TRANSFORM

WP4 – Implementation in Smart Urban Labs

Summary of the Synthesis Report

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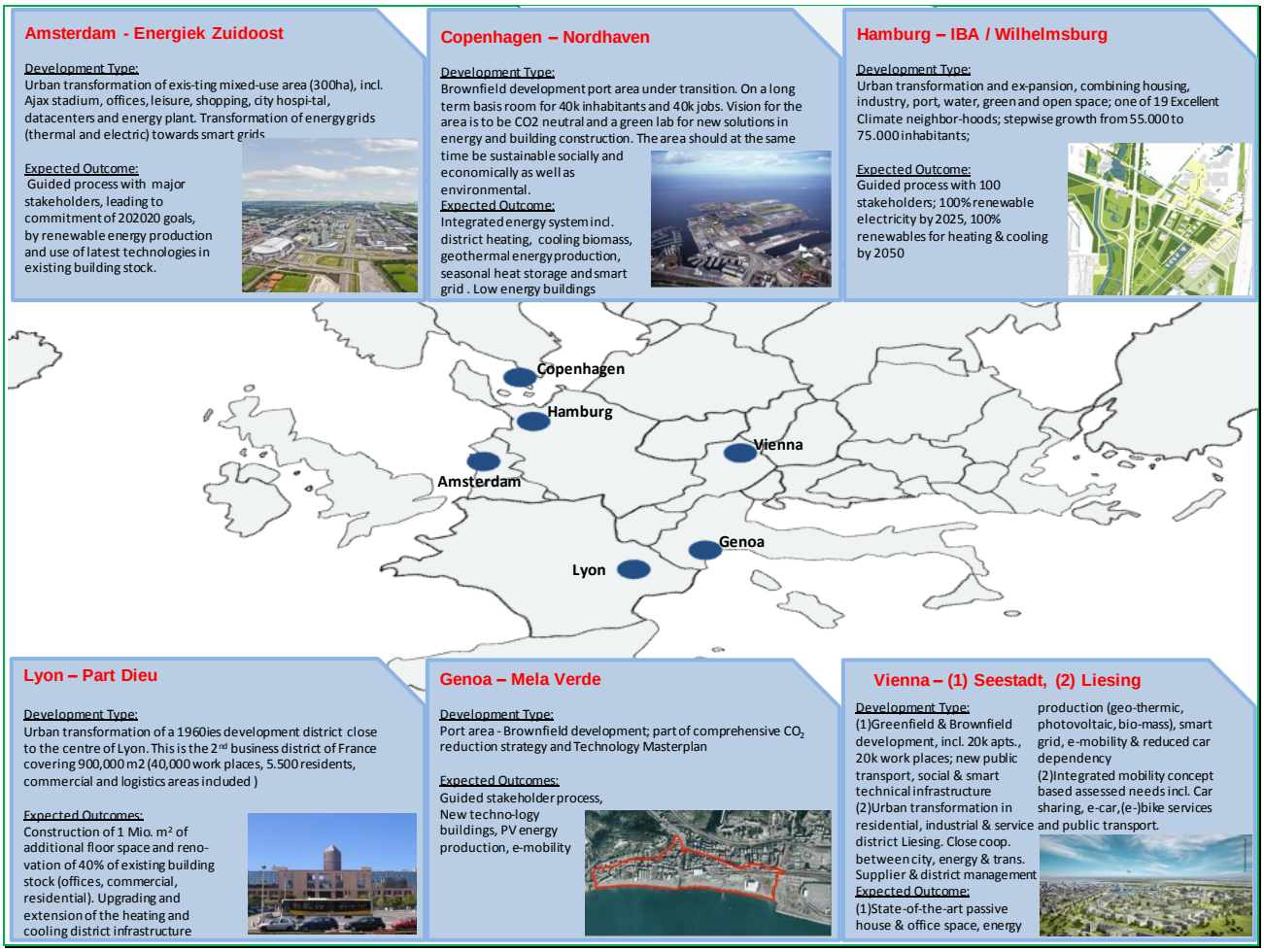
Preface

The TRANSFORM **WP4 Implementation in Smart Urban Labs** ensures the coordination of six Smart Urban Labs in each of the 6 participating cities. Through the working method "Smart Urban Labs" which included condensed working phases called **Intensive Lab Sessions (ILS)** using stakeholder involvement and design thinking methods, 5-10 year Implementation Plans have been drafted. The Implementation Plans are focusing on the conception of new energy systems, the quality and transformation of building stock, economic and legal prerequisites and – very importantly for making implementation happen – governance issues.

