GBE Factory

Green Blue Energy Factory

FACTORY GUIDE

GBE Business models and best practices in Europe

Supported by INTELLIGENT ENERGY EUROPE

SECOND GENERATION COMMERCIAL AND INDUSTRIAL BUILDINGS:
Renewable energy sources at the service of competitiveness and the environment

GREEN BLUE ENERGY FACTORY

GUIDE

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GENERAL FOREWORD

Over the last few years, environment has become a priority area for the European Union.

On 16th December 2008 the European Council published the "Climate Energy Measures 20-20-20". These measures are designed to:

- *reduce by 20% the emissions of CO2 ;*
- *increase by 20% the energy saving;*
- *enhance by 20% the consumption of energy by RES.*

In addition the document "EUROPE 2020: A strategy for smart, sustainable and inclusive growth" states that the fulfillment of these objectives of energy policy would bring a saving of about 60 billion euros for the gas and petrol imports by 2020.

Others improvements in the European energy markets integration should produce an increase of 0.6-0.8% of EU GDP. The intention to achieve around 20% of consumption by RES could create 600,000 new jobs that would become one million by adding the 20% efficiency target.

This 20-20-20 Strategy is the beginning of a plan to rationalize electrical consumption and to reduce CO2 emissions. In 1997, in fact, the European Commission published the "White book" about new policies to increase the percentage of RES's use by up to 12% of the total energy mix amount.

As of now this strategy is the first element that will produce economic growth.

Often we hear about the miraculous "Green Economy".

"Greening the economy" means mainstreaming practices that use energy efficiently. It also means developing renewable, sustainable sources of energy. In a green economy, renewable energy is easy to access and technology can be powered by these new sources. Setting up entire systems based on new energy sources requires significant time and outlay. But once this infrastructure is in place, a green economy will save money year after year, illustrating why it's a wise and forward thinking idea for countries to start the greening process now.

It is well known that a wide range of technologies and methods exist to improve energy efficiency, turn renewables into viable energy sources and reduce emissions. However, ***market conditions prevent them from reaching their full potential****: for this reason the contribution of the European's project is very important. Indeed the plans allow us to promote energy efficiency and encourage the rational use of energy sources, increasing the use of new and renewable energy sources as well as encouraging energy diversification and stimulating energy efficiency and renewables.*

PROJECT FOREWORD

The project GREEN BLUE ENERGY FACTORY promotes the installation of industrial and commercial buildings with single or combined renewable energy sources, able to provide electricity and heating and cooling for the air conditioning of premises, and/or for the business activities taking place within.

GBE FACTORY will represent the transition from fossil fuel warehouses to second generation industrial or commercial buildings. Many residential buildings are already equipped with new technologies which allow for electricity and heating/cooling without the use of fossil fuels. Now the time has come to extend this trend to the industrial sectors, starting from the countries of the project's partners (public bodies, organizations and ESCOs from Italy, Germany, Austria, Slovakia and Bulgaria), and aiming at extending the project's effects to the rest of the EU. A GBE Factory can be a single industrial or commercial building working with "zero carbon emissions", or one or more buildings equipped with plants producing renewable energy, which can be distributed to the surrounding companies in the same industrial or commercial area. In this way, abandoned industrial or commercial buildings can become local plants for the production of renewable energy, favouring new business and employment.

With this vision, the project will help companies to identify investment plans integrating renewable energies with their productive activities, with the aim of making direct profit through the existing RES financial support schemes, and indirect profit through the reduction of electricity and

heating/cooling costs as well as through the increase in value of the re-used industrial/commercial sites.

To increase interest in this field, the project has identified business models and best practices from all over Europe. The most advanced ones will be promoted through the spread of information. Indeed, the project will support the development of organizations which will make GBE FACTORY their Business Model and will enhance the framework policy and financial conditions.

The forms of intervention will be RES installation in existing, re-used or newly built industrial or commercial warehouses, which display also good energy saving features. GBE FACTORY dedicated buildings will pursue the maximization of efficiency and effectiveness of the investments, optimizing the combination of RES technologies and their integration, achieving economies of scale. In this way GBE FACTORIES can not only be self-sufficient industrial/commercial energy buildings, leading to zero emissions, but also real RES generation plants, that can share renewable electricity and thermal energy with the surrounding industrial or commercial area.

EXECUTIVE SUMMARY

To make this work useful for a practical understanding of the advantages of RES use in industrial and commercial warehouses or factories, we have brought together existing cases in Europe that we've called "Best practices".

Obviously, different countries mean different BEST PRACTICES since different primary materials suit different geographic areas.

On the basis of partner's technical skills and of the examples, four types of GBE FACTORY BUSINESS MODELS can be replicated all over Europe have been identified, in spite of differences between countries.

This Guide will show, in the easiest way possible, different business models matching them with practical examples. Of course existing cases may not have all the elements described as components of the pure business models.

The aim of the project is not only to show how others have integrated RES technologies in their commercial or industrial activity, but also to stimulate the economic and environmental opportunities for an upgrade.

The publication is divided in two sections:

1. *BUSINESS MODELS, where four typologies of business models are described;*
2. *BEST PRACTICES, where we have matched best practices with the business model in order to demonstrate a practical idea about the possible implementation of such Business Models.*

1. BUSINESS MODELS

1.1. "One by one"

THE GBE FACTORY IS LOCATED INTO THE FIRM SATISFYING THE FIRM'S ENERGY NEEDS

1.1.1. Solar thermal and solar photovoltaic plants

Executive Summary

This simple business model investigates the possibility of achieving sustainable supply of cooling, heat and power for a company or SME through a solar thermal and/or solar photovoltaic plant. According to this Business Models, an ESCO sets up a RES plant, which sells the generated energy to the SME. The RES plant is located in the same building, which

becomes a GBE Factory. Through the GBE factory energy costs will be saved. Surplus energy can be sold back to the grid.

Quick Facts

GBE FACTORY MODEL

On the roof or free surfaces of a SME building a solar thermal and/or photovoltaic plant is built. The generated RES energy (heat/cooling/power) partially covers the local energy demand.

TYPE OF INVESTMENTS

A Solar thermal and/or solar photovoltaic plant provides heat, cooling and power to meet the needs of heating, cooling and power demand of a company/SME.

CUSTOMERS AND TARGET GROUPS

The main target groups are the owners of companies and SMEs with suitable areas for the installation of solar panels, particularly in urban Centers (usually only roofs available). The entrepreneur should have strong demand for air conditioning and heating (e.g. for a shopping Centre, large office building, chemical storage warehouse, agrifood company, etc.) with particularly high energy costs.

RANGE OF THE EXPECTED ECONOMIC INDICATORS (creating and running the GBE FACTORY investment)

EBIT: 54 % (in the 5th year)

EBITDA: 89% (in the 5th year)

ROI: 36.3% (after 25 years)

ROE: 120% (after 25 years)

IRR: 13.5 % (after 25 years)

REFERENCES

http://www.solid.at/index.php?option=com_content&task=view&id=50&Itemid=68

http://www.biosolesco.org/

Strategic Vision at the base of the investment

The GBE factory covers a substantial part of the energy consumption of the building. The investment cost and energy price for the customer will be lower compared to conventional energy systems.

The value perceived (by the users)

The company/SME can benefit from an increased independence from fossil fuels, greater security of energy supply and lower energy prices which are based on a performance guarantee contract. In addition, the company can reinforce its corporate image selling a new environmentally-friendly face.

Key Activities, Key Partners, Key Resources

The main key activities are:

- Inquiry of an operating ESCOs in the field of solar energy
- Energy Audit of the building
- Scaling of the system
- Preparation of a business plan
- Contract signature between ESCO and company/SME

KEY PARTNERS GENERALLY ARE: the company/SME owner and the ESCO

KEY RESOURCES FOR FINANCING ARE:

- ESCO
- Company/SME
- Bank institutions or private Investors

Customers and target groups

The main customer is the owner of the company/SME.

The company/SME should have:

- A long-term location solution
- Specific data in regard to energy consumption
- An ongoing expensive energy supply
- Obsolete H/C system
- Suitable areas for the collector field

Operation

The solar thermal plant should not be oversized, which would result in a stagnation of the system. Therefore, the design criterion is the summer load of the building. It will produce heating and cooling.

The solar thermal cooling plant (incl. absorption chiller) works more efficiently when it covers the base cooling load of the building (investment compared with the output). The peak of solar radiation and the peak demand of cooling match perfectly and save electricity. Through an intelligent storage management with heat and cold storage, the solar percentage could be increased significantly.

In the autumn, spring and winter cooling is not necessary but due to the solar thermal system it will be possible to cover a high portion of the required heat (DHW, reheating, etc.) of the building.

The photovoltaic plant is able to provide a significant proportion of electricity.

After the commissioning phase the plant runs independently and is controlled via online monitoring.

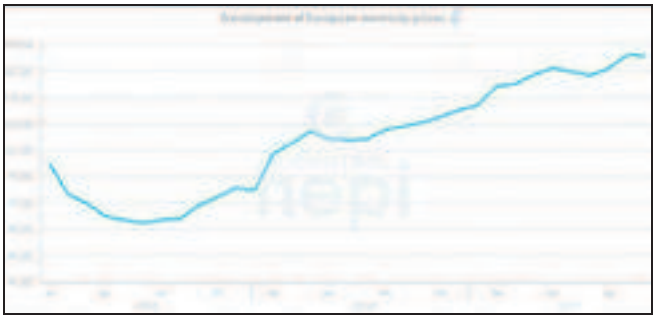
If there is not 100% RES coverage possible, a centralized or decentralized back up source is necessary.

Cost structure ratios

The main operating costs are electricity (for the operating of pumps and heat rejection of the chiller) and the maintenance of the system, attention should be given to the following points:

1. Through the selection of different components high attention to quality has to be paid, in order to ensure an error-free and profitable operation.
2. The engineering has to be done by an experienced company.
3. Insurance costs must be considered.
4. Ordinary and extraordinary maintenance costs must be considered.
5. Control and monitoring costs must be considered.
6. Costs of administration and management must be considered.

In the following graph, you can see the price trend of electricity in Europe:



Price trend of European electricity prices €/MWh

As demonstrated in the chart above, electricity has had a strong price increase over the few last years. This plant saves (through solar cooling) and produces (PV) electricity. The consumption of H/C in an office building is approx. 50%.

Energy consumers of an office building

Revenue Stream

SOURCES

From RES energy sales:

- Thermal energy supply (variable income depending on heat production -> climate conditions)
- Refrigeration energy supply (variable income depending on heat production -> climate conditions)
- Generated electricity can be feed into the public grid or sold to the SME (variable income depending on climate conditions)

From peak reduction

- By reducing the thermal (if connected with a district heating grid) and electrical peak demand, the charge for the connection power can be reduced.

From RES incentivizing system:

- RES incentives are recognized by state environment and energy authorities or related organizations (Green certificates or FIT, usually defined in advance for a fixed number of years)

- Different public grants

From company/SME status

- In case of an early termination of the performance guarantee contract (the company/SME should sign safety measures. Therefore, for variety of costs (reinstallation of the system, loss of profit, etc.) a deposit of app. 30% of the investment is paid by the company/SME. This charge will be returned in the form of lower energy prices or at a future maturity date.

Investment model and financial structure

The main investments are:

- Solar thermal, solar cooling and PV plant
- Additionally required technical parts to feed into the distribution system

Principal operating costs will include:

- Electricity
- The remote controlled supply system
- The maintenance service

The solar thermal, solar cooling and PV plant are owned by the GBE factory, through an energy service company (ESCO).

For the distribution system the company/SME is responsible. The renewable energy must be fed primarily into the distribution system. A minimum energy demand of the SMEs has to be stipulated in the contract. In case of decreasing this minimum energy demand, the company/SME has

to pay a penalty to compensate for the decreased energy supply. On the other hand the ESCO ensures a minimum of energy supply.

The project is funded by the ESCO, with approx. 30 % deposit from the company/SME.

The investment is carried out by a financial institution or investor through the ESCO.

Equity from the ESCO

The ESCO is responsible for the construction and operation of the plant.

The repayment of the investment is possible through the monthly consumption charge of the SME.

It is desirable that the engineering, procurement and construction companies have shares of the ESCO (Investors). This should/can achieve better efforts in the planning, construction and operational phase.

ESCO Barriers:

- Size limitation of solar plants
- Low energy price of conventional energy sources
- Public procurement
- Lack of trust in energy savings/supply
- No qualified staff for operation and maintenance (O & M) training
- Late detected faults in the solar plant

Business Plan main indicators

From the study of the main aspects of a business plan applied to this type of GBE FACTORY, one should consider:

1. economic gain;
2. positive SWOT analysis;
3. environmental benefits;
4. safety with advanced technology;
5. legal framework;
6. authorization process;
7. expertise of the people involved;
8. support of key-stakeholders;
9. social benefits;
10. tax framework.

The economic indicators below are predicted:

EBIT: 54 % (in the 5th year)

EBITDA: 89% (in the 5th year)

ROI: 36.3% (after 25 years)

ROE: 120% (after 25 years)

IRR: 13.5 % (after 25 years)

Environmental and economic sustainability

Solar plants (thermal and PV) are one of the most environmentally friendly RES. The installation on roofs prevents the spoiling of valuable ground areas. This RES system saves or generates valuable energy avoiding the use of fossil fuels (electricity, gas, oil, etc.).

The solar fraction of the total energy needs depends on the base load of the building and available areas for the erection of the solar plant. Because of intelligent management storage of cold and heat the solar fraction can be increased significantly.

The main sustainability from an economic point of view is a predictable constant energy supply and cost savings for the future.

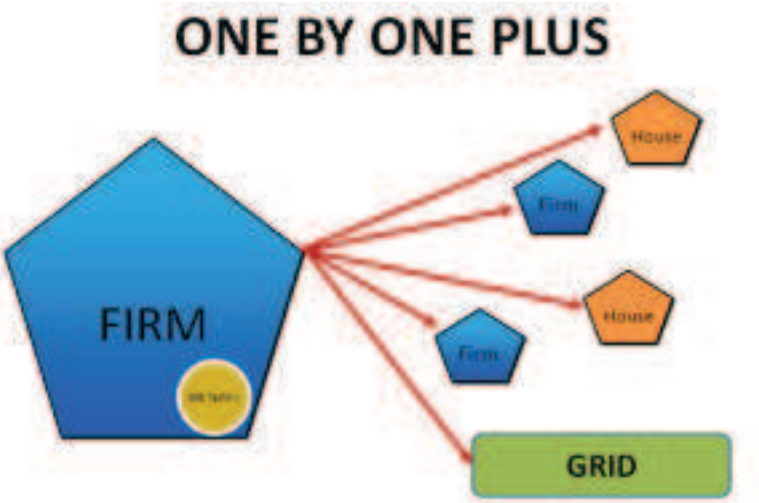
This can be achieved by:

- State-of-the-art design, implementation and maintenance from 1 hand – long life time of the solar plant of app. 25 years
- Financing by experienced partners
- Cost effectiveness by short pay-back time, positive cash flow, stable energy rates, low operating cost; reliable product quality
- Precise invoicing of produced heat (heat meter)
- Guaranteed energy supply and monitoring of savings
- Training program for local partners (O & M)

Furthermore, it is possible for companies/SMEs to stay more competitive through greater independence from energy supply and energy cost savings.

To be able to ensure economic sustainability, a long-term performance guarantee of supply contract and a safe financing scheme can be signed.

1.2. "One by one plus"



THE GBE FACTORY IS LOCATED IN THE BUSINESS SATISFYING THE BUSINESS ENERGY NEEDS AND SELLING OUT THE SURPLUS

In this particular situation the GBE FIRM not only satisfies its own energy needs but also has an overproduction that could be sold back to the grid, if there isn't any kind of pipe-network.

This model is interesting because it could be used in particular areas where, for many reasons there isn't gas or a distribution network that provides sufficient energy for local energy and H/C needs.

1.2.1. Photovoltaic plant with pipe network

Executive Summary

This simple business model investigates the possibility of achieving sustainable electricity supply not only for one single company through a photovoltaic plant, but also for others nearby SMEs. According to this Business Model, an EPC&M contractor sets up a PV plant, which sells the generated energy to the SME. In addiction you could install a pipe network to connect to other SMEs. In this way, overproduction of energy can be sold to the grid or onto other SMEs.

Quick Facts

GBE FACTORY MODEL

The RES plant is located in the same building, which therefore becomes a GBE Factory. Through the GBE factory energy costs will be saved. Surplus energy is sold back to the grid or used by other SMEs located close to the GBE Factory and connected by a pipe network.

TYPE OF INVESTMENTS

First, a photovoltaic plant provides energy to meet the needs of power demand of a company/SME. Besides, energy overproduced can be sold to the grid or, if a pipe network exists, can be sold to other SMEs nearby.

CUSTOMERS AND TARGET GROUPS

The principal target groups are the owners of companies and SMEs with suitable space for the installation of solar panels, particularly in industrial

areas. It could be simply connected to all SMEs in the same area as the GBE Factory.

RANGE OF THE EXPECTED ECONOMIC INDICATORS (creating and running the GBE FACTORY investment)

EBIT: 42 % (in the 5th year)

EBITDA: 72% (in the 5th year)

ROI: 23% (after 25 years)

ROE: 105% (after 25 years)

IRR: 7% (after 25 years)

REFERENCES

http://www.forgreen.it/realizzazioni/elenco_impianti/victor

Strategic Vision at the base of the investment

The GBE factory covers all the required energy consumption of the building. Furthermore eventually energy surplus isn't lost but is sold to the grid or used by others connected to the SMEs.

The value perceived (by the users)

Companies/SMEs involved, can benefit from an increased independence from fossil fuels, greater security of energy supply and lower energy prices. In addition, this type of investment can reinforce the environmentally-friendly image of single SMEs.

Key Activities, Key Partners, Key Resources

THE MAIN KEY ACTIVITIES ARE:

- Energy Audit of buildings
- Arrangement of the system and eventually the pipe network
- Preparation of a business plan
- Contract signature between EPC&M contractor and company/SME
- Plant and pipe network's installation

KEY PARTNERS GENERALLY ARE: the company/SME owner, EPC&M contractor and others SMEs

KEY RESOURCES FOR FINANCING ARE:

- Companies/SMEs
- Bank institutions or private Investors

Customers and target groups

The main customer the company/SME that become GBE Factory. Others stakeholders are SMEs connected with the pipe network.

The company/SME that become GBE Factory should have:

- A long-term location solution
- Specific data in regard to its energy consumption
- Suitable areas for the collector field

Others Companies that buy energy should have:

- A long-term location solution
- Specific data in regard to their energy consumption
- Pipe line network

- High energy needs

Operation

The photovoltaic plant is able to provide all the electricity need of the GBE Factory and also for others SME nearby.

After the commissioning phase the plant runs independently and is controlled via online monitoring.

Cost structure ratios

The main operating cost is the maintenance of the system. Attention should be paid to the following points:

1. Through the selection of different components high attention to quality has to be paid, in order to ensure an trouble-free and profitable operation.
2. The engineering has to be done by an experienced company.
3. Insurance costs need to be taken into account.
4. Ordinary and extraordinary maintenance costs must be considered.
5. Control and monitoring costs must be considered.
6. Costs of administration and management must be considered.

Revenue Stream

REVENUE SOURCES ARE:

- From cost energy saving

- From RES energy sales (to the grid or to connected SMEs)
- From RES incentivizing system

Investment model and financial structure

The main investments are:

- PV plant
- Pipe network
- Additionally required technical parts to feed into the distribution system

Principal operating costs will include:

- Electricity
- The remote controlled supply system
- The maintenance service

The EPC&M contractor can be responsible for the construction and operation of the plant. The repayment of the investment is possible through the monthly consumption both of the GBE Factory and others SMEs nearby (or from sales to the grid).

Business Plan main indicators

From the study of the main aspects of a business plan applied to this type of GBE FACTORY, one should consider:

11. economic gain;
12. positive SWOT analysis;
13. environmental benefits;
14. safety with advanced technology;

15. legal framework;
16. authorization process;
17. expertise of the people involved;
18. support of key-stakeholders;
19. social benefits;
20. tax framework.

