to R&D subsidies.

Recommendations to broaden the circle of committed condominiums:

- Maintain a high level of support for most of the average- and low- income homeowners, with a special focus on households with an income just above the subsidy limit.
- Strengthen individualized support, especially for the elderly.
- Use pedagogical communication materials to strengthen the communication on the campaign and foster word-of-mouth advertising.

Recommendations regarding loans and individual contributions

- Systematize the pre-financing of individual support/subsidies to avoid cash flow problems.
- Develop solutions for financing the outstanding remaining amount (streamlining access to eco-PTZ, providing loans that are adapted to the needs and accessible to all households).
- Develop specific partnerships with banks to improve lending capacity for homeowners, see next challenge.
- Encourage condominiums to create a "work fund" to finance future retrofit work.
- Provide homeowners with precise and reliable communication on the financial obligations they will be committing to.

7.4. CHALLENGE: SETTING-UP PARTNERSHIPS WITH BANKS IN GRENOBLE TO FOSTER THE ACCESS TO LOANS FOR ENERGY RETROFITTING PROJECTS

7.4.1. Introduction

As described in the previous challenge, the evaluation of the MurMur campaign (2010-2014) has pointed out that there is a lack of suitable loans available to finance collective housing renovation projects. This finding was particularly true for households with incomes just above the ceiling of the ANAH individual aids (paragraph 7.3.4).

Households trying to obtain these loans were experiencing the following barriers:

- Long and complex administrative files and technical forms
- Refusal to grant the loan depending on the situation (i.e. elderly people, debt capacity)
- Prohibitive costs of individual insurance
- Binding conditions for early repayment

In addition, there was a real problem with cash management of individual support, which was paid at the completion of the retrofit works, while the households were forced to pay for the measures in advance. This resulted in households being forced to use bridging loans against high interest rates, to cover this gap.

In order to accelerate the rate of retrofitting, La Métro wants to improve the support of households planning to rehabilitate their building (energy diagnostic of the building, technical and financial advices, follow-up during and after work, social monitoring), but also proposes more general financing solutions adapted to the needs of each household. Access to bank loans is an important condition for the success of these renovation projects. In this context, La Métro is trying to establish partnerships with different banking operators and together with the sector hoping to improve the financial schemes for retrofitting owner occupied housing.

7.4.2. The expectation of La Métro regarding the mobilization of local banking stakeholders

La Métro has proposed two models of partnership with local banks:

Group Loans: To develop a partnership with banks could improve the quality of collective financing solutions for condominiums. This partnership, currently under development, aims at facilitating access to collective loans with individual responsibility. The bank(s) have provided La Métro the necessary guarantees to propose the loans, and improve access to the collective EcoPTZ.

Individual loans: To mobilize banks in order to facilitate access to individual loans. The aim of La Métro is to:

- Facilitate access to credit by taking into account the *savings* related to the reduction of energy bills, increasing the creditworthiness of households
- Facilitate access to the Eco-PTZ
- Develop and support financing solutions at low interest rates over long periods (10-15 years)
- Involve the largest share of local banks to avoid that participants have to change to another bank
- Develop a specific communication targeted to individual houses
- Increasing the banks' interest in financing retrofit programs

The MurMur campaign schemes is now working well both on a technical and financial level. This enables La Métro to provide banks with a portfolio of condominiums that benefit from a technical expertise and administrative support. The MurMur campaign is therefore quite attractive for banks since it contributes to:

- Generate credit volume for banks (the desired volume by the banks involved is unknown) Banks prefer financing multiple loans together instead of individual loans.
- Pre-selection of the apartments that benefit from technical and administrative assistance as well as a guarantees regarding the quality of the project and the real potential energy savings
- Carrying out the technical instructions (validation of technical requirements, compatible with the eligibility criteria, etc.)
- Reduce the transaction costs of administrative processing of files (dematerialization, consultation of online files)
- Organise trainings for customer managers of local banks
- Communicate with the banks as a partner of the Métropole Energy Transition

7.4.3. Conclusion and Recommendations

The development of this partnership is still ongoing. A first meeting was organized in October 2016 and made it possible to meet a dozen representatives of banking groups in the area. This meeting confirms the interest of banking stakeholders in participating in this partnership. But the negotiations between La Métro and the representatives about this partnership are still ongoing. The barriers blocking an agreement are:

- The great diversity of the banking actors (regional or non-regional networks), whose decision-making structures are very different.
- Given the outstanding numbers of loans made by banks, financial volumes generated by MurMur are not very attractive. Banks would like a higher volume.
- Despite positive “official” speeches of bank representatives, there is still a real difficulty for households to obtain an Eco-PTZ, which is not very attractive because of the current low market rates and the complexity of administrative files.
- Banks are not willing to integrate the financial savings achieved by the reduction of the energy bill in the assessment of the credit-worthiness/credit rating of the customer and this is a barrier especially for low-income households.
- La Métro has offered guarantees on the group loans for condominiums. However, the expectations of banks regarding the total amount of guarantees on the loan that need to be provided by a local authority remain too high from the point of view of La Métro.

7.4.4. Recommendations

Changing creditworthiness assessments and including energy savings in these assessments, requires a change in banking culture. The national government could assist in addressing this topic and push financial institutions to inquire into these options.

7.5. CHALLENGE: EXAMINE THE KEY DRIVERS OF COLLECTIVE DECISION-MAKING IN CO-OWNER INVESTMENTS IN CONDOMINIUMS IN GRENOBLE

As explained in the previous chapter, La Métro decided to focus its efforts on the condominium (multi-families owned buildings) from 1945-1975 as they represent the biggest potential in terms of energy and consequently CO₂-savings. The main constraint for this topology of building is that renovation works depend on collective decision-making, which are proven to be a very long and complex processes since more than 70% of the co-owners have to vote in favour of the works.

To find out potential drivers of collective decision-making in condominiums, EDDEN (Grenoble university) is currently studying this topic. The analysis is based on economic and social data available from the MurMur campaign (investments costs, loans rate and duration, typology of households, etc.). The data have been provided by the partners of the MurMur campaign (La Métro, ALEC and Soliha) and combined and consolidated by EDDEN in one single database.

Examples from the samples used for this study are:

- all together, 176 condominiums initially applied to benefit from the MurMur 1 financial incentives. Half of them are situated in Grenoble, and the other half in other cities comprised within the Métropolitan boundaries;
- half of the condominiums were built before 1970, while the other half was built between 1970 and 1975;
- 84 condominiums decided to invest in the thermal retrofit of their building, which represents 47.7 % of the full sample.

7.5.1. General descriptive statistics:

Full costs and remaining/additional expenses for homeowners:

The MurMur 1 campaign provided financial incentives differentiated according to the retrofitting package. Therefore, the ratio between the retrofitting full costs and the remaining expenses to be borne by the owners (i.e. outstanding remaining amount) depends on the retrofitting package. The figure below shows the estimated costs, the estimated remaining expenses, and the financial incentive ratio for each of the retrofit packages. The financial incentive ratio increases as the package shifts from “progressive” to “complete” and to the highest grade “exemplary”.

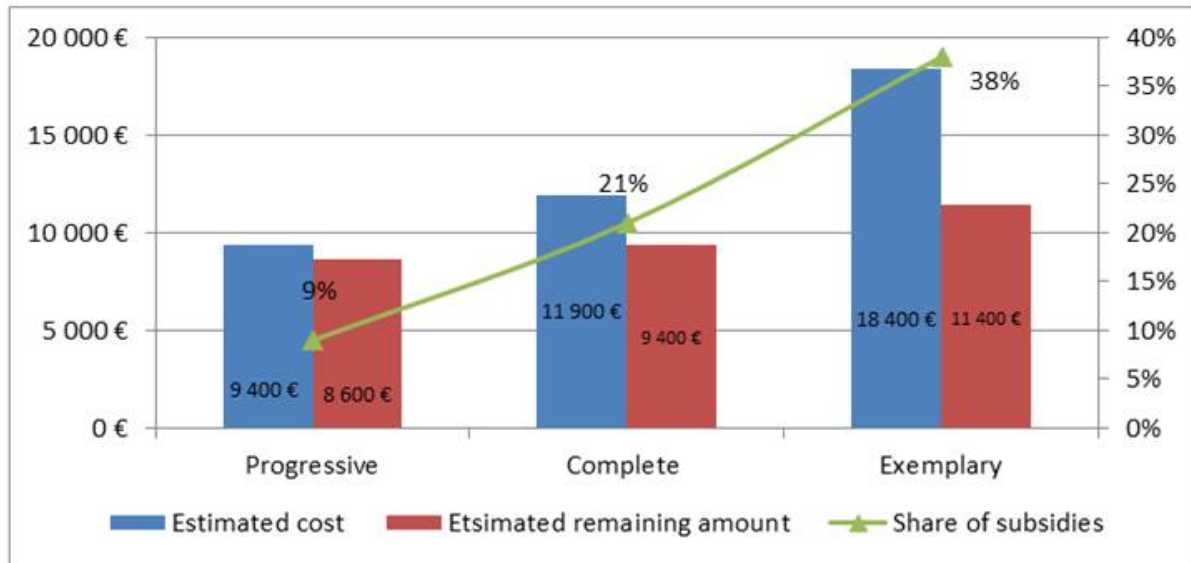


Figure 7-2 Estimated costs and outstanding remaining amounts per dwelling depending of the selected “package” of works

Estimated energy savings, as a function of the average retrofitting full cost per square meter, according to the retrofitting package

The figure below shows that the retrofitting estimated costs per m² increase more rapidly than the expected energy savings. This is a common finding of retrofitting investments: the first retrofitting steps are relatively cheap to reach a better energy performance while it costs more and more to improve the energy efficiency of a building once the “low-hanging fruits” have been collected.

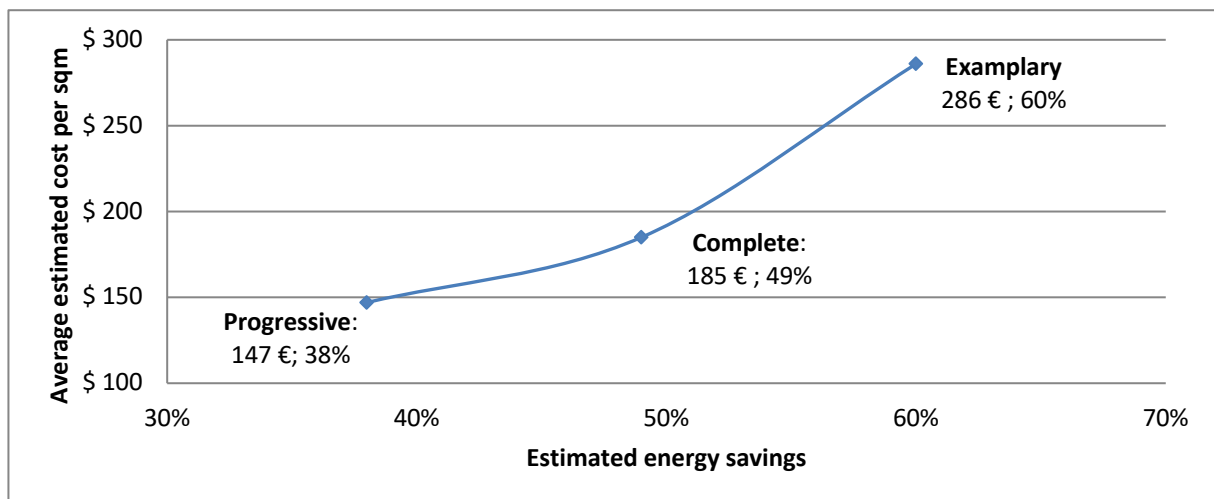


Figure 7-3 Comparative analysis of the average estimated cost per m² of retrofitting works (estimation made prior to the work, which has been used in the decision making progress) vs. estimated energy savings (in %)

Comparative analysis of the drivers influencing retrofitting vs. non retrofitting decision

The available database has been divided into two groups:

- Condominiums who have voted for the refurbishments works
- Condominiums who have voted against refurbishments works or whose process does not lead to any decision.

Various variables have been tested to find out whether the two sub-samples are statistically significantly different. EDDEN found that:

- The heating system brings a statistically significant difference: condominiums that decided not to invest in retrofitting are more frequently equipped with central heating systems. The households that did invest often have an individual heating system.

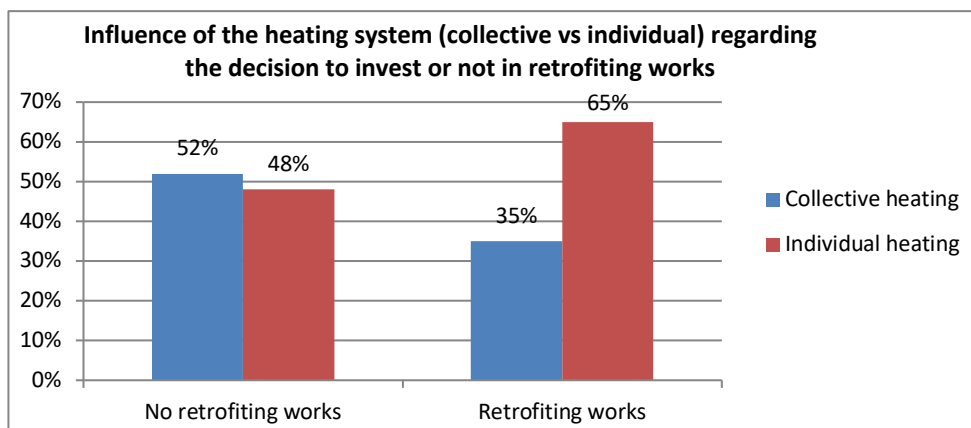


Figure 7-4 Effect of heating system on decisions regarding retrofitting

- The age of the building has also an impact on the household’s decision making: Households that decided to invest in retrofitting are living in buildings which are averagely built in 1965, while those that did not invest in retrofitting live in slightly newer buildings, average construction year of 1970.

The other variables tested did not bring any statistically significant difference between the two sub-samples. The figure below shows the share of owner occupants versus the share of landlords participating in the program.

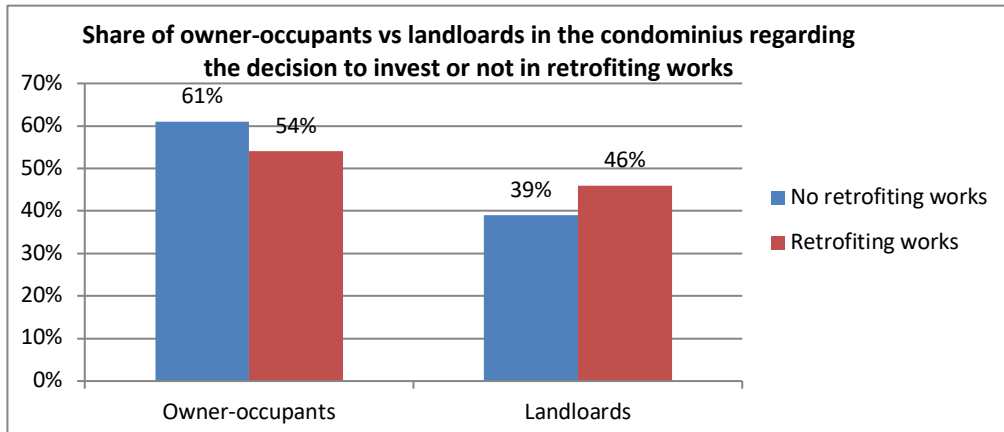


Figure 7-5 Effect of ownership on decisions regarding retrofitting

- The estimated full costs and remainders of the expenses for the condominiums as a whole, whatever the retrofitting package

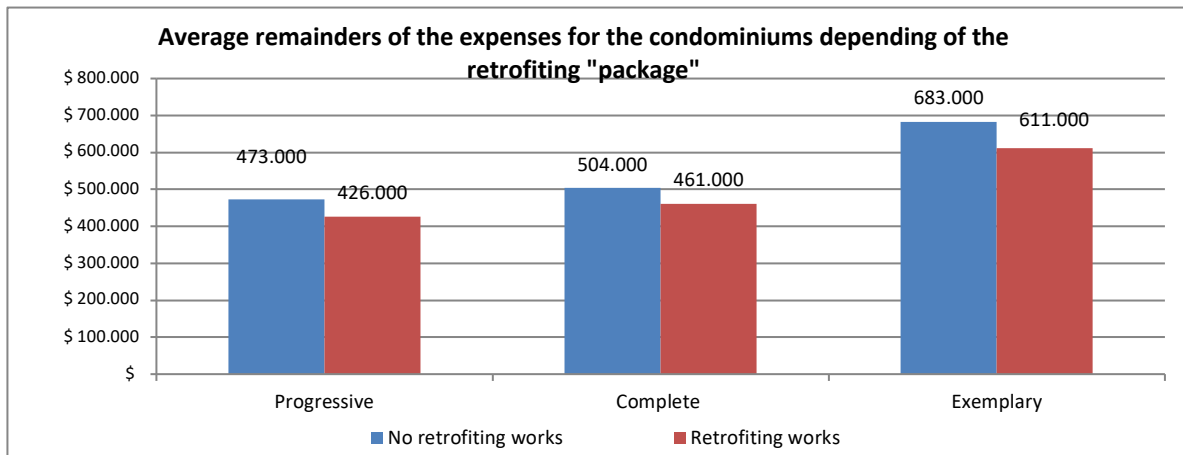


Figure 7-6 Expenses of retrofitting: remainders

- Similarly, the average estimated energy savings, whatever the retrofitting package

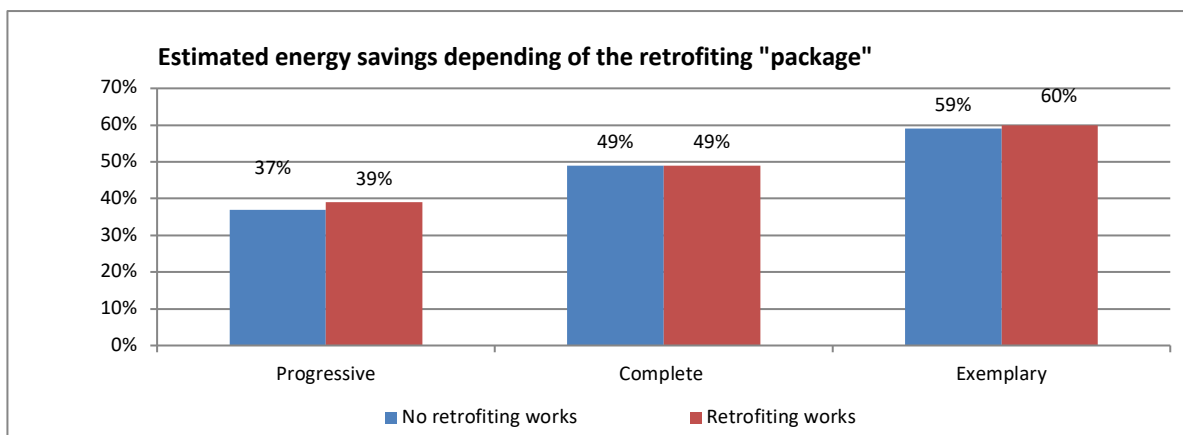


Figure 7-7 Energy savings of retrofitting

Results from the retrofitting households

The condominiums that did not decide to retrofit had a bigger share of rental apartments, were often equipped with central heating systems on block level and were built more recently, averagely 5 years ‘younger’ than buildings that were retrofitted.

The 84 condominiums that decided to invest in thermal retrofitting showed the following results

- 71% of them chose the “complete” package
- To address different types of homeowners, different retrofit packages were offered by La Métro, which corresponded with the amount of subsidies available for each package. In addition to the collective subsidy that each condominium was entitled to there are 4 categories: “very social” (the poorest households), “social”, “medium”, “off-ceiling” (the richest households). The descriptive statistics show that 25 % of the owners belong to the “very social” one while 50% of the owners are “off-ceiling”
- Real costs incurred can be as high as 58 % above the estimated initial full costs. The main reason comes from the fact that, in the end, many condominiums decided to benefit from the MurMur 1 opportunity to invest in more measures than the measures subsidized by La Métro (windfall effect)

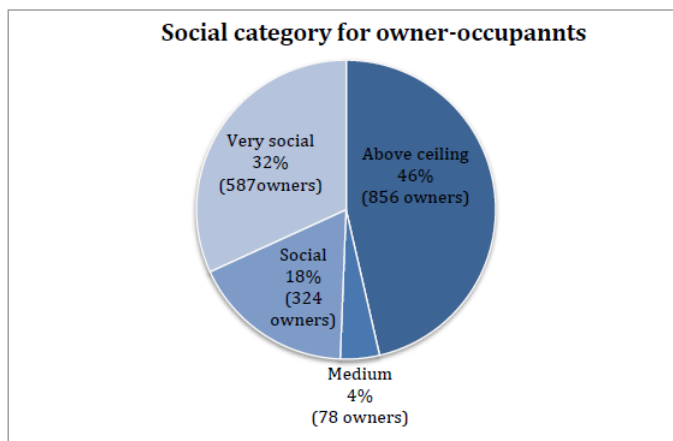


Figure 7-8 Distribution of owner-occupants according to their social category

7.5.2. Econometric analysis of the data

An econometric model is used to find out the main drivers of the decision to invest or not to invest in thermal retrofitting for households that applied for the MurMur 1 program.

The dependent variable is binary, corresponding to the decision to invest in thermal retrofitting. We have :

$$Y_i = \begin{cases} 1 & \text{if the condominium invests} \\ 0 & \text{otherwise} \end{cases} \quad \text{with } i \text{ the condominium}$$

We use a logit model to estimate the probability to invest, $Pr(Y_i=1 | X_i)$ with X_i , the housing and renovation characteristics.

The sample comprises all the condominiums for which the data of the potential explanatory variables are available (i.e. 95 condominiums).

The model points to the following explanatory variables that we suspect to impact the probability to invest in thermal retrofitting :

- The size of the condominium
- The construction year
- The years elapsed since the last facade refurbishment
- The location (Grenoble versus other cities within the Métropolian boundaries)
- The estimated remainder of the expenses per square meter for the “progressive” retrofitting package (as an indicator of the minimum expenses for the co-ownership if they decide to invest)
- The estimated energy savings
- The person in charge of helping the owners to understand and get their individual subsidies

	Effect	Significance
<i>Characteristics of the condominium</i>		
Nb of dwellings	-	**
Year of construction	-	***
Nb of years since the last facelift of the building	+	**
Grenoble	-	***
<i>Characteristics of the retrofitting works</i>		
Remaining amount per sqm for progressive retrofitting	- (-0.599)	**
Estimated energy savings	+	**
Personnel in charge of assisting the condominium	*/-	**
Nb of observations	95	

If the remainder of expenses increases by 10%, the probability to invest in a retrofit decreases by 6% *ceteris paribus*

Note: *** significance at 1%, ** significance 5%, * significance 10%

As expected, the remaining expenses per square meter have a negative effect on the probability to invest for condominiums that applied to MurMur 1. If the remaining expenses increase by 10%, the probability to invest in a retrofit decreases by 6%, given all other variables stay unchanged. The year of construction has also a significant impact: the older the condominium, the higher the probability to invest.