The selected Smart Urban Labs will provide an excellent variety of urban development phases, including the transformation of brownfield sites, former harbour areas, as well as re-development of fully built up and living districts. In this way, a realistic sample from European cities, also covering a wide range of geographic situations and different policy making traditions, is represented in this project and in workpackage 4.

The Smart Urban Labs in Copenhagen, Genoa and Vienna represent urban development districts which attempt to create a major innovative breakthrough in the integration of building technologies, smart infrastructure and in some cases, also sustainable mobility concepts.



The SUL approach in TRANSFORM has proven to be very successful, because it helped cities to start and intensify discussing energy planning within the administration and with stakeholders. By bringing stakeholders together with external advisors and experts from all over Europe, a new kind of discussion and collaboration started in our cities.

The SUL works as a platform and the method of ILS is a way to accelerate the collaboration between cities and key stakeholders in the area. By bringing together city planners and energy planners an new type of urban (re)development started. This is not only helpful for energy transition but also, in a broader sense, for the cooperation of different departments within cities' administrations: They need to work closer together to be able to involve citizens (Vienna), market players/building owners (Amsterdam, Lyon), housing corporations (Amsterdam), developers (Copenhagen and Vienna) and other stakeholders like distributors (Hamburg) and energy producers (Amsterdam, Hamburg).

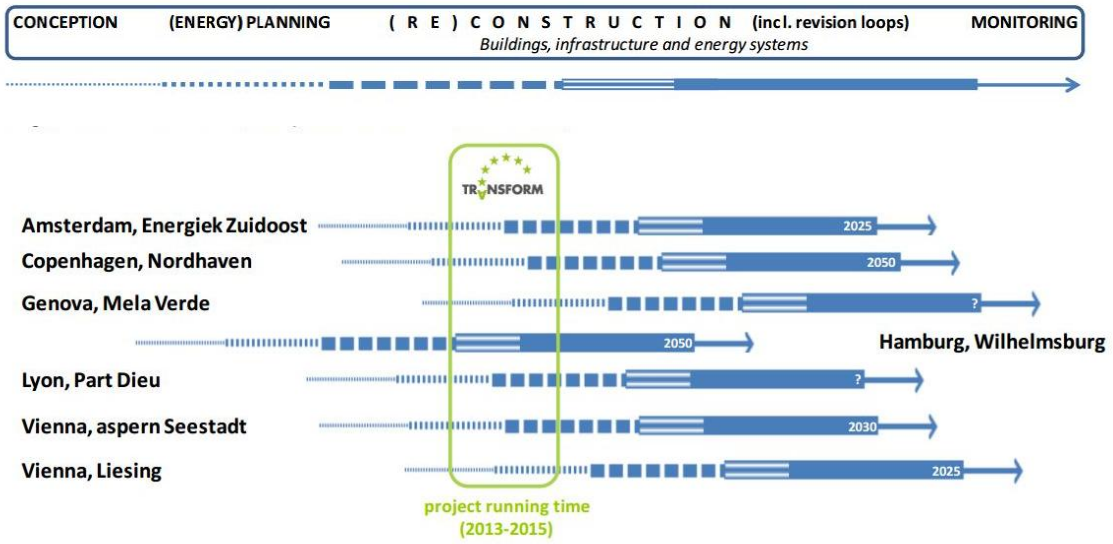
Without the TRANSFORM approach this new way of working, this new forging of alliances had not been not possible in a similar way. Through this intensive collaboration, a great number of insights on the various systems elements and their individual logic of operating and decision making could be won – the main findings and conclusions are summarized in the Synthesis Report D 4.3.

Summary

FP 7 project TRANSFORM has accompanied and supported the **urban and integrated energy system development process** in the 6 participating cities' **Smart Urban Labs (SULs)**, resulting in so-called **Implementation Plans** for each of these SULs with a 5 to 10-year perspective. The 6 SULs are of quite different character in terms of their development stage and challenges, representing the wide range from (slow) urban re-development to dynamic new (greenfield) development. This summary condenses the lessons learned from working with these SULs for two years.

