Migrating Towards Sustainability: four stories about possible change

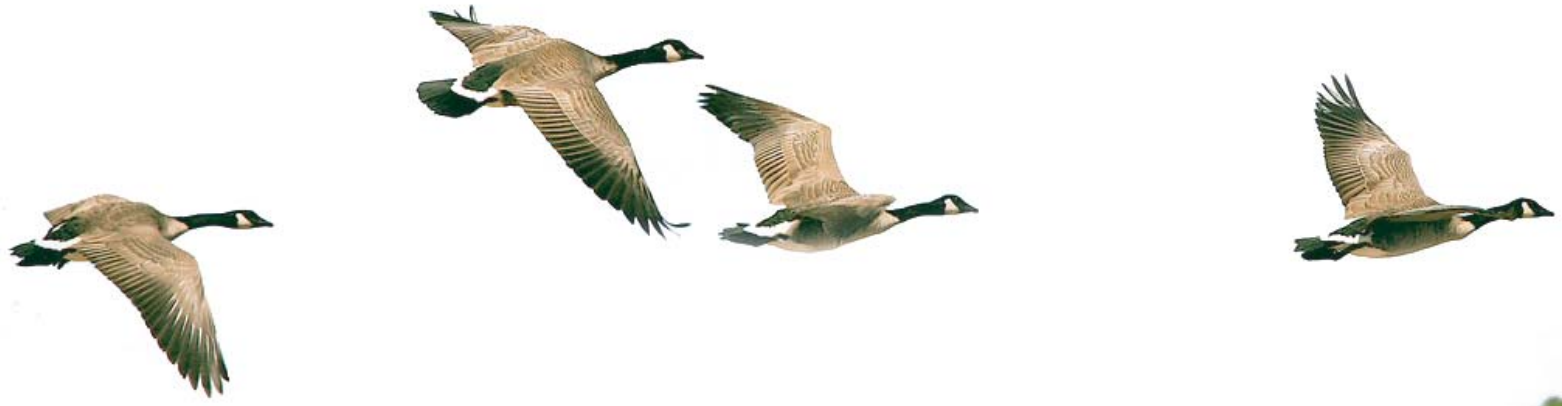
Ashdown, H.; Larsson, J.; Di Pangracio, A.; Steinbusch, K.; Asea, S.; Eve, G.; He, K.; Mansoz, M.; Kavcic, K.; Di Ponte, S.; Sonnenschein, Jonas; Wester, J.; Fierro Loor, C.; Kazlauskaité, L.; Koffi, M.; Smedby, Nora

2010

International Institute for Industrial Environmental Economics

Migrating Towards Sustainability

Four stories about possible change



The International Institute for Industrial Environmental Economics at Lund University

P.O. Box 196 · SE-221 00 Lund · Sweden

Tel: +46 46-222 02 00

www.iiiee.lu.se

iiiee@iiiee.lu.se

This publication should be cited as:

International Institute for Industrial Environmental Economics (IIIEE). 2010. *Migrating Towards Sustainability: Four stories about possible change*. Lund: IIIEE.

ISBN 978-91-88902-61-0

Table of Contents

Introducing Strategic Environmental Development

By 2050, 9 billion people are expected to populate the earth. This exponential increase, in combination with current technological and economic activities, causes stress to the environment, societal and economic systems.

The available resources are exploited in a higher pace than they regenerate. The capacity of the earth is almost exhausted due to current life style practices. In the aftermath, many environmental issues are created, the most critical and well known, climate change.

Increasing population can bring many issues. There is a need for more built space and agricultural land. Waste quantities and the demand for transport increase. The urban environment, both in terms of physical infrastructure and economic systems, cannot deal with the pace of these developments appropriately.

Micro-scale interventions are not enough to face the global challenge, but can still be considered a fundamental starting point. Regions, communities and individual actors will come to play important roles in the development of new and more sustainable production-consumption systems.

Approaching a sustainable development means that new environments have to be designed with the purpose of decreasing material and energy flows, closing the loops, as well as, rethinking and rebuilding the already existing infrastructure.

The economies of scale must be re-evaluated and other economic systems considered. Localisation, efficiency and differentiation are important key factors in the concept of Distributed Economies that aims to create resilience, economic stability and sustainable development of regions. This shift can be done by exploring potential and exploited local resources and matching them with the most efficient local uses.

To close the consumption-production loop there has to be good practical systems in place. Stakeholders' participation is crucial and incentives are needed in order to uphold a self-sustaining system. Ex-

tended Producer Responsibility can represent a sound and practical solution.

The "Strategic Environmental Development" (SED) course is a learning exercise in a real-life laboratory. The SED course aims at exploring practical applications of sustainability concepts, tools and strategies. It is an opportunity to experience how to apply theoretical knowledge in practice and gain unique insight. The students get training in practical analysis, systematic approach, assisting practice and professional conduct through intervening in real complex systems. This report is a product of the course.

The report constitutes of four different projects done by four student groups under the supervision of members of the IIIEE staff. The projects are conducted in different locations and on different spatial scales. The projects are replies to serious and real life clients' requests, part of larger more extensive projects. Different theories and concepts were used to approach the challenges in the distinct locations.

The group in Sarpsborg, Norway, studied the planning of a new zero emission community. In Shanghai, the students got the opportunity to conceptualise redevelopments of already existing infrastructure. The conditions for Distributed Economies were investigated in Val di Noto, Italy, to visualise a sustainable development of the region. Students in Belarus applied the approach of Extended Producer Responsibility to the waste issue.

The title of this volume of case studies is inspired by the thought of communities metaphorically moving towards sustainability, by identifying unsustainable practices, developing visions and starting the process of change. The report has been a combined effort of many individuals. Exploring the four projects has been a true pleasure, leading to new insight and experiences. We hope that the reader will enjoy the case studies and that they will inspire to engage in the search of sustainable solutions.

The four Teams worked in

Hafslund, Norway

Ana Di Pangracio, a lawyer from Argentina who has a background in Environmental Law,

Jennie Larsson from Sweden, who also has a law background in the fields of Criminal and Environmental Law,

Karlijn Steinbusch from the Netherlands with a background in Finance and Business Administration, and

Helen Ashdown from the UK, who has work experience in environmental consultancy in national and international companies,

with their supervisors Lars Strupeit and Philip Peck, researchers and teachers at the IIIEE,

were working on an understanding of how a potential eco-city could create value for the company and contribute to the sustainable good.

Photo above by Jarl-Morten Andersen

Shanghai, China

Gregory Eve from Italy with a background in Environmental Engineering, who started his own company in a cultural field three years ago,

He Kai from China, whose background is in Real Estate Management and City Planning,

Mathilde Mansoz from France, who studied International Economics and Journalism, and has work experience in the media and entertainment industries,

Solomon Tipelle Asea from Uganda, whose background is in Environmental Management and has worked in the humanitarian field with the UN for four years,

with their supervisor Håkan Rodhe, who is currently the director of studies at the IIIEE,

were working on a project that is based on an integration of the sustainability issues in the context of urban development.

Noto, Sicily, Italy

Katja Kavcic from Slovenia with a background in Economics and Business Administration and work experience mainly in European affairs and Investment Banking,

Silvia Di Ponte from Italy who has a background in Economic and Political Sciences and has a strong interest in renewable energy and biogas potential,

Jonas Sonnenschein from Germany with a background in Philosophy and Economics, who worked at the Wuppertal Institute in the research group for sustainable consumption and production, and

Johanna Wester from Sweden with a background in Environmental Science,

Minsk, Saligorsk & Vileyka, Belarus

Carla Fierro, a lawyer from Ecuador who studied International Private Law and Environmental Law,

Laura Kazlauskaitė, an Environmental Engineer from Lithuania with work experience in environmental consulting in the waste management field,

who started her own business focusing on environmental assessment and management systems,

together with their supervisors, members of the teaching and research team of the IIIEE, Åke Thidell and Tareq Emtairah,

evaluated the opportunities for distributed economies in Val di Noto in the area of energy, water, food and waste.

Maurice Koffi from Ivory Coast, whose background is in Environmental Risks Management and who has work experience in marketing, and

Nora Smedby, with a background in Economics who worked for a Danish economic consultancy,

with the help of Thomas Lindhqvist, associate professor at IIIEE and an expert in the subjects relating to product policy, Andrius Plepys a teacher at the IIIEE, and irreplaceable economist and photographer Lars Hansson, also associate professor at IIIEE ,

explored the waste management system in the Republic of Belarus.

Designing in Green Living: The Norwegian Window of Opportunities

By Helen Ashdown, Jennie Larsson, Ana Di Pangracio, Karlijn Steinbusch

Strawberry field (foreground) as a buffer between Hafslundbyen and the park

Background information

Hafslund ASA is a Norwegian heat and power utility producing hydropower for over 100 years. They are the largest distribution grid owner and have the highest electricity sales in Norway. The company has the idea to design a new sustainable city quarter on a 200 ha piece of agricultural land in Sarpsborg, a city of 50 000 people located in the Østfold County of Norway. Although Hafslund ASA owns the land, the company can only start building the 'eco-city' when national authorities allow the agricultural land to be used for other purposes than cultivation. A good showcase could prove that a potential eco-city can reduce environmental impacts of an urban community in the future.

Locating Hafslundbyen on the map with the park behind us

The aim of this project is to create understanding how a potential eco-city could create value for the company as well as contribute to the sustainable good. We focused on the following objectives:

- Understand what the motivation of Hafslund ASA is to develop an eco-city;
- Find out how people within the company and other stakeholders perceive a potential eco-city; and
- Raise awareness among stakeholders on a potential eco-city development.

Methodology

In preparation for our seven-day duration in Norway, we visited the Department of Environmental Strategy at Lund University in Helsingborg and interviewed Torleif Bramryd and Michael Johansson, two experts in the field. We discussed sustainable planning and transportation for future cities and received feedback on our methodology. In addition, we visited the sustainable area of Helsingborg to see the schemes in implementation. Also, we looked up

Site map with area for total development bordered in yellow

other comparable sustainable city development projects in different parts of the world, for which energy was one of the focus areas.

To help understand how the world could look like in 2030, we assessed the potential driving forces that shape the future from a macro to micro-scale perspective related to Hafslundbyen and how this could affect the development and outcome of the sustainable city quarter.

Hafslund has a centralised business in the area of electricity generation and supply, heat supply and energy service provision. We considered how the project could become a nucleus and facilitator for local, regional and national sustainable development; how can technologies, systems, and operational/business models be transferred and applied to existing municipal infrastructure in Norway (and possibly other parts of the world).

During our stay in Norway, we had a site visit to the planned development area of the sustainable city and the new waste incinerator owned by Hafslund in Sarpsborg.

In the aerial photograph, the site is bordered by the Hafslund Mansion and Park to the north of the site and is situated near the River Glomma to the west. The old smelting works can be seen in the middle of the site, with the large landfill site seen in the bottom lefthand corner.

We interviewed company representatives from different departments (grid infrastructure, district heating, waste, management, finance, telecom, smart metering and business development), public authorities (Ministry of Environment, Østfold County, Sarpsborg Municipality), researchers and local people. We used a two-step scenario technique. First, we tried to find out how the different interviewees perceived the future of Hafslundbyen. The purpose of the scenario exercise was to raise awareness on a changing business environment for Hafslund ASA and to explore various design and technology options for the eco-city.

Scenario exercise at Hafslund

Secondly, from these results we designed new future scenarios depending on whether the eco-city would be a case for the region or for the world. We then created a SWOT analysis to supplement the business cases for each concept within the scenarios.

Scope and limitations

The project did not have the aim of creating a blueprint for a potential Hafslundby. Instead of designing a sustainable city quarter, we focused on what concepts were relevant for a regional and global showcase.

One limitation was the language barrier. Several documents had to be translated from Norwegian to English, which slowed down some of the data gathering.

Another limiting factor was the occasional misinterpretation of what was meant by the concepts in the scenarios. For example, the public sectors interpreted a centralised versus decentralised infrastructure in the form of architecture having densely structured city centres. The company representatives tended to think more along the lines of networks and utility infrastructure. We believe that the misinterpretations did not lead to major mistakes in our analysis because we constantly questioned the interviewees why they choose certain concepts. By doing so, they explained to us how they understood them.

The future

Here, an overview of the driving forces for future trends for the year 2030 is presented. In order to plan a city, it is important to keep in mind how the future could look like. We start from a macro-scale and consecutively scale down to the actual location of Hafslundbyen (Figure 1). Global technology trends and environmental problems are relevant to the development of an eco-city.

"In an environmentally sustainable society, the current and future basic resource needs of people are distributed in a just and equitable manner without compromising the ability of future generations to meet their basic needs" [2]. In developed countries, many individuals consume large amounts of resources for their everyday activities, such as residential heating, cooking, commuting, eating, and shopping. Supplying people with resources and dealing with the resulting wastes and pollution can have large environmental impact, often described as the ecological footprint. Only 1.8 hectares per capita is available on earth for human use. The ecological footprint of the average Norwegian person is 6.2 hectares and ranks seventh place in comparison to other countries in the world [3]. In rapidly developing countries like China and India people are becoming more affluent, which will result in increased pressure on resource consumption. Researchers have stated that if everyone reached average US consumed similar to the average consumption levels, five more planet earths are needed with the existing technology. As global population and share of affluent people grows, there is a need for clean technologies to curb total environmental impact.

Scientists have warned that the amount of greenhouse gas (GHG) emissions needs to be reduced by 50-85% (in comparison to the 1990 level) before 2050 to avoid the 'tipping point'. If the earth on average warms 2 degrees Celsius, huge environmental disasters become more evident. Global warming is caused by natural and anthropogenic activities such as the com-

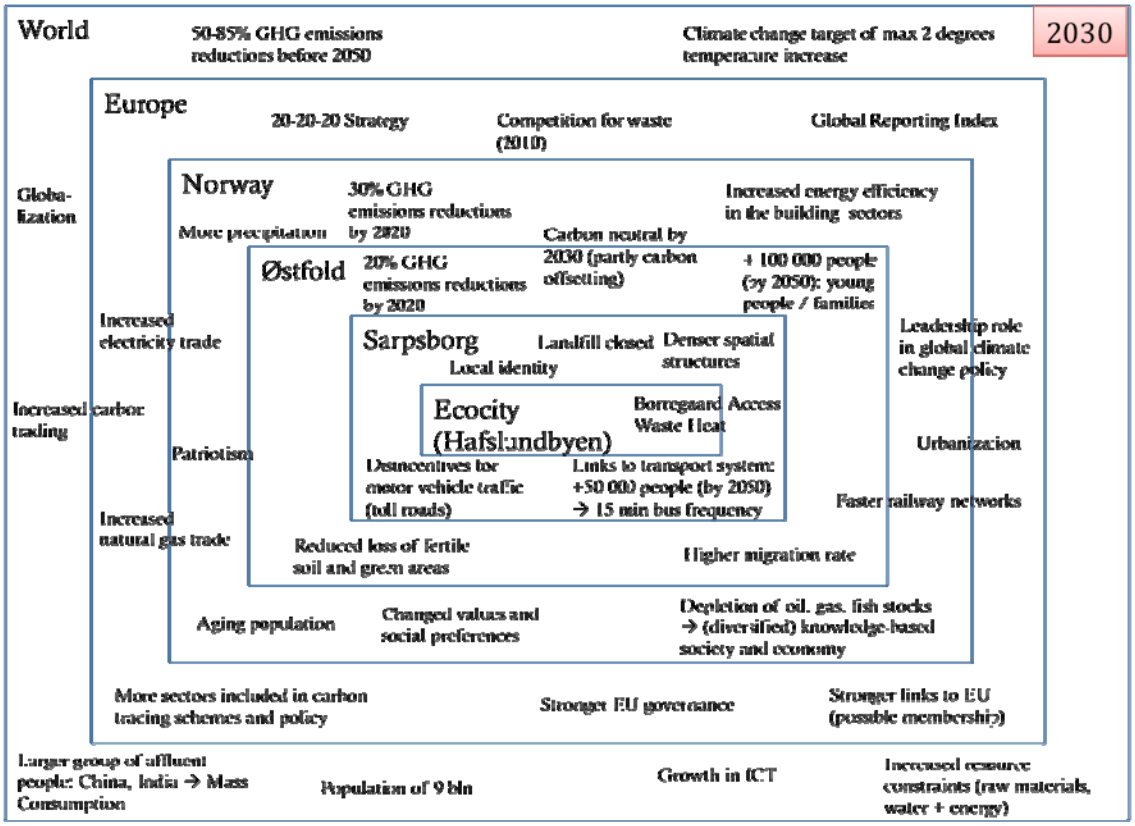


Figure 1: Macro – Micro scale drivers for the development of Hafslundbyen

bustion of fossil fuels for energy and heat production and mobility. Climate change and the succeeding Kyoto Protocol have gained a lot of attention by the media through the struggle for international co-operation to reduce their GHG emissions.

The EU has set a 20-20-20 target for the year 2020: greenhouse gas emissions need to be reduced by 20% in comparison to the 1990-level, the energy efficiency should be increased by 20% and the energy mix should contain at least 20% renewable energy sources. Although Norway is not a member state of the EU, it has set even more ambitious goals to battle climate change.

Norway aims at reducing GHG emissions by 30% in comparison to the 1990-level in 2020, and become carbon neutral by 2050. This might seem contradictory knowing that Norway's economy largely depends on oil and gas exports from the North Sea. In 2007, Norway was the world's sixth largest exporter of oil – producing around 97 million tonnes of crude oil [7]. On the other hand, electricity is almost entirely generated through hydropower.

The electricity prices for household consumers in Norway are lower than on average in Europe [5]. Since electricity has been relatively cheap, most dwellings in Norway are heated directly by electricity. In the Norwegian climate policy, the Government has set up a programme "Cities of the Future" to encourage a cooperative attempt to reduce GHG emissions amongst the largest towns, including Sarpsborg. The Government stimulates the energy recovery from waste, in the forms of biogas, biofuels, electricity and district heating of residential buildings. Furthermore, the

Government discussed that landfilling of biodegradable waste was prohibited from 2009 and that the landfill tax would remain.

The Østfold County has set up a plan for the regional development until the year 2050, in which they also discuss climate change. Around 275 000 people are currently living in the Østfold County and another 100 000 are expected to have joined by 2050. As a result, space had to be used more efficiently as there will be denser spatial structures. Sarpsborg is an amalgamation of five former towns causing it to have a low spatial settling density.

When paired with the adjacent city Fredrikstad (15 km distance), the two municipalities have a total population of approximately 125 000 citizens and present the fifth largest urban area in Norway. Sarpsborg has always functioned as an industrial city with Hafslund's hydropower dam being the city's icon. Since the last decade offshoring has led to some industries moving out of the country or completely shutting down. The municipality addresses the need to create jobs as well as attract high-skilled labour to create a mixture of social structures.

When driving into Sarpsborg on the Exit5 of the E6 highway a large open landfill of domestic refuse is the driver's first view of the town. By 2030 the landfill will likely be closed. This year (2010) Hafslund has established a waste incinerator to supply energy to Borregaard, a supplier of wood-based chemicals. Regional district heating network is planned with the option to connect to Hafslundbyen.

Road traffic congestion is a serious debilitation in the Sarpsborg area because of the high volume of private vehicles utilised for commuting. Informants from the Regional Planning Department indicated that bus frequency of 15 minutes is required between Sarpsborg and Fredrikstad in order to reach a higher percentage of the commuters. This could be more easily obtained within a closely and more densely populated region.

Scenario technique

Informants were shown four possible futures for Hafslunbyen – each markedly different and 'located' at an extreme reflecting some concepts of what an eco-city could incorporate in 20 years. These 'scenarios' supported communication and prioritisation by informants. The goal of undertaking scenario techniques [1] is to plan for future business strategies particularly for those unexpected and against the current company vision.

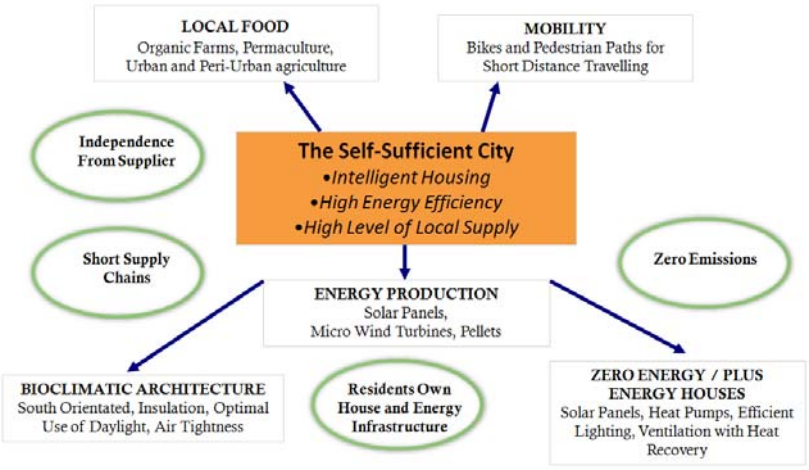
The explicit purpose of the scenario exercise was to raise awareness on a changing business environment for Hafslund ASA and to explore various design and technology options for the eco-city.

The **Self-Sufficient City** in Figure 2 describes an eco-city with a decentralised infrastructure of local food production, small-scale energy generation and mobility for within the city quarter.

The **Entrepreneurial City** in Figure 3 tries to attract high-skilled labour and create job opportunities through setting up resource and development (R&D) and businesses in clean tech as well as providing large-scale leisure facilities.

The **Hardware City** in Figure 4 shows an integrated centralised infrastructure for energy, mobility, waste and agriculture. Improving transportation times and economies of scale are at the centre.

