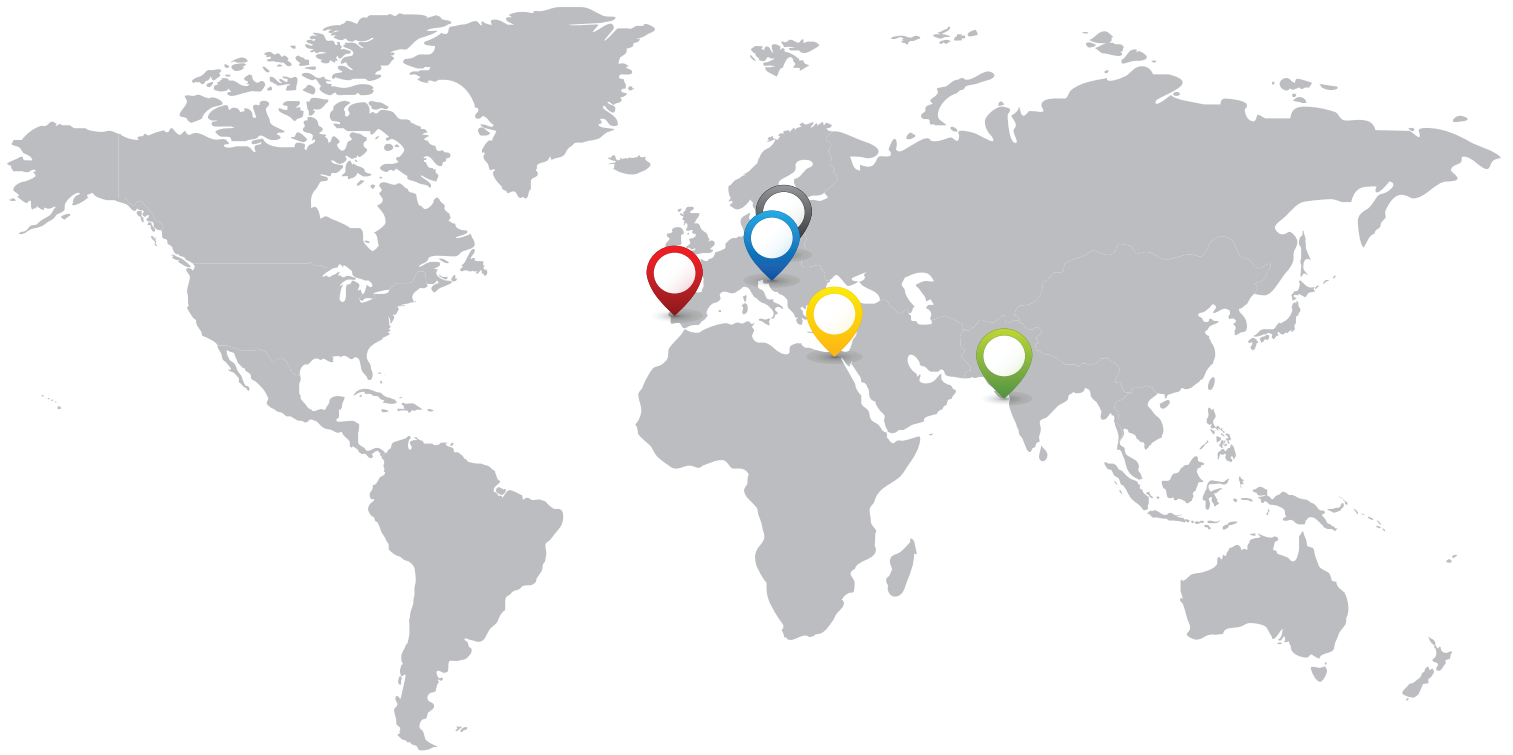


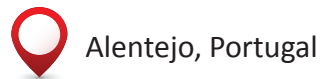
EXPANDING HORIZONS

*Five Cases Advancing
Sustainable
Solutions*





SED 2015: 20th Anniversary Edition Project Locations



Alentejo, Portugal



Cairo, Egypt



Ljubljana, Slovenia



Pipavav, India








Zabrze, Poland

This publication should be cited as:

International Institute for Industrial Environmental Economics [IIIEE]. 2015. *Expanding Horizons - Five Cases Advancing Sustainable Solutions*. Lund: IIIEE

ISBN: 978-91-87357-14-5

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Advancing Sustainable Solutions

The world faces unprecedented environmental challenges in the 21st century and societal change is needed to alter the course towards a more sustainable future. Expanding our horizons to engage with this process of change gives hope and strength. Through our experiences, we attempt to highlight the transformation already in progress around the world and showcase how societal actors are advancing sustainable solutions.

The following report is produced to showcase student-consulting projects around the world associated with the Strategic Environmental Development (SED) course. The course is among the final courses in the M.Sc Programme in Environmental Management and Policy (EMP) at the International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden. Through the course, students work in collaboration with clients in various sectors all over the world with complex environmental and sustainability challenges. The purpose of the projects is to advance sustainable solutions, and to make a small contribution to the change that our world urgently needs.

Founded in 1995, the IIIEE celebrates its 20th anniversary in 2015. The institute works in collaboration with various actors from business, governments and non-profits to advance sustainable solutions. Through the SED course, students experience working with these various actors on complex sustainability challenges on location in a real-life context. In 2015, five teams of EMP students worked on projects ranging from energy efficiency in Egypt,

sustainable wine making in Portugal, energy planning in urban development in Poland, environmental management in a seaport in India, and strategies for green growth in Slovenia.



International Institute for Industrial Environmental Economics, Lund, Sweden. Photo: Martin Risedal.

The Portugal team spent more than a week visiting several wineries to review common practices in the vini-viticulture in the Alentejo region. The task was to find improvement areas using the cleaner production approach, focusing on water and waste management and to assist the Comissão Vitivinícola Regional Alentejana in developing a cleaner production manual for the winemakers enrolled in the sustainability plan for the Alentejo wine region. Key rec-

ommendations range from small technological modifications to harnessing possible synergies, all of which have the potential to bring about significant savings in water and chemical consumption, which in turn can be reflected in waste treatment reduction and monetary savings. Also, staff involvement and commitment at all levels is a prerequisite for the implementation of new measures.

With a focus on energy service business models, the Egypt team spent two weeks in Cairo, to assess approaches facilitating the uptake of energy efficient street lighting systems. In particular, they studied the barriers and benefits of these models in addressing the promotion of energy efficiency in the Egyptian context. Working with the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), the team proposed a business model and additional elements that may enable the market to engage in energy efficiency enhancements in street lighting in the Egyptian context.

In light of Ljubljana being the European Green Capital in 2016, the Slovenia team's objective was to investigate how to better foster eco-innovation and sustainable employment in the city. The project included two parts: to begin with, good practices from the Öresund region in southern Scandinavia, including the cities of Malmö, Lund and Copenhagen, were collected. For the second part, data on the situation in Ljubljana was collected, primarily through interviews with important stakeholders. Recommendations were then given on how some of the practices from Öresund could be translated to the local context of Ljubljana.

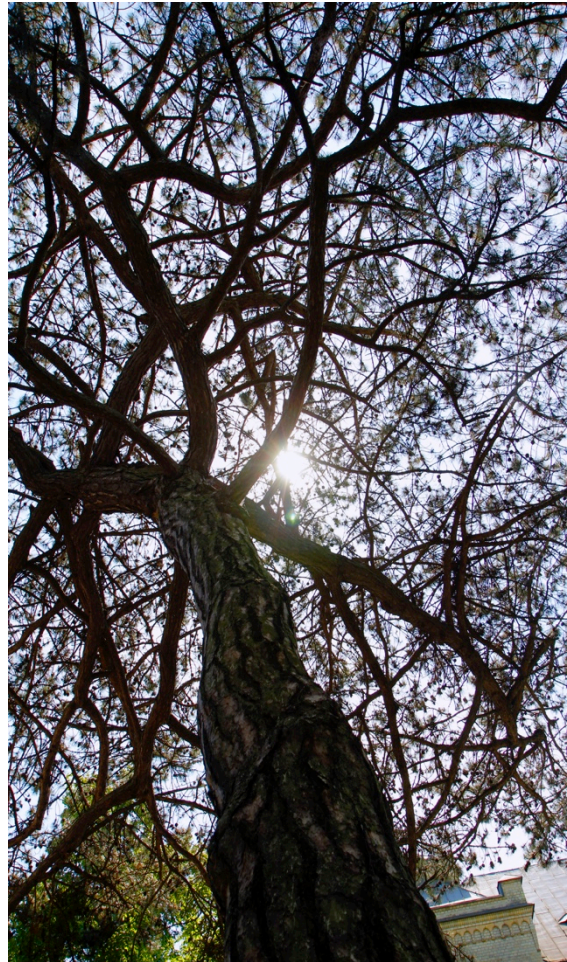


Photo: Nina Ransmyr.

By invitation of the APM Terminals HSSE Manager Asia Portfolios, the India team was given the task of supporting further development of environmental work in the seaport of Pipavav. The port is situated in an area rich of wildlife and mangroves that in some cases approach port premises. In preparation for the consulting task, the team visited several ports in Sweden, conducted interviews with industry professionals and reviewed available literature regarding best available practices. During the on-site phase, the team collected data by conducting interviews with key persons at the port, looked into the port operations and experienced the wildlife around the port. Recommendations stressed the importance of improving the port's social per-

formance and environmental footprint and showed how this can be reached by means of implementing systematic thinking into processes, establishing an internal culture of awareness, and by creating shared value with stakeholders in order to ensure successful environmental and social management.

The Poland team went to Zabrze, a city located in the coal-rich region of Silesia. As a part of the collaboration between the City of Zabrze and the City of Lund, the Swedish-Polish Energy Platform and the IIIIEE, the team was invited by Mayor Małgorzata Mańka-Szulik to give input on the energy planning of the new city district Nowe Miasto. Prior to the journey to Zabrze, the group visited new city districts in Helsingborg, Lund and Malmö to collect good examples on energy planning. Main recommendations from the project include the importance of establishing a clear vision for the new city district, to follow a framework for the energy planning process, and to use the energy planning process to gain attention from investors and potential citizens.

Key learning outcomes from the Strategic Environmental Development course include:

- how to work with multiple stakeholders;
- how to implement a systematic approach towards environmental management;
- how to move forward towards green growth strategies;
- how small steps can make a big difference towards successful environmental management systems and;
- how new innovative business models can aid in the advancement of sustainable solutions.

Collaborating with our clients has been truly inspirational. We thank all our clients, interviewees and staff from IIIIEE. We are committed to continue contributing to the advancement of sustainable solutions in these critical times.

Introducing The Teams

The members of each team are introduced in order from left to right.

Alentejo, Portugal



Tobias Hörnlein is from Germany and has a Bachelor degree in Political Science. He has worked as a musician for many years, managed a band and ran a company for music production.

Maximilian Engel is a dual-citizen of Canada and Germany and graduated from Carleton University in Political Science. Maximilian has a particular interest in sustainable business solutions and indigenous issues in the Amazon basin.

Florian Jacques is from Belgium and holds a Bachelor's degree in Management Engineering. He has a particular interest in cleaner production and resource management.

Anna Ohlsson is from Sweden and holds a Bachelor's degree in Biology and Animal Nursing, specialized in large animal anaesthesia. Anna has a special interest in nutrient and pharmaceutical residues in aquatic systems.

With their supervisor **Åke Thidell** from Sweden, Assistant Professor at the IIIIEE, educated as a chemical engineer. Prof. Thidell specialises in Cleaner Production and Bioeconomy.

Cairo, Egypt



Aurel Schmid is from Switzerland and has a working background in international and environmental policy and development. He is particularly interested in renewable energy policies.

Steven Curtis is from the United States of America and graduated with a degree in Environmental Meteorology. He hopes to work in environmental consulting on climate- and water-related issues.

Charlotte Huus-Henriksen is a dual-citizen of the United States and Denmark and graduated with a degree in Environmental Studies from Whitman College in Walla Walla, WA. She has past work experience in environmental non-profit communications and media outreach and has a strong interest in corporate environmental strategy.

INTRODUCING THE TEAMS

Anna Barford is from Canada and holds a Bachelors of Engineering in Environmental Engineering. She is interested in multi-disciplinary solution generation and wants to continue working with a variety of sectors.

With their supervisor **Philip Peck** from Australia, Associate Professor at the IIIIEE.

Ljubljana, Slovenia



Florian Proksch is from Germany and graduated with a Bachelor's degree in Management and Technology from Technische Universität München. He has worked with corporate strategy and environmental management.

Lucie Zvolkska is from the Czech Republic and graduated from University of Brighton in International Tourism Management. She has worked in the tourism sector.

Joe Hampson is from the UK and graduated from University of Bristol in Geography. He has worked in renewable energy companies in the Netherlands and Australia.

Caroline Westblom is from Sweden and graduated from Lund University in Physical Geography. She has worked with climate policy for national and international environmental NGOs.

With their supervisor **Jonas Sonnenschein** from Germany, a PhD Candidate at the IIIIEE.

Pipavav, India



Haiping Shen is from China, holds a B.A. in Environment and Business from Canada and a B.A. in Business Administration from China. Haiping is particularly interested in national & regional environmental planning and ecosystem conservation.

Markus Scheffel is from Germany, holds a B.A. in Social Sciences and has practical experience in political consulting as well as a strong interest in the circular economy.

Ronja Lidenhammar is from Sweden and holds a B.A. in Business Administration and Economics and has a particular interest in corporate environmental management and circular business models.

Kelly Dorkenoo is from France, holds a B.A. in Business Administration and has a particular interest in ecosystem management and green growth.

Mats Tedenvall is from Sweden and holds a Master's degree in Electrical Engineering and has worked with product management, project management and international standardisation.

With their supervisor **Thomas Lindqvist**, an associate professor at IIIIEE, who is the father of the Extended Producer Responsibility principle as well as the concept of Environmental Product Declarations.

Zabrze, Poland



Moa Forstorp is from Sweden and has an academic background in International Relations and Sustainable Development from Stockholm University and Lund University.

Paula Makuch is from Poland and holds an Engineering degree in Environmental Protection and Management and a Master's degree in Environmental Protection Technologies, both from Gdańsk University of Technology.

Per Wretlind is from Sweden and holds a Bachelor's degree in International Business and Politics from Copenhagen Business School and a Master's degree in Economic Growth, Innovation and Spatial Dynamics from Lund University. He has experience from politics in Malmö and Skåne, and worked with national and international NGOs.

Danica Caganic is from Sweden with an academic background in Retail Management from Lund University and she has worked in the retail sector.

Sandro Benz is from Switzerland and holds a Bachelor's degree in Economics and Business Administration from the University of Zurich. He has previous experience in environmental consulting and strong interest in the field of energy systems and renewable energy.

Together with their supervisor **Mikael Backman**, Director of the Swedish-Polish Sustainable Energy Platform and Senior Research Fellow at the IIIIEE and **Lars Hansson**, Associate Professor emeritus at IIIIEE. Both are from Sweden.

Cleaner Production in Alentejo

Waste and Water Management in Winemaking

Maximilian Engel, Tobias Hörnlein, Florian Jacques, Anna Ohlsson

Background and Task

Alentejo is one of the wine-producing regions of Portugal, representing more than 15% of the national wine production; the region is only second to the famous Douro valley. As with any other large-scale industry, winemaking can create a series of negative impacts on the environment. Although it may appear fairly homogenous, the industrial processes and production methods are extremely varied depending on the type of operation. Operationally organised along either wine growing (viticulture), wine making (viniculture) or a combination of both (vini-viticulture), the industry faces a complex mixture of, often interconnected, environmental issues [1]. The climate of Alentejo has an average temperature of 14.5 °C and 3 000 hours of sun per year, classifying it as hot-summer Mediterranean [2].

Task

To tackle those environmental challenges, the *Comissão Vitivinícola Regional Alentejana* (CVRA) decided to develop a voluntary Sustainability Plan for the Wines of Alentejo. The official regional wine commission is tasked to monitor quality and issue certifications in Alentejo and now is starting to deal with the integration of sustainability principles into the production processes. The purpose of the plan is to provide wineries with a tool to assess their current operations and provide guide-

lines to increase the competitiveness and sustainability of the region of Alentejo. Our task was to assist the CVRA in developing a cleaner production manual for the winemakers enrolled in the sustainability plan for the Alentejo wine region. The task was to find improvement opportunities through a cleaner production approach with a focus on water and waste management.

In the process of carrying out this task, we visited nine wineries and developed a benchmark by reviewing the common practices and Best Available Techniques (BATs) of other sustainable wine producing regions, such as New Zealand and California. Due to the nature of sites visited and operational impacts the winemaking process entails, the bulk of work focused on identifying opportunities within the cellars.

The waste hierarchy, as depicted in Figure 1, provided a useful guidance in assessing the most adequate approach to manage waste and water resources.

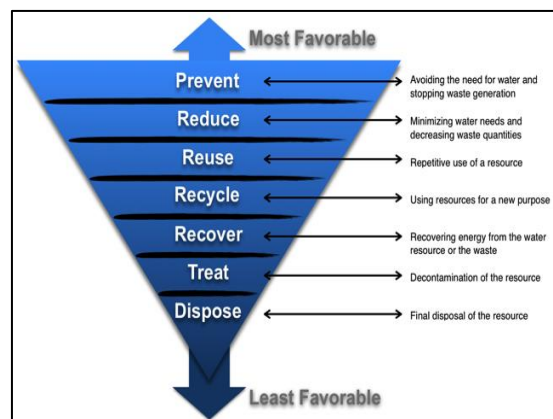


Figure 1: The waste hierarchy.

Understanding the Vinification Process

Usually, *harvesting* takes place in the cool morning hours; grapes are plucked either by hand or with the help of machines.