On the contrary, the estimated energy savings and the number of years since the last facade refurbishment have a positive effect on the probability to invest in a thermal retrofit, *ceteris paribus*.

The estimated energy savings have a positive effect: the larger the expected energy savings are, the higher the probability to invest. Also, the officer in charge of the MurMur program has a significant impact on the decision to invest. The way in which the retrofit project and individual

subsidies are presented to owners along with the personal contact with the experts seem to be important factors in the decision.

7.5.3. Conclusion and recommendations

Based on the results presented above, here are a few policy recommendations to be implemented in the MurMur2 campaign:

- as the probability for condominiums to apply to the MurMur program increases with the number of owners of the condominium and the expected energy savings, but decreases with the proportion of dwellings for rent, the construction year, the median price per square meter, and the older age of the owners, La Métro should use its Condominium Observatory to identify big, old condominiums, with a high proportion of relatively young owners, a high proportion of owner-occupants, a low median price per square meter and high expected energy savings ;
- Similarly, as the probability for condominiums to invest in thermal retrofitting is highest when the condominiums are located outside Grenoble, equipped with individual heating systems, with the oldest façade refurbishments, La Métro should primarily target these condominiums to improve its “success rate” (i.e. the rate of positive decisions to invest).
- As the probability to invest in thermal retrofitting increases with a specific officer in charge of helping the owners to understand and get their individual subsidies, La Métro could assign this person to more condominiums. If this is impossible, the person could explain and train his /her colleagues the way he/she deals with the owners.
- Putting more emphasis on energy savings during the meetings with the owners could also contribute to increasing the success rate of the public policy, as energy savings have a statistically significant positive effect on the decision to invest in thermal retrofitting.

7.5.4. Conclusion France and the Netherlands on retrofitting owner occupied dwellings

Both in the Netherlands and in France the key barriers in this market are:

- A lack of suitable available loans
- Low income households have no, or little, access to loans to finance energy efficiency measures
- Because the measures are complex and the market is relatively new, citizens experience lack of knowledge about how to retrofit: therefore both in Amsterdam and in Grenoble the local government has a focus on educating homeowners on this topic.
- Institutional investors/banks are not particularly interested in financing the existing retrofit projects because of a lack of volume/ scale and are neither showing the effort to develop financing schemes fit for small scale projects
- Banks do not (or to a limited extent) consider the financial savings achieved by the reduction of the energy bill in the assessment of the creditworthiness of the applicant, which does not facilitate/stimulate access to credit for low-income households.
- Subsidy policies differ within the City-zen project. In Grenoble La Métro is actively involved in offering more complete packages to homeowners aiming to educate homeowners, prevent energy poverty by subsidizing low income households and coordinating with banks to improve the access to capital of especially low- to middle- income households. In Amsterdam

the conditions to acquire the subsidy are very different. Here they are open to both private homeowners and landlords (private and social). The subsidy is available for renovations that will make a significant step in (theoretical) energy use reduction.²⁵⁹ The amount of subsidy available per dwelling solely depends on the amount of square meters, the measures taken, and investment made by the homeowner/landlords. The subsidy is not depending on the household's income. As a result in the category private homeowners, mostly high-income households apply for this subsidy.²⁶⁰

7.6. CHALLENGE: RENOVATION OF BUILDINGS WITH RENTERS IN THE NETHERLANDS

7.6.1. Introduction and relevance

The possibility of renovating and improving the sustainability of Amsterdam's building stock in the rental sector requires the approval of renters and/ or the establishment of sufficient legal basis for the renovation works.

Around two thirds of Amsterdam's population rents their home from a landlord. Housing corporations, (owning about 43% of the building stock²⁶¹) are challenged to improve the energy efficiency of their housing stock by both renters, local government and from within these associations. Since they own an extensive part of the Amsterdam housing stock, their policies and success rate in energy efficiency improvements are essential in the transformation to a more energy efficient city.²⁶²

Renovations that are planned and executed by the owner require the consent of renters, or sufficient legal ground. On the other hand, renters can desire improved efficiency of their homes. In that case, they will need to persuade their landlord and fellow renters that will also be affected (i.e. due to a rent increase) to take and/ or approve of the required steps.

Both perspectives (from owner and renter) are discussed here, highlighting the relevant legislation and the challenges it poses. We will start with the perspective of the building's owners (e.g. housing associations)

²⁵⁹ For the specific conditions see: <http://oud.amsterdamsmartcity.com/>: *Subsidie voor ambitieuze én innovatieve woningrenovaties*, 08.02.2016

²⁶⁰ For more information on the social analyses, contact Rick Fransman TU Delft and read: *Psychological and social factors underlying pro-environmental behaviour of residents after building retrofits in the City-zen project*, R. Fransman & A. van Timmeren, *CISBAT 2017 International Conference – Future Buildings & Districts – Energy Efficiency from Nano to Urban Scale*, CISBAT 2017 6-8 September 2017, Lausanne, Switzerland

²⁶¹ AFWC, *Jaarbericht 2016 – Tabellen en figuren woningmarkt algemeen*, Figuur 2

²⁶² This was again underlined in an agreement between the City of Amsterdam and the Amsterdam federation of housing associations in May 2016. The agreement includes an ambition to make 40.000 label steps before 2019, and 100.000 existing natural gas connections will be terminated by 2040 Unclear is what alternative heat source will be used to replace the gas connection in *Uitwerking samenwerkingsafspraken tussen Huurdersvereniging Amsterdam en de Amsterdamse Federatie van Woningcoöperaties en de Gemeente Amsterdam*, mei 2016.

7.6.2. Owner's perspective

When the owner plans for renovation works, a number of articles are important to take into account. In this case the most important provisions are included in Article 7:220 of the Dutch Civil Code (CC).

Renovations vs. urgent repairs

Energy performance upgrades fall roughly under Renovations provision, article 7:220, led 2, of the Dutch civil code. The Dutch Civil Code distinguishes urgent repairs and renovations. There is a fine line between repairs and renovations, and in case law we see that they can overlap. Urgent repairs are repairs that cannot be postponed until the termination of the contract (article 7:220 led 1). Examples are: paintwork, foundation repairs, treatment of moisture damage etc. Urgent repairs will not result in an increase of rent.²⁶³

Renovations however, are defined as (partly) renewal, changes or additions to the premises. Renovations are not to restore damages, but to increase the living comfort of residents (article 7:220 second led). Typical repairs and changes that fall under these provisions are: changing heating system, roof insulation, changing windows, adding mechanic ventilation, closing of balconies, changing out kitchen and bathroom. Many of these examples of renovation relate to the energy efficiency of the building.

Key difference between urgent repairs and renovation is that a renovation often results in a rent increase. Article 7:220 of the Dutch Civil Code (CC) regulates the obligation to tolerate urgent repairs and/or renovations, even though this is a direct infringement upon the tenants living comfort ('rustig genot', article 7:203 CC).²⁶⁴ It should be noted that the 7:220 is regulatory law, not imperative, that means that parties can agree to something else.

Apartment block renovation

A special provision is made for apartment blocks (article 7:220 led 3). Renovations concerning more than 10 dwellings that form a unit²⁶⁵ fall under this provision (*complexgewijze renovatie*). The provision states that if 70 % of tenants approve of the proposed renovation, the proposal is presumed to be reasonable. Tenants that disapprove have 8 weeks to take it to court and prove that the proposal is unreasonable. If the individual tenant has claimed satisfactorily that the proposal is unreasonable to him, the burden of proof will be laid back to the association again.²⁶⁶

For the association to prove that tenants had the possibility to appeal, they need to be able to show that 70 % of its tenants have given (explicit) permission.²⁶⁷ In addition the outcome of the approval of 70% or more, needs to be shared with the tenants. Renters that accepted the proposal will be held to keep this agreement, even if the proposal is judged unreasonable, later in court.^{268 269}

²⁶³ *Memorie van Toelichting: Dutch parliament document: Kamerstukken II 1997-98, 26089, 3*

²⁶⁴ *R.A. Dozy, F. Van der Hoek, Huurrecht, tekst en commentaar, Kluwer Deventer, 2014, p. 39*

²⁶⁵ *Unit: apartments need to be in the same building block. Housing that is spread cannot be identified as a building unit. Huurgeschillen ontleed, F.C.P. Meeuw, Eburon Delft 2016, p. 370*

²⁶⁶ *F.C.P. Meeuw, Huurgeschillen ontleed, Eburon Delft 2016, p. 377*

²⁶⁷ *Approving means that the association has the consent of 70 % of the renters, not that it has less than 30% opposing the proposal*

²⁶⁸ *Kamerstukken I 2001/02, 26 090 en 26 932, nr. 162, p. 18 en A.M. Kloosterman et al., Hoofdlijnen in het huurrecht 2014, nr. 4.7.1, p. 89*

A misunderstanding is that associations cannot proceed with renovations when 30% or more of the tenants reject the proposal.²⁷⁰ The general rule however, is that the proposal needs to be 'reasonable'. Even though 90 % of the renters do not agree, a proposal can still be validated as reasonable in court.

This was also stressed in the lawsuit that the housing association Stadsgenoot proceeded against a number of residents that refused a renovation proposal that consisted of changing out the old gas stoves and gas water heaters.²⁷¹ According to Stadsgenoot the replacement of the old heating system should be validated as an improvement and therefore a raise in rent by 20 EUR a month should be legitimate. The court rules that seen from the perspective of security and considering that the proposed heating system fits current requirements, the proposal is reasonable. The court considers the increase in rent to be reasonable, but it will be the tenants' commission that will rule on this matter (article 7:220 CC), which is the competent body on this subject.

The ruling fits within the intention of the legislator to create the possibility for owners to improve their rental units and so contribute to a high quality rental housing market.²⁷²

Reasonable proposal

As highlighted in the previous sections, an owner will need to come with a written *reasonable proposal* on the intended renovation.²⁷³ To evaluate whether or not a proposal is *reasonable* the interests of both owner and renter are measured.

The financial consequences for and the personal circumstances of renters will play a role in weighting the pros and cons. An example of an individual circumstance can be a raise in rent that would result in crossing the rental subsidy (huursubsidie) level.²⁷⁴

Renovations do not need to be urgent or necessary to be reasonable.²⁷⁵ A judge however, can decide that a proposal that is not urgent is not reasonable for the individual renter. The assessment of whether or not a proposal is reasonable will depend on the individual needs and situation of the renter. The burden of proving that the proposal is reasonable lies with the owner.

The required ingredients for a reasonable proposal are:²⁷⁶

²⁶⁹ *To make sure the association will not be bound by an agreement with those who accepted the proposal, a reservation needs to be made that the agreement will only enter into force when a number of households agreed, depending on the business case. For certain renovation projects you might need 100 % cooperation, whereas other renovations are feasible with only 60 %. Meeuw 2016*

²⁷⁰ *Associations might promise renters that if they do not reach 70% consent, they will not proceed. And when this is officially communicated, they will be bound by this: ECLI:NL:GHSHE:2008:BD4790*

²⁷¹ *ECLI:NL:GHAMS:2015:232*

²⁷² *JHV 2015/49, 27-01-2015, Gerechtshof Amsterdam, zaaknr. ECLI:NL:GHAMS:2015:232 (mnt mr. T. Gardenbroek)*

²⁷³ *The tenants organisation has the right to issue there advice in respect to the planned renovation. If not obeyed, the court can postpone the renovation works; article 4, 3 and 5 (Wet op het overleg huurders verhuurder), Meeuw 2016, p. 377*

²⁷⁴ *This means that the housing will no longer qualify as social housing and the renter will lose its right to subsidy on the rent.*

²⁷⁵ *ECLI:NL:RBHAA:2008:BF0334*

²⁷⁶ *Meeuw 2016, p. 360*

- A proposal must be made in due time. A proposal that is made shortly before the renovation will have high odds to get his proposal judged as unreasonable in court.
- The proposal needs to contain an overview of the planned works and it needs to be the final proposal. It is unreasonable to make any changes.
- It needs to include the start- and end date of the activities.
- A justification of the proposal.
- Consequences of denying the proposal.
- Possible rent increase.
- The possibility of temporarily living in another house.
- Other relevant circumstances.

7.6.3. Renter's perspective

Not only housing associations can experience a lack of cooperation in upgrading the energy performance of rental housing, also renters can be confronted with landlords/housing associations that do not want to invest in energy efficiency measures or energy production. What legal tools do renters have to enforce energy efficiency measures from the landlord?

Renters cannot force their landlord to renovate, except from taking energy efficiency measures (CV, if the old system is more than 10 years old, insulation of the thermal envelop; walls, windows). Article 7:243 CC says that a tenant has the right to require energy efficiency measures, if they are willing to pay for an increase in rent that bears a reasonable relation to the costs. To enforce this right, the tenant has to go to court. The court will decide what will be a reasonable rent increase. The law does not provide any instructions in how to balance these interests.

The reach of this article has so far been limited. There is very little case law. In 2014 the Amsterdam court decided to reject a proposal from a tenant that wanted the old gas stoves to be replaced by CV heating system. The court decided that since the article only speaks of replacement of an old CV system, this request does not fall under article 7:243. It is noteworthy that in the case of *Stadsgenoot*, the housing associations proposal to change out the old gas stoves as discussed before, was reasonable.²⁷⁷

Another possibility for tenants to improve the energy performance of their housing is to invest themselves in energy efficiency measures. Principle rule is that the tenant will need to ask permission in accordance with article 7:215, first led, unless little effort is necessary to undo the changes made and the changes do not harm the dwelling.

For more significant changes, the consent of the owner will be needed. Case law shows an example of a tenant that would like to use the rooftop to install solar panels. The association refused his demand and claimed that the rooftop was not part of that what is rented out. Moreover, they argued that the tenant does not have access to the roof and therefore did not fall under article 7:215. The court follows the housing association and demands the tenant to remove the solar panels.²⁷⁸ Led 6 of the same article, prohibits tenants to change the outside of the space rented.²⁷⁹ That means that

²⁷⁷ *ECLI:NL:GHAMS:2015:232*

²⁷⁸ *ECLI:NL:RBDHA:2014:16078*

²⁷⁹ *This might be different when one rents a rooftop terrace.*

outside walls and rooftops do not fall under article 215. Energy performance upgrades are limited to the inside of the apartment under the condition that the changes are necessary for efficient use of the property, and there are no substantial objections from the landlord.

Energy production on the outside walls or rooftop is only possible with the consent of the landlord. When a landlord is reluctant to approve, there are no legal instruments for tenants to enforce cooperation.

7.6.4. Conclusion

The assumption that associations are depending on the consent of their renters to improve the energy efficiency of their houses, is not correct. However, the road to get a proposal accepted by renters or judged as 'reasonable' through court is complex and insecure. Many factors need to be taken into account, all the way to the individual level of the renters, including financial and personal matters. A small number of financially weak households might stop the renovation of an entire complex.

In the light of the energy transition and the development of a sustainable housing stock, housing associations have a responsibility to both renters and society to make a positive contribution to this process. In assessing whether or not a proposal is reasonable, the importance and the necessity of improving the energy efficiency should not be taken lightly.

7.6.5. Recommendations

Only once every 30 to 40 years, housing undergoes major renovations, according to the housing associations. That means that every house that is renovated today, will not be extensively renovated before 2050. Today's decisions are directly impacting whether or not we will have a CO₂-neutral built environment by 2050. It is recommended that whenever big renovation works be executed, as much sustainability improvements are incorporated as possible.

At the same time, we see that the legal instruments for renters to enforce energy performance improvements, or produce renewable energy, are limited. Even when tenants are willing to make an investment, for example in solar panels, they have no legal instruments to proclaim the roof; they are fully dependent on the permission of the landlord. Fortunately, there are many associations willing and taking initiative to engage tenants for these possibilities.²⁸⁰ The question remains if private landlords are equally willing to cooperate. Irrespectively of the type of house owner, a legal instrument to support tenants to use the outside walls and rooftops, if reasonable, seems desirable. In addition, an extension of article 7:243 of the Civil Code on the rights and duties of owner and tenant needs further study.

7.7. CHALLENGE: SPLIT INCENTIVE AND THE ENERGY PERFORMANCE FEE IN THE NETHERLANDS

7.7.1. Introduction

Housing corporations and tenants have different energy incentives and this may lead to overconsumption of energy. Where the tenant pays the energy bill, corporations are responsible for the energy performance of the dwelling. Since energy costs are not discounted in the rent,

²⁸⁰ *Lessons can be learned from initiatives like: huurdezon.nl*

corporations will not get enough revenues from investing in energy saving measures. This is called the split incentive and concerns the lack of incentives to invest in the energy performance of the house because costs and benefits lay not with the same party.

Having such a substantial rental housing market, the Dutch government has introduced a new law in the spring of 2016, to overcome this split incentive and financially stimulate the landlords in refurbishing rental housing to ‘nearly-zero-energy’ housing²⁸¹, by means of an Energy Performance Fee (*Energieprestatievergoeding*, or *EPF in the remainder of this document*).²⁸² This law allows housing associations to charge renters an extra fee in return for upgrading their housing to nearly zero housing (‘nul-op-de-meter’, or ‘NOM’ houses).

The law is particularly interesting because it touches some of themes that have been addressed before, namely: managing the inhabitant’s energy costs and the questions around renovation projects. In the discussion of this challenge, these aspects will be addressed and the challenges related to this new law are studied.

7.7.2. Laws and regulations

In the Netherlands the value of a social housing unit is determined by the amount of points that are attributed to the dwelling. The rent for social housing is based on a system that will give points for every valuable aspect of the house, like the amount of square meters, outdoor space, kitchen, bathroom, market value of the building etc. Since 2011 the energy performance of a dwelling is also part of this valuation system.²⁸³ For houses with a high energy label a higher rent can be charged. Unfortunately this is not always in the interest of both the renter and the landlord, because an increase in rent can have a negative impact on the affordability of the dwelling. This needs to be seen in relation to the Dutch social housing subsidies. Renters with a low income can qualify for an extra subsidy on their rent (huursubsidie). The subsidy is only available for rental housing with a maximum of 710 EUR a month (2017). An increase in rent could mean that the renter loses the right to receive subsidy. In addition, rent increases on housing below the social rent limit of 710 EUR are regulated. Crossing this limit would also mean that the renter would lose some essential rights. The primary objective of social housing associations is to provide affordable housing for low-income households. Raising the rent because of the energy performance of the dwelling could be conflicting with their main duty. Especially in larger cities like Amsterdam and Rotterdam, the rent of an 80 m² apartment is often close to this limit and the margin available for increases limited.

7.7.3. The Energy Performance Fee (EPF)

The EPF bypasses this problem by defining the extra charges as a fee, not part of the rent. The advantage over a normal rent increase is that the official rent stays low and the renter continues to qualify for rental subsidies (huursubsidie). This means that the EPF + rent could cross the 710 EUR a

²⁸¹ *Even though the legislator argues that this law is made to create clearer borders between living costs and energy service costs, DUTCH PARLIAMENT DOCUMENT: Kamerstukken 2014/15, 34228, 3, p. 7*

²⁸² *Stb, 2016, 199, Wet van 18 mei 2016 tot wijziging van Boek 7 van het Burgerlijk Wetboek en de Uitvoeringswet huurprijzen woonruimte in verband met de mogelijkheid voor verhuurder en huurder een energieprestatievergoeding overeen te komen. Entered into force on the 1th of September 2016, Stb 2016/302,*

²⁸³ *Stb 2011, 315*

month and the renter still lives in a dwelling that is qualified as social housing and still can get subsidy.

The rationale behind the fee is that by improving the energy performance of the dwelling, the saved money on energy expenses can be used to pay for this extra fee.

Condition is that the fee will be approximately as high as the energy expenses saved by the tenant, and the total living expenses will be more or less stay the same.²⁸⁴ The result is an additional monthly fee of maximum 1,40 per m², per month, that can be charged depending on the energy performance of the house (or energy savings of the tenant) after renovation.²⁸⁵ The EPF can also be charged for new built housing that meets the required standard.

The traditional 'point-system' that is used to validate the appropriate rent, also validated the energy performance of the dwelling. To prevent double charges both through this system as through an EPF, there are limitations made. Dwellings with a high energy-index that qualify for an EPF, can only take the energy-index for a label B dwelling.²⁸⁶

Albeit this limitation, parliament was still concerned about how this new legislation would impact financially vulnerable tenants. The Parliament passed an amendment, which states that the total living costs (energy performance fee + rent + energy bill) are not allowed to increase in relation to the old situation (rent + energy bill) by the 'same' use of energy; a so called 'living cost warranty'.²⁸⁷ See figure below.

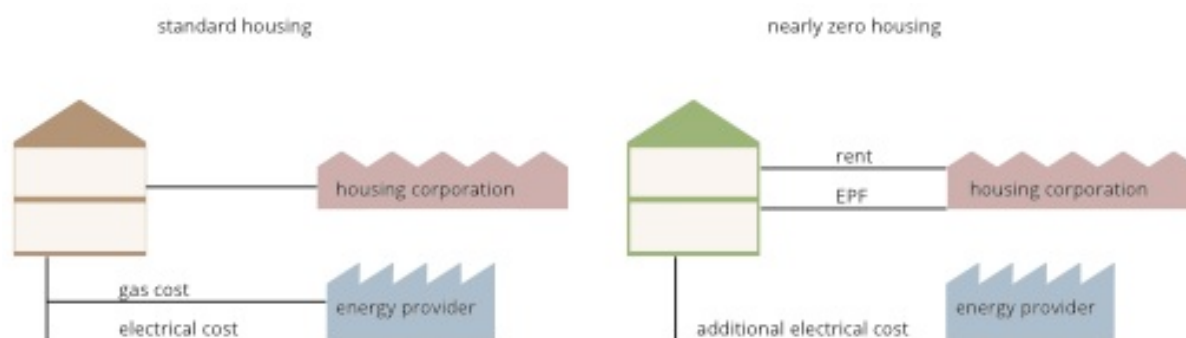


Figure 7-9 Energy flows standard and nearly zero housing

The proposal of the 'warranty' has been published in March 2017. The warranty is only available for renters that lived in the dwelling for a minimum of three years. Based on their energy consumption data, the landlord will have to offer a living cost warranty, which means that after renovation they

²⁸⁴ Example: Apartment of 90 m² with an energy bill of 120 € a month. After renovation the house consumption should be around 0 and the rent will go up with 90x1,40= 126 €. Living costs will increase by 6 € in this example. A tax refund that all households still receive on their energy bill will compensate the network costs.

