



Photo: City of Amsterdam, Edwin van Eis

Digging for District Heating

Improving Local Energy Infrastructure and Policies

Feedback report from the CASCADE Peer Review

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Executive Summary

In April 2012, a peer learning visit of experts from five European cities took place in Amsterdam in the context of the CASCADE project. Within the field of “Renewable Energy Sources and Distributed Energy Generation” (REN and DG) the focus of the visit was on the local district heating (DH) network. Instead of focusing on the core technology, the visit assessed the embedment of district heating into the city’s overall energy and climate strategy in terms of: (A) Local energy leadership and ambitions, (B) Local strategies and policies, (C) Organisational and managerial issues, (D) Stakeholder and citizen involvement, (E) Information, knowledge and awareness and (F) Financing, investments and risks.

The main impression of the visit was that the 2040 Energy Strategy¹ in Amsterdam is seen as a key policy for the city. Its targets and requirements - generally with regard to district heating - are internalised by all relevant stakeholders inside and outside the administration. The three main strategic targets for DH in Amsterdam are:

- expand the two existing grids and close them to a DH ring,
- shift the heat supply from mainly fossil based (75% gas) to more sustainable and renewable sources,
- 100.000 REU connected to DH by 2025 and 200.000 REU by 2040².

However, the financial crisis and low construction activity made it harder to achieve the city’s targets to reduce emissions and to connect buildings to DH. The peer learning team analysed this report to assess Amsterdam’s DH strategy and the way it contributes to promoting renewable energy and distributed energy generation in the city. Therefore, aspects on how to foster the closure of the DH ring and the connection of REU to the network were discussed. The question to which extend the DH system can be expanded in an economically and ecologically reasonable way was only mentioned, but not assessed in detail.

The visiting team found the following areas of improvement in the DH strategy:

- Whereas the municipality’s commitment for DH is strong, the consequences of citywide targets on the district level remained unclear. Concrete and probably negotiated (development) targets for district heating in relevant districts might clarify the role of the boroughs and strengthen their ambition.
- It could be helpful to develop timelines for the two targets “extension of the grid to a ring” and “shift from fossil fuels to 100% sustainable sources”. It would be more tangible if they were connected to the third target “connection of 100.000 REU to DH by 2020 and 200.000 by 2040”: How many REU need to be developed and connected to close the ring? How many REU can be supplied by sustainable heat by 2040?

¹ “Amsterdam: a different energy. 2040 Energy Strategy” is the title of Amsterdam’s Sustainable Energy Action Plan (SEAP).

² The latest potential study (2012), that was published after the visit, shows a total potential of 230.000 RUE of existing and new, houses and offices to be connected to the DH system by 2040.

- A main problem is the connection of the existing building stock to the network. Due to price fixing between DH and gas, there is no remarkable financial benefit for house owners and tenants to connect to the DH network. Decoupling DH from gas could help to provide more interesting offers and business cases for owners, tenants and housing companies. It might be a more interesting business case for owners, if connection to DH is combined with a guaranteed price with limited increase in long term contracts. For others it might be an argument, if the contracts include shorter periods. The pricing and contracting scheme could be adjusted to different needs and preferences. Energy Service Companies (ESCO) could help to strengthen the link between energy efficiency in existing buildings and the connection to DH (“refurbish and switch”). Furthermore, it might be helpful to initiate further R&D and demonstration projects focusing on the connection of existing buildings to the DH system.
- For closing the two existing networks to a ring it might be helpful to define strategic points. With a main focus on these single projects as attractive business cases the expansion of the grid can be fostered. The peer learning team noted, that with the recent ownership of the two existing grids, the closure of the ring would lead to a rather weak position for the city of Amsterdam: The energy provider NUON (Vattenfall) would hold about 75% of the system, the city only 25%.
- Organisation and structure of responsibilities within the municipality as well as with other actors (e.g. NUON) became very clear. However, it appeared, that decision making processes and co-ordination between the departments responsible for development projects should be shortened by cross-sectoral and cross-departmental working groups. Co-ordination between different civil engineering ground works should also be optimized. Furthermore, the municipal staff’s skills could be improved regarding the appraisal of (DH) business cases.
- District heating is a centralised system requiring a citywide (and expensive) infrastructure, which is supported by the “Heat Unless...” policy: Every new development area has to be connected to DH, unless it is economically or technically unsuitable. Project developers, however, would sometimes prefer other alternatives. The question whether funding for renewable energies is equally shared between DH and other technologies, could not be assessed during the visit. It remained also unclear, whether heat supply can be provided from 100 percent sustainable sources, if the DH system is expanded to 230.000 or more REU. Therefore, it might be an alternative to develop also smaller local heat systems for areas and building blocks in districts which are not (yet) connected to DH and to initiate projects with renewable sources like geothermal.
- The definition of the next strategic points for DH, new projects and future price advantages can be bundled and used to develop a comprehensive ‘communications package on energy’ for houses or districts covering all aspects of energy consumption and saving, including DH.

Amsterdam’s ambition and ability to take the local energy leadership became very clear during the visit. The embedment of 2040 Energy Strategy in general and DH in particular into urban, district and project development is convincing. In this respect the findings and recommendations from the peer learning visit shall encourage the city of Amsterdam in its progress.

1. Introduction

The city of Amsterdam, capital of the Netherlands, is located in the province of North Holland. It has about 770.000 inhabitants on an area of 219 km². The city consists of seven city boroughs.

The city of Amsterdam has committed to a reduction target of 40% of CO₂-emissions by 2025 compared to 1990. In 2009, Amsterdam signed the Covenant of Mayors and submitted its Sustainable Energy Action Plan (SEAP) in 2010³.

Amsterdam elaborated also two integrated strategic plans “Structural Vision Amsterdam 2040”⁴ and “Outspokenly sustainable: perspective 2040” which address general directions of the city’s development in all sectors. The city also formulated documents with a special focus on the city’s energy policies: “Amsterdam: a different energy - 2040 Energy Strategy”⁵ and “Amsterdam definitely sustainable 2011-2014”⁶. Both documents are closely linked to the above-mentioned plans.