The *crushing* step removes the grapes from their stem. Following this, the alcoholic *fermentation* occurs in fermentation tanks, whose size depends on the scale of the winery's operation. In the case of red wine, the skin is part of the fermentation process, whereas in other types of wine they are removed directly after the crushing. The step that separates the juice from the skin of the grape is called the *pressing*. The *ageing* takes place in containers (oak barrels, clay amphorae or stainless steel tanks) after the

wine has been transferred from the fermentation tanks.

In the next step, clarification and stabilisation take place. The last stage is the *bottling*; the wine is filled into bottles, sealed with a cork and labelled.

Areas for Improvement

This report is a concise overview of the findings deemed to yield the most savings. Furthermore, one needs to understand that many incremental steps can lead to an overall significant change. Hence, there is fundamental importance in considering the systematic connections and consequences of any tweaks and changes. The resulting internal synergies may prove to be the key

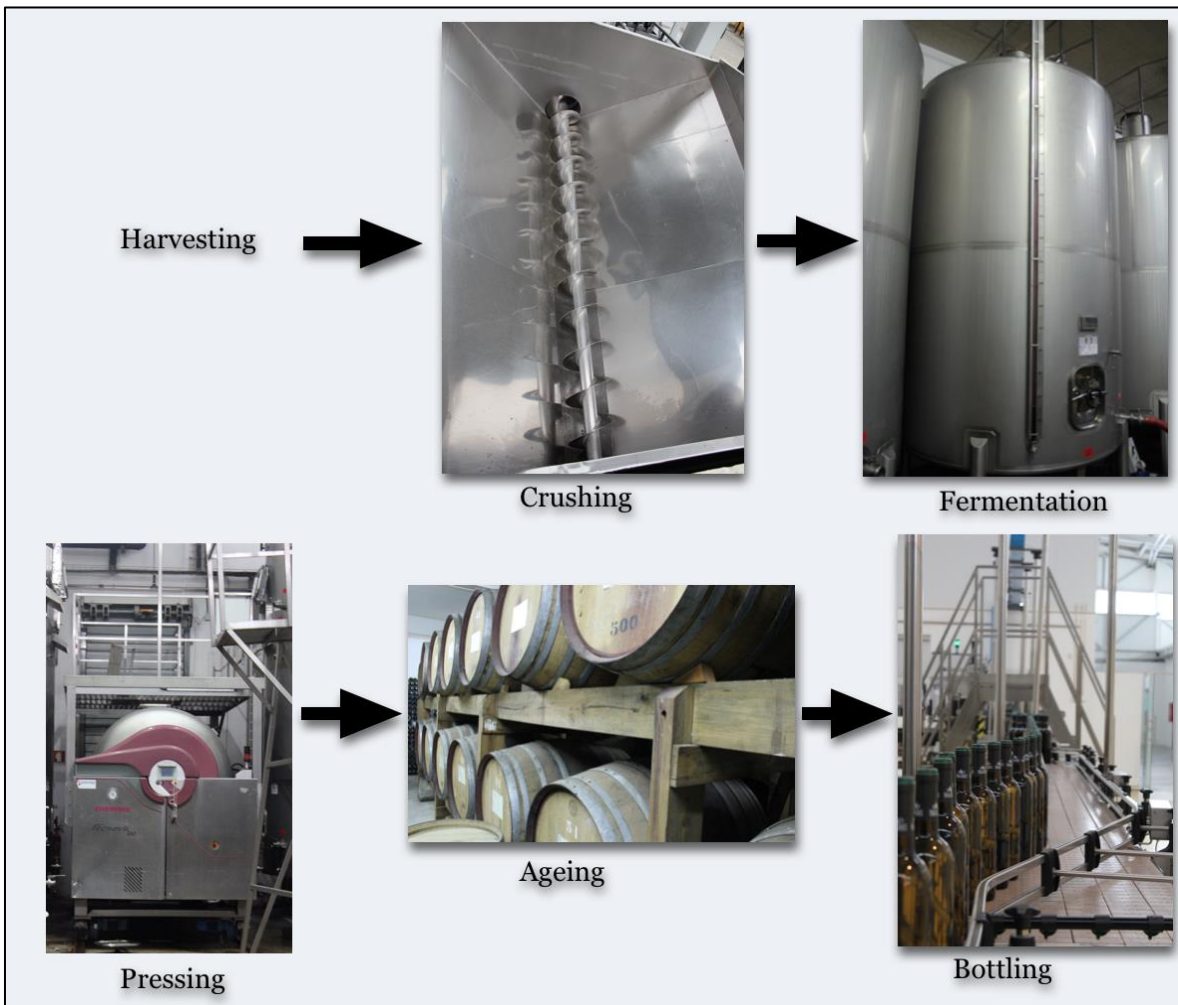


Figure 2: The vinification process

factor to decide upon a, possibly substantial, investment. The report is thus structured to display the major results of improvements followed by a concise identification of the available synergies contained within those improvements.

Each winemaking operation has to be considered individually, in varying magnitudes of procedures, their financial viability and the particular geographical conditions. The basis for any planning and action are carefully taken and tracked metrics. What is not measured cannot be managed!

Given their high potential for improvement, the following areas are developed in this section: input water in the vineyards, water usage in the cellars and treatment of wastewater. The decisive role of house-keeping is also outlined.

Input Water

Although the region of Alentejo experiences relatively high levels of precipitation, the distribution of rain over the months is uneven. Most of the 1065 mm/year fall in and around winter, leaving the soils fairly dry in summer and spring when growing vines demand high water input [2], meaning water is considered a scarce resource. Regarding the making of wine, any effort to save must be seen in conjunction with quality management of the grapes and their water demand.

The identified best practice that incorporates both demands was the following: water requirements are measured by monitoring the plants' water demands in relation to given parameters for the individual grape type.

Furthermore, soil probes are delivering readings on the moisture levels within different depths at different spots in the vine-

yard. Spots are chosen according to: grape varieties, soil composition, and elevation levels. Weather forecasts are included to proactively prepare the plant's water supply. Specialised software prepares the data and the technicians conduct the analysis guiding them to adequately irrigate the vineyards.

The soil probe is another example of a proactive system able to provide warning signals to alert of imminent stress and irrigation demand.



Picture 1: Soil probe connected to Wi-Fi readout transmitter.

Important to note are the facts that the leaves of such continuously growing plants have to be managed manually and the training in and proper usage of the system are crucial to a successful outcome.

The primary outcomes of scientifically monitoring the irrigation of vines (as opposed to approximating modelling sys-

tems) are:

- Considerable water savings and reduced load on water procurement system, such as pumps;
- Increased production, some places reported doubled production for certain grape varieties; and
- Higher grape quality.

The available synergies:

Demand-driven irrigation is primarily used for regulating the quality of grapes. In addition, such efficiency gains result in water savings. Even if water procurement costs may not be a primary concern, water shortages can most definitely be addressed by using this technique.

Furthermore, it is possible to relatively easily expand production without the need to purchase property. This also means reduced land use, which entails reduction of monocultures and positive effects on biodiversity and attractiveness of the landscape, which in turn can have positive knock-on effects for the tourism industry.

Water Usage in the Cellars

For vines to grow and for wine to be produced a vast quantity of water is required. In general, a winery’s water only represents around 8% of the total water consumption [3]; the lion’s share is taken up by irrigation. It should be stated though, that the total water consumption in vineyards is highly dependent on the yearly climate conditions and the water requirements from the grapes. In cellars, water usage ranges from 1.2 to 14.4 litres of water per litre of wine. This wide gap between the various wineries shows that there is great potential for reduction of their water con-

sumption. Although water consumption in the wineries is marginal compared to the total, given the cost of treatment before and after usage (around EUR 3/m³ for the most efficient wineries), decreasing water consumption can result in significant savings. Reusing or recirculating water can often easily decrease water usage by 1 000 m³ resulting in a minimum of EUR 3 000 saving.

When conducting a water audit in a winery, the main source of water consumption is easily identified: the cleaning of equipment. Winemaking is part of the food and drink industry and thus is heavily regulated as human consumption demands high hygienic standards. The cleaning step encompasses two procedures: washing and sanitising, which means sterilisation to an acceptable level for human consumption [4].

After each usage, every single piece of equipment used in the vinification process has to be washed and sanitised. However, based on the study visits in different wineries, only some steps are developed in this report; either because they showed more potential for improvements or because of their relatively high contribution to overall water consumption.

The fermentation process is the step where alcohol is created, either by adding yeast or employing the natural yeast contained in the skin of the grapes. They are usually left fermenting for a few weeks, depending on the type of wine. During this stage, small modifications have the potential to bring about great savings, both in water consumption and chemical usage. Such efficiency gains usually yield monetary savings, as well. An example of technological improvement is to optimise the outflow of water in cleaning equipment by replacing

regular nozzles with high-pressure low volume nozzles or valves. The use of rotating nozzles to clean tanks is also an easy and effective solution to cut down on water consumption.

When purchasing new fermentation tanks, opting for smoother tank surfaces has the potential to reduce water and chemical demand in the washing and sanitising stage. In addition, purchasing fermentation vats with an opening large enough to allow an individual to enter the tank is recommended. This option allows for an initial mechanical cleaning procedure, significantly reducing water and chemical demand when washing and sanitising and furthermore concentrating the wastewater stream.

Chlorine, although representing a cheaper alternative to other sanitisers, should be avoided given its potential negative consequences for human health, the environment and the quality of the wine. First and foremost, chlorine can generate trichloroanisole, a chemical compound, found to be a source of mouldy wines. Moreover, small chlorine powder particles can be airborne and contaminate other piece of equipment and endanger the health of workers.

In conclusion, based on practices observed and the literature gathered, the recommended cleaning procedure for tanks should be as follows:

1. (If equipment allows) Mechanical washing of the tanks;
2. First rinse with cold water;
3. Washing with a sodium hydroxide solution;
4. Washing with a citric acid solution,
5. which neutralises alkaline residues in the tank;
6. Sanitising with a peracetic solution;

and

7. A final rinse with cold water.

An alternative to further avoid the use of chemicals and water is to use ozonated water to sanitise the tanks, which would make steps 5 and 6 redundant. The equipment takes its input from the air in the winery to dissolve ozone into the water and only releases oxygen. This option costs around EUR 17 000, has a low power consumption and further reduces consumption of chemicals. It also reduces the load on the wastewater treatment facilities and saves water.

In the visited wineries, the volumes of water required for the cleaning of tanks ranged from 300 litres to 1200 litres. Notwithstanding the potential reduction that could be achieved through a reuse or recycling of the cleaning waters, cleaning a tank with a 15 000 litres capacity should not need to exceed a consumption in the range of 300 to 400 litres.

The primary outcomes of an optimised washing and sanitising procedure are:

- Water savings
- Reduction of chemical usage
- Reduction of wastewater load, resulting in decreased cost of wastewater treatment.
- Monetary savings as a consequence of previous outcomes.

The available synergies:

Keeping the waste hierarchy in mind, counter-current rinsing of the fermentation tanks is a useful option to both reduce the quantity of water and chemicals used in the cleaning step. By reusing wastewater from a previous cleaning stage for a step requiring lower quality cleaning water can dramatically decrease water consumption. Re-

cycling the water of the final tank rinse as first-rinse water for the next tank's cleaning operation reduces water demand by as much as 30-50% and does not compromise the hygiene level of the fermentation tank.

With only minor adjustments and careful monitoring of the cleaning solution, chemicals can also be used to clean more than one tank, further decreasing water and chemical consumption.

Yet another step that has a high water footprint is bottling. During this step, microbial concentrations remaining in the wine are stabilised. This prevents the wine from undergoing further changes that could subject it to alteration in taste and chemical composition, brought on by oxidation. In order to achieve this, oxygen is removed by infusing the bottle with nitrogen or a mixture of nitrogen and low concentrations of carbon dioxide, just before being filled with wine and again before being corked. Preceding this step, it is common practice for the bottles to be rinsed with cold or hot water. With comparatively little effort, higher efficiencies in water usage and ultimately higher margins can be achieved. One solution proposed, in order to avoid water use during the bottle-rinsing stage, is the use of a high-pressure oxygen infusion.

To ensure sanitary bottling conditions, the fillers are flushed with cold water in the morning and hot water at night, which is carried out with pressure washing equipment. Although water is still indispensable in this step, only minor technological modifications are required to reduce water usage. To prevent using water unnecessarily, high-pressure/low volume cleaning equipment fitted with shut-off nozzles, should be used. Secondly, to gauge water

consumption parameters, flow meters should be installed. It should be pointed out that this applies to all other water-demanding steps in the winemaking process.

Overall, particularly considering the operations' water demands and the water scarcity in Alentejo, capturing and reuse of water is of utmost importance.

The primary outcomes of optimised washing procedures are:

- Reduced water consumption
- Monetary savings



Picture 2: Cleaning of fermentation tank.

The available synergies:

The reduced demand on water leads to a reduced need for large pumps and a lowered electricity demand. Not only is the overall load on the wastewater treatment lessened but wastewater streams are more concentrated and thus can be easier and more effectively treated.



Picture 3: Bottling in progress.

Housekeeping and Waste Management

Good technical initiatives are only as useful to the degree to which they are implemented. Hence, it is no surprise that good housekeeping is of vital importance for any industry to keep an orderly work environment and to yield the environmental and economic benefits. Simple things like checking for and avoiding leakages in pipes and hoses, as well as daily instrumental and technical oversight are essential. Regular maintenance leads to properly functioning equipment, which increases longevity and thereby reduces resource demand.

Staff education and training is important to raise awareness about water usage and waste management. Others essential parts of the picture are supplier communication and the purchase and proper handling of

efficient equipment in order to decrease the use of resources.

Overall, several connected operational practises and technological modifications need to be considered: a commitment at senior management level, personnel training and motivation, communication failures, monitoring, process disturbance, equipment maintenance, resource management, reusing, recycling and recovery of waste and water.

It is also of key importance to determine whether effective sequencing and scheduling of production processes is taking place. This offers a clearer understanding on the causes of waste generation and unnecessary disposal. Exploring possible recycling and reuse options before landfill is decisive when aiming for waste minimisation. Substitution of harmful materials or substances in order to reduce the operation's impact also needs to be considered.



Picture 4: Example of leakages.

Regarding waste reduction, good housekeeping has several beneficial effects. Beyond having positive effects from environmental and economic perspectives, it also contributes to the company's quality of work, which can be reflected in the company's overall reputation. As waste is a symbol of unused resources, it is highly important to find out where in the production

process the waste occurs, why it occurs and the volumes that are created in each step of the process. This is achieved by conducting waste audits.

Housekeeping methods can be integrated into daily procedures more easily and effectively with the implementation of either an Environmental Management System such as ISO 14001 or by employing Kaizen lean production methods once developed for the automotive industry.



Picture 5: Example of bad housekeeping.

Wastewater Treatment

There are two major flows in the vinification process: wine and water. After water has been used for cleaning purposes, it carries many chemicals and, often, a heavy organic load. Proper treatment of the wastewater is of paramount importance for two reasons; first the contaminated water can, due to legal grounds, not simply be released into any receiving body. Secondly, any proper chance of water recovery presupposes adequate, initial treatment.

It is at this stage that the aforementioned

synergetic effects of measures taken become visible. Decreasing the use of chemicals and avoiding the usage of hard chemicals translate into cost savings in the treatment of the effluents. Moreover, aiming for a lower ratio of water used per litre of wine produced results in a wastewater flow with a higher density of chemicals and particles that need to be removed. This, according to the law of diminishing marginal returns, facilitates the removal of greater quantities of waste from the water: the cleaning efficiency of the wastewater treatment is increased by the higher density of chemicals and waste in the water.

Lastly, good housekeeping helps avert unnecessary waste from ending up in the wastewater.

Inspired by our visits at different wineries, the most efficient and environmentally sound way to treat effluents includes the following steps:

1. Screening, to remove gross solids;
2. Flow equalisation, to reach a neutral pH level;
3. Sedimentation tank, to remove the sludge; and
4. An aerobic or anaerobic treatment may finalise the treatment.



Picture 6: Aeration basins.

The available synergies:

Ideally, if the wastewater flows allow for it, wineries should develop a circular approach to water re-usage, which would enable the creation of biomass and a recirculation of water, once it has been treated. In such a case, after an initial screening, the effluents are transferred to aeration basins and biological filtration ponds/lagoons. Once filtered, the water can be reused for landscaping and similar secondary usages. This water should not connect to the hygienically sensitive areas such as the wine/food production. The collected sludge can, if of acceptable quality, either be recycled around the winery itself for landscaping, in the vineyards or it can be sold off as fertiliser.



Picture 7: Natural reed beds to recycle wastewater.

Conclusion

One of the keys to good quality wine is understanding the requirements of the soil, the vine and the grapes. Therefore, the winemaking industry is inherently tied to its environment; something which can no longer be ignored. With the quantity and quality of water tied inseparably to the quality of wine, winemakers in the Alentejo region protect the environment at the same time as protecting their livelihood. In addition, they preserve their culture and heritage. For all those reasons, commitment to

sustainability is already strong in the region.

However, it is still relatively easy to identify opportunities for improvements. It is precisely to fill that knowledge gap that this report has been made.

With water and waste being the main focus areas of this report several suggestions and guidelines were developed. They range from small technological modifications to possible synergies, all of which have the potential to bring about significant savings in water and chemical consumption, which in turn can be reflected in waste treatment reduction and monetary savings.

In addition, at the heart of any efficiency improvements are commitment, involvement and awareness. Raising awareness about water and waste issues among employees is at the source of the smooth implementation of new measures.

In winemaking, as has become apparent, drivers do seldom present themselves isolated from each other, let alone detached from the broader technical, environmental, or social arrangements they are part of. System synergies are the norm rather than the exception, resulting in win-win scenarios, particularly in regards to the technical aspects of cleaner production.