²⁸⁵ Depending on the performance of the dwelling, the fee will be maximum 1,40 €/m²/month for the best performing dwellings that are all electric, and 0,70 €/m²/month for housing with a connection to district heating. Besluit energieprestatievergoeding huur bijlage I, Stb 2016, nr. 199

²⁸⁶ Besluit huurprijzen woonruimte, Bijlage I A sub 4.

²⁸⁷ Dutch Parliament document: Kamerstukken II 2015-16, 34228, 22: Amendement Albert de Vries cs, woonlastenwaarborg

will not pay more than before renovation. Such a warranty is only possible if three years of data is available and if the tenant voluntarily provides the association with the data.

For those households not using the warranty, the association will calculate the energy use of an average family in the building after the upgrade. Renters with a lower consumption might get a fee for the extra, not consumed, energy produced and sold to the supplier. Renters using more than the average calculated use will be paying an extra fee to the energy supplier.

The warranty focuses on the individual consumption of a renter. A single-person household will often have a lower energy use than a family. This means that based on the legislative proposal on living costs warranty, the housing association could install less energy production to compensate the energy consumption for the single household and more for the family household. In practice we see that the housing association participating in City-zen, does not make custom made adjustments, but renovates all apartments to the same standard, which aligns with the fact that the apartment will over time house renters with different consumption patterns. Adjusting only to the current renters needs would not be sustainable.

The warranty has solely a financial impact on the EPF. There is a much higher EPF for households with a high-energy bill, and a low EPF on those with a low bill.²⁸⁸ A complex with long-term renters – more than 3 years- and very energy efficient renters makes a very bad business case.

The housing association partnering in the City-zen project first calculates with the energy index of a label B dwelling, which often means a rent increase of about 45 EUR. In addition to this increase, the energy bill of the renter will allow them to charge an extra EPF. In case of an average energy bill of 120 EUR, they will charge an extra EPF of 120 EUR. In total, the renter will pay at least for the 45 EUR rent increase. According to the housing association, the EPF is an effective instrument to make a secure business case.

The EPF was originally meant for houses that are either 'all electric' or have a connection to the district heating system, but was extended to gas heated rental homes, as long as the gas-use will be compensated by renewable energy production on the building.²⁸⁹ This is further discussed in paragraph 7.7.7.

7.7.4. Stroomversnelling

The Energy Performance Fee is developed together with a number of parties. i.e. *Stroomversnelling*.

Stroomversnelling was originally a cooperation between four building companies and six housing associations to develop renovation concepts that could bring the total energy consumption of a house to zero, the so-called 'zero on the meter' houses. Today over 180 companies and institutions are connected to *Stroomversnelling*. Aim is to develop energy neutral housing, get experience and bring down production costs over time.

Renovations of existing housing to nearly zero energy are expensive, average 65.000 EUR if you use the NOM model as developed by *Stroomversnelling*. Social housing associations play an important role in the development of these renovations. The aim is that 111.000 houses will be renovated by 2020. This will not be achieved. Since the start of *Stroomversnelling* in 2013 almost 2000 houses have been renovated, mostly by housing associations. Many housing associations are planning and

²⁸⁸ Single household with an energy bill of 50 € a month vs. A family with a bill at 120 € a month. Both apartments are of similar size, say 90 m².

²⁸⁹ *Regeling Energieprestatievergoeding huur, article 4 and the annex*

preparing renovations, so this number is expected to grow. Hopefully the experiences in the social housing sector can improve the business case for private homeowners and eventually bring down the cost significantly to 45.000 per house. Which is, according to the *Stroomversnelling*, an acceptable price for a NOM house/nearly zero energy house. Housing associations have an important societal role in developing affordable retrofit solutions for all homeowners, both owners and renters.

Business case

An average NOM renovation for a housing association costs around 65.000 EUR. In addition, there are yearly maintenance costs of 1.300 EUR for rental houses. A renovated house should be able to function at least for another 40 years. *Stroomversnelling* calculates that each renovation will be earned back in 40 years and even yields a return of around 5.25 percent. Many market parties are voicing that this might be a very optimistic calculation.

The costs for renovating to label B are also quite high, but less high as going to zero. Renovating to NOM standard has nevertheless several advantages over upgrading to label B:

- The lifetime of the house will substantially improve
- The housing association can charge an EPF
- The housing associations can use regular loans with a guarantee from the WSW²⁹⁰ to finance the investment in NOM if some specific financial conditions are met²⁹¹
- The investment has a guarantee from the NOM supplier
- The house is more future proof than a label B dwelling because of possible changing energy performance regulations, like obligated label steps from C to B to A, hence there are less risks to be subject to policy changes.

Stroomversnelling has developed a NOM quality mark, and a guarantee-institute that will ensure that the required performance is delivered when the supplier fails. There is an advantage in that housing associations are pushing this development. In case mistakes are made, and they often are when developing something new, it is easier for bigger organisations like the housing associations to address the issues than it would have been for much less powerful individual homeowners. In addition, the renters are also protected by renters' laws and can address the housing association when the house is not up to standard.

7.7.5. 'Zero-on-the-meter' does not stand for 'zero-energy-bill'

Housing associations are positive about this new legislation. It is a serious tool to overcome the split incentive in residential energy consumption and it provides the associations with a steady income to pay for their investments. The housing association involved in the City-zen project voiced that, because of this legislation, and the willingness of the building industry to make an investment in the development of nearly zero energy housing, they have a solid business case. Having said that, we have to acknowledge that there are still some important objections and considerations.

There are several risks for the inhabitants. In the first place, there is the energy performance gap between actual and theoretical consumption. Like many associations already have experienced in earlier energy upgrades, the rebound effect can be heavily underestimated (for more information

²⁹⁰ *Waarborgfonds Sociale Woningbouw: Guarantee fund for social housing:*

²⁹¹ *Stroomversnelling Nederland, Wat elke woningcoöperatie moet weten over de business case en de financiering van nul op de meter renovaties, P. 19 and 22*

see challenge 7.8). During the parliamentary debate the guarantee for constant living costs before and after renovation has been a major topic. Housing associations not only have to, preferably, convince people of the importance of upgrading the buildings energy performance. They also have an important role to play in informing their renters about energy consumption and adjusting behaviour to the new situation, after renovation. The warranty on 'same energy consumption' might provide stimulation for energy efficient behaviour of the habitant.

In addition to the behavioural challenges, there are many uncertainties to take into account that will influence the tenants' energy bills directly. Examples are: changing energy prices, -taxes and -net metering legislation. In the light of uncertainties such as these, which have also been pointed out in relation to the homeowners, and which are risks that are primarily borne by the renters, it will be the question if housing associations at all can provide a *real* 'same-living-costs-guarantee'. The current proposal does not consider any of these factors. In turn, this also presents policy makers with an important challenge of how to further tailor policy and regulations to establish a fair balance between the interests of both landlord and renter.

7.7.6. A reasonable energy efficiency proposal

An upgrade to nearly-zero energy level can be qualified as a renovation proposal to the tenants. That means that the housing association is operating within the frame discussed in the challenge on renovating buildings with renters. As we have seen before it will depend on the proposal, but also on the individual circumstances whether a proposal will be deemed reasonable. The guarantee that the living expenses will be practically similar before and after renovation (they might increase a little bit) will be a crucial element for a judge in the equation of the different interests. Nevertheless such a guarantee is problematic, and depends on many factors.

7.7.7. Gas heated nearly zero energy housing

In addition to NOM housing with a connection to district heating and all-electric systems, the legislator also extended the EPF law, by allowing an EPF for gas heated housing, under the condition that on the house an equivalent amount of renewable energy will be produced.²⁹² This is a surprising proposal because of several reasons. First of all, the definition of a 'nearly-zero-energy-house' implies also house that does not emit greenhouse gas emissions. By allowing gas heating, emissions will remain, or even increase.²⁹³ Secondly, allowing this undermines the development and innovation of district heating and 'all electric' heating solutions. Since it is easier, and most probably cheaper, to heat with gas, in the absence of an adequate CO₂-price, than with district heating or electrical appliances, associations might be tempted to choose gas over other alternative solutions. The purpose of the extra income generated by the EPF was, among other things, to invest in developing these techniques. Third, this provision can have consequences in the road to gas-free-neighbourhoods, as desired by Amsterdam in particular and The Netherlands more generally speaking. By allowing this option, these houses might be depending on the gas network for much longer, and so this can create a lock-in.²⁹⁴ Finally, today's housing stock needs to be made 2050-

²⁹² Article 4, *Regeling Energieprestatievergoeding Stc 2017, nr. 3746*

²⁹³ *The proposal would have a negative impact on the ETS system. CO₂-emissions from housing do not fall under ETS and the renewable to compensate this, do. Allowing gas consumption to be compensated by solar energy production only enlarges the emission limit and therefore undermines the ETS system.*

²⁹⁴ *Lock in: by allowing the gas connection, the gas network needs to be maintained or renewed; these investments will lead to retaining the gas network the upcoming decades.*

proof. By allowing a gas connection, these houses are not in line with the 2050 climate goals. Fortunately the EPF will only be available for gas heated homes until the first of January 2022. There is a transitional clause that will allow landlords to continue to charge an EPF if they were entitled to before 2022. This also applies if the property is subsequently rented to a new tenant.

In the light of climate change, sustainable living costs, unknown future energy prices, changing net metering legislation and energy performance gaps, this energy performance fee leaves government, tenants and housing associations with many challenges and uncertainties.

7.7.8. Conclusion

As described in this paragraph, solving the challenges posed by the ‘split incentive’ between tenants and housing associations or landlords, when aiming to develop a CO₂-neutral housing stock is not straightforward. Dutch policy makers are trying to cope with the related difficulties by means of the EPF and the fact that renovations aimed at CO₂-neutrality, may not (significantly) increase living costs for renters. Nevertheless, a lot of uncertainties (e.g. price developments for fuel and technology) can impact upon (perceived) costs and benefits on either side (tenants and housing associations/ landlords).

7.7.9. Recommendations

Because it is likely that it will be practically impossible to solve all the related difficulties upfront (in legislation), an important part of the solution might be in acknowledgement of the fact that developing a CO₂-neutral housing stock is important to all parties involved: it is a majorly important factor in preventing severe global climate change, and further pollution of one’s direct environment. Structured communication on all levels (national / local / between housing associations and their renters), and between all other stakeholders involved, might therefore be the strongest tool available to highlight the common interests and discuss / mitigate adverse effects to either party in each project. National laws should recognize the need for coping with a large multitude of interest conflicts.

Energy poverty and the ability to provide an affordable energy solution will likely become an important (political) theme in the upcoming decade(s).

7.8. CHALLENGE: MISMATCH BETWEEN CALCULATED/ PROJECTED PERFORMANCE AND ACTUAL PERFORMANCE: ENERGY PERFORMANCE GAP

7.8.1. Introduction

The energy performance of a building is qualified by so-called ‘*Energy Performance Certificates*’. These certificates are based on a theoretical consumption of the house. Housing corporations, energy advisors and architects in the different City-zen projects point out the discrepancies between theoretical energy consumption and the actual energy consumption of a building. Renovating or building a dwelling to high energy standard does not necessarily mean actual reduction in consumption of energy; this is also called the ‘energy performance gap’.²⁹⁵

²⁹⁵ E, Burman, D. Mumovic, et al. *Towards measurement and verification of energy performance under the framework of the European directive for energy performance of buildings, Energy, Volume 77, 1 December 2014, Pages 153–163*

The discrepancies between expected consumption and actual consumption have also been studied in the Netherlands by Majcen. 200.000 dwellings have been analysed in this study by Majcen at the Technical University in Delft²⁹⁶ and the results show that the theoretical consumption does not predict actual consumption. Low certified dwellings (labels F and G) have a lower energy consumption than predicted, and theoretically high performing dwellings are consuming 20% to 30 % more than expected. These discrepancies are also affecting the City-zen demonstration projects on several levels.

7.8.2. Laws and regulations

Energy performance certificates

One of the measures to improve energy efficiency is the obligation that for every building with a residential purpose that is constructed, sold or rented out to a new tenant, an energy performance certificate (EPC: not to confuse with the Energy Performance Coefficient) is issued. This obligation is an implementation of the EPBD²⁹⁷ and is in The Netherlands laid down in the Decree Energy performance of Buildings (Besluit Energieprestatie gebouwen)²⁹⁸ and Regulation Energy Performance on Buildings (Regeling energieprestatie gebouwen). The certificate does not include any obligations towards homeowners. Homeowners might invest in energy efficiency measures, but there are no legal obligations.

The Dutch national government uses the certificate level as a reference for the ambitions on improving the energy performance of the building stock. An example is that the average certificate level for social housing should be at label B by 2020.²⁹⁹

The energy performance gap

Since there is a deviation between actual and theoretical consumption, the question is if the current labelling system is adequate.

There are several reasons for the performance gap. Engineering calculations may overestimate the energy savings when investing in energy efficient techniques. In addition, engineering assumes always-perfect installation and perfect insulation. Building industry might not deliver a house with the right energy performance. This leads to overstatement of the returns.³⁰⁰ The building itself might also have been underestimated before renovation.

²⁹⁶ A. Majcen, *Predicting energy consumption and savings in the housing stock, A performance gap analysis in the Netherlands*, ABE, TUD, 2016, uitg. 4, read also: *Towards measurement and verification of energy performance under the framework of the European directive for energy performance of buildings*, E. Burman, D. Mumovic, J. Kimpian, *Energy*, Volume 77, 1 December 2014, Pages 153–163

²⁹⁷ Article 11 EPBD. *The new tool was welcomed as a tool leading to empower homeowners in their decision-making on energy efficiency. Today member states agree that the EPC tool is not leading to as much energy efficiency transformations as they hoped.* L. Murphy, *The influence of the Energy Performance Certificate: The Dutch Case*, EP, vol. 67, 2014, p. 664-672

²⁹⁸ Article 2.1 Decree Energy performance of Buildings

²⁹⁹ *Agreement between the national government and the social housing representatives: Covenant Energiebesparing Huursector*, juni 2012.

³⁰⁰ K. Gillingham & K. Palmer, *Bridging the Energy Efficiency Gap: Policy Insight from Economic Theory and Empirical Evidence*, *Review of Environmental Economics and Policy Advance Access*, 2014, p. 4

To ensure that the building that is delivered will function optimal, the building needs to be monitored and tested for leakages. In addition, the builder could give off an energy performance guarantee. This is now practice between the housing association and the builders that participate in some of the City-zen refurbishment projects. The builder will ensure a certain performance of the building.³⁰¹

Also, the EPC is only governing a part of the energy use, mainly heating. Electrical appliances and private lighting are governed by other legislation and not by the EPC.³⁰²

Occupant's behaviour

The behaviour of occupants can first of all be miscalculated because of different reasons. The house might be experienced as complex to operate; difficult heating/ventilation system, service elements are not easy to access, or the inhabitants' energy needs are underestimated.³⁰³

Another common seen effect is the rebound effect, which means that calculations often assume that energy demand will be constant before and after refurbishment. However, consumers are often more likely to increase their energy consumption because of inherent savings and increased affordable comfort.

In a similar vein, inhabitants of badly performing buildings will use less energy than calculated in the initial situation, e.g. because they do not heat sleeping rooms in order to limit exorbitant heating bills – this is the rebound effect. Once renovated, they will change their behaviour and the savings will not be as big as assumed through e.g. EPC calculations.

Economic impact

The gap between theoretical and actual performance is not only a barrier in achieving CO₂-emission goals, but it also has a significant impact on the financial feasibility of a project.³⁰⁴ The most important incentive to invest in efficiency retrofits, amongst energy savings³⁰⁵ and market value of energy efficient real estate³⁰⁶, is often said to be utility savings. In 2014 the average household in the Netherlands consumed 1200 m³ gas and 3050 kWh of electricity³⁰⁷, spending around 1600 EUR yearly. This potential of reducing one's energy bill to zero, is one of the financial incentives to make energy efficient buildings more attractive.

³⁰¹ *Eerste ervaringen met prestatiegarantiecontracten voor nul op de meter woningen, TNO, RIGO, Van Beek en Energiesprong | Platform 31*

³⁰² *H. Visscher, F. Meijer, D. Majcen, L. Itard, Improved governance for energy efficiency in housing, BRI, May 2016*

³⁰³ *H. Visscher et al. 2016*

³⁰⁴ *D. Majcen, Predicting energy consumption and savings in the housing stock, A performance gap analysis in the Netherlands, ABE, TUD, 2016, uitg. 4.*

³⁰⁵ *Investing in energy efficiency is risky because of fluctuating energy prices. K. Gillingham & K. Palmer. Legislation like the 'salderingsregeling' is among other things an (temporary) answer to this problem.*

³⁰⁶ *Green performs better: Energy efficiency and financial return on buildings, IRE/BS, M. Caijas, D. Piazzolo, A German study shows that energy efficient buildings have an up to 3.15% higher return and 0.76 €/m² higher rent prices than inefficient assets. Both developers, architects and private homeowners voiced their concern about return on their investment.*

³⁰⁷ *Energieverbruik particuliere woningen; woningtype en regio's, CBS 25 september 2015.*

Nearly-zero-energy-housing

Nearly zero housing, or deep retrofits, are not included in the study by Majcen. Although these houses are still dealing with technical challenges, according to the Energiesprong, an information platform initiated by the Dutch government,³⁰⁸ the energy savings in these deep energy retrofits are significant.³⁰⁹ A baseline for normal energy demand is set, and the house should approximately produce enough energy to fulfil this need.³¹⁰ Inhabitants that use more than this baseline, will have to pay for the extra energy they use. This might be a positive stimulation to influence the inhabitants' energy efficient behaviour.³¹¹

7.8.3. Conclusion

The current Dutch Energy Performance Certificate system does not reflect sufficiently the factual energy consumption of the building and its inhabitants. Moreover, many of the electrical appliances that are used in the house are not validated in this system and energy labelling does not incorporate changing behaviour of its occupants in changing environments.

7.8.4. Recommendation

According to Professor Visscher, professor in *Housing quality and process innovation*, et.al. the 'in-use' energy performance of the building should be part of the certificate system to overcome the performance gap.³¹² The EPBD supports this.

Also, increased responsibility for builders and experts, by energy performance guarantees on new built or retrofitted houses could prevent bad installation and building, and would lead to more testing, in case there is doubt about the performance of the property..

Municipalities could contribute to the quality of energy performance upgrades by not only monitoring more actively the design beforehand, but also the performance of the building after it is built or renovated.

Finally, the difference between actual and theoretical performance is a financial barrier, not only does it show that the estimated return time of the investment will be exceeded, it is also a barrier in further exploring how the energy savings can play a role in allowing, especially low income households, to take up a loan (which could be based on these savings). Lending based on the energy savings, can only be justified if the actual energy consumption goes down. Moreover, other developments, like tax adjustments, changing commodity prices and so on also need to be considered.

³⁰⁸ <http://www.energiesprong.nl>

³⁰⁹ *New energy retrofit concept: 'renovation trains' for mass housing*, R. Rovers, BR&I, august 2014. *Resultaten uit monitoring over: Concepten nul op de meter en 80% besparing*, Energiesprong, TNO en RIGO, mei 2015.

³¹⁰ *Variations will appear from year to year, depending on the available production.*

³¹¹ H. Visscher, et al. 2016.

³¹² H. Visscher, et al. 2016

7.9. OVERALL CONCLUSIONS CHAPTER 7

Like many other (European) countries both France and the Netherlands are struggling with finding measures to increase the energy efficiency in the built environment. For new buildings a regulatory framework, based on the EPBD, is developing and improving the energy efficiency of newly built buildings. However, upgrading the existing housing stock seems much more challenging; the regulatory framework often does not provide sufficient tools to demand improvements.

In France the national government had plans to oblige homeowners by law to upgrade the energy performance of their homes, if the energy consumption per square meter exceeds a certain amount of kWh. The law did not come into force, because the obligation was in breach with property law.

Such obligations are not discussed in the Netherlands. Although the new Environmental Act might allow *ordering provisions*, the possibilities to use *ordering provisions* in spatial planning instruments will be limited. Such obligations would also neglect the current Dutch political objective that the energy transition should be primarily market driven. Obliging private homeowners to invest in upgrading the energy efficiency of their dwelling would most probably also in the Netherlands be considered a violation of fundamental rights like the right of property.

Finding suitable and acceptable measures to improve the existing housing stock, remains thus challenging. Removing financial barriers, especially in relation to existing buildings, is also a key concern on this topic and might generate solutions that are less invoking and intervening with people's rights.

7.9.1. Scale

We see an overall contradiction between on the one hand the objective to scale up the retrofit market by offering packages and universal solutions and on the other hand the evidence that many, especially older houses need tailor made adjustments.

The scale of the current retrofit market is also experienced as a direct barrier for tapping into new sources of finance. Both in the Netherlands and in France, the experience of the City-zen partners is that banks are reluctant in investing in retrofit projects because of their size and perceived complexity.

7.9.2. New market

The market is still developing on all discussed levels: technical, financial, legal and social:

- Technically, it is a challenge to deliver the desired energy efficiency results. This is both reflected in the difference of actual and theoretical energy use and in the current label system, which does not take into account the individual differences in each house and assumes always-perfect installation.
- Financially, we see that there is the desire to earn back the full investment on the energy bill. This is by nature problematic, because of the substantial costs of deep retrofit, the ever changing energy prices, levies etc. There are only a limited number of financial schemes, which either only support specific upgrades like the City Deal/subscription, or solely support nearly zero housing, or do not make any demands on the effect of the upgrade, like the energy efficiency loans or extra mortgages. Additionally, applying for loans is often experienced as complex.

- Legally, hardly any demands are made on existing housing. As a result there is a lack of direction or goal in the market. As discussed in chapter 6 paragraph 6.2.6, can homeowners proceed with upgrades whenever it is desired and this can result in measures that are not in tune with neighbourhood plans.
- Socially, taking up an additional loan to invest in energy efficiency measures has a financial impact, especially on low income households. It is recommended that loans will be given to measures proven to lead to a reduced energy bill.

7.9.3. **Vulnerable homeowners**

Homeowners and renters, in the end, do not have the capacity to always find the right tailor made solution. Many market participants, like banks, are advocating legal obligations. Given the current problems with achieving actual energy saving and the lack of financial instruments for *all* homeowners, such obligations are still premature.

We do recommend that on a financial level, all parties involved, will contribute in developing schemes and subsidies that are available to all homeowners. A clear division between luxury upgrades (installing plasma TV, state of the art kitchen equipment) and energy efficiency, which of hopefully also will improve the living comfort of the home, (roof insulation, changing out windows) upgrades is crucial. Primary objective is that a package or measure should increase the energy independency of homeowners and prevent energy poverty.

National and local government should critically study their policies around energy subsidies to prevent that the money is only spent on households that do not necessarily need the support.

To avoid contra productive installations, government could stimulate homeowners to make an individual energy assessment/plan for each house, which shows how the building can be retrofitted to (nearly) zero (emissions/energy).³¹³ This plan could be executed over a longer period of time. This prevents measures that prove to be unnecessary and will force installers to evaluate each measure as part of a larger plan. Regulating mandatory energy assessments/plans should be studied.