Environmental and economic sustainability

Photovoltaic plants are one of the most environmentally friendly RES. The installation on roofs prevents the waste of valuable ground areas. This RES system saves or generates valuable energy avoiding the use of fossil fuels (electricity, gas, oil, etc.).

The main sustainability from an economic point of view is a predictable and constant energy supply, cost savings for the future and revenue from excess energy produced.

To be able to ensure economic sustainability, a long-term performance guarantee supply contract and a secure financing scheme can be signed.

1.3. "One to many"

A GBE FACTORY IS LOCATED IN AN INDUSTRIAL AREA AND SUPPLIES TO VARIOUS FIRMS HEATING/COOLING AND ELECTRICITY

1.3.1. Biomass power plant with pipe network

Executive Summary

The business model foresees a biomass energy fully completed project cycle utilization for customers in residential, public and industrial sectors. In the industrial sector the proposed business model provides for a consortium among users, production, engineering and logistic companies, designers, suppliers, subcontractors and ESCO companies.

Quick Facts

GBE FACTORY MODEL

Industrial buildings are supplied with thermal energy by biomass energy facilities which are built on user's sites or in the area near to the customers. The ESCO uses highly efficient and quality technologies such as automatic biomass boilers and auxiliary process equipment, wood chippers, specialized trucks for biomass logistic, subcontractors and servicing companies.

TYPE OF INVESTMENTS

Investments in a Biomass power plant (BPP) construction and pipe network to satisfy the complete actual heating and domestic hot water (DHW) need of a group of industrial buildings.

CUSTOMERS AND TARGET GROUPS

The main target customer groups are the owners of the following industrial facilities: SME's, industrial warehouses, Logistic centers, Shopping Centers, Greenhouses and Hotels

The main target groups are:

- ESCOs
- Public sector – central, regional and local levels
- Public Housing companies/Associations
- Manufacturers and installers in the biomass industry
- Entrepreneurs
- Energy agencies

- Utilities

Strategic Vision at the base of the investment

BPP construction using renewable energy in the type of wood biomass for heating and DHW supplying of a group of industrial buildings at attractive prices and high quality service level, in comparison with the existing conventional solutions for heating and DHW (project base line). Specific objectives of the business model implementation:

- Support the transfer and adoption of technology and/or know-how, technology upgrading, the development of research facilities and the updating of the facilities;
- Investment in the upgrading of production technology and equipment;
- Raises the ability of Small and Medium Enterprises to cope with competitive pressure within the European market;
- Improving the working conditions of the employers in industrial buildings;
- Significant decrease of energy carriers costs for industrial sectors;
- Sustainable growth established;
- Reduction of GHG emission and environmental impact.

The value perceived (by users)

By virtue of modern investment, high productivity and value added to the enterprises would be achieved, and the owners' factory would be fully competitive in relation to other EU companies and be capable of providing

sustainable future growth. Providing the enterprises with the opportunity to use high efficiency, environment-friendly products and technologies for the generation of thermal energy, through the utilization of wood biomass at attractive prices. Increasing productivity and high level of competitiveness according to EU requirements are also to be anticipated. Ecological advantages of production by the use of green energy are achieved.

Key Activities, Key Partners, Key Resources

The main KEY ACTIVITIES for the business model implementation are as follows:

- Biomass collection;
- Production of Chips & Pellets machinery;
- Production of Biomass Boilers and Process Equipment;
- Biomass Fuel Production & Logistics;
- Biomass Information Centers and CHSM;
- Biomass Energy Efficiency Projects Implementation

The main KEY PARTNERS are: owners, commercial banks, funds, subcontractors, independent experts and clusters.

KEY RESOURCES ARE:

- Timber industry;
- State forestry;
- Private forestry owner co-operation;

- Municipalities owners of forestry;
- Woodworking enterprises.

Customers and target group

ESCO KEY ACTIVITIES

The main ESCO activities are:

- An energy audit – to establish the potential for saving energy;
- A detailed investigation of the energy to set the base for the projections, the current consumption of energy and the base scenario for one process, one building or a group of buildings;
- The preparation of a project task;
- Finding a technical solution and creating a working project;
- Securing the financing of the project;
- Setting up the systems and the realization of complete engineering;
- Full preparation of the site “to the key”;
- Training of the customer’s personnel on the use and maintenance of the appliances;
- Maintenance of the installation for the period of the contract’s validity;
- Monitoring and comparison with the purpose of calculating the actual savings compared to the initial energy consumption and the base scenario.

The proposed business model has compliance with National and EU environmental, health and safety standards and norms.

Operation

It is very important during the project implementation in the industry and after its completion to have good collaboration between the ESCo and the business partners such as owners, subcontractors, suppliers, local authorities, installers, service organizations, designers and biomass and logistic companies.

The proposed business model uses clean technology using the wood biomass combustion for thermal energy generation in the industrial sectors. In many cases the project includes replacement of the existing light fuel oil and diesel fuel consumption for heating and domestic hot water with ecologically, cheaply and easily available wood biomass fuel.

The implemented supply system for heating and domestic hot water has to be completely controlled. In the beginning of the project an energy audit, business plan including risks and sensitivity analyses and SWOT analyses has to be prepared.

In defining the project results, the annual quantity of thermal energy used for heating per consumer is calculated. A balance of the wood biomass quantities is made and the quantity of thermal energy produced by the boilers is defined. The influence of boilers efficiency on the wood biomass combustion process has also to be considered. The electricity consumption of the boiler's own needs, operational and maintenance costs is not taken into account.

The ESCO should do monitoring and verification of the expected results and control of the investment and project schedule and in some cases to change parameters in order to achieve high performance.

Cost structure ratios

The main operational and maintenance costs are due to the wood biomass production and its logistics, servicing of the energy facilities, salary costs of the operational personnel and electricity costs for the boiler plants own requirements.

The cost structure has the following characteristics:

1. The planned cost for wood biomass based on mid to long term supply contracts including biomass logistics, in order to manage and control the biomass supply chain.
2. Contracted agreements with designers, subcontractors and suppliers for the different stages of project implementation.
3. The costs for acquiring long-term tangible assets.
4. Costs for system and equipment insurance.
5. Maintenance costs (plant and network).
6. Costs for electricity for own needs.
7. Safety costs.
8. Costs for purchasing spare parts.
9. Monitoring and control costs.
10. Transportation, office maintenance and account servicing costs.
11. The costs for training and equipping of the operational personnel.
12. Service staff salaries cost.

The allocation annual operation and maintenance cost for the example biomass power plant is shown below.

Revenue Stream

The project revenues include the following sources:

1. Thermal energy sold to customers:
    - Income from selling of thermal energy. It is dependent upon the thermal energy consumption.
    - Fixed price for thermal energy and effective and controlled O & M Costs.

2. Selling of GHG emissions reductions:

Income from selling of CO2 emissions. Is dependent on the quantities of the saved conventional fuels and methods for calculation of the reduced emissions.

Investment model and financial structure

The following investment and financial models are used:

1. Energy Performance Contracting (EPC).

It is a contract scheme between three partners:

- ESCO;
- the Customer;
- Financial Institution - Bank.

The Customer is required to pay the project costs as typically, it borrows from a third party, which more often than not is a bank or a leasing company and due to the energy savings guaranteed by the ESCO, repays the cost of the borrowed capital. The ESCO undertakes responsibility for ensuring a minimum energy saving and if a certain minimum level turns out to be exceeded by the Customer, then the former compensates the

latter for the surplus margin. In case the opposite happens, i.e., the Customer additional extra economies in comparison with the initial projections, then it pays to the ESCO the sum of the difference. Thus, the ESCO takes on the risks relating to the project fulfillment instead of the Customer. However the funding institution evaluates the credit risk with the Customer. This type of Contract is appropriate for Customers, which have greater opportunities to borrow than the ESCO.

2. Energy Contracting (EC):

These Contracts have two parties:

- Company for energy services (the Investor).
- Customer.

The investor funds the project implementation and the customer repays it by means of monthly installments, which includes the cost of the consumed energy. This energy is measured through certified equipment. Once the purchasing price is repaid, the customer owns the contracted equipment.

Software tools are available in the following areas:

- Solar and Biomass plants simulation and monitoring –evaluation.
- Economic evaluation tools.
- Flexible optimization tools.

ESCO managed measurement and verification activities typically apply to small scale energy service contract projects. The ESCO and participant will often enter into contractual agreements that include expected energy

savings, how savings are to be measured, who is responsible for short-term and long-term project management, and compensation procedures. These projects may have long development and construction cycles.

Business Plan main indicators

The main technical, judicial, financial and environmental indicators in the business plan applied to the proposed business model are as follows:

- Proven technical solutions, know-how and advanced technology.
- Mid to long term agreement with key participants.
- Net economic profit.
- Rational SWOT analysis.
- Finance plan.
- Project cash flow analysis.
- Ecological benefits.
- Risk and sensitivity analysis.
- Legal requirements.
- Completed authorization cycle.
- Compliance with National and EU environmental, health and safety standards and norms.
- Actual project calendar schedule.
- Proven social benefits.

The main performance economic indicators that are generally to be expected:

EBIT: > 25%

EBITDA: > 22%

IRR: > 15%

PBP: up to 5 Yr.

Environmental and economic sustainability

The ESCO Business model includes establishing and managing of Consolidation centers for the validation of GHG emissions. The implementation of biomass energy projects will lead to a significant reduction of greenhouse gas emissions.

The protocol of Kyoto and new EU emissions rules have created a market in which companies and governments that reduce GHG gas levels can sell the resulting emissions credits. These can be purchased by businesses and governments by developing biomass energy projects

Determination of the annual emissions of CO2 and other harmful gases is according to the Commission decision of 21.01.2004 establishing guidelines for the monitoring and reporting of Greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. The emissions factors extolled by the MOEW (Methodology for calculation of emissions of noxious substances (pollutants) released into the environment based on balance methods) have been used for the CO2 emissions assessment.

The calculation of the emissions of CO2 and other noxious substances are based on the following assumptions:

- The emissions from biomass combustion are zero;

- The decrease of harmful gas emissions equals the emissions, obtained from the combustion of an alternative fuel (electricity, heavy fuel oil, light fuel oil).
- The increase of harmful gases emissions is due to transportation costs, which emit gases when light fuel oil is used;
- The increase of harmful gases emissions is also due to electricity usage for the needs of the boiler facilities.

The economic sustainability is expected through utilizing of potential resources to best advantages.

These resources can be efficient and responsible, and are likely to provide long-term benefits. In the case of this business model, economic sustainability leads to rational using of resources so that the business model continues to function over a number of years, while consistently returning a profit.

1.3.2. Renewable trigeneration based on wood chips or waste wood

Executive Summary

This business model shows a possibility of sustainable supply of cooling, heating and power to an industry area through a trigeneration [CCHP (combined cooling, heat and power)] plant, based on biomass (woodchips and/or waste wood). Local different SMEs set up together a GBE factory, and use the generated energy in their company buildings.

Quick Facts

GBE FACTORY MODEL

For an industrial area a trigeneration plant based on wood (wood chips & waste wood) is established. It supplies RES energy to enterprises of the industrial area.

TYPE OF INVESTMENTS

Renewable trigeneration power plants (woodchips and/or waste wood) to meet the needs (complete or partial) of heating and cooling of a cluster of industrial buildings in an industry area.

CUSTOMERS AND TARGET GROUPS

The main target groups are local companies with consistent and predictable energy consumption for their buildings and processes.

RANGE OF THE EXPECTED ECONOMIC INDICATORS (creating and running GBE FACTORY investments)

EBIT: 37.4 % (in the 5th year)

EBITDA: 47.8 % (in the 5th year)

ROI: 75.28 % (after 25 years)

ROE: 130 % (after 25 years)

IRR: 17.6 % (after 25 years)

REFERENCES

1. http://www.energytech.at/pdf/lustenau_bios trom.pdf
2. http://www.econtrol.at/portal/page/portal/medienbibliothek/oekoenergie/dokumente/pdfs/Einspeisetarife%202010%20und%202011_0.pdf

Strategic Vision at the base of the investment

Establishment of a biomass combined heat, cooling and power plant based on wood chips and / or used wood. By establishing a GBE factory financing and execution of the system is performed. The energy prices and guaranteed lower price increases compared to conventional energy sources for the future are the main strategy and the reason of the investment.

The value perceived (by users)

The economics of such a project is the most important parameter for the investors (energy consumer). In addition, the SMEs can benefit from an increased independence from fossil fuels, greater security of energy supply and from a market value. Furthermore, operating and maintenance savings

can be achieved in the internal supply systems of the various participating SMEs.

Key Activities, Key Partners, Key Resources

THE MAIN KEY ACTIVITIES ARE:

- Inquiry of EPC (Engineering, Procurements, Construction)
- Energy Audit
- Scaling of the system
- Tender process
- Preparation of a business plan
- Contract signature by all parties

KEY PARTNERS GENERALLY ARE: factory's owners (GBE factory members), investment banks, energy consultants and engineering companies.

KEY RESOURCES OF FINANCING are bank institutions, private Investors (e.g.: EPC) and factory's owner (with their own equity). For the purchase of RES (wood chips & used wood) long term supply contracts should be agreed, in order to obtain price stability.

Customers and target group

The main customers are the companies themselves near to the planned distribution grid.

The companies should have:

- A long-term location choice
- Constant/predictable energy consumption
- Central heat/cold supply

Possible extensions of single factories and the industry area should be considered in advance, and taken into account in the planning phase.
Industrial areas which are not yet connected to a heating and cooling network are preferred. Otherwise the competitive pressure from the current energy supplier could be too great.

Operation

Due to the complexity of the plant, a new building is the most practical solution.
As the ORC process uses a pressurized boiler operation, no steam boiler attendant is necessary. Thus, the plant can be operated with reduced staff costs.
Waste wood is a cheap energy source (depending on market conditions: payment for the removal), but before using it has to be treated.
Power purchase contracts with minimum purchasing quantity (otherwise penalties will be incurred) between the GBE factory and SME are important for the economic success of the project.

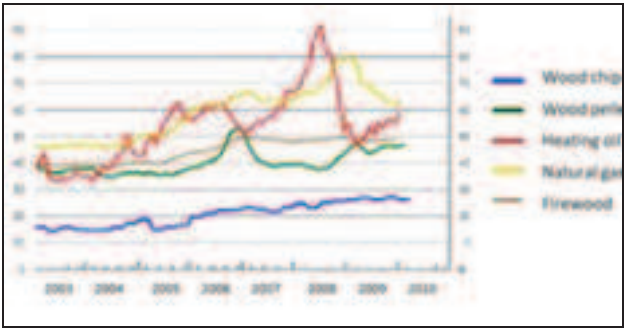
Cost structure ratios

The main operating costs are wood chips or the treating of waste wood and secondly maintenance of the system, attention should be given to the following points:

1. The cost structure should be based on a planned mid to long term supply agreement for wood chips and waste wood in order to obtain price stability.

2. It is necessary to have reliable suppliers of wood so as not to suffer from a lack of supply.
3. Waste wood treating costs.
4. Insurance costs.
5. Planned and extraordinary maintenance costs
6. Safety costs.
7. Control and monitoring costs.
8. Costs of administration and management.

In the following graph, you can see the price trend of wood chips compared to other heat sources:



Price trend of wood chips in € - Cent per 10 kWh.

As demonstrated in the graph above, wood chips are a cheap heat source with a fairly consistent price level. The long term price increase is about 3%. By using this raw material, greater price stability can be anticipated.

Revenue Stream

Revenue sources are different. The GBE factory should run as a separate company, with the various SMEs involved proportionally,

From RES energy sales:

- Thermal energy supply (variable income depending on SMEs consumption)
- Refrigeration energy supply (variable income depending on SMEs consumption)
- Connection fee for substation management, distribution and base load (minimum energy usage)
- Generated electricity can be feed into the public grid or sold in an internal grid (primarily dependant on different grant models)

From removal of waste wood:

- In collaboration with a waste contractor or different communities a fee for removal and destruction of waste wood is possible

From RES incentivizing system:

- RES incentives are recognized by public authorities and energy authorities or related organizations (Green certificates or FIT, usually defined in advance for a fixed number of years)
- Different public grants
-

From membership status:

- To join the network offered by the GBE FACTORY, an entry fee must be requested to cover part of the initial investment (Investment of equity).

Investment model and financial structure

The main investments are:

- CCHP plant;
- The heat- and refrigeration distribution grid;
- Local energy sub-stations (internal single unit distribution should be the responsibility of the end user);

Principal operating costs are:

- Wood chips and/or waste wood;
- The remote control supply system;
- Maintenance service.

The local energy coverage depends strongly on the base load and energy consumption profile of the SMEs. In regard to the profitability of the dimensions of the plant (high workload) of the GBE factory is of great importance.

Through an intelligent storage management with heat and cold storage, coverage of parts of the peak loads can also be achieved. If there is not a possibility of 100% coverage by RES, a centralized or decentralized back up source is necessary.

GBE factory members fund the project. There are several approaches possible:

The GBE factory is fully funded by their member's equity (energy users).

Additional to the GBE member's equity a bank loan could also be necessary.

It is desirable that the engineering-, procurement and construction companies have shares of the GBE factory. This should/can achieve better efforts in the planning, construction and operational phases.

Business Plan main indicators

From the examination of the main aspects of a business plan applied to this type of GBE FACTORY, the following parameters should be considered:

- economic gain;
- positive SWOT analysis;
- environmental benefits;
- safety with advanced technology;
- legal framework;
- authorization process;
- expertise of the people involved;
- support of key-stakeholders;
- social benefits;

- fiscal framework.

Economic indicators as below are to be expected:

EBIT: 37.4 % (in the 5th year)

EBITDA: 47.8 % (in the 5th year)

ROI: 75,28 % (after 25 years)

ROE: 130 % (after 25 years)

IRR: 17.6 % (after 25 years

Environmental and economic sustainability

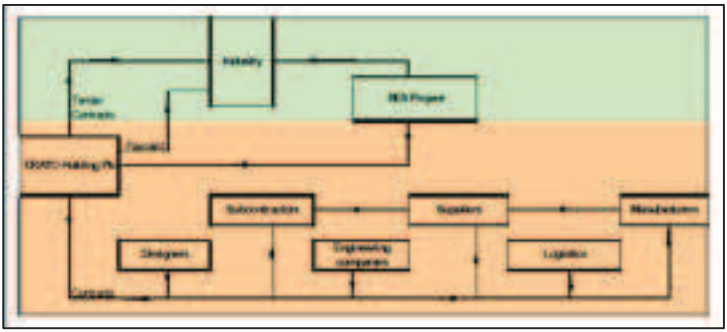
Because of the used renewable resource "wood chips and waste wood", the biomass plant is CO2 neutral. Depending on the energy consumption profile and energy mix, it should be possible to cover most of the required energy. Due to flue gas cleaning the emission of air pollutants is kept to a minimum. With sufficient resources in surrounding areas, the transportation costs and linked environmental impacts can also be kept low.

The main viability from an economic point of view is a predictable constant energy price for the future and greater independence from energy suppliers. Through energy cost savings SMEs can remain more competitive. To be able to provide economical sustainability, long-term supply contracts and a safe financing scheme are vital.

1.3.2. Biomass energy boiler using wood biomass as fuel and heat pump using electricity

Executive Summary

The proposed business model includes the implementation of RES projects for heating, domestic hot water and cooling of office buildings, small warehouses and premises in the industry. In the industrial sector the business model includes processes and schemes among owners, designers, manufacturers of systems and equipment, engineering and logistic companies, suppliers and subcontractors.



Quick Facts

GBE FACTORY MODEL

The small scale buildings in industry are supplied with hot water for heating and every day use by biomass energy boilers which are constructed on user's side. The heat pumps are used for cooling of the separate offices, small warehouses and premises of industrial buildings.