Figure 2:
Self-Sufficient Scenario



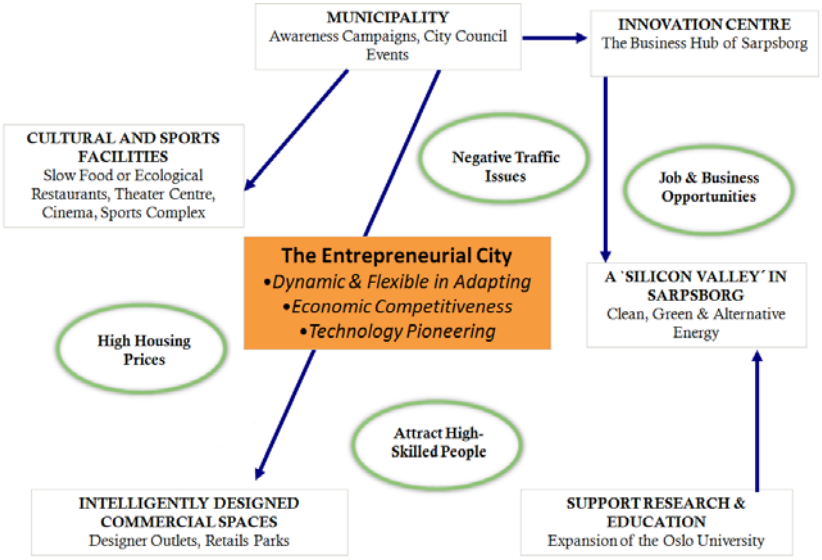


Figure 3:
The Entrepreneurial City

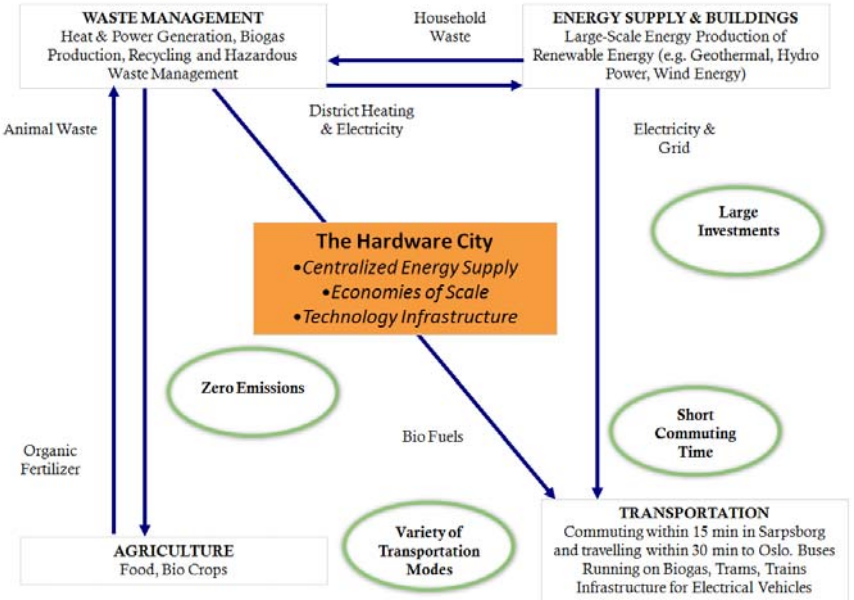


Figure 4:
The Hardware City

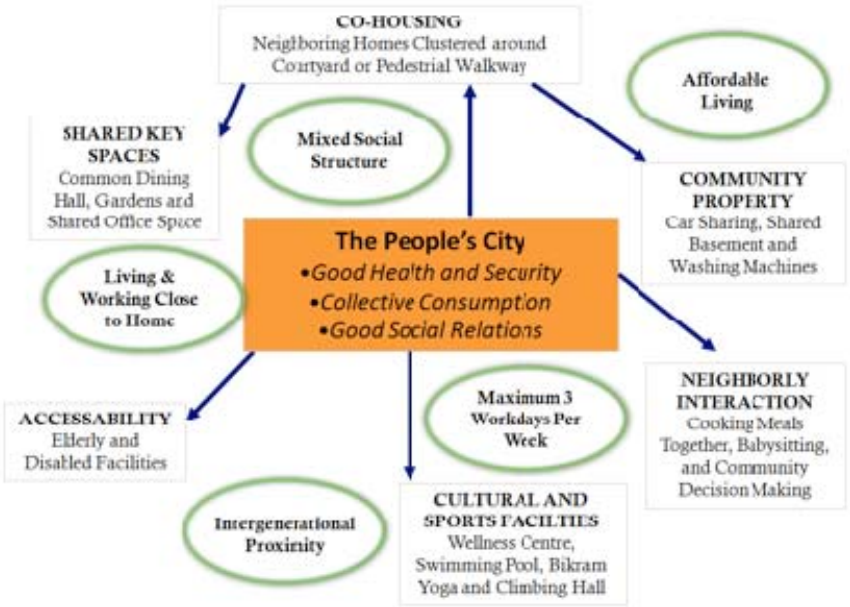


Figure 5: The People's City

The **People's City** in figure 5 illustrates how social interaction could lead to decreased collective consumption and a shorter working week with people working mostly from home.

Firstly, we tried to determine whether the informants had consistent views regarding Hafslundbyen. After presenting the four scenarios to the interviewees, we asked them to mark on the analytical framework where they thought a conventional city (such as Oslo) is situated. The theoretical framework consists of two axes. Along the X-axis from left to right are the opposing functions of working versus living (Entrepreneural City versus People's City). Along the Y-axis from top to bottom are the opposing infrastructures of the centralised versus decentralised system (Hardware City versus Self-Sufficient City).

We next asked them to mark three points on the framework, one for each of the following questions:

- "Where is a conventional city in Norway, such as Oslo, situated today?"
- "Where do you think, realistically, Hafslundbyen could be 20 years from now?"
- "Where would you like to see Hafslundbyen, so that you would be willing to live there yourself?"

For each question, the informant would place a mark relevant to the grid and the four extremes. Shortly, the framework with the total markings will be provided and discussed.

Secondly, the four scenarios we created had in total twenty-one concepts, contained in rectangular boxes. We asked the interviewees to prioritise, choosing seven of those concepts they considered to be the highest priority and other seven they regarded as lowest priority. The remaining seven would be considered as neutral. We asked explanation about the reasoning behind their choices to find out how people saw future trends in living habits and technology development.

Analysis and results

Here, the findings of the scenario technique and interviews are discussed. First, a summary of the results of the analytical framework exercise. Secondly, a summary of the feedback we received from the respondents on the concepts contained in the four scenarios.

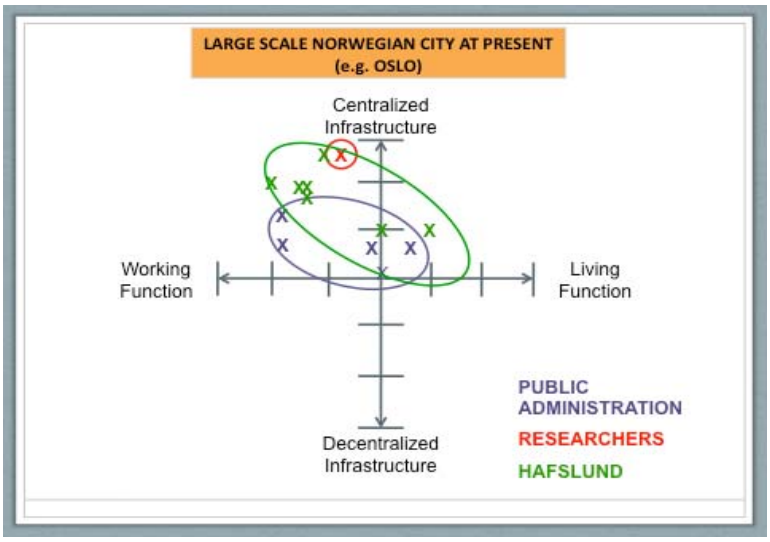


Figure 6: Conventional City Framework

A Conventional City

After presenting the four scenarios to the interviewees, they started with the analytical framework exercise.

When placing a dot for a conventional Norwegian city as of today, the general opinion appears to be consistent throughout all actors that Oslo currently seems to be a city with a centralised infrastructure and a more work-related function than living.

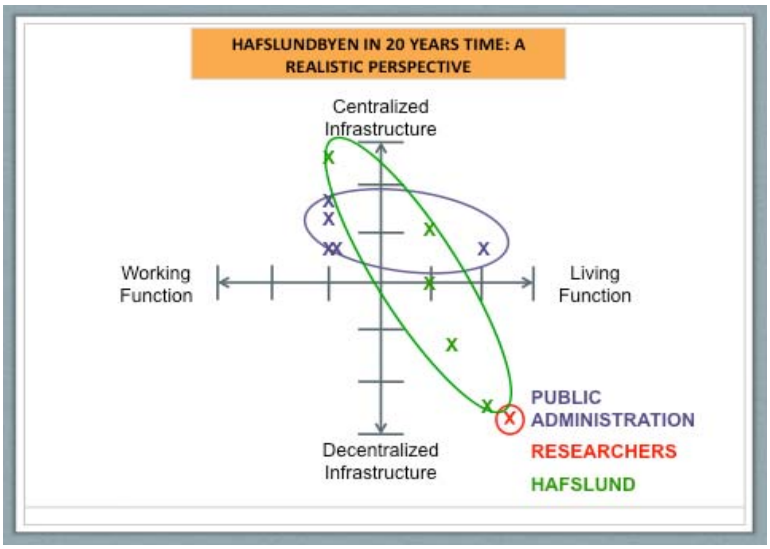
Hafslundbyen Realistically

When placing the second dot, Hafslundbyen within 20 years in realistic terms, respondents are less clearly concentrated. Within Hafslund there are very different views about what the project will deliver, but the trend appears to be towards a more decentralised living infrastructure.

The Public Administrators have a clear view that Hafslundbyen will deliver a centralised infrastructure (although we determined this was probably due to a different understanding of centralised and decentralised infrastructure to those of Hafslund and Researchers) with a slight shift towards a more liveable in city.

Researchers presented a belief in a more decentralised and innovative view of Hafslundbyen, catering to inhabitants who would prefer to spend more time living in the city rather than working away from home.

Figure 7: Hafslundbyen Realistically



Hafslundbyen Personal Wish

The personal views of informants were much more varied.

Within Hafslund ASA the trend seems to favour a more decentralised structure towards living and working from home however not all agree.

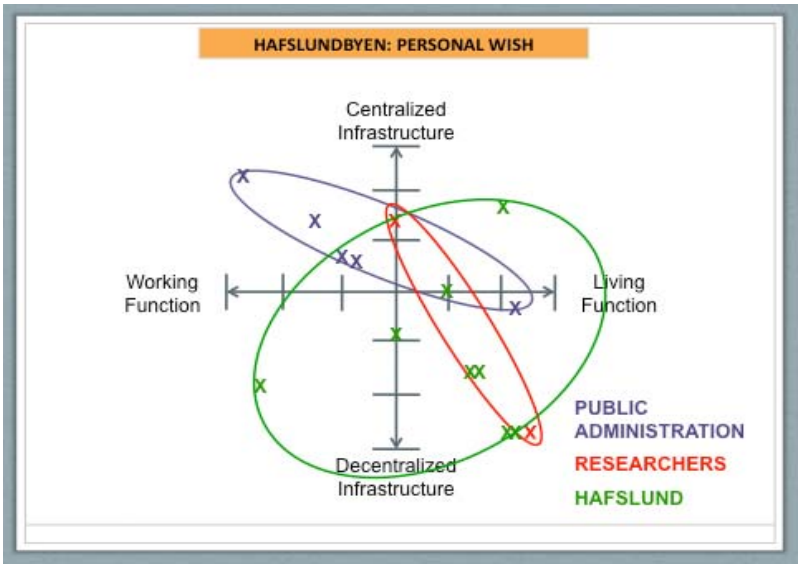


Figure 8: Personal Hafslundbyen in 20 years

Public Administration appear to favour a good mixture of living and working functions within the city – so that there are no "dead zones" through lack of inhabitants within the city during the day or evening.

Researchers this time also vary extremely with some favouring an equal mix of work and living functional elements and standalone energy production versus centralised transport systems.

Feedback on concepts

Thanks to the prioritisation exercise, we received feedback from each of the respondents on the 21 concepts contained in the four scenarios for an eco-city.

When it comes to the concepts selected as high priority, *waste management* came in first place. We understand this responds to the fact that waste is a big and complicated issue nowadays that has to be dealt with appropriately. Waste is energy, hence both industrial and household waste can be used for heat and power generation, to produce biogas and for the recycling industry.

In second place came *plus-energy houses*. They were considered to be as "a must", a key ingredient of any eco-city. The "*Silicon Valley*" concept came third. This has to do with the fact that the eco-city could become a place for the gathering of high grade technology, a centre for clean innovations.

Mobility received the fourth position. Interviewees expressed their concern about the current high number of private cars in the streets; hence short distances should be one of the main characteristics of an eco-city as to be able to move around it by bicycle or simply by foot.

Finally, in the fifth place came *transportation*. Informants from the public administration found essential to develop a holistic transportation plan for Sarpsborg. They found it very attractive to have the opportunity to commute inside Sarpsborg in just 15 minutes or to Oslo in just 30 minutes, through fast trains.

As regards to the concepts with least priority, the favourite choice was *neighbourly interaction* as it does not seem to go along with the culture and tradition of Norwegians.

In second place, with equal scores, came *agriculture, local food* and *cultural and sports facilities*. In the case of the first and latter concepts the reason behind its choice was that they were thought as large-scale actions. Interviewees saw local food as a restriction to their freedom of choice as regards to food; but also as something really difficult to achieve given Norway's particular climatic conditions. We believe this concept was misunderstood as we did not mean that people in the eco-city were supposed to eat strictly and solely what was produced in their eco-farms.

Thirdly, interviewees rejected the idea of building new *retail parks* in the area as Sarpsborg has already too many. *Large-scale production of renewable energy* was considered as the fourth least relevant concept. Considering that Sarpsborg already has a hydropower plant in place, people did not perceive new large scale investments in such matter as necessary.

Finally, with equal scores, *municipality involvement, support to research and education* and *community property* came in fifth place. This might respond to the fact that people do not perceive the involvement of the local government as relevant for the making and implementation of the eco-city in the first case and the tough competition nearby in the second one, considering the existence of a well established university in Ås. Community property is seen as a restriction to Norwegians freedom of choice and privacy.

Quotes

A summary of interesting quotes from the different stakeholders we interviewed can be found in Table 1 in the following page.

The referred stakeholders are organised in four groups:

PA: Public Administration
H: Hafslund
R: Researchers
SI: Sarpsborg Inhabitants

Some of those quotes were expressed by just one stakeholder, whereas others were expressed by more than one stakeholder. Table 1 depicts which stakeholders expressed which quote, and if there were coincidents.

Three scenarios for the eco-city

We now introduce three scenarios for the eco-city. The first two scenarios have a regional and world scale. Features and driving forces of such scenarios are included.

A SWOT analysis was prepared for the regional and world scenarios. SWOT is a strategic planning method that allows us to evaluate the Strengths, Weaknesses, Opportunities and Threats involved in Hafslundbyen. Internal and external factors that are both favourable and unfavourable for achieving the project are identified. The SWOT is internalised in the explaining of the regional and world scenario and will provide Hafslund a more accurate and comprehensive view of the project, being several components considered.

Some key elements were chosen for these scenarios in order to provide a general idea for each of them, but it is important to remark that their selection is not mandatory.

Finally, we introduce a failure scenario that presents important aspects worth bearing in mind when planning and implementing an eco-city.

QUOTE	PA	H	R	SI
There is a need to re-launch Sarpsborg's identity; the city will turn 1000 years old in 2016. The eco-city could be something for Sarpsborg to be proud of.				
Sarpsborg has lower income, lower educated inhabitants and lower quality residential areas than average. Education is important. Potential for entrepreneurial city.				
There is no need for new large scale electricity investments in Sarpsborg.				
There is no need for more retails parks, Sarpsborg already has too many.				
Sarpsborg needs a holistic transportation plan. Potential for hardware city. The numbers of cars must be reduced. More pedestrian pathways and bikes lanes.				
Due to cultural reasons, Norwegians dislike co housing and neighbourly interaction. Norwegians' favourite hobby is to build their own houses and they appreciate privacy. Today's younger generations seem to be attached to the same customs of grown-ups.				
Local food is unrealistic. It is still necessary to get food from somewhere else. Highly motivated people are necessary for that (eco-farms).				
The eco-city should be a combination of entrepreneurial and hardware.				
The eco-city should be a combination of entrepreneurial and people's city.				
The eco-city should be a combination of hardware and people's city.				
The eco-city has to be a mix of commercial and housing.				
The eco-city should be a combination of entrepreneurial and people's city, but the basis should be a mix of self-sufficient and hardware.				
The eco-city needs to be as profitable as possible. Still, The company could accept a much lower financial return from this project if the eco-city provides something extra that is truly valuable: image.				
The eco-city can be a good PR case for the company.				
Shared offices are underdeveloped today, they should part of the eco-city.				
People's city is not possible. It is a good idea in theory but difficult to implement in Norway.				
The whole idea of a self-sufficient city is not possible or trustworthy but some of its elements are good to implement.				
Hafslund could find a new niche in high tech: potential for entrepreneurial city.				
Passive houses are a must in order to live in an eco-city, though they are too expensive.				
Bioclimatic architecture is a good and interesting concept.				
What makes an eco-city are green and public spaces				
Hafslund could achieve CO_2 neutrality only in the energy and transport sector.				
When it comes to CO_2 neutrality, it is necessary to have a look at the entire picture (water, waste, buildings, transport, roads, etc.) and reduce emissions drastically in all these sectors.				
Innovation is important. It is necessary that Hafslund comes up with something really good and groundbreaking in order to get approval as farmland is being transformed. Farmland is highly valued in Norway and hence a very controversial issue.				

Table 1: Notable quotes from stakeholders

Eco-city for the region

The proposed regional scenario looks at the driving forces from Østfold, Sarpsborg and Hafslund in Figure 1 – which could influence Hafslundbyen's development as a show case at the regional scale. The Eco-City for the Region is designed as a response to the following future driving forces:

- Growth of a more multicultural society through increased rates of immigration and a need for a local identity for Sarpsborg;
- Ambitious county targets to be carbon neutral by 2030 (partly through offsetting) – ahead of EU goals;
- Increased urbanisation with denser spatial structures to cater for the expected influx of people to the region and consequently a loss of green spaces and biodiversity;
- Population grows by 100 000 persons (by 2050), mainly larger younger generations and young families;
- Strong disincentives for private motor vehicle transport through toll stations and congestion zone charging (similarly to Stockholm and London); and
- Continued supply excess of waste heat through the adjacent Borregaard industrial complex.

Regional showcase

The Regional showcase scenario involves social housing with a high content of shared key spaces, high resource efficiency, closed loop thinking on a local level and private renewable energy production.

Integration with its local surrounds is crucial when considering an ecological city. The city should also be able to reflect the local culture, heritage and ecological environment unique to Sarpsborg and Østfold. By listening and understanding the needs of the many actors which could be involved in the development and use of Hafslundbyen, the project could provide a very complementary as well as sustainable *regional showcase*. The project should utilise life cycle assessments particularly concentrated on the design and construction phase to define the options of development best suited the local conditions while keeping carbon emissions low.

The 'Eco-City for the Region' recognises that future climate change policies will require an even stronger support role at the local to regional level to reduce energy consumption. Through southerly orientated buildings with good insulation to trap in heat and larger (insulated) windows to optimise the daylight lighting levels, the energy demand from a building can be decreased. In this way *Bioclimatic Architecture* can be used in housing to optimise the heat and daylight levels from the sun.

Borregaard is expected to continue to supply excess waste heat as *District Heating* to the area although in the future there may be competition for waste as a fuel resource in this manner.

District heating

With more sustainable forms of transport envisioned for the future such features as *public pedestrian walkways and more bicycle trails* are very likely. With increased investment and reliability on public transport, commuting times will decrease between Oslo and Sarpsborg.

Future social trends suggest larger urban areas and denser cities structures while *Information and Communication Technologies (ICT)* make it easier for work to be conducted from home, increasing leisure time saved from commuting long distances from Sarpsborg to Oslo for instance.

Expected larger mixes of different culture backgrounds and coupled with an ageing population means that Hafslundbyen would need to deliver a strong social character to incorporate these changes to society while giving Sarpsborg its much sought after *local identity*.

Table 2 depicts the Strengths and Weaknesses of internal factors (Hafslund and Hafslundbyen) and Opportunities and Threats from external factors (SWOT) for an 'Eco-City for the Region'.

Business case

The SWOT analysis in Table 2 identified the need to consider the entire life cycle of Hafslundbyen from design through to use phase.

Through 'designed in' greener lifestyles, regional environmental targets could be reached. By considering the development of Sarpsborg on the city scale Hafslund can complement and add to the city's local identity.

By utilising smart metering and monitoring the energy and carbon consumption of the inhabitants, Hafslund could provide the community, Sarpsborg and Norway with an understanding of where consumption is highest. This data could provide the means for a platform or baseline through which personal carbon trading could become possible. (Strength 1 → Opportunity 1, 2 +5)

Table 2: SWOT analysis for the Regional showcase

Strengths	Weaknesses
1. Knowledge and experience in energy generation and distribution 2. Largest distribution grid owner in Norway 3. In-house knowledge of smart metering	1. Lack of construction skills to build passive and plus housing 2. Divergence of the vision for Hafslundbyen within company and amongst stakeholders 3. Creating a fixed infrastructure that does not allow system upgrades
Opportunities	**Threats**
1. Development of stricter targets in climate change policy 2. Need to reduce energy demand 3. Need to increase biodiversity 4. Need for more frequent and faster mobility 5. Demonstrating higher energy efficiency potential	1. Future trends towards decentralisation will compete with district heating and power supply 2. Biodiversity policy in Norway is a constraint for the development of Hafslundbyen due to the loss of agricultural land

Through higher energy efficiency, Hafslund could use greener electricity (hydropower) to substitute oil in the transportation sector for electric cars, trams and in the future also for heavier trucks and buses. This could lead to reduced emissions and increased energy security at the regional level. (Strength 2 + Threat 1 +Weakness 3 → Opportunity 1)

Having a visionary ecological city in Sarpsborg that the citizens could be proud of would enhance the sense of local identity By closing down and greening over the landfill at the entrance to the city, the aesthetics and green spaces have both increased. If Hafslund can prove the development of the eco-city will introduce more biodiversity into the area then the constraint on developing on agricultural land should be lifted. (Threat 2 → Opportunity 3)

By creating shared office spaces and providing these with the newest infrastructure within ICT, Hafslund would create business opportunities while also diverting commuter traffic. Hafslundbyen could provide the inhabitants with the means to reduce their carbon footprint by not having to commute to work every day. Future possibilities could be to expand the infrastructure to other areas. (Weakness 3 + Opportunity 1)

Eco-city for the world

From a macro-scale perspective – covering the World, Europe and Norway in Figure 1 – several relevant driving forces of future trends are detected:

- Growth of global population as well as the share of affluent people: increased resource constraints;
- Increased environmental concerns: climate change targets and desires to contribute to the process of avoiding a global warming of more than 2 degrees;
- Geo-political conflicts: decreased supply of non-renewable energy and larger share of decentralised energy generation within national and regional borders;
- Opening up of energy markets: increased transnational trading of e.g. electricity, natural gas, waste (as well as carbon permits);
- New regulatory environment: Stronger EU governance and more incentives for 'clean' techniques and penalising traditional fuel sources for GHG emissions;
- Improved clean technology: Small- and large-scale energy production as well as energy efficiency techniques become more cost-effective, particularly as BRIC (Brazil, Russia, India and China) countries compete fiercely with Western countries for clean tech; and
- Need for Norway to diversify economy: Shift towards a more knowledge-based economy.

Global showcase

The Global showcase scenario: high resource efficiency, closed loop thinking on a local level, renewable energy utilisation.

