

Case Study Analysis IMAGINE Low Energy Cities

- Modena -

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1) Case Study Modena

Introduction to the city of Modena

Modena is located in the North of Italy in the region of Emilia-Romagna in the Po valley, with a population of 183,114 (Covenant of Mayors 2011). Modena is a university city and the capital city of the province of Modena¹. The city is labelled as modern industrial city with a historical city centre². The region of Modena is in addition a highly shaped und connected to agriculture³. It is denoted to be one of the greenest cities in Italy. Furthermore it is a rich and well developed region in Italy⁴. Modena is also a member of the Healthy Cities Network and a signatory of the European Sustainable Cities & Towns Campaign⁵.

Energy policy

The topics of energy saving and using renewable energy resources were introduced to the municipal level by the law 10/91 “Norme in materia di uso razionale dell’ energia, di risparmio energetico e di sviluppo delle fonti rinnovabili di energia”. Following this law each community with more than 50.000 inhabitants has to formulate a plan for the use of renewable energy at the local level.

The law no. 26 from 2004 provides the formulation of an “Il Piano Energetico Regionale” (Regional Energy Plan). The Il Piano Energetico Regionale contains the topics of energy, shows scenarios for regional energy, and defines targets of a sustainable development to meet the goals of the Kyoto-Protocol. Actions within the plan are

- saving energy in the sectors of buildings, industry, traffic and agriculture,
- development of renewable energy sources and
- dissemination of small production places for energy (decentralised energy production) using cogeneration of heat and power as well as district heating.

¹ <http://en.comuni-italiani.it/036/023/>

² <http://www.lagazzettaitaliana.com/modena.aspx>

³ <http://www.handelsblatt.com/politik/international/italien-die-wirtschaftlichen-nachbeben/6663688.html>

⁴ http://www.energy-cities.eu/db/modena_573_en.pdf

⁵ <http://www.sustainablecities.eu/fileadmin/content/aalborgcharter.pdf>

The transition process of the energy sector will be accompanied by the “Piano Energetico d’Azione Comunale/Intercomunale” (Municipal Energy Action Plan). Corresponding to the regional or provincial energy action plan, the Piano Energetico d’Azione Comunale/Intercomunale provides targets, strategies and measures for implementation of a sustainable development and a sustainable energy supply (COMUNE DI MODENA 2007, p.15).

Municipal tools:

- Piano Strutturale Comunale (PSC) = Municipal structural plan
- Piano Operativo Comunale (POC) = Municipal operation plan
- Urbanistico Attuativo (PUA) = urban implementation
- Regolamento Urbanistico Edilizio (RUE) = urban buildings (COMUNE DI MODENA 2007, p.16)

Modena has been an active city in terms of engaging for a sustainable development since a couple of years. It is a member of the energy cities network since 2010 and took part in various projects to facilitate topics like climate and energy (e.g the BELIEF project – Building in Europe Local Intelligent Energy Forums). The aim of the BELIEF project, running from 01.01.2006 to 30.06.2008, was the promotion of energetically sustainable communities⁶. Within the project Modena set-up three to four energy forums to enhance energy issues in action and policy on local level. Furthermore their goal was to develop a sustainable energy action plan⁷

Modena signed the Covenant of Mayors. They submitted their first SEAP “Piano di Azione per l’energia sostenibile” on July 18th 2011 and added another SEAP on November 19th 2012. Latter one is still in the process of formal approval (Covenant of Mayors n.d.).

Step	Date
Control and reduction of greenhouse gas emissions	Since 1996
City Energy Plan	2002
Greenhouse gas balance sheet	
Climate Alliance	
Climate Star Award	2002
1 st price at Eurosolar for energy saving and climate protection policies	2003
Law 10/91 “Act about the use, energy efficiency, energy saving and development of renewable energy”	
Act of energy planning and other territorial regulations for energy	2004
BELIEF project	2006-2008
Approval of energy-efficiency requirements by region Emilia-Romagna	4 th march 2008, enter into force on 1 st July 2008
Participation to the Covenant of Mayors (CoM)	5 th December 2011

Source: http://www.energy-cities.eu/db/modena_573_en.pdf

⁶ http://www.comune.modena.it/progettoeuropa/english/ChiSiamo_Progetti_Finanziati.php?nid=15091

⁷ http://www.energy-cities.eu/db/modena_575_en.pdf



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SEAP (Piano d'Azione per l'Energia Sostenibile di Modena 18th July 2011)

The base year of the SEAP formal approved on July 18th 2011 is set for 2009. The overall CO₂ emission reduction target is 21%. Therefore the community of Modena announced 20 sectors:

- Transport
- Buildings, equipment, facilities & industries
- Local energy production (electricity & heat/ cold)
- Land use planning
- Working with citizens and the stakeholders
- Others.

The SEAP is the instruments to implement set targets and consists of two parts:

- 1) An emission inventory showing:
 - o CO₂-emissions today and in the future
 - o Identifying barriers and chances for a sustainable development for the energy sector as well as the potential for using renewable energy production modes in the region
- 2) An action plan consisting of a number of actions initiated by the local authority to implement the determined targets.

	2009	2020	Reduction absolute	Reduction %
CO ₂ -emissions	1.047.000 t	881.395 t	220.349 t per year	20%

Table 1: Reduction targets Modena

Modena announced four strategies. Therefore the city in the future should be:

- Energy efficiency,
- Urban transportation,
- Solar energy generation and
- Sustainable urban development and growth.

The SEAP contains 20 sectors with overall 50 actions divided four each strategy.

Strategy	Sector	Action
An economical and efficient city	Illuminate the city by reducing consumption	Redevelopment plan lighting public
		Energy savings in traffic lights
	Reducing the energy consumption of public buildings	Redevelopment and energy certification of public buildings
		Pilot project to reduce fuel consumption electrical systems in public buildings
		Purchase of electricity certified as 100% green energy
	Implementation and promotion of successful experiences	New buildings with high energy efficiency
		Upgrading the energy efficiency of existing buildings
	Energy savings in industry commercial and third sector	energy savings in the commercial sector
		energy savings in the tourism sector
		Energy saving measures in the structures of

		hospitals
		Upgrading the energy efficiency of Polisportiva - Cooperative Space Modena
	Good practices of companies with high energy efficiency Energy savings in residential buildings	Caprari
		Tetrapack
		CNA
		Energy upgrading housing
		Buildings of excellence cooperatives home: new buildings Abitcoop
		The buildings with high energy efficiency made by the Consortium contractors (CME)
		Promotion of energy upgrading of privately owned buildings
		Savings in residential electricity consumption
	Increased efficiency in energy and environmental services	Increased efficiency in the distribution of methane gas
		Energy saving in water networks
		Energy saving in water purification
a city that moves better	Improving intermodal transport people and public transport local	Creating an intermodal station for trains and buses
		Facilitation of local public transport
	Reduction of private transport and of urban transit vehicles	The Plan of the Stop Center "atuttasosta"
		Creation of park and ride
		Plan of the mobility of goods
		Promotion of carpooling
	Modena made for bicycles	Project to optimize transport logistics waste (CONFAPI)
		Equipping the city for sustainable mobility
	Increased efficiency in technologies for the transport	Facilitation of the soft mobility and sustainable mobility
		Encourage the purchase of less polluting cars
A city solar distributed energy	Installation of PV	Pilot project for the promotion of self-electric
		Installation of photovoltaic systems on public heritage
	Energy recovery from waste	Installation of photovoltaic systems in private buildings
		Biogas plant Via Caruso
		production of biogas from the landfill Via Caruso
	District heating and cogeneration	Energy recovery from waste incineration
		Cogeneration and micro-plants in the service of residential and commercial buildings
A city that includes growth and change in a sustainable way	urban planning	Cogeneration and district heating service and public buildings for public use
		Introduction of variable energy in the PSC
		Introduction of variable energy in the POC
	Planning mobility	Introduction of energy efficiency standards and use of renewable energy sources in building regulations
		Schedule of cycle paths
		Interventions of urban forestation
Projects of Local Agenda 21 for energy saving	Green areas for CO2 absorption and mitigation of heat island	
	Sustainable mobility projects in schools	
		Voluntary Agreements for energy saving in schools