TYPE OF INVESTMENTS

Investment in installation which includes combination of a biomass energy boiler using wood biomass as fuel and heat pump using electricity. This installation meets the owners need for heating, DHW and cooling of theirs office buildings, small warehouses and premises.

CUSTOMERS AND TARGET GROUPS

The main target customers and target groups are the owners of the following industrial facilities: small and middle office buildings, small and middle industrial warehouses, Shopping Centres and hotels. Offices and warehouses in industrial areas and business parks are also potential target groups.

Strategic Vision at the base of the investment

Combined installation of biomass boiler and heat pump using renewable energy sources for heating, DHW and cooling supplied complete or partial individual or a group of industrial office buildings, Shopping Centers, hotels and small warehouses at an attractive price and a high quality service level, in comparison with existing conventional solutions.

The investment will improve the working conditions in the industrial buildings. A reduction in energy costs will be also achieved. The proposed business model will also lead to the reduction of CO2 emission to the atmosphere.

The value perceived (by users)

Providing to the industry the opportunity to use high-efficiency and environment-friendly technologies for the generation of hot water for heating and every day needs by utilization of wood biomass at attractive prices. Possibility for cooling of the buildings is also to be expected.

Key Activities, Key Partners, Key Resources

Main KEY ACTIVITIES connected to the proposed business model implementation are as follows:

1. An energy audit – to establish the potential for saving energy;
2. A detailed exploration of the energy sets the base for the projecting, the current consumption of energy and the base scenario for one process, one building or a group of buildings;
3. The preparation of a project tender/bids;
4. Finding a technical solution and a creating a working project;
5. Setting up the systems and installation;
6. Full preparation of the site “to the key”;
7. Training of the customer’s personnel on the use and maintenance of the equipment;
8. Maintenance of the installation;
9. The proposed business model has compliance with National and EU environmental, health and safety standards and norms.

KEY PARTNERS are: owners; designers, manufacturers, subcontractors, suppliers, engineering companies and logistic services.

KEY RESOURCES are provided by the owners of small and middle industrial office buildings, small warehouses, shopping centers and hotels. In the case of new office buildings, hotels, shopping Centers and warehouses in industrial areas or business parks the target group can be real estate or facility management companies or group of participants for outsourcing the project

Customers and target group

The main customers are the companies themselves near to the proposed distribution grid.

The companies should have:

- A long-term location choice.
- Constant/predictable energy consumption
- Central heat/cold supply

Possible extensions of single factories and the industry area should be considered in advance, and taken into account in the planning phase.

Industrial areas which are not yet connected to a heating and cooling network are preferred. Otherwise the competitive pressure from the current energy supplier could be too great.

Operation

The proposed technology provides hot water, heating, and cooling for the office buildings, shopping center, hotels and houses through a combination of biomass energy boiler using wood waste as fuel and heat pump using

electricity. The proposed technology has been selected because it offers the following advantages:

- relatively low investment costs;
- high efficiency;
- wood waste availability;
- internal microclimate improvement;
- Contribution to the reduction of greenhouse gas emissions.

In defining the project results, the annual quantity of thermal and electricity energy used for heating and cooling per customer is calculated. A balance of the wood biomass quantities is made and the quantity of thermal energy produced by the boilers is defined. The electricity consumption for heat pump is also calculated. The influence of boilers efficiency on the wood biomass combustion process and COP for heat pump operation is considered.

The electricity consumption for the boiler's and heat pump own needs and operational and maintenance costs is not taken into account.

The proposed technology is a combination of biomass energy boiler for heating and heat pump for hot water and cooling. The main components of the selected technology are:

automatic hot water energy boiler fuelled by biomass, heat accumulator, internal boiler installation including distribution/returned water collectors, circulating pump, valves and insulation pipes, air water heat pump, and C&I including LCD controller It is very important during the project completion in the industrial buildings to have very good partnership between the project provider, owners, subcontractors, suppliers, local authorities, installers, service organizations, designers and logistic companies.

Cost structure ratios

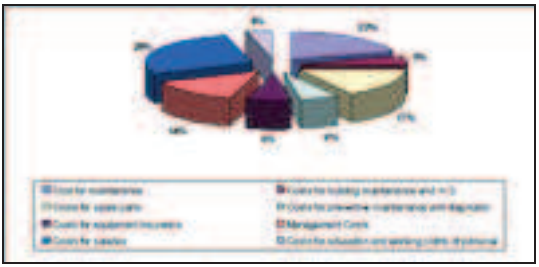
The main O & M costs (operational and maintenance costs) are due to the consumption of wood biomass and electricity. There are also servicing and salary costs of the operational staff.

The cost structure has the following features:

- Professional contracts designers, manufacturers, subcontractors and suppliers for the different stages of the project implementation
- Costs for system and equipment insurance.
- Maintenance costs
- Costs for electricity for own needs
- Safety costs
- Costs for purchasing spare parts

- Transportation costs, office maintenance costs and accounting servicing costs
- The costs for training and equipping of the operational personnel.
- Service staff salaries cost

The allocation annual O&M cost for the exemplar installation is shown below.



Revenue Stream

Project savings include the following sources:

- Energy efficiency savings as a result of replacement of old inefficient conventional heating boilers with automatic biomass boilers.
- Using efficient heat pump for cooling with minimal electricity costs.
- Control and monitoring of the expected O&M Costs.
- Income from selling of CO2 emissions. This is dependent on the quantities of the saved conventional fuels and methods for calculation of the reduced emissions.

Investment model and financial structure

Software tools available in the following areas:

- Heat pump and biomass boiler facilities simulation and monitoring tools.
- Economic evaluation tools
- Flexible optimization tools

The Financial Structure should be shown as two different options:

- Total costs by one participant who will implement and manage the project. The investors profit will be from the savings of the energy
- Costs by all of the users, who will be part of the industrial area, or Business Park, primarily to cut the energy costs. In this case the partners will invest by themselves (own capital)

Business Plan main indicators

The main indicators in the business plan applied to the proposed business model are as follows:

- Proven technical solutions and appropriate technology and equipment
- Net economical profit
- Rational SWOT analysis
- Financing plan
- Project cash flow analysis
- Ecological benefits

- Risk and sensitive analysis
- Legal legislations
- Completed authorization cycle
- Compliance with National and EU environmental, health and safety standards and norms
- Actual project calendar schedule

Environmental and economic sustainability

The proposed business model includes establishing and managing of Consolidation center for validation of GHG emissions. The implementation of biomass energy projects will lead to the significant reduction of greenhouse gas emissions. The protocol of Kyoto and new EU emissions rules have created a market in which companies and governments that reduce GHG gas levels can sell the ensuing emissions credits. Determination of the annual emissions of CO2 and of other noxious gases is according to Commission decision of 21.01.2004 establishing guidelines for the monitoring and reporting of Greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. The emissions factors elaborated by the MOEW (Methodology for calculation of emissions of noxious substances (pollutants) released into the environment based on balance methods) have been used for the CO2 emissions assessment. The economic sustainability is expected through utilizing of potential resources to best advantages. These resources can be efficient and responsible, and likely to provide long-term benefits. In the case of this business model, economic sustainability leads to rational using

of resources so that the business model continues to function over a number of years, while consistently returning a profit.

1.3.3. Biofuel- biogas CHP plant

Executive Summary

The model proposed allows sustainable supply to a whole industry area through an industrial building hosting a biofuel-biogas CHP plant, meeting partially or totally the H/C needs of the other companies. Organized as an ESCO or consortium among users and suppliers, it can allow users to achieve control over the energy streams of the area and achieve a better planning and price for the biofuel-biogas supply.

Quick Facts

GBE FACTORY MODEL:

Industrial building hosting a biofuel-biogas CHP plant supplying RES energy to other buildings in the same industrial area

TYPE OF INVESTMENTS:

Renewable energy power plant (Biofuel-Biogas CHP) to meet the needs (complete or partial) of heating and cooling of clusters of industrial buildings

CUSTOMERS AND TARGET GROUPS

The main target customers are the owners of the warehouses of the industrial area, especially those who have high demand for air conditioning for their premises (e.g. units used for food processing and pharmaceutical activities).

RANGE OF THE EXPECTED ECONOMIC INDICATORS (creating and running GBE FACTORY investments)

EBIT: 28%

EBITDA: 27.06%

ROI: 23.83%

ROE: 11.00%

REFERENCES

www.binariospa.com/it/index.php

www.escoeurope.it

Strategic Vision at the base of the investment

Developing a local renewable energy power plant (Biofuel-Biogas CHP) to meet the needs (completely or partially) of heating and cooling of clusters of industrial buildings at competitive price and service level when compared to old conventional H/C solutions.

The value perceived (by users)

The value perceived by the owners of the warehouses fuelled by renewable energy (users) is that of gaining control (both in terms of costs and physically close availability) over an important factor (energy) which influences the costs of property management. In addition there is the perception that this value will contribute to increase the intrinsic value of the property in the future.

Key Activities, Key Partners, Key Resources

THE MAIN KEY ACTIVITIES for carrying out the investment consists in a survey in the industrial area supported by local energy audits in order to consider the feasibility constraints and to calculate the realization costs that will affect the price of Renewable Energy offered (services after commissioning included).

KEY PARTNERS generally are: factory's owners; ESCO; investment banks and sometimes users themselves.

KEY RESOURCES may be supplied both directly by private investors or retrieved through a financial operation governed by agreements with banks or finance companies.

Customers and target group

The main customers are the owners of the warehouses, especially those who have high needs for air conditioning (controlled and adjustable H/C) for their premises (e.g. units used for food processing and pharmaceutical activities).

In the case of new buildings (such as the case of expansion of industrial areas) the target becomes real estate companies and / or groups of operators who act as developers in these areas.

Operation

Particular attention must be given to the renovation of the building that will host the RES plant and the building of the heating and air conditioning

remote supply systems that should be compatible with the “already built” situation.

The H/C supply system must be locally and remotely monitored and controlled.

There will be an “energy balance” to establish the return of the investment, and in some cases, change some parameters to get the best performance.

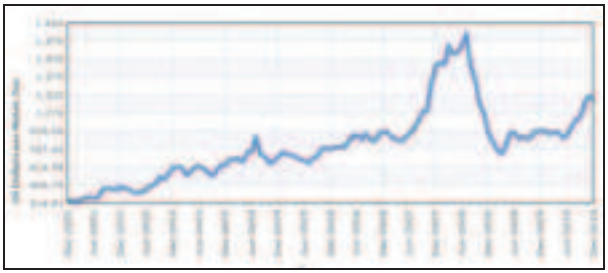
The relationship between the management organization of the real estates and the outsource partners (such as suppliers, authorities, and stakeholders) will be very important.

Cost structure ratios

Given that the main operative costs are due mainly to biofuel or biogas and secondly to the maintenance of the system working 24 hours a day, attention should be given to the following points:

- The cost structure should be based on a planned mid-long term supply agreement for biofuel-biogas, in order to have main operating costs under control
- It is vital to chose reliable suppliers of commodities so as not to incur heavy penalties due to the unreliable delivery of energy
- Insurance costs
- Ordinary and extraordinary maintenance costs
- Safety costs
- Control and monitoring costs
- Costs of administration and management

In the following diagram, we can see the commodities historic price trend:



Price trends of Rapeseed oil on the European markets (in dollars)

Revenue Stream

REVENUE SOURCES ARE DIFFERENT:

From RES energy sales

- Thermal energy supply (variable income depending on energy users consumption)
- Refrigeration energy supply (variable income depending on energy user consumption)
- Fixed tariff for substation management, distribution and eventual base load (minimum energy usage)
- Electric energy surplus (overriding user needs) can be sold in the internal network or externally to the market

From RES incentivising system

- RES incentives are recognized by state environment and energy authorities or related organizations (Green certificates or FIT, usually defined in advance for a fixed number of years).

From membership status

- To join the network offered by the GBE FACTORY, an entrance fee can be requested to cover part of the initial investment, distribution and substations costs.

Investment model and financial structure

The hardware investment required is:

- a power centre with an intensive technology RES energy production plant;
- the pipe line (sometimes pipe lines investment can be shared between the GBE FACTORY and the building constructor)
- local energy sub-stations (internal single unit distribution should be responsibility of the end user)
- Operational main costs should include:
- The primary energy plant (RES combined or totally RES).
- Remote controlled supply system.
- Maintenance and repair services.

The building of the power plant and its technology should be owned by the GBE FACTORY in the form of an Energy Service Company (ESCO). Distribution and local energy substations should be exclusively used by the GBE factory due to the importance of the energy stream control.

Another possible investment model can be that the entire system (GBE FACTORY plus the other buildings and the surrounding area) are owned by a consortium, where both producer and end user have shares.

The Financial Structure would be shown as two different options:

- Total investment by one participant who will implement and manage all of the GBE FACTORY. The investors gain will be from the selling of the energy in and out of the local district (energy produced that exceeds local consumption), and also by the incentives and other fees. This revenue will pay for the interest charges of a bank loan.
- Investment by all of the users, who will be part of the GBE FACTORY, primarily to cut the energy costs. They will be allowed to use the RES energy produced, to save on the cost and also to benefit from the renewable energy's incentives currently in place. In such case the partners will finance by themselves (own capital) the investments required.

Business Plan main indicators

From the examination of the main aspects of a business plan applied to this type of GBE FACTORY, one should consider:

- economic gain;
- positive SWOT analysis;
- environmental benefits;
- safety with advanced technology;
- legal framework;
- authorization process;
- expertise of the people involved;
- support of key-stakeholders;

- social benefits;
- fiscal framework.

The following ranges for economic indicators are generally to be expected:

EBIT: > 25%

EBITDA: > 24%

ROI: > 20%

ROE: > 10.00%

These indicators are provable when the company is fully operational (after 5 years).

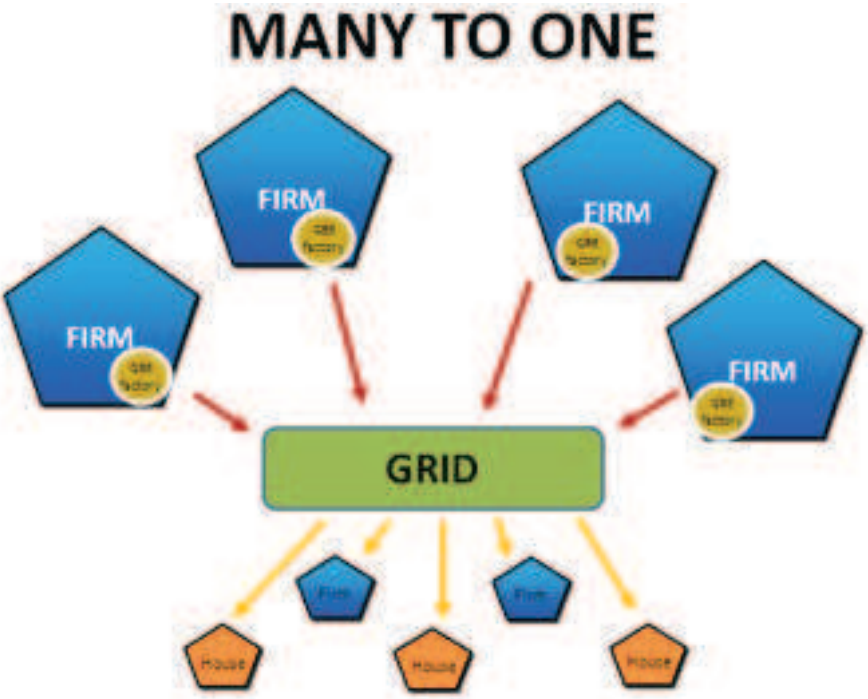
Environmental and economic sustainability

Satisfactory environmental sustainability can be considered achieved if the energy generated from RES in the GBE FACTORY is equal - or superior – to '80% of the total energy produced by the GBE FCATORY. This value may be optimal with respect to a trade-off that takes into account the costs to get a 100% RES GBE Factory and those necessary to have a GBE Factory with 80% RES and 20% fossil fuel. The 20% from traditional sources could in fact function to ensure back-up in case of inefficiency of the generation and distribution of renewable energy.

Sustainability from an economic point of view should be based on a portfolio of contracts of local supplies, which initially covers the cost of the system running well below its full capacity. The increase in supplies to reach the full capacity should ensure the achievement of necessary room for business activities. This makes sense if the costs of biofuels-biogas are

well-planned and are tiered in case of turbulence in the commodities market.

1.4. "Many to one"



PARTNERS TOGETHER WITH THEIR CUSTOMER CAN JOIN INTO A NETWORK EACH ONE PROVIDING PRODUCTION, CONSUMPTION AND RESOURCES NEEDS. THE EXTRA ENERGY PRODUCTION CAN BE SOLD TO OTHER PARTICIPANTS APART FROM THE NETWORK

1.4.1. Open self-energy production consortium

Executive Summary

The target of this project is to promote the replacement of the old asbestos roof present in the roofs of almost all the companies in a territory, while benefiting from the special government incentives currently in place.

It is well known, that most of the industrial warehouses constructed up to 1992 are roofed using asbestos, and this model develops the plan to invest in disposing of the old roofs , replacing them with new solar panels (PV or solar thermic).

This project will increase the quality of life in the area and bring new jobs, as well as producing renewable green power that can been used by both the industrial processing plants and the local inhabitants.

Quick Facts

MINIMUM RES ELECTRICITY PRODUCTION: 80%

MINIMUM RES ELECTRICITY LOCALLY CONSUMED: 80%

MINIMUM HEATING AND COOLING ENERGY NEEDED: /

MINIMUM RES HEATING AND COOLING ENERGY: /

ELECTRIC OPEN SYSTEM: YES

HEATING AND COOLING OPEN SYSTEM: YES

FIT: YES

Strategic Vision at the base of the investment

The consumption and emission of greenhouse gases is the priority of the European administration which is working on meeting the targets of the Kyoto Protocol.

It's a "win-win" project because the administrations are able to achieve the Kyoto standards and at the same time the companies gain work opportunities. Also the local inhabitants are protected by the disposing of the asbestos from their environment.

All of the above will help to safeguard the environment by producing new renewable green power.

The value perceived (by users)

This project has numerous benefits such as:

- Disposing of dangerous substances;
- Dissemination of renewable energy;
- Awareness of citizenship;
- Creation of new jobs;
- Improvements to the Environment;
- Contribution to the achievement of the targets 20 20 20;
- Support of government incentives.

Key Activities, Key Partners, Key Resources

KEY ACTIVITIES:

Analysis and supervision of the territory; promotion of the project; creation of a network of businesses and stakeholders; implementation of project.

KEY PARTNERS:

The project involves the council and local authorities, companies which have to remove the old asbestos present in their roofs, companies grouped in the network that perform the work, and the local inhabitants.

Customers and target group

The project involves different partners such as: the local authorities, the owners of the warehouses that will be reclaimed, the companies which will remove the asbestos and the companies which will install the new solar panels. Also the inhabitants that will benefit from a better quality of life. Furthermore they will be able to make use of the green power generated.

Operation

The Project will be divided into 4 parts:

1. ANALYSIS and SUPERVISION of the the TERRITORY CONCERNED:

At this stage it will be important to conduct a census of the agricultural and industrial buildings (especially poultry buildings) to find where the roofs are covered by asbestos, followed by an evaluation of the circumstances.

2. PROMOTION of the PROJECT in the TERRITORY

At this stage the project owners will meet the potentials users, such as the owners of the warehouses that will be upgraded, explaining to them the benefits that they could gain by signing up to the project.

3. CREATION a NETWORK of COMPANIES and STAKEHOLDERS:

It will be important to create a network of companies which aims to implement the project. The achievements of the network coupled with a strong approach from the stakeholders will guarantee maximum success for the project.

4. Implementation of the PROJECT:

The last stage will be to remove the old asbestos roofs and replace them with new solar panels, all of this it will be carried out by the established network of companies.

Cost structure ratios

Direct operational costs:

- Removal and disposal of the asbestos roofs : 10-25 €/m
- Cost of the new roofs : 20-45 €/m (*)
- FV system installation : 3.000-3.400 €/KWp (**)

(*) It depends on the functional requirements; such are adjustment of/to the structure, as well at the local regulations, etc.