In its energy strategy, Amsterdam pursues four “transition pathways” towards sustainability for the building, transport, port and industry as well as for the energy sector. Within the energy (generation) sector, three main strands of policies are pursued:

- the extension of the renewable energy sector (wind energy and solar panels)
- optimising the use of energy by smart grids
- extension and improvement of a combined district heating and cooling system

Currently, Amsterdam has 55,000 REU (Residential Equivalent Units) connected to the citywide district heating and cooling system with a continuous growth of about 5,000 REU per year. Amsterdam supports the growth of hot and cold storage with the incorporation in district heating and district cooling (DH & DC) networks. Facilities for DH & DC have been installed in parts of the city, and the sector is still growing. Amsterdam has an enormous amount of rest heat produced by five power plants (50-80% CO₂-emissions compared to HR-gasboilers) in the outskirts of the city and several deep lakes as resource for cooling. Hot&cold storage is also a good source in Amsterdam for lower temperatures.

In institutional terms the Climate and Energy Office of the Municipality coordinates climate and energy policies. Additionally, several other departments are involved into the process of policy development and implementation. Next to administration there are numerous actors and stakeholders involved in the city’s local energy policies such as regional water authorities,

³ City of Amsterdam (2010). Sustainable Energy Action Plan (SEAP). Download at: http://www.eumayors.eu/about/signatories_en.html?city_id=280&seap (accessed 23/05 2012) (in English)

⁴ City of Amsterdam (2011). Structural Vision Amsterdam 2040. Download at: <http://www.amsterdam.nl/publish/pages/377545/plan-01-2011-eng.pdf> (accessed 23/05 2012) (in English)

⁵ City of Amsterdam (no year). Amsterdam: a different energy - 2040 Energy Strategy. Download at: http://www.iclei-europe.org/fileadmin/templates/iclei-europe/files/content/Membership/MUTS/Amsterdam/Energystrategy_2040_-_engelse_versie_Kopenhagen.pdf (accessed 23/05 2012) (in English)

⁶ City of Amsterdam (2011). Amsterdam: Definitely Sustainable. Download at: http://www.amsterdam.nl/publish/pages/417780/dr010-vrslg_duurzaamheidsprgrmm_2010-2014_engels_losse_pag.pdf (accessed 23/05 2012) (in English)

companies, research institutions and citizens.

Within the CASCADE project, Amsterdam decided to host a peer learning visit in the field “Renewable Energy Sources and Distributed Energy Generation” (REN and DEG) with a main focus on district heating (DH).

The peer learning team thanks the city of Amsterdam for enabling the learning process, and for its attentive hospitality.

2. Peer Learning Methodology and Visit

The peer learning methodology is a method that can be used by cities to communicate and critically review each other’s sustainability policy, to improve performance and provide suggestions for further progress. It also provides the opportunity to learn and share experiences, practices and ideas with participating cities during peer learning visits by means of interviews with local stakeholders, workshops and presentations. During the visit, participating cities assess specific energy projects and plans of the host city and provide recommendations on possible areas of improvements.

2.1 Peer Learning Visit in Amsterdam

The peer learning visit in Amsterdam took place between April 18. and 20. A preparatory meeting of the supporting team with representatives of the city administration was held on April 17th.

One main reference document of the peer learning visit was the self-assessment report delivered by the City of Amsterdam on March 5th. In this document, Amsterdam conducted an assessment of the state of implementation of its energy policy with a special focus on the promotion of renewable energy sources and distributed energy generation. In order to structure both the self-assessment report and the peer learning visit, Wuppertal Institute and Eurocities provided a benchmark for this thematic issue. Detailed desk reviews by the peer learning team were delivered by April 3rd.

Further information came from the Sustainable Energy Action Plan of the City of Amsterdam, from the city’s website, the CASCADE City Profile and the strategic plans for 2040 mentioned above. During the visit, the peer learning team became acquainted with the overall process and the results of the current urban concept “Vision 2040”. The team also conducted 14 interviews with main stakeholders of the city, such as politicians and officers from the relevant city departments, the director of the Waste to Energy Company, managers of the main social housing companies and representatives of the energy companies NUON and Westpoort Warmte (WPW) responsible for the operation of the city’s district heating system⁷.

⁷ *The list of interviewees is displayed in the appendix of this report*

Additionally, the team experienced a site visit to the waste incineration company “Waste to Energy” which is a main source for the local district heating. Finally, a session was held during the visit to exchange experiences with DH from other cities among the peer learning team.

The members of the Peer Learning Team were:

City	Team Members
Edinburgh	Dave Hawkey (University of Edinburgh)
Gateshead	Peter McDermott (City of Gateshead) Jon Mallen-Beadle (The Gateshead Housing Company)
Genoa	Mario Merello (City of Genoa) Silvia Guerra (City of Genoa)
Gijon	Piroska Matos (Gijon City council) Enrique Jáimez (University of Oviedo)
Venice	Maurizio Tabuso (City of Venice) Simone Tola (A.G.I.R.E. -Energy Agency of Venice)

The peer learning team was supported and facilitated by

- Ralf Schüle, Anja Bierwirth and Jonas Friege (Wuppertal Institute)
- Jorgina Cuixart (EUROCITIES)

2.2 The CASCADE-benchmark

The benchmark for the thematic field of “Renewable Energies and Distributed Energy Generation”, developed in CASCADE, was the main reference for the peer learning process. The benchmark entails a list of criteria (‘key factors’) to assess the implementation of climate and energy policies in cities. They represent an ‘ideal’ or ‘desirable’ standard against which actual performance of a city can be compared. It addresses the following issues and indicators:

- A Local leadership and ambitions
- B Local strategies and policies
- C Organisational and managerial issues
- D Stakeholder and citizen involvement
- E Information, knowledge and awareness
- F Financing, investments and risks

However, due to the specific focus of the peer learning visit in Amsterdam (district heating and cooling; DH & DC)) brief remarks about the applicability of the benchmark and the propositions, scope and objectives of the visit are necessary:

- (1) With a special focus on renewable energies and distributed energy generation the benchmark was originally designed to facilitate the evaluation of a city’s local energy and climate

strategy. However, the Amsterdam visit with focus on DH & DC required to expand from a sole municipal perspective to a wider spectrum of relevant actors including the public and private sector (e.g. energy companies) as well as intermediate organisations (e.g. joint ventures). In this feedback report, thus, it was partly necessary to differentiate between the evaluation of the overall energy and climate strategy of the city and the evaluation of the district heating (and cooling) strategy.