	Meetings and training for professional development	Creation of professionals with skills on energy efficiency and the development of renewable energy
	Promotion of energy saving, renewable energy sources and sustainable mobility	The Triennial Program Construction Quality (PTE and PTE2) Initiatives for the promotion of energy saving, renewable energy sources and sustainable mobility

Table 2: Measures for implementation within identified sectors (SEAP 2011, pp. 6)

“Overall, the implementation of the SEAP should allow a reduction of 2020 approximately 240,565 tons of CO₂ per year, equivalent to 21.8% of CO₂ emissions compared to 2009 and then the achievement of the expected reduction of the signing of the Covenant of Mayors (-220,349 t).” (COMUNE DI MODENA 2011).

European Healthy Cities Network

The City of Modena is member of the WHO European Healthy Cities Network which is part of a global movement to promote health issues on the local level. Therefore, local governments are engaged within the network. The Healthy Cities Network facilitates to enhance “health development through the process of

- Political commitment,
- Institutional change,
- Capacity-building,
- Partnership-based planning and
- Innovative projects.“

The overall goal is to foster and enhance the topic of health as an important issue into social, economic and political agenda of participating local governments⁸. Modena is the chair of the Italian Healthy Cities Network since a couple of years. Currently in the on-going Phase V (2009-2013) the topic of focus is “health and health equity in all local policies”⁹. Core themes for the cities within Phase V are:

- Caring and supportive environments,
- Healthy living and
- Healthy urban design.^{10, 11}

European Sustainable Cities & Towns Campaign

The European Sustainable Cities & Town Campaign¹² exists since 1994. Its aim is to “mainstream sustainable actions” and “gain wider political significance to support sustainable policies”¹³. During the first European Conference on Sustainable Cities & Towns in Aalborg, Denmark 1994, the Aalborg Charta, a “policy statement for local sustainable development”¹⁴, was approved by the participants¹⁵. As a result the campaign was founded to support cities in

⁸ <http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/urban-health/activities/healthy-cities>

⁹ http://old.sund-by-net.dk/fileadmin/user_upload/PDF_FILER/WHO/January_2012_National_Network_Briefing_FINAL.pdf

¹⁰ <http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/urban-health/activities>

¹¹ http://www.euro.who.int/__data/assets/pdf_file/0009/100989/E92260.pdf

¹² <http://euronet.uwe.ac.uk/www.sustainable-cities.org/sub2.html>

¹³ <http://www.sustainablegeneva2013.org/2012/10/05/esct-campaign/?lang=en>

¹⁴ <http://euronet.uwe.ac.uk/www.sustainable-cities.org/aalborg.html>

¹⁵ <http://euronet.uwe.ac.uk/www.sustainable-cities.org/aalborg.html>



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Europe on their way into a sustainable future through exchanging experiences, learn from each other and compile long-term local action plans (Local Agendas 21)¹⁶. Every city signing the Aalborg Charta is automatically a member of the campaign⁹. The Sustainable Cities Platform is a result of the Sustainable Cities & Town Campaign (1994-2003). Developed by the member states, the European Union and several European organisations, the Reference Framework for European Sustainable Cities (RFSC) toolkit, supports sustainable cities in achieving their sustainability goals. The benefit of RFSC is to

- practically support local authorities in implementation and application of sustainability guidelines within projects and policies,
- provides a basis for a network for European cities to exchange and share experiences¹⁷.

“Some of the most important knowledge tools or systems that are currently in use to promote the sustainable city is identified as:

- Partnerships between sectors to promote sustainability (e.g. the Network for Sustainable Business (NBE).
- IT solutions that simultaneously provide economic, social and environmental benefits.
- Citizen partnership, which contributes to better value for money, provides social benefits and supports the environment.
- Holistic planning and management of the public sector to support 3-in-1 solutions.
- Corporate Social Responsibility in the private sector.
- Sustainable procurement¹⁸.”

Actors

Civic Network of the City of Modena Mo-Net (rete civica del comune di Modena)	
Contact person	CLAUDIO FORGHIERI (coordinator of Mo-Net)
Address	Comune di Modena Rete Civica Mo-Net Servizio Comunicazione Marketing e Relazione con i Cittadini Piazza Grande 17 41100 MODENA, ITALY claudio.forghieri@comune.modena.it Phone +39 059 2032456- Skype claudio.forghieri
Background	civic network of the city of Modena
Activities	cooperating with different Institutions and firms dealing with web-marketing, e-government development of education projects in information technology ¹⁹
Link	http://www.comune.modena.it/

Modena is labelled as being one of the most modern local authorities in using public online communication²⁰.

¹⁶ http://euronet.uwe.ac.uk/www.sustainable-cities.org/aal_uk.html

¹⁷ <http://www.sustainablecities.eu/news/>

¹⁸ <http://www.sustainablecities.eu/home/welcome/>

¹⁹ <http://www.comune.modena.it/~claudio/claudio.htm>

²⁰ http://www.comunitazione.it/leggi.asp?id_art=725&id_area=161&id_mac=4&t=309&trovato=usabilit%E0



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Energy and Sustainable Development Agency of Modena (Agenzia per l'Energia e lo Sviluppo Sostenibile di Modena AESS)²¹	
Contact person	Piergabriele Andreoli (executive director) Gianluca Avella (Energy planning and EU projects area)
Address	via Caruso 3, 41122 Modena – Italy +39 059 451207/ +39 059 453214 info@aess-modena.it gavella@aess-modena.it
Background	nonprofit organisation ²² member of Energy Agency Saving Company Italian Network RENAEL approved as Energy Saving Company by AEEG (Italian energy authority)
Foundation	1999 by Modena Municipality and Province, Chamber of Commerce, the former energy utility of Modena "META" and the former local transport company "ATCM" supported by EC SAVE II Programme ²³
Activities	<i>Overview:</i> "supports public and private bodies for the deployment of the environmental-energy policies of the Modena local Administrations, namely energy efficiency and renewable energies" ⁶
	"promotion of renewable energy source" ⁶
	"reduction of energy consumption among Local Authorities, SMEs and consumers" ⁶
	<i>More detailed:</i> "carries out, for its own partners, energy audits and buildings certification as accredited body by the Emilia-Romagna Region, feasibility studies on energy refurbishment projects and develop projects on renewables , through its engineer staff skilled on design."
	"provides consultancy to every level of Local Authority concerning energy planning and its regulatory tools, public lighting renovation, provides assistance in connection with Energy Performance Contracts about the management of public heating systems in schools, public offices, sport centres, libraries, nursing homes, etc."
	" promotes Memorandum of understanding and Purchasing Groups in order to ease the diffusion among citizens of renewables and energy efficiency measures and it is involved in many EU projects focused on awareness raising and innovative tools , in order to promote best practices in the field of RES and RUE."
	"has the institutional role to provide information on incentives/financial schemes about renewables and energy saving measures to the interested citizens, it is in charge of training sessions for officers, school lessons with pupils and carries out informative meetings in cooperation with public bodies or nonprofit organisations." ²⁴
Link	http://www.aess-modena.it/

²¹ <http://www.managenergy.net/actors/86>

²² <http://www.aess-modena.it/en/who-we-are.html>

²³ The aim of the SAVE Programme by the European Union was to encourage and improve energy efficiency within all sectors. SAVE II appealed to improve "energy intensity of final consumption by a further percentage point per annum over and above what would have otherwise been achieved" (European Commission 2005, p.17).