SUL type: **G** = Greenfield **T** = Transformation	Area	Population today (2013/14)	Projected population	Jobs today (2013/14)	Projected jobs	Year of projection
Amsterdam, Energiek Zuidoost **T**	300 ha	18,000	20,000	18,000	18,500	2025
Copenhagen, Nordhavn **G**	250 ha/ 350 ha	0	40,000	5,100	40,000	2040
Genoa, Mela Verde **T**	280ha	12,758	12,800	n/a	n/a	n/a
Hamburg, Wilhelmsburg **T/G**	3,500 ha	55,000	69,160	n/a	n/a	2050
Lyon, Part-Dieu **T**	135 ha	5,000	7,100	45,000	80,000	2030
Vienna, aspern Seestadt **G**	223 ha	0	26,000	1,200	23,000	2030

The 6 SULs also are in different **stages of development**, ranging from early conceptualisation to project development with stakeholders in the area of construction of infrastructure and buildings, while the TRANSFORM project phase covers only a short period:



Source: OIR

Integration of urban development and energy transformation

Starting from the overall goal of bringing urban quarters onto the path of energy-efficient, climate friendly development, the approach has been to integrate urban development perspectives with the transformation of existing or with the design of new, future-oriented energy systems. Such **integration of urban development and energy planning** – aimed at transforming the cities' use of energy – requires

- ★ overall objectives (on the city level, but broken down to quarter level),
- ★ innovative strategy development (relating to energy, urban development and mobility) and
- ★ defining measures which include both, framework conditions (legal, institutional, economic) and direct interventions (through projects and processes)

"Strategy development" in the context of transforming cities to "Smart Energy Cities" means

- ★ defining priorities and the focus of measures, differentiating between
  – urban development type: new urbanization or renewal activities,
  – energy system development: efficiency, renewable production, networks, consumption
- ★ creating legal and economic framework conditions which spur contributions to transformation from markets, stakeholders and individual households

Governance

In order to do this, cities need to redesign their governance systems. **Main governance factors** for a future integration of urban development and energy planning are:

- ★ **Institution building:** goal-oriented, strategy-based close cooperation between municipal departments and key stakeholders (in the energy economy and the building sector)

- **Open knowledge and data provision** (energy atlas): as a basis for decision making, a high degree of transparency and open access to energy and building data are necessary
- **Smart/sustainable city guidelines and targets:** Needed as a basis for strategic decisions of individual actors in line with the overall strategy, e.g. breaking down overall targets to specific urban quarters
- **Framework conditions** related to the overall strategy: e.g. referring to competition rules, conditions to provide comprehensive energy services (including all potential carriers in energy systems per area), shift to the consideration of lifecycle-costs in business calculations etc.
- **Binding agreements** between public and private actors in urban (energy) development, relating to both, the overall strategic level and to the concrete urban development at local level (e.g. urban development contracts between city and developers)

Institutional re-arrangements and concrete cooperation designs, process designs and legal standard procedures need to be developed in the future, e.g. by initiating new cooperation formats between city departments, energy stakeholders and building developers.

Development processes and methods

Because every area is different and in a different phase of development, tailor-made solutions should be the norm. Still, the experience in six TRANSFORM cities, leads to the recommendation of two types of prototype procedures for area specific energy planning. One prototype is directed at green-field areas, while the other is directed at transformation areas.

The SUL experience shows that a sequence of well defined process-steps (as described below) will provide high quality development strategies and innovative technical and economically feasible solutions, setting the basis for successful binding agreements between partners in urban development.

Considering the high uncertainties about future energy costs and the fast changing technological options, it is necessary to create a development/planning process which is geared to provide innovative and sustainable systems for new urban developments, open for future, improved technical solutions.

It is recommended to use **power modelling** when starting a SUL, a quick scan of the legal situation and of the major stakeholders (including e.g. endusers, developers, grid operators, local production). This will deliver insight on a necessary mandate and on the willingness to collaborate of relevant stakeholders on the set vision.

Local, area-specific energy system planning

Concluding from the SULs experience, it is highly relevant to integrate the overall, city-wide perspective in the planning and decision-making on the energy strategy for individual urban quarters. Therefore, area-specific targets and implementation strategies are needed, because

- they allow to focus on specific local conditions,
- they are needed for activating local actors and stakeholders,
- they give a close look at energy consumption, use and efficiency,
- they provide for an integrating planning approach towards the different energy carriers (electricity, gas, heating networks etc.), which is essential for using all potential local resources and for reflecting local consumer demands.