In order to make Hafslundbyen a *global showcase* of an integrated sustainable city area, the project should cover all life cycle phases. From the design phase, the construction phase, the use phase to the end-of-life phase. This implies that the eco-city should not merely be constructed and next perceived as 'project completed'. A sustain-

able city quarter requires a flexible infrastructure and design of the city, which will make it easier to further upgrade the eco-city functioning in time. The user's phase encompasses how human behavioural changes lead to lower environmental impact and greater sustainable good. The end-of-life cycle does not refer to the end of the city, but the need for continuous improvement through monitoring and reporting of the targets set.

The 'Eco-City for the World' recognises that future trends will reshape the business environment. At present the power and utilities supply energy, which is generated centralised, in a one-directional flow to consumers. However in 2030, the state of the world might have changed to a larger share of decentralised generation of clean energy – e.g. solar PV, solar water heating and micro CHP. *Passive and Plus Houses* generate their own energy through decentralised energy production and give customers more control over their energy, but also a consequently higher intermittent capacity. The house will also make an efficient use of the lightning and achieve ventilation with heat recovery.

Smart energy systems are a new intelligent technology, – consisting of smart grids, smart meters and smart appliances – that could provide an adjustable and flexible infrastructure. The smart grid balances the demand for energy demand with generation, also referred to as 'above the meter'. House owners produce energy for their own purposes as well as sell excess energy back to smart grids. Consumers use smart meters for their energy consumption, creating a two-way flow of energy and data ('below the meter'). Energy companies could benefit from more flexibility to manage demand and supply, whereas consumers could try to save energy and consume energy (e.g. washing the laundry) during off peak hours instead.

On a global scale, a study by Ernst & Young [6] expects that power and utilities companies will invest approximately *147 EUR* billion in developing smart energy systems. By charging electrical vehicle with their own solar PVs or micro wind turbines, costs for transportation as well as the GHG emissions can be reduced significantly. A light-rail train between Sarpsborg and Fredrikstad could optimise the public transportation.

As Norway would need to move to a more knowledge-based society, the creation of a "*Clean Tech Cluster*" would function as a centre for innovation in technologies, products, and services which lead to high eco-efficiency levels. These optimise the use of natural resources while significantly lowering the cost and hence increase profitability. These innovations can range from renewable energy generation techniques to energy-efficient buildings, smart mobility and waste management. Partnerships in the area of information and communications technology (ICT) in the form of data mining and data warehousing are found in the eco-city.

Already existent and future technologies will allow eco-cities to make the best use of shared key spaces. Smart jobs will permit people to work from home more often through *shared office spaces*. Rather than working at home behind the computer, people will share offices in the urban area to create a similar working environment with social interactions. Through *teleconferencing*, people do not need to travel distances by car or airplane, reducing the carbon footprint.

Strengths	Weaknesses
1. Knowledge and experience in energy generation and distribution 2. Largest distribution grid owner in Norway 3. In-house knowledge of smart metering	1. Divergence of the vision for Hafslundbyen within company and amongst stakeholders 2. Focus on creation of a fixed infrastructure that does not allow system upgrades
Opportunities	**Threats**
1. Growing need for energy service providers (smart metering and smart grids) 2. Increasing demand for smart techniques 3. Need for more frequent and faster mobility 4. Demonstrating higher energy efficiency potential	1. More decentralised energy generation of house owners à less control by utility 2. More intermittent capacity 3. Potential to underestimate the future of renewable energy and clean tech

Table 3: SWOT analysis for the Global showcase

Table 3 depicts the Strengths, Weaknesses of internal factors (Hafslund and Hafslundbyen) and Opportunities and Threats from external factors (SWOT) for an 'Eco-City for the World'.

Business case

From the SWOT analysis several business cases for developing Hafslundbyen become visible.

The SWOT analysis identified that a larger share of decentralised energy generation of house owners could lead to reduced control by energy companies. However, utilities are likely to play a strong role in the matching of supply and demand of energy. The front runners will connect the entire smart value chain, from grid, meters and appliance to intelligent homes. (Threat 1 + Strength 1 → Opportunity 1)

The smart energy system could make the current grid more efficient and better at feeding renewable and decentralised energy. (Threat 2 + Strength 2 → Opportunity 2)

Decentralised energy production could increase the energy supply. The technologies for solar panels and other small-scale energy generators will improve and taxes could be placed on CO_2 emissions, making these techniques ever more likely to be implemented in the near future. In Norway, most electricity is produced from hydropower, making CO_2 taxes not very effective.

An external threat (Threat 3) for underestimating the future of renewable energy and clean tech, could be reduced by setting up a Clean Tech Cluster, where Hafslundbyen could learn from implementing new techniques in an adaptable and flexible infrastructure (overcoming Weakness 2).

Second, a new business model with a service feature could transform the energy sector from producers of energy (selling kWh) to providing a 'comfortable living environment' to consumers. For example, energy companies would provide the service of heating at a constant temperature per m^3. This would be a business opportunity for Hafslund because it would expand

the value chain towards energy services. This can facilitate least life cycle cost thinking by helping consumers to outsource their energy efficiency decisions. (Opportunity 1)

Partnerships in the field of ICT for customer relationship and managements are needed. Other third parties for setting up smart mobility – e.g. a light-rail – could lead to more frequent and faster mobility. (Opportunity 3)

Furthermore, energy efficiency feasibility could be perceived by the general public and industries as an energy security enhancer and therefore require the services of an energy company offering such products. (Opportunity 1 + 4)

Increased energy efficiency (Opportunity 4) could lead to a surplus of clean energy that can be exported and hence, a result in a greater revenues and profits.

The buildings also reach higher energy efficiency levels, which could capture government support for obtaining grants and subsides for the development and implementation of new techniques. (Opportunity 2 + 4)

Smart metering could demonstrate that efficient living and working is possible. (Strength 3)

Failure Scenarios

In order to avoid certain traps in the planning and implementation process, Table 4 highlights some examples from Swedish case studies in Hammarby Sjöstad (Stockholm), Västra Hamnen (Malmö) and Östra Hamnen (Västerås) [4]. Table 4 is supplemented by comments that further elaborate some of the cause and effect scenarios.

'Over-optimistic' assumption in the behavioural change of the users: The future inhabitants were not able to participate in the planning process, while the information on how to live sustainably in the new area were only provided through brochures (both in Bo01 and Hammarby Sjöstad). In order for the city to function sustainably, it was suggested that the inhabitants get a one day training using the new technique and/or to enable them participate more actively in the planning process. Another way could be to facilitate behavioural change through improved residential infrastructure.

Lack of understanding of the difficulties of the building industry to build passive houses or plus energy houses: Could be avoided through improved communication, workshops and the elaboration of clear criteria and working directives (Bo01 and Hammarby Sjöstad).

Inconsistent Quality Management System: If the targets are vague, there will be gaps leading to misinterpretation. This can be avoided if the Quality Management System is carefully reviewed before implementation (Bo01).

Excluding stakeholder groups and/or lack of recognition of needs and expectations of different stakeholders: Not every member of the community is required to participate in the decision making process. However, workshops can be arranged to gather feedback from underrepresented stakeholders. Excluding certain members in the decisional process could lead to bad PR (Östra Hamnen in Västerås).

Certain Stakeholders may dominate the planning and design of the Eco city to serve their own purposes:

Planners need to systematically reassess their own role in the planning and implementation phases. The risk of designing an eco-city focusing too much on one interest can be avoided through a critical review of the Quality Management System before starting the project (Östra Hamnen and Bo01).

No measuring of energy targets and/ or following up of the results: A sustainable city with ambitious energy goals and targets needs consider the preferences of the people living there. Therefore, it is essential to monitor energy consumption and evaluate energy efficiency for future improvements. Effective external communication, both at the national and international level, contributes to build trustworthiness and transparency of the company (Bo01 and Hammarby Sjöstad).

Table 4: Failure Scenarios for the planning and implementation process

CAUSE	***EFFECT***
Too high investments in new techniques and fancy architecture	- Risk of negative public perception - No mix of social structure - Difficult to replicate
"Over-optimistic" assumption of behavioural change of users	- Energy savings or sustainability goals not achieved - Negative PR in media
Lack of understanding of the difficulties of the building industry to build passive houses or plus energy houses	- High investment cost - Lack of quality - Energy saving targets not achieved
Inconsistent quality management system	- Lack of quality - Energy targets not achieved
Lack of a common understanding of terms and concepts among different stakeholders (e.g. 'sustainability')	- Lack of quality - Energy goals not achieved - Critic from media
Excluding stakeholder groups in the planning and implementation process	- Bad press coverage – bad news sells better than good - No change in the behaviour of the "users" - Delays in building the city
Certain stakeholders may dominate the planning and design of the eco-city to serve their own purposes	- The eco-city may not be rationally planned to serve the needs and expectations of all stakeholder groups - Lock-in effect - No international showcase
Lack of a common vision	- Too many compromises – weak project - Delays in planning and implementation
Lack of integration of the eco-city into the surroundings	- Criticism from the local stakeholders - Bad PR - People not living and moving there
Life cycle perspective not included in the construction phase	- Lack of quality - Energy targets not achieved - No showcase
Modest design of the eco-city in terms of sustainability	- Lack of support from the public administration - Problems with planning approval
No monitoring of energy targets and/or follow-ups of the results	- Energy targets are not achieved - Bad PR
Time constraints when constructing the eco-city	- Houses with bad energy recovery - Critic from the media - Energy targets are not achieved

Life cycle perspective not included in the construction phase: By designing an eco-city to be carbon neutral with zero emission, the phase which creates the most waste and emissions (excluding the use phase) should be targeted. The construction phase would benefit from a life cycle assessment (LCA) at the start – before tenders contracts are even considered. The ability to source material responsibly, incorporate reclaimed materials, construct buildings with longer life spans (and hence reducing maintenance costs) and construct with new technologies for intelligent buildings, will all help set the standard for good quality and visionary housing.

Interviewing local inhabitants in Sarpsborg

Summary

The aim of this project was to create an understanding on how a potential eco-city could create value for the company as well as contribute to the sustainable good.

For the first objective, to understand Hafslund ASA motivation for such a project, the interviews illustrated that a large profit margin was neither expected nor realistic in such a project but rather that the value lay in the good 'green' PR with customers.

The second objective to find out how people within the company and other stakeholders perceived a potential eco-city, the scenario exercise and feedback showed a very mixed result from all actors likely to be involved as well as within Hafslund itself. We would recommend that for the Hafslundbyen project to develop further, a clearer vision is essential to be communicated within the design team and all other departments involved.

For the third objective we raised the awareness on the potential function of Hafslundbyen as an eco-city, awareness of the function of infrastructure and certain design concepts. By considering future business models of how and to whom the eco-city could add value, Hafslund can incorporate good sustainable practice throughout the process chain. Through continued monitoring (and regular transparent reporting) of the consumption behaviour of inhabitants through smart metering Hafslund could provide advice (consultancy service) as to how best to implement new features (technologies, infrastructure).

A good showcase is needed to prove that a potential eco-city could reduce environmental impacts of an urban community in the future. Through continually upgrading and improving Hafslundbyen's energy efficiency, the city then becomes a good future example of what new city and suburban expansion projects should aim for when considering the sustainable good as driven by expected stricter environmental and climate change policies.

References

[1] Bandhold, H. & Lindgren, Mats. (2003). *Scenario planning, the link between future and strategy*. Palgrave Macmillan.

[2] Miller, G.T. & Spoolman, S.E. (2009). *Living in the environment: Concepts, connections and solution*. Belmont, USA: Brooks/Cole.

[3] Globalis. (2002). *Norway: Ecological footprint*. Retrieved from: http://globalis.gvu.unu.edu/

[4] Green, A. (2006). *Hållbar energianvändning i svensk stadsplanering*. Linköping: Unitryck.

[5] Eurostat. (2009). *Electricity prices for first semester*. Retrieved on the 23 April 2010 from, http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-09-048/EN/KS-QA-09-048-EN.PDF

[6] Ernst & Young. (2010). *Seeing energy differently*. Retrieved from: http://www.ey.com/GL/en/Industries/Power---Utilities/Seeing-energy-differently

[7] IEA. (2009). *Key World Energy Statistics.*

List of people interviewed

Torleif Bramryd & Michael Johansson, Department of Environmental Strategy, Helsingborg Campus, Lund University

Gunnar Gjörtz, Senior Vice President, Treasury, Hafslund ASA

Raghnhild Marie Bakkevig, Electricity Grid, Hafslund ASA

Knut Rikkard Bakken, Electricity Grid, Hafslund ASA

Trond Nedregård, CEO Telecom, Hafslund ASA

Åsgeir Helland, Corporate Social Responsibility, Hafslund ASA

Pål Mikkelsen, CEO at Hafslund Miljøenergi AS

Øyvind Nilsen, Executive Director – Strategy and Development, Hafslund ASA

Ragnav Maalen-Johansen, Smart Metering, Hafslund ASA

Steinav Akelsen, Smart Metering, Hafslund ASA

Øyvind Aarvig, Program director "Energy in Buildings" – Cities of the Environment, Ministry of Environment

Charlotte Iversen (Cities of the Future, Buildings and Energy in Sarpsborg), Sarpsborg Municipality

Anne Elisabeth Ramtvedt (Cities of the Future, Land Use and Transport in Sarpsborg), Sarpsborg Municipality

Tore Hansen, Sarpsborg Municipality

Helge Kolstad, Østfold County

Prof. Kine Halvorsen Thorén, Landscape Architecture, Sustainability & Planning, Ås University

Prof. Arve Heistad, Mathematical Sciences and Technology, Ås University

The development area with the old smelting works in the background (Photo by Jarl-Morten Andersen)

Integrating Sustainability in Urban Planning, the Remodelling of a District in Shanghai

By Gregory Eve, Kai He, Mathilde Mansoz, Solomon Asea

Developing Shanghai

Shanghai, a city of contrasts

Shanghai is China's industrial, financial and commercial centre. Equally distant from Beijing and Hong Kong and strategically located on the East China Sea, it is expected to become the world's second largest port after Singapore by the end of 2010. The presence of a large number of industries and commercial activities makes it the country's most influential city in terms of commerce and finance. It is also China's largest [1] and wealthiest city [2].

Shanghai, view from the Pearl Tower

However, there are a number of social problems that co-exist with the impressive statistics: uneven wealth distribution, poverty, air pollution and corruption are some examples. According to the BBC, Shanghai gives the impression of being the first, second and the third world co-existing together inside China [3].

Total Area	6 340.5 km²
Urban Area	2 643 km²
Water Area	122 km²
Total estimated population	20 million (1.5% of China total)
Floating population	4 million
Total GDP [4]	134.2 billion EUR (4.9% China's total)
GDP growth rate [4]	14.3% (national average, 11.4%)
GDP per capita [4]	7 306.5 EUR (national average, 2 087.5)

Table 1 – Shanghai by numbers

Environmental issues and current action

Air

Shanghai is one of Asia's most polluted cities [5]. Air pollution in China kills 656 000 people annually, against the 41 200 estimated for the United States [6]. Its air quality has however improved significantly since 2003, particularly with the hosting of the Expo 2010 being a driving force. But much improvement is needed, starting

from the setting of stringent standards. Between 2003 and 2008, the city enjoyed 85% of days within the year with good air quality (levels I and II)[1]. This was due to the upgrade of obsolete technologies in industries, removal of coal boilers from the urban centre, promotion of public transport, wide use of electric scooters even among the poor and increased use of renewable energy including supply coming from the Three Gorges Hydro Power Dam, and newly build wind and solar power plants.

Water

Shanghai lies on the southeast side of the Yangtze Delta and therefore contains many rivers, canals and lakes. Main water sources are *Hangpu* River, *Suzhou* River, *Changjiang* River and *Tai* Lake, which is the most important lake, situated about 80 km from the city. Rainfall is also a key water source, with UNEP estimates at 1 238 mm annual precipitation in 2008 [7].

Shanghai is also listed by UN-Habitat as one of the cities in the developing world likely to face a water crisis in the near future, which will lead to acute clean water shortages, mostly due to increasing population, sea water intrusion and pollution [8a].

Consumption of water is mainly attributed to coal-fired plants and factories (56%), agriculture (14%), municipal/public services (9%) and (10%) for domestic use. By the end of 2008, Shanghai had 50 sewage treatment plants with a capacity to treat 75.5% of its sewage. Wetlands were further created to treat sewage but the quality of water remains poor [7].

Non-point source pollution from agriculture due to persistent fertiliser use has led to eutrophication of lakes and rivers. The challenge is to reduce and treat industrial, municipal and agriculture discharge and regional cooperation with neighbouring provinces. The Chinese authorities have invested a lot of resources to have clean water although, according to UNEP, the overall water quality of rivers and lakes in Shanghai "still leaves much room for improvement" [7].

Green spaces

The Shanghai municipality has shown great concern for green spaces and has developed a *Master Plan* for the years 1999 - 2020, according to which land use for urban development of green spaces and forests should cover one third of the total land of Shanghai.

Green corridors have been created along the *Huangpu* River, *Suzhou* Creek and *Yanan* highway. New public parks increased the green space for citizens from about 4 m^2 per capita in 2000 to more than 12 m^2 in 2008. The greening rate has increased to 38% from 2000 to 2008. Shanghai was awarded the title of 'National Garden City' by the government in 2004 [8b].

Around Shanghai important efforts have been made towards reforestation and afforestation (e.g. *Chongming Dongping* Forest Park, *Haiwan* Forest Park). In 2008, there were 95 000 hectares of forested land, forest coverage rate was 11.6%, a four-fold increase from 2000 [8a]. The Shanghai Landscaping Administration Bureau also started a programme in 2003 to implement green roofs. Green roofs in Shanghai currently cover 700 000 m^2, with

1 *China Environmental Monitoring Centre classifies Level I as excellent and pollution readings not exceeding 50 & Level II as fairly good and readings in range of 51 - 100.*

an annual future target of 300 000 m² and a potential of 19 million m² [9].

Nature reserves have also been created, such as the *Dongtan* Wetland Protection Area, which follows the principles of the Convention on Biological Diversity. These policies also contributed to increase biodiversity, there are now 298 different species of birds and 202 classes of fish in *Dongtan* [7].

Energy

Shanghai, like most of China, is dependent on coal for its electricity needs. The reliance on coal has greatly reduced over the years though, down to 51.5% of primary energy consumption in 2007 from 64.5% in 2001. With the industry still consuming 75% of total electricity produced, several measures were put in place by the municipality to reduce the environmental impacts associated with coal-based produced electricity. These include the closure of small and older power plants, 533 with a total capacity of 14.4 GW, which were replaced by less polluting ones with better technologies that increased efficiency. UNEP estimates that the old plants burnt 30 to 50% more coal than the modern high technology ones per unit of energy produced [7].

The project

Planning for Sustainable Urban Development is the name of the project the authors took part to. It involves a total of 50 students with diverse backgrounds from five institutions: the Royal Institute of Technology (KTH) based in Stockholm, the International Institute for Industrial Environmental Economics (IIIEE, Lund University, Sweden) and the Department of Architecture (Lund University, Sweden), as well as Shanghai's Tongji and Fudan universities. Professors from these universities, the Shanghai Jing'an Planning and Land Administration Bureau (referred from now on as Planning Bureau) and professionals were invited for lectures and interviews.

The aim of the project is to develop new proposals towards the creation of sustainable urban features for a city, with a block in the Jing'an district of Shanghai (referred as *Jing'an 103*) as the case study. The site is undergoing a redevelopment plan that shall transform it into a commercial area. Six mixed teams of students from different universities and areas of study were formed. Each team was expected to present a proposal, for the redevelopment of the area, which should somehow inspire the Planning Bureau and at the same time comply with given requirements such as the Floor Area Ratio (FAR). The authors were distributed in four different groups and acted as environmental consultants in the development of the proposals.

The proposals, which should be concrete and implementable, will be evaluated by the Planning Bureau and will be presented during the upcoming Expo 2010 in Shanghai on July 1-2.

Expo 2010 Shanghai

The Expo 2010 Shanghai, whose theme is 'Better City Better Life', will take place between May 1st and October 31st 2010 in Shanghai. The key message behind the theme of the Expo is to show exciting innovations and initiatives that will ultimately lead to achieving better living conditions and more sustainable urban environments. Over 70 million people from more than 200 countries are expected to attend [10].

District and site in focus

Jing'an district, centrally located in downtown Shanghai is the project area. Like

Shanghai, the district is one characterised by deep contrasts. A high concentration of modern architecture and infrastructures co-exists with traditional dwelling settlements called *lilongs*, inhabited by some of Shanghai's poorest inhabitants.

Geographical location of site

The project site is located in the northern part of Jing'an district, north to Changping Road, south to Kangding Road, west to Changde Road and east to Xikang Road. It is 1.1 kilometres away from *Mei Tai Heng*, the central business district in Jing'an. The areas in proximity of the site see many residential buildings, but works are in progress for the construction of 200 meters high rises for commercial and office use. The metro station of Line 7 and its ancillary facility can be found on the western side. Two thousands households currently live in the 3.4 hectares area.

An alley in the site

Jing'an 103 site location in Shanghai (Source: Shanghai Jing'an Planning and Land Administration Bureau, 2009)

A sustainability analysis

The evaluation of the sustainability of such a project is quite complex and depends on many variables. Furthermore, it has not yet been defined how the reconstruction will be carried out and no specific project has been chosen so far. Under such premises, this section presents some generic considerations and suggestions divided according to the three classical pillars of sustainability: economic, social and environmental.

Economic perspective

The project is clearly driven by economic opportunities. Land value in Shanghai is very high and the surface occupied by the *lilong* structures will be monetised by restyling existent structures and especially by rebuilding high rises for commercial use. The Planning Bureau mentioned that the municipality will roughly make a twofold profit. The economic convenience of the project is clear if accounting direct costs, but a complete analysis should also evaluate the indirect costs coming from the social and environmental dimensions. Redistribution issues (i.e. how the profits will be shared and reinvested, who gains and who

loses) are a very significant aspect but do not alter the overall convenience of the project. These considerations are related to the social dimension and are targeted in the following paragraph.

Social perspective

The rapidly changing urban landscape of Shanghai strongly affects the social structures and the life of residents, threatening cultural heritage and forcing a shift from traditional to alien lifestyles. These aspects can, however, be compensated by better living conditions provided by the improvement of infrastructures.

The demolition of Shanghai's *lilongs*, such as the Jing'an 103 site, undermines the social fabric of the communities. Most low income residents have spent much of their lives in these houses, which were built from the 1920s onwards. As the city grows, they are either obliged to relocate within the city, or to move to rural areas, making space for modern buildings. Typically the Shanghai municipality buys the properties at a rate of 10 000 RMB (1 095 EUR) per square meter, while in neighbouring redevelopments the price for a square meter reaches 45 000 RMB (4 925 EUR) on average. A single house of 12 m² would bring to its landlord 120 000 RMB (13 130 EUR), which would only allow the purchase of approximately 3 m² in the new development. Furthermore, the municipality gains a considerable profit in the operation, by selling each square meter for 30 000 RMB (3 280 EUR) on average. By resisting the relocation residents can sometimes receive a better compensation, especially if the municipality is pressing for the demolition. The site is confined between high rise buildings and non accessible centres guarded by policemen (such as the newly built Dutch cultural centre) creating marginalisation. Postings placed within the site are displayed to encourage the residents to move as soon as possible.

