NEW URBAN ENERGY

Report on Energy policy and legal context (D4.1) and on Financing and ownership (D4.2)

Part 1: Summary

DELIVERABLES D4.1 AND D4.2

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MAIN COORDINATOR

Name	Sarah Bogaert
Organization	VITO
Address	Boeretang 200, 2400 Mol (Belgium)
Phone	+32 14 33 58 14
E-mail	sarah.bogaert@vito.be

CONSORTIUM PARTNERS

N° DoW	Organization	Acronym	Country
1	Vlaamse Instelling voor Technologisch Onderzoek	VITO	BE
2	Stichting Amsterdamse Economic Board	AIM	NL
3	Universiteit van Amsterdam	UVA	NL
4	Westpoort Warmte B.V.	WPW	NL
5	Alliander	LIAN	NL
6	HESPUL Association	HESP	FR
7	The Queens University of Belfast	QUB	UK
8	Th!nk E	THNK	BE
9	DNV GL Netherlands BV	DNV GL	NL
10	Technische Universiteit Delft	TUD	NL
11	Stichting Waternet	WAT	NL
26	Greenspread Projects BV	GREE	NL
24	Sanquin	SANQ	NL
14	AEB Exploitatie BV	AEBE	NL
15	Daikin Airconditioning Netherlands B.V.	DAIK	NL
16	Siemens Nederland NV	SIEM	NL
17	Universita'degli Studi di Siena	UNIS	IT
18	Ville de Grenoble	MUNG	FR
19	Commissariat a l'Energie Atomique et aux Energies Alternatives	CEA	FR
20	Compagnie de Chauffage Intercommunale de l' Agglomeration Grenobloise	CCIA	FR
21	Gaz Electricite de Grenoble	GEG	FR
22	SAS ATOS Worldgrid	ATOS	FR
23	Clicks and Links Ltd&L	C&L	UK
25	Grenoble-Alpes Métropole	METRO	FR
27	Agence Locale de l'Energie et du Climat de La Métropole Grenobloise	ALEC	FR

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Lead organization	Center for Energy – (UvA) Post box 1030 NL - 1000 BA Amsterdam www.uva.nl/cve cve-fdr@uva.nl
Main author(s)	Eva Winters (UvA)
Contributors	Thijs Slot (DNV GL), Sylvain Koch-Mathian (la Métro), Frits Otte (UvA)
Reviewers	Han Vandevyvere (VITO) Annelies Huygen (UvA/TNO)
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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.

The UvA City-zen team: Eva Winters (UvA)
Thijs Slot (DNV GL, formerly KEMA)
Frits Otte (UvA)
Sylvain Koch-Mathian (La Métro)

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PART I: SUMMARY

1. INTRODUCTION

This report presents an overview of legal and financial challenges that are experienced in France and the Netherlands when developing sustainable projects in the built environment. More specifically, starting point of the study are the City-zen demonstration projects in Amsterdam (NL) and Grenoble (FR). On the basis of interviews and parallel desk research, this report describes the legal and financial barriers for implementation of energy measures in existing urban areas.

The first part of the report was published at the end of 2016, focussing on the legal challenges only. As legal and financial dimensions are very often strongly related, this final report presents our analysis of challenges related to both dimensions.

For each challenge, we describe what the challenge is, its cause and impacts, and what can be done to mitigate these.

The report starts with an overview of several 'General challenges' that affect various demonstration projects. These overall challenges concern: energy taxation, prices and EU ETS. The report continues by discussing challenges that are specific to the demonstration sites. The challenges identified and analysed are grouped in six theme´s: Governance, Data Collection and Processing, Sustainable and Spatial Planning, Sustainable Housing, Renewable Energy Production and Smart Grids and Flexibility. The different approach in the Netherlands (Amsterdam) and France (Grenoble) leads to different accents in these challenges.

In this summary we will highlight the main findings. A more comprehensive analysis is included in the main report, part II of this publication.

2. POLICY CONTEXT

The City-zen project creates a unique opportunity to explore a diverse collection of demonstration projects that contribute to developing a CO_2-emission free city.

Studying the legal and financial barriers of all these diverse projects results in a report addressing a wide variety of topics. The report foremost shows us the complexity of legal and financial mechanisms. Transitioning from one system to another system intervenes with so many rules and habits, that a general understanding of energy does not hold. This is also the biggest barrier in the transition, the obstinacy and complexity of all parameters involved.

2.1. France and the Netherlands

The City-zen project also gives room to collect insights in city development in two different cities: Grenoble and Amsterdam. We have learned that many of the issues that are addressed (renovating houses, collective decision making, supporting sustainable energy production, involving citizens and so on) are very similar. However, most of the present barriers are due to very (country) specific regulation and therefore a comparison of the French and Dutch barriers is often complex or even

meaningless. By contrast, the principal considerations, which form the basis of our regulatory framework, are more suitable for comparison and here we conclude that there are valuable lessons to be learned.

We observe an intrinsic difference in how both countries are managing the transition. Whereas Grenoble is portraying a more government-led transition, Amsterdam is much more relying on citizens and businesses taking responsible actions. The different approaches are also reflected in the report; in Amsterdam a research institute was in charge of the research project, in Grenoble this was in the hands of the local government, La Métro.

In Amsterdam, citizens might experience more freedom of choice, while the local government in Grenoble is active in finding the best solution for its citizens. The result in Grenoble is that there is a need for balancing on the one hand the pro-active energy policies governed by the municipality or state and supporting and making room for bottom-up approaches and relying on the actions of citizens on the other hand. In Amsterdam, we see that freedom of choice and a more market-driven approach can support citizens to take initiatives. On the other hand there is a risk that not all citizens are involved and reached and that the policy targets are not met.

Beside the differences, there are some fundamental common issues that are the basis for many of the challenges discussed in the report.

2.2. Financial

The main financial barrier in most of the projects is that there is no remuneration for avoiding/ reducing CO_2-emissions. Each of the projects is affected by the lack of a proper incentive. Instead, the business case is often depending on energy savings, tax reductions, lower operational costs etc. These types of savings are in many cases not sufficient enough to ensure a financially attractive project. Besides, the current low price of energy (especially gas) has a negative impact on the profitability of energy efficient and renewable energy projects.