³¹³ *Certain houses will never be 'nearly zero energy', but the plan can show how to effectively improve the energy performance. The label system as we know it today, makes only general suggestions and does not sufficiently look at each individual house.*

CHAPTER 8 – RENEWABLE ENERGY PRODUCTION

In both Amsterdam and Grenoble, citizens are encouraged to invest in solar panels. Within the Amsterdam demonstration projects there are private citizens retrofitting their homes and installing solar panels and there is a developer and housing association installing solar panels on, respectively, owner-occupied and rental units. In Grenoble, La Métro is setting up a local commercial company to invest in photovoltaic plants and so scale-up the development of collective renewable energy production.

To support the growth of renewable energy sources each country designs legal and financial instruments to encourage homeowners, landlords and citizens in its broadest sense, to invest in production. Many of the interviewed parties were voicing that these instruments not always had the desired effect and could even impede projects.

In this chapter we will look at legal barriers and the financial impact of each instrument that is relevant for the demonstration projects and which ingredients are necessary to make a well-functioning business case.

8.1. CHALLENGE: NET METERING LEGISLATION IN THE NETHERLANDS

In the Netherlands there are several supporting instruments to stimulate citizens to invest in renewable energy production, mostly solar panels. In this challenge we will discuss two instruments: Salderen and Postcoderoos. In this paragraph we will start with the most used instrument, which is ‘salderen’ or *net metering also called behind the meter settlement*. The net metering legislation allows small end users that produce renewables, prosumers, to deduct the total amount of kWh produced in a year from the total amount of kWh consumed in the same year. The result is that all electricity is traded between end-user and supplier against the same kWh-price, independent of time in the year (day-night, summer-winter). The prosumer can in this way feed the surplus of energy produced into the grid and extract the amount at a later time when renewable generation is insufficient, using the grid as ‘storage’.

The largest benefit for the end user of the present legislation is that, they not only save money on the commodity price, but also are released from paying energy taxes and sustainability surcharges, which stands for a significant part of the electricity price for small-end-users, as was discussed in paragraph 3.2.3.³¹⁴ Nevertheless, behind the meter settlement is not a fiscal measure, but a result of combining two measurements resulting in an aggregated number, simply deducting production from consumption.

³¹⁴ *Legal provisions can be found in article 31c Electricity act and article 50, second led, Environmental Taxes Act*

The legislation is a result from on the one hand the need to pay prosumers a ‘fair price’³¹⁵ for the produced electricity and on the other hand the technical limitations of meters in 2004, when the legislation was introduced, and the meters could only run backwards and forwards.³¹⁶

There are some important conditions to this instrument.

- Net metering is only possible on a connection with a maximum of 3*80 A. Most households and small businesses have a connection that falls within that range.
- The second condition is that the installation supplies the owner’s connection. That means that the installation should be connected to the house-owner’s system, behind the meter. If the system is connected to the public network, the owner cannot use the instrument. This will be further discussed in the second instrument: de postcoderoosregeling.
- The risks and the financial responsibility for the system should lay with the user of the system (leasing a system is allowed, solely paying for kWh is not enough)
- The prosumer (consumer that produces) can only net the amount of electricity that is consumed. If the prosumer produces more energy, the energy supplier pays around 0,10 cents This is significantly lower than the kWh price for behind the meter settlement (commodity price, Energy tax, VAT and ODE), which is today around 20 cents/kWh in the Netherlands. As a result, most prosumers only install the amount of solar panels that is equivalent to the amount of their yearly energy consumption.

An exception to the second condition is made for small-end-users renting a house and the installation. In case the installation owned by the landlord is connected directly on the property, connected ‘behind’ the meter, the renter can also *deduct* his production from his consumption.³¹⁷ This is an important exception that since its introduction in 2015 has led to many initiatives from housing associations and renters.³¹⁸

8.1.1. Success

The Instrument has been an increasing success. Because of declining system prices and increasing taxes, many households have invested in solar panels over the last years; from 2011 until 2015 there has been an average growth of 91%.³¹⁹ Altogether more than 400.000 households currently have installed solar PV production.³²⁰ The willingness of citizens to invest in solar panels is closely connected to payback periods.³²¹

³¹⁵ F. Otte en S. Akerboom, *Verkenning naar het ‘Salderen’ en het stimuleren van duurzame energie*, Centrum voor Energievraagstukken, UvA, november 2015

³¹⁶ *Handelingen II, 2003/04, 78-5053 e.v.*

³¹⁷ *Article 50, 6th led Environmental Taxes Act*

³¹⁸ *An example of a very succesful initiative is Wocozon.nl*

³¹⁹ *De Historische impact van Salderen: Onderzoek voor het Ministerie van Economische Zaken, PWC, december 2016*

³²⁰ *In 2015 340.000 installations were officialy registered, but Milieu Centraal estimates that there are a large number of installations that are not registered. 400.000 installations, means that 6 % of all households have solarpannels.*

³²¹ *De Historische impact van Salderen: Onderzoek voor het Ministerie van Economische Zaken, PWC, december 2016*

With the current instrument this investment in 2015 was earned back in seven years, without the possibility to use the instrument it would have been 14 years.³²² Many systems have a lifespan of 25 years.

8.1.2. **Barriers**

Even though the instrument has been so successful the setup of the instrument is also experienced as impeding for certain projects.

Behind the meter

One of the most important conditions for net metering is that consumption and production takes place 'behind the meter'. That means that a system or consumption before the meter is excluded from the instrument. This condition is a major barrier in many projects. Here we will discuss a handful of examples.

- Homeowners that do not have, a sufficiently large or suitable, roof cannot make use of this instrument. This is experienced as unfair and promotes inequality between those who can and who can't. To overcome this barrier, the government made an alternative instrument for those not being able to connect a system 'behind the meter'. Unfortunately, the business case for these systems is not as generous as producing behind the meter. This will be further discussed in the next paragraph.
- Institutions like schools or health centres are especially affected by this barrier. Research project *SOFIE* shows that since institutions are likely to move within the lifespan of the system, they will probably lose the possibility to 'deduct' their energy production.³²³ Without occupying the building, production cannot be deducted from the consumption of the institution, since this is only allowed 'behind the meter'. School buildings or health centres are buildings that have a higher risk of becoming vacant as selling these specialized buildings to new owner can be a lengthy process.
- In apartment blocks and high rise buildings it is almost impossible to connect solar panels to each single apartment behind the meter. This is often so costly, that it is cheaper to use another instrument. People sharing a roof are subordinated to those who do not share the roof. Network operators do not experience any advantages of connecting each system behind the meter in an apartment block.³²⁴ They often prefer to connect there where it is physically most convenient.
- Given the increase of electric transport, the electricity consumption before the meter will also increase. This consumption cannot be compensated by a larger PV installation only if the vehicle is charged behind the meter.

³²² PWC, december 2016, p. 5

³²³ *SOFIE rapport, Samen (duurzaam) Onderwijs Financieren geeft Energie, TKI Urban Energy, September 2015*

³²⁴ *The advantage of connecting behind the meter is that the use of the network is limited, but only if the system is connected correctly and if the production and consumption are coordinated. Otherwise production and consumption streams will still use the public net. This could f.e. be the case if the panels are connected to one phase and the consumption takes place through another phase. And in the current system given that there is no incentive to optimally use the produced electricity directly, it does not make a large difference whether the energy is fed in behind the meter or just before the meter.*

Storage

Approximately 30% of the energy produced by prosumers is consumed directly.³²⁵ The other two-thirds are fed into the grid and consumed at another moment when the home production is insufficient. To facilitate an optimal use of renewables and the grid, the aim is to match production and demand on a local level. The prosumer has three options: increasing consumption, selling the surplus of energy produced to another user (nearby) or storing the energy (locally) and using it at a later moment when renewables are not available.

The current legislation is facilitating prosumers to feed in their electricity whenever they want. Net metering does not contribute to adjusting consumption, selling or storage. By feeding the electricity into the net, the consumer is 'selling' it to the supplier.

This legislation provides no incentives to the 'prosumer' to align its production and consumption, because there is no (financial) incentive; the grid is essentially used as free storage for the (costless) solar power they produce. Storage capacity development in households is also hindered by this instrument: with the power grid essentially providing a free storage facility, there is no financial incentive for consumers to invest in storage in their homes.

Although it is often preferable that production systems minimize their impact on the net, today the network operator seldom has capacity problems due to solar systems.³²⁶ Given that the amount of systems will increase, this will eventually become an issue. The question remains, whether or not batteries will be installed that have enough capacity to cope with the production, or if larger cabling will be a necessity as well. Within City-zen the *virtual power plant* and *the end-to-end smartification* projects will address these questions.

Stimulating investments in batteries could help to stabilise the net, reduce capacity issues and enlarge the independency of end-users. Nevertheless, the market for adequate home-batteries that could easily charge and discharge is still very limited. These issues will be further discussed in the CHAPTER 9 – on Smart grids and flexibility.

Uncertain policies

In 2014 the government announced that the current legislation would be revised. Reason for revising the legislation is that the costs are not evenly spread between consumers. The Dutch government is also concerned that the instrument will be too expensive, around 80 million in 2015.³²⁷ Finally, the current systems give such a high return, that the compensation is too high according to the Minister. The new government announced in October of 2017 that the instrument will be revised in 2020.

The uncertainty around the instruments has been a barrier for people to invest in new systems. Changing the system can impact the payback period and will most likely result in a longer payback period. According to the report ordered by the Ministry of Economic Affairs by PWC, households are willing to invest if the payback period is less than 10 years, most optimal is 7 years. This is currently the case, and is reflected in the success of the instrument.

³²⁵ PWC, december 2016

³²⁶ *Stroomnet kan zonnepanelen-hausse in Groningen niet aan, volkskrant 6 juli 2016, In the province of Groningen the DNO has experienced capacity problems, because a large amount of PV was installed to compensate for the damages carried by the local population due to intensive gas drilling.*

³²⁷ PWC, december 2016, p. 36

Inequality

An often-heard argument against net metering is that the instrument is only available for wealthy people. Homeowners that can afford the high up-front costs or ‘qualify’ for a loan and own a sufficiently large roof can invest in an installation and use the instrument. Whether it is the lack of financial instruments or a lack of information, only less than 20% of low-income households use this support instrument.³²⁸ The distribution of climate subsidies in general is a challenge, not only for net metering, but also for other subsidies and taxes. Research shows that 80% of the benefits go to high-income households. This trend is also reflected in the City-zen renovation subsidies; besides the social housing associations mostly high-income homeowners apply for this subsidy.³²⁹

8.1.3. Conclusion

The net metering instrument has been successful in stimulating homeowners to engage and invest in renewable energy production. The instrument allows homeowners to participate in the energy transition and make a lucrative investment that is earned back in 7 years, or sometimes even less.

Because of the restrictions on ‘for your own risk and on your own account’ and the nature of behind the meter settlement, which means that the system should be connected behind the meter, larger projects on institutions like schools and apartment blocks with shared roofs are impeded, both for very different reasons; institutions because the future use of the building use is insecure, and apartment blocks, because it is costly to connect each apartment directly to the system.

Another important disadvantage of the instrument is that it does not support demand side management and storage and therefore can have an unsatisfactory impact on the grid. This is not yet a pressing problem, but will be if the amount of systems will continue to grow. Inevitably the instrument will need to change in the future to minimize the impact on the grid.

Finally, all income groups do not use the instrument equally. This is amongst other reasons, due to less financial means to invest in solar panels by low-income households.

By allowing tenants to profit from these rules, the instrument is also available to these often low-income households and this has a positive effect on eradicating energy poverty.

8.1.4. Recommendations

The net metering legislation could be improved by looking into how lower income households also can make optimal use of the instrument. Question is if this is a problem that can be fixed by adjusting the regulation, or if the financial instruments to enable this low-income group to participate in this market, should be adjusted. To avoid that low income households cannot benefit from the instrument, the government could actively develop financial schemes that are available for low-income households. This should be further explored.

Another disadvantage of net metering is that it does not support optimal use of the roof. Homeowners or renters will only be stimulated to install the amount of kWh corresponding with their (current) annual use. At the same time there are many homeowners dealing with a lack of space. In addition, the electrical consumption might change in the future if the homeowner switches

³²⁸ CE Delft, *Wie profiteert van klimaatbeleid? Verdeling van subsidies en belastingkorting tussen armere en rijkere huishoudens*, April 2017, p. 6.

³²⁹ For more information about the subsidy, contact Rick Fransman TU Delft: R.R.Fransman@tudelft.nl

from a gas-based heating system to an all-electric alternative. Lifting this administrative barrier could support a more optimal use of available roof space.

The condition that only energy produced behind the meter can be deducted makes this instrument very rigid. Building owners investing in an installation can only earn back their investment on the energy bill. This can be experienced as a barrier for buildings used for housing schools or health care institutions. Many of these institutions cannot guarantee that they will use the building the entire recovery period and that the installation will be bought by the next buyer/user. Again here the condition that net metering is only allowed behind the meter is stringent.

8.2. POSTCODEROOS: STIMULATING COLLECTIVE RENEWABLE ENERGY PRODUCTION IN THE NETHERLANDS

8.2.1. Introduction

To stimulate renewable energy production by cooperatives, a low energy tax tariff for renewable energy produced by cooperatives was created in 2014.

The reason to create this special tariff for cooperatives was to facilitate in particular homeowners that share a roof or do not have a suitable roof. Co-owners can use the owners association (vereniging van eigenaren) and are exempted from creating a new legal entity. The tax rebate applies to small-scale renewable energy production, which is not subsidized by the state and is produced in the direct environment.³³⁰

8.2.2. Conditions

The conditions for this low tariff are laid down in the Environmental taxes act, article 59 a and b :

- Zero energy tax is paid for the production of renewable energy produced up to 10.000 kWh, which is the first tax bracket (members of the cooperative still pay for the ODE)
- The reduction only counts for small-end-users (a connection up to 3x80A).
- The reduction only accounts for the amount of energy consumed by the members of the cooperation, following the net metering rules, for example: 20 members with an average consumption of 3000, makes 20 X3.000= 60.000 kWh. A tax reduction over the 60.000 kWh will be given and the energy produced will be sold to a supplier.
- Companies can partake in a cooperation up to 20 %.
- Members can only use the instrument if the production unit is 'nearby'. To define nearby the government introduced a so-called 'postal rose', which means that the production unit should be either in the same or the surrounded postal code areas.

8.2.3. The Postal Rose in practice

Both in the City-zen projects and in other projects it appears that the postal rose arrangement is a complex instrument. There are different causes underlying this complexity.

First of all the postal rose arrangement is always used in a cooperation between people (and sometimes businesses). Involving different parties in a financial investment is a challenge in itself.

³³⁰ Dutch Parliament document: Kamerstukken II 2013-14 33 752, 3, p. 10.

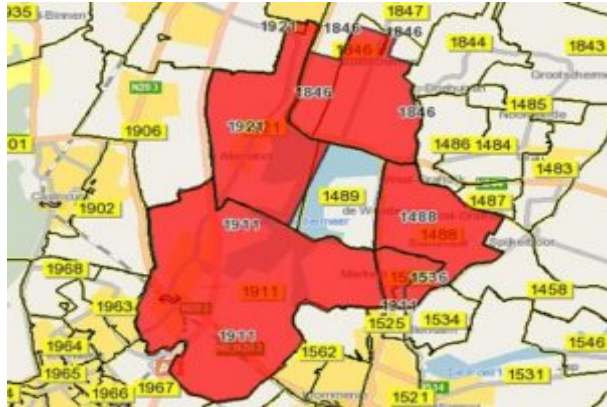


Figure 8-1 Example of a Postal Rose

Another major barrier that is experienced by cooperatives is that it is difficult to find a suitable roof. If the installation cannot be installed on the community roof, a third party needs to be found that is willing to share its roof. Since the system has a long lifespan, many roof owners will have well-founded objections against 20 years of encumbrances with a long leasehold-contract on the property.

The business case of the postal rose does not allow the cooperation to pay a large fee in return for the lease of the roof. This means that the roof owner should merely allow the lease due to social involvement and wanting to contribute to a more sustainable environment.

8.2.4. Overall barriers Postal rose and net metering

There are still several projects that fall between two stools. An example of these projects is the school that is hesitant to use the net metering instrument, because they cannot guarantee that the school will continue to use the same building. These schools can neither use the Postal Rose, since they are qualified as a company and cannot partake in a project by more than 20 %.

This also excludes the possibility to net as long as the school is in the building and change to Postal Rose in case the school is moved. Unfortunately this is, under the current regulation, impossible.³³¹

Today parties need to be willing to take the risk of losing the possibility to use these instruments. It would be desirable if the instrument would be more flexible towards these very common changes.

Financing

Cooperations have difficulties to find a suitable investor. Many banks are not willing to invest in these projects because they need a relatively small investment, with a low return and the projects are experienced as complex, because there are many people involved. A professional third party can improve the chances of success.

Involving a bank or other investor against a low interest loan could significantly improve the return time; from e.g. 7 to 5 years on the system and so improve the return time for members of the cooperation.

³³¹ Conclusions from the SOFIE report: *Samen (duurzaam) Onderwijs Financieren geeft Energie*, TKI Urban Energy, September 2015.

8.2.5. Conclusion

The energy tax reduction for cooperatives supports cooperative local energy generation. Unfortunately there are still many projects that are impeded because they do not meet the conditions of the instrument. In addition, the business case is not as good as for individuals that can net their solar PV production with consumption. Discriminating between net metering and cooperative production is arbitrary. The argument that the energy generated behind the meter is consumed behind the meter does not hold, since producers are free to feed in the volumes they produce whenever they have a surplus.

Based on the existing business case the cooperative cannot pay a fee for renting a roof. Finding a roof is a barrier. Roof owners are reluctant to place a lease for the life span of a system.

Also the definition of 'nearby' is arbitrary. Question is why such a barrier is created. It appears to be, as long as the instrument does not stimulate optimal use of own production, a purely administrative argument. Physically, the electricity will (depending on the need in area and other production plants), most likely, be consumed close by anyhow.

8.2.6. Recommendations

- Lift the difference between individual systems behind the meter and cooperative production by allowing net metering on another roof.
- It would allow individuals and cooperatives to find the most suitable places to install a system.
- In the future, legal changes are needed, so that the PV system could be combined with smart deployment of storage, to maximise use of own produced power and consequently limit any adverse impacts on the (local) network.

Note on the SDE+

In addition to these two instruments, there is a subsidy solely available for companies and non-profit organisations. This subsidy has the advantage that it is a very secure subsidy; when you get it, you will have it for 15 years. However, the subsidy is more difficult to get and is relatively low (the more you ask, the chance for getting the subsidy decreases relatively).

8.2.7. Overall conclusion on net metering and postal rose in The Netherlands

Subsidies and incentives on producing renewable (solar) energy offered by the government are plenty and complex. There is not one incentive that covers the needs of all projects. Conditions per subsidy/ incentive differ and this can lead to the need of combining different incentives or even worse; no incentive is available for the specific project. To make optimal use of the existing subsidies and incentives, especially larger citizen initiatives are depending on an expert to do the financial calculations and paperwork.

8.2.8. Overall recommendations

The complexity is a challenge and requires that potential users either invest a large amount of time, to understand the different incentives, or money, to buy expertise. There is a need for a secure/ stable, simpler and more comprehensive policy, in which equal access for citizens is an important condition.

8.3. CHALLENGE: COLLECTIVE SELF-CONSUMPTION OF PHOTOVOLTAIC ENERGY IN FRANCE

8.3.1. Introduction

With the implementation of the Energy Transition Law in 2015, France has set ambitious goals, which are translated into operational goals in the multi-annual energy plan. The National Energy Plan³³² contains specific goals for PV energy production. The ambition is to install 1.55 GW on a yearly basis between 2016 and 2023 (compared to around 800 MW/year in 2016) of which 350 MW/year on buildings.

A number of adaptations in regulations and stimulation have been set in place in order to achieve these targets. Yet, a number of challenges remain.

8.3.2. Collective PV-plants

To achieve these ambitious goals, all types of photovoltaic plants must be developed and all types of roofs mobilised, over the whole territory.

For individual housing, the PV system can be connected to the electric board, thus in an individual self-consumption (partial or total) scheme, and the connection point is in that case equipped with bi-directional smart meter that counts instantaneously what is injected in or consumed from the network. The main problem with this scheme is that encouraging self-consumption with zero injection in the network leads consumers to exploit only a small fraction of the roof's potential so as to guarantee that production will not exceed base load consumption.

Besides PV-panels on an individual housing, collective PV-plants could be developed on roofs of multi-apartment buildings or on other suitable roofs. Recent changes in the French legal framework make it now possible to set up a collective self-consumption project, which allows to attribute the production of one single PV-plant to various consumers.



Figure 8-2 Collective PV in Grenoble

The figure below presents the different regimes in a collective self-consumption project:

³³² <https://www.ecologique-solidaire.gouv.fr/programmations-pluriannuelles-lenergie-ppe>

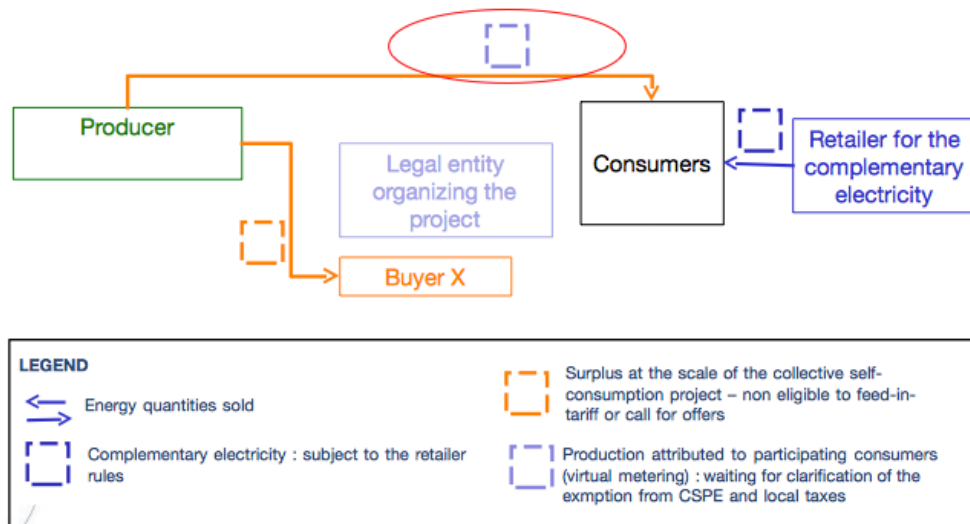


Figure 8-3 Legal classification of energy quantities sold in a collective self-consumption project.
Source: Hespul

8.3.3. Legal, regulatory and contractual context

The following paragraph presents the changes introduced in the legal and regulatory parts of Energy Code, followed by the conditions set by the DNO.