'The sooner you move, the quicker the city will develop', says this municipality's posting on the site

Lilongs have been designed in a way to allow easy interaction between residents, creating a strong community life. In Chinese, *li* means neighbourhood and long means lanes. House doors are open most of the time. Housewives wash their laundry in the alleys' basins, or share a washing machine. There are a number of local shops, services and small businesses such as hairdressers, groceries, tea shops or restaurants.

Residents Committees were promulgated by the Democratic Socialist Party in the 1950s. They act as leading administrative bodies and report information from the Party to the residents. They also ensure social structure in neighbourhoods. People become members of the committees through an election process. Today with the widespread use of high rises and the new fast pace of life, the role and the structure of these committees are changing.

They tend to become landlord committees and less care is provided to the community.

These houses, however, often have bad infrastructures, providing low living conditions and poor sanitation. The oldest *lilongs* do not have toilets and people have to use buckets instead. There is no hot water. People use gas cookers installed on the ground floor nearby the entrance to heat it and to cook. Relocation could thus be beneficial for the residents. The conciliation of the needs of the local government with the needs of the residents represents a difficult challenge [11].

Ironically, the traditional way of life that remains in *lilongs* does have sustainable aspects. Integrating and adapting them to 'modern' life styles would also contribute to preserve the cultural heritage and memory of those districts.

A good example comes from the waste collection and sorting. Plastics, papers, wood and metals are collected and piled on their three-wheeled carts by informal collectors, who signal their presence by ringing a bell. They then sell this waste in a central location of the city. After being pre-sorted, they are loaded on trucks that take them to a huge sorting centre outside of Shanghai. Such a process of collecting waste, driven by economic necessity, appears to be effective. However it is not easily practicable in areas with high rises gated residences. Combined with awareness on waste recycling and inspired collection processes, this tradition may offer some sustainable solutions to the problem of waste for the city. Similarly, the habit of sharing washing machines within the *lilongs* could be exported to the new developments and integrated in the design and functions of the buildings as it is done in Sweden.

Environmental perspective

It is not possible to evaluate the environmental impacts of a project that has not been defined yet. Besides of not having the opportunity to present quantitative data, the qualitative analysis is also constrained. Nevertheless presenting a list of environmental aspects to be considered in the choice and implementation of the project can be useful. The purpose is to supply some general concise guidelines meant to inspire the improvements of the project's environmental performance. The aspects have been grouped according to the life cycle of the structures and are presented in Table 2.

Traditional waste collection three-wheeled bicycle

	Area of impact	General recommendation	Recommendation for Shanghai
Demolition of existent structures	Energy	Typically a small fraction of whole life cycle but intensive	Minor problem in Shanghai for low rises, structures are hammered down by workers
	Air Pollution	Dust, fine particles and some heavy metals	Main concerns for workers but also for surrounding areas
	Waste	Materials should be reused when possible	Old linings can be made of high quality bricks
	Noise Pollution	Reduce when possible	Shanghai is a huge construction site. Could improve living quality
Construction of new buildings	Energy	Energy-intensive (still small if compared to use phase), on site generators	Little data available, monitoring and benchmarking programs opportunities. Improvements expected to be cost efficient and improve air quality
	Construction Material	Refurbish structures and reuse materials if possible	For new structures (high rises) prioritise locally produced materials
Use phase	Energy	Energy-efficient structures lead to large savings in long run. Natural ventilation, solar cooling interesting options Centralised solutions for heating and cooling	Increasing problem in Shanghai, especially because of air conditioning, but not demanding regulation. Room for smart metering programs and benchmarking between different activities.
	Water	Devices such as air mixing taps to reduce consumption, water collection and reuse of grey water for low quality uses Closed loop local water treatment	Water is not drinkable in Shanghai. Disinfection devices in the area could improve sanitation levels.
	Waste	Beyond waste minimisation, waste sorting and recycling allow resource optimisation and renewable energy production	Great potential for biogas production in Shanghai (52% of waste is organic fraction). Still 23% gap of safe disposal. Minimise impacts from incinerators with better sorting. Educational programs needed but informal collectors are an available workforce.

Table 2: Main environmental aspect related to the redevelopment of a built area. General recommendations and specific observations related to Shanghai's context. Sources: Dancouse, 2006 [12], Ortiz, 2010 [13], Xing, 2008 [14], Dong, 2005 [15], Naukkarinen, 2009 [16], UNEP, 2010 [8]

Increasing green spaces in the city not only improves social interactions but also has beneficial environmental effects. Air quality is locally improved and heat islands are curbed. The same considerations apply to the introduction of green roofs, which also can help regulating rainwater drainage and naturally lower the temperature of buildings during summer.

Positive impacts coming from the redevelopment of the area also include the transportation system. Helping interconnections and improving the service quality of public mass transit will translate into indirect environmental benefits.

Indirect positive impacts will arise also from the activities that will be hosted in the area. It would be possible to give priority to 'green' companies or more sustainable activities such as markets of local producers. This could be done either through direct incentives or by destining a fraction of the available spaces to activities that follow predefined criteria.

Governance and local conditions

Governance on city development

The urban development of Shanghai's region is firmly controlled and directed. A broad spectrum of regulations, such as the definition of an outer green ring limiting the expansion and sprawl of the city, is used. More specific indications are promulgated under a *neighbourhood approach* philosophy. The intention is to develop the units of the city in order to make them integrated and independent at the same time, avoiding excessive migrations of people through the city. This can happen by distributing residential structures, offices, commercial activities, cultural and social spaces in a homogeneous way. On the other hand, the limited and fixed availability of space creates strong economic opportunities for the district authorities to redevelop the areas by rebuilding higher value spaces, also accounting for the very high pressure and demand they are facing. Typically the FAR is raised, more spaces for commercial use are introduced and public spaces are minimised. The districts' bureaus can try to influence these processes by setting restrictions and requirements for the developer's projects.

Governance towards sustainability

When it comes to environmental policies, national and municipal approaches vary. For example, national building standards in terms of energy efficiency trace back to 1984, while Shanghai updated and enforced more stringent requirements. Of course the efforts can appear not very substantial if compared to Nordic countries standards, and the situation gets even worse if we look at waste and water management systems. Nevertheless some pilot cases, such as in the *Xintiandi* area of

ENVIRONMENTAL GOVERNANCE IN CHINA

The national environmental agency of China is the "State Environmental Protection Administration" (SEPA). Its role has been traditionally weak, often bypassed by higher governmental agencies. Local governments have their "own agendas" [17]. In addition, due to the growing concern on sustainable issues, local groups and international Non-Governmental Organisations (NGOs) play an active role in sustainable governance. NGOs such as Friends of Nature and the Worldwatch Institute are now cooperating with the Chinese government on environmental matters [17]. And public protests, albeit risky, slowly start to have some effects on governance.

Shanghai, shed some light on the city's future development.

Local officers of the Planning Bureau demonstrated interest in new ideas coming from foreign urban planning experiences. Besides, they showed commitment towards sustainability issues.

Divergence between central and local governments

A good example of divergence between central government and local government can be reported from the lectures about Shanghai's transport system. While the central government is subsidising the car industry and pressures for road infrastructures, Shanghai's municipality does not really go along with it. For example, in order to reduce traffic congestions which accompanied the city's enrichment, Shanghai began to regulate the number of new licensed plates from 1986. Local government started using auctions to sell new licenses. The average license plate price in Shanghai in February 2010 reached the record of 38 620 RMB (4 245 EUR), 309 RMB higher than January's price. Furthermore, the greatest share of the revenues is reinvested in public transportation, e.g. the metro. In the meantime the central government keeps encouraging the private car market as the 2009 revision of the *Automotive Industry Development Policy* proves.

Chinese perception of environmental issues

The perception of sustainability varies in a country characterised by huge social and regional inequalities. In Shanghai for example, the standard of living ranges from luxury to extreme poverty. One can have a meal for more than 300 EUR or for less than 1 EUR. The country's development is extremely imbalanced, with urban centres driving the growth and attracting people from rural areas.

Chinese government and urban residents are aware and concerned about environmental issues, such as the high level of air pollution. Being healthy and having a healthy family is a very high concern for Chinese people. Therefore health could be the key for raising environmental awareness and influencing policy making. And sustainability is a source of business opportunities, both at an investment level and from a life cycle perspective. To reach the long term goal of 6% of renewable energy in the energy mix by 2020, China investments are growing in the renewable energy sector. According to Bloomberg New Energy Finance [18], the investments in renewable energy (mostly wind) in China increased from 17.5 billion EUR in 2008 to 26 billion EUR in 2009, whereas they have decreased in the United States from 24 billion EUR to 14 billion EUR.

At a citizen level, the majority of people interviewed in and around the Jing'an 103 site are mainly concerned with the level of air pollution and to a less extent with water quality. A foreigner who has been living in Shanghai for the past 10 years was alarmed by the level of air pollution and according to him, air pollution measurements are falsified by the Shanghai's municipality. But contrarily to most Chinese interviewees, he acknowledged the efforts made by the municipality in providing green spaces. The city, despite its high density, contains a fair amount of greeneries (see introduction). It was observed through interviews that people would like to live in a more environmentally friendly surrounding. Nevertheless, a significant majority is not necessarily ready to contribute to it, either finan-

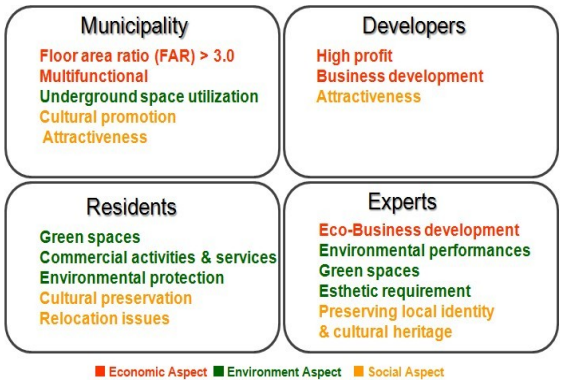
cially or physically (e.g. through the maintenance of green roofs). Finally, parks play an important role in people's life. A wide range of activities take place in parks such as Tai Chi, calligraphy, birds clubs, dancing clubs or opera singing. In that context, green roofs are seen more as a decoration than an area to be experienced.

The head of the Jing'an 103 site's *Residents Committee* turned down our interview request, explaining that she felt that her opinion would not make a difference in the decision making of the municipality and government. The citizens seem to have a strong feeling of lack of empowerment.

The concept of sustainability in China is to be seen within its cultural and economic conditions. The fast economic growth of the country is creating serious environmental issues that need to be addressed if China wants to sustain its development. Investments, innovation and development of green technologies can represent a long term competitive advantage for China in the international arena.

A developer's perspective

Refocusing the attention on urban planning, it is interesting to report the experience of the manager of an urban development company. David Nieh from Shui On Land Lmtd pointed out that when the government sells the land-use to developers that are also performing the construction phase and then maintain property of the spaces (i.e. leasing or renting them), there are stronger incentives for building efficient structures. The integrated services realisation (such as energy production, waste and wastewater management) can also be left to the developers, and their value is discounted from the land purchase price. The long-term investments for developing sustainability oriented 'closed-loop' projects thus become cost-efficient and appealing, especially if the interested area is quite extensive. When the market is fragmented between government, developers, constructors and final users, the conditions for such investments are met very seldom.



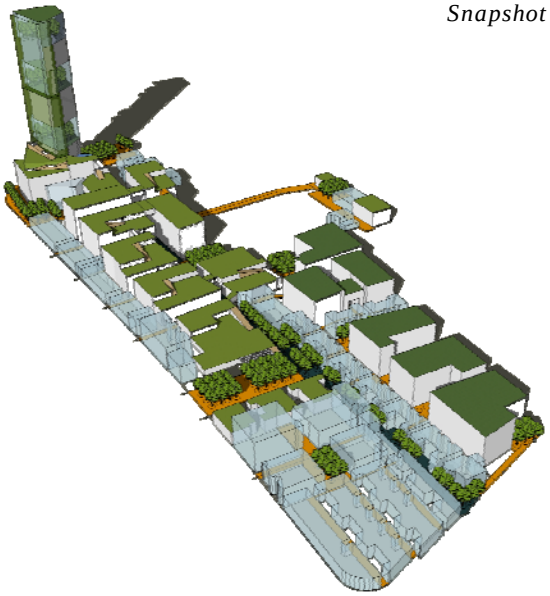
Actors and drivers for a redevelopment project

Projects

This section shows how sustainability issues were integrated in four of the proposed projects. Given the time constraints (proposals had to be developed and submitted in 5 days) the project could not possibly include the specifications required for an environmental assessment. It is interesting, though, to report the sustainability aspects that were baked into the core of the proposals, giving each project a diverse connotation either under a social, economic or environmental perspective.

The climbing garden green node

This project proposes to redevelop the area into a green node. The keyword for this project is connectivity. Two thirds of the area are expected to be demolished and rebuild, giving birth to a rooftop public garden climbing from an open square up to the 15th floor of a skyscraper. The new structures have been assigned to mixed functions such as commercial activities,



Snapshot of the climbing roof top garden

offices and entertainment centres. The remaining third of the block involves the preservation of *lilongs*, reinventing them as 'cultural experience hotels' or giving the opportunity to some small businesses to continue operating.

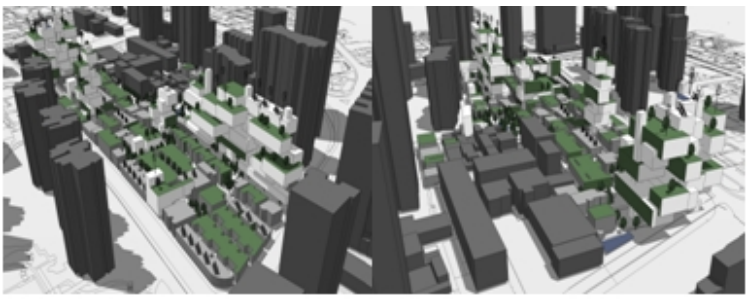
The plan, though, concentrates on connectivity, prioritising interconnections between the surrounding blocks and the integration of different means of transport. With the subway being at the centre of the scheme, pedestrian routes, taxi stations, bike racks and underground car parks have been planned to optimise connection systems.

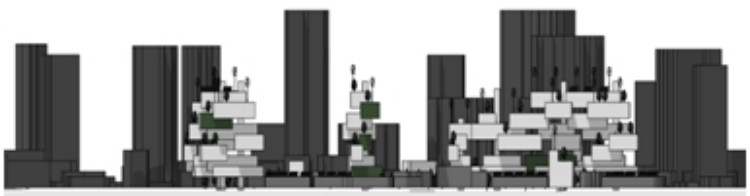
The economic dimension is accounted by complying with the '100% commercial area' requirement, thus maximising profit opportunities. The social dimension is tackled by the creation of a lively area with increased green public spaces, by the preservation of some traditional structures and activities. Furthermore, recommendations upon redistribution are presented. The maximisation of profits is encouraged in order to set aside a greater amount of capital destined to compensate the relocated families. Finally, the environmental qualities of the project lie in the improved air quality in the area, in the curbing of heat island phenomena and above all, in the improvement of connection to the public transit service.

Living sustainably in Shanghai: a reference eco-model as a landmark

This model is based on combining environmental and social sustainability by adapting the 'low-tech' current sustainable lifestyle of the site with 'high-tech' technologies, thereby preserving some cultural traditions. In the proposal, most of the houses are maintained and are renovated in a style that matches the district heritage. A limited amount of high rises are built in order to reach the 3.0 value of the FAR imposed by the Jing'an municipality.

Urban perspectives of the eco-model





Choosing lunch?

The new model aims at the creation of a sustainable and vibrant living experience for local residents and beyond, attracting sustainable and/or organic commerce, services and businesses. In a fully green environment, that stands out from the surrounding high rises and is highly visible from the large avenue on the West side, local residents and visitors enjoy a sustainable shopping and relaxing experience (organic coffee shops, restaurants, food, clothing, design), as well as cultural life (cinema, bookshops, artists' studios).

The new area includes a sustainable living and research centre or platform, where locals can learn about sustainability and businesses with researchers' contribution.

Finally this sustainability-oriented landmark represents an innovative showcase meant to exhibit, research and develop sustainable (water, energy) and *Information and Communication Technologies* (ICT) solutions. These solutions are both experienced by the residents and exhibited for the visitors. Green roofs, vertical walls, a central green zone connecting the life in the area, wind and solar powered street lamps, as well as a 'closed-loop' water treatment plant, are some of the proposed features.

Eco-lilong, Shanghai memory

Lilongs have been part of Shanghai's history for close to a century and represent a key part of the city's historical heritage. The majority of the *lilongs* and their residential functions are preserved. Sustainable aspects are also integrated, such as a rain collection and water reuse system on site to help with Shanghai water shortages.

After investigation and analysis, it was decided to demolish one block of the *lilong* in the eastern part to create green public spaces for local community. In this public space, green roofs, green surfaces and bamboos to build a rain collecting system are used. Rain water is channelled to a canal running through the middle of the public space. With a combination of water landscape, greenery surface and leisure activity along the street, a harmonious picture between humans and nature is created.

Commercial and leisure structures introduce dynamism in the new site. Besides water usage, solar panels on roofs facing south to be used for heating and street lighting are installed.

View of the eco-lilong development

Sharing is caring

Locals do not necessarily have to leave the place or feel marginalised but rather be able to share the available space with the incoming commercial users. A vision to achieve this objective is identified under three themes namely urban space, environmental and social aspects.

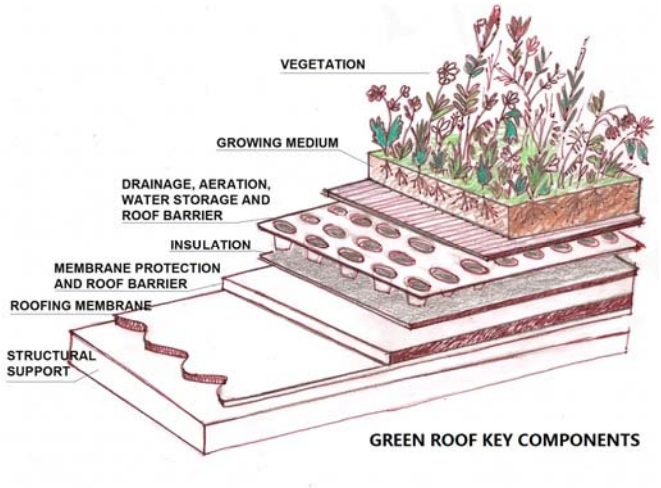
The urban space theme is about preserving as many buildings as possible for historical, cultural and resources saving reasons. Some spaces could be restructured to serve as waste collection centres and shared laundry rooms. The development of multifunctional open spaces including a playground, exhibition centres and bike parkings are also planned.

Under the social theme, the key ideas are about local business development as well as inclusion and participation of existing communities in the decision-making process. Redevelopment of the site should take the views of the local communities into consideration. Promoting local business to primarily benefit existing communities is crucial. The group suggests small-scale services like salons, day care centres, gyms, restaurants, shops, bars and grocery stores which could be used both by the commercial centre users and by the residents. For example, employees coming to work in the commercial activities and offices could leave their children in the day care centre within the site.

The key idea behind the environmental theme is about sharing facilities as well as collective responsibility. As mentioned earlier, modification of some of the old houses into shared laundry centres fitted with energy and water-efficient washing machines represents valuable sustainable solutions. In reference to transports, the use of bikes is encouraged as a user friendly and environmentally sound option.

Green roofs, a common feature to the projects

Green roofs have been implemented in most of final proposals presented to the Planning Bureau. Green roofs are living surfaces and act as habitats for vegetation such as draught tolerant plants, flowers and trees that are planted in a soil layer typically placed on top of the roof. Green roofs can be downscaled for smaller infrastructures such as bus stops, letter and post boxes, gas stations, etc. They are relatively easy to build, both on retrofit and new buildings, and have multiple environmental and ecological benefits. They require different types of maintenance depending on the type installed (see box on different types of green roofs).



Green roofs can compensate the carbon footprint caused by the construction of the building [19]. The environmental benefits of installing green roofs include natural drainage (preventing flooding, building

erosion and performing water cleansing), microclimate conditions and air quality improvements, development of biodiversity, better energy building performances. From a social standpoint well-being is increased through green views and extension of natural space. Finally, green roofs can create new markets for designers, architects and green roof installers.

In Shanghai, where air pollution represents a tremendous challenge, green roofs can play the role of bio-filters and can have a positive effect on human health, a major concern for the Chinese population. They reduce the temperature and contribute to direct and indirect cooling effects. Green roofs, on average, lower the temperature of the buildings by 3 °C reducing the considerable energy costs due to air conditioning. Through evapo-transpiration, the water goes back to the atmosphere and cools the city, thus reducing heat island effect, a problem during Shanghainese summers. They also reduce the formation of photochemical smog due to lower air temperatures.

THREE TYPES OF GREEN ROOFS

Intensive: they are similar to an ordinary garden, have a thick soil layer and contain trees and shrubs. They require the same maintenance as a garden. They can be constructed on roofs that can support heavy loads. The surface of the roofs must be fairly flat, with a slope of 3% maximum. They significantly contribute to a sustainable urban drainage system.

Semi-intensive: the range of species is more diverse than on extensive roofs. They are usually 150 mm thick and provide good functions for water retention. Suitable plants for this kind of roofs are those that grow naturally on free draining soils, alpine plants or wildflowers meadow mixes.

Extensive: they are based on shallower soil layers and are typically composed of sedums, mosses, and meadow flowers. They require little maintenance, and often are non-access roofs. The choice of plants is more limited. Suitable plants are usually dry or semi-dry plants with rocky surfaces. These roofs can be constructed on roof slopes up to 30%, and can be retrofitted onto existing structures with no or little modifications.

Source: Augustenborg's Botanical Roof Garden, Malmö, Sweden

Conclusion

The redevelopment of a district is a great challenge for a city. Not only it involves the physical relocation of families and activities but it can also disrupt the social fabric and undermine traditions and cultural heritage. Analysing redevelopment projects under the perspective of sustainability can help reducing the environmental impacts and spotting the opportunities to increase life quality in cities. If economic interests often represent a strong driver, the social and environmental dimensions are very complex and challenging. Nevertheless, the systematic inclusion of these issues from the project's cradle opens up the doors to ideas and proposals with embedded values and long term logic. Many stakeholders can be involved in the process, and this fragmentation does not help the adoption of sustainability oriented choices. Government, developers, construction companies, agencies and final users are hard to coordinate outside of a short term savings perspective. Simplification of this picture (with the existence of a single company acting as developer, constructor and leaser) can have beneficial effects from an environmental standpoint. The available technologies and knowledge offer a great spectrum of possibilities for decision makers, possibilities that can and must be caught to

improve the quality of life, in a time in which 50% of the world's population lives in cities.