Participants in the City-zen demonstration projects are mostly public or non-profit organisations. The financial risks involved in these projects seem to be very high for commercial parties to participate.

2.3. Legal

The legal system is such a mosaic of rules, that it is impossible to oversee beforehand the possible barriers that will be encountered. In practice it occurs that regulations are even contradictory, leading to lawsuits over different interpretations. Therefore practical experience is of paramount importance to get an insight in the frictions. To illustrate this, the smart grid projects are generating information about the role of flexibility in our future energy system. Without such information, we cannot even propose legal changes to eliminate barriers.

Many of the rules we have today serve an important purpose – like grid stability, third party access –, the question is whether these purposes can be combined with new policies, or that we have to loosen up some of these rules. At the same time we see that optimisation can be achieved within certain policy fields, for example by adjusting subsidy rules on renewable energy, where such major interests are less jeopardized.

2.4. A reflection on Governance

The energy transition has a profound impact on many aspects of modern society and such a complex and extensive endeavour requires well-contemplated governance. In its ideal form, the governance is built up in its fundamental levels and the associated normative layers.

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 made without a view on sustainability, either because their mere age or because of a neglect in the scope of their effect.

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.

We recommend the 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 of all the fields involved energy, taxation, building, environment 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.

In the following paragraphs the conclusions and recommendations are presented in analogue with the report.

3. THEME: GENERAL CHALLENGES

3.1. Low Energy prices and emission costs

Current low energy and emission prices are not in favour of driving sustainable development forward: low wholesale prices are not a big stimulus for energy efficiency measures and the absence of significant costs of CO_2-emissions do not give a big (price-based) push to invest in renewable energy technologies.

Recommendations

Low wholesale prices do not stimulate investments in 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 impact 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. Energy taxation

Energy taxes and levies have a large impact on the energy price; both in France and the Netherlands they make up a significant part (up to half in the Netherlands and France) of the total electricity price

for households. Throughout the demonstration projects the importance of the energy price is confirmed.

The polluter-pays-principle is not reflected in the Dutch Energy tax system on electricity. The Energy Tax on electricity in the Netherlands does not discriminate between electricity produced with fossil fuel sources and electricity from a sustainable source. In addition, large consumers pay a significantly lower energy tax rate per kWh than small users. In sum, the current system does not give any financial incentive to buy green energy electricity through a supplier and does not support energy efficiency amongst the large consumers.

By contrast, the system does stimulate the development of individually owned production plants, because of relatively high taxes for small-end-users on all energy (gas, electricity (green and grey)

In France, the energy tax system is partly based on the polluter-pays-principle. For example, petroleum products are over-taxed by comparison to other energies, as the combustion of fuel products emits more CO_2 than natural gas or electricity generation. Besides, the development of heat networks whose energy mix contains more than 50% of renewable energy (including heat produced by waste incineration) is encouraged since the energy sold by these networks benefits from a reduced VAT rate (5.5% instead of 20%). However, the taxes level on gas remains very low, that combines with low gas price makes it very competitive compared to renewable energy. Also in France, large consumers pay a significantly lower energy tax rate then small users

Since 2016, French government reinforced the polluter-pays principle by introducing a share in internal consumption taxes that is proportional to CO_2-emissions from fossil products: the climate-energy contribution (CCE).

The French government voices the intention to make CO_2-emissions a leading factor in its tax system. In autumn 2017 the new Dutch government announced to introduce a national CO2-tax, which will be a minimum emission price for energy producers. Also, the emission factor has since 2016 acquired a more important role by adjusting the taxes levied on gas.

To implement a fully CO_2-based system will be complex, given that the existing business cases in the Netherlands and France are based on the current system. At the same time there are alternatives available, for example slowly changing from an output to an input tax, which could improve the steering effects of the energy tax incentives.

Recommendations

We recommend that the national government is clear on the policy objectives of the energy tax system. When taxes are used to impact the choices people and businesses 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 based on fossil fuel burning, for example through an input tax. This would strengthen the business case of many of the City-zen projects in Amsterdam. Increasing the taxes on gas would improve the business case of many of the projects in Grenoble.

Also a fairer distribution of taxes in both France and the Netherlands would support energy efficiency of large consumers.

4. THEME: GOVERNANCE

4.1. Governance of the energy transition: Grenoble and Amsterdam

Both in the Netherlands and France, we currently see governments that choose to increasingly place the responsibilities for renewable energy development and sustainable heat supply at the level of 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, local governance levels (i.e. national/ provincial and municipal) increasingly tailor high-level regulation and ambitions to provisions that are or 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 extends depending on the local conditions.

In the Netherlands the national government's objective is that the transition should be society/market driven. One of the leading documents in the energy transition is the Energy Agreement (het Energieakkoord), a voluntary agreement between many different parties like social organisations, governments, companies, and financial institutions. An important part of the responsibility for sustainable development is laid in the hands of all these parties. Both on a national and local level, political voices ask for a more transparent national policy, in which tasks and means of national government and of local governments are defined. Without a clear description of its task regarding the energy transition, municipalities may fail to set the proper steps.

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 operate in close cooperation with the energy companies. In contrast to the Netherlands were citizens and companies are expected to engage in the transition, Grenoble uses more of a centrally governmentally controlled approach.

To illustrate the different approaches between the Netherlands and France, we briefly zoom in on the governance of (the development of) district heating networks:

The Netherlands struggles with the question how to unify the need for up scaling district heating to keep average costs low, with the personal freedom of choice and the legal right of the consumer to use an alternative heating source.

France adopts a more directive approach, and has made a choice to roll-out a large-scale district heating network, and is now concerned about how to best govern its development; in a recent decision, it was concluded that best management and organisation set-up shall be a Public Service Delegation (i.e. the service will be delegated to a private company) with investments on production capacity directly in the hands of La Métro.