The Energy Code

The legal changes affecting self-consumption are laid down in art. L.315 of the Energy Code and lead to the possibility to split the production data of a PV system (“Virtual metering”) in order to set-up a collective self-consumption project. Two major conditions for collective self-consumption are that the consumers and producers are affiliated through a legal entity and that electricity consumers and PV system must be on the same MV/LV substation.

The decree gives several conditions to implement a collective self-consumption project:

- The production shall be split at a time step corresponding to the time step of the payment of tertiary reserves by the Balance responsible parties according to the observed differences between forecasted and real consumption-production within the balance perimeter. The time step is 30 minutes.
- No transfer of overproduction or overconsumption is allowed between one time step and another: at each time step, the total quantity of self-consumption cannot exceed either the total production or the total consumption, and that the quantity of production attributed to each consumer cannot exceed his total consumption at the same time step (no negative index is allowed).
- Storage must be metered, where storage is considered as “consumption” and discharge of the storage is considered as “production”.
- The default splitting rule will be a split proportional to the consumption of participating consumers.

- The calculating method for the complementary bought electricity (electricity consumed outside production periods or deficit of electricity during production period to satisfy the total consumption measured) must be defined.

Rules of the DNO

In addition, the Energy Code has given the DNO a central role in collective self-consumption projects. The DNO is in charge of the implementation of the technical and contractual framework of self-consumption projects, including the split of production data among electricity consumers. The splitting rule is given by the entity in charge of the collective self-consumption project.

Self-consumption projects shall be declared to the DNO before their commissioning.

Besides, it specifies that complementary elements necessary to the implementation of collective self-consumption projects will be published in the Technical documentation of DNOs. The time step of the production split is 30 minutes, in line with BRP-regulations. It means that the calculation of the difference between the energy produced and the energy consumed is done for each half-hour.

Enedis, the main French DNO, has set up transitional rules for the experimentation of the first collective self-consumption projects. These first experiments shall serve to capitalise hands-on experiences and establish new rules. At the time of writing this report, the temporary rules are in the process of consultation and have yet to be published. Nevertheless, some elements can already be foreseen as problematic for proper implementation:

- The DNO demands that the splitting rules (repartition of the shares of production) is provided by the legal entity responsible for the operation under the form of fixed percentages, over 3 months or for each time step of 30 minutes over 3 months, of total production attributed to each consumer participating.
- The splitting rules and/ or the list of participants can only be changed every 3 months.
- The legal entity must on behalf of the producers/participants, sign the contract with the balancing responsible party.

8.3.4. Financial aspects

Net metering

Behind the meter settlement of production and consumption is valued on the avoided costs of purchase of electricity (retail price including grid tariffs and all taxes) and amounts to 14,5 c/kWh in the residential sector and around 12 c/kWh for a tertiary client (although important variations are observed in the later sector).

There is not a net metering instrument on annual basis in France, like there is in the Netherlands. As explained above, individual self-consumption projects that consist in connecting PV systems to the private electricity grid (“behind the meter”), paying electricity consumed from the network according the real time measurements of the meter and selling the surplus. No transfer of overproduction or overconsumption is possible since billing is based on meter measurements. In contrast, collective self-consumption projects, billing is based on both real measurement and algorithms due to the electric scheme (1 meter for the whole power plant, 1 meter per consumer). Overall however, billing is based on quantities that should mirror the reality, with a very short time frame of behind the meter settlement of 30-minutes: produced energy that is not consumed that participating consumers over a 30-minute time step is considered “injected into the grid” and thus not split amongst them.

Feed-in-tariffs

An important instrument for stimulating PV-plants is the 20-year guaranteed feed-in-tariff. The latest decree on feed-in-tariffs, issued May 9th 2017, transformed the structure of the feed-in tariff scheme by introducing a specific bonus for individual self-consumption PV system injecting excess energy in the grid. This fixed annual bonus ranging from 100-400 EUR/kWp (depending of the size of the installation). However, the decree has also substantially cut the feed-in-tariff for excess energy injected by individual self-consumption plants. In the earlier version of the decree, no distinction was made between plants directly connected to the grid (injecting the whole production) and individual self-consumption plants (partial injection).

The level of feed-in-tariffs has been constantly changing over the last years. The latest decree on feed-in-tariffs, issued May 9th 2017, gives the tariffs only to PV-plants, connected to the grid before September 30th 2017. Once granted, a feed-in-tariff is guaranteed for 20 years. The tariffs from October 1, 2017 and beyond are 2017 not yet known by late September.

However, collective self-consumption does not benefit from a bonus, neither does the decree enable collective self-consumption to get a feed-in tariff for the surplus electricity that is fed into the grid. The electricity fed into the grid can only be sold on the energy market against retail prices.

Additional benefits

The Code of Local Authorities (Code des Collectivités Territoriales) and the Community Customs Code (Code des Douanes) have also been modified which contributes to the business case of PV plants:

- Photovoltaic production from a partial self-consumption set-up (up to 1000 kWp) is exempted from the contribution to the public service of electricity which is used for subsidizing renewable energy (“CSPE”), and which amounts to 2,25 c/kWh. In reality, this legalizes a current practice that production consumed on site was not measured and thus CSPE could not be collected, which is a form of behind the meter settlement.
- Production consumed on site in a complete and partial self-consumption set up is exempted from local taxes (departmental and municipal), which are defined by each department and municipality and vary between 0,05 and 0,96 c/kWh, again under the condition that the annual production is lower than 240GWh or that the installed power of the production unit does not exceed 1000 kWp.

However, it is still unclear if production split between consumers in collective self-consumption projects is eligible to these exemptions or not. This element is key since the economic model of the collective self-consumption projects is fragile.

The French Energy Code has undergone substantial changes with the insertion of a new chapter dedicated to self-consumption. One of those changes is Article L.315-3 that regulates that specific grid fees shall be granted to collective self-consumption projects if the PV system has a power lower than 100 kWp.

8.3.5. Challenges

Virtual metering

In this context, virtual metering, which came about through projects in the Netherlands and Germany, made its way in the minds while professionals of the sector were insisting to government to consider a more collective dimension in self-consumption that could go beyond the individual

opportunistic approach and encompass created societal benefits. Virtual metering allows to develop a single photovoltaic plant on a roof, which production can be shared by several tenants or occupying owners by using algorithms based on metered energy values rather than a complex technical wiring solution.

Splitting rules

The article on collective self-consumption of the Energy Code stipulates that the settlement of production and consumption should be done within a 30-minute time frame. This requires consumers that would want to participate in a collective self-consumption project to provide their consent for the activation of their load curve (in France, by default smart meters Linky measure and store only daily index values; lower time step values require consumers to provide active consent).

On the other hand, the DNO requires more static splitting rules (see paragraph below) in which means the splitting will not have a relation to the real consumption of the owners, but are based on a fixed percentage, at least in the transitional phase. The DNO does not allow for more refined rules that could allow for re-adjustments of the splitting rules based on historical data.

Furthermore, the 3-month period for revising splitting rules is long and prevents any quick adjustments to market conditions.

The mandatory contract with a balance responsible party may bring about extra costs, not envisaged in the set up of the PV-scheme.

Connexion to the same MV/LV feeder

The legal requirement that the electricity consumers and PV system must be on the same MV/LV substation forms a barrier.

A social housing association in the south of France aims at developing photovoltaic plants on all its buildings of the neighbourhood as part of a global ambitious refurbishment operation.

- 14 multi-apartment buildings, 9 MV/LV substations
- Photovoltaic power: 950 kWp

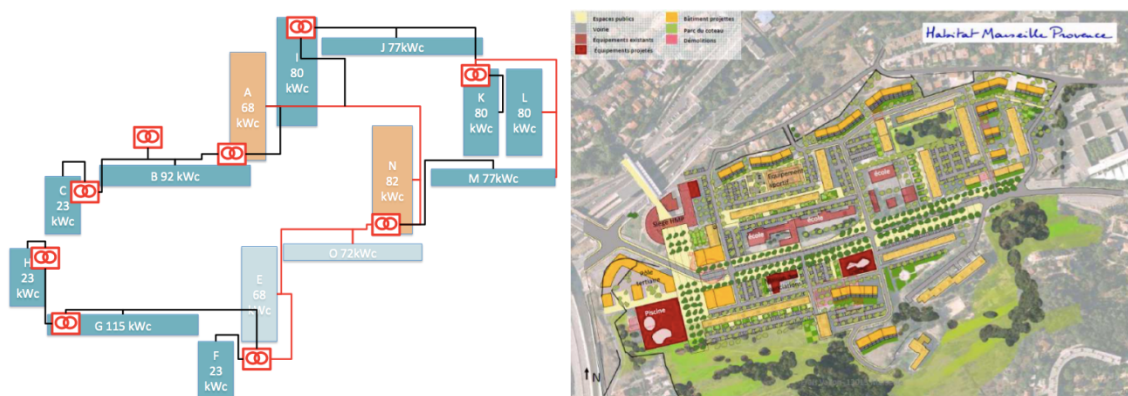


Figure 8-4 The network scheme of the neighborhood showing the 9 MV/LV substations on the left and the urbanistic plan of the neighborhood as envisioned by experts on the right. Source: Hespul, HMP.

By law, a single collective self-consumption operation is impossible here due to the criteria that producers and consumers must be connected to the same MV/LV substations. The housing association is obliged to establish 9 independent schemes, which is affecting financial efficiency.

Financing and (Local) markets

A collective self-consumption PV-plant has income from the energy directly consumed by its members plus the revenues from the selling of the surplus electricity generated. An effective demand response by the members to the generation curve will contribute to the feasibility of the scheme (as far as not hampered by DNO-conditions, see above paragraph “Splitting Rules”).

The surplus electricity generated by the PV plants could be sold to the market. Unfortunately the today’s level of retail prices are low relative to production costs of a PV-plant. These prices are insufficient to successfully develop a photovoltaic plant. The actual feed-in-tariffs for plants with installed power below 100kWp are more attractive, but continuation of these feed-in-tariffs is uncertain, and in any case, collective self-consumption are currently ineligible to this scheme.

Additional instruments, as a reduction of the TURPE (grid fees), local taxes, and CSPE contribution to the public service of electricity is necessary to make collective self-consumption project competitive.

Designing a well functioning splitting rule

One of the main challenges of collective self-consumption projects will be to set up correctly the division of energy produced between the owners of the collective PV plant, the splitting rule, in order to optimise as much as possible the share of the energy that is consumed by its members.

One must consider that the legal entity will have the responsibility for optimally dividing the amount of electricity produced over its members for every 30 minutes time frame. First it implies that the collective acquires competence to make such a division, but also to ensure that such a rule is transparent to producers and consumers and adapted to the entry and exit of consumers in the operation (especially in the case of tenants). In the next paragraph three types of ‘splitting rules’ are explored (other rules are possible).

Case 1: the default rule: splitting according to actual consumption

The first possible setup of the “split rule” to assure that the share of production attributed to each affiliated consumer is proportional to its forecasted consumption (this is the rule by default): the more a user consumes energy, the more production is attributed to this consumer.

In the transitional phase, this rule will not be implemented by the DNO. Legal entities will have to suggest fixed percentages for each 30 min period.

Case 2: the investment rule: splitting according to the consumers’ investment

A second option for the legal entity is to set up a different rule by attributing the energy production proportionally to the consumers investment in the photovoltaic plant. However, since no transfer of overproduction or overconsumption is allowed between one time step (30 minutes) and another, the split rule can lead to a consumer having a negative index. Then this virtual “excess” production will be considered as a surplus and sold to a third party, for the actual (low) electricity wholesale price, whom the producer has a contract with for the surplus electricity.

These are only illustrative cases. The real challenges are to 1) identify a meaningful splitting rule that is at the same time not too complex for consumers to understand and agree on and limits the surplus for which there is no feed-in-tariff, 2) ensure that the DNO will not be too restrictive so as to the type

of splitting rules allowed by implementing appropriate databases and tools. It is unclear yet what the price of this new DNO service will be.

The optimal solution may be that the legal entity responsible for the operation implement the split and have the DNO only validate that the splitting results respect the rule : no transfer of overconsumption and overproduction between 30-min time-step. Results from first experimentations will reveal where the major hurdles are and what should be the appropriate response.

Finally, despite the interdiction of net metering in the regulatory dispositions of the Energy code, net billing could be considered and implemented. Retailers could position themselves on this subject and make appropriate offers, for example buying their client's surplus and deducting its value from the client's bill.

Conclusion

The new laws and regulations in France have opened up for a new way of developing energy production projects, namely collective self-consumption. The advantage of collective self-consumption is that the retail tariff is expected to increase from year to year and hopefully will be higher than a flat feed-in-tariff for 20 years. However, making a business case for a collective PV systems is complex. The rules are depending on many different factors. In addition, the retail prices, system costs and feed-in tariffs are constantly changing.

Uncertainties in taxes and tariffs

The new business model for collective PV-schemes has to deal with the uncertainty whether its production split between consumers is exempted from CSPE, TURPE (grid fees) and local taxes. New regulations are not clear in this respect. The energy regulatory commission has announced that the specific grid fee for collective self-consumption project will be defined in January 2018 with application in Summer 2018.

Implementation of production split

The DNO is currently in a transitional phase, where it aims at developing appropriate skills and tools to implement virtual metering according to the specifications of the decree. The future of collective self-consumption projects will depend on the flexibility of the DNO to integrate various rules for the split and rules that change rapidly following entry and exit of consumers.

Eligibility of the surplus to feed-in-tariffs and call for offers

It is actually unclear why the surplus from collective self-consumption projects is not eligible to feed-in-tariffs under 100kWp nor call for offers for installations above 100 kWp. These provisions are currently discussed in round tables organised by the Regulatory Commission.

8.3.6. Recommendations

Overall we can conclude that the changes are new and that there is still insufficient experience to have a good overview of the legal and financial barriers.

It is therefore recommended that the demonstration projects from the City-zen-project are evaluated by La Métro, where it investigates its role as a local authority in facilitating collective self-consumption projects, and notably it identifies cases where conditions are favourable and where the new regulations are still restricting developments.

8.4. CHALLENGE: CONTRIBUTION OF LOCAL AUTHORITIES TO FOSTER RENEWABLE ENERGY PRODUCTION IN GRENOBLE

8.4.1. Introduction

In this challenge we will look into how the local government of La Métro and the municipalities in the region can contribute to increase the amount of PV energy production in the area.

The challenge is to achieve the creation of wealth for local residents, local public authorities and local companies. The wealth generated may be monetary (profits, investments, jobs etc) or social (improved social dynamics, common sense of belonging, improved neighbourhood relations, and so on) and not least a contribution to an increase of local renewable energy production.

The local government has many roles in the region and a number of these can contribute to investments in renewable energy generation. As a government body, it can facilitate projects in its policies regarding urban planning, taxation etc. As a real estate owner, it can offer its roofs (and other surfaces) for installing PV-panels. And as an end-user of energy, it can participate in collective energy projects.

Collective investment projects may be managed by citizens (citizen governance) or financed by citizens (crowd funded) – or both. A citizen group that creates a company with a cooperative management status may also call on crowd funding to complete its financing.

To stimulate the local production of photovoltaic energy La Métro decided to introduce a commercial company in which citizens, local companies and La Métro invest in PV plants. The company was set up in cooperation between ENERCOOP (renewable energy provider), the Local Energy and Climate Agency and Grenoble-Alpes Métropole.

8.4.2. Legal context

Different legal vehicles can be used for collective investment: the chosen vehicle will depend on different criteria such as flexibility, the type of shareholders, and so on. French law used to limit the possibilities for local governments to enter into commercial venture and the supervision from national government (Conseil d'État) used to be strict. However, the Energy Transition Act of 17 August 2015 (Article L. 2253-1) introduced two elements that enable local authorities to invest in renewable energy production companies without obtaining an authorisation by decree of the Conseil d'État:

- Article 109 of the Energy Transition Act modifies the above mentioned article (L. 2253-1) to include the following paragraph: “By way of derogation of the first paragraph, municipalities and their associations may, by resolution of their governing bodies, participate in the capital of an anonymous corporation (SA) or simplified joint-stock companies (SAS) whose corporate purpose is the production of renewable energy on or near their territory, when participating to its energy supply.”
- Article 111, of the Energy Transition Act introduced into French law the concept of participatory investment in renewable energy, with the addition of a new article (Art L 314-27) to the Energy Code. It allows the financial participation of communities and citizens in commercial companies investing in renewables under the condition that the renewable energy project is located on the territory of the municipality and “close” to the residence of the users (citizens). The article addresses joint-stock companies (SAS), economic interest group (GIE) and local mixed economy companies (SEML). The article mentions that

participation can take place either at the time of creation of the company (constitution of capital) or during capital increases, which is particularly interesting for companies with variable capital.

8.4.3. The new company “Energ’Y Citoyenne”

In conclusion, Grenoble-Alpes Métropole together with local citizens, ENERCOOP (a renewable energy provider) and ALEC (local energy agency) have decided to create a local company, named *Energ’Y Citoyenne*³³³, whose mission it is to develop PV systems on small and medium size roofs by mobilizing citizens and local authorities investments.

The following scheme represents the models developed for *Energ’Y Citoyenne*:

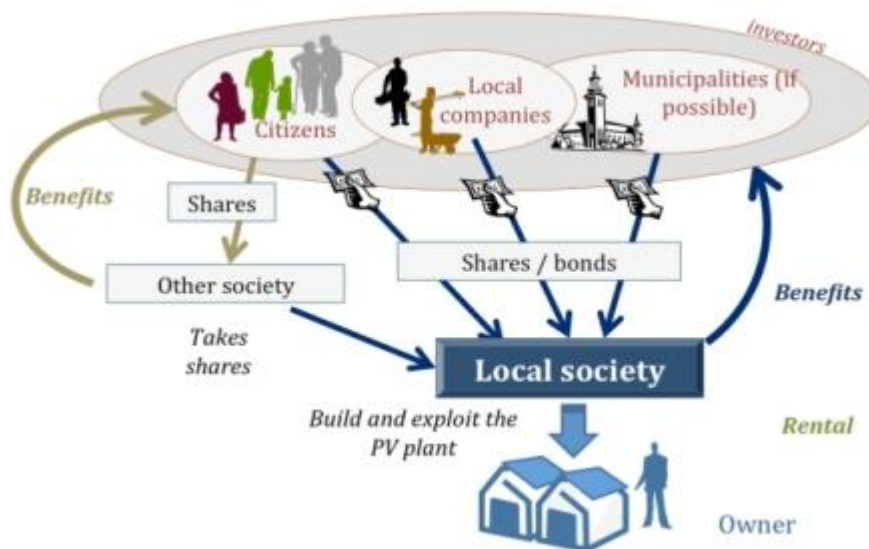


Figure 8-5 Principles of collective investment handled Energ’Y Citoyenne

For the citizen, this set up presents several advantages:

- They can invest in the local production of renewable energy even if they do not own a roof, and
- Homeowners can have a PV system on their own roof if they do not have enough money to invest in PV themselves or if they do not wish to be responsible for all the technical, administrative and financial processes.

There are also several disadvantages to this set up:

- Little financial gain: citizens investing in the company will benefit from dividend only at mid-term. They will not get a part of the energy produced allocated to them, so they do not net any of their production against their consumption. According to La Métro citizens are merely

³³³ Legal document of the company: *Energ’Y Citoyennes, S.A.S. à capital variable statuts, 29 septembre 2016.*
For more information see: <http://solairedici.org/>

investing in this company because of an interest in promoting local renewable energy production, rather than receiving any financial gain.

- Roof owners providing their roof to this project will be bound the long-term agreements (lifetime of the installation) and during this period they will not have the possibility to install a system themselves. Feed-in tariffs of electricity prices might change in the future, but over the upcoming 20 or more years they will not be able use their roof for their own PV plant. This can later on be experienced as a disadvantage.
- Both investors and roof owners are on paper not necessarily using any green energy. The renewables produced by the system will be sold to the supplier and might be bought by anyone interested in buying green energy (certificates) all over Europe. The project stimulates local production, but not necessarily local green consumption.³³⁴

The first PV plant has been installed in the summer of 2017.

8.4.4. The business model of Energ'Y Citoyenne

Energ'Y Citoyenne is a simplified joint stock company (SAS) that is adapted for a small company and offers high flexibility and cooperative governance. Citizens, local authorities and local partners will provide capital through the acquisition of shares.

La Métro invests 25.000 EUR amongst the 96.300 EUR of capital owned by Energ'Y Citoyenne in 2017. The following graph describes the overview of the shareholders as well as the dynamic of share subscription following the first communication campaign.

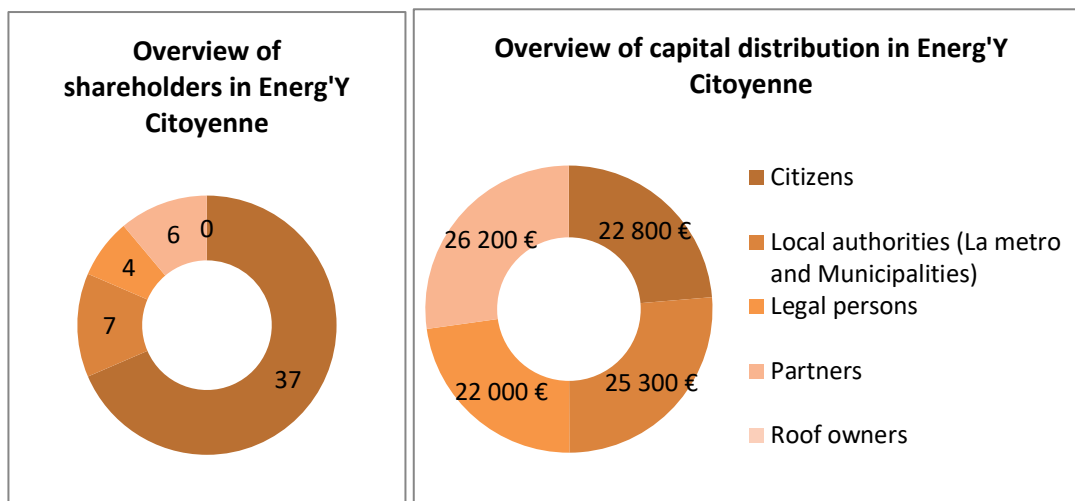


Figure 8-6 Energ'Y Citoyenne : Overview of the shareholders and capital distribution

With the first development phase of Energ'Y Citoyenne (15 PV plants), the estimated annual turnover of the company is about 30.000 EUR for a cumulated net profit over 20 years of 80.000 EUR. It should be noted that these figures do not take into account costs of personnel and overheads.

³³⁴ The renewable energy might be physically used nearby, but according to the EU system of guarantees of origin, they can only claim the use of this energy if they also can provide the certificates. Buying the green certificates from the supplier is not part of the project.