References

[1] Embassy of Peoples' Republic of China, Sweden. (2004). http://se2.mofcom.gov.cn/aarticle/aboutchina/majorcity/200412/20041200009725.html. Last consulted on April 25, 2010.

[2] University of Liverpool. (2010). *City of Shanghai.* http://www.liv.ac.uk/shanghai-expo/at-a-glance/city-of-shanghai.htm. Last consulted on April 25, 2010.

[3] Hogg, C. (2009). *Is China a Rich or Poor Country?* http://news.bbc.co.uk/2/hi/asia-pacific/8035906.stm. Last consulted on April 25, 2010.

[4] National Bureau of Statistics of China. (2007). http://www.stats.gov.cn/tjsj/ndsj/2008/indexch.htm. Last consulted on April 25, 2010.

[5] Jiang, D. (2005). The Air we Breathe: UNEP / Tongji Institute of Environment for Sustainable Development. www.rrcap.unep.org/uneptg05/outline/env/JiangDahe2005.ppt. Last consulted on April 25, 2010.

[6] Platt, K.H. (2007). *Chinese Air Pollution Deadliest in World, Report Says.* http://news.nationalgeographic.com/news/2007/07/070709-china-pollution.html. Last consulted on April 25, 2010.

[7] United Nations Environment Programme. (2010). UNEP Environmental Assessment, Expo 2010 Shanghai, China.

[8a] UN Habitat Press Release. Water Crisis to strike most developing world cities by 2010. http://www.un.org/Conferences/habitat/unchs/press/water.htm Last consulted on 26th April 2010.

[8b] Bureau of Statistics of Shanghai. (2008). http://www.statsh.gov.cn/2003shtj/tjnj/nj09.htm?d1=2009tjnj/C0100.htm. Last consulted on April 25, 2010.

[9] Shanghai Municipality. (2009). *700 000 m² Green Roofs Decorate Shanghai.* http://www.shanghai.gov.cn/shanghai/node2314/node2315/node4411/userobject21ai357148.html. Last consulted on April 25, 2010.

[10] UN-Habitat. (2010). *The United Nations Pavilion Unveils its Logo.* http://www.unhabitat.org/categories.asp?catid=56. Last consulted on April 25, 2010

[11] Interview. Yang, G. (2010). Professor in Urban Planning, Tongji University. Interview performed on 23 April 2010.

[12] Dancause, D. (2006). Demolition Dangers. *Health Facilities Management, August 2006,* 33-36.

[13] Ortiz, O., Pasqualino, J. & Castells, F. (2010). Environmental Performance of Construction Waste: Comparing Three Scenarios from a Case Study in Catalonia, Spain. *Waste Management, 30(4),* 646-654.

[14] Xing, S., Xu, Z. & Jun, G. (2008). Inventory Analysis of LCA on Steel- and Concrete-construction Office Buildings. *Energy and Buildings, 40(7),* 1188-1193.

[15] Dong, B., Kennedy, C. & Pressnail, K. (2005). Comparing Life Cycle Implications of Building Retrofit and Replacement Options. *Canadian Journal of Civil Engineering, 32(6),* 1051-1064.

[16] Naukkarinen, P. (2009). Solar Air Conditioning and its Role in Alleviating the Energy Crisis of the Mediterranean Hotels. *International Journal of Sustainable Energy, 28: 1,* 93 — 100.

[17] Goffman, E. (2007). *China and the Path to Environmental Sustainability.* http://www.csa.com/discoveryguides/china/review7.php. Last consulted on April 25, 2010.

[18] CNN. (2010). *China Trouncing U.S. in Clean Energy Investing.* http://money.cnn.com/2010/03/25/news/international/china_energy_spending/. Last consulted on April 25, 2010

[19] Green Roof Research Program at the Michigan State University. (2006). *The future of green roofs in the United States.* http://www.hrt.msu.edu/greenroof/#The%20future%20of%20green%20roofs%20in%20the%20United%20States. Last consulted on April 14, 2010.

A Culture of Short Distances in Val di Noto

Rich Heritage – Current Challenges – Distributed Future

By Silvia Di Ponte, Katja Kavcic, Jonas Sonnenschein, Johanna Wester

The contemporary society is based on economical and technological activities of a resource intense nature. We are dependent on ecosystem services such as of sufficient and nutritious food, energy, clean air and water [1]. The overexploitation of these natural resources and the creation of large amounts of waste have implications on the environment and also on our own livelihoods. Human behaviour causes the degradation of important ecosystems and other environmental effects such as climate change. It is evident that our social well-being and economic development are highly intertwined with ecological systems.

The concept of sustainable development recognises this and aims at economic development that is consistent with the preservation of natural capital and social stability.

Project outline

The SED project 2010 in Val di Noto in Sicily, Italy, is a part of a wider project called *Sustainable Culture in Sicily* meant to develop "cities of short distances" in Val di Noto. The actors participating in the project are the Victorian Eco Innovation Lab (VEIL), under the guidance of Chris Ryan, the cultural association Lacunae through the management of Silvana Toccio, the Consorzio Universitario Mediterraneo Orientale (C.U.M.O.) through Salvatore Cavallo and researchers of the International Institute for Industrial Environmental Economics (IIIEE) at Lund University.

The aim of this SED project was to map the region in terms of resource use and start developing a sustainability vision for the region by applying the concept of distributed economies.

View over Noto

The next step of the project will be an expert conference in Noto in autumn 2010. This conference, Convegno Laboratorio Innovazione Sostenibile, will build on the findings of the SED research.

Before the findings are reported, some background information about the region Val di Noto and the main elements of the concept of distributed economies shall be presented.

Val di Noto

The geographical area that is analysed in this report is called *Val di Noto* (Noto Valley) and it is part of the Province of Siracusa in Sicily. In 2002, Val di Noto was included in the UNESCO World Heritage List, because of its natural and cultural heritage (Noto is considered the capital of Italian Baroque).

Figure 1: Map of Val di Noto

Val di Noto consists of five municipalities: Avola, Noto, Pachino, Portopalo and Rosolini. It has about 120 000 inhabitants. The area is considered a homogeneous territory because of many common physical and cultural features, problems and opportunities. The five municipalities have a common Agenda 21 office and are coordinating common EU-funded projects that are connected to regional development.

The landscape is characterised by scenic grape, citrus and almond plantations, intensive production of vegetables and a beautiful, partially protected coast line. In some parts large greenhouses disrupt the idyllic scenery. Moving towards the internal uplands, the landscape is dominated by *Maquis Shrubland* (typical Mediterranean vegetation). The Province of Siracusa hosts the largest amount of parks and protected areas in Sicily. A new national park is going to be created in the Iblei Mountains, partially covering the five municipalities.

The economy of Val di noto relies mainly on agriculture and tourism. The main plantations are olive, citrus, almond and carob trees, wine yards and vegetables (grown especially in greenhouses), among which the production of the Pachino Tomato dominates. Many agricultural products are of high quality – famous all around the world. For example, many excellent red wines are obtained from the grape *Nero d'Avola*. Recently a "new" development of small activities dealing with food processing and the export of agricultural products with added value is emerging. Fishing activities were in the past heavily dependent on tuna fish. But that business has closed down and the remaining fishing activity mainly takes place in Portopalo.

Large-scale industry is not present in the selected area. The food processing industry plays a minor role. But north of Val di Noto, the cities Priolo, Augusta and Melilli have impressive oil refineries and a large electricity generation plant.

Tourism is progressively increasing. It is a very diverse sector with activities mainly linked to the cultural heritage and the clean, lovely and "partially wild" coasts. Cultural tourism with short stays takes place throughout the year, beach holidays are mainly concentrated in the summer months and visits of school classes are common in spring and autumn.

Distributed Economies

Sustainable development in Val di Noto can be looked at from different perspectives. As stated above, the framework that has been used for this report is Distributed Economies (DE). The DE concept refers to models of production and consumption that are based on local resource availability and its sustainable utilisation. The distributed approach incorporates a set of different smaller systems that provide services to the consumers. These systems are location-specific and cover a wide area of resources. The distributed approach departs from linear systems that focus on single resources [2].

The main goal of DEs is to improve and maintain quality of life for the people in the area. This goal has several aspects. Wealth, occupation, social inclusion, an intact natural environment and stability are all factors that improve quality of life. To work towards this goal, several strategies can be followed (see separate box).

A truly distributed economy has four main features. First it is *localised*, to avoid the current wide distance between resource supply and demand; second, it is *networked* to enable information flow and co-operation; third, it is *modular* to make local distribution networks efficient and less vulnerable if some modules fail; and finally, it is *open* to promote greater understanding among local stakeholders of how local capital is utilised [3].

Strategies for Distributed Economies [3, 5]

Increase physical resilience of infrastructure:

- Create diversity
- Create redundancies
- Ensure modularity

Foster social and institutional flexibility and innovation:

- Replication
- Amplification
- Regeneration
- Simplification
- Percolation
- Information

Reduce the environmental footprint of consumption and production:

- Reduce resource use of transportation
- Maximise the value of local resources
- Modify consumer behaviour

In this report DE is used as a concept to develop a vision for Val di Noto. A vision is the end-point of a development that might never be reached. Nevertheless, visions have several important functions. They map a space of plausible alternatives to the status quo. Additionally, they can be used as a tool to point out problems of existing structures. They can serve as a frame for target-setting and function as a common symbol for building actor networks. Finally, they offer an appealing story that might help to gather capital or other necessary resources [4].

Part of the vision for Val di Noto can be grounded in its rich cultural heritage and its history. Many traditions have been preserved in current farming practices, water management and building styles. Other

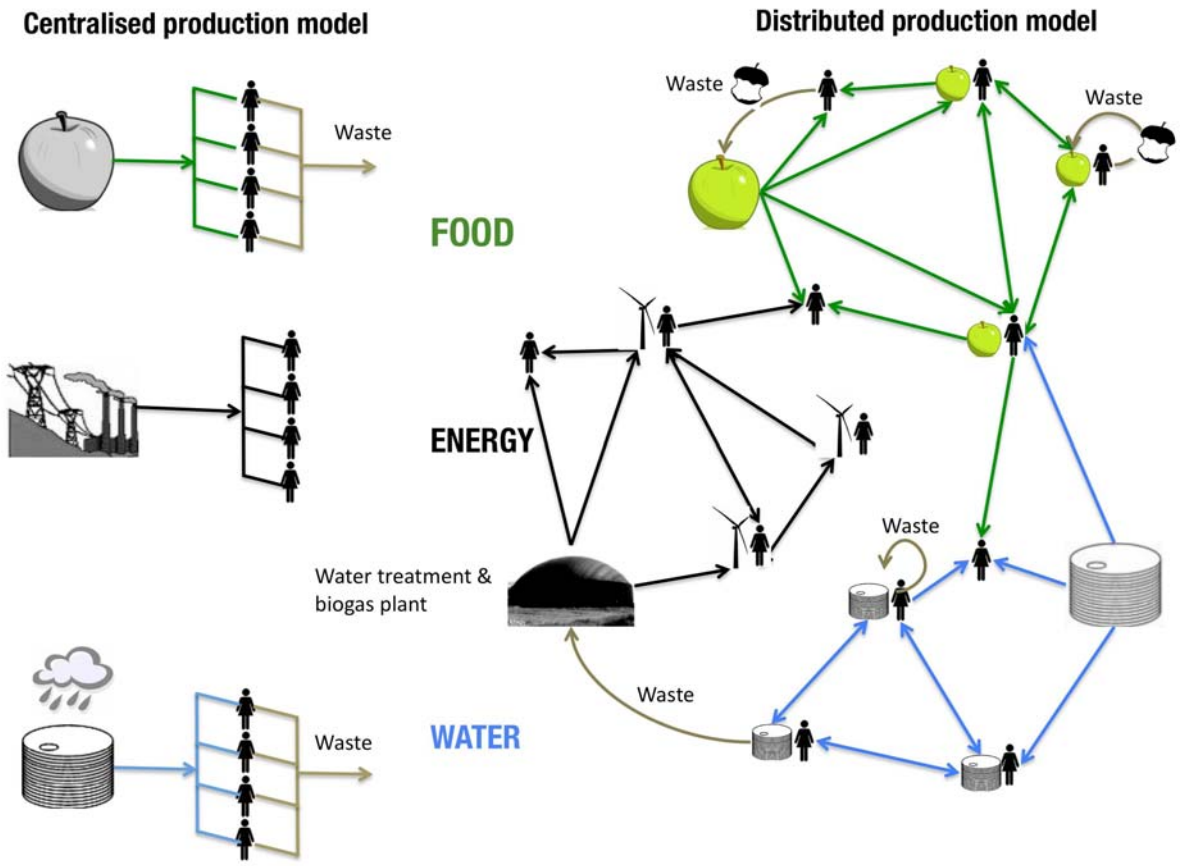


Figure 2: Schematic illustration of centralised vs decentralised systems [3]

traditions have been lost or are about to be lost. Some of the traditional practices were much more sustainable than modern ones and offer ideas for distributed solutions. The combination of traditional experience with modern technology provides valuable inspiration.

Val di Noto is an area with great potential that lies, for example, in its culture and its specific climate and soil which enable the production of valuable products that carry a high nutritional value and a value of origin. Not all of the local potential is used and some of the natural resources are threatened by the current pattern of consumption and production.

This report examines the energy, water, food and waste systems in Val di Noto. These systems determine the economic, social and physical characteristics of the region to a great extent. They are interconnected and have an influence on the landscape and on social and cultural development. The food system in particular has a high economic value for the region and is therefore a focus area of the report. Tourism has not been researched as a single entity but has been considered as an important factor throughout the project.

The four sections about energy, waste, water and food are all organised along the same structure. A mapping part that includes the major challenges of the area is followed by a distributed vision. Additionally, some specific *Distributed Ideas* are presented in each section.

Energy

The five municipalities in Val di Noto mainly rely on electricity and natural gas provided through the grid as well as on import of petrol and diesel. In Sicily there is also a production of hydropower that differentiates the island slightly from the rest of Italy, which is highly dependent on external sources for energy. According to Fausto Fiorini, local development manager at Centro Studi e Iniziative per lo Sviluppo locale ed Integrato (CESIS) the energy situation in the region "lacks connection to the local reality". The transport and the housing sector are the largest consumers of electricity.

In the built environment for instance, many of the buildings are old. But according to the architect Lorenzo Aiello, there are examples even of ancient buildings where sun, wind and vegetation have been considered. The local patterns of light, shade and wind, as well as thermal properties of the locally available building materials are important determinants for heating and cooling of buildings. Some buildings built after the 1970s phase large energy efficiency problems. One example is the tallest building in Noto, situated just outside the old central core. The building consists of similar modules constructed without taking into account sun, shade and wind patterns (and ruins the view on the baroque centre of Noto). There are few local building codes with energy efficiency demands and these codes are not sufficiently enforced. Many of the buildings are constructed without permits. The illegal buildings are usually constructed in very short time to avoid interference or interruptions by authorities which affects the quality of these buildings. The energy efficiency in buildings basically boils down to two main issues: The enforcement of building codes and the lack of best practice examples.

Distributed vision – Energy

The concept of DE suggests that it is preferable to create resilient and flexible systems that are not dependent on one centralised source of energy. The vision may therefore be described as *a long term self-sufficient and renewable energy system*. It is crucial to perceive the vision as a system that is still part of the national network in order to enable the exchange of information, knowledge and technology. Energy systems demand long-term planning and it is crucial to avoid lock-in effects. The energy systems must also be sustainable with respect to social, environmental and economical aspects.

In the context of this project in Val di Noto, many observations of existing ideas and opportunities for distributed energy systems were made. The energy opportunities in the region can be categorised into renewable energy production and energy efficiency in new and already existing buildings.

View over parts of central Noto from the clock tower

Renewable energy can be exploited in several different ways, such as photovoltaic and solar thermal power systems, wind

turbines, biogas plants and solar thermal panels for heating. A reappearing comment of people dealing with sustainable development in the region is *"we have plenty of sun"*.

Farmers could start producing energy to diversify their source of income and thereby contribute to a more sustainable energy supply. So far this opportunity has not been exploited as best practice examples are missing. In some cases farmers rent out land to professional renewable energy investors (mainly photovoltaic). Small-scale photovoltaic opportunities are not restricted to farmers but could also be used by owners of residential buildings. In the distributed energy vision for Val di Noto a decentralised network of small-scale photovoltaic systems that is supported and maintained by skilled project planners, engineers and financing professionals is the central element.

Solar-thermal installation on residential building

There are no large-scale photovoltaic projects in Val di Noto, though theoretical and practical knowledge can be found nearby, just outside Priolo Gargallo (Syracuse) where the Archimedes project is located. The Archimedes project was created as an initiative by the Italian government and the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA). In 2007, Enel, the major Italian energy company also joined the project. The aim is to have an operational solar thermal power plant sometime in 2010. In order to use as much as possible of the local solar potential of Val di Noto large-scale photovoltaic or solar thermal power plants are part of the distributed vision. Without them self-sufficiency seems to be hard to achieve.

Another way to exploit solar energy is the technology of solar thermal panels. In Val di Noto it is already fairly common to install solar thermal panels on the roofs of private houses to produce hot water.

To create resilience and flexibility in the distributed energy system it is important to consider several sources of energy. In this context wind turbines are another available technology. During the research in Val di Noto, no modern wind turbines were observed. In several citrus plantations there are old wind turbines with two blades that were used to pump water for irrigation. In Val di Noto two constraints for investments into wind power are evident. According to Sebastino Tiberio, president of Legambiente Noto, the first one regards the local grid capacity, which is not sufficient for the integration of wind power. The second issue deals with the "not in my backyard" (NIMBY) problem. Wind power turbines are frequently considered to ruin the aesthetics of the area. It is crucial to gain local acceptance, as public resistance constitute a major barrier to development of wind power. If locals are a part of the ownership structure of a DE system, there is less resistance as evidence from the installation of cooperative wind turbines in Denmark suggests [6]. Another problem has been the regulation of industrial activity in national

Distributed Idea 1: Energy from olive oil [7]

Is it possible to create energy from olive oil production? In Spain, Andalucia, the olive oil residues are used as bio- energy source. During 1995, the first power plant was operational and today there are 15 plants providing 164 MW bioenergy per year.

reserves by national laws. A project for a wind park outside Avola failed as it was categorised as industrial activity.

Wind turbines under a distributed vision add to the diversification of energy supply in Val di Noto. The use of wind power in the region has to be balanced with other core business activities, like tourism.

DE as a concept under the umbrella of sustainable development does not only call for diversification of energy production to increase resilience but also for a radical change in consumption patterns. Sufficiency and efficiency in the use of (renewable) energy are important elements of the distributed energy vision for Val di Noto [8].

Energy efficiency can be achieved in both new and existing buildings. One way to increase awareness may be to bring more 'know-how' to the region by introducing best practice examples. There is a considerable amount of business opportunities, both within renewable energy adaptation and energy efficiency in the region that can attract business and enterprises. This can create employment opportunities and a new source of income for the region.

Waste

More than 90% of the municipal solid waste (MSW) that is created in Val di Noto is disposed in landfills. European legislation requires Italy to have a differentiated collection rate of 60% by 2011 [9]. The regional target that applies for Val di Noto is 20% differentiated collection in 2010.

Differentiated collection of waste in Val di Noto is still minor. In Avola, that introduced separated kerbside collection in 2002, the rate is the highest with 14%. The other municipalities have an average of merely 6%. These figures show that waste management in Val di Noto can still be significantly improved.

According to Piero Argentino, waste manager of Avola, the average inhabitant of Avola creates 1.4 kg of MSW per day. Local efforts to *reduce* the amount of waste by avoiding waste, minimising it or reusing products have not been researched. The next steps of waste management are separation and collection. *Separation* is organised differently in the five communities of Val di Noto. In Noto separation takes place at the household level. Organic, paper, glass, plastic and aluminium waste are collected kerbside on different days of the week. In Avola households just separate the dry fraction (paper, plastic, metal and glass) from the rest. The sorting of the different dry fractions of the Avola-system happens after the door to door collection in a sorting facility in Rosolini. In addition to kerbside collection, a substantial part of Val di Noto's MSW is collected through big bins for unsorted waste in the streets.

The actual *recycling* of separated dry fractions takes place outside Val di Noto on the Italian mainland. The residual waste – by far the biggest fraction – is disposed in *landfills*, especially in the one in Augusta, 45 km from Avola. Thermal energy *recovery* from residual waste does not exist in Sicily.

Demonstration of waste separation in Val di Noto

The current waste management practice in Val di Noto is not sustainable. The lack of awareness at the household level causes low rates of differentiated collection and also manifests itself through littering of the landscape that can be observed. Moreover, the only local option for final waste management is landfilling. The landfill that is used for the waste from Avola has capacity for another two years before it has to be expanded. It appears like it is easier to gain acceptance for using sites as landfills than for photovoltaic parks to generate electricity. The closest composting facility is 100 km north of Avola, in Grammichele. Because of high transportation costs (30 EUR/t from Avola) it is not economic for any of the five communities to organise a separate collection of organic waste and transport it to the composting site.

In addition to the lack of awareness and missing waste management facilities, the absence of coordination and cooperation within the waste management of Val di Noto is a major problem. City limits also seem to be the borders for waste management efforts. Every city has its own system.

Distributed vision – Waste

The ideal sustainable waste management system would lead to a zero waste society by taking a *cradle-to-cradle* approach [10]. All waste would either be avoided, reused or recycled. The Distributed Vision for the waste system in Val di Noto borrows several features from this objective of the European waste policy. But it is grounded in the local realities and provides a direction in which waste management shall develop.

The first feature of the vision is a functioning public communication network about environmental problems that are related to waste. The network is based on environmental education in schools. Information *percolates* from school children to their parents, to their relatives, to their neighbours and so forth. The spreading of awareness takes time but does not start from zero. A current project of the local Agenda 21 office brings environmental experts from many different institutions to the middle schools of Val di Noto to *inform* both pupils and teachers about local environmental issues. Furthermore, municipalities inform people about the importance of waste separation and educate them how to separate. Information campaigns in local media and prices for good separation, like the “waste bingo” (Piero Argentino) in Avola, are possible ways to reach the vision of a well-functioning communication network. Under the vision the results of the communication network would be less MSW, less littering and a better separation rate.

Distributed Idea 2: Organic waste – Rediscovering a local resource

The problems that are connected to organic waste are a rather new phenomenon. In the past there was less food waste and the existing waste was brought back to nature by composting or just dumping it. Today organic waste is a substantial fraction of the waste from Val di Noto that goes to the landfill where it takes space and causes methane emissions. Both the energy contained in organic waste and the mineral nutrients are lost in the landfill.