A recommended **city-wide typology approach of urban quarters** could provide systematic information on the socio economic conditions, building structures and the existing energy supply system.

Prototype procedure for area-specific energy system planning: Greenfield

The following steps represent a **prototype procedure** for **integrated energy and urban development**, applicable for new urban quarters:

(1) City Planning department (or a development corporation) provides an urban development masterplan

(2) City Planning department (or a development corporation) in cooperation with Energy Planning department tenders an extended energy analysis/assessment to provide the necessary facts for decision making.
The assessment explores energy system options for the area based on the given, overall/city-wide targets and criteria and provides:
- ★ Energy demand forecasts based on different building standards and densities, for the overall plan and per development phase
- ★ Reachable CO_2 targets for alternative technical systems
- ★ Cost estimates
- ★ Different energy supply options for energy conversion and distribution to endusers
- ★ Possible governance structures for developing and running the energy system
- ★ And the systems are assessed by a social costs/benefit analysis.

(3) System selection:
City planning, energy planning, housing and other related departments decide the requirements for the future energy system, set CO_2 targets, define a financial strategy and other criteria (e.g. price ceilings etc.). A public hearing can be part of the selection process.

(4) Energy planning department leads a tender procedure for concession and selects a consortium of energy suppliers to give **a full service solution**, which means including the full scope of all energy carriers and needed supportive solutions like ICT and administrative necessities.

(5) City and energy planning define a connection area in accordance with the selected energy system (e.g. district heating and cooling) and obliges land owners/investors to link up to the grid via urban development contracts (or through a specific regulation in the Zoning Plan, if that is applicable)

(6) Implementation phase

(7) Monitoring and control: CO_2 limits, price levels, technical quality and security of the system (to be performed through cities or their agencies)

Experience with **these types of processes** – a stepwise development of options and targets, followed by a stringent tendering procedure – will **generate energy system solutions with best efficiency and CO_2 performance within given cost limits** and engages the public.

Prototype procedure for area-specific energy system planning: Transformation

For existing areas, the advised roadmap differs from the above, because energy systems and building stock are already in place. The legal framework to change this existing context is often

very limited in power. In order to transform, the commitment of all the asset owners is needed. Therefore in existing areas the focus is much more of a circular process including:

- ★ stakeholder management with a focus on the whole chain of local prosumers, grids and building owners/inhabitants to create a joint vision and approach
- ★ test and develop business cases, feedback this to the jointly set development approach and adjust the approach where needed.
- ★ The institutional organization and cooperation on planning, implementation and maintenance for urban development, energy systems and possibly other relevant topics like waste and mobility.

The prototype of this approach can be defined as follows:

(1) Stakeholder and citizen engagement:
Inventarisation of visions and investment agendas in smart energy topics
(2) Parallel, analyse the area quantitatively on the physical part (building stock, energy system etc).
(3) Parallel, make a power (to implement) model of the joining parties. Add parties and/or develop strategies to redistribute power to implement strategies to redistribute power to implement.
(4) Define a joint vision, development process and related projects
(5) Test projects on feasibility and develop new value models if needed (e.g. local integration of waste and or e-mobility with energy)
(6) If needed and possible: improve framework conditions like financing models, legislation, open data, collaboration models. This an essential link to city's planning (TA) or governmental administrations on the national/EU level
(7) Replicate successful projects and erect a structural collaboration which facilitates the management of the steps above

TRANSFORM process intensification: The Intensive Lab Session (ILS) Method

Through the participation of TRANSFORM cities' experts in the course of the project, all 6 SULs experienced an intensification of their ongoing development processes, using the **TRANSFORM-method of Intensive Lab Sessions (ILS).** This three-day open-innovation-type setting, with participation of all relevant stakeholders and experts from the international group, has proven to create a helpful and continuous work process. It is particularly helpful in a situation, where major stakeholders for energy systems and urban development needs to be brought together in an early stage of planning. The ILS- format should be seen as a process-intervention to be set at a specific point in time, when a flow of communication and the creation of ideas about an area's future shall be generated and sped up (e.g. in steps 2 and 3 of the prototype process, above).