(**) From 100-200 KWp to up than 1 MWp .That depends on the building, geographic location, technology option and so on.

In addition to the directs costs, we have to consider the cost and times of the general activities such:

- Evaluation of the technical and economic feasibility
- Administrative assistance
- Financial assistance

	Quantity	Price	Total
NEW ROOF (Worehouse)	**1.600 mq**	35	**56.000,00**
Disposal of dangerous substances (asbestos) and replacement with PV panels			
PV IMPLANT of 100 kWp (800 mq)	**100 kWp**	2.400,00	**240.000,00**
CONNECTION to the GRID			**7.500,00**
TOTAL			**303.500,00**

Example of costs substitution

Revenue Stream

Law 19 February 2007 introduces an incentive mechanism that supports the replacement of asbestos roofs with PV or solar thermal implants.

This type of benefit was reconfirmed in the "Fourth Energy Law" (05.05.2011).

This extra benefit permits:

- In the worst case, to ask to warehouse owners to pay a part of the operating costs;
- Normally, to cover the total costs of disposing the asbestos and replacing it with the new "renewable" roof;
- In the best case, to produce extras revenue (if we consider that the owners could receive a fee for the rent of his roof).

Investment model and financial structure

Investments required are:

- study of the territory. It is necessary to check all industrial or commercial roof that have the asbestos above;
- dismantling of asbestos' roofs;
- replacement with PV or solar thermic implants.

Principal operating costs are:

- the construction of energy plants;
- the remote controlled supply system;
- the maintenance and repair services.

The building of the power plant and its technology should be owned by the GBE FACTORY in the form of capital company. It is constituted by a financial structure that is the team leader of the entire project.

The Financial Structure should be shown as follows: total investment by one participant who will implement the GBE FACTORY system. The investors gain will be from the selling of the energy in and out of the warehouses, and also by the incentives and other fees. This revenue will pay the annual interest charges of a bank loan.

It is possible that the investment could be met by other users, who will be part of the GBE FACTORY, primarily to cut the energy costs. They will be allowed to use the RES energy produced, to save on the cost of it and also to benefit from the renewable energy's incentives currently in place. In such case the partners will finance by themselves (own capital) the investments required.

Business Plan main indicators

The main indicators of a good business plan are:

1. economic gain;
2. positive SWOT analysis;
3. environmental benefits;
4. safety with advanced technology;
5. legal framework;
6. authorization process;
7. expertise of the people involved;
8. support of key-stakeholders;
9. social benefits;
10. fiscal framework.

Environmental and economic sustainability

From the Environment's point of view this is a winning model because: it's going to be eliminate a dangerous and noxious material such as asbestos, meanwhile replacing them with solar panels which produce energy and also hot water.

That energy will be exploited by the warehouse and any excess, will be sold to the network, increasing the economic advantage of the operation.

From the economical point of view, the financial cost is going to sustain the requalification building's costs, and it's going to get the direct economic benefits of the operation.

The energy produced, instead, would be either used in the warehouse or sold elsewhere.

The warehouse owners get the monthly income from the rent of their roof's surfaces used. (So they will essentially receive a guaranteed income.)

2. BEST PRACTICES: THE EXISTING GBE FACTORY IN EUROPE

2.1. "ONE BY ONE"

2.1.1. KVK Koerner Chemieanlagen GesmbH

Description of the project

The company KVK Körner manufactures pickling tanks for galvanizing processes and also for hot dip galvanizing of metal parts. The production of these plates happens on a "production table", which is heated by heating coils with hot water. The working surface of the table is always kept at a temperature of 30 °C and therefore requires a high energy consumption of natural gas. The installed solar thermal plant covers a significant part of the needed heat energy, saves natural gas thus reducing the CO2 impact.

Sales & Purchase Agreement

The solar thermal collectors are mounted on the south facing façade of the production plant.

This plant is an example for a cost - effective installation of RES in SMEs, with considerable savings. The simple design allows an easy transferability

of the concept to other SMEs. Thanks to the system 49.4 % of the heat demand of this process is covered by solar energy.

Quick Facts

LOCATION: Am Bahnhof 26, Eibiswald - Austria

PLANT SIZE: 85.8 sqm

TECHNOLOGY/RES: Solar thermal GS collectors

SITE OWNERSHIP: KVK Koerner GesmbH

INVESTOR: KVK Koerner GesmbH GmbH

PROJECT COST: 35,440 €

State grants: 30 %

KEY PARTNERS: S.O.L.I.D. GmbH (Design & Installation)

CURRENT STATUS: Operational

Design and construction

The solar plant feeds in over a heat exchanger into a storage tank with approx. 10 m^3. The storage tank supplies the production line with heat.

Due to the size of the storage tank and the continuous and ongoing operation of the production table, overheating is not possible. Thus, an optimum solar yield can be reached from the collectors.

<u>TECHNICAL DETAILS:</u>

TOTAL SURFACE: 85.8 sqm

NUMBER of thermal collectors: 6 (each 14.3 m^2)

HEAT STORAGE: 10 m^3

TOTAL solar yield: 41.5 MWh/year

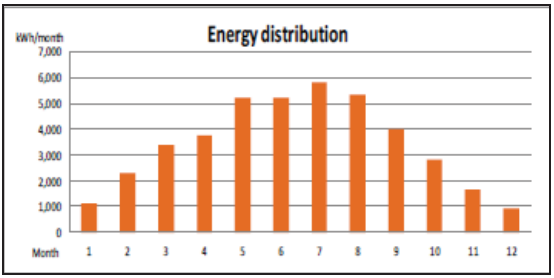
SPECIFIC solar yield: 485 kWh/m²BRUTTO*a

PARAMETERS OF INSTALLATION

Installation: 1nd QT 2007

Capacity [kWtherm]: 43.5

MONTHLY TOTAL ENERGY GENERATED



ENERGY DISTRIBUTION

The total produced solar thermal energy is used locally in production.

Local energy consumption = 100% (41.5 MWh/a)

SUBSTITUTED ENERGY

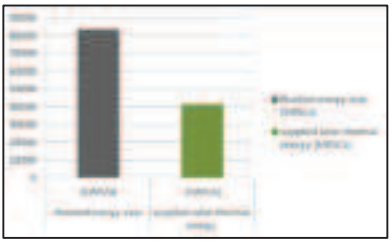
Form of conventional energy source: natural gas

Price, natural gas: 47.45 €/MWh net

Total heat consumption: 84 MWh/year

Solar thermal production: 41.5 MWh/year

SOLAR COVERAGE



Economic Basics

PARAMETERS OF ECONOMIC'S SIMULATION SALE

INTEREST RATE: 4.0 %

GRANTS: 10,632 €

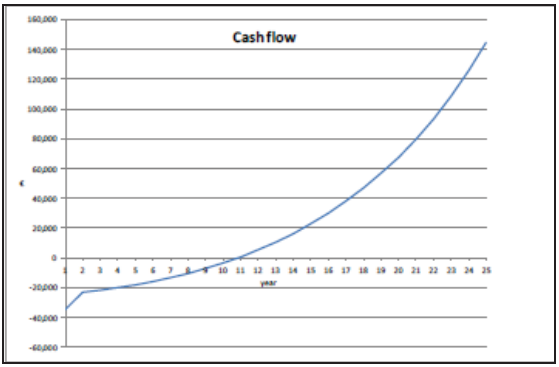
MAINTENANCE AND INSURANCE COST: app. 100 €/year

INSURANCE COST: app. 20 €/year

DEPRECIATION PERIOD: 25 years

SYSTEM'S DEPRECIATION CHARGE: 4 %

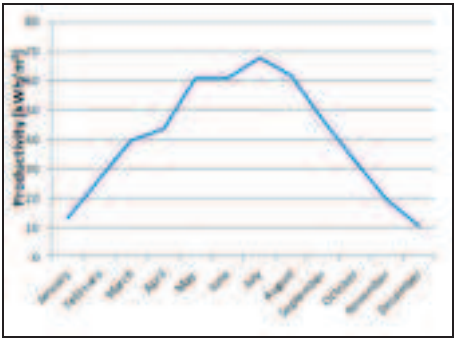
COST INCREASE FUEL: 8%



Environmental & Economic Sustainability

The measured total solar yield is shown in the table below.

	Total solar production [kWh/month]	Total solar production [kWh/(sq.m*mth)]
January	1,122	13.1
February	2,285	26.6
March	3,397	39.6
April	3,733	43.5
May	5,220	60.8
June	5,209	60.7
July	5,804	67.7
August	5,322	62.0
September	4,015	46.8
October	2,811	32.8
November	1,653	19.3
December	920	10.7
SUM	43,494	10.8



TOTAL MONTHLY TREND ANALYSIS OVER THE YEAR:

Solar thermal energy is CO2-free and therefore environmentally friendly. In determining the CO2 savings following substituted heat source are

considered: natural gas. The impact of natural gas amounts to 205 kg CO2/MWh.

Contribution to the environment		
CO_2 Savings	8,506	[tons CO2/year]

Through this investment the company is less dependent on gas and unexpected fuel price increase.

Substituted quantity of fossil fuels		
natural gas	3.7	[tons/year]

Lessons Learnt

This solar thermal system demonstrates to us the following points:

- High efficiency of small solar thermal applications;
- The solar yield depends strongly on the required temperature level of the process heat application;
- Good economics
- Easy transferability to other SMEs.

This example shows the successful use of small solar thermal plants for industrial process heat application. Due to the easy transferability to other SMEs and possible duplication significant CO2 savings can be achieved.

2.1.2. Caixa Geral de Depositos

Description of the project

In Lisbon a large office building of the bank Caixa Geral de Depósitos (CGD) are supported by solar heat and cold. The collector area is installed on the roof of the office building. The office building has 17 floors with an office space of 100,000 m². During the working day 6,000 employees are permanently in the building. The generated energy is used to power an absorption chiller. Furthermore, the energy is used for the reheating system of the ventilation appliances as well as contributing to the heating of hot water.

Sales & Purchase Agreement

On the one side CGD wished to install an economical RES to save energy, on the other side the architecture and appearance of the building had to be considered. Because of the location the only available useful area is the roof of the building. The design of the collectors could be optimal combined with the existing blue tile roof. With the integration of the system the existing energy distribution system has been optimized, and further energy savings achieved.

Thanks to the system app. 45% of the domestic hot water demand, 15 % of reheating and 8% of the cold demand can be covered with this solar thermal system.

Quick Facts

LOCATION: Rua Arco do Cego, Piso 1; Lisbon Portugal

PLANT SIZE: 1,579 sqm

TECHNOLOGY/RES: Solar thermal HT collectors

SITE OWNERSHIP: Caixa Geral de Depósitos

INVESTOR: Caixa Geral de Depósitos

PROJECT COST: 1,040,000 €

State grants: 0 %

KEY PARTNERS: S.O.L.I.D. GmbH (Design & Installation), Energia de Portugal (EdP)

CURRENT STATUS: Operational

Design and construction

The solar energy is for building cooling and air conditioning in the CGD building, in the months of April to September. Extra thermal energy from the plant may also be used to heat up the water coming from the existing 100 m^3 tanks in the basement and to replace the electric energy used by the heat pumps to cover the heat needs for

DHW and reheating the air. The solar energy is used for heating purposes mainly in the months of October to March. The energy output and current system data can be displayed on a monitor in the CGD offices as well as online, adding visibility and control of the energy output to the solar solution.

PRIORITY: 1. DHW, 2. reheating, 3. Cooling

TECHNICAL DETAILS:

TOTAL SURFACE: 1,579 sqm

NUMBER OF THERMAL COLLECTORS: app. 112

SOLAR HEAT STORAGE: 10 m^3

TOTAL SOLAR YIELD HOT: 978.2 MWh/year

SOLAR YIELD COLD (COOLING): 263 MWh/year

SOLAR YIELD REHEATING: 202.6 MWh/year

SOLAR YIELD DHW: 400 MWh/year

SPECIFIC SOLAR YIELD HOT: ~ 619.5 kWh/m^2BRUTTO*a

PARAMETERS OF INSTALLATION

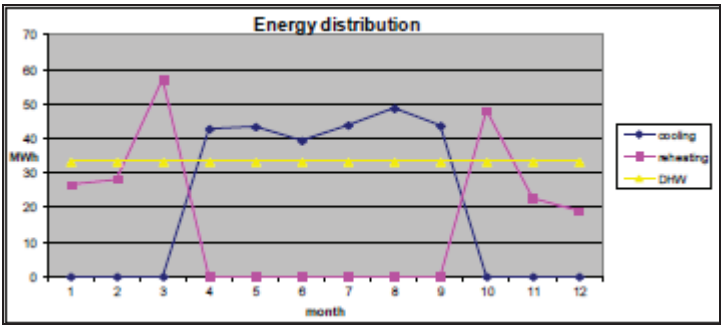
TYPOLOGY AND PROFITABILITY OF EQUIPMENT:

INSTALLATION: 1th QT 2008

CAPACITY [kWtherm]: 845

CAPACITY ABSORPTION CHILLER: 545 kW

MONTHLY TOTAL ENERGY GENERATED



ENERGY DISTRIBUTION

THE TOTAL PRODUCED SOLAR THERMAL ENERGY IS USED LOCALLY.

SUBSTITUTED ENERGY

FORM OF ENERGY: electricity (heat pump and compression chiller)

PRICE ELECTRICITY: 68 [€/MWh]

SOLAR THERMAL PRODUCTION: 978,2 [MWh/year]

SOLAR COVERAGE

The exact total consumption of the building is not known. Thus, the solar coverage can be roughly estimated.

SOLAR COVERAGE:

Cold: 8 %

DHW: 40 %

Reheating: 15 %

Economic Basics

PARAMETERS OF ECONOMIC'S SIMULATION SALE

INTEREST RATE: 6.0%

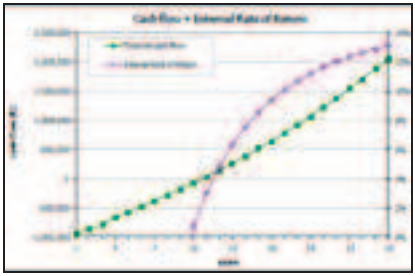
GRANTS: 0 €

MAINTENANCE AND INSURANCE COST: € 6000/year

DEPRECIATION PERIOD: 25 years

SYSTEM'S DEPRECIATION CHARGE: 4 %

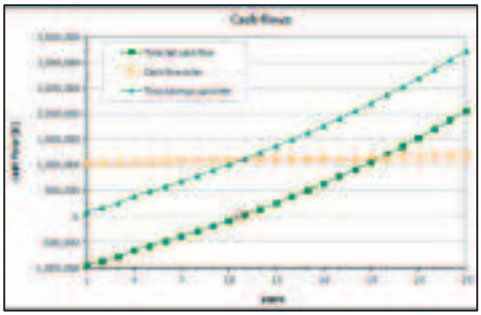
COST INCREASE FUEL: 6 %



PAYBACK TIME: 10.8 years

IRR after 25 years: 13.1 %

A comparison of the two cash flows for solar system (expenses) and electric energy savings results in the "Total net cash flow".



TOTAL ELECTRICITY SAVINGS: 1,252 MWh/year

Lessons Learnt

Solar thermal system shows us following points:

- Efficiency of a combined solar thermal system - cooling & heating;
- The peak of solar radiation and the peak demand of solar cooling match perfectly;
- The solar yield depends strongly on the required temperature level of the application;
- Provided energy is often limited by available collector area;
- Often, a optimization of the existing system is possible by the integration of RES;
- Solar cooling cuts off electricity peaks and saves the most expensive electricity;
- Absorption Chillers have a long life (> 25 years);
- Cooling load reduction (external loads) because of the mounted collectors on the roof;
- Good economy also without grants;
- Easy transferability to other office buildings.

2.1.3. Orgachim

Description of the project

Orgachim Jsc is situated within the territory of the town of Russe.

Orgachim SC is the biggest Bulgarian producer of paints, lacquers, dispersions, alkyd resins, epoxy resins, unsaturated and saturated polyester resins, amino resins, water based resins, maleic anhydride, plasticizers, pigments and other chemicals for machine-building, construction, furniture industry, electronics, processing plastics and other industrial branches. At present, the personnel of the company amount to 515 people. In 2008-2009 and energy efficiency project was developed and implemented with the support of EBRD European Union Energy Efficiency Finance Facility (EUEEFF). The EBRD provides a credit line to Unicredit Bulbank for qualifying projects, according to an Agreement between Unicredit Bulbank and the EBRD. One of the implemented energy saving measures is installation of solar system for domestic hot water (DHW) preparation.

GBE Factory Model

The project envisages a solar water heating installation replacing the existing gas fired boilers. The installation includes: 62 solar collectors with selective roofing of 133.3 m2, the heat exchanger of 150 kW, the pump unit, the pipeline and the auxiliary equipment. The choice of the solar collectors with selective absorbers allows for the solar installation continuous operation, even during cloudy weather conditions, which

increases its overall efficiency. The solar installation is installed on the building's Southern roof slopes.

Quick Facts

LOCATION: 21 Bul. Treti Mart, Russe, Bulgaria

PLANT SIZE (W/C0): 471

TECHNOLOGY/IES: Solar collectors

SITE OWNERSHIP: Orgachim JSC

INVESTOR: Orgachim JSC

PROJECT COST: 31 440 €

KEY PARTNERS: Unicredit Bulbank

CURRENT STATUS: Realized

Design and construction

System Characteristics and Estimated Annual Production of DHW by Solar Collectors

SITE CONDITIONS VALUE UNIT

PROJECT NAME: Installation of a solar system

PROJECT LOCATION: Town of Russe

NEAREST LOCATION FOR WEATHER DATA RUSSE

ANNUAL SOLAR RADIATION (tilted surface): 1.32 MWh/m²

ANNUAL AVERAGE TEMPERATURE: 12.1 °C

ANNUAL AVERAGE WIND SPEED: 4.9 m/s

NUMBER OF MONTHS ANALYSED: 12.0 month

ENERGY DEMAND FOR MONTH ANALYSED: 181.56 MWh

SYSTEM CHARACTERISTICS

APPLICATION TYPE: active with accumulate

SOLAR COLLECTOR TYPE: Select Classic

SOLAR WATER HEATING COLLECTOR MANUFACTURER: NES Ltd

ABSORBER TYPE: copper with Titanium Nitrit Oxide

MODEL: SL/C

AREA PER COLLECTOR 2.15 m^2

FR (TAU ALPHA) COEFFICIENT 0.79 -

WIND CORRECTION FOR FR (tau alpha) 0.00 s/m

FR UL COEFFICIENT 3.56 $(W/m^2)/°C$

WIND CORRECTION FOR FR UL 0.00 $(J/m^3)/°C$

NUMBER OF COLLECTORS 62

TOTAL COLLECTOR AREA 133.30 m^2

FIT and additional benefits

PARAMETERS OF INSTALLATION:

INSTALLED CAPACITY: 471 W/C0

NUMBER OF COLLECTORS: 62

TOTAL COLLECTOR AREA: 133.30 m^2

ELECTRICITY TARIFF: 45 €/MWh

NATURAL GAS TARIFF: 182 €/1000 Nm3

ANNUAL HEAT PRODUCTION: 117.956 MWh.

ANNUAL ELECTRICITY CONSUMPTION FOR PUMPING: 1.050 MWh/yr

ANNUAL NATURAL GAS SAVINGS: 24,000 Nm3/yr

ANNUAL MONETARY SAVINGS: 4 263 €/yr

Economic Basics

CONSUMPTION PARAMETERS

ANNUAL NATURAL GAS CONSUMPTION FOR DOMESTIC HOT WATER - 24,000 Nm3/yr.

ANNUAL NATURAL GAS SAVINGS ANNUAL NATURAL GAS CONSUMPTION FOR DOMESTIC HOT WATER - 24,000 Nm3/yr. (100%).