Recommendations

Given the described and potential drawbacks of the current approaches, we see a need for an overall stronger coordinating and monitoring role, 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 recognize inefficiencies, overlaps, and general sub-optimization with respect to the overall national (and ultimately European) goals. Care should be taken, as more central monitoring may also eliminate bottom up initiatives from within the regions or consumers. Installing a coordinating or monitoring role should be created in cooperation with local interests and initiatives. In this way authorities act as facilitators or enablers, however without neglecting the overall policy lines.

4.2. The control over energy networks in the Grenoble

The role of electricity, gas and heat distribution networks appeared to be central to implement the energy transition roadmap. The transition of the current highly centralised energy system toward a decentralised energy system based on local renewable energy production implies an in depth evaluation of the energy networks: decentralized architecture, integration of renewable energy, new usages, storage 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 as Energy Organising Authority needs to improve its control and the coordination for the operation and the development of energy networks.

DNO: local vs. national

The advantage of the local DNO is that there is a fruitful cooperation with La Métro, which contributes to the climate goals of the Métropole.

The cooperation with the national DNO has been less successful. The national DNOs have to comply with common rules at the national level and are therefore less flexible to adapt their practices to the local context, and as a result impeding La Métro in carrying out its 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, which are now operated by ENEDI and GRDF.

Heat network

The existing heat network is currently operated by CCIAG (Compagnie de Chauffage Intercommunale de l'Agglomération de Grenobloise) as part of a public service concession agreement. This 30 years agreement will end by July 2018. 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 it can improve the new contract and avoid development barriers.

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.

Recommendations

According to La Métro, there are three solutions to improve the cooperation with the DNO: (i) transfer the operation of the network to a local network operator that will be capable of a sound reaction to the region's policies; (ii) reorganisation of the national DNOs into regional offices with the appropriate level of autonomy, or (iii) modify the delegation contract with national DSO to adapt network development strategy and investment policies to local needs. La Métro´s delegation contracts for all energy networks should therefore by reviewed to make sure that the strategy of both the national and the local operators in line with the Métropolitan energy transition roadmap.

5. THEME: DATA COLLECTION AND PROCESSING

The collection and processing of data has become a more important topic over the last decade, this is largely due to a certain developments in this area:

- The enabling of more and reliable data collection because of smart meters, as a result data is increasingly important for providing (future) services (network management, flexibility services etc.)
- Collection of, and dependency on data makes the system and all players more vulnerable: suppliers and network operators have to manage more complex administrative systems. Also, in this context issues relating to ownership of data and privacy are of growing importance.

The roll out and deployment of smart energy meters 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, rules on data exchange and processing describe merely the procedures, grown over the last two decades and are not welcoming for new services that require other data and other processing. Furthermore, 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.

5.1. Data ownership is conflicting with use for energy planning in Grenoble

The question on who has access and who owns the data also plays an important role for local governments. 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.

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 the data requested by La Métro is shared by DNO. The situation has improved significantly since 2015 with the signing of several cooperation agreements with the DNOs for the development of the energy transition roadmap, which is also part of the Vivacité project.

After years of negotiations a new Energy Transition law made it mandatory for the DNO to provide local authorities with energy data at the block level (minimum 10 dwellings). 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. La Métro would like to get insight in the monthly energy data at building level. The data will be used for developing energy planning purposes (energy atlas, dashboard to monitor the impact of energy policies).

Status of the project

To get insights in more detailed data, La Métro is exploring how the collection of energy data by a single platform called Vivacité, which has been developed by GEG (an integrated energy local company) with Atos (an international information technology services company), could be transferred to La Métro and expanded to the whole metropolitan area. To achieve this expansion to

the metropolitan area, cooperation with the national DNO is required. The cooperation between La Métro and the national DNO is challenging (see challenge 4.2). Under the current legal framework, La Métro does not have access to this data, but negotiations with both the Data protection agency and DNOs has started.

6. THEME: SUSTAINABILITY AND SPATIAL PLANNING

6.1. Spatial planning and energy transition in the Netherlands

In the Netherlands 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 these instruments that could assist them to stimulate and the transition to a sustainable energy system. Unfortunately, this is not always the case; laws are plenty and instruments unclear. The new Dutch Environmental Act needs to bring salvation to this wide heard complaint.

Improvements

- The newly developed 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 and allowing administrative bodies to set quality demands, energy efficiency rules, like the quality of the energy infrastructure, now can be incorporated in spatial planning.
- The abolishment of the mandatory connection to the gas and electricity network in the building regulations, opens up, from environmental law, the possibility for self-supporting energy houses, or neighborhoods 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 a *Spatial Plan.*
- The Act has an improved overall focus on sustainability

Barriers

- Expertise: The question remains if there is enough expertise in all 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 instruments.
- No legal obligations: 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, Environmental Act, does not sufficiently enough consider barriers experienced in other laws, like the Gas Act, Electricity Act and the Heat Act, but also in the Decree Building Living Environment, which controls building regulations. And therefore the instruments of the municipalities will continue to be limited.

Recommendations

The legislator should provide municipalities with tools and guidelines on how to use these new instruments. Given the role of municipalities in the energy transition, it is 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 possibilities and barriers ahead and the effort that is needed to comply with their, often high, ambitions.

At the local level the City-Zen projects show how many different fields of law are interacting and therefore the legislator should strive to look at all relevant laws involved when designing new legislation to support sustainable developments.

6.2. Phasing out the existing gas network in the Netherlands/Amsterdam

In the Netherlands, natural gas currently provides 93% of total heat demand. To comply with our climate commitments, the Netherlands will need to find sustainable heating sources and, as a result of this, phase out much of the existing gas infrastructures.

Changing out energy infrastructure and sources is a complex transition. In the Netherlands, the discussion has only started; legal and financial measures are not yet in place and will be explored in the near future. 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 will be abolished in the proposed changes in the Gas Act. The municipality will only be allowed to connect new buildings to gas if there is no alternative that is (financially) feasible.

Recommendations

Given the limited time at hand, 33 years before all natural gas use needs to be phased out completely, an integrated approach on how to phase out existing gas networks is needed within the near future. This entails at least that each local government will plan the energy system together with the relevant stakeholders (e.g. network operators, housing associations and citizens) to contribute to optimal decision-making and preventing double investments. It also means that an evaluation of all relevant laws involved is needed.