By reading this report, we hope that wineries can benefit from their further integration into a more environmentally sound industrial production.

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Adega Mayor (2015-04-15)

Carlos Contradaças (Sustainability Champion); Tiago Correia (Enoturism)

The Comissão Vitivinícola Regional Alentejana (2015-04-15)

Dora Simoes (president); João Barroso (Sustainability Manager)

List of people interviewed

This list represents both the operations and people interviewed, including their professional functions. The list doubles as a record of visits undertaken.

Adega Cooperativa da Vidigueira (2015-04-09)

José Miguel Almeida (General Manager); Daniela Almeida (Marketing); Sandra Silva (Winery Technical staff)

Fundação Eugénio de Almeida (2015-04-09)

Pedro Baptista (Winemaking Manager)

Cortes de Cima (2015-04-10)

H-K Jörgensen (General Manager); Cristina Ferrão (Winery Technical staff); Simão Mendez (Viticulture Technical staff)

Casa Agrícola Alexandre Relvas (2015-04-10)

Nuno Franco (Winemaking Manager)

Esporão (2015-04-13)

Miguel Jorge (Maintenance Director)

Adega Cooperativa de Borba (2015-04-13)

Helena Ferreira (Production and Quality Management); Óscar Gato (Winemaking Manager)

Herdade dos Grous (2015-04-14)
Luis Duarte (Winemaking Manager); Mafalda Vasques (Winemaking)

Herdade da Mingorra (2015-04-14)

Pedro Hipólito (Winemaking Manager)

Towards a New Energy Ideal

Energy Service Business Models in Outdoor Lighting in Egypt

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Introduction

Egypt is at the beginning of an energy sector transformation. Rapid population growth and rampant urbanisation have triggered increasing electricity demand and challenges to the country's ability to close the significant electricity supply deficit (3GW peak summer deficit for 29GW installed generation capacity) [1]. As a consequence, the country faces rolling brownouts. Both public and private sector actors are looking towards energy efficiency projects. This shift requires changing the way Egyptians consider energy production and energy efficiency.



Picture 1. Streetlights on during the day in Cairo

The government is currently in the first year of phasing out electricity subsidies. This will see an increase in the cost of electricity by four-fold (estimated from EUR

0.06/kwh to 0.24/kwh) over the next five years) [2]. This provides an impetus to public and private sector actors to consider energy efficiency projects. These will reduce the burden of increasing electricity prices. There is currently not a coordinated national energy strategy; past efforts to manage energy use have been piecemeal and thus have had limited measurable success.

The potential of energy efficiency is clear in Egypt; simply by installing energy efficient lighting, total grid demand could be reduced to approximately 26GW, 90% of current capacity [3]. This would eliminate the need for planned brownouts. Despite increasing awareness and economic pressure, many contextual challenges impede the development of energy efficiency projects in Egypt. This leads to opportunities for energy service providers, which facilitate installation of energy efficient solutions.

Given the need for energy efficiency in Egypt, we look to identify the most suitable business model for an energy service company (ESCO) to encourage energy efficiency projects in Egypt.

This is done as part of a project by the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), to promote private investment and energy efficiency in Egypt. A highly visible demonstration project will follow as a trial of the concept in context.

Approach

Outdoor lighting has been identified as a suitable field for developing an energy efficiency demonstration project because of low technical complexity, comparatively high savings, and short payback periods.

The content of this report reflects the results of a two-phase study. Phase I was a desktop study of various energy efficiency business models. Phase II was a field study involving a comprehensive series of interviews conducted among experts and stakeholders in the public and private sectors in Cairo during April 2015.

This report first defines Energy Service Companies and presents a range of relevant business models. It then contextualises the Egyptian ESCO market including constraints and potential solutions based on 17 interviews carried out in Cairo. This allows us to elaborate on the most suitable ESCO business models in Egypt and suggest three additional elements to support the business-case in Egypt, increasing the chances for success. Before concluding, we test our findings with a case study on the privately-run city Madinaty.

Energy Service Companies

Context and Definition

ESCOs emerged in the 1990s in the United States primarily as a financial mechanism to provide consistent energy supply and improve energy performance and efficiency. They allowed actors who would not otherwise have been able to raise the capital for projects to achieve significant gains in energy efficiency. While various business models exist, the concept of the ESCO is the same: an entity delivers energy services and/or other energy efficiency improve-

ment measures to an end-user and accepts some degree of financial risk in so doing [4]. The payment for the services delivered is based (wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria. The company contracts with an end-user to provide and organise required knowledge, technical equipment and capital within the existing legal framework.

A distinction among ESCOs is made on the basis of the service provided: ESCOs can engage in Energy Supply Contracts (ESCs) or Energy Performance Contracts (EPCs) (Figure 2) [5].

Energy Supply Contract

With ESCs, a company provides useful energy, such as electricity for appliances or heat for industrial processes. This type of service model may deliver efficiency improvements with the focus on the supply of energy and energy security.

ESCs exist in various business models: Fee-for-Service; Contract Energy Management; and Business Improvement Service.

The straightforward Fee-for-Service business model has the ESCO providing a specified service for a fixed fee. This approach may be the most applicable in a less-developed country context due to its lack of complexity [6].

Energy Performance Contract

The EPC service models focus on the energy efficiency gains of a project often by retrofitting existing technology with that which is more energy efficient.

EPCs exist in various business models: Shared Savings; Guaranteed Savings; First-Out; Build-Own-Operate-Transfer; Chauffage.

The primary difference between the business models lies in which actor (the ESCO or the Client) borrows credit and bears the financial risk. Shared Savings, First-Out, Build-Own-Operate-Transfer and Chauffage typically have the ESCO financing the energy efficiency project. In contrast, the Guaranteed Savings model sees the Client financing the project and the ESCO providing the design and maintenance services along with efficiency performance guarantees. For more detailed review of Shared Savings and Guaranteed Savings business models, see Figures 2 and 3.

Towards the Best Business Model for Egypt

With a focus on outdoor lighting and energy efficiency improvements, the EPC ESCOs business models appear most relevant for Egypt. Build-Own-Operate-Transfer is suitable for larger investments than is usual in lighting; Chauffage is most applicable for heating; and the distinction between the First-Out model and the Shared Savings model lies in the contract details. Thus, these were removed from consideration in this report. Therefore, the Shared Savings and the Guaranteed Savings busi-

ness model are the focus for analysis in the Egyptian context.

ESCOs in Egypt

History of ESCOs in Egypt

ESCOs have been tried in Egypt in the past. In 1999, the Egyptian Energy Service Business Association formed to support ESCOs and related companies in the market. From 1999 – 2004, the association held various trainings supporting energy auditing, technology, proposal writing, etc. The association’s activities and membership dwindled until 2012 when the association officially ended due to lack of support and willingness among members to pay dues [6]. The primary cause of the associations decline was the abundance of subsidised energy, and therefore disincentive for potential Clients to invest in energy efficiency projects. At its peak, the association had fourteen members.

Current ESCO activity

While our research could not determine to what extent ESCOs are active in Egypt at the present time, anecdotal evidence suggested that they currently could occupy no

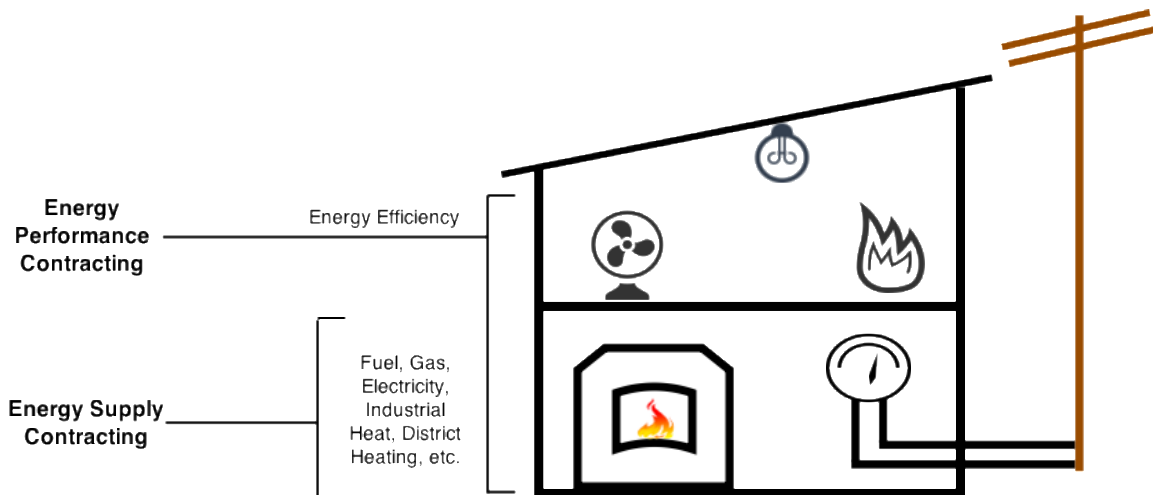


Figure 1. Differentiation between EPC and ESC

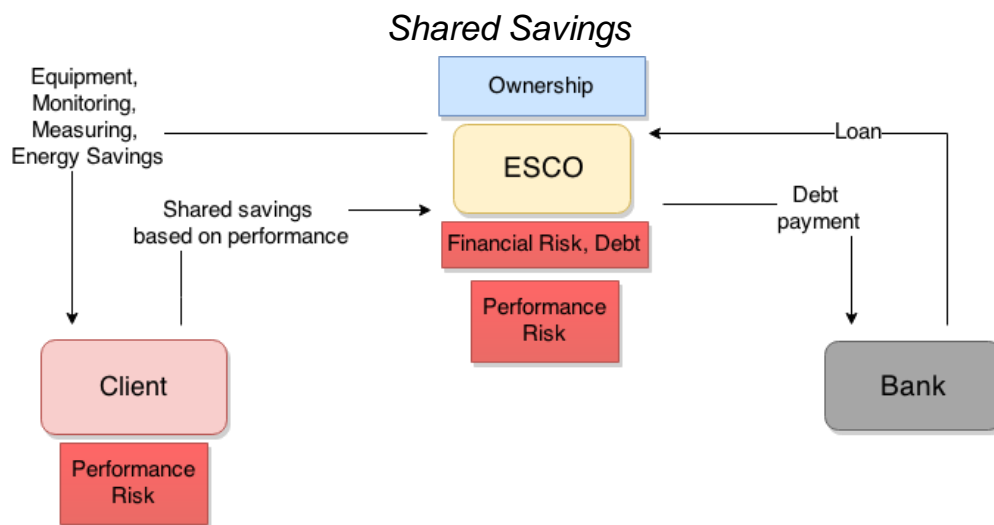


Figure 2. Shared Savings Business Model

In Figure 3, the ESCO receives a loan from a Financier, such as a bank or an investor, to pay for an energy project requested by a Client. The ESCO finances the energy efficiency project and bears the financial risk, retaining ownership of the equipment until the loan is paid off. It is called Shared Savings as the Client and ESCO share the electricity savings. This savings is based on the difference between the baseline energy costs before the installation of the new equipment and the performance of the ongoing savings recouped by the energy efficient technology. The ESCO and the Client also share in the performance risk as both benefit from the efficiency gains.

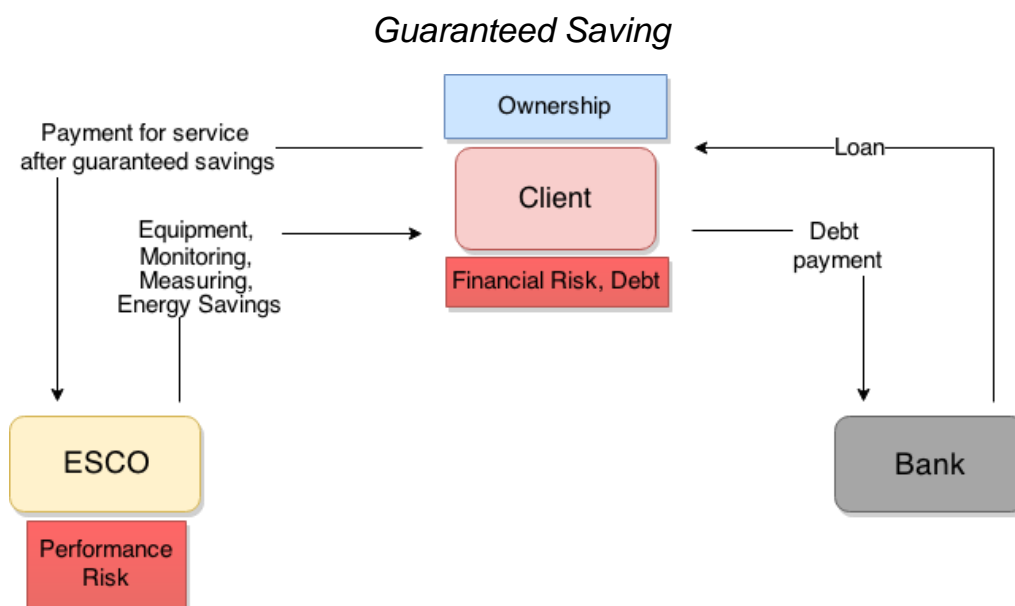


Figure 3. Guaranteed Savings Business Model

In Figure 4, the Client deals directly with the Financier, finances the project and is responsible to repay the debt. The Client then owns and operates the equipment through the contract and afterwards. The ESCO has no direct contractual obligation to repay the Financier. The ESCO is only responsible to guarantee the savings achieved by the equipment purchased by the Client. This savings is generally equal to the necessary debt payments. Therefore, the ESCO only carries the performance risk, and all other risks are born by the Client.

more than a small share of the market.

Problems with access to finance, poor service quality and lack of interested Clients, due to an abundance of cheap energy have prevented their entrance into the mainstream energy market.

Given the rapidly evolving technological solutions and the changing price incentives due to the phasing out of electricity subsidies, ESCOs are now poised to take the market by storm. Our research determined that several actors are looking into the possibility of establishing full-fledged ESCO activities. This is why a highly salient and visible demonstration project could contribute to addressing the logistical challenges for ESCOs in Egypt.

Constraints for ESCOs in Egypt

Financial: Access to capital is a major constraint in Egypt. In part, this is due to the unwillingness of banks to offer credit and prevailing high interest rates. Interest rates were reported to be between 12-15% for loans in Egyptian Pounds and given to only the most creditworthy of businesses [7]. This is a significant issue for potential new entrants to markets.

ESCOs may circumvent high interest rates by taking loans in USD or EUR. However, currency fluctuations increase risk; therefore, shorter payback periods of two to three years are preferred for projects financed in this manner [7]. This becomes awkward for projects, which take longer than this to complete or involving Clients that would prefer to lengthen the contract in order to reduce payment size.

Social/Cultural: The perception of ESCOs is quite negative in Egypt [7]. There is evidence that in the past, many companies have offered services for which they lack

the capacity to execute and guarantee performance. Informants to this study have described many service offerings to companies that failed to deliver. Interviewees also described a proliferation of scams in the market taking advantage of those needing to save some money with energy efficiency projects.

Additionally, ownership and control of equipment are given high priority in the Egyptian context [8]. ESCO models that involve relinquishing of ownership, outsourcing of operation and management of technical equipment will be seen as a constraint as this is outside of the Egyptian's normal.

Our research raised significant concern over the general lack of awareness regarding energy efficiency and for the potential of ESCOs in facilitating investment in energy efficiency measures. However, it was frequently mentioned that awareness for the need of higher energy efficiency is rapidly increasing due to price increases.

Among other limiting factors, lack of availability and retention of skilled personnel is an issue for the advancement of ESCOs [8, 9]. Organisations simply are struggling to attract and retain the talent necessary to undertake the technical and financial aspects of ESCOs.

Legal/Governmental: As mentioned in the introduction, artificially low energy prices have reduced incentives for the private and the public sector to consider their energy use and energy efficiency potential. Also, the current lack of a coherent national energy (efficiency) strategy creates uncertainty and may prevent investment decisions in energy efficiency [10].

The lack of contractual enforcement in Egypt is a major constraint for ESCOs

whose complex financing, ownership and risk agreements depend on the ability to develop mutual agreements and enforce contracts in the case of non-compliance of a party.

Technological: The significant supply shortage creates frequency and voltage fluctuations, which may reduce the rated lifespan of equipment and may limit the viability of certain technologies. It is reported that grid voltage fluctuates between 180 and 280 volts and can reduce the lifetime of an LED light bulb to that of just a year or so [11, 2].



Picture 2. Students interview Dr. Helal (CEO of Futek Egyptian Micro Electronics) and visit his LED manufacturing facility.

Multiple interviewees indicated that a lack of monitoring and verification protocols to deal with the voltage fluctuations is a major constraint in the wider adoption of ESCOs that rely on robust measures of baseline consumption in order to establish saving. This constraint is due to limited trust in personnel and technical capacity.

Solutions Allowing the Establishment of a Vibrant ESCO Market

Given the contextual challenges associated with the development of the ESCO business model in Egypt, a business that both meets needs and has good chances of suc-

cess must work with the constraints listed. But before we present the business model that we believe is most applicable for Egypt, let us elaborate on some solutions to overcome the contextual constraints that have been raised by our interview partners.

Financial: Foreign investment, either through private actors, public development banks or grant programmes, may alleviate the burden on ESCOs to secure capital for energy efficiency projects [12].

As government currently subsidises energy heavily, it is in its best financial interest to promote energy efficiency. This will reduce government expenditure on subsidies, which currently consist of 25% of the government's annual budget [10]. A low interest loan programme, targeted specifically at loans for energy efficiency projects such as ESCOs may thus be financially advantageous for the government and ease ESCOs access to capital.