In Val di Noto the planning to create a compost centre and organise the separated collection of organic waste started in 2004. So far the implementation failed because no EU funding was allocated to the region by the government of Sicily. Piero Argentino, waste manager of Avola, has low expectations for the composting centre: "I am 50 years old and in my lifetime I will not see a functioning composting centre in Val di Noto. Public decision-making is too slow and there is a lack of private action because of a lack of experience." But he is sure that such a facility would be beneficial for the people and the environment.

In the context of distributed economies it could be interesting to investigate if a network of actors could afford the investment without relying on EU funding. The five municipalities could share the upfront costs with farmers who receive the valuable compost and with the households that would help the financing by paying higher waste charges. This process could be started with a common workshop where a first network is created. In such a workshop external expertise is necessary as there is no local experience with composting centres. The process should be open to different kind of solutions. In this way also a biogas plant could be discussed as a viable option. Moreover, agricultural waste could be included as feed for a biogas or composting facility.

In the end the energy and mineral nutrients contained in organic waste might be fully used as a renewable local resource again.

MSW could also be reduced by alternative ways of selling products and innovative packaging. Local markets create less packaging waste than big grocery stores and many products are suitable to be put in reusable containers that consumers bring to the shops to be filled (e.g. dispensers for milk, olive oil, wine and detergents; pasta and rice from big boxes) [11]. Reusing bottles, containers and boxes is nothing new but has been abandoned because of extremely cheap one-way packaging materials.

The second main part of the vision is a Val di Noto waste management network. Waste separation and collection are *coordinated* between the five communities. This simplifies the waste management system in the area. A common system that is jointly run by all communities is economically attractive (economies of scale, joint collection vehicles, efficient use of employees, shared administration).

Clean differentiated waste streams are treated as a *local resource* rather than a problem under this vision. The organic waste fraction is a source for bioenergy and serves as a fertiliser after treatment. It is recycled locally (see Distributed Idea 2). Moreover, local treatment facilities reduce resource use and costs for transportation.

But not all recycling and recovery takes place locally. Recycling of packaging materials takes place in close-by sites in Sicily as somewhat bigger facilities located close to bigger cities offer higher efficiencies. The location of treatment facilities is optimised to make the transport of separated waste fractions as short as possible.

Just a very small fraction of the MSW is disposed in a modern landfill or incinerated in a modern plant that recovers most of the energy.

The main characteristic of the distributed waste management vision is its *diversity*. There is no panacea. Problems are solved

by networks of both information and material flows, by local and supra-local waste management modules, by changes in individual behaviour and by cooperation and enthusiasm of the municipal administration.

Water

In Val di Noto, water is used for irrigation in agriculture, for domestic use and in industry. Agriculture is apparently the main user though there is no data on available water resources or the total consumption/ withdrawal from the groundwater.

Water is extracted from natural springs, public and private wells and surface waters. Farmers or farmers' Consortia own the private wells while the municipalities are responsible for the public wells and the municipal water supply.

With the enactment of Law 1/5/1994, No. 36, "Provisions on water resources", the Italian Republic has started a process of institutional restructuring in the area of water, sewerage and water treatment. The objective of this process is the unified management of integrated water services under provincial bodies (ATO Idrico – Ambito Territoriale Ottimale). However, currently the distribution and management of domestic water is still in the hands of the municipalities. Even if the ATOs will be requested to introduce improvements, like metering systems in households, municipalities are reluctant to give away their responsibilities. They fear that under the ATO both the maintenance will be lower and the excessive use of water will worsen due to a lack of interest in informing households about the importance of appropriate water use.

Observing the situation in Rosolini, the public water distribution consists of two consecutive steps. In the first, water is pumped from the well or spring to accumulation tanks, and in the second, from the accumulation tanks to the buildings. The water is pumped to different zones of the town, two to three hours per day for each zone. The accumulation tanks are communicating vessels of an average capacity of 1 500 m^3 each and are used for daily storage and disinfection. The disinfection is done with chlorine that is automatically added to the tanks. The quality of the water is checked twice per week by a public hygiene service. The pipes that are used for water distribution date from 1950 to 1980 and are the biggest cause of the loss in the network, which is estimated by Tino Scala, water engineer, to be approximately 30% of the municipal water utility.

The consumption of the individual users is not monitored and the tariff system is not based on the actual water consumption. In Rosolini, there are three different flat tariffs. Households with one to two people pay ca 150 EUR per year; households with more than three people pay ca 200 EUR per year. The tariff for commercial activities ranges from 180 EUR to 500 EUR per year, depending on the municipality and the type of the business. The payment for water treatment (when in place) is included in the waste tariffs. The current practice of wastewater treatment in Val di Noto is to release brownwater or untreated wastewater into the rivers.

There are many illegal withdrawals of water, mainly by farmers. Uncontrolled withdrawal adds to the problem of excessive water use in agriculture. Together with the losses in the municipal distribution system and the current tariff system, inefficient use of water in agriculture was reported as a major cause of diminishing levels of wa-

ter in the aquifers in the recent years. Moreover, some natural springs have been contaminated with bacteria and the intensive agriculture imposes the risk to further contaminate the groundwater with fertilisers and pesticides.

Well in Rosolini

Another problem in the area is salt-water intrusion into the aquifers. Paradoxically, slightly salty water is beneficial to the Pachino tomato, which is one of the main agriculture products of the region. Drinking water, nevertheless, should be free of salt and pesticides.

Distributed vision – Water

The prevention of further pollution of aquifers with pesticides and falling water tables in Val di Noto are strong arguments for a more sustainable approach to agriculture. Our vision is to emphasise and fully exploit the cultural aspect of the agricultural products of the region. Organic production of high quality agricultural products instead of intensive farming could not only reduce the water use and reduce the pesticides in the groundwater but could also add to the exploration of the anthropological and nutritional values of the products of the region. The vision of high quality food production is further described in the Food section.

The other important aspect of our vision is to reduce the excessive water use through efficient delivery of water to the main users, efficient use of water and using alternative water sources, as well as recycled water. The vision is to reduce water use to a point where the water tables of the aquifers stabilise or rise again and the pollution of water is prevented.

The two main DE ideas developed to fulfil the objective of reduced water use are: boosting the efficiency of water use and closing the water system.

The lack of metering, control and information creates wrong incentives for the use of water. Water use in Val di Noto is very inefficient. To boost the efficiency, one DE approach is the involvement of and coordination between stakeholders. This could be established through a sound management of competing water users that are extracting from the same aquifer. The first steps in that direction could be prevention of unlimited access to water and its illegal use, implementation of a tariff system based on actual water consumption and better information to the users about the importance of efficient water use.

Another principle of DE is adaptive water management that fosters capacity to detect and respond quickly to new conditions. Renovation of the old distribution system that is causing relatively high inefficiency and introduction of a measuring system are first two steps towards adaptive water management. A sound management of the water system is important to reach the sustainable levels of water use. There is, however, also a lot of space for improvement in the irrigations systems in the agriculture.

Distributed Idea 3: Distributed water recycling, in towns and countryside [3]

In the town

The different buildings, independently or linked by a separate pipeline for grey water, should be all active points of rainwater collection. The independent way is easier to implement and integrate to each water system of the house. The collected water could be used in garden watering or toilet flushing. The same can be done in municipal buildings to support common green spaces.

In the countryside

A system of canals and tanks could be used by every farmer to collect rainwater and use it for irrigation. The potential of treated waste water for irrigation could be even more significant.

The emerging framework is a multi-source system where each actor is a "Prosumer" that uses the larger scale and one-way distribution system only in a complementary way. The resulting spotted and connected system is more flexible and less exposed to risk of failure in facing water scarcity period.

The second main area, closing the water loop, builds on the local recycling and reuse of water. To prevent the loss of water resources, the DE principle of learning from experience and experimentation could be exploited through the introduction of an alternative water collection system and water reuse system. Already in the past, farmers and households have been collecting the rainwater that was used for watering and cleaning. Rainwater collection systems are not a sole alternative to the current groundwater sources. However, they could be a relevant complementary source to improve service security, reduce risk of system failure, reduce costs and resource use and protect and regenerate the natural environment, that are all objectives of DE. The concept of short distances applies, since the water is collected where it is used.

Food

Agriculture plays a crucial role in the economy of Val di Noto, while the food processing industry is just of minor importance. Grapes, lemons, oranges, almonds, carob and vegetables, in particular the small tomato named "Pachino", are the main agricultural products.

Several actors are involved in the system. The group of the farmers is very diverse. There are small and large scale farmers, practising many different kinds of agriculture, like organic, subsistence or intensive farming. The intensive production has the largest share of the income generated from agricultural activity and has the highest impact on the land.

The farmers, except for being members of sectoral national associations like Coldiretti, Confagricoltura and CIA – Confederazione Italiana Agricoltori – are sometimes grouped together in local Consortia. Consortia are private organisations that support the farmers in the certification process and provide legal consultancy. Moreover, they check and control illegal imports in defence of the high quality standard of local production. The main Consortia are the "Pomodoro Pachino", "Strada del Vino", limone "Femminello", melone "Cantalupo", "Mandorla Pizzuta" and "Carota Novella".

The distribution of agricultural products is dominated by few multinational distributors with substantial negotiation power. Direct distribution exists but the share is negligible. The existing situation is perceived as problematic by many farmers because they feel locked-in by existing relations and are forced to accept prices and quantities to a large extent decided by the strong distributors.

Sales of agricultural products involve mainly supermarkets, but also directly the farmers. The greatest part of the production is currently exported abroad. Restaurants, final consumers and processing industry are the final users of the products.

The local institutional setting is composed of the municipalities and other entities. These are consultants or bodies like the CSA – *Centro Servizi Agricoli* (Centre for Agricultural Services), GAL – *Gruppo di Azione Locale* (Local Action Group), or ASCA – *Analisi e Servizi per la Certificazione in Agricoltura* (Analysis and Services for Certification in Agriculture), crucial either in coordinating the 5 municipalities' actions or in providing services for implementing development projects for the area.

The current situation encompasses some critical challenges. Agriculture is facing a crisis, mainly caused by the strong focus on price reduction adopted in the past. This is emphasised by the competition from North African countries that are increasingly engaged in growing similar products but have relatively lower labour and production costs. Moreover, North African products are illegally brought to Sicily to receive local certifications of their quality and their Sicilian origin. The existing framework is characterised by low prices, an increased level of unemployment, inability to place the whole production on the market and incapability to expan§d the borders of the business.

Other issues that the current agricultural system has to face are soil degradation, water exploitation, the competition among different land uses and the almost not existing organic waste management for agricultural by-products.

Projects for agriculture in Val di Noto

1) Leader – PSL Eloro

The programme is locally implemented locally by the GAL – Local Action Group – constituted by private and public members. At its third edition (2010-2013), the PSL Eloro is financing projects in three areas: tourism, agriculture and environment. In agriculture the fields of intervention are: production, marketing and shortening the distances. The previous editions have contributed to the formation of a local common identity.

2) Patto Territoriale

Rosolini is the leader and coordinator for the project. The process has been developed, managed and checked by five consultants. The Patto aims at boosting agriculture and reducing unemployment and environmental impact. A fund of 19 million EUR has been allocated to 75 companies (90% agriculture, 10% fishing). Almost all of the projects have been started or are already operating.

3) Centro Servizi Agricoli & Innovazione Tecnologica

Five offices in the five municipalities support agriculture and promote the anthropological value of the productions. The offices essentially distribute information to farmers (about certifications, available financing and so forth).

The innovation project deals with: anthropological value; internationalisation of the economy; introduction of technology in the area.

4) Local farmers' markets – mercato del contadino

There are five planned or existing (in Noto and Rosolini) markets for the five municipalities. Today they take place every one or two weeks. The current municipal management misses proper advertisement, facilities and location. They try to promote local productions and consumption and rebuild the relationship farmer-consumer. For farmers they still represent a small source of income.

5) Purchasing groups

The GAS- Gruppo di Acquisto Solidale- are emerging in the Province of Siracusa. One group is present even in Noto. They are voluntary groups of consumers that self-organise a direct purchase from the local producers. [12]

A number of projects and actions are today in place, representing a cornerstone to catalyse a sustainable food system.

Distributed vision – Food

Both the large ecological footprint of the current food system and the occurrence of economic crisis in the agricultural sector call for long term sustainable solutions that are economically viable, environmentally sound and socially responsible.

At international level, the Slow Food movement is suggesting an alternative way aiming at preserving the biodiversity and the variety local culinary traditions, promoting small-scale processing and farming, "taste education" and ethical buying, avoiding the several drawbacks of fast food, agribusiness, factory farms and monocultures [13].

The application of the theory of DE to the food system of Val di Noto pursues the creation of a sustainable and context-related option. The achievement such a model should lead to is a higher quality of life, which incorporates aspects such as wealth, supply of tasty and healthy food, preservation of biodiversity, a low environmental impact and stability. There are various approaches and strategies to reach this goal. The resulting system should be resilient, comprehensible, diversified and dynamically collaborative and communicative. Manzini uses four summarising concepts in defining a distributed system: small, local, open and connected [14].

The ideal future of the region should be identified with a framework where high quality and organic productions, outside the greenhouses and integrated with the natural landscape, will be dominant and diffused. This kind of agriculture should address both local inhabitants and tourists' needs and niche markets in Italy and abroad.

A first element of the vision is related to material flows. Ideally, a new development path should be chosen, leading to an agriculture with a limited and sustainable impact on the environment and its resources. The areas to focus on are both the methods of production and the way to distribute and sell the products. It should be opted for the small-scale cultivations of the several local species that not only match with the physical peculiarities of the territory but also are unique and embed a strong cultural heritage. Moreover, intensive methods should be avoided. Intensive practices that employ large amount of water, chemical fertilisers and pesticides, are already strongly stressing the ecosystems during the whole year.

Greenhouses nearby Pachino

The quality and quantity of the water resources, the natural properties of the soil, the landscape and other activities, like tourism are negative affected by them.

In order to catalyse methods 'alternative to the greenhouses', markets must be enlarged or created. Here the second side of the vision, related to actors' network creation, begins to be relevant.

In order to shorten the distances, the local market should be expanded. The experience of the *Mercato del Contadino* (Farmers' Market) can be considered a starting point. But further improvements should be thought and put in place to strengthen it. For example, one instead of five, well-structured and permanent local farmers' market, providing local food to the local people, could be an option and maybe a viable and strong enough alternative to the existing supermarkets services. Currently the farmers think that the existing *Mercato del Contadino* are weak, because the advertisement, facilities and locations are not appropriate. The management of such a structure should be in the hands of a third party running its own business. Maybe it would be good start with such a centralised model, that can be split into many parts once the practice is established and well working.

Additional ways to put in practice the concept of *filera corta* (short distances) are the purchasing groups and a community-based

Distributed Idea 4: The Local Market – A hub in the network

A formal and well-established network is essential in a distributed system. It can help to make a system actually flexible, able to evolve, open and 'democratic', involving even the weak actors that in an informal net can be left outside.

In the food system of Val di Noto some initiatives promoting a sustainable and local production and consumption are existing. But the lack of a general, recognisable and set vision, together with weaknesses and bottlenecks in the coordination among actors and actions, seem to represent two of the crucial obstacles to the implementation of a sustainable food system.

The creation of a structured and formal network could represent one possibility to establish a distributed agriculture in the context of Val di Noto. It can support actions, enable synergies and avoid overlapping interventions.

The network could be centred on a unique Hub, where both material and immaterial flows take place. This local Hub is the point where both food and information are exchanged. It can be seen as a Local Market for two different kinds of goods. The food is organic and locally produced by the farmers. The information flow takes place not only among farmers but involves even other stakeholders like final consumers, restaurants, hotels and tourist service providers or municipal departments.

The consumer can obtain in this place information on the sold products but even additional education about 'good behaviours' in additional area, like the waste, energy or water uses. An interesting activity could be providing news on the economic incentives and some practical tips for the recourse to renewables, like the installation of a PV panel.

The Hub could be the arena where other services can be provided, like marketing, knowledge sharing (best practices, exchange of contacts and meetings and educational lectures.

Such a Local Market-Hub is a new structure that can at the same time benefit and start from what already exists. Both the experience and the connections already created by the Mercato del Contadino and by the Centro Servizi Agricoli could be the starting point for the development of such a kind of Hub and Net. In addition, infrastructure, like a new destined space, and the definition of the management of such a structure are essential.

agriculture. The latter is particularly positive because it is able to significantly reduce the farmers' risks. At the beginning of every year a group of consumers would decide in accordance with the farmers the amount and varieties of fruit and vegetable that will be demanded, and provide the producers with a financial cover (represented by the quotas that has to be paid for the bought share) [15].

The development of the connections with tourism represents another way to increase the agricultural business. The creation of formal and reciprocal enhancing linkages could help the development both of high quality tourism and high quality agriculture.

It is known that the current production is mostly destined for markets abroad and that the local one is not able to absorb the whole production. It is reasonable to assume that foreign markets represent a crucial arena even in the future. More sustainable opportunities can be seen in making the certification system stronger and creating a solid branding that allows to reach new niche markets even abroad. Smaller but higher value production is easier to place in the market and can represent part of the solution to the current (and past) crisis of agriculture in *Val di Noto*.

An additional opportunity is represented by the introduction of food processing industries in the area. It is easier (especially in the bargaining with the strong distributors) and safer to sell narrow amounts of processed and certified products instead of large amounts of perishable and "imitable" raw goods. In order to enable the existence of a distributed agriculture, the creation of a structured network would be useful (see Distributed Idea 4).

Enabling the DE vision

The distributed visions that are outlined above provide suggestions on possible directions for sustainable development in Val di Noto. But the challenge of how to enable such a sustainability transition remains.

According to the literature, the important types of institutional settings that are needed for enabling a DE type of development include:

Coordination: Local governance enables networking and links between planning processes and local decision [3].

Participation: Local actors are included in the decision-making processes [16].

Ownership: Local ownership gives stakeholders more weight and enables the reinvestment of the local returns in the region [16].

Before any specific enabling measures can take place, the first step is to create a common vision for the five municipalities. From this vision a sustainable development plan can evolve that can be used to steer the efforts of the different municipalities. The development plan should include common objectives and targets for Val di Noto. These targets and objectives can be quantifiable, like renewable energy penetration rates or the share of agritourism, or aim at processes, like issuing building permits or establishing a consultation centre for farmers. By doing so, the local planning process becomes more transparent and open for regional influence. Expert knowledge (planners, engineers, researchers, environmental experts etc.) from both inside and outside Val di Noto should be utilised to develop the plan. Once in place, the plan helps to monitor the success of the sustainable development process.

The coordination of scattered efforts in Val di Noto to implement the sustainable development plan could be done through a 'sustainable development office' that coordinates the communication and cooperation between different actors. The sustainable development office could organise seminars, talks and workshops in order to connect relevant actors to reach the sustainability objectives of the region.

Inclusion and participation of local actors can be enabled through making information more easily accessible and attainable. This could also be supported by a common sustainability office. Furthermore, municipal decision making has to be open for all stakeholders. This means to actively contact all relevant actors and have consultations with them. The relevant actors include farmers' associations, cooperatives, the tourism sector, local NGOs. A high degree of transparency can prevent influence from interest groups and criminal societies. If everything is discussed with local stakeholders and presented in the media it becomes harder to hide irregularities.

The third approach for enabling DE is to promote local ownership, for example the ownership of wind turbines or photovoltaic systems that was mentioned in the energy chapter. Through local ownership more weight is given to local interest and profits will be returned to the region.

Conclusion

As stated in the introduction, this report is part of a bigger research project on *Sustainable Culture in Sicily* in Val di Noto. As the purpose was to screen the four areas energy, water, food and waste, to identify the main problems and to develop a general vision the report does not end with comprehensive recommendations. Some helpful steps towards sustainable development in Val di Noto have been outlined in the section about enabling DEs. The 'Distributed Ideas' that are presented above show that the concept of DEs can be applied in the local reality of Val di Noto.

Several actors in the region have recognised the need for sustainable development and the opportunities it offers. The best indicator for this awareness is that the *Sustainable Culture in Sicily* project around this report has been initiated and will proceed. Despite a general level of awareness crucial infrastructure and expert knowledge are still missing. Furthermore, projects and visions around sustainable development in Val di Noto are scattered. No common sustainable development plan with concrete targets exists. This report is *not* a development plan but just an inspiration, a starting point for further research.

While the research that was conducted for this report explored the area, future research should focus on one problem or area at a time and try to bring together local decision makers, local knowledge and external expertise. The lack of data, e.g. no information about the in- and outflows of the natural aquifers, should not be used as an excuse to delay actions. Even without comprehensive data problem indications exist. Similarly the lack of (EU) funding might lead to a passive approach towards sustainable development. It is the spirit of the DE concept to have a more active role, trying to connect to all stakeholders that might benefit from a specific project and figure out how a project might be financed corporately.

References

[1] Folke, C. et al. (2002). Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations. *Ambio, 31(5),* 437-440.

[2] Johansson, A. et al. (2005). Distributed econmies – a new engine for innovation. *Journal of Cleaner Production, 13(10-11),* 971–979.

[3] Biggs, C. et al. (2010). Distributed Systems: A design model for sustainable and resilient infrastructure. Retrieved March 20, 2010, from www.ecoinnovationlab.com.

[4] Smith A. et al. (2005). The governance of sustainable socio-technical transitions. *Research Policy,* 34(10), 1491-1510.

[5] Ryan, C. (2010, forthcoming). *Eco-Acupuncture 2010*. Victorian Eco-Innovation Lab, University of Melbourne.

[6] Danmarks Vindmølleforeningen. (2009). Cooperatives – a local and democratic ownership to wind turbines. Retrieved March 24, 2010, from www.dkvind.dk/eng/faq/cooperatives.pdf.

[7] Allen, A. (2010). Bioenergy from olive oil. Retrieved March 24, 2010, from www.renewableenergyfocus.com/view/7438/bioenergy-from-olive-oil.

[8] Princen, T. (2005). *The Logic of Sufficiency*. MIT Press.

[9] ARPA Sicilia. (2008). Annuario Regionale dei dati ambientale, Rifiuti. Retrieved March 24, 2010, from http://www.arpa.sicilia.it/UploadDocs/1898_CAP_VI.pdf.

[10] McDonough, W. & Braungart, M. (2003). *Cradle to Cradle: Remaking the Way We Make Things*. Rodale Press.

[11] www.effecorta.it

[12] Grupi di Acquisto Solidale (2010). What's a G.A.S.? Retrieved April 20, 2010, from www.retegas.org.

[13] Honore, C. (2004). *In Praise of Slow*. Orion Books.

[14] Manzini, E. (2008). New design knowledge. Retrieved April 24, 2010, from blog "Sustainable Everyday Project", www.sustainable-everyday.net/manzini .

[15] International Institute for Industrial Environmental Economics (IIIEE). (2009). *The Future Is Distributed: A Vision of Sustainable Economies*. Lund: IIIEE.