Design criteria for smart local, integrated energy systems

Judging from the experience in 6 SULs, which are of quite different character (new urban quarters/urban redevelopment; fast growing or stable/shrinking population etc.), future "smart" energy systems need to feature **openness with respect to input sources and technological innovations as well as to changes in urban development.**

Sustainable, innovative and "smart" energy systems need to be designed

- in a "future-open" way with respect to (new) energy producers, technological innovations and efficiency gains
- to provide the potential for input from local (renewable) energy and other sources, like waste heat, in a stepwise mode, as the area evolves,
- to use local heating and cooling networks as backup systems for near-zero energy neighbourhoods, where hot water remains as the main heating energy consumption, (new areas only)
- to expect technological improvements, e.g. in PV and in storage systems, making future systems more independent from large grid power supply,
- to expect development in legal frameworks like for local energy exchange, new feed-in tariffs for electricity, and for energy performance for buildings.
- to cover different market conditions and price regimes, e.g. changes in prices for power and gas, as well as changes in the energy use on the consumer side.

One recommendation for cities is to bundle and integrate the systems designed not only in technological terms, but also in operational and economic terms. Long-term, holistic calculations for the business models seem to be a necessary precondition. A high degree of independence from short-term market conditions is needed to provide for more economic stability (see, for instance, the impact of current changes in energy prices on gas-powered CHP and heating systems).

Implementation Plans: Key strategies for local, integrated energy systems in the SULs

As indicated above, urban development perspectives in the 6 SULs differ widely, and so do the energy related strategies applied. A shortcut reads as:

- Amsterdam is applying an intensive process of stakeholder –based project development with respect to local energy production, waste heat use and building refurbishment for the area Amsterdam Southeast
- Genoa in a most difficult, stagnant economic and demographic situation, is focusing on urban redevelopment as precondition for energy optimization in the area of Mela Verde
- Hamburg, based on the 7 year IBA impulse, has already implemented a good deal of heating system infrastructure, using multiple energy sources and has developed a comprehensive plan for the area of Hamburg-Wilhelmsburg to become carbon neutral by 2050
- Lyon is planning to use major economic redevelopment schemes in the area of Part Dieu as the basis for a new energy system, including energy efficient buildings and the integration of energy carriers in the area, with the objective to double the areas' floor space at the current level of energy consumption
- Copenhagen, within the framework of the city's carbon neutral strategy 2025, is designing its new Nordhaven urban development project in near zero to plus-energy standards, using renewable energy production from the surrounding areas (mainly windpower)
- Vienna, within the new Smart City Framework Strategy, is designing the new urban development area aspern Seestadt with near zero building standards and flexible heat networks, using waste heat, biomass, groundwater and CHP sources.

These urban quarter represent good examples for characteristic situations currently to be experienced in European cities, while, of course, a great many more types exist.

SUL Implementation Plans – main strategies for integrated urban and energy system development

existing areas *new areas*

	Amsterdam, Energiek Zuidoost	**Genoa, Mela Verde**	**Hamburg, Wilhelmsburg**	**Lyon, Part-Dieu**	**Copenhagen, Nordhavn**	**Vienna, aspern Seestadt**
Stakeholder involvement	Stimulation for action	Governance (main stakeholders)	Stakeholder participation	Club Part Dieu	Early dialogue	
Buildings			building standards	building standards	smart buildings	building standards
Renewable energy production	big scale solar projects (7 000-15 000m2)	seawater heatpumps	priority for local renewable energy (heat and power)		PV-use	priority for local renewable energy (heat and power)
Electricity (demand, smart grids)	demand supply management, storage and e-car charging	smart meter, smart grids		electricity consumption, design and management of grids	demand management	
District heating	use of local waste heat		open DH networks	design and management	DH in the first phase	flexible DH networks
Transport infrastructure and mobility	charging infra-structure: electricity and green gas	light rail, bicycle infrastructure			mobility, transp. infra.	mobility, transp. infra.
Public participation	key element of development approach		accomp. participation			participation, neighbourhood management

Establishing integrated, local energy systems for urban quarters

Integrated local energy systems offer the chance to most efficiently use energy and integrate locally produced, renewable energies. “Integrated” also means comprehensive planning and prioritizing the use of different energy carriers towards overall efficiency and service quality. Such integrated energy systems are, however, highly complex in design, maintenance and cost sharing issues and it is not easy to achieve economic efficiency.