FINANCING SCHEME

Support of EBRD European Union Energy Efficiency Finance Facility (EUEEFF) – loan from Unicredit Bulbank

Environmental & Economic Sustainability

CARBON EMISSION REDUCTION

From Natural Gas Savings: 44 (tCO2/yr.)

COST BENEFIT ANALYSIS

INVESTMENT: 31 440 €

ANNUAL MONETARY SAVINGS: 4 263 €/yr

INTEREST RATE: 8%

INFLATION RATE: 3.5%

PROJECT LIFE: 10 years

PAYBACK PERIOD: 7,4 years

NPV: 2292

IRR: 6%

COST BENEFIT ANALYSIS WITH 15% GRANT

PAYBACK PERIOD: 6,3 years

NPV: 7008

IRR: 10%

Lessons Learnt

The results of the completed project implementation are:

- reduction of consumption of natural gas by 24,000 Nm3/yr.
- reduction of carbon emission by 44 t/yr.

Use of solar panels for production of DHW is an economically sustainable project. Integration of this kind of projects with other energy saving and renewable energy projects increases their total environmental impact and financial results of the company.

2.1.4. MEGA Engineering Ltd.

Description of the project

Mega Engineering Ltd. specializes in the areas of design, development, implementation, maintenance/service/; complex engineering devices and systems for automation. Since its establishment in 1993 company constantly develops and implements the latest advances in electronics, microprocessors, and automation. Automation systems, implemented by the company comply with European standards and requirements relating to the implementation of the standards of Good Manufacturing Practices "GMP".

GBE Factory Model

The company is a systems integrator that implemented control systems instrumentation – SKIU. Before the project implementation the buildings at MEGA Engineering Ltd are heated with hot water generated by a hot water boiler using light fuel oil as a fuel. The hot water is delivered by circulation pumps via the existing pipelines. The condition of the temperature regimes in the production premises where concentrate workers are is not satisfactory. ERATO Holding Plc has signed a HDC (Heating delivery contract) for thermal energy sales. As a result of the project implementation (fuel switch project) MEGA Engineering Ltd will save 17 tons of light fuel oil or EUR 21,570 annually.

Quick Facts

LOCATION**:** 52 Makedonia Str., Haskovo (Bulgaria)

HEATED SPACE (m3): 3,300 m3

TECHNOLOGY/IES: Biomass heating

SITE OWNERSHIP**:** MEGA Engineering Ltd.

INVESTOR**:** ERATO Holding Plc. (ESCO provider)

PROJECT COST: 35,400 €

KEY PARTNERS: MEGA Engineering Ltd.

CURRENT STATUS: Implemented

Design and construction

The project included production and installation of biomass boiler facilities, including biomass hot water boiler, wood chips warehouse, system for feeding of chips into the boiler chamber, ash cleaning system, exhausted gases cleaning system and PLC control system. Commissioning test and start-up were also implemented. The hot water is transported through pipe network with diameter 100 mm to the local substation. From the substation the hot water is transported to the radiators in the plant's premises.

TECHNICAL DETAILS:

TOTAL SURFACE (m2): 1,222

BOILER CAPACITY (kWth): 80

TOTAL ANNUAL ENERGY (kWhth/yr.) 77,440

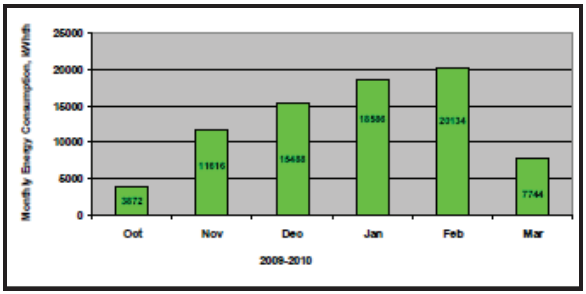
BOILER EFFICIENCY (%): 92

HOT WATER TEMPERATURE (oC): 80

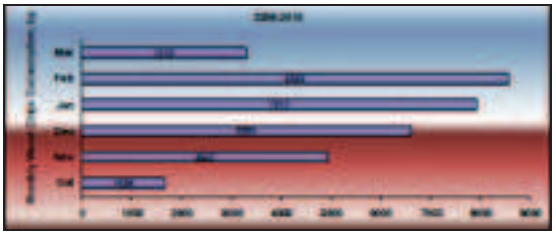
WOOD CHIPS CONSUMPTION (t/yr.): 33

WOOD CHIPS CALORICITY (kWh/kg): 2.56

MONTHLY TOTAL THERMAL ENERGY GENERATED



MONTHLY WOOD CHIPS CONSUMPTION



After the project completion the building at MEGA Engineering Ltd is heated by high efficient biomass energy boiler using ecological fuel in the type of wood chips. The wood chips with humidity up to 45% are produced by wood creeper with capacity of 12 m3/h. The generated thermal energy is distributed to the consumers through an insulated pipe network.

FIT and additional benefits

PARAMETERS OF INSTALLATION:

PROJECT DESIGN PREPARATION: February, 2009

DELIVERY AND INSTALLATION OF EQUIPMENT: April, 2009

BOILER HOUSE CONSTRUCTION: May, 2009

COMMISSIONING TEST AND START UP: July, 2009

PROJECT COMPLETION: August, 2009

THERMAL POWER (KWTH): 80

THERMAL ENERGY PRICES (€/KWTH): 0.142

Economic Basics

An energy audit and business plan were prepared. The technical and financial calculation of ESCo operation has been made. The ERATO Holding Plc offers to the management of MEGA Engineering Ltd ESCo operation through energy contracting for selling of thermal energy. This energy is measured through a certified gauge.

CONSUMPTION PARAMETERS

COSTUMER'S ENERGY COST (€/KWHTH): 0.142

THERMAL POWER (KWTH): 80

CONSUMPTION TE (KWHTH/YR.): 71,245

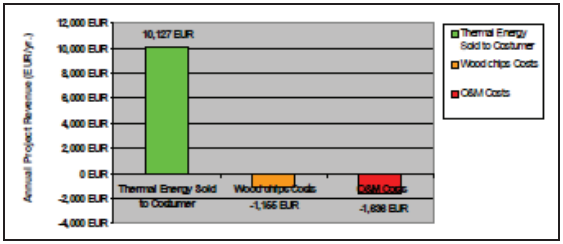
ANNUAL PROJECT REVENUES

THERMAL ENERGY SOLD TO CUSTOMERS (€/yr.): 10,127

WOOD CHIPS COSTS (€/YR.): 1,155

O&M COSTS (€/YR.): 1,636 approx.

CASH REVENUES (€/YR.): 7,336



FINANCIAL SCHEME

BASE PROJECT COSTS (€): 35,400

DEBT (€): 31,860

EQUITY (€): 3,540

INFLATION INDEX (%): 4.5

FIXED DISCOUNT RATE (%): 7

IRR (%): 18.3

NPV (EUR): 46,020

PAYBACK PERIOD (YR.): 5.45

BIOMASS BOILER

The biomass energy boiler with thermal capacity of 80kW and the auxiliary process equipment are installed into boiler room. The fuel feeding system and used biomass fuel are situated in the feel storage. The biomass hot water boiler is compact one, made of steel, panel with control devices, and is equipped with an automated fuel feeding device for wood chips or wood pellets and fire safety system.

TECHNICAL PARAMETERS:

A system for automated regulation of the heat supply is also installed. The installation into the energy cabin includes also circulating pumps, expander, multicyclone, isolated pipes, valves, thermostats and C&I. Furthermore, a chimney for the separation of the exhausted gases will be constructed.

The hot water biomass boiler is using for burning of wood chips and wood pellets. These biomass energy boilers are suitable for heating and DHW preparation in the public building, industrial facilities, hotels and greenhouses.

Nominal Thermal Power	Efficiency	Diameter of chimney	Hopper capacity	Weight	Length	High	Width
kW	%	mm	l	kg	mm	mm	mm
80	92	200	450	550	2200	1330	700

Environmental & Economic Sustainability

Determination of the annual emissions of CO2 and of other noxious gases is according to Commission Decision of 21.01.2004 establishing guidelines for the monitoring and reporting of Greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. The emissions factors elaborated by the MOEW (Methodology for calculation of emissions of noxious substances (pollutants) released into the environment based on balance methods) have been used for the CO2 and other noxious gases emissions assessment.

The CO2 emissions will decrease by 47 tons in 2010 and for the period 2010 - 2014 they will decrease by 234 tons, as a result of the project implementation.

Emissions Characteristics		2010	2011	2012	2013	2014	Total
Light Fuel Oil Savings	t/yr	17	17	17	17	17	85
Light Fuel Oil Savings	GJ/yr.	676	676	676	676	676	3383
CO2 emissions factor for LFO	tCO2/GJ	0.0702	0.0702	0.0702	0.0702	0.0702	
CO2 emissions reduction from LFO savings		47	47	47	47	47	237
LFO for biomass transportation	t/yr	0.20	0.20	0.20	0.20	0.20	1
CO2 emissions factor for transportation	tCO2/t	3.14	3.14	3.14	3.14	3.14	
CO2 emission Reduction from transportation	tCO2/yr.	-0.6	-0.6	-0.6	-0.6	-0.6	-3
Carbon emissions reduction	tCO2/yr.	47	47	47	47	47	234

The project is characterized with economical sustainability.

PROJECT REVENUES:

		2010	2011	2012	2013	2014
Energy						
Thermal Energy Sold to customers	kWh/yr.	71,245	71,245	71,245	71,245	71,245
Wood chips	t/yr.	33	33	33	33	33
O&M Costs	EUR/yr.	1,072	1,072	1,072	1,072	1,072
Tariffs						
Thermal Energy Sold to customers	EUR/kWh	0.142	0.142	0.142	0.142	0.142
Wood chips	EUR/t	35	35	35	35	35
Total Project Revenues						
Thermal Energy Sold to customers	EUR/yr.	10,127	10,127	10,127	10,127	10,127
Wood chips	EUR/yr.	-1,155	-1,155	-1,155	-1,155	-1,155
O&M Costs	EUR/yr.	-1,636	-1,636	-1,636	-1,636	-1,636
Gross Profit	EUR/yr.	**7,336**	**7,336**	**7,336**	**7,336**	**7,336**

The construction of the biomass energy facilities will improve the working conditions of the operating personnel in MEGA Engineering Ltd. The operation is characterized by a lower noise level, better hygiene and decreased risks of failure.

Lessons Learnt

The proposed ESCO business scheme of ERATO Holding Plc will lead to the proven economic and ecological benefits to MEGA Engineering Ltd. The implemented fuel switch project is very efficient; the generated thermal energy is high quality and this energy is sold to the customer at an appropriate price.

The data analysis shown that this project is bankable with a very good investment return.

2.1.5. ECOTHERM Project Ltd.

Description of the project

ECOTHERM Project Ltd is research and development organization with core business activities connected with the development of prototypes, testing and measurement of heating equipment and implementation of new products in the market in Bulgaria and EU. ECOTHERM Project Ltd has a large building in which is situated biomass training center with offices and conference room for the training of salespeople and installers of biomass heating equipment. There is also heating laboratory and large warehouse in the biomass training center.

GBE Factory Model

The biomass training center was constructed in 2008. The separate premises and warehouse of ECOTHERM Project Ltd are heated with hot water generated by a hot water boiler with thermal capacity of 300kW, using light fuel oil as a fuel. The condition of the temperature regimes in the production premises where concentrate expert, operational staff and trainees was not satisfactory.

ERATO Holding Plc has signed a HDC (Heating delivery contract) for thermal energy sales. As a result of the project implementation (fuel switch project) ECOTHERM Project Ltd will save 33 tons of light fuel oil or EUR 45,215 annually.

Quick Facts

LOCATION: Ring-road, Haskovo (Bulgaria)

HEATED SPACE (m3): 7,290 m3

TECHNOLOGY/IES: Biomass heating

SITE OWNERSHIP: ECOTHERM Project Ltd.

INVESTOR: ERATO Holding Plc. (ESCO provider)

PROJECT COST: 108,120 €

KEY PARTNERS: ECOTHERM Project Ltd.

CURRENT STATUS: Implemented

Design and construction

The project included construction of biomass boiler plant, including biomass hot water boiler, wood chips warehouse, system for feeding of chips into the boiler chamber, ash cleaning system, exhausted gases cleaning system and PLC control system. Commissioning test and start-up were also implemented. The hot water is transported through a pipe network with length of 400 m and diameter of 150 mm to the local substation. From the substation the hot water is transported to the radiators and convertors in the biomass training center.

<u>TECHNICAL DETAILS:</u>

TOTAL SURFACE (m2): 2,700

BOILER CAPACITY (kWth): 300

TOTAL ANNUAL ENERGY (kWhth/yr.) 290,400

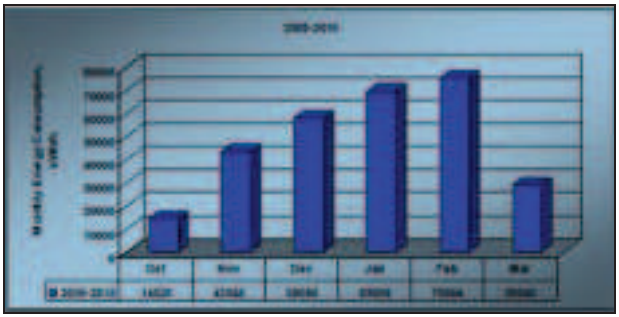
BOILER EFFICIENCY (%): 88

HOT WATER TEMPERATURE (oC): 90

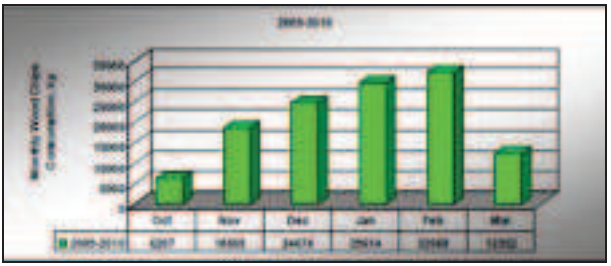
WOOD CHIPS CONSUMPTION (t/yr.): 123

WOOD CHIPS CALORICITY (kWh/kg): 2.56

MONTHLY TOTAL THERMAL ENERGY GENERATED



MONTHLY WOOD CHIPS CONSUMPTION



After the project implementation the building of ECOTHERM Project Ltd is supplied by hot water for heating through automatic biomass energy boiler using wood chips. The wood chips with humidity up to 45% are produced by wood creeper with capacity up to 15 m3/h. The generated thermal energy is distributed to the consumers through constructed pipe network.

FIT and additional benefits

PARAMETERS OF INSTALLATION:

PROJECT DESIGN PREPARATION: January, 2009

DELIVERY AND INSTALLATION OF EQUIPMENT: March, 2009

BOILER HOUSE CONSTRUCTION: May, 2009

COMMISSIONING TEST AND START UP: July, 2009

PROJECT COMPLETION: August, 2009

THERMAL POWER (kWth): 300

THERMAL ENERGY PRICES (€/kWth): 0.142

Economic Basics

ERATO's staff has a prepared business plan. The technical and financial calculation of ESCO operation has been made. The ERATO Holding Plc offers to the management of ECOTHERM Project Ltd ESCO operation through energy contracting for selling of thermal energy. This energy is measured through a certified gauge.

CONSUMPTION PARAMETERS

COSTUMER'S ENERGY COST (€/kWhth): 0.142

THERMAL POWER (kWth): 300

CONSUMPTION TE (Kwhth/yr.): 255,552

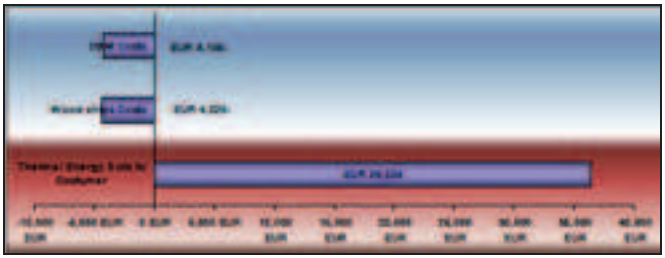
ANNUAL PROJECT REVENUES

THERMAL ENERGY SOLD TO CUSTOMERS (€/yr.): 36,324

WOOD CHIPS COSTS (€/yr.): 4,320

O&M COSTS (€/yr.): 4,100 approx.

CASH REVENUES (€/yr.): 27,905



FINANCIAL SCHEME

BASE PROJECT COSTS (€): 108,120

DEBT (€): 97,308

EQUITY (€): 10,812

INFLATION INDEX (%): 4.5

FIXED DISCOUNT RATE (%): 7

IRR (%): 25.4

NPV (EUR): 151,368

PAYBACK PERIOD (YR.): 4.4

BIOMASS PLANT

The biomass boiler plant use wood chips as a fuel. The wood chips are stored in a separate warehouse, located next to the biomass boilers. The

wood chips are fed automatically from the warehouse to the Boiler hopper by screw conveyor with length of 4 m.

From the boiler hopper the biomass is transported in the boiler chamber by internal screws. The combustion of wood chips takes place in the burning chamber. On the display of the control panel it is Possible to read the current boiler output, load and all other relevant parameters. The control panel is fitted with PLC control.

The hot water by the heat accumulator with a temperature of 90C is transported to the distributing water collector by means of circulating pump. The heating units in the rooms are supplied with hot water from the distributing water collector. A returned water collector collects the water used by the heating units that has a temperature of 70 C. The water is fed from the returned collector into the water heating boiler by means of a circulating pump.

TECHNICAL PARAMETERS

Nominal Thermal Power	Fuel Consumption	Maximum Fuel Humidity	Maximum Water Temperature	Maximum Water Pressure	Water Capacity	Length	Height	Width
(kW)	(kg/h)	(%)	(°C)	(MPa)	(l)	(mm)	(mm)	(mm)
300	132	45	90	0.25	1,310	5,100	3,150	1,500

All facilities of the boiler station are equipped with control and safety valves as well as with control, measuring and automated devices.

Environmental & Economic Sustainability

Determination of the annual emissions of CO2 and of other noxious gases is according to Commission Decision of 21.01.2004 establishing guidelines for the monitoring and reporting of Greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. The emissions factors elaborated by the MOEW (Methodology for calculation of emissions of noxious substances (pollutants) released into the environment based on balance methods) have been used for the CO2 and other noxious gases emissions assessment.

The CO2 emissions will decrease by 87 tons in 2010 and for the period 2010 - 2014 they will decrease by 436 tons, as a result of the project implementation.

Emissions Characteristics		2010	2011	2012	2013	2014	Total
Light Fuel Oil Savings	t/yr	33	33	33	33	33	165
Light Fuel Oil Savings	GJ/yr.	1313	1313	1313	1313	1313	6564
CO2 emissions factor for LFO	tCO2/GJ	0.0702	0.0702	0.0702	0.0702	0.0702	
CO2 emissions reduction from LFO savings		92	92	92	92	92	461
LFO for biomass transportation	t/yr.	1.55	1.55	1.55	1.55	1.55	8
CO2 emissions factor for transportation	tCO2/t	3.14	3.14	3.14	3.14	3.14	
CO2 emission Reduction from transportation	tCO2/yr.	-4.9	-4.9	-4.9	-4.9	-4.9	-24
Carbon emissions reduction	tCO2/yr.	87	87	87	87	87	436

The ESCO project is characterized with economical sustainability.

PROJECT REVENUES:

		2010	2011	2012	2013	2014
Energy						
Thermal Energy Sold to customers	kWh/yr	255.552	255.552	255.552	255.552	255.552
Wood chips	t/yr	123	123	123	123	123
O&M Costs	EUR/yr	4.100	4.100	4.100	4.100	4.100
Tariffs						
Thermal Energy Sold to customers	EUR/kWh	0.142	0.142	0.142	0.142	0.142
Wood chips	EUR/t	35	35	35	35	35
Total Project Revenues						
Thermal Energy Sold to customers	EUR/yr	36.324	36.324	36.324	36.324	36.324
Wood chips	EUR/yr	-4.320	-4.320	-4.320	-4.320	-4.320
O&M Costs	EUR/yr	-4.100	-4.100	-4.100	-4.100	-4.100
Gross Profit	EUR/yr	27.905	27.905	27.903	27.903	27.903

The construction of the biomass energy facilities will improve the comfort conditions of the operating personnel in ECOTHERM Project Ltd. The operation is characterized with a lower noise level, better hygiene and decreased risks of failure.