Positive development is that the obligation to connect new buildings will be 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 (all-electric) heat sources.

The current legal framework does not provide local governments with the tools to disconnect existing buildings. Local governments can only seduce homeowners to disconnect. This will not be very ineffective and costly in the long run. Legal tools to organise obligatory disconnection will need to be made with care for the customers connected.

The legislator will need to take into account that phasing out an existing gas network does not only include spatial planning measures, but will also 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 on this topic.

6.3. Expanding the district-heating network in Amsterdam

One of the measures by which the city of Amsterdam wants to achieve its climate ambitions is to abolish all natural gas consumption by 2050. To provide citizens with an alternative source of heat, the city plans i.e. to expand the district-heating network. 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.

Barriers

Only new buildings in a heat-district are obliged to connect to district heating. Connection to district heating of existing housing in a heat area is done voluntarily. Under the current legal framework there are no legal obligations to connect existing housing to district heating. 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 some of the City-zen renovation projects.

District heating often 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. The absence of an obligation to connect existing housing can be a financial barrier.

Under the current Dutch legal framework only new buildings can be obliged to get a connection to district heating. The Building Act demands that all households that prefer an alternative heating source to district heating can call upon the 'equivalence' article. The ´equivalence´ test allows homeowners to use another heat source, which should be equal in energy efficiency, and protection of the environment. The equivalence test focuses on the environmental and the energetic properties of the alternative compared to the district heating system.

Critical note

Today the district-heating network in Amsterdam is not based on sustainable sources. Before expanding the district heating network, the question on ´greening´ these sources needs to be addressed by the municipality. Low temperature heat sources, for example from wastewater, could be an interesting (low temperature) alternative. District heating based on the current sources could otherwise become another undesirable lock-in, like the gas system is becoming today in the Netherlands.

Recommendations

If the connection of existing housing to a district heating network can be obliged by the municipality in the future, it is important to formulate a well-balanced ´equivalence'-test in law. Such an article will give homeowners the freedom to find an alternative solution, but can also stimulate the district-heating system to become more sustainable. Hence, finding a sustainable equal alternative to a very energy efficient and sustainable district-heating system is harder than to a fossil fuel based district-heating system.

Last, but not least, it should be recognised that heat supply from waste incineration might no longer be considered 'sustainable' in the future. An approach and execution plan(s) should be developed for how the foreseen district-heating network will be supplied with sustainable source(s) of heat in the future. This is also important to prevent Amsterdam from being ' locked-in' to a (renewed) central source of heat supply (the DH network) that delivers heat from unsustainable source(s).

6.4. Densifying existing district-heating network in Grenoble

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).

Recommendations

Using the classification procedure is according La Métro needed in order to achieve economic optimization. However, the classification procedure is only possible if the heating network remains a competitive heating mode compared to other sources of energy, which requires controlling the cost of district-heating while ensuring a level of investment allowing densification.

Next steps for La Métro include specifying priority developments 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.

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 and sustainable (low temperature) heat systems.

Heat plans

In Grenoble, La Métro evaluates this using the *classification procedure*; a tool, which will enable it 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 oblige all new buildings in that area to connect to district heating. Also, a heat plan should include a derogation from this obligation; namely that homeowners can install an alternative heating system 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 district-heating 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 these could impede other sustainable heating alternatives.

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 the heat is qualified as renewable sources, which are mainly wood and recovery heat from waste incineration.

In Amsterdam the larger heating systems are based on waste incineration, residual heat from a coal fired power plant (Hemweg) and from a gas fired power plant (Diemen).

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.

6.5. Comfort-cooling development in the Amsterdam Houthavens

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.

The cooling is extracted from surface water of the IJ, 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. A small part of the cold supply is delivered through a cold network. Amsterdam has the highest number of small cooling networks, namely 25. The comfort-cooling network is the first cooling network delivering sustainable cooling to households in Amsterdam.

Recommendations

In the demonstration project homeowners were obliged to pay the connection of the cold system and the mandatory standard annual fee. Whether or not such obligations have a legal basis is a question. The legislator should clarify the position of these networks and their (captive) customers.

Due to increasing insulation requirement and expected temperature increases, the product could be very valuable in making buildings more comfortable during summertime and preventing the use of often polluting classical air conditioners.

Furthermore, it looks as if the product and service can be offered at relatively low costs for consumers, in case a minimum number of connections are realized.

The project in de Houthavens has been an opportunity to evaluate the experiences of homeowners with comfort cooling. The Amsterdam municipality is planning on increasing the amount of cooling connections in new built areas.

In the Netherlands there is a relatively low cold demand in residential buildings. This product would be very interesting in other countries with a higher cold demand.

6.6. Development of innovative installations in Amsterdam (case of the bio-refinery)

In the new built area of Buiksloterham, a post-industrial site, Waternet, the public water company, will build a biorefinery. 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

The plant will separate grey water (from showers, washing machines etc.) and black water (faeces, urine, organic waste); 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.

The following conclusions are drawn from our assessment of the current set-up of the project and its business-case:

A persistent public water company that was willing to invest in an economically unattractive project made 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 ambitions 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 lacking for such projects to become undeniable financially attractive, such as: a CO_2-price/tax, including the long-term interests into the business case.

Recommendations

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 to them, as described in 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. Delaying this step will lead to unnecessary uncertainties and possibly a lack of physical space. (Local) governments, as the competent authority for spatial planning, have a key role in preventing such uncertainties.

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 current asymmetric build-up of phosphates and nitrates in our environment.

Low temperature vs. district heating

Today (almost) only new built houses are connected to the district-heating network. New houses are very well insulated and are also suitable for low temperature heat sources, like heat recovery from wastewater.

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. Older houses often need a more powerful heat source to reach the desired indoor temperature. High temperature heating might be of better use in older buildings then in new buildings. Further investigating the needs of housing and possibilities of the different sources and the optimal deployment of these sources is needed.

CO_2

Finally and again, this project suffers from low CO_2-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.

6.7. Making optimal use of local resources in Amsterdam (extracting heat and cold from drinking water)

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

Using heat or cold from these pipelines is technically relatively simple, but geographically limited to costumers at little distance from 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 (aquifer thermal energy storage) 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 a project's benefits in terms of sustainability.