Social/Cultural: It is expected that increasing costs for energy will raise awareness for energy efficiency and alter the current energy consumption culture significantly. The motivation to realise energy efficiency opportunities may be stronger than the cultural preference to own equipment.

Legal/Government: The government can create monitoring and verification standards and support the enforcement of contracts by strengthening the judicial system and creating effective incentives to fulfil contractual obligations.

In looking at solutions, a group of interviewees highlighted the success of the Korean ESCO model. In this model, a third party affiliated with the government reviews all ESCO contracts and performs monitoring and verification to ensure performance of the system and arbitrate even-

tual disputes.

Technological: Significant investment is required by companies and the government to provide monitoring and auditing standards and verified equipment [9]. Only once these are readily available and their quality is assured, trustworthy baseline studies may be conducted to identify energy savings potential. The third party mentioned in the previous section will facilitate these changes and investments.

Access to technical expertise is a critical advantage of ESCOs. Installation of energy efficient equipment by more traditional actors is likely not to protect equipment against damage caused by the unstable grid. ESCOs will install complete systems to ensure that equipment is operational for its maximum lifespan and energy efficiency potential is fully realised.

The Best Suited Business Model

As was demonstrated previously, numerous constraints have until now prevented ESCO business models from being successfully used in Egypt. It is thus unreasonable to assume that there is a silver bullet business model that deals with all these constraints. However, several important constraints such as a price incentives and awareness for the importance of energy efficiency may be altered in the near future enabling the emergence of ESCOs. This section further examines the weaknesses and strengths of the Shared Savings and the Guaranteed Savings business model in the Egyptian context.

Shared Savings Business Model

The majority of interviewees have indicated that this model is preferred in Egypt.

They highlight the significant advantage that in this model the ESCO provides financing and accepts financial risk. Additionally, the common financial interest in high savings increases Client's saving efforts and mutual trust.

However, the fact that the ESCO needs to accept the financial risk can also be a weakness. ESCOs can face major difficulties to fund projects due to banks being unfamiliar with the business model, low bankability of the saving based cash flow and unsustainable high debt ratios on the ESCOs balance sheets.

Guaranteed Saving Business Model

According to our literature research, which summarised the international experience with ESCOs, this business model is rarely successfully applied in a developing country [6]. Interviews have confirmed the major difficulties that Clients face in financing projects as well as difficulties to verify and monitor as well as to enforce contracts.

Conclusion Business Model

Overall, it seems that the Shared Saving Business models is more appropriate in the Egyptian context. However, the Guaranteed Savings model could provide an interesting alternative in some cases.

Additional Elements

The numerous constraints highlight the need for additions to any ESCO business model and to the overall business context for it to spread more widely. We suggest three enhancements that address these constraints and help guarantee success (Figure 5).

Consumption Repayment Plan

Numerous interviewees suggested that maintenance of the lighting technology is

key to ensure performance and efficiency. [11, 2].

Therefore, to incentivise the Client, the repayment plan will reflect the consumption and efficiency of the system. Should the Client maintain designed efficiency and demonstrate a decrease in electricity consumption, the Client will get to keep a higher percentage of the savings. For example, should the Client maintain efficiency, the ESCO and Client could split the savings 50%-50%. However, should the Client not maintain the system properly, the ESCO receives a higher percentage of the savings to ensure it is able to meet its financial obligations.

Loan Interest Rate Subsidy

As mentioned, the government currently highly subsidises electricity prices. As energy efficiency reduces the total demand of electricity generated, the government has an incentive to reduce consumption by subsidising energy efficiency projects. For

example, the government may work with banks to subsidise interest rates or provide loan guarantees. Since energy efficiency projects offer drastic savings, the loan is likely to be repaid and the government benefits from lessened demand of electricity.

Third Party Body

As discussed previously, a significant number of interviewees indicated that an independent third party body may be an essential component to any sustainable ESCO market in Egypt. Depending on the political feasibility, such a body could have a wide set of tasks such as overseeing the ESCO market and ensuring both the technical and financial aspects of contracts, as well as facilitating tendering and contract dispute processes. Given the dominant role of the government in the energy sector in Egypt, such a third party is anticipated to have government affiliation. It would have technical capabilities including monitoring and evaluating of performance of equip-

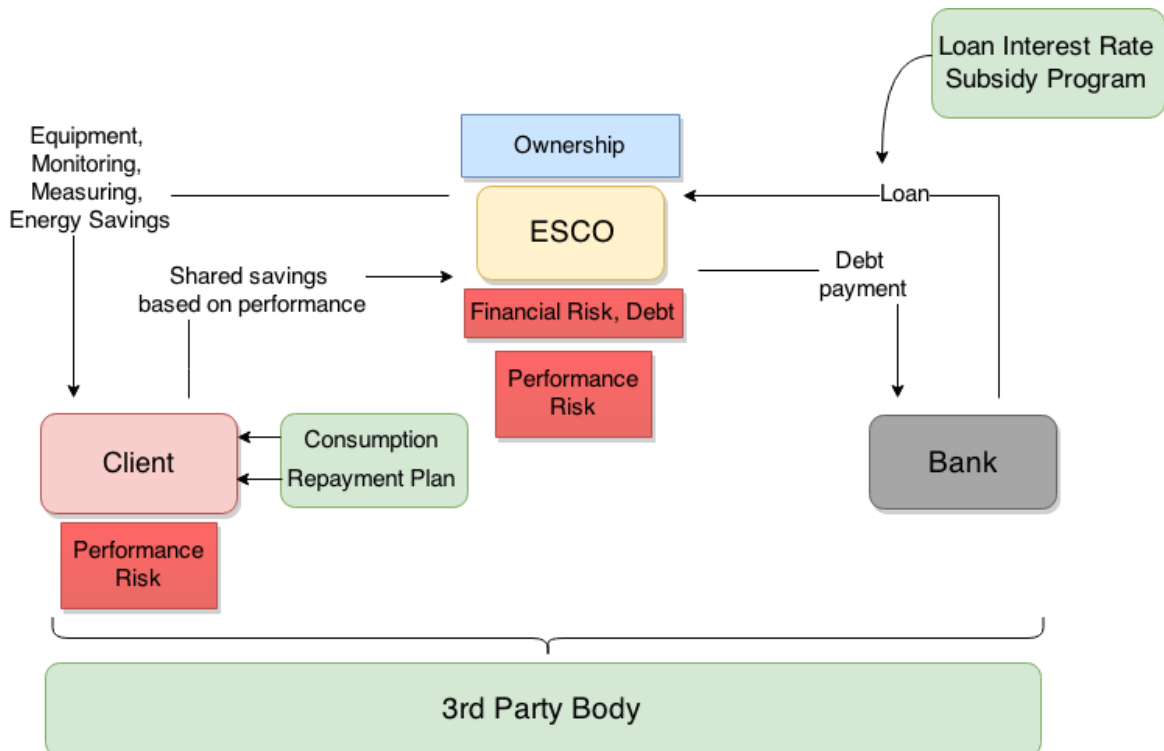


Figure 4. Additional Elements to the ESCO Business Model

ment, as well as analytic capabilities to ensure financial reasonableness of contracts.

Defining the Market

This section looks to elaborate on the needs of the key actors involved in the ESCO market in Egypt, as found through numerous interviews.

The Financiers

The Financier can take the form of a bank,

development bank or investor. Regardless of the actor, all such actors require a return on investment. The Financier does not necessarily judge the project based on its merits, but rather on the trustworthiness of the Client [6].

Through interviews with Egyptian stakeholders, a patchwork picture of the local banking industry indicates that the largest banks such as the central bank are more familiar with providing project-based lend-

Case Study: Madinaty

Madinaty is a privately run residential compound of several hundred thousand inhabitants outside Cairo. Catering to a wealthier clientele, the compound provides all essential services but relies on external utilities for energy and water.



Picture 2. Madinaty Compound

Compounds, such as Madinaty, are suitable as a demonstration project for energy efficiency services in street lighting because a number of variables and constraints are removed that would be limiting in the public context.

- Residents expect adequate street lighting and the compound has the incentive to maintain equipment and efficiency;
- Being privately run, it can base decisions on economic, and not political, criteria and avoid much of the bureaucracy tied to public procurement processes;
- The cost of electricity is higher for private actors compared to municipal street lighting; therefore, Madinaty has an increased incentive to invest in energy efficiency relative to municipal actors.

Needs

According to discussions with Madinaty representatives, the compound's administration is concerned with rising electricity prices and is actively evaluating ways of financing energy efficiency measures [15,16]. The compound wants to use existing infrastructure in any demonstration project, as the compound is relatively new. Additionally, Madinaty seeks greater enhancements such as wireless control, targeted dimming and camera surveillance. Madinaty is explicitly interested in the Shared Savings model and would be ready to negotiate ownership, revenue sharing and risk with ESCOs.

Constraints

The main condition for Madinaty to move forward is the presence of a trusted partner that can provide the technology and has proven efficiency gains in a small demonstration installation.

ing to energy savings projects than any of the smaller banks. Because many of the local banks may be unfamiliar with this kind of business model, they may not be willing to accept future energy savings as the form of collateral [7]. This is very significant in the Egyptian market where the only assurance for repayment is through collateral. Therefore, it is advantageous to any ESCO or Client to have the ability to self-finance a certain amount of energy efficiency projects and to begin generating a cash flow.

The ESCO

In order to install, operate, and generally contract for services, the ESCO needs to know that the Client is in good standing with reliable credit to guarantee their own repayment [7]. That being said, it is in the ESCO's interest to have a shorter payback plan to the bank in order to minimise credit risk and the accruing interest rates. In Egypt, one of the other concerns relates to the currency fluctuations and in the interest of ensuring the rate of exchange on any one currency over time, the shorter the payback period, the better [7]. However, should the Client prefer a long-term payment plan for equipment and services, then as long as they can prove their creditworthiness, this option represents a steady cash flow on the balance sheets for the ESCO and remains an attractive option.

To incentivise the Client to maintain the equipment and use it appropriately, the ESCO may be interested to tie the payback amount to incremental consumption instead of incremental savings as elaborated in the preceding section [13]. This helps protecting the ESCOs investment and ability to pay down their loan, as they are less subject to poor Clients.

The Client

Generally speaking, Clients are looking for a guarantee on performance of the energy efficiency project. Clients with a steady credit line and access to cheap capital may desire a long contract length [14, 15]. This will have to be balanced with any desires by ESCOs or Financiers to decrease loan length due to credit or potential currency fluctuations.

Conclusions

While several Energy Supply Contract models currently exist in Egypt, Energy Service Companies, implementing energy efficiency projects against a share of the realised savings have had limited success in Egypt. However, the contextual circumstances and incentive structures are changing and energy prices are increasing as subsidies are being removed. ESCOs may now allow Egyptian enterprises and organisations to access energy efficiency improvements that otherwise would be unavailable to them due to excessive capital costs and lack of technical expertise within the organisation.

Several constraints have been identified which will need to be overcome if ESCOs are to succeed in Egypt. A negative reputation of ESCOs, difficult access to finance, lack of awareness and incentives for energy efficiency, weak contract enforcement and reluctance to engage in new business models with partners of unknown trustworthiness have been reported. These constraints have varying importance for different actors, but are considered to be potential stoppages to the dissemination of the model in Egypt.

Solutions to overcome these constraints have been proposed, but will likely require

a coordinated effort on behalf of all actors. Most notably, the government and/or international investors could provide more readily available funds; independent third party bodies may alleviate some of the trust, monitoring and enforcement related challenges.

The Shared Savings business model has been suggested to be the most suitable in the Egyptian context because it helps to deal with the financing issues and creates incentives for trust-based business collaboration between the Client and the ESCO. The Guaranteed Savings model was generally deemed less suitable although it may be appropriate in some specific cases where the Client can easily access capital.

Generally, this project has revealed huge opportunities for energy efficiency investments but also a significant doubt about the current viability of ESCOs. It is important to note that the development of ESCO projects needs to be demand-driven and not supply-driven. However, most interviewees welcomed the idea that a pilot project such as the presented case study may demonstrate the strengths of ESCOs and agreed that if successful and communicated, other actors may quickly follow.

Further research should include an investigation of Integrated Energy Management. This approach combines supply of valuable energy and a focus on energy efficiency improvements that may be particularly relevant to Egypt.

There is enormous potential for ESCOs to spread energy efficiency in Egypt; however, the context requires that all those interested in their proliferation must act cautiously in order to ensure their success.

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- [13] Interview with Magd F. Manzalawi, Energy Committee Chairman, Egyptian Businessmen's Association, 2015-4-11
- [14] Interview with Tarek Shams, Assistant Director of Operations, TGM Holdings – Madinaty, 2015-4-14
- [15] Interview with Mohsen Radwan, General Manager of Operations and Maintenance, TGM Holdings – Madinaty, 2015-4-14

List of Additional People Interviewed

Interview with Emad Hassan, Energy Advisor, Ministry of Tourism, 2015-4-7

Interview with Moataz El-Ballat, Project Development, Altawakol for Electrical Industries, 2015-4-8

Interview with Ibrahim Ahmed Eshra, Vice President | Head of Energy and Electromechanical Division, ECG - Engineering Consultants Group, 2015-4-9

Interview with Abdelwahab Aziz Qamar, Energy Specialist, Energy Efficiency Unit - The Egyptian Cabinet: Information and Decision Support Center, 2015-4-9

Interview with Soheir Serageldin, CEO, Badayel Energy Solutions, 2015-4-12

Interview with Mansour Wajih Murad, CEO, Consolidated Energy and Economic Engineering, 2015-4-12

Fostering Eco-Innovation and Green Jobs

Success Factors in the Öresund Region and Implications for Ljubljana

By Joseph Hampson, Florian Proksch, Caroline Westblom and Lucie Zvolška

Introduction

Ljubljana, European Green Capital

Ljubljana, the vibrant capital of Slovenia, is the winner of the European Green Capital Award (EGCA) for 2016. This title, awarded by an independent jury, goes to cities that demonstrate high environmental standards alongside ambitious commitments to sustainable development and the ability to act as a role model for other European cities.

Indeed, Ljubljana with its 280 000 inhabitants has made an impressive shift towards sustainability in the last 15 years.

After years of inner city traffic, the centre is now pedestrianised with cars being phased out. Mobility has been prioritized through the development of a sophisticated public transport system including a bike sharing scheme and cycle lanes.

In addition, three-quarters of the city consists of green spaces, including new parks and Natura 2000 areas, which are protected nature areas in the territory of the EU. Furthermore, the city is committed to improving waste and water waste treatment and is the first European Capital to adopt a zero waste strategy. Moreover, the city has implemented green public procurement (GPP) and makes 70% of all purchases according to GPP criteria [1].

Ljubljana's journey to become a truly green city is all but over. Its sustainable strategy called *Vision 2025* sets ambitious targets and is supported by several plans and strategies such as the Environmental Protection Programme, the Sustainable Energy Action Plan, the Sustainable Mobility Plan and the Electromobility Strategy [2].



Picture 1: Bike sharing scheme in Ljubljana

Our Project

The application for the EGCA includes 12 focus areas that cities are judged on, such as transport, water management and biodiversity. Focus area 10 is *Eco-Innovation and Sustainable Employment* and includes the city's activities to foster innovation in a broad range of areas such as energy and resource efficiency as well as environmental protection. It also encompasses activities to create green jobs, support entrepreneurs and promote the uptake of environ-

mentally sound technologies.

Despite Ljubljana's success so far, focus area 10 has been identified as a field with potential for improvement. Therefore, the objective of this project was to investigate how to better foster eco-innovation and sustainable employment in the city of Ljubljana, with the Municipality of Ljubljana (MoL) as client.

The project is made up of two parts. In the first part, good practices from the Öresund region in southern Scandinavia, including the cities of Malmö, Lund and Copenhagen, have been collected. This was done through a background study, supplemented by interviews with important stakeholders. The Öresund region is one of the most innovative regions in the world [3]. It is also characterised by ambitious environmental policies, which justified our focus. For the second part, data on the situation in Ljubljana was collected, primarily through interviews.



Picture 2: The city of Ljubljana

Whilst in Ljubljana, access to two important stakeholder groups, entrepreneurs and members of municipalities and Ministries, was facilitated through the local NGO *Umanotera*. We presented our findings and facilitated workshops to introduce our lessons learned from the Öresund region. This fed into a discussion on the context in

Ljubljana to see what was being done and what could be improved in terms of MoL's work to stimulate eco-innovation and green jobs. This report also covers energy efficiency and tourism as cases sectors, as our interviewees identified them as areas with high potential to contribute to eco-innovation and green jobs in Ljubljana.

Whilst this report provides best practices from the Öresund region, we acknowledge that the context in Ljubljana is different and that this needs to be taken into account when assessing the transferability of findings or designing policies.

Definitions

The first criterion, eco-innovation, has been defined by the European Commission as “any innovation that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle” [4].

Further, this report touches on green jobs as the environmental aspect of sustainable employment. The following United Nations Environmental Program (UNEP) definition of green jobs is used: “Work in agricultural, manufacturing, research and development, administrative and service activities that contribute(s) substantially to preserving or restoring environmental quality” [5].

Eco-innovation and green jobs are both drivers of green growth, which is defined as “fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies” [6]. These two drivers of green growth are strongly interlinked with other drivers and are results of underlying policies. The next chapter provides a framework for fostering green growth in an urban setting.

Policies and Drivers for Urban Green Growth

Figure 1 shows a schematic overview of policy instruments for and key drivers of urban green growth. It is adapted from a framework put forward by researchers at the London School of Economics [7]. We have used this framework to guide our research process and the key drivers helped us identify which stakeholders to interview in Öresund and Ljubljana.