[16] Mirata, M. et al. (2005). Production systems aligned with distributed economies: Examples from energy and biomass sectors. *Journal of Cleaner Production, 13(10-11),* 981-991.

List of people interviewed

Lorenzo Aiello, University of Catania

Piero Argentino, Manager recycling depot Avola

Nicola Campo, City Council Pachino

Salvatore Cavallo, CUMO

Dott. Cicero, Agenzia di Sicurezza Alimentare

Fausto Fiorini, Centro Studi e Iniziative per lo Sviluppo Locale ed Integrato (CESIS)

Giovanni Fugà, Local Agenda 21, Noto

Alfonso Lapira, Heritage and Tourism Manager

Sebastiano Mandalà, City Council, Pachino

Salvatore Muscoiona, Botanist and herbalist

Antonino Savarino, Mayor of Rosolini

Tino Scala, Water Engineer, Rosolini

Sebastiano Tiberio, President Legambiente, Noto

Agata Tramontana, City Council Rosolini

Corrado Valvo, Mayor of Noto

Future Waste Management in Belarus: Bringing Private and Public Actors Together

By Carla Fierro, Laura Kazlauskaitė, Maurice Koffi, Nora Smedby

Belarusian waste management is, to a large extent, based on landfilling. The environmental standards of the landfills are generally poor, with environmental harm, detrimental health effects and waste of natural resources as a consequence. The development of a more organised waste management system requires initiatives within investment, coordination and regulation. By assigning environmental responsibility of a product's full life cycle to the producer (so called Extended Producer Responsibility, EPR), sufficient capital for the waste management can be secured and the problem of waste will be addressed at its root. However, EU experiences show that implementation of such a system requires substantial efforts regarding coordination between different actors. One approach for merging the private and municipal interests is to introduce the so called 'public private partnerships'.

The purpose of this project has been to investigate the feasibility of different options for improving the Belarusian waste management system by developing the cooperation between public and private actors.

The work forms part of a project of IIIEE and the Swedish EPA aiming to strengthen the development of Extended Producer Responsibility (EPR) in Belarus. A special focus has been put on the management of packaging waste and waste from electrical and electronic equipment (WEEE).

EPR and its implementation

The concept of EPR

Extended Producer Responsibility is a concept based upon preventative environ-

The Minsk city

Waste collection from countryside

mental strategies with the aim to encourage producers to improve the environmental performance of their products by assigning the responsibility for end-of-life management to the producers [1,2]. Within this context the producer includes any party that professionally manufactures, imports or sells the relevant product [26]. The system can provide capital for recycling/recovery of materials, and give incentives to design changes in order to lower disposal costs in the production process [3].

How to design an EPR system?

The design of an EPR system must ensure the compliance and the respect of environmental standards, and also the determination of responsibilities and cooperation between producers. The choice of an EPR system can also be influenced by: the producers' market share, the demographics, consumer's awareness or acceptance, and the culture as well as the producers' acceptance of other manufacturers' waste. There are three main design options for an EPR system: an individual producer responsibility (IPR) system, a national collective system or a PRO-based system [3].

IPR System

The implementation of an IPR system requires direct financial responsibility of each producer. IPR gives stronger incentives for eco-design practices by directly linking the producers to end-of-life costs [4, 5].

National Collective System

In a national collective system, the total costs for all producers, according to their market or return shares, are shared among the producers through a state-run administration; it leads to a collective responsibility among all producers for the collection, recycling and financing of their collective waste.

PRO-based System

Here the producers are coordinated through one or several producer responsibility organisations (PRO – an organisation created by producers and accredited by authorities to coordinate the producers financial contribution to manage the waste of the products they put on the market), to facilitate the collection and recycling of waste. This system is the most used in the EU member states. It is favoured as it facilitates government control, as compared

to individual systems, and is believed to keep the costs lower than the alternatives.

It is, in principle, possible to implement both the IPR and PRO-based systems by calculating the actual recovery costs for products of each brand and allocating these costs to the individual producers [6].

PPP for waste management

There is no standard definition of what constitutes a Public Private Partnership (PPP). The OECD [7] defines a public-private partnership as: "an agreement between the government and one or more private partners (which may include the operators and the financers) according to which the private partners deliver the service in such a manner that the service delivery objectives of the government are aligned with the profit objectives of the private partners, and where the effectiveness of the alignment depends on a sufficient transfer of risk to the private partners". The main idea behind PPP is the risk transfer to the party who can manage it the best; other issues are of secondary importance.

Success factors of a PPP include transparency, accountability, external auditing, commitment from all partners, and well-defined definitions of responsibilities [8,9].

The advantages of this form of contract are multiple: acceleration by pre-financing of the realisation of a critical project; contribution to the community by the dynamism and the creativity from the private sector; a guarantee of performance in time; an optimal spread of the risk between the public sector and the private one, each one supporting the risks which it controls the best [10].

EU and EPR legislation

The European Union (EU) Waste Electrical and Electronic Equipment (WEEE) Directive is a legal document which promotes the collection and recycling of WEEE. According to this Directive consumers should be able to return their products free of charge.

The main objectives of the directive are:

- To prevent electrical and electronic waste;
- To increase the recycling and reuse (separate collection, treatment and recovery).

According to the Directive, there are different responsibilities that need to be defined in order to have a successful system: physical, financial and information [11,12].

The EU was a pioneer in the legislation of EPR for the WEEE with the Directive, but the implementation is still at its infant stage. The transposition and its implementation vary across the EU; in the majority of the member states the individual responsibility is not encouraged [13].

The intention of the EU Packaging Directive is to harmonise measures to prevent the impact of packaging waste on the environment of member states and third coun-

Waste collection point in Saligorsk

tries, and to ensure the functioning of the internal market through the application of EPR. The Directive stipulates provisions for the prevention; reuse, and recycling of packaging waste and also promotes energy recovery.

The Directive covers the industrial and commercial entities as well as the households in the member states.

The objectives of the Directive are:

- Reduction of the overall volume of packaging for final disposal;
- Collection; and
- Recovery and recycling [14].

Experiences from three EU member countries; France, Sweden and Lithuania, are given in boxes below. The implementation of a relevant waste management system in any country must be built according to the characteristics of the country. Therefore, an overview of the characteristics of the Republic of Belarus is presented first.

The Republic of Belarus

Since 1994, Belarus is governed by president Lukashenka, who has developed a system which he labels as market socialism. The Government openly states that they want to control all economic activity [17].

Belarusian private sector is small compared to most countries. According to a foreign expert on Belarusian politics, the private sector is approximately 25%. The challenges in operating private businesses are mirrored in the Index of Economic Freedom, in which the country is rated 150th with a score of 48.7. According to the Index, recent reforms have somewhat increased the business freedom. Concerning freedom for international trade, major barriers include considerable import restrictions, quotas, licensing requirements, non-transparent and arbitrary regulations, poor enforcement of property rights, government procurement giving preference to domestic actors, and government subsidies. The economy is also characterised by

Landfill in Saligorsk

a high rate of inflation (12.6% between 2006-2008). The preferable treatment by the government of state-owned companies makes investment difficult and still many sectors are exclusively owned by the government [17].

However, the state has lately made efforts to open towards the international market. An expert on Belarusian politics stresses that foreign investment is a very important way for the country to acquire capital, especially in light of the phase-out of Russian oil subsidies. To support foreign investment, an ordinance has been introduced [18]. Among other things, the ordinance guarantees certain tax exemptions and possibility to buy land without an auction. The effects of this ordinance remain to be seen.

Belarus General Facts (2008) [3]
Population: 9.7 million
Urban/Rural: 70/30
Area: 208 000 km^2
Capital: Minsk (pop. 1.7 m)
GDP/capita: 8 000 EUR (2008 est.)
GDP growth: ~ 9% per annum (2006)
Human Development Index ranking: 53rd (2002)
Language: Belarusian and Russian
Political system: Former Soviet state, independent since 1991.
Economy: agriculture 8.4%, industry 41.5%, services: 50.1% (2008 est.)
Main trading partners: Russia 36.5% metals and energy, Netherlands 17.8%, UK 6.3%, Ukraine 6.1%, Poland 5%, Latvia 4.1%
Neighbouring countries: Russia, Ukraine, Poland, Lithuania, Latvia.

French EPR experience

Since 1992 the EPR system exists through PROs mandated to collect producers' financial obligations, and ensure the redistribution towards the municipalities in charge of the waste management, or to select the recycling companies for the treatment of the waste collected by municipalities.

The WEEE EPR system is managed through a group of 4 PROs coordinated by a clearing house since 2006. Today the WEEE system is the most effective compared to the packaging one, because of:

- the clearing house role, supervising the PROs and allowing synergy effects in the system;
- relatively beneficial subsidies for the collection of WEEE;
- a well-developed network for WEEE collection; and
- a good communication on alternatives to discard WEEE.

According to the Index of Economic Freedom, private property is not fully ensured by the legal system and the courts do not always enforce contracts consistently. In addition, the judicial system is not independent and objective compared to international standards.

General waste management

The waste management system in Belarus is mainly based on landfills. It is prohibited by law to landfill secondary raw materials [19,20,21], therefore household waste is collected in at least two streams: mixed waste and recyclables. However, the existing waste chutes in the apartment buildings make the public participation in source separation difficult. Bulky waste and WEEE are so far collected together with other household waste.

In addition to conventional collection points next to the apartment buildings, shops, mainly in rural areas, are functioning as collection points for recyclables. In these shops, people are being given compensation in relation to the raw material price of the material they have brought there. The most valuable are paper and scrap metal, but people get paid even for PET bottles (other types of plastic are not collected so far). According to a researcher, however, the prices are not set high enough to motivate the returning of material, except for limited amounts of metal.

Mixed waste ends up in landfills, while recyclables are supposed to be treated and utilised as a secondary material. However, municipal actors experience a lack of capacity for treatment.

The Ministry of Natural Resources and Environmental Protection (MNREP) sets the waste management policy and objectives and afterwards monitors the implementation of these [3,22]. Local authorities are responsible for organisation of waste collection from households.

Tariffs for the waste management are more or less the same in all regions, and are set by the Council of Ministers. Households do not pay the landfilling and decontamination costs, while companies have to pay for that. Currently, the State is subsidising approximately 40% of the waste management costs for the households; the rest (60%) is paid by the households [22]. Non-differentiation of the waste tariffs for the households also adds up to the difficulties when motivating people to separate waste at source.

Swedish EPR experience

The cooperation within EPR works relatively well for the WEEE as compared to packaging. This is also mirrored by recycling statistics in which Sweden, together with Germany and Denmark, has the highest collection rates in kg per capita of electronic waste in the EU [15].

A national agreement between the PRO for WEEE, Elkretsen, and the municipalities, stipulating that the municipalities are contracted by Elkretsen for taking care of collection at recycling centres and from there, the producers are responsible for transporting, treating and recycling the waste.

Cooperation regarding packaging and newsprint, on the other hand, shows more problems. The system is less centralised than for WEEE and the main conflict here relates to whether the targets are set high enough, and whether producers are responsible also for that share of their waste that ends up in the mixed waste. Another problem is that, when consumers/citizens are discontent with the collection facilities, they normally turn to municipalities.

Possible explanations why the WEEE system works better than the packaging include:

- The clarity of the legislation;
- The attitude of the industry;
- The relatively low costs for collecting WEEE; and
- The compatibility of the EPR with current system.

Existing EPR programs in Belarus

There are two EPR programs in Belarus: for rubber products (mainly tyres) and for plastic packaging [25].

According to the Decree of MNREP No 5 of January 25th 2008, from January 1st 2009 manufacturers and importers of tyres have to ensure the collection and recovery of waste according to 50% of the products they produce or import. This can be done in two ways, either by collecting and recovering themselves, or by contracting organisations that provide such services [25].

EPR for plastic packaging is based on a tax, which is paid by producers and importers

to the Environmental Protection Fund. The money collected to the fund is only in part used to finance the activities related to the treatment of waste plastics, the rest goes to financing other investments within the environmental area [25].

There is also a possibility within the EPR system for plastic packaging to opt out of the tax and organise your own waste management. According to a private actor within waste management, this obligation only concerns the recyclers, but not the collectors of plastic. Therefore, if you are providing the collection service, but not the recycling, your expenses are not covered by this solution.

There is also a tax for the paper producers/importers forming a type of collective EPR program [20].

One of the major challenges for MNREP is that it cannot independently set the EPR for any type of waste without collaboration with other ministries. For example, for WEEE it is likely that the Ministry of Industry has more power, as it is responsible for the ferrous and nonferrous metals including their recycling. There is a draft version of an EPR law for WEEE but the differentiation of responsibilities for secondary material is a serious constraint in the legislation process [22].

Lithuanian EPR experience

Since 2005, a waste management system for WEEE based on EPR was introduced. The management of WEEE is left for the free market.

Involved parties include: The Ministry of Environment, the importers/producers, the producers' organisation, waste treatment companies, municipalities (RWTC), municipal waste collection operators, waste collection operators, consumers/waste owners (households, offices, organisations).

The system is constrained by a number of problems, including:

- Producers focus on collection rates but do not address prevention and consumer education;
- Lack of an official reuse system;
- Existence of informal sectors;
- Discrepancies in the collected amount of waste → questionable monitoring system; and
- Recyclers operating without a licence.

Case study: Saligorsk

The City of Saligorsk is one of the newest cities in Belarus (established in 1958), with a population of 101 400 in 2007 [23].

A researcher within the field of waste management, Professor Sarhei Daroszhka, describes it as a pioneer and leader within waste management in the country.

In Saligorsk, the waste management duty is transferred to the state-owned independent (from other municipal services) company Ecocomplex, which ensures the collection and transportation of household waste and is also responsible for managing the landfills in the Saligorsk region [19]. As a result of the recent economic crisis, some investments are necessary and must be done through the municipality or the ministry's funds.

Households in the city separate their waste into at least four fractions. Different types of containers are placed next to the buildings: for mixed waste, paper and cardboard, PET and glass.

The main advantages of the waste management in Saligorsk according to the municipal interviewees are:

- Regional waste collection targets are confirmed after research on the common waste composition, quantity, etc.;

Sorted glass for recycling

- The independence of Ecocomplex allows for the possibility to raise capital for upgrading the equipment;
- Separate collection of recyclables (three waste streams: paper & cardboard, PET, glass); and
- Relatively high awareness of the households.

The difficulties mentioned include:

- Fluctuation of the secondary raw material prices;
- Slow market development with regard to companies buying recyclables, existing monopoly;
- Lack of freedom in taking decisions on the local level;
- Low capacity of waste treatment; and
- Lack of capital for investment to upgrade the existing machinery/equipment.

Case study: Vileyka

The town of Vileyka had a population of 30 000 people in 2009 and is the capital of the Vileyka region (2009 population of the region – 55 000 people) [24]. Municipal actors interviewed explain the lack of private investors and the small size of the region as important obstacles. On the other hand, the small size of the town facilitates the raising of awareness among the citizens [20].

Vileyka town has a relatively large collection network in geographical terms. Local municipal services are the main actors in the waste management chain in accordance with Belarusian legislation, and the main collectors. In addition to collection points next to the households, shops (mainly in the countryside) are functioning as additional collection points for the recyclables. In addition, schools and local council act as collection teams on a small scale.

There are no recycling facilities in the town because the amount of generated waste is too small. Therefore collected materials are transported across the country, but mainly sent to state-owned enterprises in the Minsk's region [20].

The problematic waste streams in this district are the used cars and home appliances. According to the municipal actors interviewed, the lack of a running system for the EPR in this sphere has, for example, led to the situation when not a single plant in the country can treat used cars. Regarding home appliances, the municipal services collect the unit, then dismantle it locally, and send the secondary materials to recycling facilities, e.g. scrap metal is sent to the state-owned company BelVtorMet. What cannot be used is deposited to the landfill. In the town of Vileyka the coverage of waste management services is almost 100%, whereas it is about 40% in the rural areas.

According to the interviewees, the most wanted changes on governmental level for improving local waste management would be investment in recycling facilities, as a lot of recyclable material needs to be transported across the country and/or stored due to the lack of recycling capacity. In addition, they express a wish for more funding for the municipalities to organise the collection sites and buy the containers for the separate collection of recyclable material [20].

Lessons learned and avenues for the future waste management

A lack of long-term strategy incorporating all steps of waste management has led to unsystematic investments and inefficient waste management. With a higher degree of investment (more money allocated to waste management) and more systematic approach for investment decisions, Belarusian waste management can take a leap forward towards sustainable management of waste and more security in raw material supply.

According to actors in the relatively progressive municipality of Saligorsk, a key factor for success in efficient use of resources and positive results within municipal waste management is the development of ambitious, yet realistic, long-term plans. To do this, careful analysis is needed. According to their view, many municipal plans for waste management are patchy and do not provide realistic solutions on a full scale.

Remondis in Belarus [19,22]

Remondis', a German company, negotiation to enter the Belarusian market is a good case illustrating possible strategies and constraints for a PPP in waste management in Belarus. According to the governmental actor in the area, one of the usual reasons why the private actors give up PPP projects in Belarus is that they normally want a big ownership share (more than 51%). It is believed that Remondis is ready to accept the 51%/49% partition with the Minsk and Saligorsk authorities, for the building of treatment facilities. One of their strategies in a context of complex bureaucratic system like in Belarus is said to be to involve the public partners to make the business easier. According to the local experts in waste management, even if they are able to take 100%, Remondis prefers to share at least 20% with the public authorities.

According to the law, the Belarusian Government has defined certain recycling targets to be met but the waste management actors argue that it is impossible to fulfil these objectives. The lack of infrastructure and the low awareness among the public are two problems that the municipalities have to work with.

The Belarusian Government seems to prioritise other areas than waste, such as agriculture. As municipalities' lobbying power

is weak, changes in waste management at the regional level have been lagging behind. The municipalities cannot ignore the law in its activities. They are responsible of collecting the waste and for providing the place of final destination.

Financial responsibility

The investments necessary for making Belarusian waste management more environmentally efficient require considerable amounts of capital. Furthermore, additional funding is needed to cover the running costs of a more modernised system. There are mainly three sources of financing that can be combined with one another:

1. State/municipal funding through taxes;
2. Producers funding through an EPR system; and
3. Funding through higher tariffs.

In addition, organisations such as the UN can contribute by financing pilot projects. The current waste management system for plastic packaging in Belarus can be described as a mix between the first and the second forms of funding. The Environmental Protection Fund, which earns parts of its revenue from taxes on packaging, can be used for subsidising major investments. One recurrent concern during the interviews with researchers and some municipal actors is that the fund's broad scope of application, it can for example involve sponsoring of sport events, diminishes the amount of resources allocated to waste treatment (see for example, [26]).

For electronic waste, the costs are still completely covered by state and municipality or indirectly by other actors contributing to the Environmental Protection Fund.

One strength of a state-funded waste management system is that it facilitates coordination between various waste types and regions. It can also be easier to address political issues such as equity or support of national industries with a state funding. In this solution, the costs are ultimately covered by tax payers, and the distribution of the financial burden will depend on how the tax structure looks like.

Industrial site in South-western Belarus

A well-designed EPR system offers the strength of ensuring supply of capital for waste management and providing incentives for design changes and waste minimisation. The more direct the responsibility is, for example with an individualised physical responsibility, the stronger incentives can be expected. On the other hand, a

more direct, individualised system also risks being connected with losses in terms of economies of scale and higher transaction costs.

A common conflict within EPR systems, reflected by, for example, Swedish experiences, concerns the definition of responsibilities between producers and municipalities. Many municipalities are unwilling to hand over responsibility to the producers. The reasons for this can, for instance, include a willingness to keep a big municipal organisation or keep control as citizens tend to turn to the municipality if the waste management is not working properly. In Sweden, the problem has been larger in the case of packaging waste than for WEEE. It seems as critical factors in this context is the compatibility with existing waste management systems, the approach of the different actors in the negotiations and the nature of the waste. In the Belarusian context, there are, in many cases, no existing systems to build upon. There, instead, a common view on how to develop these systems and incorporate them in the country's infrastructure is necessary. It is important to keep in mind that, in the case of packaging, a lot of overlap with mixed household waste exists. To minimise areas of conflict, this has to be resolved by clearly defining targets and responsibilities.

Everyday shopping in Minsk

In an EPR system, the cheapest ways to reach the set recycling targets will most likely be chosen; therefore, there is a risk of remote areas not being covered by the system. From an efficiency perspective, this does not have to be problematic as recycling might be unprofitable from a socio-economic point of view with the long distance transportation needs characterising these areas. It is, however, important that government and producers clearly communicate such prioritisations, for ensuring the legitimacy of the system. Yet, the Swedish experience shows that an EPR system can be very effective for gathering capital for waste management investments.

A private actor within waste management in Minsk supports the view that EPR systems can provide important capital for investment, but argues that the current system does not function as intended. It is difficult to get money for investments from the Environmental Protection Fund, as tax incomes from packaging producers are not earmarked for the purpose of waste management. If producers choose to opt out of the tax, they have to organise waste management themselves, but, according to the interviewee, in practice, the responsibility does not cover collection of waste.

Container for waste

If the funding is done completely through tariffs on waste management, this can potentially provide incentives for citizens to minimise waste. There is, however, a risk that waste ends up outside the waste management system as a way of avoiding waste fees, with environmental harm and littering as a consequence. The magnitude of this risk depends on enforcement and risk of being caught, but also on the culture of the country. As public space in general is very clean from litter in Belarus, the risk for such behaviour might be limited.

Depending on the level of the tariffs, these can provide capital for investments in waste management. The setting of high tariffs for waste management is often politically sensitive. The current Belarusian Government is highly concerned with ensuring the political support of the population (according to an interview with a foreign expert on the political situation of the country). Another sensitive issue is that tariffs set by the market would imply politically unacceptable differentiation of tariffs, e.g., higher tariffs in the countryside.

For a system with private funding to work, there needs to be an institutional framework in place, ensuring, for instance, that payments can be collected.

According to a private actor within the waste management field, his major business risk is unpaid bills. If approaching these customers (often municipal actors) with his demands for payment, the response often is to threaten to stop buying his services and instead turn to municipal waste management services.

In some of the interviews, a fear of private actors of doing too well was also expressed, as the government might choose to nationalise successful companies.

According to actors at municipal level, costs for investments are normally covered by the Environmental Protection Fund. This leads to capital costs being largely neglected by each specific municipality in their waste management. The weak link between capital and running costs can lead to investments not being prioritised in a cost-effective way. Running costs can potentially be considered when allocating the resources of the Environmental Protection Fund, but, as the Environmental Protection Fund and its decision makers do not have a clear connection to the running costs of waste management, there are no strong incentives for this.

Putting the financial responsibility for investments, as well as, for running costs

Housing area in Minsk

within the same organisation, regardless of whether it is municipalities, producers or private actors, can lead to a more cost-effective prioritisation of investments.