Major success-factor in the project that was successful between the blood bank Sanquin and Waternet, 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.

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.

7. THEME: SUSTAINABLE HOUSING

7.1. Legal challenges in developing a sustainable housing stock in the Netherlands

The Dutch Building Act provides a high energy-performance level for new buildings, due to strict EU regulations. 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 requirements 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 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´.

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 7.2) is often experienced as undesirable. It could be disproportional, and limited by property rights. 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, as proposed by professor Fokkema (BR September 2011) 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 transformation projects, than laid down in the Decree in the renovation chapter, like article 4.155 for new housing. 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. 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. Therefore, regarding energy efficiency of transformation projects, disregarding other building qualities/demands, and considering the current housing market, such demands would 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 performance of the existing housing stock, nor in supporting voluntary agreements and neither in creating a legal basis for challenging new city development in existing buildings, like in transformation projects.

7.2. Upgrading the existing building stock

By 2050 all buildings must have achieved substantial improvements in energy efficiency, be energy-neutral or even -positive depending on the building and its context. The most important barriers for homeowners and financers that were discussed during the interviews, held during the research, will be discussed here.

Barriers impeding homeowners:

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.

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 over 30 years. The long-term investments and the period the owners (are planning to) live the same house are conflicting and do not lead to optimal, or sensible (from a homeowners ' perspective) long-term investments.

Also, considering the home-owner's differing situations, deep retrofits, aiming for nearly zero level, can today, even over a longer period, often not be earned back on the energy bill only.

Guarantees

Another challenge is found in the complexity of guarantees of the energy performance of the renovated housing and its equipment. Guarantees used are often unreliable or the homeowner is not able to check whether the measure taken is answering to the promised quality. Rebound effects may substantially add to the problem with guarantees.

Fair distribution of benefits and Energy Poverty

The energy-saving measures that are taken are in the Netherlands attributable to the wealthier group of homeowners (CE Delft 2017), 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 homeowners is challenging.

Barriers impeding financers:

Mismatch between project scale (often decentralized/ local projects) and project size desired by large investors

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. The market for retrofitting is huge. The cases of individual homeowners however, are relatively (very) small from the perspective of large-scale investors: 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.

They voice 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

Overcoming the barriers

Legal measures

In interviews, several investment parties have argued for more legal obligations for end-consumers to improve sustainability of their homes, at mutation (moving) – allowing these investors to develop standardized financial investment projects to support compliance at the local level.

Legal obligations on existing housing are uncommon in the national building regulations of European countries. France tried to implement an obligation on homeowners to improve the energy label of the house if they used more than 330 kWh of primary energy per square meter per year, corresponding to all housing with an energy label F or G (30% of dwellings in France). 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.

In the Netherlands the national government is looking into the possibilities to translate voluntary agreements within specific sectors (industry, office buildings, social housing) into legal obligations. Private homeowners have so far been outside this scope and there are no concrete plans to lay down any of such obligations on existing housing in law.

Financial measures

Besides legal obligations, providing homeowners with the financial means to upgrade the energy efficiency of their homes, could also improve their willingness to retrofit.

For consumers energy efficiency measures generally involve significant up-front costs. To support consumers in covering these costs, several financial instruments are already developed in public-private constructs like low interest-loans, energy efficiency mortgages, subsidies and (currently under consideration) building attached loans. These instruments are not available to everyone and will only be granted to homeowners that fulfil certain minimum credit requirements (e.g. minimum income of 33.000 EUR per year for energy efficiency mortgages).

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 one scheme discussed, the City-deal/ *woningabonnement*, tries to offer a more all-round package that addresses multiple challenges. By taking away a number of the barriers at once and offering a full package (knowledge, loan, installers/builders), it hopes to expand to new customers and enlarge its portfolio.

To overcome the split incentive between the current homeowner (investor in improvement) and the future homeowner (reaps benefits of the investment, or could be faced with costs for out-dated technology), new forms of loans, like building attached loans are studied.

Recommendations

Investment parties argue for more legal obligations – allowing them to develop standardized financial investment projects to support compliance at the local level.

Alternatively, in face of current lack of such obligatory regulations, 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 involved, than generally desired by these parties. Government could help to develop 'special purpose' public-private entities in partnership with these commercial investors.

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, address the issue of the so-called split incentive between investor/ current owner and (future) user.

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 risks are born by the homeowners. 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.

7.3. Scaling-up thermal refurbishment of the private housing stock in Grenoble: a case study MURMUR

With the new Energy Transition Law and its decrees, the French government aims to have the built environment completely renovated by 2050. However, most of the energy experts agree that the number of dwellings directly affected by the legal obligations is too limited to meet the objectives, as is the case in the Netherlands. Additional actions developed by local authorities to foster the renovation of the private building stock are therefore of high importance.

Grenoble-Alpes Métropole Region (La Métro) decided to focus its efforts on the condominiums (multi-family owned buildings) built between 1945 and 1975 as they represent the biggest potential in terms of energy and consequently CO_2-savings. The major barrier for this topology of building is that renovation works depend 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 renovation).

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 risk of failure. The renovation market is principally supply driven; this can lead to a mismatch between the offered products and the end-user's needs. Many customers accept high operating costs and poor environmental performance over the alternative with high upfront costs, 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.

To overcome these barriers and to gain experience in renovating existing housing blocks, La Métro designed a renovation program called MurMur (2010-2014). The City-zen project has given La Métro the opportunity to make an in-depth analysis of the results of this first renovation program and improve the design of the new program MurMur2 (2016-2020) based on the lessons learnt and feedback of all parties involved.

To assist the homeowners in their decision-making-progress a specific one-stop shop has been created to provide homeowners with information on technical administrative and financial issues.