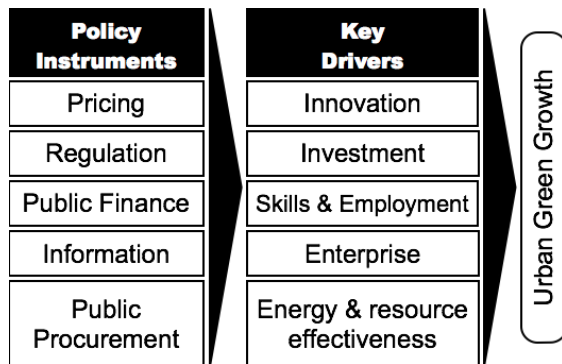


Figure 1: Urban green growth framework (own illustration based on [7])

Policy Instruments

Pricing as an economic policy instrument can be used to put monetary pressure on market actors to change their behaviour in a favourable way. It includes, for example, taxation on carbon emissions and congestion charges for inner city traffic.

Regulation is a powerful instrument to legally mandate compliance with environmentally related standards. Mandatory requirements for energy efficient buildings, transport or environmentally sound waste management are examples of this instrument. Through regulation, innovations can be fostered and demand for energy and resource efficient products can be created.

Public finance can be used to foster inno-

vation and help new technologies become established on the market. Public finance may take the form of investments or subsidies for example in infrastructure projects, like green city districts, or support for R&D in new technologies.

Public procurement and especially green public procurement (GPP) is a way to use the buying power of a public institution to guide the market in a certain direction. It is a tool to create demand for green technologies or products and improves the environmental performance of a public administration, while sending a clear statement regarding the importance of environmental issues to the population.

Information can influence societal behaviour effectively. Raising awareness of environmental problems or promoting good behaviour can be achieved through information campaigns or other measures such as eco-labels.

Key Drivers

Innovation in general and eco-innovation in particular is needed to solve the complex sustainability challenges cities are facing today. Universities, research institutions and enterprises are all sources of innovation and can be supported through several policy measures introduced above.

Investment in new and established businesses is crucial to drive urban green growth. Aside from public investment, foreign direct investment (FDI) is an important source of capital. Attractive conditions for foreign companies, a stable political environment as well as a reliable legal framework are ways to facilitate investment.

Skills & Employment create the foundation for urban green growth. Having an educat-

ed workforce with the right skillset is a prerequisite for success. Education, capacity building programs or favourable working conditions to attract talent are ways to support and retain a skilled workforce.

Enterprises & Entrepreneurship are central sources for innovation and employment. Business incubators or hubs, industry clusters, networking platforms and support for entrepreneurs are ways to make a region attractive for new or established businesses.

Energy and resource effectiveness are central challenges for cities and can be important drivers for innovative technologies and new employment. Addressing key challenges including the reduction of energy consumption or the production of waste have the ability to contribute to urban green growth.

Urban Green Growth in the Öresund Region

Overarching Success Factors

The Öresund region is characterised by a stable political and regulatory environment with a highly educated population. Based on the research conducted in the first part of the project, three overarching success factors for the Öresund region in fostering green urban growth were identified, as shown in figure 2.

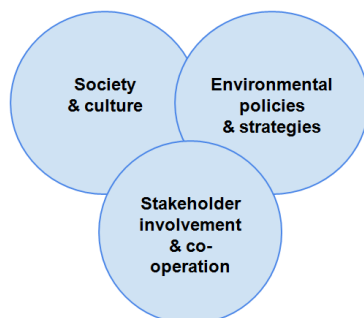


Figure 1: Success factors in the Öresund region

The first success factor relates to *society and culture*. In Scandinavia, environmental issues have been on the political agenda for more than 20 years. In Sweden for example, it is mandatory to include sustainable development in all levels of education. As a result, there is high awareness of social and environmental issues in society and a high legitimacy of environmentalism. There is also a significant demand for green products and services from the population as well as acceptance for environmental taxes: Sweden has the highest carbon tax in the world, EUR 119 per tonne CO₂ compared to the price on the EU Emissions Trading Scheme of around EUR 7 per tonne [8,9]. Such pricing instruments are effectively used to drive eco-innovation, both in Scandinavia in general and in the Öresund region. Öresund is using this to brand itself as a green region, something that attracts foreign investors and sends signals to the market to develop in a greener direction.

The second success factor is related to *stakeholder involvement and cooperation*. Municipalities in the Öresund region see themselves not only as public authorities but as developers of networks and platforms for collaboration between regional stakeholders such as research institutions, businesses and public actors. This leads to municipal projects characterised by multi-stakeholder cooperation, for example public-private partnerships. Great effort is also put into strategic allocation of financial resources, such as the creation of cleantech clusters, business hubs and incubators.

The third success factor encompasses *environmental policies and strategies*. Scandinavia has holistic long-term strategies that include environment issues at national and municipal level. Examples are Sweden's

target for a fossil independent vehicle fleet by 2030 and Copenhagen's goal to become the first carbon neutral capital by 2025.

Stimulating Demand

In the above framework, we identified several policy instruments used at a national or municipal level to create demand for innovative and environmentally beneficial solutions. Below we focus on two aspects of public procurement that our interviewees identified as important; Green Public Procurement (GPP) and Technology Procurement. This section includes examples from Copenhagen and Stockholm. Whilst not in the Öresund region, Stockholm was European Green Capital in 2010 and was thus included in our initial research.

Public authorities such as municipalities can have considerable purchasing power; Copenhagen spends around EUR 1.2 billion per year [10]. As noted above, GPP combines the spending power with an environmental focus. This sends a signal to the market that there is demand for greener solutions, which can stimulate investment in product development. Copenhagen puts this into practice, legislating that 90% of food served in public kitchens will be organic in 2015 [11]. Another way to use procurement to influence the market is through contractual clauses; Stockholm requires waste collection companies to run their vehicles on biodiesel.

Overall, our research found that successful GPP comes from collaboration between municipal departments. Traditionally the procurement department is separate from the environmental department; collaboration between the two can take time to develop but is of utmost importance.

Another aspect of demand creation is technology procurement. This is where public

authorities engage with private business and request a specific, innovative solution that is not yet on the market, leading to the development of new products. Whilst common in the defence sector, this practice has more recently been used to develop new solutions in the energy efficiency sector [12]. The city of Stockholm sponsored a project to develop LED light traffic signals with a longer lifetime that also reduced energy consumption by 85%. This product was then procured by the National Road Agency. As with GPP, collaboration is vital. Technology procurement requires the municipality to have strong internal capabilities. If lacking, that can be a barrier to developing the practice further. Additionally, in technology procurement different stakeholders are involved, particularly from the private sector. Developing relationships with business can be difficult, particularly for inexperienced public actors. However, if managed effectively they can lead to win-win situations and allow for a solution to be developed faster than if left to the market. Technology procurement thus also leads to increased resource efficiency and reduced environmental impact of municipal activities [13].

Developing Supply

Helping develop the supply of innovative solutions, both cleantech and otherwise, has long been high on the agenda in the Öresund region. We have found that a range of funding is available from both public and private actors, helping to encourage business development. Whilst this is important, below we focus on more innovative measures that help to develop supply.

As mentioned above, a driver of success is the co-operation between actors such as universities, municipalities and companies.

This is especially strong in the Öresund region and helps to develop networks and partnerships, bringing access to markets and investors both domestically and abroad. This has led to the region becoming an *Innovation Leader* according to the EU Regional Innovation Scoreboard whilst in 2012 Denmark and Sweden were ranked first and third in the inaugural Global Cleantech Innovation Index [14,7]. Below we present some of the ways that business is supported, as found through interviews.

Organisation	Funding	Key Initiative
CLEAN Copenhagen	Initially City of Copenhagen and EU cohesion funds. Now membership fees	Network development for members, links between municipalities and business and methodology for how to cooperate within tender laws
Future By Lund (FBL)	VINNOVA; Swedish Innovation Agency	Capacity building for entrepreneurs to help them develop solutions for transport, waste management and energy use in a city context
Malmö Cleantech City (MCC)	Municipality	Use city buildings as a testing environment for new energy efficiency technology. Free networking and meeting space
Malmö Sustainable Business Hub (MSBH)	75% Region Skåne, 25% membership fees	Pitch & Match; SBH use their network to find companies that can pitch solutions to the problems of other companies, matching demand with supply

Table 1: Key initiatives from Öresund addressing eco-innovation (based on interview findings)

Rather than a comprehensive overview, these different initiatives represent a snapshot of interesting aspects of the support provided by each organisation. Furthermore, these organisations represent a small sample of the overall support available to entrepreneurs and businesses in the Öresund region. The organisations take different forms and have different target groups. FBL is a platform for sustainable city development, initiated by Lund municipality. It targets entrepreneurs and helps to build capacity for small business. The initiative is linked to the city science park, IDEON, which is a business incubator that provides networking opportunities and access to capital. This support helps new companies move through the initial phases and ultimately make the transition to market.

MCC's Cleantech Testbed initiative helps cleantech companies test their solutions in a live environment through the use of municipal buildings. This benefits the city as they can procure successful technology, whilst also helping business to refine their solutions. In addition, they offer space for meetings, network development and access to export markets. This initiative shows entrepreneurs in the area that the city values cleantech solutions, thus steering the market.

Whilst the former organisations focus on start-ups and developing businesses, CLEAN and MSBH work to support existing cleantech companies. Through the *Pitch & Match* initiative, MSBH helps businesses that want to solve specific cleantech problems to find companies who can develop or provide solutions, thus matching supply and demand. CLEAN is a cluster organisation for stakeholders in the Danish cleantech sector. It boasts over 170

members including 7 municipalities, several universities and numerous medium-to-large enterprises. They allow for meetings on a neutral platform, which is especially helpful for municipalities who wish to have solutions developed whilst remaining within EU tender laws; either for GPP or technology procurement. They have developed a model for the city to engage more actively with companies in the pre-procurement phase, which aims to improve the solutions available for GPP and improve the procurement process.

Urban Green Growth in Ljubljana

Current Status and Future Pathways

Based on the research conducted during the second part of the project, which took place in Ljubljana, we were able to identify some key strengths, weaknesses, opportunities and threats when it comes to fostering eco-innovation and creating green jobs in the city. Strengths and weaknesses were identified both at an administrative level for MoL as well as on a wider city level.

A clear strength of Ljubljana is that MoL already has strong environmental strategies in place, such as the Zero Waste Strategy 2025. The fact that MoL is the only public administration in Slovenia with an EMAS-certified environmental management system is also positive as it paves the way for continuous improvement of environmental work.

A key strength on the citywide level is that the population seems to be environmentally conscious. We found that entrepreneurs are present in the city, putting effort into networking and helping each other develop ideas, for example via the Poligon, a coworking initiative in Ljubljana (picture

3).



Picture 3: Poligon coworking initiative in Ljubljana

This is however linked to one of the key weaknesses, which is that there is a lack of physical space for entrepreneurial activities where projects can be showcased and products tested. An opportunity identified in relation to that is that there are numerous municipal buildings which are currently empty and which could be used for such purposes, as seen in Malmö. That could create a win-win situation for MoL as it helps entrepreneurial activities to develop further. Concentrating entrepreneurial activities around one location in the city could also lead to the development of a creative centre, which might be attractive for the wider population and for tourists.

Our research shows that there is a strong focus on knowledge creation in Ljubljana thanks to the large University and other independent research organisations. Additionally, the city hosts Technology Ljubljana Park (TPL); an organisation that helps companies, mainly small and medium sized enterprises within the region, to develop ideas and bring products to market. TPL is part-owned by MoL, which creates an opportunity to steer the focus in a greener direction. This can also help the city to address its environmental challeng-

es.

An identified weakness, however, is that there seems to be a lack of communication between the different stakeholders involved in technology development. The opportunity here is that the stakeholders, such as the University and the businesses located at the technology park, are willing to collaborate with the MoL if the right conditions are given. MoL could follow the lead of the municipalities in the Öresund region and establish further public-private partnerships, for example through technology procurement.

GPP is already being performed by MoL, which is a clear strength. One example is the procurement of the eco-friendly toilet paper developed by Eco NATURAL Lucart. The paper is produced from recycled Tetra Pak packages, which reduces the need for virgin material for toilet paper production as shown picture 4 [15].



Picture 4: Eco-friendly paper towels by Eco Natural Lucart

One identified weakness however, is that technological knowledge needed to scale up GPP is missing within the municipal administration. This is probably a reason why technology procurement has not yet been considered by MoL or its utility companies. We also found that the criteria for the

product groups included in GPP are outdated (2007). This reduces the potential of GPP to foster eco-innovation in Ljubljana. Overall, we found that developing technical knowledge, better inter-departmental collaboration and links with business would be beneficial for fostering eco-innovation. This was something, which the municipal representative in Malmö highlighted as particularly important for their administration to be able to scale up GPP.

External factors, which can pose threats to the fostering of eco-innovation and green jobs creation in Ljubljana were mostly identified at the state level. The fact that the state is in significant financial debt is currently blocking loan opportunities for companies in Ljubljana. This, in combination with the weaknesses already mentioned above, can lead to a brain-drain of the region as entrepreneurs or young, educated people might leave the region for places with better opportunities. It was also identified that a high level of bureaucracy at the state level is currently preventing FDI, consequently leading to foreign companies investing elsewhere instead of in Ljubljana.

A great opportunity lies in the EU Smart Cities Initiative, which is currently being developed by MoL and the technology park and which encompasses Sustainable Urban Mobility, Integrated Planning, Policy, Regulation and Management, Integrated Infrastructures and Processes across Energy, ICT and Transport [16]. We found that there is potential to develop green jobs and to use a large project like this to strengthen the relationships between municipal and private actors, as seen in the Öresund region.

Case Sector 1: Energy Efficiency

Based on the conducted interviews, we found that there is great potential for energy efficiency refurbishment in the city of Ljubljana, which is why it is highlighted in this report. In Slovenia, 80% of the building stock has poor insulation and would benefit from energy refurbishment measures [17]. Fostering energy refurbishment has the potential to significantly improve the environmental performance of building stock. As seen in the framework introduced earlier, energy and resource effectiveness can be drivers of urban green growth. This can create new jobs in consulting or the construction and retrofitting sector; something that needs development in Ljubljana. It could also facilitate the uptake of innovative technologies.

Interviewees pointed out that while small and medium sized enterprises are more flexible and innovative in providing energy efficiency solutions, they have difficulties in dealing with larger projects through financial limitations especially due to limited access to loans. This leads to smaller projects being completed, whilst deeper renovations, which are more environmentally beneficial but require larger initial investments, not being done. Some suggestions for MoL to support these businesses include the use of public buildings as test spaces to trial and showcase new technologies and ideas, a measure already applied in Malmö. Moreover, developing relationships and networks with existing companies in this sector can help improve GPP practices on a municipal level.

Case Sector 2: Tourism

Tourism was chosen as one of the two case sectors due to its economic importance to Ljubljana and the significant opportunity

to foster urban green growth and the creation of green jobs. The tourism sector contributes 13% to Slovenian GDP and the number of tourists traveling to Ljubljana has more than doubled over the past ten years [18]. Ljubljana is already on the right path to become a green destination, shown by the fact that it is in the top 100 most sustainable destinations in the world [19]. It has recently introduced the European indicators for sustainable destinations (ETIS) and the Global Sustainable Tourism Review (GSTR) to monitor its sustainability performance and provide comparison with other destinations.



Picture 5: Historical centre of Ljubljana

Our research showed that Ljubljana is a great starting point for green tourism activities in the surrounding area such as the coastal town of Piran, the Alpine lakes Bled and Bohinj, or skiing and hiking in the Alps. This expands Ljubljana's possibilities to market green tours and other activities. Although such tours and trips are already offered on the official Ljubljana website, they are currently not being marketed as "green". The tourists, who come to Ljubljana, especially in 2016 when the city is the European Green Capital, will expect a truly green destination, offering a variety of green accommodation, activities and food. The Green Capital Award therefore offers a

great opportunity to green the tourism industry.



Picture 6: The Alps as seen from Ljubljana

We see an opportunity to further green the tourism sector if local businesses implement ecolabels, certificates and standards. These could be adopted for example by accommodation facilities, restaurants and activities. Depending on the specific label, the above measures will result in the installation of green technologies, improved energy and water efficiency, green education of employees and local sourcing of goods. Increased demand for green solutions could thus also develop green jobs in other sectors.

There are great opportunities to showcase green tourism in Ljubljana, for example through leaflets, information boards, the tourism office or social networking. Such promotion would allow MoL along with the local businesses to communicate to the tourists, as well as to locals, what they have achieved and what green products and services are available in the city.

Conclusion

This report has given insights on how to advance urban green growth in Ljubljana through looking at success factors in the front runner region of Öresund in Scandi-

navia.

While acknowledging that the local context is important when designing policies, similarities between these two regions can be identified. Both are characterised by small, environmentally conscious populations and a strong focus on knowledge creation. Whilst the Öresund region made the transition towards sustainability earlier than Ljubljana, both regions now have stringent and ambitious policies for environmental performance in place.

Lessons learned from the Öresund region, such as supporting eco-innovation through strategic allocation of resources and multi-stakeholder cooperation, could therefore be transferred to Ljubljana as MoL now moves forward on their way to sustainability; as the Green Capital of Europe in 2016 and beyond.