Investment costs and business model

Costs of PV systems remain quite expensive for small photovoltaic plants, but it rapidly decreases if the installed total power increases. The following table gives an illustration of the price of the PV systems depending of the installed power in France.

Size of the installation	Average of investment cost (VTA excluded)
3 - 9 kWp	2,2 - 2,8 €/Wp
9 - 36 kWp	1,8 - 2,2 €/Wp
36 - 100 kWp	1,15 - 1,8 €/Wp
100 - 250 kWp	1,1 - 1,2 €/Wp

Figure 8-7 Overview of the average of investment costs in PV systems depending of its size

At the moment of finalising this report, these figures will be out-dated by lower figures (Dutch sellers of PV-panels state levels of 1,0 to 1,3 EUR/Wp).

It is therefore a challenge to decrease investments costs by making bulk purchase. To achieve this, *Energ'Y Citoyenne* made a unique consultation for the first bulk of installations. It permits to decrease the average cost of photovoltaic panels as well as the cost of the installation, as the installation company can optimise its own costs by being a unique company in charge of all the PV plants.

The business model developed by *Energ'Y Citoyenne* involves investing simultaneously in 15 PV plants for a total of more than 120kWp of PV panels.

Professional backing

The present business plan of *Energ'Y Citoyenne* heavily relies on the volunteering of its members to carry out an important share of the technical, administrative and financial process. This situation is very limiting to scale-up the local energy production. So as to significantly increase the number of new PV systems that will be installed by *Energ'Y Citoyenne* each year, it is necessary to employ one person dedicated to the management of the company, development of new projects, coordination of the works, as well as communication issues.

However, as it has been detailed in the previous paragraph, the current business plan of the company does not generate sufficient benefits to appoint a paid employee. In 2018 an additional study will be commissioned to improve *Energ'Y Citoyenne*'s future business model and to analyse what should be the size of the portfolio of PV systems owned by *Energ'Y Citoyenne* to reach a balance that enables it to hire professional backing.

Besides this analysis, the review in 2018 will also analyse the possibilities to offer a dividend to its shareholders at mid-term.

8.4.5. Transparency rules for the participation of citizens as shareholders

To stimulate the participation of citizens as shareholders, a challenge is to develop a sound and above all transparent business model and to provide shareholders with clear rules regarding the distribution of the benefits.

The company articles of association of *Energ'Y Citoyenne* define the rules that regulate the distribution of benefits amongst the shareholders. The following principles have been accepted to provide sufficient guarantees to citizen and local authorities:

- After approval of the financial statements and recognition of the existence of distributable profits, the shareholders, on the proposal of the management board of *Energ'Y Citoyenne*, decide either to reinvest it in the company for future developments or distribute it to shareholders. In the latter case, the amounts distributed shall be deducted from the distributable profit for the year and then from the reserve account. This distribution is furthermore subject to the following provisions:
- 5% of the profit for the year, after deduction of any previous losses, is allocated to a statutory reserve account until it reaches 10% of the share capital, and / or 20% of the profit for the financial year, after deduction of any previous losses, is allocated to a statutory reserve account.
- The distribution of dividends among shareholders is proportional to their share in the company.
- Payment of the dividend shall be made in accordance with the conditions laid down by the management board at its first meeting following the general meeting. It shall take place within a maximum period of nine months.

Furthermore, all relevant information will be made public by means of the website of *Energ'Y Citoyenne*.

8.5. OVERALL CONCLUSION ON CHAPTER SOLAR ENERGY PRODUCTION

Business cases of privately owned renewable energy production either individual or in a collective are both in France and the Netherlands strongly depending on stimulating policies. Net metering has proven to be a financially interesting method, mainly because of avoiding paying for all the extra levies raised on energy consumption.

Both in the Netherlands as in France the legal framework for individual owned renewable energy production is easier than the framework for collective production. This translates also into a better business case for individual plants than for collective plants.

The business case for collective production systems is very complex. In France these barriers seem to root from a relatively new law and therefore unknown territory.

In the Netherlands there is more experience with collective production, but unfortunately relatively little projects are realized, because the legal framework is still too complex.

The complexity is found in the numerous conditions attached to the instruments stimulating collective projects. The geographical limitations are often arbitrary and not always well founded. Limitations in relation to the size and production of the plant can also limit the installation of more capacity.

None of the schemes today stimulate demand side management or storage. As long as these elements are not incorporated in the system, the geographical limitations are difficult to justify.

8.5.1. Different policies of the local government in France and the Netherlands

In the Netherlands cooperatives are often either citizens, or a cooperation between citizens and businesses and/or other institutions and organizations. The (local) government takes a more facilitating role.

In France, on the contrary, the local government desires to participate in the project. This will give it a much more controlling position in the development of the project, business case and objectives. This need of La Métro for more control in the energy system is a subject throughout many of the projects and issues described in the report, see also chapter 4.

Citizens participating, by investing, in a project in which the municipality (as a professional, large shareholder) has an economic interest, are by nature in a more vulnerable position as the interests of the citizen and the municipality may diverge. It is the municipalities' responsibility to communicate clearly the interests and objectives of the project.

CHAPTER 9 – SMART GRIDS AND FLEXIBILITY

The term ‘Smart grid’ is very broad, and there is not one single definition available. For the purpose of this report, we consider ‘smart grid’-projects as the ones that aim at improving the functionality and use of the grid and connected resources (i.e. consumers that can also provide generation, storage and demand response capacity). Especially, smart grids should facilitate more flexibility in the use of energy and use of the grid.

Market parties use the intraday market to keep their demand and supply in balance up to real time. Any real time differences between demand and supply on national level are then compensated by the TSO through auctions for ancillary services. This system currently provides the Dutch electricity system with sufficient flexibility to balance supply and demand at all times.

In a sustainable energy supply, less predictable generation will replace the present, flexible thermal power plants. The importance of flexibility will increase accordingly.

9.1. CHALLENGE: VALUE OF FLEXIBILITY IN THE NETHERLANDS

In order to make optimal use of growing shares of variable renewable energy sources (particularly solar and wind power) in the urban generation mix, the need for flexibility to balance the variability of this renewable production is growing. Promoting flexibility is not embedded in the current legal framework in the Netherlands, resulting in challenges concerning the development of flexibility.

Not only the variability stresses the system, but also the synchronous generation of electricity in the case of especially solar panels: the outbound flow of electricity from a residential area may easily be larger on a sunny day during the holidays than the total demand on a dark winter day, illustrating the impact that solar PV feed-in might have on the traditional (approach to) system planning and development. Specific points in the grid may become congested and there is an increased risk of (local) black outs, hence a security of supply risk.

9.1.1. The benefit of flexibility

In the Netherlands the basic principle is that everyone connected to the (electricity) network has balance responsibility; in other words: the responsibility to match continuously its demand and supply. The energy laws dictate that the balance responsibility of small end users (SMEs and consumers) is taken over by their supplier (‘leverancier’)³³⁵ and thus they cannot benefit from offering flexibility for balancing demand and supply. In the Netherlands, only a limited number of parties (today 45) are responsible for the real time balancing (per 15 min) between demand and supply within their own portfolio.³³⁶ Remaining balancing in real-time is the responsibility of the TSO, who has made upfront contracts for provision of balancing power with individual market parties. In

³³⁵ Article 3.1.1 and 3.2 of the System Code

³³⁶ For an overview on all balance responsible parties:
<http://www.tennet.eu/nl/elektriciteitsmarkt/nederlandse-markt/pv-register/>

this set-up, there is no real incentive for small end users to react by adjusting demand (or supply) to the actual 'needs' of the system; for example, supply surpluses (leading to possible congestions in the grid) or supply deficits.

9.1.2. Value of flexibility: grid expansion vs. flexibility

Currently, the value attached to the provision of flexibility to the local distribution network is still unknown and depending on the location. Generally speaking distribution grids in the Netherlands can still cope very well with local feed-in of power³³⁷. Also, if a local overload may occur, the grid operator is today by law obliged to add additional network capacity (cables).

In densely populated areas, such as the city centre of Amsterdam however, local conditions make a grid extension cumbersome (e.g. need for road blocks, old cables whose position is not exactly known) and it is attractive to investigate alternatives, such as storage in the distribution grid, or incentivising demand response locally. As local grid congestion is expected to occur more often in the long-term future, with more and more feed-in from decentralised generation, a framework in which the DNO can assess multiple flexibility options (besides straightforward grid expansion) will be desirable.

This framework should enable the network operator to assess the option of grid extensions towards using flexibility options. Investing in flexibility measures is especially interesting if a grid expansion would be required to only cope with scarce peaks in required network capacity in a densely populated area. An alternative based on flexibility might prove to be very attractive. In that case, the network operator should be allowed to stimulate (directly or indirectly through an aggregator) demand side management or for example invest in the use of storage capacity that is available on the market. In this assessment, it should be taken into account that local peak generation will have a value for the national energy balance and for the sustainability of the energy supply. In other words, if local generation could avoid the investment in a (thermal) peak power plant, it would be ill-advised to limit the local network capacity.

A legal barrier impeding the DNO to buy in flexibility is for example reflected in the energy laws, which in the first place obligate the DNO to facilitate the market. Buying flexibility directly in the market is not explicitly forbidden, but to facilitate net traffic the DNO is up to now always expected to reinforce or expand the network. Another impeding factor is that the law does not allow the DNO to raise flexible tariffs. For reasons of accessibility, affordability, transparency, the network tariffs are strictly regulated. Experimenting with flexible network tariffs to stimulate demand side management will not be part of the smart grid projects.³³⁸

9.1.3. Energy tariffs

→ Energy tax and flexibility

The relatively high energy taxes and the low commodity prices have a negative effect on stimulating demand side management. Stimulating demand side management by paying a real time commodity price will have a relatively small impact because taxes will stay the same. The participating aggregator in the City-zen project also points out this barrier.

³³⁷ This is expressed by various DNOs in the Netherlands, with whom the project team has discussed this topic.

In times of scarcity the kWh price may rise, but as long as this is only a couple of cents it will not have a large impact on the total kWh price. Only if prices will vary more drastically it will beat the steady energy taxes levied. In that case, other questions concerning the guarantee of affordable energy and the protection of the customer against financial risks will become important issues. Today's price fluctuations will have a minor impact on the total kWh price for small end users, and thus the incentive effect will be low.

9.1.4. Conclusion

The current regulatory framework is not in favour of (developing) local flexibility solutions: the DNO is expected to expand and increase the network instead of investing in flexibility or buying flexibility from the market. In addition, there is no direct reward system for small end-users to provide the local grid with such capacity or power.³³⁹ Furthermore DNOs are currently not allowed to stimulate flexible behaviour through network tariffs.

9.1.5. Recommendations

To mitigate these challenges, we suggest that flexible network tariffs and energy taxation need to be carefully studied in relation to the needed flexibility in demand and supply of electricity, also on a local scale. Also, the possibility for the DNO to invest in flexibility instead of extensions or in buying flexibility directly from the market should be explored.

9.2. CHALLENGE: ACCESS TO THE MARKET AND THE AGGREGATOR IN THE NETHERLANDS

9.2.1. Passive versus active end users

In many small-scale energy projects, consumers seek to increase sustainability by setting up a local energy community where the 'home made' energy is traded within the community. These communities need flexibility in laws and regulations to do so. But these communities can, as can the active prosumer, also contribute to flexibility in the energy system on a larger, national scale.

At this moment, there is no independent trade possible for these transactions. Many of the mentioned barriers are rooted on the practical limitations of administrating energy transactions in the 1990s, when the structure of the present energy markets was shaped. Several barriers need to be addressed: the strict allocation of the balance responsibility, the non-existent small-scale trade floor³⁴⁰ etc. Vehicle-to-grid projects are confronted with the same barriers.

³³⁹ *There are aggregators developing services that reward small end users for up front providing flexibility to transmission and distribution network operators. Their are different examples of aggregators using the storage capacity in electrical vehicles.*

³⁴⁰ *It is forbidden to supply small-end-users without a permit according to article 95a section 1 Electricity act. An small end user can not qualify for such a permit, according the Decree on the permit supply of electricity to small end users, (Besluit vergunning levering elektriciteit aan kleinverbruikers) and is therefor not allowed to supply another small end user; more general; a small end user can not match his own production by supplying another end user directly, without the interference of a registered energy supplier.*

9.2.2. The new actor: the aggregator

Only a very limited number of consumers will be prepared to trade themselves actively on a daily or hourly basis on the energy market: it is a too time consuming activity for a limited revenue. As a new service, a role is foreseen for the aggregator for an automated management of the flexibility of its clients. Market parties will develop these services, once the barriers for market access of end users are removed. Innovations in these services should not be hampered by new, limiting legislation.

At this moment, policy makers and energy industry (e.g. USEF) are reflecting on the way to regulate the new role of aggregators; parties that can bundle supply and demand of numerous small prosumers to achieve sufficient scale, at least 0,1 MW³⁴¹, in order to not only have sufficient volume to trade at the market, but also make active trading financially attractive.

The question thus arises, what policy regarding these aggregators should be recommended. At this moment, virtually all larger end users (SMEs to industry) use the services from a third company to manage their energy contracts. Private companies themselves have developed these services and no laws or bylaws regulate them.

Nevertheless, it stays important that the vulnerable consumer is protected against an overactive aggregator. Also, the balance responsibility from end users should be clearly defined in relation between end users (large and small), service providers, DNOs and the TSO.³⁴²

9.2.3. Energy supplier permit

In the Netherlands, for selling to small end users, the retailer needs a permit and the conditions for such a permit are strict and extensive. One of the obstacles experienced is that energy suppliers have the obligation to supply upon request every small end user in the Netherlands. In addition, the potential supplier will have to provide certain financial securities. Furthermore, he has to pass a administrative and ICT test before accessing the central energy data system. The current permit was developed with the larger companies in view and they can fulfil all these conditions easily.

In the Dutch legislative package on the energy supply, the government proposed the possibility of a 'light-permit for suppliers, supplying less then 500 connections.³⁴³ This was not adopted in the legislative proposal and the full legislative package was rejected in the Upper House.

To allow more players, and especially small players in this market, the energy supplier permit conditions should be reconsidered.

9.2.4. Balance responsibility

Every user is balance responsible (programmaverantwoordelijk in Dutch). This means that every user (including small end users) is responsible for their energy program (e-program), balancing demand with production or procurement of electricity. The balance responsibility of small-end users is transferred to the energy supplier. Small end users cannot perform these tasks themselves or via a contracted independent service provider. The role of the balance responsible party is essential to the

³⁴¹ *EPEX SPOT Netherlands 2017*

³⁴² *A current pilot in the Netherlands by the Dutch TSO Tennet, which asks for small-scale pilots for provision of flexibility – in this case primary reserve to the transmission grid. Some of these pilots incorporate the aggregation of storage (in EVs) and/or demand response capacity from consumers/ producers connected to lower grid levels.*

³⁴³ *Consultatierapport Stroom, Ministry of Economic Affairs, January 2014*

subject of flexibility. It is exactly these tasks that allow the supplier to optimize the deployment of its portfolio. Being able to deliver that what has been calculated beforehand can avoid extra imbalance penalties. Being balance responsible party is a financially interesting role. Especially on larger portfolios with the advantage of being able to pool customers, but still charge them individually for their imbalance, a good business case can be created.

In the current system a lot of (financial) power has been transferred from the end user to the large energy companies, by forcing small end users to use an energy supplier and automatically transferring their balance responsibility to this supplier.

The historical allocation of these different roles needs to be reconsidered, especially now that the aggregator as independent party needs to be regulated. As long as the small-end-user is solely seen as a simple customer, paying for services and taxes, there are little incentives to adjust its behaviour. Thus an important source of flexibility would be neglected.

9.2.5. Conclusion

To make the system more flexible requires a system in which all end users have direct access to a market where they can trade with other consumers or with larger market parties. Many of the mentioned barriers are rooted on the practical limitations of administrating energy transactions, but with present IT systems that can be used to do almost everything (e.g. tracing source of power via block-chain), these barriers miss ground.

Furthermore, under the current framework stimulating flexibility is limited because of this strict division of roles.

9.2.6. Recommendations

New innovative services will emerge ('aggregators'). Market parties (e.g. the present energy exchanges as EPEX) can develop an efficient trade floor for small, local volumes of energy. A clear stimulus from government can support these developments.

However, adjusting the system and allowing more financial instruments to stimulate consumption and production patterns could also lead to exposing end-users for undesirable financial risks. This will need to be studied further.

9.3. ROLE OF THE DISTRIBUTION NETWORK/SYSTEM OPERATOR IN THE NETHERLANDS

9.3.1. Legal and financial barriers

How can the regional grid operator contribute to a sustainable development and support the energy transition? Within City-zen the largest DNO of the Netherlands, Alliander, develops three demonstration projects to improve the electricity grid for the uptake of renewables on the grid: vehicle to grid, virtual power plant and End2End smartification.

9.3.2. City-zen smart grid projects

The vehicle to grid project explores the ability to use the car battery for other purposes, for example to assist optimisation of residential energy use and of grid operations. In the virtual power plant project City-zen partners, Energy Exchange Enablers (EXE) and Greenspread are testing an online platform that aggregates end users generation (solar energy/unloading battery) and consumption (consumption/battery loading). In the project home batteries are installed in solar panel equipped

households. Greenspread, taking the role of aggregator, trades the aggregated volume of the participants on the wholesale market.

In the End2End smartification project the existing iNet (smart grid of Alliander in Amsterdam New West) will be further equipped with computer and sensor technology. Insight in (near) real-time power flows and voltage profile makes it possible for the DNO to see how an increase of PV-plants and storage affects the net. The project does not actively manage consumer behaviour, but the storage capacity of the households in the virtual power plant project can be used for optimal grid management.³⁴⁴

9.3.3. Value of flexibility for the DNO

The common thread in all the projects is how the network will be affected by the increase of local renewable energy production and storage. Renewable energy sources, particularly wind and solar, are intermittent and less predictable. This impacts the available amount of energy and the energy flows through the system: balancing and grid capacity. At times, there might be insufficient capacity to transport the volumes from the new areas of generation to the areas of demand. To safeguard security of supply, the network operator has two options; reinforcing the grid, increasing storage capacity, buying flexibility from the market or minimizing peak loads by contributing to management of production and consumption, also called demand side management (DSM). This could eventually lead to avoiding additional grid investment and increase the lifetime of the existing grid.

Furthermore the DNO wants to have insight in how flexible consumption (consumption/loading battery) and production (solar production/ unloading battery) could contribute to minimizing peak loads. Storage capacity could also play a role in the balancing by the TSOs.

In paragraph 9.1.2 we discussed the DNOs incentive to avoid the prevention of local network extensions. An assessment of local costs and national benefits has to be made, as on a national or EU-scale, restraining renewable power to prevent a local grid investment may lead to a greater loss than the savings in the local grid. The activities of DNOs in this respect should take this into account at the risk of finding sub-optimal solutions.

9.3.4. TSO vs. DNO

Looking at the City-zen projects shows that the distribution network operator is involved in exploring and stimulating demand side management and finding flexibility extensions (for example through the use of storage) to avoid capacity problems and looking at how storage could play a role in balancing supply and demand. In the current system only the TSO (Tennet) not the DNO, is responsible for the real-time balance between supply and demand, and the TSO has contracts with (large) consumers/ producers to instantly correct the balance. The DNO is not explicitly allowed to make such agreements.

To understand why the DNO is interested in exploring this field is closely related to the change from large centralized fossil based energy production to small scale, local renewable energy production.

In the transition to a sustainable energy system, more of our energy will come from small-scale plants and consequently there will be many of such production entities to be able to supply our demand.³⁴⁵ As a result our production will become more local (or everywhere) and connected to the

³⁴⁴ <http://www.cityzen-smartcity.eu/ressources/smart-grids/virtual-power-plant/>

³⁴⁵ *As long as no new alternatives are developed, today's sustainable sources are mostly, small-scale.*

networks operated by the DNO, not the TSO. The DNOs are anticipating this growth in local production (and storage) and are therefore exploring how to optimally develop the network to facilitate these changes. Flexibility issues have moved from TSO level to the level of local networks. Under the current regulations, DNOs do nothing in terms of real-time control of the distribution grid – its role is in grid development, connections and maintenance. With these tools the only option the operator has to facilitate the increase of local production, is to maintain, reinforce and expand the grid.

9.3.5. Tension between commercial and network activities

Since the implementation in 2006 of the Independent network operator law (Wet onafhankelijk netbeheer WON) it is since 2011 forbidden for a network operator to be part of an integrated energy company, which is also active in generation and supply of energy. Unbundling, which is both regulated in European and National laws, resulted in the Netherlands in the so-called ‘group prohibition’ (groepsverbod), which is a radical form for unbundling that prohibits the network operator to be part of a group (defined in book 2 of the Dutch Civil Law) with other companies that are involved in generation/supply/ trading of energy.³⁴⁶ Neither are other companies joined in a group with a network operator, allowed to be shareholder in a company that is involved in the generation/supply/trading of energy and vice versa.³⁴⁷ In the Netherlands the economic property of the network lays with the network operator.³⁴⁸ Shares of the DNO are in the hand of local governments.³⁴⁹

The radical unbundling in the Netherlands also led to a definition of the tasks of the network operator, as to prevent the network operator to get involved in more ‘commercial’ (energy) activities, which are activities that are in conflict with managing the network.³⁵⁰ There are two important arguments for this distinction between commercial activities and network activities. Firstly, commercial activities would again increase the economical risks and thus jeopardize the economic stability of the network operator, but more important, the unbundling prevents that the network operator as the owner of the network, which is defined as a natural and legal monopoly, having a position of privilege, could hamper the competition of other market players in this market.

9.3.6. Defining the role of the network operator

As a grid operator, Alliander is in the first place responsible for maintaining and upgrading the grid, roll out of new networks, assuring sufficient capacity for the transportation of electricity and assuring the safety of the network. Next to these key network activities, the network operator has to facilitate the penetration of a rising share of renewable energy production, or as formulated in the Dutch

³⁴⁶ *A number of the energy companies went to court to dispute the unbundling. In the first case the companies lost, but at the Higher Court was in favour of the companies, concluding that the Group Prohibition was in breach with European law. The Dutch Supreme Court submitted preliminary questions to the European Court of Justice. The Dutch Unbundling legislation was judged not to be in breach with European law, and the Supreme Court overturns the judgement of the Higher Court in June 2015: Hoge Raad 26 juni 2015, ECLI:NL:HR:2015:1727; 1728 en 1729.*

³⁴⁷ *Article 10b, Electricity Act*

³⁴⁸ *Article 10A first led, Electricity Act*

³⁴⁹ *Article 93, Electricity Act*

³⁵⁰ *Article 17, second and third led, Electricity Act*

Electricity Act: The network operator has the task to *set up, repair, renew or expand the networks, taking into consideration measures in the field of renewable electricity, energy saving and demand management or decentralized electricity production, which can overcome the need for replacement or increase of production capacity*³⁵¹.