(2) Another point was the role of DH & DC systems being appropriate in the context of the local integrated sustainability strategy. As all sectoral energy strategies and technologies, district heating systems and their intended extensions, too, entail specific ambivalences that need to be addressed in local policy evaluations:

First, the expansion of a DH system carries the risk of a technical and investment lock in reducing the opportunities of a city to invest in decentralised renewable energies or in energy efficiency strategies. Within the evaluation, this proposition of the Amsterdam energy policy was not questioned, whereas the risk of a technological lock in is clearly articulated in this report.

Second, in ambitious climate and energy strategies a main aspect of local DH strategies is the shift from fossil fuels to renewable energies (biomass, geothermal energy, solar energy), which is necessary to reach the emission reduction targets. This point was not assessed during the visit either, but mentioned as crucial for the sustainability of DH.

Third, during the visit, the environmental effects of waste incineration as such and especially of importing waste from other countries for the local district heating in Amsterdam were discussed. On the one hand, the need of waste for heating might compete with recycling targets, and the import of waste causes emissions due to transportation, what is generally questionable. On the other hand the import of energy sources for generation is a normal practice of all operating companies in European member states. Additionally, from the current point of view, the import and incineration of waste (currently 15% to 20% of AEB's input is commercial waste imported from the UK to Amsterdam by shipping) is a better practice than landfilling. The visit could neither address this ambivalent aspect of the DH system in Amsterdam.

Fourth, due to the special focus on district heating and cooling, parallel strategies and targets for decentral renewable energy technologies and efficiency policies were not subject of the assessment. In this sense, visit and assessment of the Amsterdam's climate and energy strategy focused on organisational, infrastructural and financial issues of district heating being an important part of the overall energy supply (see figure 1).

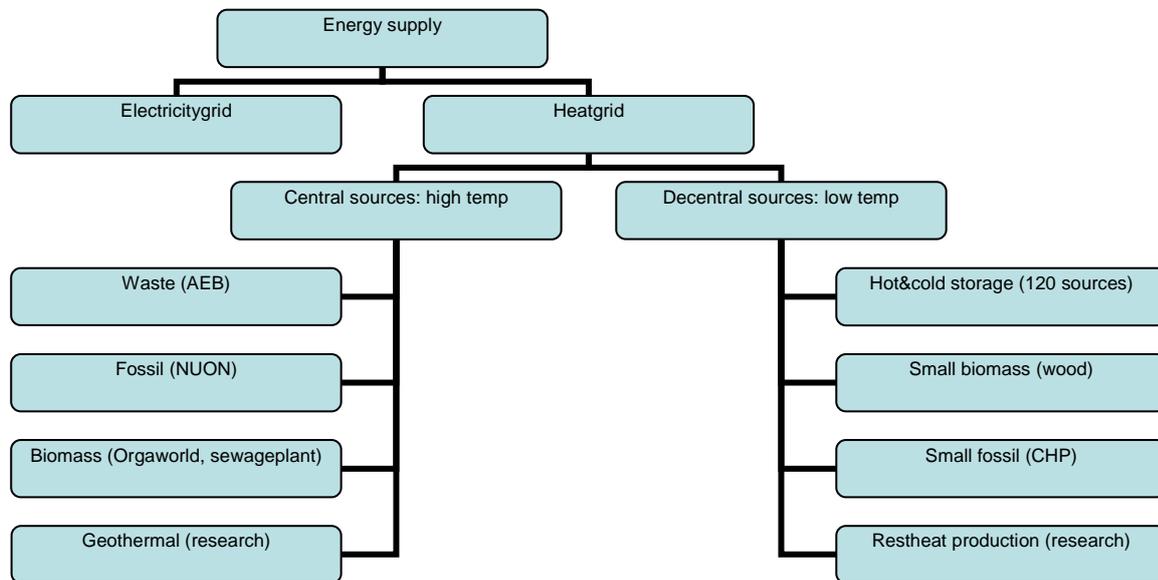


Figure 1: District Heating embedded in the city's energy and climate strategy in Amsterdam

In Amsterdam heat is recovered from a gasfired and a wastefired powerplant. Two new gasfired CHP are built by Nuon-Vattenfall. There is enough (low price) heat available for the total demand of the city of Amsterdam, but in the future even more renewable sources as Orgaworld (biomass) and biogas (sewage) will be necessary to replace fossil fuel based facilities. In Amsterdam, the main focus of the DH policy is to expand and to connect the two existing networks. All new large development areas are contracted (tripartite: municipality-WPW-developers). Another focus is on contracting large quantities of existing buildings which have to be renovated. To accelerate the expansion new connections (small and big ring) will be necessary.

The main responsibilities and activities in the field of district heating are divided between the following actors:

- NUON is the main energy supplier in Amsterdam. Since 2009 it belongs to the Vattenfall company. NUON supplies district heating to the eastern and southern areas of Amsterdam.
- Westpoort Warmte (WPW) is a joint venture between the city of Amsterdam and Nuon. WPW supplies the following districts on the western side of Amsterdam: the Westpoort harbour area, Westelijke Tuinsteden and the Amsterdam North urban district.
- Afval Energie Bedrijf (AEB) is Amsterdam's Waste and Energy Company. 25% of the heat for DH is produced by AEB's waste incinerator.
- Waternet, formerly the City of Amsterdam's Water and Sewage Department, covers the whole water cycle. Waternet is working in and for the City of Amsterdam and parts of the provinces of Utrecht and Noord-Holland.
- Dienst Ruimtelijke Ordening (DRO) is the Department of Physical Planning, one of the city of Amsterdam's centralised services, and responsible for all spatial planning.

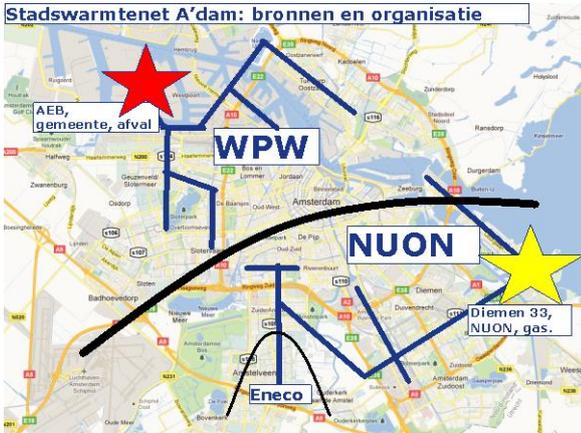


Figure 2: The DH Network in Amsterdam

3. *The Assessment*

The following chapter describes the key factors and reviews them with regard to Amsterdam's local energy policy in general and district heating in particular. It also illustrates the conclusions and recommendations given by the peer learning team.