²⁴ <http://www.aess-modena.it/en/what-we-do.html>



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City of Modena – Secretariat of the Italian Healthy Cities Network	
Contact person:	Daniele Biagioni (National Coordinator Italian Healthy Cities Network)
Address	Comune di Modena Settore Ambiente - Comune di Modena via Santi 40, 5th Floor 41123 Modena + 39 059 2033535 daniele.biagioni@comune.modena.it
Background	National department of a special agency of the United Nations organisation WHO
Activities	"developing and sustaining their national health policies, health systems and public health programmes; working to identify, prevent and overcome potential threats to health; anticipating future challenges; and advocating public health."
Link	www.retecittasane.it

Modena has a deep tradition of working closely in collaboration with local schools

The earthquake happened in May 2012 and served as an opportunity to implement aspects of sustainability immediately. New buildings should not only be earthquake save, but in general sustainable, including energy efficient and at the highest standard for sustainable energy requirements. During the seminar in Modena, several people mentioned the increase of energy efficient and sustainable buildings after this event.

The case of Modena shows that other circumstances, like in this case high air pollution due to the local economy and being located in a valley with barely any wind, contributed to a high awareness and consciousness for topics of sustainability.

Another cut was the economic crisis in Italy, leading to decreased budgets.

2) Transition Activities in Modena

Cluster	Activity	Manifestation	Description	Assessment
Strategic	Problem structuring	National law no 10/91	Requires the development of a hierarchy of plans on national, regional, local level to reach CO ₂ emission reduction targets ("Strategia Energetica Nazionale", Piano Energetico Regionale", Piano Energetico Comunale"), aims to reduce emissions through renewable energy generation and increasing energy efficiency and savings	<ul style="list-style-type: none"> • Energy transition framed as technical problem of energy generation, efficiency and savings by national legislation • Connection with the topics of air quality and public health at the local level • Aspects of individual behaviour, consumption, values not covered/addressed <ul style="list-style-type: none"> ▶ Design a more open and adaptable process of problem definition and goal formulation ▶ Use the participatory benefits of qualitative analyses and models ▶ Identify and involve frontrunners in problem structuring ▶ Establish a broader, integrative perspective on energy transition
		Regional Energy Plan ("Piano Energetico Regionale")	Analysis of the so-called "pressione energitica territoriale" ("spatial energy pressure") of the City of Modena and definition of a basic approach of action, methodology legally defined	
		Local Energy Plan ("Piano Energetico Comunale")	Local plan dealing with the topics of energy efficiency and use of renewable energy sources, definition of action strategy, legally required by national law	
	Envisioning	-	No abstract overall long-term vision	<ul style="list-style-type: none"> • Lack of an overall long-term vision which could integrate and bundle different administrative activities <ul style="list-style-type: none"> ▶ Develop a transition vision ▶ Develop a transition vision in a participatory process ▶ Adjust the transition vision during the transition process
	Exchange of perspectives	Workshops, forums, use of webpages, newsletters, social media	Various forms of participation using different forms of communication targeted at different groups of local community, use of digital and social media, on-going process, public participation in planning, implementation, and evaluation	<ul style="list-style-type: none"> • Well-established practices of participation using different means of communication • Allow agenda setting by community members • Can function as a transition arena • Provides the opportunity to integrate a big share of the local community in the discussion of energy transition by building on well-established practices of participation <ul style="list-style-type: none"> ▶ Gather and share ideas of a "low energy city with a high quality of life" ▶ Use established forms of communication to communicate the transition vision
		The Civic Network of Modena ("Rete Civica MoNet")	Website of the City of Modena, used to spread information, discuss municipal plans, strategies, measures, projects and make suggestions by the local community	
"Effetto Modena"		Platform of information and discussion using different formats of participation (public meetings, discussions with experts, information via social media, lectures by professionals, etc.) to bring together citizens, experts, businesses, organisations, broad thematic focus: urban planning, economy, welfare		
Tactical	Thematic visions	Modena Energy City	Overall mid-term goals: 20% of energy demand covered by renewable energy sources, 20% reduction of energy consumption, 20% reduction of CO ₂ emissions by 2020, vision/strategy connected to SEAP	<ul style="list-style-type: none"> • Mid-term vision which connects goals of (technical) energy transitions with urban planning, urban transport and urban health • Thematic visions not integrated due to the lack of an overall, long-term vision
		Local Energy Plan ("Piano Energetico Comunale")	Local plan dealing with the topics of energy efficiency and use of renewable energy sources, definition of action strategy, legally required by national law	
	Agenda	Goals and fields of action of SEAP	Development of goals for the strategic fields energy consumption and efficiency, urban transport and renewable energy production	<ul style="list-style-type: none"> • Transition agenda mainly characterized by technical aspects of energy transition <ul style="list-style-type: none"> ▶ Address the role of individual behaviour, consumption, values and awareness for energy transition ▶ Orient and integrate strategies and plans towards long-term goals and the transition vision
		Goals of Local Energy Plan ("Piano Energetico Comunale")	Development of goals as part of an action strategy, topics: energy efficiency and use of renewable energy sources	

	Networks	European Healthy Cities Network	Network of municipalities to promote public health through collaborative measures on the local level	<ul style="list-style-type: none"> • Active involvement in international city networks enhance learning • Informal networks involving citizens on local level characterized by changing participants <ul style="list-style-type: none"> ▶ Build and promote coalitions for energy transition ▶ Develop and implement goals, strategies, plans and projects in co-operation
		European Sustainable Cities & Towns Campaign	Network of European municipalities to share knowledge and transfer good practices to mainstream sustainable actions into local policies	
		Participatory budgeting ("via per via")	Series of meetings which gives local citizens the opportunity to decide on how a defined share of the public budget is to be spent, topics: safety, liveability, urban maintenance, quality of life in the City of Modena	
Operational	Experiments	Project "Sole per Tutti"	Foundation of a cooperative of the LA, citizens, teachers and parents to finance photovoltaic panels on the roof of a primary school	<ul style="list-style-type: none"> • Transition experiment that fits the transition activities in Modena <ul style="list-style-type: none"> ▶ Develop a portfolio of experimental projects ▶ Design experiments for learning purposes
	Implementation	Fields of action of SEAP	Development of measures for 20 so called sectors related to energy consumption and efficiency, urban transport and renewable energy production, definition of implementation costs, time frames, responsibilities	<ul style="list-style-type: none"> • Development and implementation of extensive technical measures <ul style="list-style-type: none"> ▶ Promote the cooperation of actors in implementation
		Actions of Local Energy Plan	Development of measures based on the action strategy, topics: energy efficiency and use of renewable energy sources	
Reflexive	Monitoring/Evaluation	Emission inventory of SEAP and Local Energy Plan	Analysis of local emissions establishing baseline for Local Energy Plan and SEAP	<ul style="list-style-type: none"> • Monitoring only captures tactical and operational activities <ul style="list-style-type: none"> ▶ Broaden the scope of monitoring and evaluation
	Adaptation/Adjustment	On project level		<ul style="list-style-type: none"> • Adjustment of sectoral plans, targets and projects likely