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List of people interviewed

Casper Harboe, Programme Manager for Copenhagen Green Capital, Sharing Copenhagen, 13/03/2015

Steven Curtis, Entrepreneur and Co-founder, Luv Solar, 14/03/2015

Linda Persson, Project Manager for Stockholm Green Capital, City of Stockholm, 23/03/2015

Dagmar Gormsen, Project Manager for Future by Lund, Lund Municipality, 24/03/2015

Anne-Marie Martel, Policy Officer, Nantes Eco-Innovation Factory, 27/03/2015

Annika Kruise, Environmental Strategist, City of Malmö, 08/04/2015

Per Flink, Project Director, Sustainable Business Hub, 08/04/2015

Jakob Economou, Project Manager, Malmö Clean Tech City, 08/04/2015

Renata Karba, Project Manager, Umanotera, 10/04/2015

Vida Ogorolec, Director, Umanotera, 10/04/2015

Jana Apih, Senior Consultant, Good Place, 13/04/2015

Luka Piškorič, Co-founder, Slovenia Coworking Initiative, 13/04/2015

Jure Vetecjek, Researcher, Institute for Innovation and Development of University of Ljubljana, 13/04/2015

Polona Lah, Project Developer, Energy Efficiency Center at Jozef Stefan institute, 15/04/2015

Iztok Lesjak, General Manager, Technology Park Ljubljana, 15/04/2015

Dr. Alexander Keseljovic, Associate Professor, University of Ljubljana, 15/04/2015

Antonija Božič Cerar, Independent Advisor, Chamber of Commerce, 16/04/2015

Alenka Burja, consultant and project leader on GPP, 16/04/2015

Setting Sail for Beyond Compliance

Opportunities and lessons learnt from APM Terminals Pipavav

By Kelly Dorkenoo, Ronja Lidenhammar, Markus Scheffel, Haiping Shen, Mats Tedenvall

Background

The port of Pipavav is a gateway port located in the state of Gujarat, India. It is operated by APM Terminals, one of the largest container terminal operators in the world and part of the A.P. Moller-Maersk Group.

The port has a strategic location with high connectivity to India's rich hinterland and access to shipping lines through international routes.



Figure 1 Location of port Pipavav in Gujarat, India.

Currently, it is the fastest growing port in India and expansion projects are being undertaken on an ongoing basis.

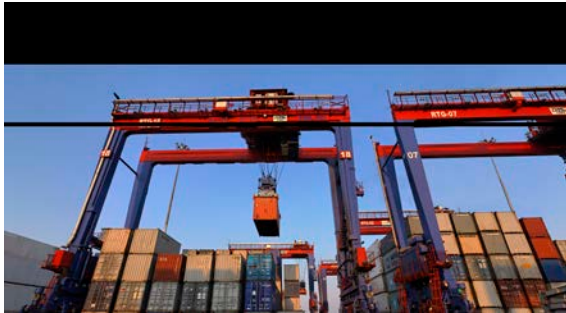


Picture 1 Port of Pipavav from Post-Panamax crane

Furthermore, in contrast to the majority of ports around the world, its location does not impose expansion constraints or other landside bottlenecks as it is not placed in proximity to urban areas. Instead, the port is surrounded by mangroves, wetlands (coastal floodplains) and a rich animal life. It is situated approximately 100 km from *Gir* national park, famous for the endangered Asiatic lion.

The port of Pipavav has a modern infrastructure that can accommodate multi-cargo and multi-user operations. This has been enabled through continuous investments by APM Terminals. Unlike port Pipavav which is privately run, the majority of Indian ports are government owned. The majority of Indian ports are located in the cities causing major challenges in enhancing the port capacities and the overall infrastructure [1]. Today, port Pipavav handles containers (850 000 twenty-foot

equivalent units per annum), bulk cargo with a majority consisting of coal and fertilizer (annual capacity approx. 5 million tonnes) as well as liquid cargo (annual capacity approx. 2 million tonnes).



Picture 2 Container handling in Port of Pipavav

By invitation of the APM Terminals HSSE Manager Asia Portfolios, the IIIIEE team was given the task of supporting further development of environmental work in the port.

Prior to our departure, we spent three weeks preparing for and improving our understanding of the current situation. This included study visits to three Swedish ports as well as interviews with industry professionals. We then took off for a week-long study visit to APM Terminals Pipavav.

As we were being picked-up by company cars at the Bhavnagar airport, we immediately noticed the safety instructions in the car. The ride from the airport to the port was calm and pleasant which contrasted with the hectic rhythm we observed looking out the windows. We later learned that all this was due to the company's ambitious safety programme.

On-site observations and interviews provided significant new information for us. In some cases assumptions were confirmed, but as often is the case, the reality looked different from what the background research had suggested. These observations

made a large impact on the project direction and it became clear that our project should recommend improvements in creating a culture of awareness, systematic thinking as well as shared value (figure 2).

The findings and the stemming recommendations were presented to the management team including the APM Terminals Pipavav HSSE manager and the Chief Operational Officer as well as the APM Terminals Asia-Pacific HSSE manager.

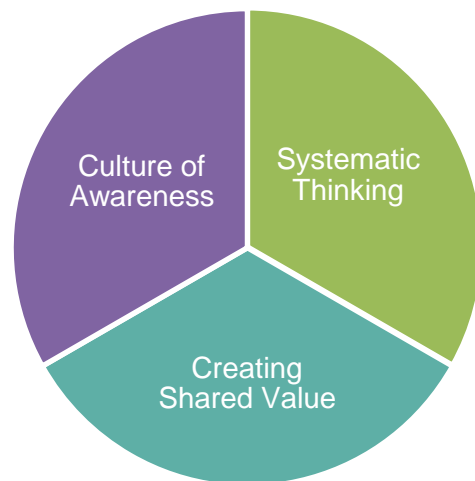


Figure 2 Categories for improvement

This brief presents the resulting recommendations given to APM Terminals Pipavav to advance environmental performance to levels beyond compliance.

Current Situation

APM Terminals Pipavav has made eco-investments for safer industrial processes and cleaner port operations during the last five years resulting in energy savings, reduced costs and a reduced carbon footprint. Initiatives include: electric connections for tugs (boats that facilitate vessel entry and positioning in the port) that are installed on-shore and used for charging during idle time; installation of solar-powered lighting systems in various loca-

tions around the port and installation of ECO RTG and electricity powered Rail Mounted Gantry Cranes. A system for reducing water use by harvesting rainwater mounting to 15 million litres/year has also been installed.



Picture 3 Water reservoir

Although these initiatives are positive from an environmental perspective, it was found that environmental management in APM Terminals Pipavav has largely focused on reaching full compliance with environmental regulations. Environmental inspectors visit the port regularly and provide binding directions for improvements. Currently the authorities conduct much of the monitoring and priority setting for environmental improvements. This reactive approach, taken by port management, is illustrated in the figure below. It is expected to have led to lower efficiency due to time consumed maintaining high flexibility in order to respond to the new unannounced directives from the authorities, leaving less time to spend on developing a roadmap for future improvement.

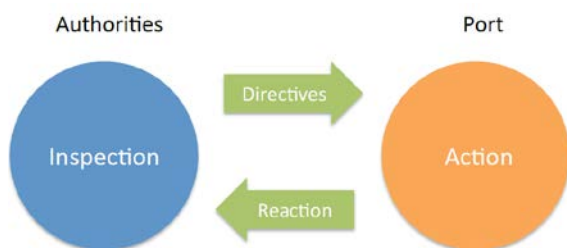


Figure 3 Reactive approach

Taking the next steps

A more proactive way of working could entail a structured management system where the port sets an ambitious agenda for continuous improvement. The figure below shows the fundamental parts of an Environmental Management System (EMS).



Figure 4 Fundamental activities in an EMS [2].

By introducing a system for structured improvements, environmental management will become easier and allow for higher levels of compliance. By introducing an EMS, the port would also prepare for an ISO 14001 certification if that should become of interest in the future.

Drivers for beyond compliance

Ports evolve in a rather competitive market where cost sensitivity of clients (shipping lines) often leads to only a minimum level of environmental management aiming mainly at achieving regulatory compliance. However, pressure to go beyond minimum requirements and set targets that are higher can originate from diverse stakeholders. They are not necessarily located in the vicinity of the port itself and are often posi-

tioned on a more global scale. Currently air quality, energy consumption, dust emissions and water quality constitute some of the main environmental priorities within the port industry [3]. Drivers for advancing environmental management towards beyond compliance for APM Terminals Pipavav entail cost reduction, brand and reputational improvements, stakeholder pressure as well as future legislation changes.

Increased public and community pressure is being put on port operations. More stringent legislation is expected to decrease environmental impacts and call for ports to move towards a more proactive approach to environmental management. This is particularly true in the case of APM Terminals Pipavav. The Indian regulatory context appears rather challenging with national policy rapidly evolving towards higher stringency [4]. By adopting a proactive approach that aims at performing beyond what is legally required, APM Terminals Pipavav would improve its licence to grow, be prepared for upcoming regulations or even set the pace within the industry by both positioning itself as an example for other actors as well as raising the bar for new policies. In parallel, this would reduce costs and workload associated with achieving compliance.

Alongside lower costs, port reputation and image benefits could be outcomes of environmental and social responsibility. Becoming more attractive to new talent is a further expected outcome due to the growing willingness of the younger generations in India to work for companies with strong values [4]. Similarly, there is an increasing interest among investors to invest in socially responsible companies [5].

Finally, moving towards a beyond compliance strategy is also a question of securing future business for APM Terminals Pipavav and ports in general; it was found that international companies (e.g. Toyota and Tetra Pak) have started to set environmental requirements (such as having an Environmental Management System (EMS) in place) as prerequisites in setting up contracts with certain ports [6]. On a more global scale, it becomes evident that, without mitigation efforts, increased resource scarcity and pollution would ultimately severely impact and jeopardise ports operations and business success.



Picture 4 Skilled workforce in action

Culture of awareness

Aligned with taking a proactive approach to environmental management is ensuring environmental awareness and values among employees. For a proactive mindset to be secured, a pervasive organisational philosophy should be maintained [7]. Employees often have unique knowledge of the business which can support progressive environmental management within the company and should not be underestimated.

Vision

Without a clear vision of the environmental and social ambition of the company, alignment of organisational efforts risk becoming a struggle. A recommendation giv-

en to APM Terminals Pipavav was therefore to formulate and anchor a vision that expresses how the company wants to be portrayed in order to facilitate motivation and environmental efforts within the company. It was further recommended that the creation of a vision can be facilitated if it is combined with setting targets and objectives.

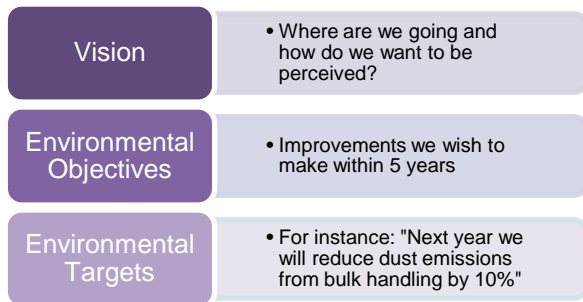


Figure 5 Illustration of vision, objectives and targets

The vision and targets should be communicated to the workforce, both on an operational and managerial level, so that employees are aware of the targets and their role in working towards them. Research shows that commitment to reaching targets has been identified as an important motivational influence on employee behaviour [8]. It was also recommended that procedures for periodic updates of the vision, objectives and targets should be included in the systematic environmental management procedures previously mentioned, in order to ensure continuous improvement and maintenance of proactive thinking within the company.

Internal communication

Building on the vision-developing process, the creation of a culture of awareness with regard to the environment will also require strengthened communication. Effective internal communication is an essential component of organisational success; it can

help in developing a certain level of understanding in the workforce along with a sense of belonging and commitment [9]. Therefore, internal communication has been identified as a crucial element for APM Terminals Pipavav. Based on that finding a number of recommendations were provided.

Systematic inclusion of updates in newsletters and meetings regarding environmental initiatives should be used in order to maintain a level of awareness and a sense of achievement regarding the environmental work undertaken.

Another recommendation provided was to include an environmental component in employee trainings; both for newly hired and existing workforce. Similarly, it was suggested to integrate such a component in the already existing mandatory safety induction that all external persons wanting to access the port area have to undertake before entry.



Figure 6 Strengthening internal communication

Finally, the use of signs within the port premises has been suggested in order to show simple actions identified as beneficial for the environment that employees and their families could do on a day-to-day ba-

sis. For example, reminders or educational signs such as: “Help the climate. Help to reduce our electricity consumption, switch the lights off when you leave the room” or “Did you know that mangroves are excellent carbon sinks? A carbon sink is...”.

Overall, strengthened internal communication pertaining to environmental management can facilitate continuous capacity building among the employees and in turn ensure facilitated implementation of new environmental measures.

Systematic approach

Managing employee safety is critical for ports due to the risk of heavy falling objects when lifting containers, the large amount of traffic, sources of stored energy in machinery and equipment, as well as, any work being done at great height. The same applies for APM Terminals global which has an ambitious action plan for minimising risk and has made safety the way it does business. It became apparent that safety thinking and procedures have been successfully integrated into all levels and areas of the port and that safety instruction given by the management are being followed. In comparison to other ports in India, APM Terminals Pipavav has developed into a frontrunner in safety and won the Maritime and Logistics Award Port Operator of the year for maintaining highest standards of Health, Safety and Quality in 2013 [4]. The systematic work in improving port safety has followed the hierarchy of control and both guided and facilitated systematic elimination of accident risk throughout port operations.

The controls to eliminate safety risks are ordered from the most to least effective measure with the goal of completely eliminating accident risk if possible. If no feasi-

ble solution for elimination of risk can be found, continued investigation is to be conducted with the aim of finding feasible solutions or substitutions. In the hierarchy of control, the least effective and least desired solution is protection against the risk which in this case entails providing Personal Protection Equipment (PPE) (for instance gloves, helmets, glasses and safety footwear).

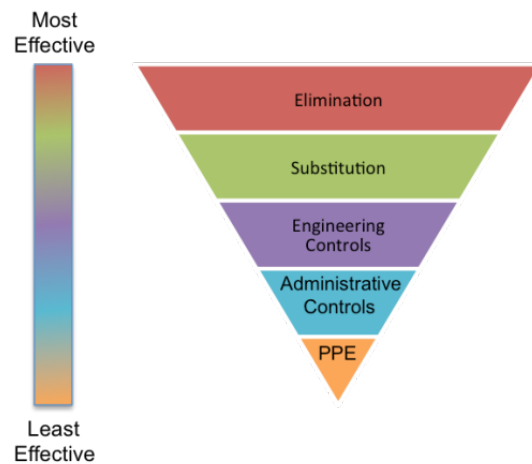


Figure 7 Hierarchy of control [10]

Imitating successful internal procedures from different operational strategies for managing environmental issues can turn out to be beneficial for companies as legitimacy issues can be decreased due to the previous institutionalisation of the strategy or procedure. Hence, one of the recommendations given to APM Terminals Pipavav was to explore the feasibility of using the hierarchy of control – which has been successful and deeply institutionalised into operational practices – also for environmental management purposes. The underlying reason being that although APM Terminals Pipavav has taken measures for improving environmental impacts, no systematic approach for continuous improvement has yet been implemented into operational procedures. Fur-

thermore, as with safety, where elimination of risk is the most desired outcome, the elimination of the root cause is always preferred before end-of-pipe solutions when optimising environmental performance. Utilising the hierarchy of control in regards to the management of emissions from machinery and trucks, dust emissions from bulk handling, run-off water, spills and other operational struggles was perceived as an efficient solution for APM Terminals Pipavav. This since they all require systematic procedures for continuous proactive management in order to achieve beyond compliance. However, the model is found to be suitable for all environmental issues within the port including waste management (due to similarities with the waste hierarchy model where prevention is the most desired outcome and disposal the least desired outcome), energy efficiency improvements, handling impacts on local communities, etc.

Applied systematic thinking

Pollution prevention, whether it involves reducing waste, using fewer resources, decreasing energy consumption or emitting substances below legal limits, often result in both lower costs and resource use in the long term. Opportunities for improved efficiency can sometimes be found as *low-hanging fruits* which entail minor retrofits and automation; alternatively, they may entail larger investments or re-structuring. However, what they have in common is the facilitated identification of opportunities through systematic procedures for evaluating current practices and techniques.

The identified areas for improved eco-efficiency were: marine and soil pollution from runoff water and berth spills, as well as dust emissions from the intermediate

storage area for dry bulk materials (fertiliser, coal and limestone).



Picture 5 Conveyor belt to coal yard

Leaching and run-off from storm water can have negative environmental impacts on the ground surface, groundwater, sea and other water bodies. APM Terminals Pipavav has invested in curtains that are placed between a vessel and the berth during loading and debarking procedures. An automatic conveyor belt has also been installed which transports coal from the berth to the designated coal yard in order to decrease spills and potential leaching during transpiration. In regards to dust, APM Terminals Pipavav possesses a storage area for urea, coal and limestone where dry bulk materials are stored. The preventative measures to reduce dust emissions that have been implemented include a sprinkling system (for the coal yard), dust curtains, ventilation systems in covered storage areas as well as green belt plantations of specific dust resistant species.

It is important for ports to ensure that the infrastructure for minimisation of pollution is put in place. However, when this is not the case, other measures need to be taken. One recommendation made to APM Terminals Pipavav was to use the hierarchy of control in order to manage these environmental impact categories and to ap-

proach what information should be gathered in order to get a holistic view of potential issues. By investigating and implementing procedures for identifying where, why and how much spills/emissions occur, a systematic approach evolves that facilitates improvement strategies and approaches to how these spills/emissions should be handled.

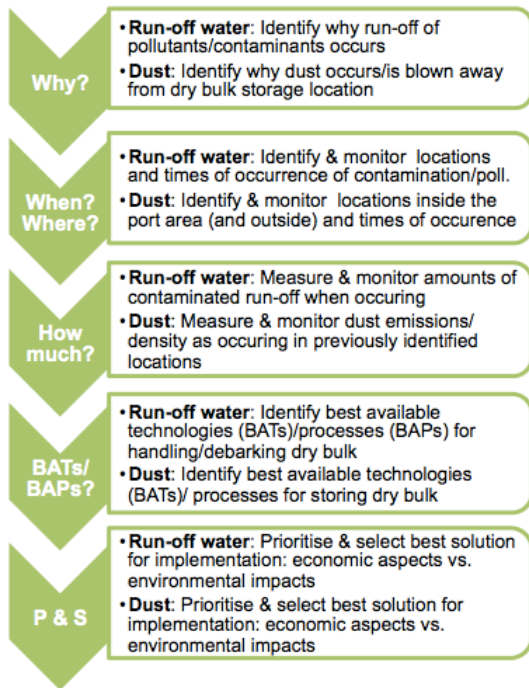


Figure 8 Applying the Systematic Thinking approach to run-off water and dust problematics in the port of Pipavav.