A - Local energy leadership and ambitions

The legal options for cities differ from country to country. But within the existing legal framework cities can be pioneers and even exceed national standards. The related key factors cover the issues concerning the role of the administration in the entire city: political commitment, use of regulatory capacities at local level, consistency of strategy and cultural affinity to innovative projects.

Today there are two existing DH networks in Amsterdam owned by NUON (yellow) and WPW (orange).

NUON is the local energy company owned by Vattenfall, WPW is a joint venture of the city and NUON. The future goal of the DH strategy is to close the circle:

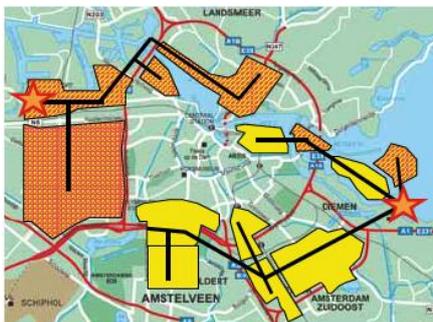


figure 3 The existing and contracted networks



figure 4 Future scenario : single heat provider and closed network

Source: City of Amsterdam/NUON: District Heating and Cooling.

(2) Review and evidences

The political commitment of the city of Amsterdam for energy and climate related ambitions (key factor A1) is very strong. The extension of district heating is seen as very important to reach the ambitious targets of the Energy Strategy. It seems that possible changes of the current political landscape after upcoming elections will principally not threaten the commitment in general nor a further extension of district heating and cooling. However, it appeared that the main focus of ambition differs between involved parties and stakeholders, means the point of view to what extent the district heating system can or should be developed further. This aspect arised regarding the relationship between the municipality and district administrations as well as the different levels of ambition by different actors.

Amsterdam uses its legislative capacities (A2) to support the extension of renewable energy sources and district heating. The city is owner of the major part of territory (about 80%), a very advantageous position to develop energy related projects, e.g. to support solar panels and windmills in the port area of Amsterdam. Within the city of Amsterdam there are currently 400.000 dwellings (the large local housing companies own about half of it) and 20 million square meters of non-residential buildings. The municipality's targets for their own buildings and

energy use is even exceeding the national standard.

The ambitious targets for the extension of district heating are addressed by the so called ‘Heat unless...’ policy. This policy implies that sites with new buildings should be connected to the district heating, as long as it is feasible in economic and technical terms. From a top down perspective (municipality), this means a clear definition of a priority technology for new buildings. From the bottom up perspective of project developers and representatives of local districts⁸, the view was partly different and the value of the policy was doubted.

The long term goals and visions (A3) of the district heating strategy are an important part of Amsterdam’s overall energy and climate strategy. The Energy Strategy defines clear short, mid- and long-term goals, for REN as well as for DH (see box on the left). But the financial crisis has influenced investments in the building sector: areas have been developed with less residential equivalent units (REU) than it was expected and planned before, which hinders the expansion of the heating network.

Regarding the existing building stock it was stated, that it is difficult to make house owners connect to the district heating system. However, unless energy performance standards are defined for existing buildings in the Netherlands (other than for newly built houses), heat consumption in older houses will likely remain at high levels also in the future and will thus be an interesting business case for the DH system operators. This holds especially valid for the medieval city centre, which is under protection of the UNESCO World Heritage Convention with its limited opportunities to reduce energy consumption by energy efficiency improvement measures.

The peer learning team got to know very innovative and interesting projects in the city (A4). Recently developed and newly planned areas as *Houdhaven* and *Zeeburgereiland* are built as (nearly) Zero-Emission-Districts. Regarding the DH system, it is remarkable that it is used for cooling as well. There are different potential technologies for cooling in the city (district cooling, hot and cold storage or comfort cooling.⁹ The recently developed district *Zuidas*, for example, is supplied by cold water from a deep lake nearby.

As an overall assessment, the City of Amsterdam is very progressive, comprehensive and innovative, takes sustainability and energy challenges very seriously, is conscious about its European leadership role and wants to find sustainable solutions that combine sustainability issues with a high quality of life.

(3) Recommendations

Regarding local energy leadership and ambitions, the following recommendations can be formulated:

⁸ See in more detail part “D - Stakeholders and citizens involvement”

⁹ Comfort cooling represents the cold part of hot&cold storage with a low temperature for houses (18 C). District cooling means low temperature (6 C) for offices etc.

- On the one hand, there is a strong political commitment for district heating in the municipality. However, the peer learning team regards it as crucial to increase the commitment in the city boroughs. This might be strengthened by concrete and probably negotiated (development) targets for district heating in relevant boroughs and districts.
- It is obvious that the integration of the existing building stock into the DH system is a main challenge in the future DH strategy. It might be helpful to initiate further R&D and demonstration projects focusing on this issue, such as the project in New West, in which about 30% of the connected buildings are from the existing building stock.
- The paper “Continuous growth and increased sustainability: District Heating and Cooling” sees a potential of 500.000 REU connected to DH. It should be carefully assessed if DH can cover the heat demand sustainably then or if other possible renewable sources (such as geothermal, biomass or solar) would offer more sustainable solutions.

B - Local strategies and policies

(1) Description of key factors

The cluster “Local strategies and policies” addresses the city’s local strategies and policies with a special focus on policy integration. The related key factors are:

(2) Review and evidences

The city has developed a comprehensive strategy regarding energy and climate action including renewable energy sources and efficiency in general as well as for district heating (B1). Regarding DH there are three main targets:

- Expansion of the system: close the existing pipelines to a ring around the city
- Heat generation: shift from fossil fuels (75% of the heat comes from gas) to 100% sustainable sources
- Supplied buildings: Connect 100.000 REU to DH by 2020 and 200.000 by 2040

Besides the target of connected buildings until 2040, it seems that there is no timeline for the connection of the two existing grids to a ring or for the shift of heat generation to 100% sustainable sources.