As a prerequisite, it is necessary to create future legal framework conditions and economic incentive structures providing

- ★ attractive conditions for citizens to live in low energy, sustainable housing and to enjoy affordable energy services
- ★ opportunities to participate in local or city-wide efficiency programmes, and
- ★ reliable economic grounds for citizens and firms to actively participate in the production and use of local energy sources, such as renewable or waste energies.

New framework conditions for integrated, local energy systems

The local area approach which includes decentralized production, storage and feed-in, is partly contradictory to the traditional top-down approach provided for in the legal framework conditions of today. Necessary changes in the legal (and financial) frameworks are:

- ★ Legal reforms, allowing the formation of (local) producer and consumer societies with respect to energy production, exchange and energy services (particularly important for electricity and heat)

- Legal reforms, allowing the integration of different energy carriers in production, distribution, storage and services for enterprises and (local) energy societies in order to make the approach of local area-focused energy service provision economically feasible and ecologically efficient
- Establishing a system of fair cost sharing between overall energy companies providing energy supply and grids on a supra-local level (city-wide, national or European level) and the local area system societies or companies.

Potential future model: Local Area-ESCOs for integrated energy systems

A future example would be the creation of Local Area ESCOs (energy service companies), servicing defined urban quarters in an integrated way, providing local renewable input, using efficiently "imports" from area-external energy markets, investing and operating in new supply systems and implementing retrofit programmes. For this purpose, city wide standards, tender procedures and concession processes will be needed.

Three-level energy systems: Cities and citizens are key

Concluding from the TRANSFORM-experience, European countries' future energy systems should develop towards interacting two or three-level systems, where the formation of local, integrated energy systems become established as new partners for the existing national or European carriers. Cities will play a key role in creating the framework conditions for initiating and establishing the local level Area-ESCOs, providing a procedural and legal framework with reduced risks for investors – be they from corporate background or from local citizens.

Winning the citizens' support for this new urban energy future is a main task for innovative politicians and the energy sector in the years to come – providing opportunities for citizens to invest in their own sustainable energy future could be a promising way.

Important issues for future research and development

Future research and development shall focus on both, technological and economic/legal issues with the objective to create efficient, integrated energy systems which can be handled and maintained at reasonable costs for the end users. **Main research and development issues** include:

- Design of a regulatory framework which allows for the build-up of the above sketched three-level energy system, with particular focus on the interaction between international/national carriers and networks and the local area service entities. The role and freedom of consumers/pro-sumers in such a three-level system should be elaborated with the objective to create stable, reliable and efficient system conditions relating to costs and environmental impact.
- Cities need support in the development of fast and effective transformation strategies for existing urban quarters, where the improvement of existing building stock and energy system stock is the main objective, while given infrastructure and contracts do not encourage such changes. The question is, if there are attractive incentive models which could be provided for market actors to spur investment in such transformation.
- A number of pilots projects for integrated local area energy services (performed through ESCOs) should be supported and monitored closely relating to their energy and environ-

mental performance as well as relating to their economic viability. For such pilot projects, a minimum number of test years will be necessary, with analytical comparison of the necessary regulatory preconditions and the energy system outcomes. Based on such an experience, the general design of governance and regulatory settings could be improved, providing for a general roll out of the local area service approach in the cities.

- ★ Existing financing schemes for research and development, including pilot projects and other high-level observatories should be adapted in order to make the funding accessible for the above purposes (Horizon 2020 and others).

In terms of **research policies** it seems important to

- ★ continue to provide the possibilities for international learning and knowledge exchange on (smart energy) district development,
- ★ stimulate the development of district organizations which have the mandate and capability to invest (or direct investments) in smart energy districts, e.g. through designated calls on this topic and by stimulating (comparative) research,
- ★ test other support schemes than calling for research and/or demonstration proposals. In addition, calling for financial support of local finance schemes or (revolving) funds can prove to be successful too.

The role of EU institutions in the evolution of a European sustainable, and smart future energy system cannot be underestimated: Energy, climate change and environmental sustainability are key themes on the European agenda, ranging from climate protection to economic and political independence from fossil fuel production countries. Therefore, with such important objectives in mind, European partners from all levels should cooperate closely to create integrated, smart energy systems and transform existing urban structures in our cities.