9.3.7. Commercial activities

Tasks related to the integration of renewable energy sources, energy savings and DSM could involve commercial (related) activities, activities that are in conflict with operating the network or activities defined as production, supply or trade.

One of the activities that was under discussion is the development of software programs to stimulate demand side management by EXE (part of the Alliander group and part of the City-zen project)

Essent argues that the network operator is not allowed to develop any non-infrastructure and commercial activities. It claims that with EXE (and other daughter companies) Alliander is competing with private companies on the energy market.

The law does not forbid the DNO to perform commercial activities, as long as they are not energy related. According to the Supreme Court, in an earlier case, the unbundling is in the first place a measure to prevent market-distorting activities, instead of reducing the risks of commercial activities.³⁵²

Question is if the activities in the field of e-mobility and development trade programs as developed by EXE can be qualified as energy related commercial activities.

In 2015 two of the major energy companies, RWE/Essent en Nuon, have filed complaints against the Alliander network company for engaging in commercial activities. Last year, May 2016, the national regulator ACM concluded that the activities as developed by Alliander are not in conflict with the Dutch unbundling regulations.³⁵³ Essent and Nuon brought the case to court. On September 14 2017, the judge denounced the complaints of NUON and ESSENT and followed the ruling of the ACM.³⁵⁴

9.3.8. Energy transition

At the time the unbundling legislation was developed, after the liberalisation/ deregulation, of the energy market in 2004, the focus was primarily on developing a competitive energy market. The networks, described as a natural monopoly, must be accessible to all market players and the role of the network operator is to facilitate this market. Typically the network operator would maintain the net and provide connection, whereas the trader or supplier provides the connected users with products and services.

Since the implementation of the unbundling legislation there has been a shift in perspective on the cohesion of network and products offered. Many of the flexibility services have relation to the network and also development of storage and mobility affect the network and the balance of supply and demand, directly. The strict, or up to now also unclear, distinction between commercial 'energy'

³⁵¹ Article 16, first led, sub C Electricity Act.

³⁵² ECLI:NL:HR:2015:1727, consideration 3.22.3

³⁵³ Handhavingsbesluit Alliander over voorzetten nevenactiviteiten, ACM, May 2016, ACM/DE/2016/201932_0V

³⁵⁴ Verdict Court of Law Rotterdam, ECLI:NL:RBROT:2017:7043

activities on the one hand and pure network operator tasks on the other hand, is challenged by the DNOs.

In this discussion, it is essential that the possibilities of the DNOs to contribute to a more renewable energy system are well established. At this moment, only the possible gains in avoided local grid investments are researched.

9.3.9. Public, private, citizens

One of the underlying themes is the division between public and private energy companies. All network operators are publicly owned. The trade, supply and production business, formerly also publicly owned, were soon after the liberalisation divested and sold to (international) private companies.³⁵⁵

The last years local governments wish to be more at the steering wheel of the energy transition and are initiating new energy companies, which mainly focus on supporting the transition of local green energy developments.

Another development is the growth in energy cooperatives, which could qualify as a collectively owned energy company. Unfortunately these cooperatives often do not have the same possibilities and financial benefits as other permitted suppliers, because of regulatory limitations, see challenges 9.2, but also 8.2 and 8.3. What is more interesting in this context, is the property structure, meaning that individuals collectively invest in their energy production and no longer want to depend on private companies for these services.

Improving the design of our energy system, including the different roles and tasks each stakeholder is fulfilling in this system, cannot be seen separate from the question of ownership: who is in charge of which services: governments (including DNOs), citizens or private companies?

9.3.10. Conclusion

There is an important societal question to solve here, balancing the common interest versus the rules of the free market. It is clear that the present design of the system based on archaic structures and a free market model 'pushed' over it, has become obsolete and even contra productive. As long as the regulators do not respond at the level of this challenge, 'bricolage' and the resultant problems will continue to cause conflicts and delays in the energy transition.

The question on how the DNO can contribute to sustainable development and support the energy transition, has a complex answer.

Under the current regulation the DNO is limited in his activities to mere operating his network. The DNO is not in charge of balancing (other than in a locally congested area) and can neither stimulate demand side management by using economical incentives. In addition, the DNO cannot perform activities that involve trade/supply and production or possibly activities related or competing with energy trade/supply and production. The law is unclear in making a clear distinction between commercial energy related activities and the activities that could be performed by the DNO.

The energy transition i.e. the shift from large scale to small scale and from centralized balanced production to small scale intermittent, less-predictable production has a large impact on the

³⁵⁵ *Nuon to Vattenfal, Eon to RWE. Eneco and Delta lost their plea to suspend the Dutch unbundling legislation. Shareholders of the commercial branches of Delta and Eneco are reconsidering their position and are possibly selling the companies.*

networks operated by the DNOs. Consequently, DNOs can desire to study the impact on their net and if there is a need for new activities in this new landscape. The question is whether we find this expansion desirable, or that we prefer other parties (citizens, private companies) to (exclusively) develop these activities.

9.4. CHALLENGE: WASTE INCINERATION: COMPETITION BETWEEN SUSTAINABLE PRODUCTS IN AMSTERDAM

Process optimisation for Waste to Electricity, Waste to Heat or Waste to Chemicals in the Amsterdam waste incinerator AEB is difficult, given the different environmental and economical outcomes. The same internal questions will arise in other industries, where processes have to be optimised to an array of products. For 'centralised' (industrial) companies with an option to switch between processes, such as AEB in one of the demonstration projects in Amsterdam, there is the issue that there is uncertainty about (future/ foreseen) policies. This provides an uncertain framework with regard to the development of flexibility by shifting between processes.

Another factor impacting upon the perceived necessity for developing an advanced dispatch optimization tool are low electricity prices.

9.4.1. Low electricity prices

As described in challenge **Fout! Verwijzingsbron niet gevonden.** electricity prices are low and the potential to sell balancing power is very limited. This makes the generation and supply of electricity, a much less attractive revenue stream for AEB.

9.4.2. Heat supply obligations

Another complicating matter is the required heat provision from AEB. Supply obligations resulting from heat demand from the (developing) heat network in Amsterdam, also impact upon the opportunities to switch between processes.

9.4.3. Definition of waste streams

Challenge for policy makers is to provide clear guidance on the waste streams/ products that should be separated and/or produced by AEB, and – where necessary – in which volumes, and when (i.e. in the case of heat supply). This sets clearer boundaries with regards to the processes, products and volumes (including timing, in case of heat supply) that should be involved in the development of dispatch optimization tools that can help to better source locally available flexibility.

Additionally, to make more flexibility available to the (local) electricity system, one could consider measures to make the provision of flexibility to the electricity market more attractive. An important consideration in this case will be whether Waste to energy will (continue to) fall under the EU ETS or not.

9.4.4. Conclusion

As the only shareholder, Amsterdam council can set environmental targets for its waste incineration plant, next to the economic goals common in any industry. Thus, a better optimisation between process activities can be made possible for this public company. Currently, the uncertainties on (upcoming) requirements for separation of waste products, required heat production and low energy prices, make the overall optimization of, and between different processes, a very complex task.

9.4.5. Recommendation

To optimise between different revenue streams, such as heat, electricity and chemicals extracted from the waste streams, it is necessary for AEB to set clear priorities. These priorities in optimising dispatch of the waste processing and incineration plant need to be based on: 1. Legal obligations, such as heat provision obligations, 2. Policy targets from the municipality for waste, energy and climate and 3. Economic optima, e.g. which products generate the most revenues.

Amsterdam council can set these priorities, although different aldermen are responsible for sustainable policy and shareholder management.

9.5. OVERALL CONCLUSION CHAPTER 9

In the Netherlands and France the legal framework is designed for and characterized by central generation of electricity by large power plants and mere distribution of energy to end-users. This is not only reflected in the roles, and the protection of these roles, of the historic stakeholders by law, but even more in a system that does not acknowledge that renewable energy sources are variable and unpredictable.

To provide sufficient security of supply, the need for flexibility to balance the variability, is growing. Network tariffs and energy taxation need to be evaluated, the net metering of homemade electricity needs to be replaced by a more market-based system, and end users must be remunerated for demand side management. These aspects are impeded in today's legal framework.

A redesign of the legal framework, based on the present long-term policy targets, is of vital importance.

CHAPTER 10 – FINAL RECOMMENDATIONS

The most important recommendations are summarized here, listed per theme.

10.1. GOVERNANCE

- Innovations, stimulated by sustainability targets, are confronted with non-sustainable laws and financial constructions. A consistent approach to sustainability is needed at all government levels (UN – EU – Member States – local government) and all fields (climate, energy, taxes, building, urban planning).
- The national legislator has to clearly attribute responsibilities to local authorities; they can be strengthened by anchoring them in law
- The coordinating role of the municipality at the local level should be further established.

10.2. TAXATION AND PRICING

- Energy taxes should contribute to the polluter-pays-principle. Because of low tax rates, large consumers are not effectively stimulated to invest in sustainable measures.
- Environmental levies paid by end-users could be used to empower the end-user, both as a (co) owner of production and improving its energy independency.
- All the business cases of the demonstration projects are suffering from a lack of CO₂-pricing. In many of the projects the (future) financial value of avoiding emissions is not at all part of the business case. Many experts have repeatedly pointed out the importance of adequate CO₂-pricing as a steering mechanism towards a sustainable (energy) system.

10.3. DATA

- The current administrative system is not taking into account the new possibilities that are created by IT-developments, therefore new policies on data management, collection and processing, should be established.
- The access to (close to) real-time data enables new services that can contribute to flexibility, system operation and further development and deployment of renewable sources.
- Energy data plays an important role in planning the energy transition. Member States should reconsider the importance of the public interest of energy planning versus the infringement of privacy by using personal energy data.

10.4. SUSTAINABILITY AND SPATIAL PLANNING

- Make clear regional, municipal energy plans, up to neighbourhood and street level, in order to guide citizens and other stakeholders, like network operators, in making the appropriate alterations and investments in and on their house/building. This will avoid counter-productive investments.
- For each street or building (depending on the type of housing) energy plans are needed to guide citizens and municipalities in making and planning the appropriate investments to make an optimal energy efficient building.
- Citizens should be allowed to choose a suitable sustainable solution. In case of a captive system and for as long as the connection to this system is not yet established, the customer should be free to choose a cleaner solution.
- The Dutch legislator has to provide for a legal framework that supports municipalities to phase out gas networks in the existing built environment. All laws involved will need to be evaluated (energy, administrative, environmental, building regulations, but also property laws)
- A financial framework (subsidies/loans etc) has to support this legal framework and allow all citizens, including low-income households, to be included and participate in this transition.
- Work on transparency and completeness of business models, as well as on trust relations between actors to improve risk assessment and transaction costs. In a similar way identify the most promising unburdening setups;

10.5. SUSTAINABLE HOUSING

- Building regulations regulating existing buildings do not sufficiently stimulate and support sustainable measures in renovation projects. Especially towards professional owners/ and developers, and taking into account the buildings limits, the municipality should have the possibility to demand an energy efficiency performance that is higher than laid down in the Dutch Building Act.
- Develop a pre-financing for poorest households in order to bridge the time before receiving a subsidy;
- Further investigate the possibilities of building attached loans so that the discrepancy between payback period and an investor's financial/logistic planning horizon can be bridged more easily;
- Further investigate the possibility of allowing the reduction on the energy bill to play a role in the creditworthiness of the applicant.
- Investigate the possibilities of pooled projects so that big investors (pension funds, but also banks) can be attracted.
- But also stimulate large investors to develop scheme's to finance small projects
- Promote/provide an independent advice to building owners e.g. through mechanisms under control or supervision by local authorities;

- Find mechanisms and financial programs to finance deep renovations with longer payback periods.
- Find mechanisms and financial schemes that support the transition of a complete street or neighbourhood. A street-wise approach is essential in the process of changing a complete system. The MurMur campaign is an interesting example of financing block upgrades and developing packages that are available and attractive to all households (rich and poor).
- Support only those financial schemes that contribute to the optimal energy performance of the building, taking into account energy plans in its neighbourhood.
- Improve the legal instruments for renters to enforce their landlord to invest in improving energy performance of the dwelling.
- Support landlords (social housing and private) to perform deep retrofits. The Dutch legislator developed an interesting financial instrument, the Energy Performance Fee, to support landlords to perform deep retrofits.
- Limit the mismatch between theoretical and actual energy consumption by improving the labelling system and increase awareness about behavioural changes after upgrades, but also check for mal-installations and technical issues.
- Build on improvement of knowledge of new technologies and (financial) possibilities with contractors, consultants and developers.

10.6. RENEWABLE ENERGY PRODUCTION

- Simplify laws and regulations. The present legal framework has become clogged after adaptation on adaptation, leading to internal contradictions and causing confusion among all concerned parties.
- Give investors in EE and RE a stable long-term investment framework by limiting the pace of alterations in subsidy mechanisms and regulation updates.

10.7. SMART GRID AND FLEXIBILITY

- Balance the common interest in sustainable development versus the rules of the free market on issues as storage, flexibility and DSM in smart grids.
- The present design of the electricity system based on archaic structures and a free market model ‘pushed’ over it in 2004, has in certain areas become counter-productive to the energy transition. As long as the regulator does not really respond at the level of this challenge, ‘bricolage’ and the resultant problems will continue to cause conflicts and delays in the energy transition.
- Enable small end-users, through the use of smart technology, to provide flexibility, needed in view of the growth of renewables.
- Find ways to improve access to this market, which is impeded by rules made by and for large players (companies). The legislator will have to evaluate how and to which extend these barriers can be lifted, balancing consumer protection and consumer action.

GLOSSARY

Aggregator:	An energy service company, mostly commercial, providing a broad range of energy solutions with regard to management and trading of energy generation and energy use.
EPBD:	Energy Performance of Buildings Directive: 2010/31/EC
EPEX-Exchange:	the power exchange for spot trading in Germany, France, the United Kingdom, the Netherlands, Belgium, Austria, Switzerland and Luxembourg. In 2015, EPEX SPOT integrated with the former APX Group.
EPC:	Energy performance coefficient is an index indicating the energetic efficiency of new buildings
EPF:	Energy Performance Fee
ESCO:	energy service company or energy savings company (ESCO or ESCo) is a commercial or non-profit business providing a broad range of energy solutions. In this report ESCO is limited to services regarding energy conservation.
EU-ETS:	EU Emissions trading system: Directive 2003/87/EC.
DH:	District heating: System distributing heat generated in a central location(s), supplying buildings with warm water used for space heating and water heating.
DNO:	Distribution Network Operator.
La Métro:	the French administrative region Grenoble Alpes Métropolitain
NOM:	<i>A nearly zero (Energy) house: or nul-op de meter woning, is a house who's input and output energy flows for building-based energy in a normal life pattern are equal to or lower than zero and with additional power generation capacity for user-related energy of at least a number of kWh, depending on the size and position of the house</i>
Prosumer:	Consumer that also produces RES for non-commercial grounds.
SME:	Small and medium-sized enterprises.
Small-end user (NL):	a building with a connection with a maximum capacity of 3*80 A at 230V, approx. 65 kW.
TSO:	Transportation and System Operator.

APPENDIX I

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APPENDIX II

LIST OF THE INTERVIEWEES

Amsterdam

The project team has conducted interviews with the following key people (listed below). Many of the interviewees are closely involved in the various demonstration projects in Amsterdam.

- AEB (Afval Energie Bedrijf), Strategic advisor
- Alliander (DNO), Project Manager Virtual Power Plant: Martijn van der Eerden*; Project Leader End2End Smartification: Ruben van Loon*; and Projectleader Virtual Power Plant: Jan-Willem Eissing*
- Amsterdam Economic Board: project leader renovations: Annelies van der Stoep*; and Strategic advisor
- ASN Bank: Account manager sustainable project financing; and manager institutionele relaties Vermogensopbouw
- DVDW Consultancy, Financial consultant for several banks and pension funds: David van der Wal
- Eigen Haard (social housing co-operation), Developer renovation projects; and Sustainability Expert
- Greenspread, Projectleader Virtual Power Plant
- iLINQ: Renovation, architect and energy expert: Daniel de Witte
- J-OB, Independent consultant and owner, board member RElocal: Job Swens
- Liander (DNO), Project leader Vehicle to grid: Paul Bierman*; and Project leader for City-zen smart grid projects: Celina Kroon*
- MennoKooijstra architects, Renovation expert: Peter van Gelder*
- Municipality of Amsterdam, Advisor Sustainability: Erik Theissing, and Renovation expert Sustainability Division: Sebastiaan Jacobs
- Ondernemerscoöperatie NWENRG, energy advisor on retrofits: Pauline Westendorp
- Ons dorp (social housing co-operation), Elisabeth Wolfstraat, Private building group, Renovation expert
- SOR (social housing co-operation), Advisor portfolio and assets management: Stefan Kusters
- SQ consult, Expert in Energy transition and business development: Bart van der Ree
- StartGreen Capital, Investment Director: Karel Asselberg
- TNO: sustainable VvE (owners association) researcher
- Vereniging Eigen Huis (national association of homeowners), Financial expert: Karin Boog, Energy expert: Maarten Eeke van der Veen, and Financial policy maker: Michel Ligtlee
- Waternet, Bio-refinery and cooling: Otto Reinstra*, and the Programma Manager Nieuwe Sanitatie

- Westpoort Warmte, District heating Amsterdam and comfort-cooling: Jannis van Zanten*
- Woonstichting De Zes Kernen, Bernisse (social housing co-operation), Directeur-bestuurder: Anja van der Sijde
- IJburg (social housing co-operation) Areamanager Watergraafsmeer

Grenoble

Interviews have taken place with several stakeholders at local and regional level. Many interviewees are closely involved in Cityzen demonstration projects.

- ADEME (French Energy Agency), Follow-up of Sustainable energy action plan
- ALEC* (Local Energy Agency), Executive Director
- AURG (Urban Planning Agency), Territorial development projects director
- CCIAG *, Executive director
- EDF, Regional director
- ENEDIS, Iserre territory director; and chief Smart Grid Unit
- Enercoop (Renewable energy provider), Regional director
- FBTP (French federation of building and public works),
- GEG*, Executive Director; and chief of unit Network and smart grid division
- GRDF, Iserre territory director
- Groupe 38 (urban development operator), Executive Director
- Innovia *, Project director; and Executive director
- OSER (ESCO), Executive director
- Région Rhône Alpes, Vice-president Energy Transition
- SEDI (Energy departmental association), President; and Executive Director

Interviews have also been conducted with several departments of La Métro (water, sanitation, waste, housing, land use and urban projects, mobility).

*) participant in City-zen

APPENDIX III BUSINESS MODEL CANVASSES

Appendix III contains the business model canvasses to some of the City-zen project and provide a more detailed insight to the business case behind each of these project.

Bio-refinery Buiksloterham

Project description:

Demonstration of a local small-scale ‘New Sanitation’ waste water treatment facility (as opposed to a conventional centralized large-scale waste water treatment plant) based on biological processes.

This bio-refinery will contribute to the creation of a ‘circular’ neighbourhood Buiksloterham: a post-industrial area in the North of Amsterdam that being transformed into a neighbourhood with high ‘circular’ ambitions. In 2015 these ambitions were agreed upon by 20 public and private organizations in the manifesto “Circulair Buiksloterham”, The area will see 3,500 new homes and 200,000 m2 of office space over the coming years.

The bio-refinery is the central part of a New Sanitation System that is designed to maximize the recuperation of energy and nutrients from the waste water on a neighbourhood level. In this system the waste water is separated within the household into black water (organic sludge) and grey water (slightly polluted household water). Black water will be collected and transported through a vacuum sewer system.

Key elements in the project:

Cooperation: Three public organizations (Municipality, two foundations finding a sustainable solution, using an open business case)

Technique: Separation of waste water streams at the source, vacuum sewerage, recovery of energy and raw materials from black waste water

Economics: Relatively large initial investment. This is a pilot project aimed at a much wider application, primarily in new buildings.

Geographical: The Municipality of Amsterdam and Waternet consider the application of ‘New Sanitation’ in the municipal plan ‘Koers 2025’ (or ‘Destination 2025’): the masterplan to built 50.000 new housing units between 2015 and 2025.