Representatives of the city of Amsterdam noted that it is a challenge to achieve the city’s emission reduction targets, in particular the target for a climate neutral municipality by 2015 and for the sustainability of traffic and electricity. The economic growth of the city is opposing energy efficiency and emission reduction, thus making it very hard to achieve the 40% reduction target: One third (1,1 Mton) of current emissions are not covered by climate action yet.

Regarding connection of buildings to the DH system, the main obstacles are seen in the financial crisis and the subsequent decrease of municipal revenues from newly built areas. Some of the

development projects are still realised but with less residential and office buildings as planned before. On the positive side, there are more existing buildings connected to the network than it was expected.

The development of new areas such as Zeeburgereiland and Houthaven shows that REN and DH have been very well integrated into urban development plans and projects (B2). In combination with a high energy performance of buildings, Amsterdam has implemented (almost) carbon neutral projects in these areas. However, the development of REN and DH within the existing building stock is more challenging, especially in the protected city centre area. The peer learning team saw evidence that this point is on the agenda but it is not clear how the city of Amsterdam aims to address this issue in the future.

Future models of DH ownership

Next to the organisational and technical challenge of integrating the two DH systems into one "ring", there are different models for how the system could be owned and operated in future. The current 50/50 split in WPW brings advantages in commercial terms but broader goals than a purely commercial approach:

Today NUON owns 85% of all assets in DH in Amsterdam (counting NUON's own network and the 50% of WPW). So the overall share of the city is only at 15% but regarding the WPW system, the city holds 50% with the corresponding influence on future development. If the two systems grow at current projections, a shift of power structures will happen: By 2025, NUON would hold around 75% share of DH in Amsterdam. The city's share on all assets would increase but its influence on the own DH system would decrease.

Several organisational models are discussed at the moment.

The DH network and its intended extension are systematically integrated and coordinated with the relevant institutions (B3), especially with the energy supply company NUON, that operates the local DH network in the South and East. The joint venture of NUON and the city of Amsterdam called Westpoort Warmte (WPW) has installed the DH network in the West and North of the city.

Besides the collaboration with NUON, the co-ordination between different responsible city departments (B3) was subject of the discussion: it seemed that the erecting of the DH infrastructure is not always well co-ordinated with other civil engineering such as water, sewage, electricity, phone and others. Co-ordination with other responsible departments could reduce costs for the connection of existing buildings and minimise the inconvenience for residents.

Another strong cooperation could be established with local housing companies. On one hand, the peers found evidence that the housing companies are highly interested in connecting their buildings to DH. On the other hand, it was stated that the price advantage of DH compared to gas is not high enough, if it remains linked to gas price levels. Due to the "Heat unless..." policy, connecting new buildings to the network is usual practice, but the connection of existing buildings would

be more interesting regarding emission reduction and, in the long term, to save energy costs, if price linkage to the gas price will be derestricted.

A further issue dealt with the question if existing energy supply contracts between housing companies and WPW running over 15 to 30 years are reasonable. While a long term contract seems to be too binding, it also gives security to the customer. However, if technology changes, there might be a viable alternative to DH that customers (e.g. housing companies) want to move to. If a contract is running over 15-20 years, customers have no flexibility to change until the end of a contract period. At the same time, it is understandable that NOUN / WPW need long contracts in

order to have more security / protection as regards their upfront investment.

Besides co-operations on local level, the city of Amsterdam collaborates as well at the regional level with neighbouring cities in the Metropolitan area (B4). It is possible to deliver heat from AEB to surrounding cities, however, the focus of the city of Amsterdam and NUON is on the growth of the network within Amsterdam.

(3) Recommendations

- It could be helpful to develop timelines for the two targets “extension of the grid to a ring” and “shift from fossil fuels to 100% sustainable sources”. It would be more tangible if they were connected to the third target “connection of 100.000 REU to DH by 2020 and 200.000 by 2040”: How many REU need to be developed and connected to close the ring? How many REU can be supplied by sustainable heat by 2040?
- Consider to decouple the price for district heating from the gas price in the near future (either a particular date or a particular gas price). Against the background that gas prices have increased by 24% over the last years, decoupling would compile a real cost advantage of DH against gas supply and attain to more house owners in existing buildings. A guaranteed price with limited increase for DH can be fixed in long term contracts to give price security to customers.
- Find alternative pricing models for DH: There are examples of cities where price advantages of DH against gas and/or oil are significant and difficulties to connect existing buildings to the system (e.g. Copenhagen (Denmark) are lower: Almost 99% of heat demand is covered by DH, the consumer price for district heating in 2009: around 45% of oil heating and around 56% of natural gas for a home of 130 m² and a consumption of app. 18 MWh/year).
- The municipality should be aware of its own influence on the DH system and its future extension due to the share it holds in this business. In the current organisational structure, a further growth of the system would result in a loss of the city’s control over the grid to the benefit of NUON.
- Screen the existing co-ordination between DH ground works and other civic engineering departments: Is it possible to optimise it? Are empty tubes (gas, water, electricity, phone etc.) provided on a regular basis wherever certain conduits will be needed in the future when it comes to the extension of DH (or the other way round)?

C - Organisational and managerial issues

(1) Description of key factors

With regard to energy and climate issues it is necessary to overcome the traditional disciplinary separation of organisational structures in municipalities in order to develop integrative solutions. Therefore, these factors especially address organisational and managerial issues with a special focus on monitoring:

(2) Review and evidences

The organisational structure of the municipality with its Climate and Energy Office is clear as well as responsibilities and functions of district heating (description of the structure see Section 2).

Comprehensive management structures have been established and responsibilities have been allocated (C1). But, nevertheless, it seemed that the municipal Waste and Energy Company Afval Energie Bedrijf (AEB) will be in a weak position against NUON, when the DH network will be extended of, as described above. Since NUON is responsible for the calculation of prices, infrastructure costs, etc., currently the city does not seem to be on a par with NUON to compare different business cases. It was mentioned that the city does not have the technical or financial expertise to scrutinise, check or challenge the work of NUON.