Strategic Activities

Problem structuring

The discourse regarding the energy transition of the City of Modena is shaped by national legislation which frames the problem of greenhouse gas emissions as a technical problem of energy generation, efficiency and savings (COMUNE DI MODENA 2007: 9ff.). The regional and local level are legally required to develop Regional and Local Energy Plans (“Piano Energetico Regionale” and “Piano Energetico Comunale”) which contain analyses and targets for the reduction of CO₂-emissions at the regional and local level. Thus, even though the SEAP of Modena does not refer to the Local Energy Plan of Modena it can still be considered to structure the perception and handling of the problem. Consequently, the SEAP of the City of Modena is also a technical document in nature with mainly technical measures focusing on the energy efficiency of buildings, the generation of renewable energy and measures in urban transportation to reach its goals (COMUNE DI MODENA 2011: 6ff.; INTERVIEW 5). Changes in individual behaviour and consumption patterns are not covered by the official strategies and plans even though the need for addressing these aspects is seen by local stakeholders (INTERVIEWS 5, 6, 7).

Furthermore, the local discourse of energy transition and reaching emission reduction targets has been connected with the discussion of air pollution and air quality in the City of Modena. Local activities to reach the reduction of CO₂ emissions through energy transition are also discussed as measures to reduce air pollution and improve air quality and public health (COMUNE DI MODENA 2011: 3; INTERVIEW 7). The City of Modena plays a very active role in the WHO Healthy City Network where it holds the chair of the Italian Healthy City Network (INTERVIEW 5). Therefore, WHO targets are broken down into local plans and strategies. Furthermore, as air the quality of the City of Modena has always been an issue due to its geographical position (INTERVIEW 7) the topics of climate mitigation, energy transition and air quality have been strategically connected (INTERVIEW 6).

The problem definition is dominated by regime actors and institutions (LA, Energy Agency, national institutions on the landscape level). There is no involvement of other societal actors as a participatory problem structuring is missing. This results in a one-sided perspective and conceptualization of energy transition with a technical focus. This is also reflected in the system analysis which quantifies energy generation and consumption and neglects qualitative analyses and the influence of behaviour and consumption. The connection of energy transition with problems of air quality is specific to the local situation and increases the urgency to act of different actors.

Recommendations:

Design a more open and adaptable process of problem definition and goal formulation. *Let non-public actors (of businesses, knowledge institutions, NGOs) participate in discussions about the problem, its urgency and complexity. This may result in a more integrative perspective, a shared conceptualization of the problem and an increased willingness of non-municipal actors to contribute to energy transition with individual measures. Furthermore, it brings various forms of knowledge together and allows the co-production of knowledge through cooperation. Moreover, the feedback from actors can make the process more adaptable to technical and ecological changes in regard to innovation and structural change.*

Use the participatory benefits of qualitative analyses and models. *To broaden the system analysis quantitative models and indicators should be supplemented with qualitative as-*

pects. While quantitative analyses need to be executed by experts and favour these in discussions about problems and possible solutions quantitative models promote the discussion beyond the small group of experts. They are easier to communicate to laymen and can thus enable a broad discussion on the various aspects and interrelations of energy transition.

Identify and involve frontrunners in problem structuring. Key actors and networks should be integrated in the process of problem definition and goal formulation. The selected actors should reflect the most important societal perspectives relevant to energy transition. Frontrunners should have the ability to consider complex problems at a high level of abstraction, look beyond the limits of their own discipline, enjoy authority within various networks, have the ability to communicate energy transition within their own network (or organisation) and be open for innovation instead of having specific solutions in mind.

Establish a broader, integrative perspective on energy transition. Energy transition is a complex field of action with various interrelations with other aspects. Connecting energy transition with other topics, as already done with the discussions on air quality, may result in a higher motivation of non-municipal actors to realize individual measures as it may increase the urgency of the problem. A broader, more integrative problem definition is likely to result from the involvement of different actors in the process of problem structuring and goal formulation.

Envisioning

There could no abstract, overall vision be identified which could provide long-term orientation for the local energy transition process. Thus, the City of Modena lacks a fundamental debate upon its future, long-term development which could achieve new insights and determine the trajectory of future transition activities. The vision of Modena's SEAP, Modena Energy City, formulates the desired future state targeted by the SEAP for the timeframe of 2020. As such it covers the areas energy efficiency and savings, urban transportation and production of renewable energy (COMUNE DI MODENA 2011: 16f.). It can be considered a try to integrate these areas with the future urban development of the city. However, with its mid-term orientation and rather technical nature, Modena Energy City is not the type of shared, inspiring, mobilizing vision suggested by Transition Management.

Local stakeholders also perceive a lack of an overall vision (INTERVIEWS 6, 7). The SEAP of the City of Modena is considered to be too technical to function as a long-term vision (INTERVIEW 5). Therefore, it is considered to be not suitable to trigger and support cultural and behavioural changes of individuals and institutions (INTERVIEW 5). Furthermore, with its time horizon of 2020 the SEAP is too short-term oriented to target long-term changes and challenges. Local stakeholders see the need of a long-term vision to form the basis for the development of goals and projects (INTERVIEWS 5, 7). The development and discussion of a shared vision is considered to be able to change the perception of the people involved (INTERVIEW 5) and therefore can be crucial for the success of the local transition process.

Furthermore, local stakeholders describe the missing integration of different long-term strategies and plans of different administrative sectors at the local level (INTERVIEW 6). Reaching the integration of strategies and targets and increasing the collaboration and communication among different administrative sectors at the local level is considered to be crucial (INTERVIEW 6). Therefore, the development of a long-term vision of energy transition is seen as a means to support the integration across different administrative sectors and produce synergies (INTERVIEW 6). However, local stakeholders consider the current economic crisis to hinder the formulation of an ambitious long-term vision of the future development of the city as a vision is seen as "bet for the future" (INTERVIEW 7) which no one is willing to take at the current circumstances.

There is no abstract, long-term vision in place. Therefore, goals, strategies, plans and measures of different (administrative) sectors and actors are not integrated towards a shared overall goal. A common reference frame to guide short-term action is missing. The parallel existence of the Local Energy Plan and the SEAP is one indicator for that. Furthermore, the potential of mobilizing individual activities of different actors by a shared, inspiring vision is not used for the energy transition process.