Lessons Learnt

The proposed ESCO business model of ERATO Holding Plc will lead to the proved economic and ecological benefits to ECOTHERM Project Ltd. The implemented fuel switch project is very efficient; the generated thermal energy is with high quality and this energy is sold to the customer on appropriate price. The data analysis shown that this project is bankable with very good returning of investment cost.

2.1.6. RODOPI Kardjali Plc.

Description of the project

RODOPI Kardjali Plc was founded in 1959 first as "Rodop" printing house and has been bringing the traditions since that time of "mettre-en-page" and typesetting. The company has the capacity to provide collared printing of brochures, catalogues, leaflets, calendars, paper and cardboard packaging. RODOPI Kardjali Plc works with a wide range of paper for the requirements of its customers. The factory uses new computer technologies and they have recently started in the polygraph business the printing house started working with computers for the preparation of the printer's activity and they also bought large-format six-color printer.

GBE Factory model

The production workshops of RODOPI Kardjali Plc are located in a two-storey brick building with a total heating volume of 3,800 m3. Cast-iron radiators, connected to two service pipes are mounted in the workshops. The boiler heating facility uses wood waste as a fuel for the production of thermal energy. ERATO Holding Plc has signed a HDC (Heating delivery contract) for thermal energy sales. As a result of the project implementation RODOPI Kardjali Plc will save 11 tons of light fuel oil or EUR 15,350 per year.

Quick Facts

LOCATION**:** 50 Republikanska Str., Kardjali (Bulgaria)

HEATED SPACE (m3): 3,800 m3

TECHNOLOGY/IES: Biomass heating

SITE OWNERSHIP: RODOPI Kardjali Plc.

INVESTOR: ERATO Holding Plc. (ESCO provider)

PROJECT COST: 25,800 €

KEY PARTNERS: RODOPI Kardjali Plc.

CURRENT STATUS: Implemented

Design and construction

The heating boiler facility uses wood logs with a humidity of 20% as fuel for the production of thermal energy. A water heating boiler Atmos DC 100 with a unit heat capacity of 99 kW is mounted in the boiler room. The boiler is designed for pyrolysis burning of wood logs with a high efficiency in the combustion process - 80%. The hot water produced by the boiler with a temperature of 80 C is supplied to the production workshops by means of a circulating pump Grundfos UPS 32/80. The return water from workshops with a temperature of 60 C is fed into the water heating boiler. All facilities of the boiler room are equipped with control and safety valves as well as with control, measuring and automated devices.

<u>TECHNICAL DETAILS:</u>

TOTAL SURFACE (m2): 1,407

BOILER CAPACITY (kWth): 99

TOTAL ANNUAL ENERGY (kWhth/yr.) 95,832

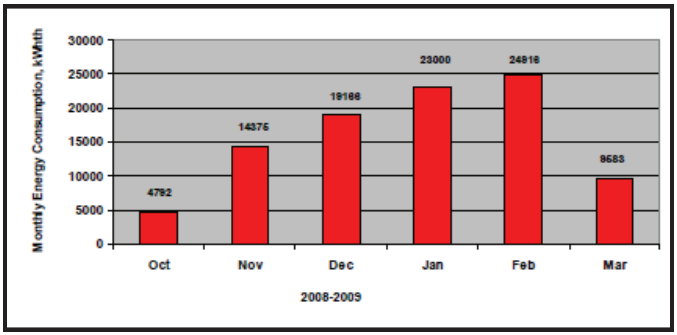
BOILER EFFICIENCY (%): 80

HOT WATER TEMPERATURE (oC): 80

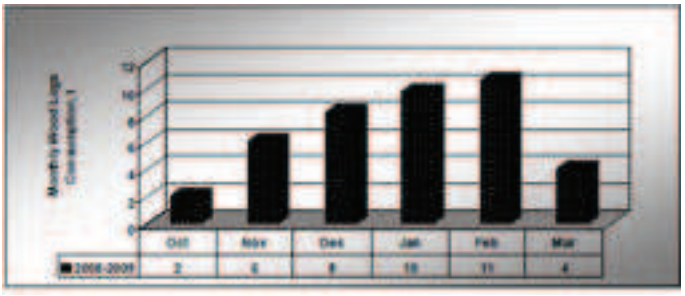
WOOD LOGS CONSUMPTION (t/yr.): 41

WOOD LOGS CALORICITY (kWh/kg): 3.00

MONTHLY TOTAL THERMAL ENERGY GENERATED



MONTHLY WOOD LOGS CONSUMPTION



After the project implementation the production workshops of RODOPI Kardjali Plc is supplied by hot water for heating through boiler using wood logs. The wood logs with humidity up to 20% are delivered to the boiler warehouse.

FIT and additional benefits

PARAMETERS OF INSTALLATION:

PROJECT DESIGN PREPARATION: March, 2008

DELIVERY AND INSTALLATION OF EQUIPMENT: April, 2008

BOILER ROOM RECONSTRUCTION: May, 2008

COMMISSIONING TEST AND START UP: June, 2008

PROJECT COMPLETION: August, 2008

THERMAL POWER (kWth): 99

THERMAL ENERGY PRICES (€/kWth): 0.123

Economic Basics

ERATO has prepared an energy audit and business plan. The technical and financial calculation of ESCO operation has been made. The ERATO Holding Plc offers to the RODOPI Kardjali Plc ESCO operation through energy contracting for the selling of thermal energy. This energy is measured through a certified gauge.

CONSUMPTION PARAMETERS

CUSTOMER'S ENERGY COST (€/kWhth): 0.123

THERMAL POWER (kWth): 99

CONSUMPTION TE (kWhth/yr.): 76,666

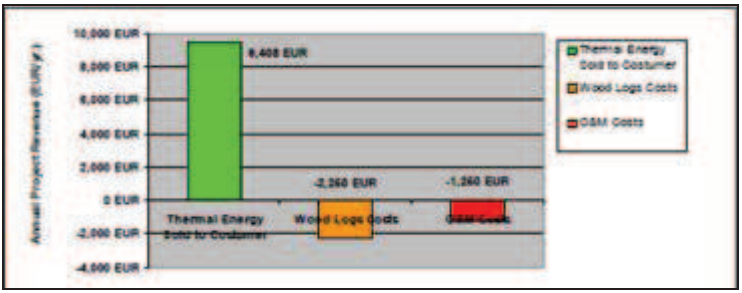
ANNUAL PROJECT REVENUES

THERMAL ENERGY SOLD TO CUSTOMERS (€/yr.): 9,408

WOOD LOGS COSTS (€/yr.): 2,250

O&M COSTS (€/yr.): 1,250 approx.

CASH REVENUES (€/yr.): 5,908



FINANCIAL SCHEME

BASE PROJECT COSTS (€): 25,800

DEBT (€): 23,220

EQUITY (€): 2,580

INFLATION INDEX (%): 4.5

FIXED DISCOUNT RATE (%): 7

IRR (%): 20.1

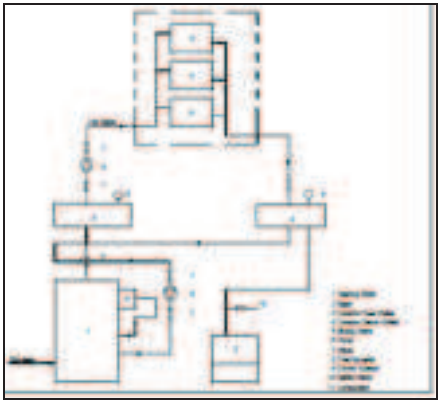
NPV (EUR): 33,540

PAYBACK PERIOD (YR.): 4.9ù

BOILER ROOM

The biomass boiler uses wood logs as a fuel. The wood logs are stored in a separate warehouse, located next to the boiler room. RODOPI Kardjali Plc has bought the produced thermal energy for heating of the production

workshops by the seller company – ERATO Holding Plc. The preparation of the total invoice for the users is done based on the actual consumed amount of thermal energy, measured by certified technical devise.



TECHNICAL PARAMETERS

Nominal Thermal Power	Efficiency	Fuel Consumption	Chamber capacity	Weight	Length	High	Width
kW	%	kg/h	dm3	kg	mm	mm	mm
99	80	26	400	780	1,120	1,530	980

All facilities of the boiler room are equipped with control and safety valves as well as with control, measuring and automated devices.

Environmental & Economic Sustainability

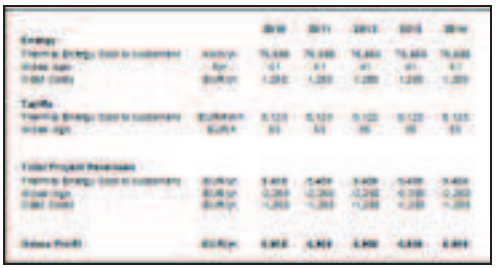
Determination of the annual emissions of CO2 and of other noxious gases is according to Commission Decision of 21.01.2004 establishing guidelines for the monitoring and reporting of Greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. The emissions factors elaborated by the MOEW (Methodology for calculation of emissions of noxious substances (pollutants) released into the environment based on balance methods) have been used for the CO2 and other noxious gases emissions assessment.

The CO2 emissions will decrease by 8 tons in 2010 and for the period 2010 - 2014 they will decrease by 39 tons, as a result of the project implementation.

Emissions Characteristics		2010	2011	2012	2013	2014	Total
Light Fuel Oil Savings	ltr	11	11	11	11	11	55
Light Fuel Oil Savings	GJ/yr	116	116	116	116	116	579
CO2 emissions factor for LFO	tCO2/GJ	0.0702	0.0702	0.0702	0.0702	0.0702	
CO2 emissions reduction from LFO savings		8	8	8	8	8	41
LFO for biomass transportation	ltr	0.12	0.12	0.12	0.12	0.12	1
CO2 emissions factor for transportation	tCO2/t	3.14	3.14	3.14	3.14	3.14	
CO2 emission Reduction from transportation	tCO2/yr	-0.4	-0.4	-0.4	-0.4	-0.4	-2
Carbon emissions reduction	tCO2/yr	8	8	8	8	8	39

The implemented ESCO project is characterized with economical sustainability.

PROJECT REVENUES:



The construction of the biomass energy facilities will improve the waking conditions of the company staff in RODOPI Kardjali Plc. The operation is characterized by a lower noise level, better hygiene and decreased risks of failure.

Lessons Learnt

The proposed Heating Delivering Contract (HDC) through ESCO business scheme of ERATO

Company will lead to the proved economic and ecological benefits to RODOPI Kardjali Plc. The implemented fuel switch project is very efficient; the generated thermal energy is of a high quality and this energy is sold to the customer at a proportional price.

The data analysis shown that this project is viable with very good return on the cost of the original investment.

2.1.7. Ebm-papst Mulfingen GmbH & Co.

Description of the project

The Ebm-papst Mulfingen GmbH & Co. KG is a producer of fans and motors, blowers and pumps. When they planned a new branch in Mulfingen, they took issues like RES, energy efficiency and climate protection into consideration right from the beginning.

The company addressed different questions concerning renewable energy sources, climate protection and the use of waste-heat.

The company installed solar panels, a heat pump, an innovative ventilation system and took measures to utilize the waste heat. The company also installed a storage system for heat that is coupled with the heat pump.

The heat pump is also used to cool the building if the outside-temperature is above 24 degree.

Quick Facts

LOCATION: Hollenbach/ Germany

PLANT SIZE (kwe;kwt): photovoltaic: 153 kWp

TECHNOLOGY/IES: heat pump, photovoltaic panels, utilization of waste heat, innovative ventilation system with EC fans.

SITE OWNERSHIP: Ebm-papst Mulfingen GmbH & Co. KG.

INVESTOR: Ebm-papst Mulfingen GmbH & Co. KG

PROJECT COST: 1 m Euro

KEY PARTNERS: N/ A

CURRENT STATUS: Realized

Design and construction

- Installation of a heat pump with a coefficient of performance (COP) > 4
- Utilization of industrial waste heat of the machinery
- Installation of a 153 kWp-solar power-plant
- Optimization of the heat distribution
- Installation of pumps heating and cooling pumps of the energy-efficiency class A, utilization of energy-saving ventilation systems.

FIT and additional benefits

ENERGY COSTS SAVED PER YEAR: 87. 485 Euro

ENERGY SAVED TOTAL: 91 %

ELECTRICITY SAVED: 19 %

THERMAL ENERGY SAVED: 99 %

ROI ON THE ADDITIONAL COSTS FOR EFFICIENCY MEASURES: 146 %

(estimation on the basis of fixed prices on energy (oil/ electricity))

Environmental & Economic Sustainability

When the company decided to build a new production facility in Hollenbach, the aim was to cover the complete heating needs of the facility (750.000 kWh/ year for the five separate buildings, 13600 m2 altogether).

One key element was to use the industrial waste heat that is emitted by the machinery, robots and compressors.

A suppression ventilation system was installed that uses the waste heat/ high temperatures under the roof of the hall. This heat/ warm air can be used to heat the other buildings (e. g. buildings with not so much heat-emitting machinery like the canteen or the incoming goods department). Excess heat is stored in an 11.000 hl sprinkler tank. This tank is also used as a heat sink for the heat pump. If the outside temperature is above 24 degree, the buildings are cooled with the heat pump.

In comparison to a conventional system the consumption of electricity decreased by 19% and that of thermal energy by 99 %.

Lessons Learnt

This is a very interesting solution for a manufacturing company because different renewable energy sources and energy efficiency measures are combined, with a clear focus on heating issues.

This model also includes obvious RES like photovoltaic or heat-pumps with energy sources that are less common like the well thought out use of industrial waste heat and the possibility to store the heat on a large scale with the sprinkler tank.

Another interesting feature is the combination of the different needs and possibilities of the buildings and their interconnection.

CO2 emissions were reduced from 340 tons to 43 tons a year.

2.1.8. SOLON Corporate Headquarter

Description of the project

SOLON is a leading producer of Solar PV systems, and dedicated to the principles of sustainable production and consumption and consequent use of renewable energy sources. The company's newly constructed corporate headquarters, joining administration and production under one roof, is a display of those principles as well as the company's constant striving for innovation. Architects and designers have worked closely together to create a smart, efficient, and highly productive building with a flexible, positive, and energizing environment for the people within.

Gbe Factory Model

Reducing energy demand to ¼ of that in similar buildings was a key demand as was to maximize generation on-site while the users' comfort is central. An integrated design and implementation process results in a positive energy balance where total production exceeds consumption.

Quick Facts

LOCATION: Am Studio 16, 12489 Berlin (Germany)

PLANT SIZE (kwe;kwt): PV: 210 kWp

BIOGAS COGENERATION UNIT: 530 kWth, 230 kWel

TECHNOLOGY/IES: Biogas Cogeneration, Solar PV, wireless communication technology, monitoring

SITE OWNERSHIP: SOLON SE

INVESTOR: SOLON SE

PROJECT COST: 47.000.000 €

KEY PARTNERS: EGS Plan GmbH Stuttgart

Design and construction

Design was guided by the goals of achieving a low heat load and primary energy demand, high energy production and flexible working space.

ENERGY EFFICIENCY

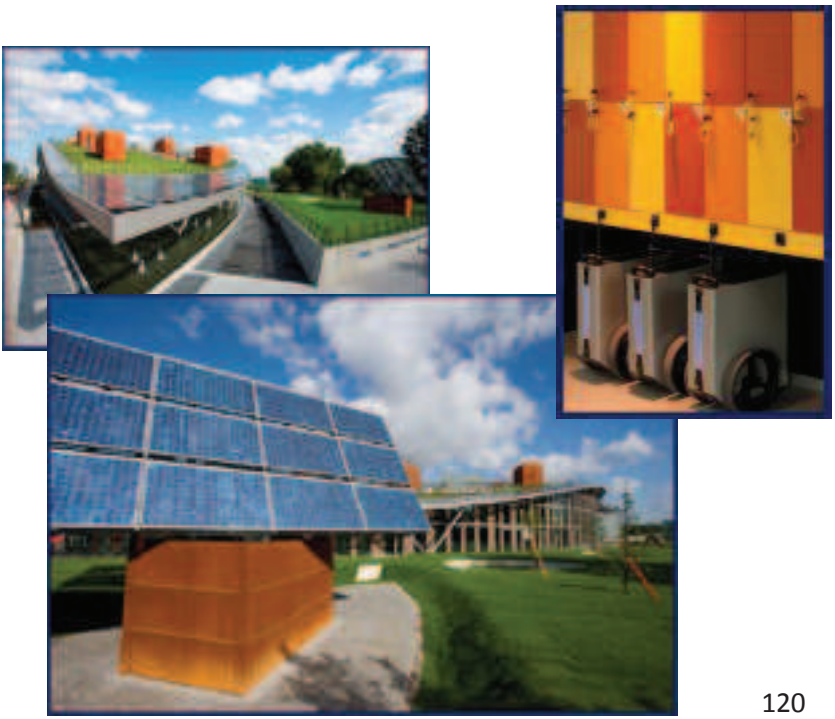
For the façade, pre-manufactured panels were developed. Triple glazing provides powerful insulation. Optimal sun protection is achieved by means of external shading devices and radiation control glazing. Great attention was paid to the possibility of natural ventilation via windows. Further, small radiators are part of the panel. The high-tech envelope has excellent insulating qualities, is made of quality and durable materials. (main: glass, wood and steel).

Electricity needs are supported by a building-integrated photovoltaic system with 210 kWp while a biogas cogeneration unit provides base loads of both heat and electricity, including supply for an absorption cooling machine in the summer. The demand for heating and cooling across the building is achieved with a simple but effective technology, concrete core activation: water pipes are integrated into the concrete ceilings/floors. In

this manner 80% of the heating demand of ca. 25 kWh/m2 net floor area and 85% of the cooling demand (ca 30kWh/m2 net floor area) are covered. The remaining part is covered via convectors. The positioning of the building allows optimum use of natural lighting, but it is complimented by low general and targeted work space lighting.

Building Automation. The building is equipped with innovative control system. Users control their work space comfort via touchpad and PC, while a system of wireless sensors monitor overall conditions, ensuring operations optimization.

E-mobility: A special feature and showing the integral approach are the eight company-owned electric scooters, fuelled by the PV system.



FIT and additional benefits

PARAMETERS:

POWER (kWp):

SOLAR PV 210 kWp

BIOMASS COGENERATION: 530 kWth, 230 kWel

FEED-IN-TARIFF PV (€/kWh): 0.4398

FEED-IN-TARIFF ELECTRICITY FROM BIOMASS CO-GENERATION (€/kWh): 0.0967

Economic Basics

The decision on following an integral concept is a display of the company's values and striving for innovation, a statement and demonstration of possibilities for future workspace organization today. The building is also part of an RTD project, a living laboratory for further progress and innovation for tomorrow's buildings.

FEATURES BUILDING ENVELOPE

U-value of exterior walls 1.20

U-value window (including frame) 1.20

U-value roof 0.23

U-value roof lights (including frame) 1.60

U-value of basement ceiling / floor plate 0.30

Average U-value of the building envelope 0.75

Construction: Hybrid medium-duty construction

NETWORK INFRASTRUCTURE AND ENERGY

Electricity network infrastructure, local district heating network, Building integrated Solar PV system.

SOLUTION STRATEGIES AREAS CONCEPT

Integrated planning, mechanical ventilation, vacuum insulation, combined heat and power using biogas, district heating network, own power supply, investment in biogas plant, Photovoltaic, quality assurance and operational optimization.