Generally, the city administration supports activities in the field of renewable energy and distributed generation (C2). Major projects next to DH are windmills that will be built and / or repowered in the port and new development areas. However, it was stated that the “old” administrative structures are not appropriate for the “new” requirements and challenges regarding the DH system. For the implementation of new and innovative projects, for example, the official channels were described as very time-consuming, which can be hindering: Different departments or persons involved can have diverging ideas of, for example, the right energy supply system for a new development area. It was stated, that the waste to energy plant still has heat resources. The ambition of the municipality and other actors to expand the DH grid and use this energy is partly seen as not strong enough to further develop DH.

Regarding the interaction between the city and the district / project developers level, differing views could be observed during the visit: On the one hand, the ‘Heat unless ...’ policy is a clear evidence for Amsterdam’s strategy (top down) to extend and support district heating. On the other hand, from the developers’ point of view (bottom up), the DH system is sometimes regarded as hindering and inflexible.

It was impressive for the peer learning team to see how everyone involved seemed to be very well informed about the need of action regarding energy and climate topics, the city’s strategy, targets and projects (C3). The fields of action and their potentials for emission reduction are very well documented and projects are being implemented. From some project developers’ perspective the DH system in some cases is seen as too inflexible (“big pipes”) and not necessarily regarded as the most feasible and sustainable solution. In this case, rather decentralised solutions of energy supply

are usually preferred.

Adequate monitoring and reporting systems are in place (C4). Therefore, the city is clearly aware that with the current progression the very ambitious energy targets are unlikely to be reached: Until the year 2025 there is a gap of 1.100 t CO₂ emissions calculated as (implemented) policies and projects are not as successful as they were supposed to be (e.g. see above: less offices and homes constructed in development areas). The peers appreciated the honest communication of this topic.

(3) Recommendations and areas of possible improvements

- The influence, function and skills of the city of Amsterdam and its employees regarding the extension of the DH system could be strengthened by a revised organisational structure ('WPW 2.0').
- To shorten the decision-making progress for the implementation of single projects, a partly reorganised municipality might be helpful. This could be for example cross-sectoral and interdisciplinary groups of those departments, that are usually involved into the decision making progress of a local development project.
- Define sites in the city that are of strategic importance for the extension of the DH system. Put most emphasis (and incentives) on the development of these projects, make business cases more attractive for developers on these sites.
- Check possibilities to individualise contracts for DH, e.g. offer shorter contracts to developers or investors if requested.
- Think about smaller, local heat systems for areas and building blocks in those districts that will not be connected to the ring pipeline in the mid-term future. It might be helpful to find sustainable and feasible solutions for the heat supply of existing buildings from renewable sources.

D - Stakeholders and citizens involvement

(1) Description of key factors

There is a need to involve professional stakeholders and citizens in order to promote sustainable urban development and energy generation. Partnerships, professional networks and information campaigns are approaches to involve social groups into the city's strategy on renewable energy sources and distributed energy generation and to motivate them to invest in these.

(2) Review and evidences

WPW, the joint venture between the city of Amsterdam and the local energy company NUON, has been established to enforce the extension of the DH system (D1). Despite a possible imbalance in the arrangement, as mentioned in the previous chapter, the partnership seems to be very robust and functional.

It was mentioned that WPW and NUON are working on the integration of other renewable energy sources into the DH system, such as biogas, geothermal and solar power (D2). Against the background that the district heating in Amsterdam today is predominantly fossil based (25% waste incineration, 75% gas-fired power plant), it appears that, next to the connection of more buildings to the DH system, transformation of heat generation towards sustainable fuels can significantly contribute to local emission reduction in the long term. After the decommissioning of the today existing power plants and waste incinerator (in approximately 30 years), sustainable heat has to be produced to be fed in the network. (Bio)gas used in CHP to produce electricity and heat might be a serious alternative next to geothermal and solar heat. While the focus of the municipality's main efforts is currently on the closure of the DH city ring and the growth of the grid, it remained inconclusive, however, if this development is enforced consequently.

The city works in close co-operation with local housing companies (D3) focussing the option to connect newly built or refurbished buildings to the DH system where possible. It appeared that there is a clear communication between WPW and the housing companies and a common engagement for the targets to be achieved. But still the perception of pros and cons of this option differs from case to case and between the partners involved, as mentioned in previous chapters.

Next to NUON and WPW and the housing companies there is the group of tenants, which was not mentioned yet. The residents are regularly involved into the decision of switching from gas to district heating: 70% of the occupants have to agree to the changeover, what can be an obstacle for the expansion of the DH system. Efforts in public relations are required here: acceptance by the tenants is one crucial factor to be addressed by the city and co-operating housing or energy companies.

Energy saving programmes are in place, conducted by the housing companies to help people to reduce their energy bills. But Amsterdam has not yet established any Energy Service Companies (ESCO). An ESCO could help to address energy efficiency in buildings and address at the same time the energy supply, contributing to the refurbishment of existing buildings to carbon neutral buildings.

Due to the focus of the visit on district heating, the engagement of private persons and companies into other renewable projects was assessed on a small scale. But it was mentioned that citizens can invest in other RE projects as well (e.g. solar, wind).

Another evidence for co-operation is the Amsterdam Smart City project. It is based on a private and public relationship with 71 partners: the City Council, local companies, knowledge institutions and citizens.

(3) Recommendations and areas of possible improvement

- Rethink how to prioritise renewable energy sources for district heating. If possible initiate pilot projects, e.g. the integration of geothermal into the DH system¹⁰.
- Think about financial incentives for owners and / or tenants switching to DH to make it more attractive.
- Consider Energy Performance Contracting (EPC) as a means to strengthen the links between energy efficiency and district heating in existing buildings. During the interviews, two options were mentioned: The municipality itself could provide EPC services (by setting up an ESCO in co-operation with local companies) or leave it to the market. Though developing a municipal ESCO requires an investment, there will also be a higher influence on projects to achieve carbon neutrality. A commercial company might focus on the most profitable options without aiming at carbon neutrality.
- While the connection of an existing building to DH is predominantly a business case for the supplier, the benefit could be shared with owners and tenants by developing business cases in which the connection to the grid is combined with energetic refurbishment and modernisation of the building.

E - Information, knowledge and awareness

(1) Description of key factors

Even though information and knowledge is a rather “soft” factor, it is the basis for stakeholders and the general public to contribute to the city’s strategy on renewable energy sources and distributed energy generation. The development of technologies, regulation and scientific findings proceed rapidly, hence it is essential for the municipal staff to improve their skills continuously.