Recommendations:

Develop a transition vision. *An inspiring, attractive and imaginative vision of the future that defines a structurally different and more sustainable (energy) system is needed to guide mid- and short term actions. The transition vision is an abstract, qualitative and normative metaphor/picture of a sustainable (energy) system (“a low energy city with a high quality of life”). It aligns individual actions (of public, private and societal actors) towards long-term goals and mobilizes and coordinates different actors across sector boundaries.*

Develop a transition vision in a participatory process. *The transition vision should be based on a shared problem definition accomplished by different actors (frontrunners of public institutions, private businesses, NGOs, networks, etc.). Envisioning is the next step following the participatory problem definition. In order to be able to develop an alternative image of the future (sustainable) state of the system in question the people involved should be innovative opinion makers, trend setters and generalists with overview and social authority (see also recommendations on problems structuring). These are able to communicate the vision within their institution and thus actively spread the developed image within institutions and organisations relevant for energy transition.*

Adjust the transition vision during the transition management process. *The transition vision is not a fixed goal. Rather, it should be adjusted to lessons learnt, experiences made and changing framework conditions. Continuous learning on problems and solutions is crucial for energy transition. Therefore, long-term visions and goals defining “the right direction” have to be redefined as the long-term process towards sustainability proceeds.*

Exchange of Perspectives

The City of Modena has established constant processes of communication targeted at different groups of the local community. Information and participation is reached by using different means of communication such as media (print, TV), digital and social media, round tables, information events etc. Local stakeholders are not only constantly informed using different formats but also have the opportunity to actively participate e.g. by making suggestions using the website of the City of Modena especially established for this purpose. Digital and social media are very actively used both by local institutions and local networks. Participation is possible at the planning, implementation, and evaluation phase of municipal plans and strategies (INTERVIEWS 5, 6). The offers to participate by the municipality are well received as they attract wide interest in the local community (INTERVIEW 6). Furthermore, the long tradition of using different forms of direct communication and participation by the city has created the expectation among citizens, businesses and institutions to be provided with information about municipal plans and measures (INTERVIEW 7).

The “constant exchange of information between the local government and local stakeholders” (INTERVIEW 6) is seen to establish a new relationship between the local administration and the general public where direct communication and collaboration is possible (INTERVIEWS 6, 7) and a new form of virtual access to the city administration and its services is created (INTERVIEW 7). Participation is seen as a means to strengthen the position of local

citizens compared to the municipal administration (INTERVIEW 7). Furthermore, members of the administration of the City of Modena consider the participation of local stakeholders as means to generate and integrate new ideas and thus to create new opportunities for the city (INTERVIEW 5). Public participation is regarded as contribution to the change of behaviour and attitudes (INTERVIEW 5). As these changes are considered to be crucial for the successful energy transition process (INTERVIEWS 5, 7) this explains the high value that is assigned to the contribution of public participation.

The well-established platforms of communication form a sound basis for discussing and enhancing the energy transition process in the City of Modena. As an overall long-term vision has not been developed yet they have not been used for exchanging ideas about the vision of a low energy city with a high quality of life. However, as they are well accepted and widely used they provide the opportunity to involve a wide share of the local community in the vision development process.

Furthermore, there is a tradition to involve the main economic and environmental associations in plan development processes (INTERVIEW 6). However, to directly involve small and medium businesses is considered to be problematic but crucial for reaching the low energy city (INTERVIEWS 5, 6). Reasons for the difficulties in communicating with small and medium businesses are seen in the low experiences in communicating with this target group and the narrow view of the businesses on energy transition as they are only interested in measures which benefit them right away (INTERVIEWS 5, 6). Framing the energy transition as economic opportunity is seen as a chance to engage local business with the long-term process (INTERVIEW 5).

There is no exchange of perspective on the level of strategic activities. Therefore, there is no guiding and integrating long-term perspective of an alternative (sustainable) future. This results in the lack of a shared problem definition which acknowledges its complexity and a lack of integration and mobilization of individual actions of different actors. However, there are well established forms of communication and participation which can be used for an exchange of perspectives on strategic level.

Recommendations:

Gather and share ideas of a “low energy city with a high quality of life”. The LA successfully uses social and digital media to exchange views and discuss with local stakeholders and citizens. These well-established forms of communication can be used to develop innovative, creative and inspiring ideas of an alternative and more sustainable future. These may be used for the development of a broadly shared transition vision.

Use established forms of communication to communicate the transition vision. Once developed the well-established forms of communication and participation can be used to communicate the transition vision to citizens and stakeholders. This can further raise awareness for the topic of energy transition and promote discussions and individual actions of different actors.

Tactical Activities

Thematic visions

In the City of Modena there are a number of individual plans and strategies which formulate mid-term goals or visions for specific subthemes of energy transition. However, as an overall vision is missing these are not integrated and do not work towards an overall long-term goal. The vision Modena Energy City formulates the desired future state targeted by the SEAP of Modena. As such it covers the areas energy efficiency and savings, urban transportation and

production of renewable energy for the timeframe of 2020. Furthermore, it thematises the integration of these topics into urban planning and the communication with the local community (COMUNE DI MODENA 2011: 16f.).

Next to the SEAP there is the Local Energy Plan (“Piano Energetico Comunale”) which defines mid-term goals for the thematic areas of energy efficiency and the production of renewable energy at the local level. The municipality is legally required to draw up this plan while its thematic extent is congruent with the topics covered by the SEAP. Both documents are fairly technical and can thus be regarded as thematic visions for defined sectors.

In particular, the parallel existence of the SEAP and the Local Energy Plan can be interpreted as a symptom of their missing integration. While the Local Energy Plan is mandatory, the SEAP stems from the voluntary commitment of the City of Modena in the Covenant of Mayors. This has led to parallel structures due to the lack of integration.

The co-existence and missing integration of different mid-term strategies is also perceived by local stakeholders (INTERVIEWS 5, 6). Main challenges in the development of integrated strategies of energy transition are seen in the shared responsibilities within the municipal administration for fields like urban planning, building and housing, urban transportation, etc. and the high level of communication and collaboration required (INTERVIEWS 5, 6). Thus, the integration of activities within the municipal administration presents a major challenge.

There are various more concrete sector-specific strategies and plans which define mid-term goals to guide the formulation of specific measures. However, these are not integrated towards an overall, long-term goal which hampers the energy transition process. Following the problem structuring, technical aspects of energy transition on city and building level (urban planning, urban transportation, building and housing) are focused.

Recommendations:

Following the recommendations for the strategic transition management activities will result in a broader approach towards energy transition (including individual behaviour, consumption and awareness) and the integration of sectoral goals, strategies and plans towards the (yet to be defined) long-term vision. Furthermore, the LA is experienced in developing sectoral goals, strategies and plans. Therefore, there are no specific recommendations needed for developing ‘sectoral visions’.

Agenda

At the local level of the City of Modena, the 20 fields of action defined in the SEAP (COMUNE DI MODENA 2011: 6ff.) and the goals of the Local Energy Plan (COMUNE DI MODENA 2007: 33ff.) can be interpreted as transition agendas. Both make specific statements about measures and sub-goals to reach the vision Modena Energy City. However, as these plans are rather sectoral plans which lack an integrated approach (see ‘envisioning’) it only provides an agenda for the technical energy transition. There are no other implementation plans covering other aspects of energy transition such as the behaviour and consumption of individuals. This can be seen as a direct consequence of the missing overall vision.