CONSUMPTION CHARACTERISTICS (2009) In kWh/m2

Heat energy consumption/demand measured 26, 60

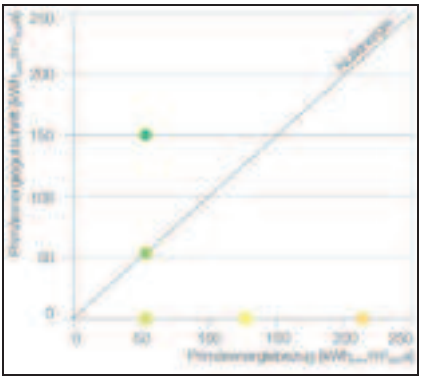
Water heating /demand 13.40

Final energy heat (incl. hot water) 69.09 / (40.00)

Electricity consumption / demand 42.91

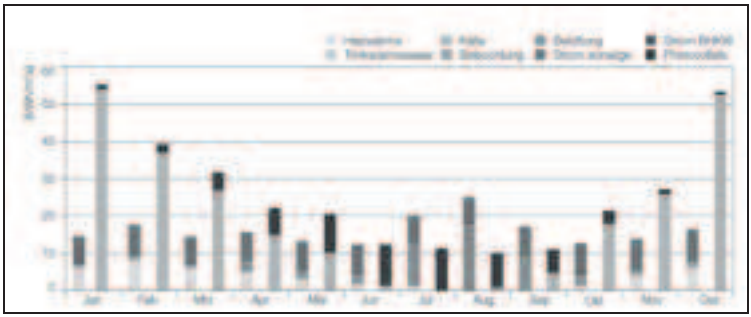
Primary energy consumption total 98.36

Primary energy feed-in 83.06



The dark green dot shows the overall energy balance is positive, providing more energy than is consumed.

MONTHLY ENERGY BALANCE



Environmental & Economic Sustainability

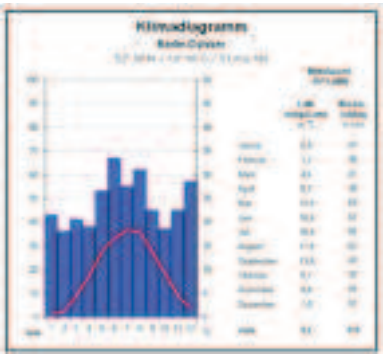
LOCATION PARAMETRES

LOCATION: Berlin, Germany

ANNUAL GLOBAL RADIATION: 1050 kWh/m2a

ANNUAL MEAN TEMPERATURE: 9,3 °C

ENVIRONMENT: urban



ENVIRONMENTAL PARAMETERS

The solar PV produces approximately 258.000 kWh of electricity per annum, the biogas co-generation unit with its 530 kWth contributes 100% district heating based on renewable sources.

The total amount of CO2 avoided ranges between 600.000 and one million tons per year.

Lessons Learnt

With the early set up of an interdisciplinary planning team and a careful analysis of the design, functional and organizational and technical possibilities, an optimal concept was developed. After nearly one year of intensive fine tuning and adjustments, the building is now under normal operation. It displays its qualities in terms of comfort and energy efficiency not only through test measurements, but also from the employees' feedback.

2.1.9. SMA Solar Technology AG

Description of the project

The SMA Solar Technology AG, a leading solar inverter producer, has in 2009 inaugurated the Solar Plant 1, a new production hall with a CO2-neutral energy concept. Every day up to 4000 solar inverters of different sizes and types can be produced, making it the currently largest factory of its kind. While not a fully self-sufficient energy supply, the model of the factory is linking regional availability of renewable energy sources with its own production in a highly efficient and symbiotic manner.

A four-gigawatt production capacity spread over 18,000 square meters of floor space based on a CO2 neutral concept with:

- PV system of 1,2 MW peak;
- Biogas co-generation unit;
- Heat recovery (compressed air);
- District heating, 98,5 % via co-generation;
- 100 % renewable energy use.

Quick Facts

LOCATION: Sonnenallee 1, 34266 Niestetal, Germany

PLANT SIZE (kwe;kwt): 1,2 MW (PV)

TECHNOLOGY/IES: Photovoltaic, Co-generation

SITE OWNERSHIP: SMA Solar Technology AG

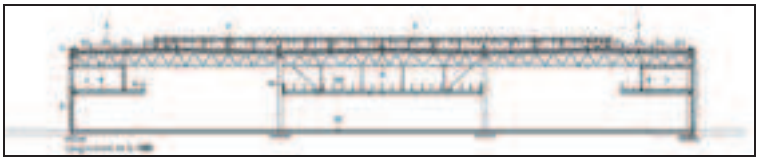
INVESTOR: SMA Solar Technology AG

PROJECT COST: 9.500.000 €

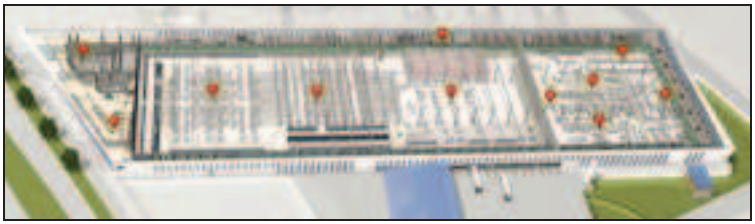
KEY PARTNERS: EGS Plan GmbH Stuttgart

CURRENT STATUS: Realized

Design and construction



Design was guided by the principles of minimizing the energy demand and CO2 neutralization via full use of renewable energy sources. High flexibility for the production was another demand. Assembly lines can be changed within hours. The energy and building technology follows suit equally open to various uses.



The building shell of the factory conforms to low-energy-building standards while cutting-edge technology ensures the optimum use of locally supplied biogas for heating and electric generation. PV generated electricity is fed on the low wastage side of the grid, and either used in-house or fed into the grid.

CO2 neutralization involves drawing renewable electricity from the public utility and combining the heat and power of the neighboring waste incineration plant with the refined biogas obtained from two regional installations in the internal co-generation unit. Another source of heat is an electric compressor, whose waste heat is recycled into the ventilation system, for example in cases of maintenance of other systems. A condensing boiler is only used as a back-up.

Cooling is generated in two ways. An absorption cooling machine uses the perpetual heat of the biogas plant to drive its cooling system. A vapor-compression system is powered by electricity and functions in the same way as a commercial air conditioning unit. The high lux needs (1000) were responded to by using particularly efficient technologies and control for lighting.

FIT and additional benefits

PARAMETERS OF PV INSTALLATION:

POWER (kWp): 1,2 MW

FEED-IN-TARIFF (€/kWh): 0.3448

(Installation larger than 1 MW and operational since 2009)

Economic Basics

The decision on the new factory with a climate neutral energy concept is to demonstrate the company's climate stewardship, and is more than an investment in a new production site.

INVESTMENT AND ROE

ENERGY & BUILDING TECHNOLOGY COSTS:

- Ca. €9.500.000 ;
- Total Investments ca €10.200.000;
- Return on capital employed more to achieve efficiency levels: 21%.

GENERATION PARAMETERS

- Heat load 670 kW;
- Cooling load 1525 kW;
- Biogas-Co-generation 350 kWth, 225 kWel;
- Heat recovery compressed air 105 kW;
- District Heating 1600 kW;
- Gas-condensing boiler (back-up) 310 kW;
- Absorption cooling machine 270 kW;
- Vapor-compression system 2x 670 kW.

ENERGY DEMAND & CONSUMPTION

- Heat load 670 kW
- Cooling load 1525 kW
- Annual energy costs: ca. 536.000 €
- Annual Electricity consumption:
- 5.200.000 kWh
- Annual fuel consumption (biogas needed for the cogeneration unit): 1.700.000 kWh

BUILDING AUTOMATION & ENERGY MANAGEMENT

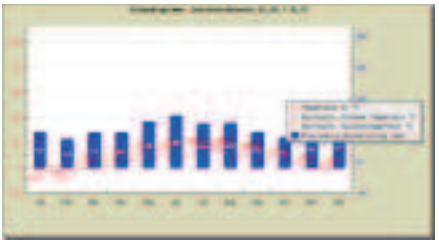
For heating, cooling and ventilation, some 3500 data points have been installed, building control overall has 4300 data points. Communication via BACnet ensures an optimal operation, flexible to react to current needs and situations.

Measurement data points for production relevant consumption further on enable monitoring and targeting via separate software, the modern way of efficient and sufficient use of energy resources.

Environmental & Economic Sustainability

SOLAR INPUT: Global solar radiation in the region is about 1030 kWh/2

CLIMATE CONDITIONS: The climate diagram for the location.



GREENHOUSE GAS EMISSIONS

The amount of CO2 avoided per year (calculation based on GEMIS) is 1.700 tons/an M&T.

The integration of a large number of measurement points not only for building automation, but also for energy consumption is on its own a practical step for long term achievement of efficient operations in the solar plant under various conditions.

Lessons Learnt

The key lesson is that a clever combination of possibilities for local on-site and regional energy sources (renewable) allows a CO2 neutral industrial application to be successful, and set standards for other industrial applications.

2.1.10. Best Western Premier Hotel Victoria

Description of the project

The Best Western Premier Hotel Victoria is a 4 star city hotel with 69 rooms, a breakfast room and two cocktail bars, situated in Freiburg, Germany.

They started their environmental project in 1985 but a big improvement was done during spring of 2002 when they replaced old oil-based heating system by a modern wood-pellet heating system with an exhaust-gas cleaning system.

Afterwards, during the spring of 2007, eco-friendly air-conditioning for the historic main house was put into operation putting further milestones on the way to zero-emission hotel applying efficiency technologies helping them saving electricity and money.

The Victoria Hotel has won numerous awards for its commitment for the environment.

The environmental protection project in Hotel Victoria started in 1985. But it was in 2002 when the hotel developed into a zero-emissions building, referred to the CO2 emission value. The protection and care of its shared environment and acting according to solid ecological principles, such as environmental awareness, modernity and sustainability are the preconditions for this hotel to operate.

Quick Facts

LOCATION: Am Colombipark, Eisenbahnstraße 54
79098 Freiburg, Germany

PLANT SIZE: Photov. panels =200m²

4 wind turbines (with 2 kW produced Power each)

ENERGY PRODUCED: Solar Energy: 21 000 kWh per year

Wind Energy: 70 000 kWh per year

TECHNOLOGY/IES: Photovoltaics and aeolics (wind)

SITE OWNERSHIP: Astrid & Bertram Späth

INVESTOR: Best Western

CURRENT STATUS: Realized

Design and construction

After starting with its environmental protection project and since 2002 the hotel became a zero-emissions building (based on the CO2 value), due to the constant and continuous application of modern solar, eolic and many other environmental friendly technologies.

Its environmental performance is continuously improving thanks to its environmental management system EMAS.

The optimum insulation of the building is a requirement for low energy needs, therefore, 3 heat insulating panels were built in the windows of the entire building. The rear building was completely insulated in 2009 and an impressive primary energy requirement of 82 kWh/m² was reached, which undershoots the set point of a new building by 70%. Intelligent air supply units, through which an inflow of temperate air is possible, were integrated in the face of the building. The inflowing air is adjusted to the room size and number of guests in the room.

The heat for warm water and heating is up to 100% produced by only renewable energy: a wood-pellet heater combined with a thermal solar collector.

Oil heating was replaced by a modern wood pellet heater with exhaust gas treatment. The heater has a maximum performance of 300 kW. This means that about 100 tons of wood from natural finish saw dust are spent every year. Wood, when burnt, produces the same amount of the gas carbon dioxide (CO^2) as it absorbed from the atmosphere during its growth. The latter guaranties a closed CO2 circuit that is beneficial for the greenhouse effect.

The thermal-solar energy plant with a collector area of 30 m^2 supports the warm water production. During sunny days, the required amount of heat for washing and showering is produced solely by the solar plant.

The environmentally friendly ground water cooling system was built in 2007 for the climate control of the hotel rooms. A pump furnishes 10 to 13 degrees (Celsius) cold water from a depth of about 16 to 20 meters from the water well located in the hotel courtyard and supplies the heat exchanger system. In the hotel rooms, the guests can adjust the requested room temperature with convector ventilators. The cool water circulates through a pipe system into the room before being then released back to the ground (well) with a maximum temperature of 16 degrees Celsius through an injection pipe, where it drains away and cools down.

TECHNICAL DETAILS

THE YEARLY ENERGY CONSUMPTIONS ARE:

Electrical energy: 210 000 kWh

Heating energy: 450 000 kWh

Since 2003 the consumed energy was completely eco-energy supplied by renewable energy sources.

MONTHLY TOTAL ELECTRICAL ENERGY GENERATED:

By Photovoltaic: 21 000 kWh

By wind turbines: 70 000 kWh

The energy produced by the wind turbines, which is then fed into the net, is calculated and payed back via the electricity bill.

FIT and additional benefits

Its solar energy plant on the roof garden produces 21.000 kWh solar energy per year. The four wind turbines also installed have a nominal power of 2 kW.

Consequently almost all hotel rooms can be supplied with electricity. A display panel at the reception desk illustrates the production of solar and wind power.

The roof can be visited by guests and interested parties.

With its investment in the wind power station Ettenheim it produces about 70.000 kWh environmentally friendly wind power, which is a credit to its consumption. In 2002 the hotel shifted to green electricity, which it actually buys for a small surcharge from its power supply company EWS in Schönau. With that surplus, the EWS arranges the installation of further regenerative current generators in the region.

Economic Basics

The Best Western Premier Hotel Victoria is a major energy consumer. 210 000 kWh electricity and 450,000 kWh of heat energy are annually consumed.

Each guest consumes about 30 kWh of energy per overnight stay. It saves energy through smart technology applications without losing the comfort standard required by its guests. The Hotel uses energy sources such as sun, wind, water and wood coming from local production.

The solar power plant on the roof has a production capacity of 7,600 W per year, which means 7,000 kWh of solar electricity. Thus, about one-quarter of all rooms are supplied with electricity.

Through its participation in the wind power plant Ettenheim the hotel contributes to the production of environmentally friendly wind power. Its share in the 1.3 megawatt plant produces every year around 70,000 kWh which are then calculated as bonus pay-back in the electricity bill.

Environmental & Economic Sustainability

The concept involves co-workers and guests actively in their approach to the environment, criticism and suggestions are recorded, the will to try something new and to maintain the achieved goals is also promoted.

As an exemplary environmental hotel, it wants to encourage others to imitate their successful model. This applies to hotels, suppliers, guests, partners, neighbors and businesses.

The energy consumption (electricity, warm water) is monitored and entered into the monthly energy accounting. These out of plan fluctuations are detected immediately. The accounting department also serves as a basis for benchmarking and as a basis for a further saving measures. The acquisition and systematization of the company from running up and the energy and material flow, as for example, the purchase of regional and organic products is planned in advance. Ideally, this leads not only to improve the ecological, but also the economic and ecological performance of its operations.

Through the use of durable, high-quality materials, it strives to avoid superfluous renovation and construction waste.

When reconstructing or rebuilding the hotel pays particular attention to environmentally friendly materials and uses water-soluble paints and varnishes. Its environmental protection plans are continuing to develop. It follows the guidelines that are given from the European Union under the EMAS environment policy.

The combustion of pellets produces as much greenhouse carbon dioxide gas as the wood has absorbed during its growth from the atmosphere. The sustainable forest management of the Black Forest guarantees furthermore that the CO2-circle is closed and no greenhouse effect is built. The reduction of CO2 emissions annually is about 154 tons compared to the old oil heating-system.

The hotel thus achieves the following value:

CO2 Emission-values:

Pellets = 0.025 kg/kWh

Natural gas = 0.224 kg/kWh

Eco-energy (EZWS)=0.051kg/kWh

Lessons Learnt

All key suppliers, guests and stakeholders are informed about environmental protection and their business philosophy. In this way, the hotel arranges meetings and guided tours for international groups, environmental and medical journals and also for interested tourists.

A monitoring program was developed jointly with the Energy Agency of the Freiburg Region, to be supervised on a monthly basis consumption of all values. These results are accessible for all interested parties. The reduction of annual CO2 emissions values thanks to its modern wood pellet heating system, in comparison to the old oil heating system, is impressive.

2.1.11. Heineken Brewery

Description of the project

Heineken Slovensko has been the leader on the Slovak beer market for over 11 years, with an ever increasing market share of approximately 45 %. Heineken Slovensko has a strong brand portfolio with the famous international brand Heineken, the most valuable Slovak brand Zlatý Bažant, strong Slovak brands Corgo and Kelt, regional brands Martiner and Gemer as well as popular foreign brands Krušovice, Starobrno and Desperados. Heineken Slovensko brews its brands in Hurbanovo, the largest brewery in Slovakia, established in 1969.

Quick Facts

Heineken Slovensko performance in energy consumption has been very positive over the past year and the brewery managed to decrease the total energy consumption from 153.1 MJ/hl in 2009 to 149.6 MJ/hl in 2010, reaching the target of 155.2 MJ/hl.

The Heineken Slovensko brewery has met targets of 15% energy reduction between 2002 and 2010 within the global "Aware of Energy" Programme, which is aimed specifically at the reduction of thermal energy and electricity use in production.

Design and construction

Renovated wastewater treatment plant, supplemented by anaerobic treatment, which resulted in both increased capacity of waste water, but also the production of renewable energy source (biogas).

In the construction of biogas plants provide:

Phase 1 - Project part:

- The study site (feasibility study)
- Connectivity Study - Request for mount point
- Project (spatial, construction, enforcement)

Phase 2 - construction part:

- From a foundation - the supply of construction work
- Delivery of the cogeneration unit
- Delivery of the biogas process
- Project start

Phase 3 - use / processing of waste heat from biogas plants:

- Secondary heat recovery operation
- Sales of heat to the surrounding buildings (heat pipes)
- Treatment of secondary heat for electricity generation

Phase 4 - servicing after starting the operation:

- Biogas Technology Service
- Providing running biogas plant - management protects

The cost structure needs to be based on a planned mid-long term supply agreement for biofuel-biogas, in order to keep the principal operating costs under control.

It is necessary to have chosen reliable suppliers of commodities not to incur heavy penalties due to the unstable delivery of energy, insurance costs, ordinary and extraordinary maintenance costs, safety costs, control and monitoring costs…

FIT and additional benefits

Electricity used for own purposes. Brings benefits concerning the decrease the external purchase of power, decreases operational costs.

Economic Basics

Actually, brewery in Hurbanov has managed a 42% improvement since 2002. The thermal energy consumption decreased from 85.2 MJ/hl in 2009 to 82.9 MJ/hl in 2010, reaching the target of 85 MJ/hl set for 2010. However, its future goal, which corresponds to the technical state of the brewery, is to reduce thermal energy consumption by up to 77 MJ/hl or even less.

Obviously, additional investments will be required. In the first stage they plan to invest in heat recuperation from brew house vapors. In terms of electricity consumption they achieved a decrease from 7.5 kWh/hl in 2009 to 7.4 kWh/hl in 2010, reaching the target of 7.8 kWh/hl.

Environmental & Economic Sustainability

In 2011 the brewery starts using biogas from a wastewater treatment plant for the co-generation of electric energy, increase OPI lines to optimize the energy consumption and these changes to run alongside more simple measures such as turning off lights when rooms or areas are not in use.

Lessons Learnt

Utilization of the waste products in the food and distillery sector could provide additional free sources for operating costs, or covering human resources costs. The model of an energy self-sufficient firm allows for a total reduction in the negative impact on the environment and a decrease of the negative effect of CO2 emissions.

2.1.12. AMS Engineering GmbH

Description of the project

AMSEC building is a modern office building and computing center housing more than 300 high end servers. The waste heat of the servers and the floor distribution racks is used for heating the building. Cooling is performed by heat pumps using groundwater. Compared to a conventional office building 70% of the heating and cooling costs and 40% of electricity costs can be reduced.

GBE Factory Model

Heating using waste heat of servers and the floor distribution racks. Cooling is covered by heat pumps using groundwater, alternative re-cooling systems implemented as architectural elements. The building has 6.500 m² office space, including event center, server rooms, laboratories and workshops.