There are many international private actors within the waste management field. These often have unique experiences when it comes to assessing investments. A further opening of the Belarusian market for waste management could, therefore, potentially lead to more efficient allocation of resources. In addition, these actors have access to important sources of capital, such as shareholders or cooperation partners. It follows from the interviewee that the Belarusian market and legal framework is not perceived as mature and predictable enough to be able to attract investors. For many western European companies, there are also major cultural barriers for operating in this part of the world.

One way to facilitate the introduction of foreign investors could be through the development of PPP. Within these partnerships, risks can be shared and foreign investors can obtain a better insight into the national context.

Pricing and ownership of waste

An important aspect for investments in waste management is the price of recovered secondary materials. These are set by the different ministries. Often, the prices are artificially low, resulting in decreased incentives for investments in recycling [3]. Regulation of prices could theoretically encourage recycling through the provision of stable prices of raw materials. But in an international market, the price regulation constitutes a source of risk and constrains foreign investment in the country.

Different ministries are legal owners of various secondary materials. This constitutes a hinder for treatment outside the borders of Belarus. This ownership, and the involvement of several ministries in the area, has also constrained the possibilities for developing an EPR system for electronic waste.

Physical management of waste

There are roughly two options for the physical management of waste:

1. Municipality,
   - as part of general municipal services;
   - or as an independent municipal company; or
2. On a market with private (and possibly municipal) actors.

The most common solution in Belarus is that municipalities, sometimes through independent companies which are municipality-owned, are responsible for the collection and transportation of waste. An interviewed Belarusian municipal actor with experience of independent municipal companies prefers this form as it provides more flexibility and ensures certain financial allocation to the waste management.

If the purchase of waste management services is not done on a market with several actors, the incentives for efficient waste management become weak and waste management runs the risk of being too costly, of bad quality or both.

A way for municipal actors to make use of the know-how and capital of private actors is to involve in a PPP. This could for example be a way of avoiding the conflicts with the private sector that the Swedish municipalities sometimes have had to deal with. The PPP can open up for private actors while the states still have some influence.

Private actors often have more flexibility and a competitive market for waste management services can lead to increased efficiency and service level. A private actor within waste management in Minsk argues that increased competition on the market forces him to be more customer-friendly and flexible. On the other hand, in terms of economies of scale there are also gains from having one actor doing the municipal services. The existence of economies of scale implies a tendency of monopoly on the market. In many countries, this issue is addressed by the awarding of time-limited contracts on waste management. However, experiences in, for example, Sweden reveal a tendency of contracts not to be actively renegotiated.

Belarus has lately been showing a willingness to open up for foreign investment. However, there are still several hurdles for foreign private actors to enter the Belarusian market, including complicated administrative and legal framework, and reluctance of municipalities to hand over their responsibilities. The companies with the capacity to invest in good waste management are mainly western, which want to go into markets which offer sufficient legal security and the reality is that Belarus lacks in sufficient transparency and predictability.

One potential solution to this, according to a Swedish actor on the international mar-

ket for waste management, is to treat Belarusian waste in nearby countries. To some extent, this has been done in, for example, Lithuania. However, for a larger scale application, changes in the legal framework are necessary for this solution to have an acceptable administrative burden.

Conclusions

The investigation of the waste management system through the interviews with Belarusian actors of the waste management system, both public and private, has provided us with an overview of the difficulties for enhancing the cooperation between the public and the private sector.

The legal framework, as well as the overlapping responsibilities between the different ministries in charge of the ferrous and precious metals contained in the WEEE, and the inefficient way of the management of the environmental funds regarding the packaging, continue to constitute constraints for the waste management system. Also the barriers for private investments, such as the cost of capital and the business climate for foreign companies, render less attractive the waste management field for investors. The environmental challenges of waste management when it comes to health risks linked to the waste, the growing Belarusian middle class with the associated increasing levels of consumption, and the available experiences of the Western countries are issues that ought to be taken into account when searching for new solutions for waste management. The private investors are important for raising sufficient capital to make the investments necessary to improve the waste management in Belarus. The condition of this private investment must be improved to coordinate the two forces of the private and the public sectors to manage the waste in an environmentally efficient way.

References

[1] Ökopol. (2007). *The Producer Responsibility Principle of the WEEE Directive,* (DG ENV, Study Contract No. 07010401/2006/449269/MAR/G4). Luxembourg: Office for Official Publications of the European Communities.

[2] Lindhqvist, T. (2000). *Extended Producer Responsibility in Cleaner Production*. Lund: Lund University.

[3] Breitholtz, C., Finney, D., Maneschi, D., Montero, G. & Rantanen, J. (2009). *Strategic Environmental Development: Implementing EPR for WEEE in Belarus*. IIIEE, Lund University.

[4] Tojo, N. (2004). *Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality?* Lund: Lund University.

[5] Lindhqvist, T. & Lifset, R. (2003). Can we take the concept of individual responsibility from theory to practice. *Journal of Industrial Ecology*, 7(2), 36.

[6] van Rossem, C. (2008). *Individual Producer Responsibility in the WEEE Directive. From Theory to Practice?* Lund: Lund University.

[7] OECD. (2008). *Public-Private Partnerships: In Pursuit of Risk Sharing and Value for Money*, OECD Publishing, Paris.

[8] CIFAL Plock. (2006). *Public-Private Partnerships and Integrated Waste Management*, final report from workshop 23 – 25 January 2006, Plock, Poland.

[9] Ordif, Observatoir Régionale des Déchets d'Ile-de-France. (2006). *Le contrat de partenariat public privé fait son apparition dans la gestion des déchets*.

[10] Delmon. (2010). Understanding Options for Public-Private Partnerships in Infrastructure Sorting out the forest from the trees: BOT, DBFO, DCMF, concession, lease.... *World Bank Policy Research Working Paper* 5173.

[11] Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

[12] Directive 2002/96/ EC of the European Parliament and of the Council of 27 January 2003 on waste Electrical and Electronical Equipment.

[13] Tojo, N. (2010). *EPR in Practice: WEEE Systems* – Lecture 8 February 2010 at IIIEE, Lund University, Sweden.

[14] Directive 2004/12/CE of the European Parliament and of the Council of 11 February 2004 on Packaging and Packaging waste.

[15] Eurostat. (2010). *Waste electronical and electronic equipment*.

[16] Breitholtz, C., Finney, D., Maneschi, D., Guillermo, M. & Rantanen, J. (2009). *Implementing EPR for WEEE in Belarus*. IIIEE, Lund University.

[17] The Heritage Foundation & Wall Street Journal. (2010). *Index of Economic Freedom*, www.heritage.org

[18] Presidential Decree Number Ten of August 6 2009.

[19] Interview with Alexander Kanivets

[20] Interview with Viktar Paulouski

[21] Interview with Vitalij Brouka

[22] Interview with Tatsiana Auramchyk

[23] http://www.by.allbiz.info/guide/population

[24] Shestakovsky, A. L. (2009). *Применение принципа расширенной ответственнстн производителя по отношению к сложной бытовой технике в Республике Беларусь* [Implementation of EPR for complex household appliances in the Republic of Belarus]. M.Sc. thesis. Minsk: Belarusian National Technical University.

[25] Marino, A., Pitot, A,. Tekle, G. & Viswanathan, S. (2008). *Who Can be Responsible for that Smell? Analysis of MSW Management in Belarus and Implementation of Extended Producer Responsibility*. IIIEE, Lund University.

[26] Tyson, G. J. (2005). *Extended Producer Responsibility and Local Government. Exploring Municipal Roles in Managing Packaging and Paper Wastes*. IIIEE, Lund University.

List of people interviewed in Belarus

Sergei Darozhka, Professor of the Belarusian National Technical University, Minsk / 2010,04,14

Tatsiana Auramchyk, Vice-Chairman, City Environment Committee Minsk/ 2010,04,14

Aliaksandr Hnedau, Consultant and Researcher, Minsk/ 2010, 04,14

Alexander Shastakouski, Researcher, Minsk/ 2010, 04,14

Uladzimir Darozhka, Researcher, Minsk/ 2010, 04,14

Siarhey Chopchits, Chief Engineer, Municipality of Saligorsk Saligorsk/2010,04,17

Aliaksandr Kanivets, Manufacturing Director of Waste Management Organisation KP Domservis Saligorsk/ 2010,04,17

Viktar Paulouski, Director of Communal Service Minsk Region Vileyka/2010,04,19

Vitalij Brouka, Director Ekologia Gorda (City Ecology) Minsk /2010,04,20

Siarhei Kuzmiankou, Head of WM Inspection, Ministry of Nature Res. and Environmental Protection of Belarus Minsk/ 2010,04,20

List of people interviewed in Sweden

Magnus Öhrnborg, FTI (packaging PRO), manager of Regional branch of west Sweden
Telephone 2010,03,18

Peter Ingvarsson, FTI (packaging PRO), Information manager
Telephone 2010,03,18

Ulrika Eliasson, Elkretsen (PRO for WEEE), Information and Market manager
Telephone 2010,03,19

Håkan Rosquist, NSR*, Research manager
Lund, 2010,03,19

Mats Jerslind, Sysav*, Advisor
Telephone, 2010,03,19

Göran Nilsson, Pressretur (PRO for paper), MD
Telephone 2010,03,26

Nils Lundqvist, Stockholms municipality, Traffic department
Telephone 2010,03,26

Agneta Lanto Forsgren, Skellefteå municipality, construction and environmental department
Telephone 2010,03,29.

Peter Wenster, Swedish Association of Local Authorities and Regions
Telephone 2010,04,03

Frank Tholfsson, Svensk GlasÅtervinning (PROGlass packaging), MD
Telephone 2010,04,03

Peter Domini, Business Developer, Stena Metall
Telephone 2010,04,22

* NSR and Sysav are companies owned by a group of municipalities for managing waste in the region Scania in South Sweden. NSR works in North-west Scania and Sysav works in the South-west of Scania.

A Sustainable Pathway for the Future

Future trends, such as an increased global population, growing resource extraction and material flows, will lead to a greater need for environmental strategies to deal with higher resource constraints and environmental problems. Technological improvements and sustainable consumption are two elements, which could contribute to lower total environmental impact. Although the four SED projects had different regional and cultural backgrounds, they were all dealing with sustainable regional development in the areas of energy, waste, water, food and/or mobility. From our combined work, we obtained several lessons learned, which will be outlined below.

A ***general vision*** is needed amongst regional stakeholders to increase acceptability, coordinate tasks and strive towards the same targets. It could reduce the risk of a failure scenario. In several projects, different stakeholders had different targets, which were competing.

All our projects were still in the development and exploratory phase and thus pointing out directions and potential solutions.

For instance, the establishment of an EPR system in Belarus or a sustainable city quarter in Sarpsborg is not completed after implementation. Monitoring and reporting requires the system to be continuously upgraded and further developed.

From a sustainable perspective environmental strategies should be first developed using a ***preventive approach***. Integration of sustainability into urban design right from the cradle creates opportunities

in which urban spaces can be utilised more efficiently, leading to better quality of life in urban areas. Increased transnational trade in electricity and waste could lead to the perception that resource usage is optimised. However, reducing the need for energy through higher energy efficiency and waste minimisation are to be prioritised before end-of-pipe treatment, installation of new energy capacity, and recycling systems. It should be stressed that all our projects aimed at reduced resource consumption and more sustainable production patterns.

The projects could benefit from ***community participation and capacity building***. There could be a need to protect cultural heritage, where traditional lifestyles might clash with unsustainable development. In the Val di Noto project, the several local actors' involvement and acceptance are crucial ingredients in visioning a distributed future. Awareness and knowledge among the public concerning environmental issues could lead to growing understanding and involvement in both generating solutions and participation in the implementation. In Shanghai, public opinion in urban redevelopment is crucial, particularly for a country where decisions are traditionally made at the top. A bottom up approach ensures a more inclusive integration of ideas from different stakeholders, which is a pre requisite for sustainability.

Acknowledgements

The ***Norway*** Team would like to give our thanks to Hafslund ASA and in particular Åsgeir Helland for his time and effort to organise the schedule for the interviews and the great accommodation in Norway. We enjoyed visiting the interest groups of Hafslundbyen and discovering the great surroundings Norway has to offer. Secondly, the visit to Torleif Bramryd and Michael Johansson at the Department of Environmental Strategy of Lund University in Helsingborg increased our understanding of eco-cities. Thanks to all the persons we interviewed, including the local people of Sarpsborg. All interviewees have been very useful. On top, our gratitude goes to our supervisors Philip Peck and Lars Strupeit for their insights and guidance.

The ***Shanghai*** team would like to appreciate the following for making the project a success:
The Nordic Centre for facilitating and organising the project. The Swedish Ministry of Environment for financing the project.
Göran Cars and the students of the Royal Institute of Technology (KTH), Stockholm, for their valuable inputs.
Students from the Urban Design Department of Lund University whose inputs from the urban design perspective are highly appreciated.
Lecturers and students from Fudan and Tongji Universities that provided further insight and ideas about Shanghai.
Shanghai Jing'an Planning and Land Administration Bureau for opening up to new

and interesting ideas from Swedish students.
We certainly thank *Mother Nature* for delaying the intensity of the volcanic ashes until after our departure lest the project would never have been.
The course supervisors Håkan Rodhe, Caroline Dahl and Thomas Lindhqvist for their guidance and moral support.

The ***Italy*** team would like to express its gratitude and thank the following. Professor Salvatore Cavallo at CUMO for his enthusiasm, knowledge and support. Thank you for inviting us to your home for an unforgettable day of pizza and the Mediterranean Sea. Silvana Tuccio at Lacunae for your interest in a sustainable Sicily and for skillfully organising our interviews and time. Your limoneto is wonderful. Marcello Scrofani (the Hub) for being the perfect host and for enthusiastic participation. Don't worry! Maria Teresa Pomillo for warm Sicilian hospitality. We would also like to thank staff and students at CUMO for supporting and welcoming us. All the interviewees for sharing their knowledge and experience, municipal staff and other participants contributing to our wonderful stay in Val di Noto, Sicily. The course supervisors Tareq Emtairah and Åke Thidell for guidance and insightful advice. Tack!

The ***Belarus*** Team would like to express the sincere gratitude to:
Siarhei and Uladzimir Darozhka, for all the organisational-administrative support and the time devoted for us. Aliaksandr (Sasha) Shastakouski who greatly contributed to the project by helping us not to get lost in the translations, for the valuable time and all the knowledge shared with us.
Administrations of Vileyka and Saligorsk for the cooperation and extremely warm welcoming, especially Viktar Paulouski and Aliaksandr Kanivets. As well as all other helpful people involved, without whose generous help this project would not have been possible, in particular: Tatsiana Auramchyk, Siarhei Kuzmiankou, Vitaliy Brouka and Aliaksandr Hnedau.
In Lithuania: Almontas Kybartas and his team at EMP recycling, as well as, Rasa Uselytė, UAB Ekokonsultacijos.
The representatives of PROs and municipalities in Sweden for generously sharing their time and experiences.
Our supervisors Thomas Lindhqvist and Andrius Plepys for the guidance, patience, knowledge as well as nice moments and places shared with us. Lars Hansson for making the memories of the trip last forever.
The Swedish Institute for making a multi-year cooperation with Belarus possible through their continuous support and, in particular, this study.

IIIEE – The International Institute for Industrial Environmental Economics

With the firm conviction that prevention is better than cure, the International Institute for Industrial Environmental Economics (IIIEE) was funded in 1994 at Lund University to engage in multidisciplinary research and educational activities with the overall ambition to develop and spread knowledge about strategies and policies for sustainable solutions to the contemporary and future challenges.

The Institute's educational effort is focused on masters' level courses and is carried out through two programs: MSc in Environmental Management and Policy (EMP), and MSc in Environmental Sciences, Policy and Management (MESPOM).

Multidisciplinary
Applied
International

The EMP program is the original IIIEE masters degree that started in 1995. It is an applied and multidisciplinary program designed to provide graduates with a solid foundation for action in the area of preventive environmental management and strategies. Students come from all continents and the alumni represent some ninety different countries. However a majority of the students are from the OECD countries, with Sweden, Canada, USA, Germany and China being the five countries with most alumni.

Candidates arriving to Lund have a professional degree in subjects relevant for work with issues around sustainable consumption and production, for instance, law, business, or engineering, and frequently have several years of work experience.

The courses are intense and demanding but also rewarding: our graduates have done very well in the job market and essentially all move on as professionals in the environmental field. Our education aims to be applied with many interactions with industry, government and NGOs.

The EMP program starts with one semester on distance and at reduced speed in order to make it possible to limit the time spent on campus in Lund and the time period fully devoted to studies. During the distance semester the students are provided an understanding of the environmental challenges and how the human activities influence the environment. All students are also given basic knowledge in the fields of business administration, management, environmental technology and economics, so as to facilitate understanding in fields earlier not studied and to enhance possibilities for communication with experts in various fields.

Prevention is better than cure

This first semester is followed by two on-campus semesters in Lund (from mid-August to mid-May) when the students gain further understanding of how to define and measure the various sustainability challenges and, in particular, how to address and solve these. The focus is on how to deal with problems at organisational and policy level; the natural science of the challenges is taken as a starting point but is a very small part of the program. Consequently, the students are provided with the knowledge of how to act in enterprises or government when addressing these challenges and the tools that facilitate this work. The fourth semester is devoted to thesis research and writing and can take place on or off-campus.

There is a variety of disciplines among topics covered: management of organisations, technical systems, economics, law and policy, etc. In-house research related to most of these areas gives excellent opportunities for research papers and theses. The staff is experienced and highly committed, several have gone through the masters program themselves. The staff is also international and represents various disciplines with a common interest of making knowledge and understanding useful in practice.

The students experience close contacts with an impressive and very active alumni network for the sharing of new developments and professional achievements. Alumni continue to keep frequent contacts

also after leaving Lund; sharing experiences, knowledge and information through the IIIEE Alumni Network. Every two years the alumni meet in Lund for a two-day conference.

IIIEE also runs educational programs at PhD level, participate in teaching on undergraduate level, and is involved in executive training.

Research at the IIIEE focuses on policy and strategies for sustainable solutions. The research includes the design, application and evaluation of policy instruments from a governmental, as well as, corporate perspective, and special attention is given to research that identifies and supports strategies and approaches for more sustainable business practice. In recent years, research has also focused on how to better understand the power of innovation and entrepreneurship to address sustainability challenges.

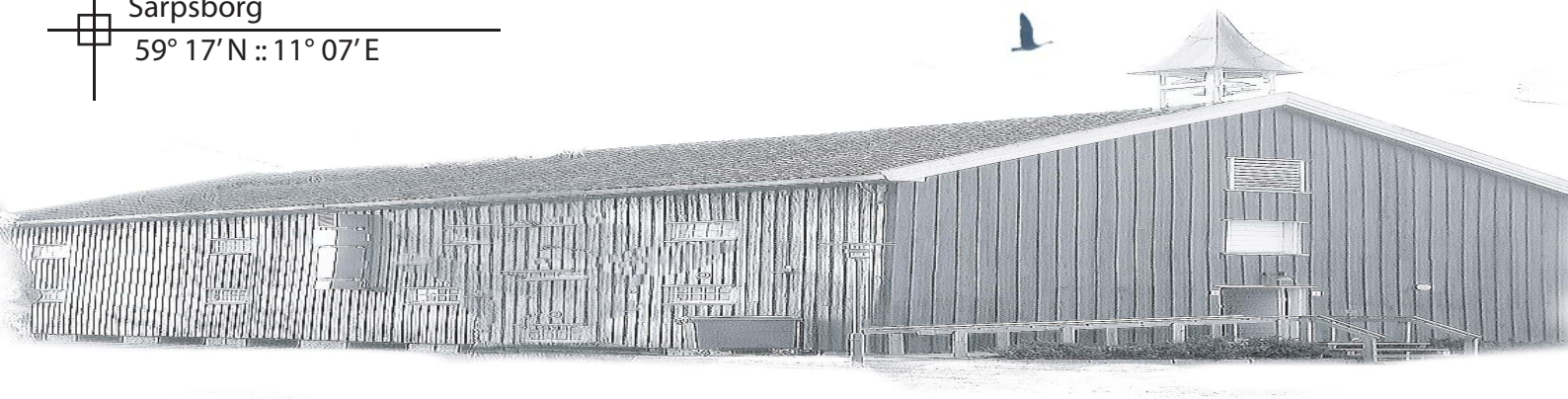
The research areas are numerous and cover topics of clean product and production-systems, consumption, waste management, renewable energy, energy efficiency, climate change, material flows, industrial ecology, the built environment, city development, tourism, mobility and information technology. The research is organised to encourage crosscutting actions and to allow for activities that address topical challenges and incorporate new approaches. Many researchers are active in more than one of the research areas and several of the research projects can be attributed to more than one of the areas.

IIIEE was established by the Swedish Parliament. It is a unique and creative response to the global challenge for sustainable development. It is part of Lund University and governed by a Board appointed by the University and the Government.

For more information see
www.iiiee.lu.se

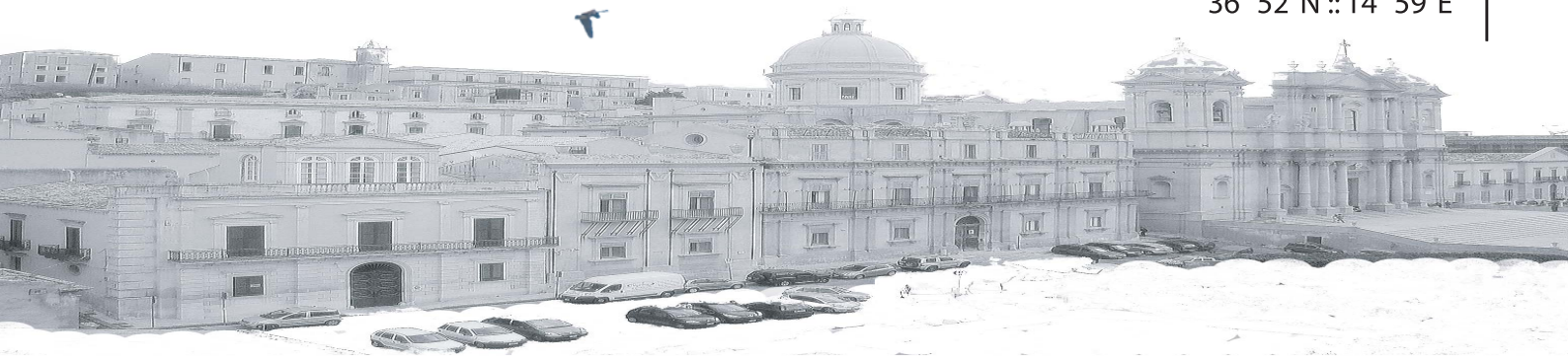
The IIIEE building in the centre of Lund

Sarpsborg
59° 17′ N :: 11° 07′ E



Shanghai
31° 14′ N :: 121° 29′ E

Noto
36° 52′ N :: 14° 59′ E



Minsk
53° 52′ N :: 27° 32′ E