Co-existing with nature

The port of Pipavav is unique in its location, 100 km from the Gir National Park which is a natural habitat for Asiatic lions, Indian leopards, Indian mongoose, jungle cats, sarus crane, flamingos and other species [11]. Due to good conditions and care-taking, the numbers of the lions living in the national park have been increasing [12]. While this is good news for nature conservationists, it has the side-effect of the park not being able to accommodate

the rising number of lions. This causes them to leave the park in order to follow their prey (such as the Nilgai) outside Gir [13]. Today, lions are regularly found in proximity to port Pipavav.



Picture 6 Left: Female Nilgai. Right: Asiatic lions

Hence, wildlife risks being injured as they approach the Pipavav port area which not only is a tragic event but could also attract negative media attention.

The recommendation given to APM Terminals Pipavav included applying systematic thinking in managing wildlife approaching the port as well as ensuring a mind-set of building and coexisting with nature rather than trying to fence off surrounding habitats. Introducing *Building with Nature* concepts can be value adding during this period of port expansion and growth [14]. Hence, the investigation should primarily focus on how the risk could be eliminated and if no solution can be found, evaluate and prioritise solutions to a satisfactory degree. In addition, it may sometimes be beneficial to identify solutions that could be used outside of the port premises.

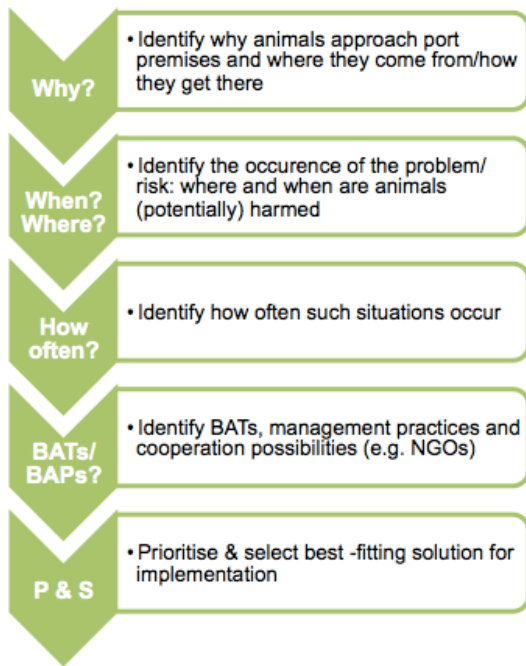


Figure 9 Applying systematic thinking on biodiversity

Another unique feature of APM Terminals Pipavav is the mangrove forest located within the port area. Its protection is achieved through common efforts from APM Terminals Pipavav and the local authorities. The mangroves which originally covered 60 ha, have expanded to reach 83 ha today. Mangroves as complex ecosystems perform a number of essential environmental services that are beneficial to the port such as water filtration, flood control and carbon sequestration [15].



Picture 7 Mangrove forest within port Pipavav

In addition to those services, it was found that the mangrove forest could contribute greatly to improve the living environment of employees in the port by providing valuable recreational services. For instance, the water pond (which serves as a drinking spot for a number of animals) and trails found in one part of the mangrove forest could be used as a sitting and walking area used for bird watching or educational purposes. Such an initiative would apart from allowing for a better living environment for the local workforce, contribute to improve community relations by ensuring the maintenance of the mangroves, as well as, implementing innovative solutions that protect the wildlife, while at the same time reducing the business risk for APM Terminals Pipavav.

Creating shared value

APM Terminals Pipavav has been active in supporting the local community and initiatives include: engaging in construction and renovation of local schools, as well as, distribution of basic schools supplies. In collaboration with the local government, the company has also been involved in promoting girls education within the local community. Shiyal bet Island, which is situated outside of Pipavav port has been equipped with solar-powered lights. The company also operates an on-site medical centre that, apart from port employees and their families, also serves all the nearby villagers with free medical assistance.

Building on initiatives that APM Terminals Pipavav has taken towards building a close relationship with the local community, additional education/partnership activities

Initiatives	How?	Target Group
College/University Sustainability Education Funding	1. Provide financial support for students 2. Mandatory environmental courses to complete; 3. Contracting with students for employment after graduation	Local young people with excellent high school performance but have financial concerns for university education
Environmental Scholarship for High School Students	Collaborating with local high school to provide financial incentives for teenagers to participate and perform better in environmental courses	Local high school students having distinctive performance in environmental courses
Offer internship positions at HSSE Department	Building partnerships with local universities/research institutes Offering internship positions researching topic based on needs of APM Terminals Pipavav	University students or young researchers with expertise in certain environmental area such as biodiversity study

Table 1 Initiatives for education and partnerships

presented in the table above were proposed to link its social activities with environmental endeavours. The underlying reasons for these suggestions are not only to strengthen relationships with the local community but also ensure future recruitment of talented and skilled personnel. The latter could become a challenge due to the remote location of port Pipavav, and the regulatory requirement of sourcing 85% of the work force from the state of Gujarat, a state of generally low educational levels [4]. The identified reputational benefits that the initiatives in the table below could bring to APM Terminals Pipavav are manifold. Not only could the provision of environmental scholarships for high school students and funding for sustainability education lead to higher capacities among future potential employees but also attract and secure future talent. Engaging in these activities could also lead to an improved image for APM Terminals Pipavav as well as a spread effect of environmental education in the local community. Additionally, by offering internship positions at the APM Terminals Pipavav HSSE department, external expertise could be brought in to advance

environmental knowledge sharing as well as building capacity among current employees.

Conclusions

APM Terminals, along with ports in general, will be facing a number of challenges to remain competitive in a cost-sensitive market, where increased attention and pressure from the local, national, as well as international community on environmental management is being put on corporate actors. Business growth without due regard for the environment is expected to become increasingly difficult. The trend points towards higher resource scarcity with price volatility. As a result, more stringent regulations will be integrated into national and international policymaking and communities will increasingly put pressure on their corporate neighbours. In order for ports to be better equipped for future challenges, it is recommended to advance environmental efforts to levels beyond compliance.

The main recommendations provided to APM Terminals Pipavav, presented in this brief, may benefit the company as well as inspire other ports around the world to

improve their social performance and environmental footprint.

This brief has highlighted the importance for ports to implement systematic thinking into all processes, establish an internal culture of awareness, as well as, create shared value with stakeholders in order to ensure successful environmental and social management.

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List of additional interviewees

Mr. Capt. Christian Schell, Head of HSSE, APM Terminals Gothenburg AB, March 16, 2015.

Mr. Christer Nilsson, Environmental Officer, Port of Helsingborg AB, March 24, 2015.

Mr. Wouter de Gier, Head of HSSE – Asia Pacific Portfolios. APM Terminals Management (Singapore), April 14, 2015.

Ms. Dharati Acharya, Senior Manager – Environment, APM Terminals Pipavav (India), April 10, 2015.

Mr. Deepak Mahamunkar, General Manager (Administration), APM Terminals Pipavav (India)

Energizing Zabrze

From Ideas to Action in Energy Planning in Nowe Miasto

By Danica Caganic, Moa Forstorp, Paula Makuch, Per Wretlind, Sandro Benz

Introducing Zabrze

The City of Zabrze aims to step up its game and start competing to attract investments, businesses and people. Zabrze, situated in southern Poland, experiences the negative sides of what is often called *structural economic changes*. The decline of large-scale industry has left Zabrze with shrinking job opportunities, a declining population and sense of being excluded from progress. The municipality has a plan to counter this wherein the construction of a new residential and commercial city district called Nowe Miasto has a central role.

Zabrze, a city of over 170 000 inhabitants, is located in the middle of the Upper Silesian Metropolitan area consisting of 14 cities and more than 2 million inhabitants. The region has a long history of coal mining and still holds a large share of Poland's hard coal and lignite resources. Apart from the mining industry, the region has, among others, a medical, biomedical, chemical and automotive industry. Zabrze has a vision of contributing to sustainable development in the economic, social, environmental and spatial context. With the plans for a new city district, Nowe Miasto, Zabrze has an opportunity to advance sustainable urban development and generate synergies for the region. The plans for Nowe Miasto are, as of 2015, on a conceptual stage and the municipality is on the hunt for developers. The district is planned to be located on 250 hectares of agricultural land, 7 km

north of the city centre. The location will connect two spatially separate residential areas, and a developing special economic zone where investors are exempted from certain taxes and receive more favourable conditions.

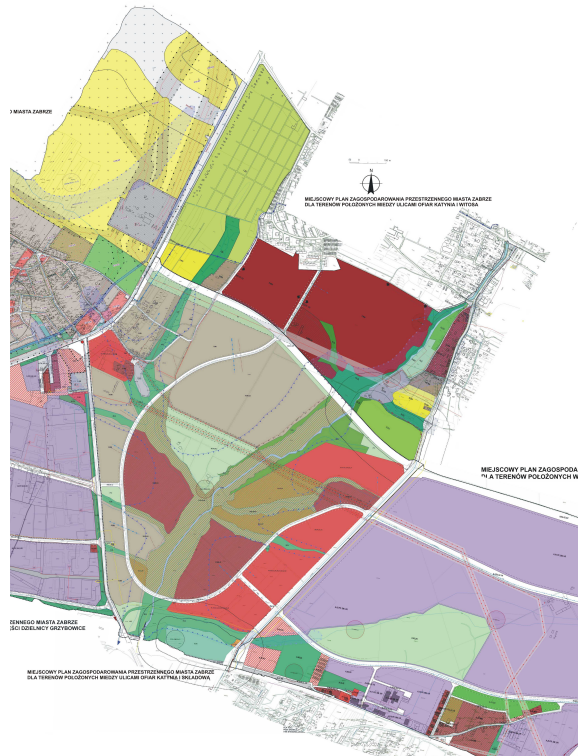


Figure 1 - The existing plan for Nowe Miasto. The red represents commercial areas, purple for industry and brown greyish colour represents residential areas.

As a part of the collaboration between the twin cities of Zabrze and Lund, the Swedish-Polish Energy Platform, and the International Institute for Industrial Environmental Economics (IIIEE), our group was invited by Mayor Małgorzata Mańka-

Szulik to give input to the energy planning of Nowe Miasto. In 2014, the SED student group from IIIIEE gave advice on the overall sustainability aspects of the



Picture 1 - Malgorzata Mańka-Szulik, the Mayor of Zabrze, during the presentation of our findings.

Nowe Miasto project in the report “Smart Zabrze – Building on a Mine of Opportunities”. The report introduced the framework of value-based planning and a number of smart solutions in the area of energy, transportation, building design, water and waste for Nowe Miasto. The main recommendations of the report were to:

1. preserve and enhance the areas value: create a green network;
2. become the region’s sustainability fore-runner: build a smart pilot community;
3. build on existing potential: foster transition to sustainability in the old city.

As stated, the task for the IIIIEE team in 2015 was to give input on the energy planning of Nowe Miasto. After informative and fruitful meetings with experts in energy planning of new city districts in Helsingborg, Lund and Malmö in Sweden, and key stakeholders in Zabrze, the main recommendations of the report revolve around *the process of energy planning*. The reason for this focus is that the technical solutions are numerous and often available, but to make it happen leader-

ship, vision, collaboration between key stakeholders and a long-term perspective need to be in place. To build on the mine of opportunities, we hope that our input can energize the process of making Nowe Miasto a reality.

The report will unfold as follows. First, the rationale of why this project happens now is presented. Later follows a description of what has been done during the project, whereupon our main recommendations are presented. The report concludes with a future outlook for the project in Zabrze and points to potential spin-off effects it can have on the city and region as a whole.

Background to our project

There are many drivers both pushing and pulling sustainable urban development in Poland. Push factors are drivers that Zabrze has to implement, such as EU Directives or national regulations. Pull factors are drivers that represent an opportunity for Zabrze to pursue sustainable development. We have identified six drivers that are presented below.

Push factors

- Upcoming EU regulations

Pull factors

- First mover advantage of becoming a green showcase
- Numerous funding options available
- Opportunity of learning from the mistakes of others
- Opportunity of improving the local air quality
- Fostering economic development

Upcoming EU regulations

There are several significant regulations that will come into force shortly and thus

push Zabrze to implement and fulfil them. According to the 2010 European Energy Performance of Buildings Directive (Directive 2010/31), all new buildings must be nearly zero energy buildings by the close of 2020; public buildings need to be so by 2018 [1]. Other EU legislation that will influence the energy system in Poland are the EU Air Quality Directive (2008/50/EC) which regulates the maximum levels of air pollution allowed [2], and the European Emissions Trading Scheme where the share of auctioning of emissions allowances will increase, which is expected to influence the price of carbon emissions. But regulations can also act as pull factors, as in the case with the Renewable Act in Poland adopted in February 2015, favouring small-scale private generation of electricity and introducing feed-in tariffs [3].



Picture 2 – The air quality is adversely affected by the burning of coal that is often used for heating purposes in Zabrze.

First-mover advantage of becoming a green showcase

Turning to pull factors, an important factor

is that if Zabrze wishes to utilize the construction of Nowe Miasto as a means to attract investors and people, the city should grasp this opportunity of first-mover advantage. In a Polish context, Nowe Miasto is a unique example of a city district that aims to be environmentally sustainable. But if it becomes just one of many, the uniqueness factor disappears. Hence time is short.

Numerous funding options available

There are considerable funding opportunities for this type of development available at the moment. During the period of 2014-2020, Poland is the largest recipient of funds from the European Structural and Investment Funds and will receive EUR 77.6 billion. Two prioritised areas are projects promoting a shift to a low-carbon economy and those promoting sustainable transport [4]. Nowe Miasto fits squarely within these objectives.

Opportunity of learning from the mistakes of others

Zabrze has a great opportunity as it can learn from the previous mistakes that other cities have done when constructing districts with similar objectives. The case studies we did in Sweden point to this and if Zabrze takes these lessons to heart, it can leapfrog ahead.

Opportunity of improving the local air quality

Improving local air quality can also be considered as a pull factor. According to the NGO Health and Environment Alliance, the annual health costs caused by coal pollution in Poland is estimated to EUR 8.2 billion. Initiatives for more sustainable energy management can contribute to better air quality in the city, which decreases

health costs as less people become ill [5]. Better air quality also increases the attractiveness of the city for potential residents.

Fostering economic development

Another pull factor is the need of economic development in the area to turn the trend of a decreasing population [6]. Zabrze has experienced a steadily declining population during the last decades, which places an increasing strain on the city's finances, as fewer inhabitants have to maintain the existing infrastructure and services. The building of a new city district could, together with other measures, kick-start economic development and reverse the trend [7].

Our Journey to Zabrze

As mentioned above, we made three study visits before going to Zabrze to learn about the H+ area in Helsingborg, Brunnsög in Lund, and Hyllie in Malmö. We also studied the case of Västra Hamnen in Malmö as several of the experts had previously worked on the project. There is much to learn from the energy planning process of these projects – in general and for Zabrze in particular. Lessons include innovative and ambitious technical solutions such as the smart grids that are developed by E.ON in collaboration with the City of Malmö in Hyllie [8]; the utilization of waste heat in Brunnsög that is developed between local utility company Krafringen and the City of Lund and the world-leading research facilities Max IV and the European Spallation Source (ESS) [9]; as well as the energy solutions in Västra Hamnen in Malmö based on 100% locally produced renewable heat and electricity [10]. Moreover, there are lessons regarding organisational aspects of how stakeholders have collaborated in the energy planning process, which have ad-

vanced these innovative solutions and are relevant for Zabrze.

These insightful examples were coupled with considerable review of research of energy planning and sustainable urban development processes. With this knowledge in our backpack, we travelled to Zabrze for an intensive week. It included meetings with numerous officials within the municipality, including the deputy mayor, heads of the urban planning office and the investors' issues office respectively. We also met with external stakeholders such as the electricity supplier and the company owning the district-heating network. These meetings provided us with a good idea of where Zabrze was in the process of planning Nowe Miasto, as well as how the different stakeholders perceived their role within it. This was coupled with two meetings in Warsaw. We met with a representative of the Swedish Embassy, as the Embassy takes part in the Swedish-Polish Energy Platform, and representatives of the Ministry of Infrastructure and Development. These offered a broader outlook of the situation in Poland and placed Nowe Miasto in a national context, and as well informed us about the ambitions and plans that the national government has with their new National Urban Policy. Lastly, we compiled a client report, of which this text is a short summary.

Key Recommendations

Zabrze finds itself in an excellent place to speed up the process of constructing Nowe Miasto and kick-start a dynamic sustainable development of the city, the region and Poland. Based on the numerous meetings and our research, we here present three main recommendations for Zabrze to consider given where the city is today.

Establish a Clear Vision

Our first recommendation for Zabrze is to establish a clear vision for Nowe Miasto. Seeds of one already exist as several of the representatives of the municipality referred to plans and expressed their own visions regarding the district. It has not, crucially, been discussed with a wider audience nor has it been written down, rendering the vision unclear. It might result in that different internal stakeholders strive to achieve different objectives. The process of vision formulation would engage internal stakeholders within the municipality, draw on their competence to improve the vision and ensure that all are on the same page.