Business Model Canvas

Project/Organisation Name:
 Neighbourhood bio refinery for the treatment of pre-separated waste water as a facilitator for a circular city district

Date:
 5 May 2017

<p>Key Partners</p> <p>Waternet is the executive organization for the Water Authority Amstel, Gooi & Vecht (AGV), and for the water-related tasks of the Municipality of Amsterdam. Among others, Waternet is responsible for the sewerage and the waste water treatment in Amsterdam.</p> <p>The Municipality of Amsterdam is responsible for the development of the Buiksloterham neighbourhood.</p> <p>De Alliantie is a social housing corporation that owns 53.000 houses in and around Amsterdam. It is responsible for the development of Buiksloterham&Co, a block in the Buiksloterham. The development of this block follows the 'cityplots' concept, and will encompass a mix of private houses, social housing, rental apartments and spaces for small business.</p>	<p>Key Activities</p> <p>A "New Sanitation" (NS) system, consisting of:</p> <p>Two separate sewer systems: a vacuum system for black water (faeces, urine, organic waste) and a traditional system for grey water (water from showers, washing machines etc.).</p> <p>In-house installation designed for the separation of wastewater into black water and grey water: vacuum toilets and vacuum pipes for the black water, and traditional pipes for the grey water.</p> <p>A local bio-refinery to treat the black water, extracting biogas and raw materials.</p> <p>The aim of an NS system is to be much better able to recover energy and plant nutrients from waste water, compared to regular sewer systems.</p>	<p>Value Proposition</p> <p>Geographical opportunity:</p> <p>At this point in time an NS system is best installed in a new neighbourhood, because a separated sewer system is much harder to retrofit in existing houses.</p> <p>For a pilot project to introduce and test NS, the Buiksloterham had the following extra advantages:</p> <ul style="list-style-type: none"> • Neighbourhood being transformed from industrial to residential: almost a greenfield. • Stakeholders and (future) inhabitants share a motivation to create a 'circular' neighbourhood. • An already existing sewer system in place provides a credible fallback scenario. • Located near the city center: attractive showcase <p>NS meets the demand from many citizens for more sustainable housing, and for greater self-reliance.</p> <p>The system will save up to 30% drinking water per person (12,5 m3 /person, year), save energy, produce biogas and phosphorus (struvite) and has the potential to recover heat.</p>	<p>Customer Relationships</p> <p>Successful implementation relies on the cooperation of the main stakeholders: the house-owner, the tenants, the waste water company, the Municipality, the energy supplier. The business cases should be transparent, and in the case of heat recovery from waste water, preferably be combined.</p> <p>The customers are also suppliers of waste water and heat. They may expect to be involved in the governance, and probably also remunerated for their input.</p> <p>To enable this, new combined cross-sectoral pricing systems would have to be developed. There are two obstacles against this:</p> <ol style="list-style-type: none"> 1) The current tariff for sewerage in Amsterdam is based on 'socialization of costs and risks', i.e. everybody pays a flat tariff, regardless of the actual costs of their specific part of the sewerage system. 2) Energy suppliers are usually profit-driven enterprises. In an open market they are not willing to 'open their books' to agree on a tariff structure that is beneficial to all. 	<p>Customer Segments</p> <p>At his moments there are no 'real' customers for "New Sanitation", although certain segments of the society are very interested in the sustainability benefits.</p> <p>House-owners need to install vacuum systems and vacuum toilets in their homes. These cost more, and currently there is no price incentive apart from saving water. Many people consider vacuum toilets less attractive than 'normal' toilets, and vacuum sewerage introduces an extra system that could possibly fail.</p> <p>Customers for heat: Using heat from grey water can help creating energy-neutral neighbourhoods, make house-owners independent from the energy market. It is also expected to be cheaper than alternatives for heating. However, the concept of grey water heat is in its infancy, and both the government and the Municipality of Amsterdam still put much emphasis on the expansion of district heating, even though in Amsterdam the heat is supplied by non-sustainable sources: a fossil gas power plant, and a waste burning plant.</p> <p>Another impediment for low-temperature heat is the complexity of the system (heat distribution, cold distribution, heat input from multiple sources etc) and the involvement of many stakeholders (see Customer</p>
	<p>Key Resources</p>	<p>In a densely populated urban area it is desirable to combine NS with the use kitchen waste grinders</p>	<p>Channels</p>	

	<p>The NS system uses waste water that is separated at the source in this way the different components can be more easily recovered than from a traditional sewer system:</p> <ul style="list-style-type: none"> - Heat - Biogas - Minerals (plant nutrients) 	<p>(otherwise not allowed in the Netherlands). This improves the separation of solid household waste, and adds more valuable organic material to the NS system. However, in the Buiksloterham the housing association has refused to install kitchen grinders because of the costs.</p> <p>Low-temperature heat can be recovered from grey water. The heat can be stored in an ATES system, and used for low-temperature heating of houses via heat pumps. Waternet has proposed this for the Buiksloterham but the Municipality has refused it, mainly for the following reasons:</p> <ul style="list-style-type: none"> • A high-temperature district heating system had already been planned. • For the execution of NS projects, best practices have not yet been established. Therefore the municipal project coordinators saw it as too big a risk. 	<p>First, Waternet needs to be able to point to some successful pilot projects. Then we think we can convince the Municipality and house developers to make this a standard for new neighbourhoods. Only then we might be able to expand it to existing neighbourhoods.</p>	<p>relationships). At this moment, commercial energy companies show very little interest to invest in this type of heating systems: for them the risks are too high.</p> <p>In Amsterdam the market risks are exacerbated by the fact that the Municipality insists on offering the inhabitants a free market choice for energy. This means that there is no guarantee that individual house-owners will link up to the communal heating system.</p> <p>Currently there is hardly a market for fertilizers from waste water: NS is a very efficient way to recover valuable plant nutrients (phosphate, nitrogen, potassium) from waste water. However using plant nutrients from (sewage sludge) waste water for agriculture is legally forbidden in the Netherlands (with the exception of phosphorus in the form of struvite). Also, because the Netherlands struggle with large surpluses of these minerals and on top of that produces a large amount of artificial fertilizer, there is currently hardly any market demand for more fertilizers.</p>
<p>Project Internal Cost Structure</p> <p>Buiksloterham is a small scale pilot project in a special place, because the traditional infrastructure is already in place and can be used for grey water. Therefore the costs are not truly representative.</p> <p>For the new neighbourhood Centrumeiland we have made a businesscase to compare the total costs and benefits for a system with NS in combination with ATES heating with a traditional sewerage system plus district heating (screenshot is added separately). This system will not be implemented, but the business case is a good benchmark for future greenfield neighbourhoods. The conclusion is that the 'society level TCO' (that is: the combined total cost of ownership for the Water Authority AGV, the Municipality of Amsterdam, the energy company and the house owners put together) is positive: the total difference over an evaluation period of 50 years is around 62M€ compared to 86 M€ , so the total benefits over this period are around 27%.</p> <p>CO₂ emissions are expected to be 40% less: from 765 to 450 ton CO₂/year</p>		<p>Project Internal Revenue Streams</p> <p>See business case and case sheet (separate)</p>		

<p>CO₂ emissions could go further down if re-use of the sludge from the digester for agriculture would be permitted.</p> <p>What scope is there for cost reduction (e.g. streamlining processes, rethinking provider network, economies of scale and/or scope)?</p> <ol style="list-style-type: none"> 1. Waternet is currently considering an energy role: supplier of low-temperature heat, and exploitation of public ATEs systems. This would simplify the governance structure, make repetitive projects easier, and would make it easier for Waternet to reach more professionalism and higher economies of scale. 2. Recovery of plant nutrients would make more sense in the Netherlands if the government would accept their use in agriculture (now only accepted for struvite), following the EU 'Sewage Sludge Directive 86/278/EEC' 	
<p>Additional community costs/disruptions</p> <p>Does our VP lead to socio-environmental disruptions/harms? No, it does not. This is a system aimed at better sustainability. It can also help social integration if the system of nutrients recovery and/or energy recovery is run by a local neighbourhood collective.</p> <p>Can we precisely measure the impact (ideally, monetarily)? For our enterprise (financial, brand, regulators)? It is still a bit too early for that</p>	<p>Additional community Benefits</p> <p>As stated above, the possible benefits are:</p> <ul style="list-style-type: none"> - Higher sustainability, lower carbon footprint - Financial benefits - Energy independence and stable energy prices - Shared responsibility for decentralized systems, community building - Inputs for local circular agriculture
<p>Overall assessment</p> <p>What is the community impact?</p> <p>More sustainable, less CO₂</p> <p>Decentralized system, more responsibility for local community and more stakeholder interaction.</p> <p>Is our BM financially sound? What are the promises and risks here?</p> <p>Positive 'society level' business case if all stakeholders cooperate.</p> <p>Risks are mentioned above, several of them due to government decisions: the market for fertilizers is skewed because fertilizers from waste water are not allowed, communal heating systems are undercut by a free energy choice for house owners etc.</p>	

Cooling Sanquin Waternet

Project description:

Sustainable process cooling and heating with thermal energy from public infrastructures

Waternet delivers cold through a main water transportation pipeline connected through a heat exchanging installation to Sanquin. Sanquin uses cold from water pipes for cooling of primary processes. CO₂-reduction: 1100 ton/yr, estimated 8 % of Sanquin’s total emissions.

Key elements in the project:

Cooperation: two foundations finding a sustainable solution, using an open business case

Technique: Extracting cold from public drinking water pipelines

Economics: relatively large initial investment. Considering the total cost of ownership this solution was cheaper than traditional electric cooling.

Geographical: Waternet explored the possible market for cold along the existing cold water pipeline.

Project/Organisation Name:
Cold delivery Sanquin-Waternet/ Sanquin

Date:
16 Nov 2016

Business Model Canvas

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
<p>Waternet – delivers cold through water main transportation pipeline connected through heat exchanging installation to Sanquin</p> <p>Sanquin – uses cold from water pipes for cooling of primary processes</p> <p><i>Who are our key partners (suppliers, public authorities, etc.)?</i></p> <p>Waternet is i.a. the watersupplier of</p>	<p><i>What key activities does our VP require?</i></p> <p>Heat exchanger installation, pumps and piping for the connection Sanquin – Waternet in an utility building</p> <p>Piping to and on Sanquin territory (connection between utility building and Sanquin processes)</p>	<p>Geographical opportunity</p> <p>Cooling of Sanquins primary processes can be done using the cold from a nearby main water transport pipe, owned and operated by Waternet. This connection saves Sanquin the investment and variable costs associated to a traditional</p>	<p>Good relationship between partners, based on transparency of business cases. In this case without too much problems possible because cooperation concerns two foundations without profit goals.</p> <p>General lesson learned considering</p>	<p>Additional benefits for Waternet – potential benefits for their customers (citizens of Amsterdam) since the water temperature will rise to more desirable levels in the winter.</p> <p>Cost-effective and sustainable cooling supply for Sanquin; cost-savings for</p>

<p>Amsterdam. They are a foundation in which both the Amsterdam municipality and the local 'water board' are represented. In this particular project only the municipality is represented.</p> <p>Sanquin: core activities are producing and supplying blood and plasma products.</p> <p>Sanquin is ,like Waternet, a foundation and thus a non-profit organization.</p> <p>For which key resources do we rely on partners?</p> <p>Drinking water transportation infrastructure</p> <p>For which key activities do we rely on partners?</p> <p>Transportation of cold water</p> <p>Municipality/ provinces: are not direct partners, but necessary for providing the required permits (ATES and building permits).</p>	<p>Contracts between energy supplier (Waternet) and user (Sanquin)</p>	<p>(electric) cooling installation.</p> <p>Natural opportunity: renewing and expansion</p> <p>Sanquin was already considering renewed cooling supply that was tailored to growth ambitions of their (production) processes.</p> <p>In the end, the cost per GJ cooling is expected to be around 30% of costs per GJ involved in the traditional solution, even though the 'traditional' solution involves lower investment costs. Overall, considering the total cost of ownership, cold supply from Waternet is the cheapest solution (based on installation's foreseen lifetime of 30 years).</p> <p>Which citizen need(s) are we satisfying? How important is this to them?</p> <p>What is our Value Proposition (VP), i.e. our concrete solution to solving the aforementioned problem?</p> <p>Is our solution better than any alternative?</p>	<p>possible reproductions is that this innovation should be possible along drinking water pipes throughout EU (or in a broader perspective next to rivers).</p> <p>What type of relationship does each of our customer segments expect us to establish and maintain with them?</p> <p>Which ones have we established?</p> <p>How are they integrated with the rest of our business model?</p> <p>How costly are they?</p>	<p>bloodbank and potentially their customers. Also, the technical solutions required for the innovation are rather straightforward, guaranteeing high availability of the system.</p> <p>For whom are we creating value?</p> <p>Who are our most important customers?</p>
<p>Project Internal Cost Structure</p> <p>Fixed costs: cold exchanger + building + piping into sanquin + automation; fixed charge of ~6,000 €/yr will be paid to Waternet (Variable costs: additional variable component per GJ (not fixed; depending on Waternet income; current GJ price around 30% of normal cost); initial volume at least 20.000 GJ/ year, growing to 40.000 GJ. In this case preventive and corrective maintenance costs are included in the GJ price.</p> <p>Building for Waternet 1.8 Mio (earned back through tariffs paid by Sanquin); Sanquin 1.3 Mio.</p> <p>Considering total cost of ownership, this was the best alternative a.o.t. 'traditional cold supply' options</p> <p>Which costs do we have? Which ones are fixed? Which ones are variables?</p>	<p>Project Internal Revenue Streams</p> <p>Apart from significant cost reduction for cooling; mere 30% of original costs per GJ, environmental benefits are:</p> <p>Savings Sanquin – foreseen CO₂-reduction 1100 ton/yr; estimated 8% of emissions Sanquin. The amount of CO₂ reduction for the customers of Waternet is unknown. Waternet estimates the reduction on a couple of tons, because water temperature is raised towards desired level (from 8 to 15 degrees to about 15 degrees Celcius). Also, this solution does not require a lot of space on or in buildings, which traditional mechanical cooling does, noise levels are reduced and less peak electrical power (and thus emergency power) is required.</p> <p>Further process improvements through this connection possible for cooling and heating of the clean rooms</p>			

<p>Which are the most important ones?</p> <p>What scope is there for cost reduction (e.g. streamlining processes, rethinking provider network, economies of scale and/or scope)?</p> <p>Reduction in other future projects will depend on:</p> <ul style="list-style-type: none"> -Size of pipe; how much cold can be extracted -Temperature of the water transported -Consumption of the customer, - Geographical factors; distance between the supplier/pipeline and the customer, possible obstacles etc. 	<p>(pharmaceutical production processes)</p> <p>What are our different revenue streams (if variation across products, customer type, distribution channel, geography, etc.)?</p> <p>How much does each revenue stream contribute to overall revenues? (For each stream, a value can be obtained through the following equation “Revenue = Price/Unit * Volume Sold”)</p> <p>What scope is there for revenue maximization (e.g. better price points, information campaign)?</p>
<p>Additional community costs/disruptions</p> <p>Does our VP lead to socio-environmental disruptions/harms? No additional harm to society</p> <p>Has an impact on the temperature of drinking water;</p> <p>Can we precisely measure the impact (ideally, monetarily)? For our enterprise (financial, brand, regulators)?</p> <p>Costs for cold exchanger and related assets and automation</p> <p>For society by enlarge? What scope for improvement is there?</p>	<p>Additional community Benefits</p> <p>Foreseen CO₂-reduction 1100 ton/yr; estimated 8% of emissions Sanquin.</p> <p>What socio-environmental contributions does our VP make?</p> <p>Energy efficient use of available cooling capacity</p> <p>Can we precisely measure the impact (ideally, monetarily)? For our enterprise (financial, brand, regulators)? for society by enlarge? Can we maximise this?</p>
<p>Overall assessment</p> <p>What is the community impact?</p> <p>Is our BM financially sound? What are the promises and risks here? Risk might be water temperature variations affecting primary process of Sanquin; covered contractually</p> <p>Connecting another customer upstream to the pipeline would influence the supply of Sanquin.</p> <p>More general: Limited amount of cold can be extracted, extracting too much cold can lead to undesirable temperature of the water supply.</p> <p>Large investment, 1,4 M+1.8M (initially paid by Waternet; repaid by Sanquin through fixed connection fee and variable costs/GJ (tbd))</p>	

Comfort-cooling Houthavens

In the Houthaven area the well-insulated newly built buildings have a connection to a cooling network using the cold from the IJ river. The cooling system will generate cold water in wintertime through free cooling with outside air, which is being stored for usage during summertime using Aquifer Thermal Energy Storage (ATES) technique.

by Jannis van Zanten 17 nov 2016

Business Model Canvas Comfort-cooling Houthavens

<p>Key Partners Who are our key partners (suppliers, public authorities, etc.)? Public authorities which decided to make an obligation to connect to the comfort-cooling site</p> <p>For which key resources do we rely on partners? None</p> <p>For which key activities do we rely on partners? None</p>	<p>Key Activities What key activities does our VP require? - Production of cold by storing cold in ATES during wintertime harvested from surface water. - Delivering cold in buildings during summertime out of ATES</p>	<p>Value Proposition Which citizen need(s) are we satisfying? How important is this to them? Need of cooling during summertime What is our Value Proposition (VP), i.e. our concrete solution to solving the aforementioned problem? Sustainable cold Is our solution better than any alternative? Yes, cheaper, more sustainable and reliable in comparison with conventional chillers</p>	<p>Customer Relationships What type of relationship does each of our customer segments expect us to establish and maintain with them? - Customer relation Which ones have we established? - Over 600 customers today, and estimate over 3000 in 2020 How are they integrated with the rest of our business model? - They are also heat customers How costly are they? We earn money</p>	<p>Customer Segments For whom are we creating value? Sustainable comfort-cooling for inhabitants of Houthaven neighbourhood, utilities, schools and the city of Amsterdam. Who are our most important customer Customers</p>
	<p>Key Resources What key resources does our VP require? - Cold surface water during wintertime - Sustainable power for pump energy</p>		<p>Channels How are we reaching customers? Comfort-cooling is an obligation in the building process. Customers are informed from the beginning. Which ones work best? Which ones are most cost-efficient? How are we integrating them with</p>	

			<p>customer routines? Obligation to connect is common in the heat business in Amsterdam</p>	
<p>Project Internal Cost Structure</p> <p>Which costs do we have? Which ones are fixed? Which ones are variables?</p> <ul style="list-style-type: none"> - Fixed: Investments in comfort-cooling plant and network - Variable: energy for pumps <p>Which are the most important ones?</p> <ul style="list-style-type: none"> - fixed <p>What scope is there for cost reduction (e.g. streamlining processes, rethinking provider network, economies of scale and/or scope)?</p> <p>This project was possible because of scale. The obligation to connect of the city was necessary!</p>		<p>Project Internal Revenue Streams</p> <p>What are our different revenue streams (if variation across products, customer type, distribution channel, geography, etc.)?</p> <ul style="list-style-type: none"> - connection fee +/- 3000 € - fixed fee annually of 162,- € <p>There is no GJ-price.</p> <p>How much does each revenue stream contribute to overall revenues? (For each stream, a value can be obtained through the following equation "Revenue = Price/Unit * Volume Sold")</p> <ul style="list-style-type: none"> - connection fee almost covers the investments in production and network. Fixed fee covers operational costs. <p>What scope is there for revenue maximization (e.g. better price points, information campaign)?</p> <ul style="list-style-type: none"> -Speeding up building process in Houthavens 		
<p>Additional community costs/disruptions</p> <p>Does our VP lead to socio-environmental disruptions/harms?</p> <p>No</p> <p>Can we precisely measure the impact (ideally, monetarily)? For our enterprise (financial, brand, regulators)? For society by enlarge? What scope for improvement is there?</p> <p>The most important question is of comfort-cooling is necessary and the city obligate to connect. The system is available in the city and is sustainable.</p>		<p>Additional community Benefits</p> <p>What socio-environmental contributions does our VP make?</p> <ul style="list-style-type: none"> - sustainable cold <p>Can we precisely measure the impact (ideally, monetarily)? For our enterprise (financial, brand, regulators)? For society by enlarge? Can we maximise this?</p> <p>Yes when the system is fully operational in a few years time. The impact can be precisely measured.</p>		
<p>Overall assessment</p> <p>What is the community impact?</p> <p>Sustainable comfort-cooling for Houthaven</p> <p>Is our BM financially sound? What are the promises and risks here?</p> <p>Largest risk is the building speed. The others are known techniques: ATEs and pumping water, which are combined for the first time.</p>				

Business Model Canvas - ALEC

<p>Key Partners</p> <p>Who are our key partners (suppliers, public authorities, etc.)?</p> <p>For which key resources do we rely on partners?</p> <p>For which key activities do we rely on partners?</p> <ul style="list-style-type: none"> - Building owner - Building managers - Power grid operator - Energy provider 	<p>Key Activities</p> <p>What key activities does our VP require?</p> <p>Design and implement (WP6T6) a PV plant on the roof of a tertiary building with smart power management and storage features with the aim to self-consume the photovoltaic electricity, in order to not be any more depending of the French feed-in-tariff</p> <p>Other administrative tasks (start from June 2016) :</p> <p>Urbanism declaration to the local authorities' services (accepted), grid connection formalities</p>	<p>Value Proposition</p> <p>Showing the conditions of a new business model for PV with onsite storage and consumption, applicable more largely on tertiary buildings</p> <p>Which citizen need(s) are we satisfying? How important is this to them?</p> <p>What is our Value Proposition (VP), i.e. our concrete solution to solving the aforementioned problem?</p> <p>Is our solution better than any alternative?</p>	<p>Customer Relationships</p> <p>What type of relationship does each of our customer segments expect us to establish and maintain with them?</p> <p>The building owners have to accept: the PV plant installed (on roof for instance).</p> <p>The building manager should accept to buy the electricity that we produce onsite (a dedicated contract has to be established between the plant owner and the customer (building manager)</p> <p>Which ones have we established?</p> <p>How are they integrated with the rest of our business model?</p> <p>How costly are they?</p>	<p>Customer Segments</p> <p>For whom are we creating value?</p> <p>Who are our most important customers? Tertiary building (offices) because PV production curve fits to building consumption demand in a good way.</p> <p>Another segment would be condominium for collective uses of electricity (lifts, lighting, air treatment)</p> <p>-</p>
	<p>Key Resources</p> <p>What key resources does our VP require?</p> <p>Technical engineering for PV plant ,storage, smart management design and monitoring</p>		<p>Channels</p> <p>How are we reaching customers?</p> <p>Which ones work best?</p> <p>Which ones are most cost-efficient?</p> <p>How are we integrating them with customer routines?</p>	

<p>Project Internal Cost Structure</p> <p>Which costs do we have? Which ones are fixed? Which ones are variables?</p> <p>For a 15kWp installation, with 10kWh storage, total cost is about 55k€ , 35k€ considering Citizen subsidies (50% of 45k€ max budget, excluding panels)</p> <p>Which are the most important ones?</p> <p>The PV panels (1€ /W) remains one fourth of the global investment. The battery (about 800€ /kWh) is very costly as well (10k€). Its choice has to be optimized in order to get maximum onsite valorization of the PV production.</p> <p>What scope is there for cost reduction (e.g. streamlining processes, rethinking provider network, economies of scale and/or scope)?</p> <p>PV panels, as well as storage cost should decrease in a significant amount</p>	<p>Project Internal Revenue Streams</p> <p>What are our different revenue streams (if variation across products, customer type, distribution channel, geography, etc.)?</p> <ul style="list-style-type: none"> - Revenue comes from the electricity savings inside building : onsite consumption of the PV production avoid to buy this electricity to an external provider <p>How much does each revenue stream contribute to overall revenues? (For each stream, a value can be obtained through the following equation “Revenue = Price/Unit * Volume Sold”)</p> <ul style="list-style-type: none"> - 14.8c€ /kWh (on proportional part of the bill)* 18000 kWh /yr production * 84% Onsite valorization = 2.2k€ /year. - Actual situation gives a Payback on roughly 15 years considering Cityzen subsidies. (+2.5%/yr increase of electricity price gives 14yr payback, 12 years if the increase is +4%/yr) <p>What scope is there for revenue maximization (e.g. better price points, information campaign)?</p> <ul style="list-style-type: none"> - The national electricity price should increase in a large way so that this model get more interesting - Battery can help to minimize the power contracting with the provider kVA, reducing the fixed part of the electricity bill - Delivering the extra production on external grid and selling it to an external provider , to a price about 10c€ /kWh, would help with about 200€ /yr more revenue
<p>Additional community costs/disruptions</p> <p>Does our VP lead to socio-environmental disruptions/harms?</p> <ul style="list-style-type: none"> - Battery are costly and their lifecycle has to be considered in the global approach. - Security with fire risks is also an issue <p>Can we precisely measure the impact (ideally, monetarily)? For our enterprise (financial, brand, regulators)? For society by enlarge? What scope for improvement is there?</p>	<p>Additional community Benefits</p> <p>What socio-environmental contributions does our VP make?</p> <ul style="list-style-type: none"> - This model would allow increasing decentralized renewable PV production in a large amount. <p>Can we precisely measure the impact (ideally, monetarily)? For our enterprise (financial, brand, regulators)? For society by enlarge? Can we maximise this?</p>
<p>Overall assessment</p> <p>What is the community impact?</p> <p>Is our BM financially sound? What are the promises and risks here?</p>	

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