Local actors consider financial support of the regional, national and international levels necessary to realize local transition agendas (INTERVIEW 5). Therefore, the coordination with national and regional activities is crucial, also to exploit funding opportunities by these levels to further promote the transition process. Furthermore, cooperating and co-financing measures with private actors is also considered highly important (INTERVIEW 5). As the influence and (financial) means of the local level is limited improving the cooperation with private actors in developing and implementing measures on a regular basis provides the op-

portunity to further promote the local energy transition. Framing the transition as an economic opportunity (see also 'exchange of perspectives') can be a means to reach this goal.

Both the SEAP and the Local Energy Action Plan can be considered transition agendas as they comprise action plans that define intermediate goals, actions, means and responsibilities. However, due to the lack of an overall vision these are not integrated and coherent. Also, the narrow problem definition, framing energy transition as a technical problem, results in transition agendas which don't follow the broad, integrative approach needed to tackle complex problems such as energy transition. Both aspects hinder the transition process as it makes coherent action of different actors and the development of a variety of measures difficult.

Recommendations:

Address the role of individual behaviour, consumption, values and awareness for energy transition. *The transition to a more sustainable energy system requires more than just technical measures. Therefore, the expansion beyond technical questions is needed. Introducing the role of individual behaviour and consumption, values and awareness of citizens and stakeholders in (municipal) goals, strategies, plans and measures further broadens and promotes energy transition. Thus, municipal, goals, strategies, plans and measures should address these non-technical fields of action.*

Orient and integrate strategies and plans (transition agendas) towards long-term goals. *Due to the lack of an overall, long-term vision parallel activities could emerge such as the SEAP and the Local Energy Action Plan. Once a transition vision was developed, sectoral goals, strategies and plans should be integrated towards its abstract, overall goals. The vision works as a framework for orientation for actors of different sectors and domains and their short-term action.*

Networks

The City of Modena is very active in international city networks such as the WHO Healthy Cities Network and the collaboration in INTERREG projects. These can function as platforms for exchange which can lead to the introduction of new topics to the local level. Furthermore, sharing experiences with other cities can enhance learning processes among members of the municipality which may be reflected in municipal projects, plans and processes. Thus, the collaboration in international city networks may promote local transition activities as it may introduce innovative measures and practices to the City of Modena. However, the influence of the international networks is highly interdependent with various other factors such as on the institutional and individual level. Therefore, their actual influence on local transition activities may be low or non-existent and cannot be evaluated with this analysis.

Moreover, the City of Modena follows a pro-active approach in communicating with local stakeholders through the use of the internet and social media both on the strategic and on the tactical level (see 'exchange of perspectives' above). Due to these well-established channels of communication relationships with actors of the private sector could be established (INTERVIEW 7). Furthermore, local residents can discuss and decide on measures and projects close to them (for example through participatory budgeting). However, there are no continuous, more formalized forms of collaboration with local stakeholders. The development of networks with more persistent institutional structures could not be identified. Thus, the networks with local stakeholders are characterized through changing participants from the private sector and society depending on the topic/project of discussion. This approach has the advantage that there are low barriers for the participation of new stakeholders rather

than defining a set group of actors. Niche actors therefore can introduce their topics to the discussion which may enhance innovation and thus transition. However, the ad-hoc networks may make it difficult to consistently work towards an overall goal such as the transition to a low energy city.

Local actor networks are mostly ad-hoc, centred on specific projects and volatile. Persistent, institutionalized actor networks could not be identified on the local level. As actor networks play an important role in communicating and thus spreading the transition vision, contributing to innovation creation and implementing experiments and actions the lack of persistent actor networks may hamper the local energy transition process.

Recommendations:

Build and promote coalitions for energy transition. *Energy transition requires action not only by public (municipal) actors but also by private and societal actors. Actor networks have to develop and implement (innovative) projects and communicate goals and content of the transition agendas in order to broaden energy transition beyond the public sector and enhance the whole process. Therefore, the promotion of new and existing actor networks is crucial for promoting the local energy transition. A variety of actor networks (with and without the involvement of the LA) touching on different aspects relevant for energy transition is beneficial.*

Develop and implement goals, strategies, plans and projects in cooperation. *A successful energy transition requires participation and cooperation in problem structuring, vision development, agenda building, experimentation and implementation. Formal and informal actor networks communicate and thus spread transition vision and goals, may develop innovations as result of their interaction and develop and implement plans and projects. Therefore, goal formulation and strategy and plan development cannot be closed process dominated by the LA. Rather, these processes should be genuinely cooperative, allowing actors to get involved in planning and implementation exercises. Co-developing and co-financing measures may also be a means to promote action in light of scarce financial resources of public institutions. Framing energy transition as an economic opportunity for private actors may promote their engagement and cooperation.*

Operational Activities

Experiments

In Modena there is a long tradition of working with primary and secondary schools (INTERVIEW 7). Thus, information targeted at teachers and pupils is used to inform, educate and influence behaviour and values. Local stakeholders highly value the direct communication and collaboration with the educational sector and consider it “a part of the soul of the city” (INTERVIEW 7). When the City of Modena realized the installation of photovoltaic panels as cooperative project they built on the tradition of working with schools. As part of “sole per tutti” project there was a cooperative founded to finance the installation of photovoltaic panels on a local school. The local authority, teachers, parents and local citizens collaboratively invested in the project. Thus, “sole per tutti” can be considered a not-business-as-usual-project to realize innovative forms of collaboration and funding of projects.

The “sole per tutti” project well fits in the local transition activities focusing on technical aspects of energy generation. Furthermore, it can carry on the discussion of so far technical questions of transition to aspects of individual behaviour through the collaboration with the school and the integration of the topic into education. Thus, the experiment can contribute to the energy transition of the City of Modena. However, evaluating the experiment in order to

learn from the experiences is highly crucial. Furthermore, the experiment should be repeated under different circumstances and supporting transition experiments should be developed in order to further promote the transition process.

There is a long tradition to cooperate with schools and the educational sector. First experimental projects were also developed and implemented in this context. These fit into the specific transition path of Modena. However, there is no systematic approach towards developing a portfolio of experiments that are designed to reinforce each other. Furthermore, their contribution to the local energy transition is hampered by the lack of systematic evaluation and feedback into local strategies and plans.

Recommendations:

Develop a portfolio of experimental projects. *Experiments should enhance and support transition agendas, goals and visions. They should be derived from these and support their realization. Experimental projects should not be limited to technical innovations but also include a wide variety of other activities such as innovative organizational and governance practices. Furthermore, different experiments should be coherent and mutually support each other. They should be developed and implemented in a systematic manner in order to be able to promote the transition process. Therefore, developing a portfolio of experimental projects which includes establishing a systematic approach towards the design, implementation and evaluation of experiments is needed.*

The well-established structures of cooperation with local schools are a good opportunity to combine iconic projects with measures of education and awareness raising, new forms of cooperative project development, implementation and financing involving citizens, public and private actors. A systematic approach towards experimentation could be developed around these projects including their systematic evaluation and feeding-back of experiences and lessons learnt into strategy, plan and project development.