In addition, several of our interviewees pointed out that while the municipality has plans, they are flexible should there come an interested developer. It is understandable that Zabrze wish to be flexible towards potential developers, but if Zabrze does not have a clear vision and idea of what it want to achieve, there is a high risk of it disappearing in the discussions with potential developers. For those working with construction in general and sustainable urban development, it comes as no surprise to hear that developers are often reluctant to try new innovative ideas [11]. This is understandable from their vantage point, but Zabrze must both dare to be steadfast in their ambitions, and know what they are.

Follow the Energy Planning Process

Once a vision is established, our recommendation is for Zabrze to follow an energy process plan of how to implement an energy system. It is a complicated process that involves numerous actors, new technology, changing behaviour as well as economic risks. We suggest Zabrze to follow a framework that United Nation Environ-

mental Programme has developed as it systematically and stepwise provides guidance of what to consider. The framework is briefly explained in Box 1. It also prompts the municipality to initiate partnerships with key stakeholders, something that seen as crucial for success in the Swedish examples. Zabrze has a good starting point here too, especially in relation to heating as the municipality own the company controlling the district heating network.

Attract Attention from Investors and Potential Citizens

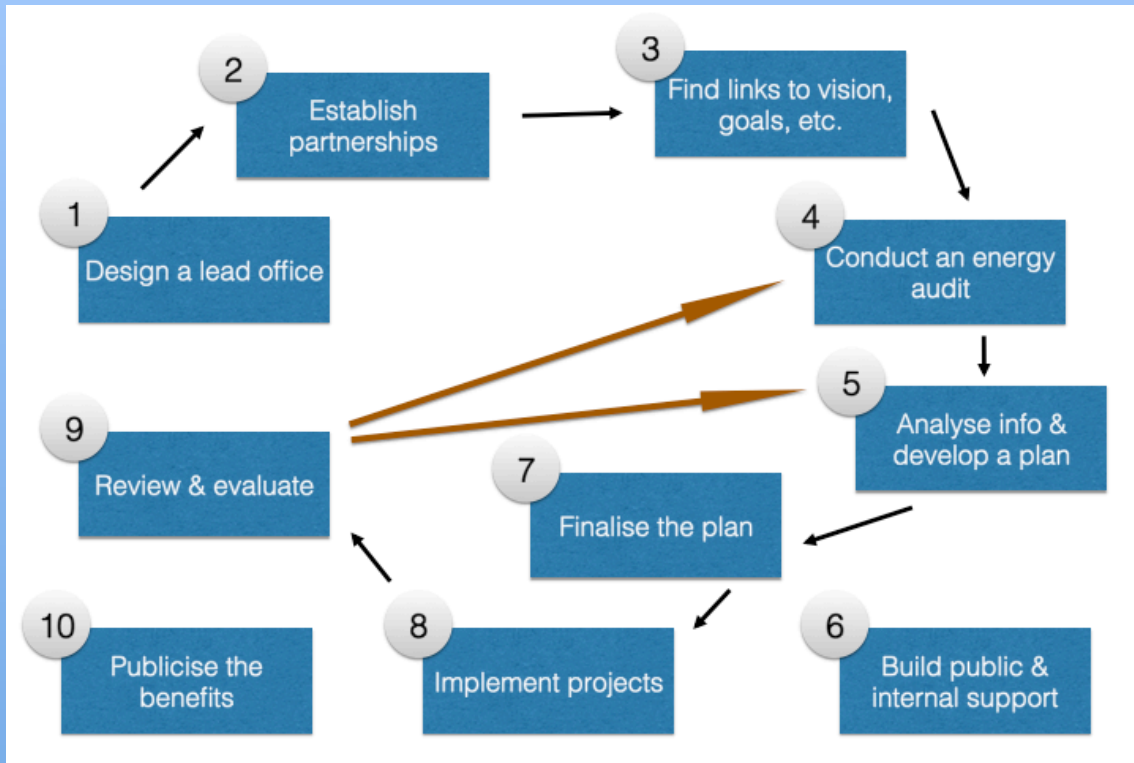
Lastly, in formulating a vision and working with the process with internal and external stakeholders, Zabrze also has a great potential to galvanize the interest of developers. As said, the vision formulation can be used to energize their best ambassadors – their employees – to talk of the project and the city in general. This is a cheap measure that can change the mood and perception of a city fast, as Zabrze employs more than two thousand of people.

As well as part of the processes of formulating the vision and energy planning, communication to and involvement of the public is important. Here, Zabrze has a good opportunity to involve citizens and to instil pride of the city in them, generating more ambassadors.

Moreover, in working with external partners to develop the visions and plans for the area, these documents and ideas can be used to convince investors that this is a development which they do not want to forego. Developers will also identify the drivers that Zabrze already has, and the innovative actors will want to gain valuable know-how and experience to come ahead of their competitors, thus fostering a “race to the top”.

Box 1: The City's Energy Plan Process

The framework below has been adopted from one developed by the United Nation Environmental Programme, ICLEI – Local Governments for Sustainability and UN Habitat. It shows how to effectively implement energy planning in an urban development project [12]. The process contains 10 key steps that should be followed stepwise. However, step 6 and 10 should be a continuous work throughout the whole process, as both aims to involve and build up support from the citizens in the energy plans. A short description of each step is described below.



1. The first step starts with deciding where and who should lead an energy plan project. We suggest that the lead office should be close to someone who can give support for the project.

2. To implement an energy plan in the city usually requires expertise, resources and support from different actors. Therefore, it is important to identify valuable actors and establish partnerships.

3. The energy plan's vision and goals need to be coherent with the city's vision of the overall urban development project.

4. An energy audit collects the necessary data to establish an energy plan. It usually initiates a search for the city's energy balance, its demand and supply for energy.

5. All the collected data needs to be analysed and later ranked after the city's prioritize and accordingly to which plan can gain most beneficial effects for the environment and the citizens.

6. Building up public and internal support should be a continuous process, but it is essential that this come before finalizing and implementing the plan as support from many actors is needed.

7. Review and confirm that the goals and visions for the energy plan are fulfilled, and then finalize the plan.

8. Implement the energy plan, and do not only aim for short-term benefits, as many are visible after a longer time.

9. Review and evaluate the energy plan. Be aware of other urban developments' successes, new energy systems and the requirements of citizens. The identified information should be feed back into step 4 and 5 and a new energy plan begins!

10. Go public with the benefits with the implemented projects and how it involves the sustainable living for the citizens!

Outlook & Conclusions

The project of Nowe Miasto has the potential to become the vitamin injection that Zabrze hopes it will be if the city develops and stays true to their visionary ambitions. It could attract investors and people to Zabrze, and allow Zabrze to convert itself into a leader of sustainable transitions to low-carbon societies. Nowe Miasto could also generate synergies for the city of Zabrze - some examples are described below.

Within the area of mobility, investments in innovative solutions such as better public transportation, bike-lanes, bike-sharing options, and car-pools in and to Nowe Miasto, can have positive spin-off effects for all the citizens of Zabrze. It requires investments that will improve the mobility throughout the city and can also create interest among citizens to use new modes of transportation.

Another positive spin-off effect of the Nowe Miasto project can be new partnerships and collaboration with key stakeholders and sustainable cities all over the world. Many cities are striving to build sustainable city districts and have formed numerous networks to learn from one another. One example is ICLEI - Local Governments for Sustainability. Other than the experience exchange and learning aspects, these partnerships can bring increased exposure through visits by international and national delegations that want to learn from the case of Zabrze. This could lead to increased



Picture 3 - The tower Turning Torso in Västra Hamnen in Malmö.

attractiveness for investors and new citizens, as well as an increased sense of pride among the residents of Zabrze.

If Zabrze continues to develop its visionary plan for Nowe Miasto and manages to implement it, the district could become the game-changer that municipality is searching for. However, Zabrze should not just strive to follow in the footsteps of cities such as Malmö which has transformed and reinvented itself as an attractive post-industrial city; it should learn from its mistakes and leapfrog ahead. Crucially then, is that while for example Västra Hamnen was important for Malmö's transformation, it was only part of the transformation [13]. Many other changes have together fuelled the transformation that is still on-going. Zabrze has already embarked on a journey where Nowe Miasto is just the first stop on a long, but energizing, voyage.

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List of interviewed people:

- Andreas Kertes. (2015, March 17). Head of Strategic Business Development, Öresundskraft. Helsingborg, Sweden.
- Grzegorz Kotyczka. (2015, April 10). Head of Connection Unit, Tauron. Zabrze, Poland.
- Grzegorz Syrek. (2015, April 10). Head of Planning and Development Department in Zabrze. Zabrze, Poland.
- Janusz Famulicki. (2015, April 9). Head of the Ecology Department in Zabrze. Zabrze, Poland.
- Jens Gille. (2015, March 17). Environmental Coordinator for H+, Municipality of Helsingborg. Helsingborg, Sweden.
- Jozef Neterowicz. (2015, April 15). Counsellor (Business Promotion), Embassy of Sweden. Warsaw, Poland
- Karolina Thel. (2015, April 15). Ministry of Infrastructure and Development, Warsaw, Poland.
- Katarzyna Dzióba. (2015, April 9). Deputy Mayor of Zabrze. Zabrze, Poland.
- Kerstin Rubenson. (2015, March 20). Climate Strategist for Hyllie, City of Malmö. Malmö, Sweden.
- Krystyna Kurowska. (2015, April 9). Advisor to the Mayor of Zabrze. Zabrze, Poland.
- Lesław Złotorowicz. (2015, April 10). President, Zabrze Enterprise for Thermal Energetics (ZPEC). Zabrze, Poland.
- Nora Smedby. (2015, March 26). Phd candidate, IIIIEE, Lund, Sweden.
- Paulina Radecka. (2015, April 15). Ministry of Infrastructure and Development, Warsaw, Poland.
- Rafał Kobos. (2015, April 10). Head of Investors' Issues Office of Zabrze. Zabrze, Poland.
- Richard Bengtsson. (2015, March 19). Project Manager for Brunnsbög, Kraftringen. Lund, Sweden.
- Walenty Biedulski. (2015, April 9). Advisor to the Mayor of Zabrze. Zabrze, Poland.
- Wojciech Wichary. (2015, April 9). CEO, Wichary Technic Sp. z o. o. Zabrze, Poland.
- Zenon Rodak. (2015, April 10). Head of the Urban Planning Office in Zabrze. Zabrze, Poland.

Acknowledgements

Alentejo, Portugal

First and foremost we would like to express our sincere thank you to our hosts and clients from The Comissão Vitivinícola Regional Alentejana, João Barroso (sustainability manager and IIIIEE Alumni), who acted as our host, liaison and translator and Dora Simoes (President), for entrusting us with the task of contributing to a manual of cleaner production for the wine producers of Alentejo.

We would also like to extend our gratitude to our interviewees José Miguel Almeida (General Manager), Daniela Almeida (Marketing) and Sandra Silva (Winery Technical staff) from Adega Cooperativa da Vidigueira; Pedro Baptista (Winemaking Manager) from the Fundação Eugénio de Almeida; H-K Jörgensen (General Manager), Cristina Ferrão (Winery Technical staff) and Simão Mendez (Viticulture Technical staff) from Cortes de Cima; Nuno Franco (Winemaking Manager) from Casa Agrícola Alexandre Relvas; Miguel Jorge (Maintenance Director) from Esporão; Helena Ferreira (Production and Quality Management) and Óscar Gato (Winemaking Manager) from Adega Cooperativa de Borba; Luis Duarte (Winemaking Manager) and Mafalda Vasques (Winemaking) from Herdade dos Grous; Pedro Hipólito (Winemaking Manager) from Herdade da Mingorra and Carlos Contradanças (Sustainability Champion) and Tiago Correia (Enoturism) from Adega Mayor for sharing their precious time, their professional insights and hospitality during our visits.

Last but not least, we would also like to extend our gratitude to Åke Thidell, who tirelessly provided us with constructive input and for driving us to all our appointments with our interviewees. Thereby, having to abstain from the wine tastings that followed most of our visits, a great sacrifice for the greater good.

Cairo, Egypt

We recognize that this report would not have been possible without the help and insights of many individuals. We would like to thank all staff at both RCREEE and the IIIIEE for their support leading up to and during the study visit, but in particular Amer Barghouth, Tarek Emtairah, Håkan Rodhe and Birgitta Olofson. The project and interviews would not have been possible without the extensive support of Hind Il Idrissi, Philip Peck, as well as the APSEY interns. Their knowledge and recommendations were critical to project completion. We would also like to thank all parties who agreed to meet with us or be interviewed.

Ljubljana, Slovenia

We would like to thank Kristina Ina Novak for supporting our project and giving us the chance to present our findings to representatives of the Municipality of Ljubljana. Moreover, we would like to thank Vida Ogorolec and Renata Karba from Umanotera for their support and insight. We wish to thank all the people we have interviewed for their valuable time and help. Very valuable input was also given by Nora Smedby,

PhD Candidate at the IIIIEE.

Special thanks goes to our supervisor Jonas Sonnenschein, PhD Candidate at the IIIIEE, for enabling this project and giving us guidance throughout our work.

Pipavav, India

The IIIIEE team are truly appreciative to APM Terminals for making this excellent chance for collaborative learning possible.

We would like to express our sincere gratitude to the management and staff at APM Terminals Pipavav for being excellent hosts, offering hearty reception in their premises as well as openness in sharing knowledge and information when answering our questions. We truly felt very welcome and very well taken care of.

We are indebted to Mr. Sanjay Singh for his excellent support, patience and remarkable dedication that he provided throughout the project. His contribution was an essential pillar in the successful project outcome. We are also thankful for showing us around the astonishing surroundings and the fun activities that he organised.

We would also like to thank Mr. Wouter de Gier for the time he devoted and the invaluable support and facilitating efforts throughout the project.

Finally, a great thank you to our supervisor; Thomas Lindqvist for initiating this project and guiding us through it.

Zabrze, Poland

We would like to show our gratitude to all the people who have made this project possible and gave us the unique opportunity to apply our abilities in “real world”.

First and foremost we would like to thank the Małgorzata Mańka-Szulik, the Mayor of Zabrze, for inviting us to her city and believing in our capabilities and expertise regarding the energy planning process for the new city district.

Special thanks go to Marcin Lesiak, Zbigniew Rau, Ewa Pawłowska, Marcin Bania, and our driver Andrzej Kleczka for making our stay in Zabrze worthwhile, effective and inspiring. Their hospitality, organisation and coordination of all the interviews, study visits, helping with translating, taking us to an old coal mine, arranging lunch, and everything else has been truly amazing and extremely helpful. Dziękujemy bardzo!

In Zabrze we have been fortunate enough to meet with a number of key stakeholders for the Nowe Miasto project and would like to show our appreciation for their willingness to share their time and knowledge with us. In addition, we would also like to thank all our interviewees in Sweden for sharing their time and wisdom on energy planning and urban development in Skåne.

Last but not least, a great thank you goes to Mikael Backman and Lars Hansson from the IIIIEE for the initiation of this project and the good collaboration and guidance throughout the project.

And finally, we also would like to thank all our fellow-EMPers who have been to Zabrze in former years and paved the way for this great collaboration between the city and the IIIIEE. Without your fantastic work this project would not have been possible for us.

The International Institute for Industrial Environmental Economics



The IIIIEE building in central Lund.

The principal idea that prevention is better than cure is the core foundation of the International Institute for Industrial Environmental Economics, IIIIEE, at Lund University. The institute is a unique initiative established in 1994, with the purpose of addressing the global challenges of sustainable development. At that time, the proactive approach emerged out of the concern that decisions impacting the environment were reactive.

Today, securing a sustainable future has become a common, global concern. As a result, the institute is engaged in multi-disciplinary research and activities, bringing together cultures from all parts of the world. The ambition is to advance strate-

gies for sustainable solutions. The topics taught and researched include environmental law, extended producer responsibility, sustainable consumption, energy efficiency and renewables, corporate environmental management as well as product, energy and climate policy.

The institute educates through PhD and two MSc programmes: Environmental Management and Policy (EMP) and Environmental Sciences, Policy and Management (MESPOM). Since its establishment, the institute has developed noteworthy relationships with Swedish and European industries, governments and NGOs that are leveraged throughout the MSc programmes.

The EMP programme has been a part of the institute since its inception. It is an applied 120 ECTS credits degree, designed to provide graduates with a solid foundation for action in the area of preventive environmental management and strategies.



Guest lecture by Prof. Hans Bruynickx from the European Environment Agency in the IIIIEE aula.

The emphasis is on creating preventative

environmental solutions for industry and governments, understanding the public and industrial societal systems and applying appropriate policies and measures to solve integrated environmental problems. Theoretical education is combined with hands-on activities, such as assessing industrial systems in the field. The students conduct a large number of study visits and work with a broad range of organisations to create solutions that can be applied within industry, government and NGOs.

It is a global classroom with a multicultural atmosphere and cross-disciplinary perspectives. This year's Batch, the 20th in line, is made up of students representing Belgium, Canada, China, Croatia, Czech Republic, Denmark, France, Germany, Poland, Sweden, Switzerland, United Kingdom, and USA. The candidates have various academic backgrounds, for example, environmental science, business administration, political science, engineering, geography, retail management and tourism.



Students on a fieldtrip in Kullen (a nature-reserve outside Helsingborg).

The first year of the programme is taught online, allowing students to continue working in their home countries. After completing the distance component, the students meet in Lund for an intense, challenging



Students from Batch 20 during the graduation day for Batch 19.

and fun year on campus. The courses are demanding, but also create strong professional and personal networks.

The programme opens the door to a wide range of international environmental careers. The 500+ alumni from more than 90 countries are found within consulting, industry, research, NGOs and in international, national and local government institutions. After graduation, students continue sharing knowledge and cooperating through the alumni network, meeting regularly at alumni conferences.

The institute is governed by a Board appointed by Lund University and the Government. For more information, please visit www.iiiee.lu.se.

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