La Métro specifically wanted to meet the financial needs of the low income-households. By using public funds, La Métro was able to get a high amount of subsidies from the State. Notwithstanding the high subsidies available many homeowners experienced difficulties paying the remaining up-front costs, due to following factors:

- Subsidies were paid at the termination of the construction work, but the homeowner had to make an advance payment at the start of the project, resulting in needing to find a temporary loan to cover this period.
- Homeowners had problems to qualify for a special zero interest loan to cover the upfront costs, due to complex paperwork. Instead many households used a regular consumer loan, which is more expensive.
- Only households with an income lower than 37.000 EUR a year, qualify for individual subsidies. Households with an income just above this limit, do not benefit from individual subsidies, and can experience problems in obtaining the consequently higher loan.

Recommendations

- Systematize the pre-financing of individual subsidies to avoid cash flow problems.
- Develop solutions for financing the loan (streamlining access to the zero interest loan, 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. Setting-up partnerships with banks in Grenoble to foster the access to loans for energy retrofitting projects

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 subsidy ceiling of 37.000 EUR/year.

In order to accelerate the rate of retrofitting, La Métro aims at proposing more general financing 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 establishing partnerships with

different financial actors, for the improvement of the financial schemes for retrofitting privately owned housing.

The development of these partnerships is still ongoing. A first meeting was organized in October 2016 and made it possible to meet a dozen representatives of banks in the area. This meeting confirms the interest of stakeholders in participating in this partnership. The barriers blocking an agreement so far 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.
- Despite positive "official" speeches of bank representatives, there is still a real difficulty for households to obtain a zero-interest-loan for their renovation, 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. 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.

Recommendations

Changing credit-worthiness assessments and including energy savings in these assessments, requires a change in banking culture. The European and the national governments could assist in addressing this topic and push financial institutions to engage into these possibilities.

7.5. Examine the key drivers of collective decision-making in co-owner investments in condominiums in Grenoble

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, loan rate and duration, typology of households, etc.).

Results

The condominiums that decided to retrofit, all had a bigger share of owner-occupied apartments, were often equipped with individual heating systems on apartment level and were older (on average by 5 years) than buildings that were not retrofitted.

The willingness to invest in thermal retrofitting increases when a professional is appointed to help the owners to understand the positive effects of thermal retrofitting and to apply for individual subsidies.

Recommendations

- The results can be used to select the buildings with a high percentage of owner-occupied apartments, and high potential on energy savings, and
- Develop strategies to increase the interest for retrofitting among landlords.

- Upgrading the amount of individually metered heating systems, would contribute to the willingness to invest in energy efficiency measures.
- Studying why certain officers have a higher success rate in persuading homeowners to retrofit. These officers can share their methods and insights with other staff members.
- Putting more emphasis on energy savings during the meetings with the owners could also contribute to increasing the success rate, as energy savings have a statistically significant positive effect on the decision to invest in thermal retrofitting.

Conclusion France and the Netherlands on retrofitting owner-occupied dwellings

Both in the Netherlands and in France the key barriers in this market are:

- Low-income households have too 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 and banks are to a limited extent interested in financing the retrofit projects because of a lack of volume and scale. Also, financing schemes for small-scale projects are underdeveloped.
- Banks do not consider the financial savings achieved by the energy savings in the assessment of the credit-worthiness of the applicant.

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 housing). The subsidy is available for renovations that will make a significant step in reduction of energy consumption. The amount of subsidy available per dwelling solely depends on the amount of square meters, the measures taken, and investment made by the homeowner/landlord. The subsidy is not depending on the household's income. As a result mostly high-income households apply for this subsidy.

7.6. Renovation of buildings with renters in the Netherlands

The possibility of renovating and improving the sustainability of Amsterdam's building stock in the rental sector requires the approval of sufficient renters as legal basis for the renovation works.

Around two thirds of Amsterdam's population rents their home from a landlord. Housing corporations are challenged to improve the energy efficiency of their housing stock by their renters, by local government and by the association of housing corporations. As they own an extensive part of the Amsterdam housing stock (about 43%), their policies and success rate in energy efficiency improvements are essential in the transformation to a more energy efficient city.

Renovations that are planned and executed by the landlord 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.

The assumption that housing associations are depending on the consent of the renter 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.

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.

Renters cannot force their landlord to renovate, except from taking energy efficiency measures (central heating, if the old system is more than 10 years old, insulation of the thermal envelop). Article 7:243 Civil Code states that a tenant has the right to require energy efficiency measures, if he is 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.

For more significant changes, the consent of the owner will be needed. Case law shows that outside walls and rooftops cannot be used for solar panels if the renter does not have the consent of the landlord.

Recommendations

Only once every 30 to 40 years, a residential building 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 CO_2-neutral built environment by 2050. It is recommended that whenever big renovation works be executed, the building is brought as much as possible to the state-of-the-art in energy performance.

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. 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. Split incentive and the energy performance fee in The Netherlands

Housing corporations and tenants have different energy incentives and this may lead to a high energy consumption. 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, 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 2017, to overcome this split incentive and financially stimulate the landlords in refurbishing rental housing to 'nearly-zero energy' housing, by means of an Energy Performance Fee (Energieprestatievergoeding, or EPF in the remainder of this document). This law allows housing associations to charge renters an extra fee in return for upgrading their housing to nearly zero energy housing ('nul-op-de-meter', or 'NOM' houses).

The EPF is designed to overcome a couple of barriers:

- The EPF is in the first place an instrument that provides a new financial incentive for landlords (associations) to invest in energy efficiency measures
- The EPF is charged as an extra fee, which does not qualify as rent, and therefore does not lead to a 'rent increase'. Since only housing with a rent under 711 EUR a month is defined as social rental housing, the extra fee does not have any effect on lifting housing over this limit and renters will keep the legal protection and financial subsidies even if they pay an EPF.
- Households pay a fixed price for the EPF. The fixed EPF does not impede energy efficient behaviour.
- Housing associations can use regular loans with a guarantee from the social housing fund 'WSW' to finance the investment in nearly zero housing under some specific financial conditions.
- The EPF is also designed to stimulate landlords to aim for the highest energy performance possible and so make a more future proof investment (instead of aiming at energy label B, aiming for nearly-zero-level)

Naturally not all barriers are solved by the EPF. The EPF is not a correct financial incentive for historic housing that cannot reach the nearly-zero-level with the current technologies. Also apartment blocks with limited space for PV-panels might not qualify for an EPF. Risks for the inhabitants cannot be excluded. In the first place, after an energy-upgrade the renter can change his energy consumption, resulting in higher total costs. In addition to the behavioural challenges, there are many uncertainties to take into account that will influence tenants' energy bill directly. Examples are the energy price, taxation and the legislation on net metering. These uncertainties have also been pointed out in relation to the homeowners and which are risks that are primarily borne by the renters.