Design experiments for learning purposes. *Transition experiments are searching and learning processes. They are designed to learn from practice and explore alternative solutions. Therefore, the evaluation of their learning experiences is crucial in order to be able to learn about different options and solutions. Transition experiments should be systematically monitored and evaluated in order to be able to derive lessons learnt for future projects.*

Implementation

The SEAP of the City of Modena defines measures for 20 so called sectors (“settore”) which relate to the strategic fields energy consumption and efficiency, urban transport and renewable energy production (COMUNE DI MODENA 2011: 6ff.). It contains specific statements about responsibilities, funding, and the expected effect of individual measures on energy consumption and CO₂ emissions. Thus, the SEAP of Modena can be considered a measure portfolio. Furthermore, the Local Energy Plan also defines measures in the fields of energy efficiency and the use of renewable energy sources (COMUNE DI MODENA 2007: 202ff.) and thus also qualifies as measure portfolio against the background of transition management. Overall, it stays unclear how the measures of the SEAP and the Local Energy Plan relate to each other and if they supplement, replace or contradict each other.

The analysis was not able to identify the involvement of non-municipal actors in the implementation of SEAP and Local Energy Plan. Transition Management suggests that the collaboration among public sector and local businesses, industries and other societal actors may enhance innovation of local practices and structures. However, this could be the result of the analytical framework which focuses on municipal activities.

The implementation of regular (non-experimental) projects and measures is dominated by public (municipal) actors. There is a low level of cooperation between public and private actors in the implementation of regular projects. As all solutions needed to realize a successful transition process cannot be defined beforehand but need to be the outcome of actor interactions the low level of cooperation in project implementation could hamper the local energy transition process.

Recommendations:

Promote the cooperation of actors in implementation. *Energy transition requires action not only by public (municipal) actors but also by private and societal actors and institutions. Therefore, measures have to be implemented by public, private and societal actors both individually and in cooperation. Furthermore, the cooperation in implementation increases the interaction of different actors which may result in innovative, not business-as-usual solutions and new ideas. Therefore, developing and implementing projects in cooperation benefits the transition process. Increasing the exchange and direct involvement of non-municipal actors and creating an environment which promotes individual interactions is crucial for a successful transition process.*

Reflexive Activities

Monitoring/evaluation

There is an emission inventory of local CO₂ emissions which can be used as baseline for the evaluation of measures, plans and strategies as both the SEAP and the Local Energy Plan of the City of Modena contain an extensive analysis of local emissions (COMUNE DI MODENA 2007: 23ff.; COMUNE DI MODENA 2011: 18ff.; INTERVIEW 6). The SEAP is to be evaluated in two-year intervals which results in the first evaluation of its progress in 2013. However, the extent and results of the evaluation were not yet defined at the time the interviews were conducted. Thus, specifics of the progress assessment and applied criteria cannot yet be evaluated. However, as the SEAP is a technical document the evaluation will also capture information of technical nature, focusing on the effects of technical measures to cut local emissions. Social changes and changing behaviour of individuals will not be considered (INTERVIEW 6). Thus, the monitoring activities of the City of Modena focus on the tactical and operational phases of transition management. Long-term and societal changes are not evaluated.

The monitoring and evaluation activities are focused on the technical aspects of energy transition. They correspond to Modena's narrow focus on energy transition. Overall, they don't meet the requirements of TM. Aspects specific to the transition process such as long-term changes on landscape level, niche development, actor networks and transition management activities themselves are not captured. Therefore, the capability for learning and adaptation is strongly limited.

Recommendations:

Broaden the scope of monitoring and evaluation. *All activities targeted at influencing or stimulating the transition process should be subject to monitoring and evaluation. Also, framework conditions and the progress in energy transition should be included. This is crucial to stimulate modulation and refinement of future activities and to support learning about the problem at hand and possible solutions. Therefore, a broader approach towards monitoring and evaluation is needed. Non-technical aspects of energy transition should be captured as*

well as slow, long-term (e.g. changing trends, world views, external events) and short-term changes (e.g. innovations, actors and initiatives). External processes, i.e. beyond the city level (e.g. new institutions and regulations) may be as important as changes on the local level (e.g. actor networks, new businesses). A broader, more inclusive approach towards monitoring and evaluation also allows a better adjustment of measures and processes and adaptation to changing developments.

Adaptation/adjustment

As mentioned above the monitoring focuses on the level of project and plan implementation and does not capture changes on societal level or the behaviour of stakeholders (see also 'monitoring/evaluation'). Thus, adaptation and adjustment is mainly expected to occur through changes of implementation schemes and short to mid-term goals and plans. Thus, adaptation of strategic activities is difficult due to the lack of a long-term vision and short to mid-term focus of monitoring activities. However, local stakeholders demonstrate awareness of the need to address questions beyond technical aspects and mid-term considerations (INTERVIEWS 5, 6, 7) to enhance the local transition process (see also 'envisioning'). Thus, the requirements to broaden local transition activities are given.

The potential adjustment of activities, measures and processes is limited due to the narrow approach towards monitoring and evaluation. A broader, more inclusive monitoring and evaluation methodology and process will automatically also improve the city's capability for adaptation and adjustment.

Role of LA in Modena

The local authority of the City of Modena very actively enhances the dialogue between members of the municipality and local citizens, organisations and businesses. For this purpose the municipality applies different forms of communication and participation. Furthermore, members of the municipality demonstrate high appreciation of the contribution of public participation to local plans and policies. They are open to integrate local community members in plan and policy development. Thus, it allows debates about municipal plans and measures and the introduction of new ideas and thus innovation to the local authority. However, these discussions are limited to tactical and strategic activities of transition management. Currently, the City of Modena lacks the discussion of overall, long-term goals. Furthermore, the local authority is addressee or initiator of all identified forms of communication and collaboration regarding local energy transition. However, transition management suggests that practices of communication and collaboration among local businesses, organisations and citizens (without involvement of the local authority) are crucial for niche development and innovation.

The local authority of Modena developed various technical measures to enhance energy transition focusing on energy generation, enhancing energy efficiency and increasing energy savings. However, the plans and measures of the local authority of Modena only cover part of the changes needed for energy transition. Up to today municipal plans and debate do not take account of individual behaviour, consumption and values and their contribution to energy transition. Thus, the local authority of Modena has not yet unlocked the potential of these aspects for the local energy transition process. As members of the local authority are aware of this the requirements to widen the debate of energy transition beyond technical questions are given. Restructuring energy transition not only as technical but also as societal challenge can form the basis for vision, plan and policy development. Moreover, this may enrich local debate and enhance innovation.

The well established forms of participation can also be considered networks among the municipality and local stakeholders. These are characterized through changing actors as participation depends on topic or measure of discussion. There could no more constant form of network among local stakeholders be identified. This approach has the benefit of avoiding the establishment of elites through the inclusion and exclusion of small groups of stakeholders. Furthermore, it easily allows the introduction of new ideas to the local authority which may benefit the energy transition process. However, these ad-hoc networks prevent the engagement and collaboration of local stakeholders to work towards mid- or long-term goals. This is especially the case as long as there is no shared vision which could guide independent measures. Thus, the development of a shared long-term vision and the establishment of more persistent networks among stakeholders can enhance energy transition. Furthermore, establishing networks among local businesses and the local authority may allow framing energy transition as (economic) opportunity for local businesses and thus increase their engagement in the process.

3) Recommendations for further transition process

- Design a more open and adaptable process of problem definition and goal formulation. Let non-public actors (of businesses, knowledge institutions, NGOs) participate in discussions about the problem, its urgency and complexity. This may result in a more integrative perspective, a shared conceptualization of the problem and an increased willingness of non-municipal actors to contribute to energy transition with individual measures. Furthermore, it brings various forms of knowledge together and allows the co-production of knowledge through cooperation. Moreover, the feedback from actors can make the process more adaptable to technical and ecological changes in regard to innovation and structural change.