This indicator covers the following key factors:

(2) Review and evidences

As it was mentioned before, all experts interviewed during the peer learning visit seemed to be very well informed about the sustainability and energy policy of the city. Innovative projects in Amsterdam (e.g. deep lake cooling integrated in the DH network) show the high level on which Amsterdam and its municipal staff is currently working regarding renewable energies and distributed generation (E1). Obviously, the city benefits very much from the skills that NUON

A broad participatory process to develop the “Structural Vision 2040” for the City of Amsterdam

The public involvement for the development of the “Structural Vision 2040” addressed in a very innovative way a wide range of social groups including students, retired persons, homeless people and many more. Through this process, more than 2,500 inhabitants contributed with their views and ideas to the final plan.

¹⁰ One pilot project is Orgaworld with a 100% sustainable heat supply from old food from supermarkets and restaurants.

contributes to the partnership¹¹. At some point, the question came up, whether the municipal staff needs more technological and economical skills to have a better overview and scrutiny over business cases.

Sustainability in general as well as renewable energies and distributed generation in particular are communicated broadly and in a refreshing creative way in public addressing a wide range of different social groups (see box). But whereas the communication between the city, NUON, WPW and Waternet was described as very strong and passionate, it was stated that district heating is of less interest to the public (E3), though its importance and strategic relevance in the ‘big picture’ is always mentioned prominently (Energy Strategy and other documents). A reason might be that clear financial advantages are missing (see section B), so that DH is of low interest from the user’s point of view (E4).

Different possible reasons were mentioned:

- Residents do not want contracts over 15 to 30 years because of possible changes in their lives.
- The existing gas supply works well and people do not see the need for a new infrastructure (a point strengthened by the gas lobby).
- Communication strategy is weak.
- District heating as an ‘underground’ technology is not visible and therefore of less interest.
- Linking the gas price and missing price advantages impede the communication strategy. It can be assumed that decoupling prices from the gas price, will increase demand for the system, thus pushing forward the expansion of DH from bottom up (customer led), instead of being marketed and sold from a top down approach (supplier led).
- For most people, district heating as such is not the most exciting topic within the whole climate and sustainability debate.

Finally, at this point the question came up, whether a broader communication strategy for DH is needed or whether the focus on the development areas, districts, stakeholders and inhabitants that are affected by the next steps of extension will be more reasonable.

(2) Recommendations

- The definition of the next strategic points for DH (see recommendations in chapter C) can be used for the communication with relevant stakeholders (e.g. project developers).
- Communication strategies for tenants in new projects need to be developed.
- Amsterdam could develop a comprehensive ‘communications package on energy’ for houses or districts covering all aspects of energy consumption and saving, including DH.

¹¹ It remained inconclusive if the high skills of planners and engineers can be attributed to a city’s strategy (E2). This point is not assessed here.

F - Financing, investments and risks

(1) Description of key factors

The final cluster of factors focuses on financial and investment issues. What are the resources the city has made available for investments and maintenance of renewable energy sources and distributed energy generation? What activities have been developed to reduce investment risks and to initiate additional private investments?

(2) Review and evidences

Regarding the personnel capacity the Climate and Energy Office is responsible for the co-ordination of relevant policies and actions. Another 100 people from several departments and public companies are involved into the process (F1).

With the joint venture of WPW, additional funding for DH comes from local actors (here NUON) as well as personnel capacity (F2). In addition, individual citizens and companies have the opportunity to invest in other renewable energies (see chapter D). However, the budget for developing a more sustainable energy supply is limited. This is why the following questions came up:

- a) Can the city / WPW gain enough financial capacity for the expensive infrastructure of DH? and - if yes -
- b) Is the financial stock divided adequately between DH and the development of other sustainable infrastructure?

The Amsterdam Investment Fund (AIF)

Amsterdam was shareholder of NUON and earned almost a billion Euros by selling NUON to Vattenfall in 2009.

With the transfer fee, the city set up a revolving financial instrument (AIF). With a budget 150 million Euros in 2011, the city funded projects in three main areas: City Development and Accessibility (40 million), Economy and Innovation (50 million) and Climate, Sustainability and Air Quality (60 million).

The potential for CO₂ reductions is a key evaluation criteria to access to AIF funding across the three themes.

In general it was stated that the city of Amsterdam is acting very supportive with regard to renewable energy and other innovative projects, e.g. at Zeeburgereiland (F3). The city's investment into the DH system can be seen as both, a major support itself and a reduction of risks (F4). A main risk for NUON / WPW is the possibility that buildings will not be connected to a new part of the DH System. By using its legislative power, the city of Amsterdam can reduce this risk.

(3) Recommendation

- Check possibilities to combine special offers with the connection to DH, e.g. 'refurbish and switch' in co-operation with an ESCO (see recommendation chapter D).

4. Appendix

4.1 List of Interviewees

- Bram van Beek; Policy advisor, City District North
- Cees Groot; Advisor Sustainable Building, City of Amsterdam
- Edward Goossens; Programmanager, Amsterdam Smart City
- Erik Koldenhof, Commercial Director & Innovation AEB, Director WPW
- Eric van der Kooij, Head of the planning department, City of Amsterdam
- Jos De Bruijn, Officer of the Agency of Building and Environment, City of Amsterdam
- Maarten van Poelgeest, Alderman, City of Amsterdam
- Marcel Meiling, Accountmanager, NUON Heat
- Marco de Goede; City council member Greenparty
- Marice de Lange, Project manager Development, Zeeburgereiland
- Paul Tuijp, Sustainability Manager Ymere, Social housing company
- Rob Kemmeren; Hot and cold policy advisor Waternet
- Steven Kerstel, Project manager NUON Heat
- Wybrand Pieksma; Advisor Sustainability, Eigen Haard, Social housing company

4.2 Peer exchange seminar Amsterdam: Summaries of Presentations

Initiatives presented during the peer exchange seminar, Friday 20 April 2012.

Gateshead District Energy Scheme

Presented by: Peter McDermott (City of Gateshead)

The city of Gateshead considered a range of low carbon energy schemes. District energy was identified as one potential significant opportunity. The council and a facilities management company have been working on a detailed feasibility study over the last years and concluded that district heating was technically feasible and economically viable for Gateshead. The main conclusions were:

- There is a sufficient heat demand to support a viable DH scheme for the city,
- Gas engine CHP currently provides the most robust and cost effective energy centre technology to get the scheme “of the ground”,
- Pipe network provides Gateshead with at least 50 years infrastructure, future-proofed to meet anticipated development demands,
- There is potential to upgrade energy centre to a full renewable energy option
- The provision of lower cost, lower carbon heat can benefit future development such as Housing Joint Venture, Baltic Business Quarter (BBQ), Gateshead Quays.