Solving the challenges posed by the 'split incentive' between tenants and housing associations or landlords 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 CO_2-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).

Recommendations

Because it is unlikely all the related difficulties can be solved upfront in legislation, an important part of the solution might be in the acknowledgement that developing a CO_2-neutral housing stock is of common interest to all parties involved: it is a most important factor in preventing climate change and the 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 and the resulting need to reconcile these.

7.8. Mismatch between calculated/ projected performance and actual performance: The Energy Performance Gap

The energy performance of a building is qualified by so-called ´*Energy Performance Certificates*´ (EPC). These certificates are based on the theoretical consumption of the building. Housing corporations, energy advisors and architects in the different City-zen projects point out the often large discrepancies between theoretical and 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 called the ´energy performance gap'.

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 the always-perfect installation. This can lead to overstatement of the returns. The building itself might also have been overestimated before renovation. Furthermore, behavioural aspects are insufficiently considered currently.

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.

The gap between theoretical and actual performance is not only a barrier in achieving CO_2-emission goals, but it also has a significant impact on the financial feasibility of a project. The most important incentive to invest in efficiency retrofits, amongst the market value of the real estate, is the savings on the energy costs. The difference between actual and theoretical costs forms a financial barrier, not only does is 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 extending the loan capacity of households and the credit-worthiness of homeowners.

Recommendation

To ensure that the building that is delivered and functioning 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.

Also, the EPC is only governing a part of the energy use, mainly heating. Electrical appliances and private lighting however are governed by other legislation and not by the EPC. According to Visscher et.al. to overcome the performance gap, the 'in-use' energy performance of the building should also be part of the certificate system. The EPBD also allows for including the actual use in the label system.

In parallel to better incorporating behavioural factors, the effects of behaviour should be presented to and discussed with the inhabitants or users of the building to raise awareness about the impacts of (changes in) behaviour.

Overall conclusions and recommendations on retrofitting

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, an example is nearly-zero-housing. 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 proposed a law to oblige homeowners to upgrade the energy performance of their homes, if the energy consumption per square meter exceeds a certain amount of kWh. The proposal never became law as the obligation was in breach with property law.

Such obligations are not discussed in the Netherlands. Although the new Environmental Act might widen the tools of local authorities, the new Decree Building Living Environment, only allows municipalities to pose higher demands on the energy performance of new buildings not on existing buildings. Such obligations would also be in contrast with the current Dutch political objective that the energy transition should be primarily market driven.

Finding suitable and acceptable measures to improve the existing housing stock, remains thus challenging. Instead of imposing legal obligations on homeowners, 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.

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 they are experienced as relatively small-sized and complex.

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 in the lower energy bill. This is by nature problematic, because of the ever changing energy prices, levies etc. Additionally, applying for loans is often experienced as complex.
- Legally, hardly any requirements are set for existing housing. As a result there is a lack of direction or goal in the market. Homeowners can proceed with upgrades whenever it is desired and can invest in moderate or even contra productive upgrades.
- Socially, since there are no obligations on upgrading, retrofitting needs to be attractive. This could lead to offers that bear little relation to energy efficiency. On the other hand,

combining neighbourhood renovations by the local government with building renovations by homeowners and housing associations could make retrofitting more attractive.

Vulnerable homeowners

Homeowners and renters, in the end, are not capable to find the right tailor-made solution. Many market participants 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 contribute to the development of schemes and subsidies that are available to all homeowners. A clear division between more luxury upgrades and energy efficiency 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 a subsidy as support.

To avoid counter-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). 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.

8. THEME: 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.

8.1. Net metering legislation in The Netherlands

In the Netherlands there are several instruments to stimulate citizens to invest in renewable energy production, mostly solar panels. The most important instrument is the net metering rules (*salderen* in Dutch) that allows small-end-users (prosumers), which produce renewables, to deduct the total amount of kWh fed into the grid in a year from the total amount of kWh taken from the grid in the same year. The result is that all electricity is traded between end-user and supplier against the same kWh-price, independent of the 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 net-metering rules is that, they trade the surplus of electricity to the commodity price plus the energy taxes and sustainability surcharges, which

stands for a significant part of the electricity price for small-end-users. Nevertheless, it is not a fiscal measure, but a result of combining two measurements resulting in an aggregated number, simply deducting production from consumption (behind the meter settlement).

To qualify for this instrument there are some important conditions. The two most important condition are that the net metering is only possible on a connection with a maximum of 3*80 A (small end-users). 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 directly. That means that the installation should be connected to the homeowner's system, behind the meter. If the system is connected to the public network or someone else's network, the owner cannot use this instrument. Owners of a collective system that is not connected to each individual household behind the meter are thus excluded from using this instrument.

Net metering 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, which is earned back in 7 years or less.

Barriers

Because of the restrictions and the nature of this instrument, which means that the system should be connected behind the meter, larger projects on institutions like schools and apartment blocks with a shared roofs are impeded, both for very different reasons; institutions because the future use of the building is insecure, apartment blocks, because it is costly to connect each apartment directly to the system.

Another important disadvantage of net metering is that the instrument 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 as also recently confirmed by the national government the instrument will need to change in the future to minimize the impact on the grid.

Finally, all income groups do not benefit from this instrument equally. This is amongst other reasons, due to less financial means to invest in solar panels by low-income households. However, by allowing tenants to profit from behind the meter settlement, the instrument is also available to these often low-income households and this has a positive effect on eradicating energy poverty.

Recommendations

The new government announced in the end of 2017 that they will adjust the instrument in 2020. 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 instrument, or if the financial instruments to enable this low-income group to participate 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 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 settled makes this instrument very rigid. Building owners investing in an installation can only earn back their investment on the energy bill as long as they use the building. 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. 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

Due to the condition that net metering is only available for systems connected behind the meter, another instrument to stimulate renewable energy production by cooperatives was created in 2014: a low energy tax tariff for renewable energy produced by cooperatives.