- Use the participatory benefits of qualitative analyses and models. To broaden the system analysis quantitative models and indicators should be supplemented with qualitative aspects. While quantitative analyses need to be executed by experts and favour these in discussions about problems and possible solutions quantitative models promote the discussion beyond the small group of experts. They are easier to communicate to laymen and can thus enable a broad discussion on the various aspects and interrelations of energy transition.

- Identify and involve frontrunners in problem structuring. Key actors and networks should be integrated in the process of problem definition and goal formulation. The selected actors should reflect the most important societal perspectives relevant to energy transition. Frontrunners should have the ability to consider complex problems at a high level of abstraction, look beyond the limits of their own discipline, enjoy authority within various networks, have the ability to communicate energy transition within their own network (or organisation) and be open for innovation instead of having specific solutions in mind.

- Establish a broader, integrative perspective on energy transition. Energy transition is a complex field of action with various interrelations with other aspects. Connecting energy transition with other topics, as already done with the discussions on air quality, may result in a higher motivation of non-municipal actors to realize individual measures as it may increase the urgency of the problem. A broader, more integrative problem definition is likely to result from the involvement of different actors in the process of problem structuring and goal formulation.

- Develop a transition vision. An inspiring, attractive and imaginative vision of the future that defines a structurally different and more sustainable (energy) system is needed to guide mid- and short term actions. The transition vision is an abstract, qualitative and normative metaphor/picture of a sustainable (energy) system (“a low energy city with a high quality of life”). It aligns individual actions (of public, private and societal actors) towards long-term goals and mobilizes and coordinates different actors across sector boundaries.

- Develop a transition vision in a participatory process. The transition vision should be based on a shared problem definition accomplished by different actors (frontrunners of public institutions, private businesses, NGOs, networks, etc.). Envisioning is the next step following the participatory problem definition. In order to be able to develop an alternative image of the future (sustainable) state of the system in question the people involved should be innovative opinion makers, trend setters and generalists with overview and social authority (see also recommendations on problems structuring). These are able to communicate the vision within their institution and thus actively spread the developed image within institutions and organisations relevant for energy transition.

- Adjust the transition vision during the transition management process. The transition vision is not a fixed goal. Rather, it should be adjusted to lessons learnt, experiences made and changing framework conditions. Continuous learning on problems and solutions is cru-

cial for energy transition. Therefore, long-term visions and goals defining “the right direction” have to be redefined as the long-term process towards sustainability proceeds.

- **Gather and share ideas of a “low energy city with a high quality of life”.** The LA successfully uses social and digital media to exchange views and discuss with local stakeholders and citizens. These well-established forms of communication can be used to develop innovative, creative and inspiring ideas of an alternative and more sustainable future. These may be used for the development of a broadly shared transition vision.

- **Use established forms of communication to communicate the transition vision.** Once developed the well-established forms of communication and participation can be used to communicate the transition vision to citizens and stakeholders. This can further raise awareness for the topic of energy transition and promote discussions and individual actions of different actors.

- **Address the role of individual behaviour, consumption, values and awareness for energy transition.** The transition to a more sustainable energy system requires more than just technical measures. Therefore, the expansion beyond technical questions is needed. Introducing the role of individual behaviour and consumption, values and awareness of citizens and stakeholders in (municipal) goals, strategies, plans and measures further broadens and promotes energy transition. Thus, municipal, goals, strategies, plans and measures should address these non-technical fields of action.

- **Orient and integrate strategies and plans towards long-term goals.** Due to the lack of an overall, long-term vision parallel activities could emerge such as the SEAP and the Local Energy Action Plan. Once a transition vision was developed, sectoral goals, strategies and plans should be integrated towards its abstract, overall goals. The vision works as a framework for orientation for actors of different sectors and domains and their short-term action.

- **Build and promote coalitions for energy transition.** Energy transition requires action not only by public (municipal) actors but also by private and societal actors. Actor networks have to develop and implement (innovative) projects and communicate goals and content of the transition agendas in order to broaden energy transition beyond the public sector and enhance the whole process. Therefore, the promotion of new and existing actor networks is crucial for promoting the local energy transition. A variety of actor networks (with and without the involvement of the LA) touching on different aspects relevant for energy transition is beneficial.

- **Develop and implement goals, strategies, plans and projects in cooperation.** A successful energy transition requires participation and cooperation in problem structuring, vision development, agenda building, experimentation and implementation. Formal and informal actor networks communicate and thus spread transition vision and goals, may develop innovations as result of their interaction and develop and implement plans and projects. Therefore, goal formulation and strategy and plan development cannot be closed process dominated by the LA. Rather, these processes should be genuinely cooperative, allowing actors to get involved in planning and implementation exercises. Co-developing and co-financing measures may also be a means to promote action in light of scarce financial resources of public institutions. Framing energy transition as an economic opportunity for private actors may promote their engagement and cooperation.

- **Develop a portfolio of experimental projects.** Experiments should enhance and support transition agendas, goals and visions. They should be derived from these and support their realization. Experimental projects should not be limited to technical innovations but also include a wide variety of other activities such as innovative organizational and governance practices. Furthermore, different experiments should be coherent and mutually support each other. They should be developed and implemented in a systematic manner in order to be

able to promote the transition process. Therefore, developing a portfolio of experimental projects which includes establishing a systematic approach towards the design, implementation and evaluation of experiments is needed.

The well-established structures of cooperation with local schools are a good opportunity to combine iconic projects with measures of education and awareness raising, new forms of cooperative project development, implementation and financing involving citizens, public and private actors. A systematic approach towards experimentation could be developed around these projects including their systematic evaluation and feeding-back of experiences and lessons learnt into strategy, plan and project development.

- Design experiments for learning purposes. Transition experiments are searching and learning processes. They are designed to learn from practice and explore alternative solutions. Therefore, the evaluation of their learning experiences is crucial in order to be able to learn about different options and solutions. Transition experiments should be systematically monitored and evaluated in order to be able to derive lessons learnt for future projects.

- Promote the cooperation of actors in implementation. Energy transition requires action not only by public (municipal) actors but also by private and societal actors and institutions. Therefore, measures have to be implemented by public, private and societal actors both individually and in cooperation. Furthermore, the cooperation in implementation increases the interaction of different actors which may result in innovative, not business-as-usual solutions and new ideas. Therefore, developing and implementing projects in cooperation benefits the transition process. Increasing the exchange and direct involvement of non-municipal actors and creating an environment which promotes individual interactions is crucial for a successful transition process.

- Broaden the scope of monitoring and evaluation. All activities targeted at influencing or stimulating the transition process should be subject to monitoring and evaluation. Also, framework conditions and the progress in energy transition should be included. This is crucial to stimulate modulation and refinement of future activities and to support learning about the problem at hand and possible solutions. Therefore, a broader approach towards monitoring and evaluation is needed. Non-technical aspects of energy transition should be captured as well as slow, long-term (e.g. changing trends, world views, external events) and short-term changes (e.g. innovations, actors and initiatives). External processes, i.e. beyond the city level (e.g. new institutions and regulations) may be as important as changes on the local level (e.g. actor networks, new businesses). A broader, more inclusive approach towards monitoring and evaluation also allows a better adjustment of measures and processes and adaptation to changing developments.

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