The gas engine CHP as a tried and tested low carbon technology turned out to be the most viable option to develop a scheme with an estimated 6,000 tonnes of initial CO₂-reduction and a future potential of 30,000 tonnes per year.

Such district energy scheme will have many customer benefits in existing and new buildings. The heat costs will be lower and customers will be resilient to future rising energy prices. Also the maintenance costs for existing plants will be lower and their lifetime will be extended. For developers, this solution is a cheaper option. Last but not least, the carbon footprint of the buildings will be significantly reduced.

In April 2012, the Council started the procurement process for the district energy scheme. In the construction is planned by 2013 in order to be operational in 2014.

Gateshead: Decent Homes

Presented by: Jon Mallen-Beadle (Gateshead Housing Company)

The “Decent Homes Standard” was set in 2000 and updated in 2006 as a technical standard for social housing which establishes that a home:

- has to be wind and water tight,
- has to be in a reasonable state of repair,
- has reasonably modern facilities and
- has a reasonable degree of thermal comfort.

This standard does not necessarily meet customer expectations of tenants for a modern home. To help to address those expectations the following additional Gateshead Standard was developed:

- Kitchens, bathrooms and heating distribution systems are key building elements,
- Kitchen layout was maximised by removing built-in cupboards or remodelling rooms,
- Specified high efficiency boilers as the standard for all heating replacements,
- Allowed for insulation over and above the industry guidance and
- Ensured, on replacement, the installation of high energy and security performance doors and windows.

The Decent Homes Initiative has delivered the largest relative investment in the Gateshead housing stock since its construction (£ 330 million, over 5000 properties).

Venice: Energy Supply - Generation and Distribution

Presented by: Simone Tola (AGIRE)

By signing the Covenant of Mayors, the city of Venice started to elaborate a Sustainable Energy Action Plan (SEAP) with a broad participation of all city departments and external stakeholders like the public transportation company, port, airport, energy multi-utility etc for the first time. In 2011 Venice started two projects (co-)financed by the Environmental National Department:

Isola della Certosa (Certosa Island)

Through a public-private-partnership, this initiative includes the refurbishment of an existing building to low energy standards and the management of a public park in which public spaces and economic activities will take place (training halls, sailing school, sport, residences, pleasure boating). The private (financing) partner has to ensure that all building activities will be conducted on high efficiency standards. A local energy network based on biomass (from maintenance of the park) will cover the demand for heating and cooling. Solar thermal systems for hot water, PV and experimental micro wind systems are also planned. The lighting system will be low-energy using LED and will prevent light pollution. A low carbon transportation system is being designed for people and logistics inside the island.

The main obstacle for the island's heating network is a regulation specific to Venice that bans all solid and liquid fuels including biomass from the Venetian Lagoon because of fire danger. Because of that, an exceptional allowance is needed from national government.

Porto Marghera

Porto Marghera aims at converting a brownfield area into a new Eco-District characterised by:

- efficient engines for waste selection plants to treat municipal and special-non dangerous waste,
- a small tri-generation plant (CCHP) providing district heating and cooling based on biomass and biofuels and energy generation for office buildings in the area,
- a research & development area for testing new low carbon technologies. This area will be an "enterprise incubator" for new enterprises working on the "green" field.

Next to this, the City of Venice has just awarded the new maintenance & electricity supply for public lighting. The new contractor will supply only certified green electricity. Furthermore, a new hydrogen electricity plant (15 MW) has been built.

Despite these very innovative and positive projects, an integrated plan and organic vision for a climate strategy in Venice is still lacking. The elaboration of the SEAP should be a helpful step to improve the management and coordination of different energy projects in the city.

Genoa: District Contract 2 - Molassana

Presented by: Silvia Guerra (Assistant Designer)

The “District Contract 2” is an urban recovery program, including building requalification, improvement of environmental conditions, the conformity and development of urbanization works and of private and public services equipment. The city of Genoa has designed and presented five “District Contract 2” proposals. One of these, called “Dwelling and living near rivers“, concerns the requalification of two areas: the quarter around Via Sertoli and Via Molassana (including the old Cinema Nazionale) in Molassana District.

The second project will built new public offices in the district. The main goals regarding functionality are to fulfil two common needs:

- the citizen’s necessity to easily reach all the different municipal public offices, placed in comfortable spaces and accessible by everyone;
- the rationalisation of public administration expenses, pursuing a drastic decrease of passive rents and maintenance.

The goals regarding architectonic and environmental aspects are the creation of new suitable public aggregation spaces. These spaces, together with the new building, will have to be both a recognisable “sign” and an appropriate urban and environmental “reference point” for the Molassana area. The building itself has been designed in suitable shapes and sustainable materials which characterize the building as representative for the public. The project includes the demolition of an existing building to realise a public open space as an essential element to valorise the urban environment.

District heating in Edinburgh

Presented by: David Hawkey (University of Edinburgh)

In the United Kingdom, thermal electricity generation makes very little use of the efficient CHP technology, although concerns about climate change, energy security and fuel poverty are leading towards a renewed focus on capturing sustainable sources of heat.

The Scottish Government recently commissioned a study into the feasibility of capturing heat from large power stations fitted with Carbon Capture and Storage (CCS) technologies to deliver zero carbon heat to urban areas. The interest in delivering heat from large scale CHP in the UK, however, is not new.

Edinburgh, for example, has been the site of a number of ambitious plans dating back to the end of the 1970s. The challenges of constructing the infrastructure for distributing heat, particularly in the UK context with an extensive natural gas network and (historically) cheap indigenous supplies are quite similar to those from the Netherlands. As a result, these earlier plans rarely developed into concrete projects. Two exceptions are found in Sheffield and Nottingham.

Currently, several UK local authorities are taking a variety of approaches to develop heat networks. In Edinburgh, the Council is installing communal heating systems into some of its multi-dwelling accommodations, with an eye to future expanding these to other buildings, if possible.