The reason to create this special tariff for co-operatives was to facilitate in particular homeowners that share a roof or do not have a suitable roof for individual systems. The tax rebate applies to small-scale renewable energy production, which is not subsidized by the state and is produced in the nearby environment.

Barriers

Even though energy tax reduction for cooperatives supports cooperative local energy generation, 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 free of charge.

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.

Recommendations

- Lift the difference between individual systems behind the meter and cooperative production.
- It would allow individuals and cooperatives to find the most suitable places to install a system.
- In the future the system should be combined with smart deployment of storage in combination with PV, to maximize use of own produced power and consequently limit any adverse impacts on the (local) network.

Overall conclusions on net metering and postal rose

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. Background and conditions differ per policy instrument 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.

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 -preferably one- policy, in which equal access for all citizens, is an important condition.

8.3. Collective self-consumption of photovoltaic energy in France

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 Plan 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.

To achieve these ambitious goals, all types of photovoltaic plants must be developed and all types of roofs mobilised, over the whole territory. The net metering instrument is supporting individual systems, where the annual production is subtracted from the annual consumption of electricity. This net metering system is impeding larger systems, because there is only an economic incentive to install the amount of production that is consumed behind the individual meter.

Besides PV-panels on an individual dwelling, 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 attributing the production of one single PV-plant to various consumers.

It can be concluded that developing a well-functioning business case for collective systems under the new laws is complex. The new business model for collective PV-schemes has to deal with the uncertainty whether its production is exempted from CSPE (sustainability levy), TURPE (grid fees) and local taxes.

The ensemble of new regulations seems to encompass some contradictions. Where the consumption and production in a collective PV-plant is to be netted and balanced for every 30 minutes interval (dynamic), the DNO-conditions do only allow for a splitting scheme on a pre-defined profile basis (static). Using the actual 30-minute metering data to both balance the scheme and allocate the produced electricity to the members of the scheme, seems common sense, but is not sought in the DNOs approach. The generally valued possibilities of demand response are thus blocked.

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. Contribution of local authorities to foster renewable energy production in Grenoble

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 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.

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,* whose mission it is to develop PV systems on small and medium size roofs by mobilizing citizens and local authorities investments

Energ'Y Citoyenne is a simplified joint stock company (SAS) that is adapted for a small company and offers high flexibility and cooperative governance. La Métro invests 25.000 EUR amongst the 96.300 EUR of capital owned by Energ'Y Citoyenne in 2017. Other investors are citizens, roof-owners, local companies and partners of La Métro.

To stimulate the participation of citizens as shareholders, a challenge is to develop a sound business model and to provide shareholders with clear rules regarding the distribution of the benefits.

The business case of Energ´Y Citoyenne is very weak. 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.

For the citizens, 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 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. They will not be able to use possibly future more attractive net metering instruments or improved feed-in tariffs over the upcoming 20 or more years. 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.

Recommendations

In 2018 an additional study will be commissioned to improve Energ'Y Citoyenne 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 them 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.

Citizens participating, by investing, in a project in which the municipality has an economic interest, are by nature in a more vulnerable position (the municipality has more expertise and fulfils an exemplary role). It is the municipality's responsibility to communicate clearly the interests and objectives of the project.

Overall conclusions on 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 this is still 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. An example is the geographical limitations, which 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 scheme's 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.

9. THEME: SMART GRID 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 allow 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.

9.1. The 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.

The benefit of flexibility

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. Remaining balancing efforts in real-time is the responsibility of the TSO, who has made upfront contracts for provision of balancing power with individual market parties. In this set-up, there is no direct incentive for small end users to react by adjusting demand (or supply) to the actual 'needs' of the system.

Value of flexibility: grid expenses vs. flexibility

Currently, there is no real value attached to the provision of flexibility to the local distribution network. The network operator is not allowed to stimulate demand side management through for example flexible network tariffs or by buying flexibility form the market indirectly through for example an aggregator. The legal framework is either unclear and network tariffs are strictly regulated.

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.

Recommendations

To mitigate these challenges, we suggest that buying flexibility directly or indirectly through a third party, like a supplier or aggregator should be studies. The City-zen smart grid projects are lookin into this. 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. The scale of such a study should be large in order to compare local savings in network costs with potential (inter)national savings in generation capacity and CO_2-emissions.

The possibilities to value flexibility for the end-users should be taken into account in these studies.

9.2. Access to the market and the aggregator in The Netherlands

In many small-scale energy projects, consumers seek to increase sustainability by setting up a local energy community where the 'home-grown' energy is traded within the community. These communities need, as described above, 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 floor etc. Vehicle-to-grid projects are confronted with the same barriers.

Recommendations

New innovative services will emerge ('aggregators'). Market parties (e.g. the present energy exchanges as EPEX) can also 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 to undesirable financial risks. This will need to be studied further.

9.3. Role of the distribution network/system operator in the Netherlands

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.

The common threat 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 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 seeks an insight in how flexible consumption (consumption by loading the battery) and production (solar production/ unloading the battery) could contribute to minimizing peak loads. Storage capacity could also play a role in the balancing by the TSOs.

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 a company, which is also active in generation, trade and supply of energy.

The Netherlands chose a radical form for unbundling. 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 ´commercial´ (energy) activities, which may be in conflict with managing the network.

In 2015 two of the major energy companies, RWE/Essent en Nuon, have filed complains 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 do not conflict with the Dutch unbundling regulations. 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.

Conclusions

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 with a 'pushed' over free market model, has become sometimes 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, 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 production to small scale intermittent, less-predictable production has a large impact on the networks operated by the DNOs. Consequently, DNO´s desire to expand their role and activities to investigate 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. 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.

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.

Recommendations

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, will be based on: 1. Legal obligations, such as heat provision obligations, 2. 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.

10. LIST OF FINAL RECOMMENDATIONS

The most important recommendations are listed here 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 CO_2-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.
- 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:	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*
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 II

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, Isere 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, Isere 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