Quick Facts

LOCATION: Softwarepark 37, Hagenberg (Austria)

BUILDING SIZE (m2): 6.500 m2

30 kW CONTINOUS SERVER CAPACITY

TECHNOLOGY/IES HEAT: server waste heat using

SITE OWNERSHIP: AMS Engineering GmbH

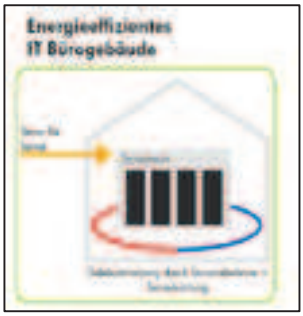
INVESTOR: STIWA Group

PROJECT COST: not known

CURRENT STATUS: Realized

Design and construction

- Building automation (intelligent systems for: lightning, ventilation, heating, cooling, software)
- "Software heats - Soil cools"
- IT-technology
- Integrated planning process
- Planning of heating, cooling, ventilation, electrical installation and control center

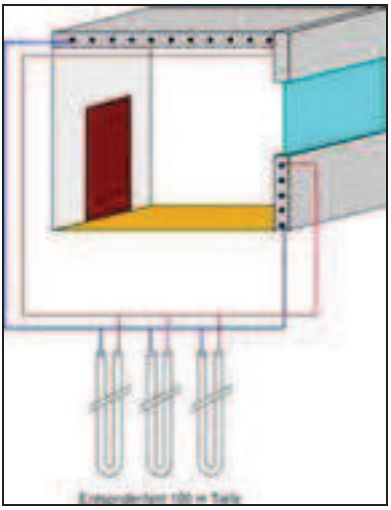


ENERGY CONCEPT

- 100% of the heat for the building is supplied from waste heat generated by the servers

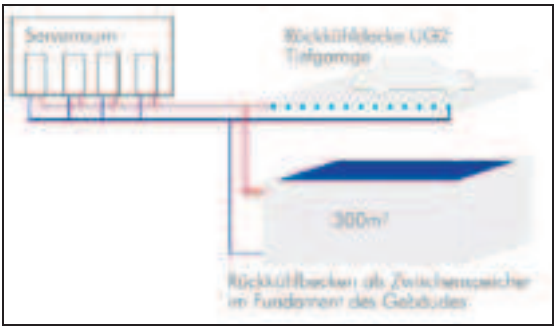
RECOOLING SYSTEM FOR SERVER HEAT

- alternative recooling systems in summer



Building recoolingsystem in summer

· temporary storage of 300 m3 water in building basement for recooling



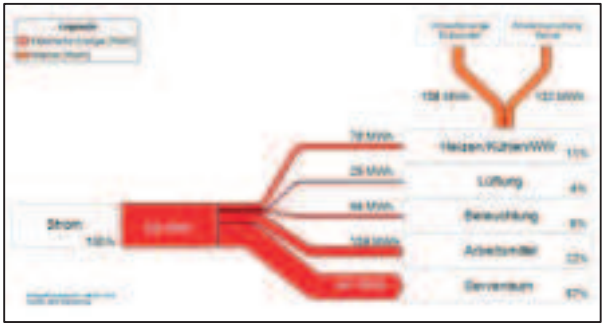
Serverhousing recooling in summer

ENERGY EFFICIENCY MEASURES

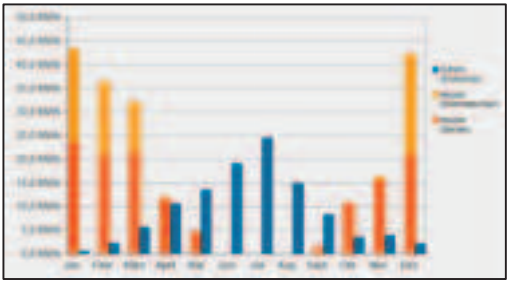
- Optimized building envelope

- Innovative & sustainable energy concept or Low temperature heating- and cooling-system or Using waste heat, solar, biomass and geothermal
- Integrated planning process

Architectural elements for recooling



Energy flow chart



Energy demand per year

2.1.13.Va.lu.va. Srl

Description of the project

Va.lu.va Frutta s.r.l. deals with trade and production in the fruit processing (pears, apples, cherries, Persimmons). This case study relates to the new warehouse situated in Via Torricelli, 52 (Verona, Italy).

GBE Factory Model

Here, there is a large and efficient store, which is equipped with many big fridges used to conserve the fruit. The warehouse roof has been covered with Photovoltaic panels after the old asbestos roof panels were removed. Thanks to the new solar energy's system, the warehouse produces about 75% of the energy it requires.

Quick Facts

LOCATION: Via Torricelli, 52 - Verona (Italy)

PLANT SIZE (kwe;kwt): 1.147,47 mq

TECHNOLOGY/IES: Photovoltaic panel

SITE OWNERSHIP: Va.lu.va. S.r.l.

INVESTOR: Va.lu.va. S.r.l.

PROJECT COST: 500.000 €

KEY PARTNERS: Va.lu.va. S.r.l.

CURRENT STATUS: Realized

Design and construction

The installation is grid-connected and has a three-phases medium voltage connection.

There are 690 Photovoltaic panels on 1.147,47 sq./m that are able to generate a high power output of 158.700 Kw and 158.046,05 KWh yearly.

The panels are connected to an inverter, used to exchange the power on the site.

The installation has been divided in 4 lines inclined 6°20 to the south-east each.

TECHNICAL DETAILS:

TOTAL SURFACE: 1.147,47 mq

NUMBER Of PHOTOVOLTAIC PANELS: 690

NUMBER Of INVERTER: 1

TOTAL Annual energy: 158.046,05 kWh

TOTAL OUTPUT POWER: 158.700 kW

ENERGY PER kW: 995,88 kWh/kW

BOS: 74,97%

FIT and additional benefits

PARAMETERS OF INSTALLATION:

Typology and Profitability of equipment:

Installation on building: (2nd QT 2011)

Power (kWp): 177.1

Feed-in-Tariff (€/kWh): 0.341

Tariff's bonus (€/kWh): asbestos+ 10%: 0.034

Feed-in-Tariff + bonus (€/kWh): 0.375

Economic Basics

The economic rationale was to install a photovoltaic system to reduce the buildings carbon footprint and reduce energy costs.

CONSUMPTION PARAMETERS

Costumer's energy cost (€/kWh): 0.15

Power: MT (200 kW)

Consumption EE (kWh/annual): 204.000

PARAMETERS OF ECONOMIC'S SIMULATION SALE

Inflation EE: 4.0%

Maintenance and insurance cost: € 9.000 approx.

System's Depreciation charge: 9%

Discount Rate: 3.0%

IRAP (TAX): 3.90%

IRES (TAX): 27.50 %

SIMULATION'S TECNICALS PARAMETERS

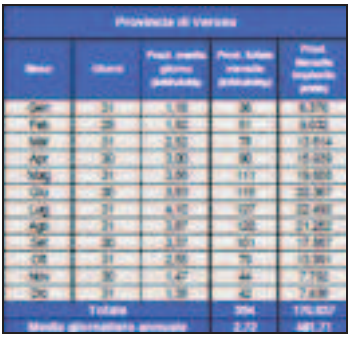
Self-consumption: 100 %

Annual performance degradation: 0.8 %

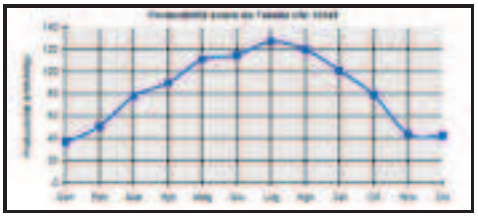
% Requirements covered by photovoltaic energy: 74.97%

Environmental & Economic Sustainability

In accordance with the area and its related solar belt, the average monthly production is set out in the table below (amount per KWp installed). The database used is tab UNI10349 which produces the optimal productivity.



TOTAL MONTHLY TREND ANALYSIS OFF THE YEAR:



The totally energy production from this kind of system is green-energy; therefore this is a highly environmentally friendly system.

CO2 saved: 88.0 ton/Year

Also the system allows us to reduce our dependency on petrol and carbon fuel.

PETROL saved: 5.788 barrel/year

Lessons Learnt

This is a very efficiently and interesting solar system model because it allowed a big company with a high energy request such as VA.LU.VA S.r.l. to generate its own energy's requirements.

Besides, looking at the data, the economic feasibility of this investment is clear.

2.1.14. Carrera Spa

Description of the project

Carrera is an Italian company, located in Verona, which has developed and maintains the secret of its success – namely, the ability to combine cutting-edge technology with craftsmanship, to transform a delicate flower like cotton into beautiful and tough products in the meantime while respecting the environment.

GBE Factory Model

The building roof has been covered with Photovoltaic panels in all areas. The logistic hub' roof has been covered with Photovoltaic panels after the old asbestos roof panels were removed. Thanks to the new solar energy's system, the warehouse produces about 100% of the energy it needs.

Quick Facts

LOCATION HQ: Via Sant'Irene - Caldiero - Verona (Italy)
LOCATION PV SYSTEMS: Warehouse in Stallavena (Verona) and Logistic hub in Povegliano Veronese (Verona)
TOTALE PLANT PV SIZE: 3.500 sq/m
TECHNOLOGY/IES: Photovoltaic panel
PV SYSTEMS NUMBERS: 3 (19.8, 110, 215)
SITE OWNERSHIP: Carrera Spa
INVESTOR: Carrera Spa
PROJECT COST: €1,000,000
KEY PARTNERS: Carrera Spa
CURRENT STATUS: Realized

Design and construction

Installation type is grid-connected and has a three-phase medium voltage connection.

The installation has been divided into 3 photovoltaic systems: 2 warehouse and plain roof in Warehouse Site and 1 warehouse roof in the Logistics hub Site.

There are 1.590 Photovoltaic panels on 5.580 sq/m that are able to generate a high output power in the region of 344,8 kWp and 357.902 kWh annualy.

The panels are connected to an inverter used to exchange the power on the site.

TECHNICAL DETAILS

TOTAL SURFACE: 1.590 sq/m

NUMBER OF PHOTOVOLTAIC PANELS: 1.590

NUMBER OF INVERTER: 6

TOTAL Annual energy: 357.902 kWh

TOTAL OUTPUT POWER: 344,8 kWp

ENERGY PER kW: 1.038 kWh/kWp

BOS: 74,97%

TOTAL ANNUAL ENERGY CONSUMPTION

Annual energy consumption 435.000,00 KWh

FIT and additional benefits

PARAMETERS OF INSTALLATION:

TYPOLOGY AND PROFITABILITY OF EQUIPMENT: Installation on building (2009-2010)

POWER (KWP): 344,8

AVERAGE FEED-IN-TARIFF (€/KWH): 0,421

Economic Basics

The economic rationale was to install a photovoltaic system to reduce the buildings carbon footprint and reduce energy costs.

CONSUMPTION PARAMETERS

COSTUMER'S ENERGY COST (€/KWH): 0,16

POWER: MT (300)

CONSUMPTION EE (KWH/ANNUAL): 435.000

PARAMETERS OF ECONOMIC'S SIMULATION SALE

Inflation EE: 3%

Operations & Maintenance and insurance cost: € 8,000 approx.

SYSTEM'S DEPRECIATION CHARGE: 9%

DISCOUNT RATE: 3%

IRAP (TAX): 3,9%

IRES (TAX): 27.5 %

FINANCIAL DATA

Financial Index	**100% equity**
IRR 20 years	14,07%
IRR 25 years	14,27%
Revenues 20 years	€ 1.968.383
Revenues 25 years	€ 2.208.672
Payback Period	6,41

Financial Index	**30% equity** **70% bank financing**
IRR 20 years	30,83%
IRR 25 years	30,88%
Revenues 20 years	€ 1.695.766
Revenues 25 years	€ 1.936.054
Payback Period	3,21

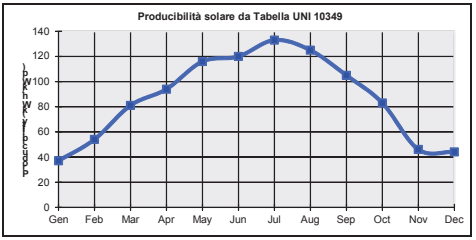
Environmental & Economic Sustainability

In accordance to the area and its related solar belt, the average monthly production is set out in the table below (amount per KWp installed).

The database used is table UNI10349 with respect to the optimal productivity.

Carrera Spa, PV Systems				
Month	Day	Average daily producibility (kWh/kWp)	Total monthly producibility (kWh/kWp)	Total monthly production (kWh/kWp)
Gen	31	1,19	37	12.758
Feb	28	1,93	54	18.619
Mar	31	2,61	81	27.929
Apr	30	3,13	94	32.411
May	31	3,74	116	39.997
Jun	30	4,00	120	41.376
Jul	31	4,29	133	45.858
Aug	31	4,03	125	43.100
Sep	30	3,50	105	36.204
Oct	31	2,68	83	28.618
Nov	30	1,53	46	15.861
Dec	31	1,42	44	15.171
Totale			**1.038**	**357.902**
Annual average daily			**2,84**	**979,23**

TOTAL MONTHLY TREND ANALYSIS OVER THE YEAR:



The totally energy production from this kind of system is green-energy, therefore this is an extremely environmental friendly system.

Contribution to the environment	
CO_2 emissions avoided (tons/year)	179,0

Also the system allows Carrera to reduce their dependency on petrol and carbon fuel.

Compsumption of oil avoided	
Oil saved (barrel/years)	11.767

Lessons Learnt

This is a very efficient and interesting solar system model because it has allowed a big company with a high energy requirement such as Carrera to generate its own energy's needs.

2.1.15 Johann Pengg AG

Description of the project

As the only Austrian manufacturer of oil tempered sprung steel wire, the Joh. Pengg AG in Thörl/Styria, has specialized its product line for applications in the automotive, electrical and machinery sectors. Manufacturing oil tempered sprung steel wire is an highly energy intensive process with several heating and cooling steps.

GBE Factory Model

The Project shows the potential of using renewable resources and the energy amounts that could be saved through more efficiency in the production process.
Using a hydro-electric power plant for electricity and a biomass plant for heat and hot water.

SPECIFIC PROJECT GOALS:

1. analyze the current energy flow (Sankey diagram), to assess the potential savings.
2. increase the energy conversion efficiency.
3. investigate the possibilities to increase the use of renewable energy sources.

Quick Facts

LOCATION**:** 8621 Thörl (Stmk)

ELECTRICITY TECHNOLOGY: Hydro-electric power plant

TECHNOLOGY/IES HEAT: Biomass, Heat recovery

SITE OWNERSHIP: Joh. Pengg AG

INVESTOR**:** Joh. Pengg AG

PROJECT COST: not known

KEY PARTNERS: Johanneum Research

Design and construction

CURRENT ENERGY FLOW

Total energy consumption of 45,35 MWh/a

- 26% Electricity
- 74% Natural Gas

What is Electricity used for:

- 58% is used for mechanical energy to operate the manufacturing lines
- 32% is used for creating heat
- 6% is used for lighting
- 4% is used for pressurized air

What is Natural Gas used for?

- 60% is used for creating the direct process heat in the tempering process
- 29% is used for the production of hot water process heat and to heat production buildings
- 5% to operate the gas radiators
- 3% for heating offices and hot water production
- 3% or auxiliary power and the exomat.

Abbildung 4.6: Monatlicher Erdgasverbrauch in Nm³ im Jahr 2000

ENERGY CONVERSION EFFICIENCY

During the productions steps where a high consumption of energy is required, new ways of using waste heat were established.

To increase the use of renewable energy it was suggested to replace the natural gas boiler by a biomass fired boiler for the production of the hot water process heat thus reducing the use of natural gas by 9,9 MWh/a.

In addition production waste can be incinerated in the boiler. The increased use of hydroelectricity was not recommended for economic reasons.

ENERGY REDUCTION POTENTIAL

The analysis of the energy conversion processes identified measures leading to a reduction of 5,70 Mio kWh/a of natural gas and 1,13 Mio kWh/a of electricity per annum.

The biggest potential saving can be seen in the use of waste heat for the gas burners, heating the wire at the beginning of the tempering process.

2.1.16 Sunny Energy Building

Description of the project

This highly energy-efficient office building is a reference project to increase the popularity of highly energy-efficient construction projects. The "ENERGY base" office building was planned and put together by architects, scientists and specialist consultants in an integrated planning process. It is an outstanding building due to its innovative architecture, advanced building technologies and the highest possible level of user comfort. The particularly low, cost-saving energy consumption is in line with the passive house standard is completely covered by renewable, ecologically sustainable energy sources. The building is exemplary in its ability to harmonize economic and ecological considerations in the construction of a state-of-the-art office and economically viable commercial real estate.

GBE Factory Model

The building concept is based on three core qualities:

- Energy efficiency (high developed energy- and facility-management)
- Application of renewable energy sources (geothermal energy, solar power)
- Highest level of comfort for occupants

By the use of different solutions an energy reduction of 80% can be achieved, this means a reduction of 200t/a CO2, has been reached.

Quick Facts

LOCATION: Vienna (Austria)

BUILDING SIZE (m^2): 7.500m^2

TECHNOLOGY/IES: Passive house office building

SITE OWNERSHIP: WWFF

PROJECT COST: €14. Mio.

KEY PARTNERS: POS Architects; Schneider, U.

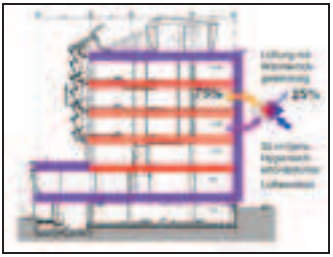
CURRENT STATUS: In operation since 2008

Design and construction

Three main principles serve as the underlying basis for the passive house concept:

- insulation against the loss of heat
- air-tightness (sealed construction)
- controlled ventilation with heat recovery

One of the innovative features of ENERGY base is the exclusive use of renewable energies. The passive house standard makes it possible to keep energy requirements at a particularly low level.



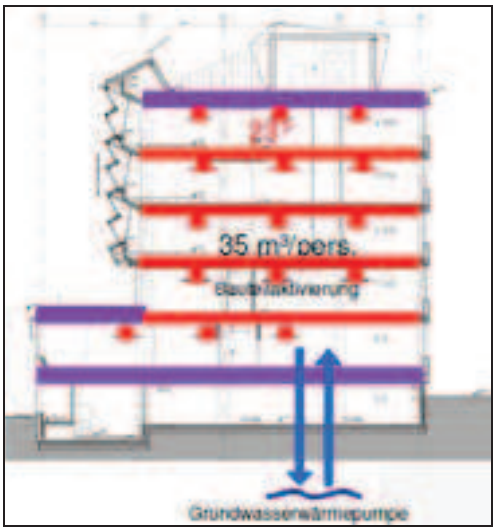
The passive application of solar energy will also be implemented at ENERGY base.

ENERGY CONCEPT

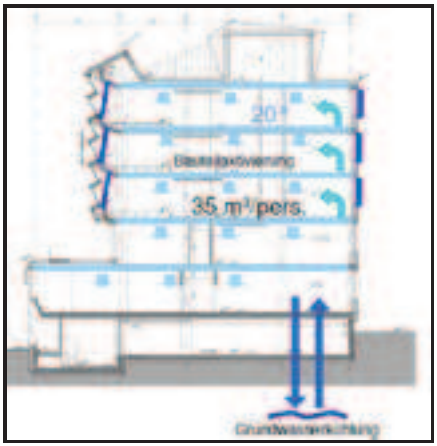
The generated geothermal energy completely covers all heating and cooling needs.

Furthermore, a 400m² photovoltaic facility located on the south facade of the building will also supply part of the total electricity requirements.

HEATING AND COOLING BY GEOTHERMAL ENERGY:



An innovative ventilation concept enables the integration of solar energy in summer by means of solar cooling (solar absorption supported air conditioning), as well as the use of plants to ensure ecologically-friendly, controlled humidification in winter.



FIT and additional benefits

PARAMETERS OF INSTALLATION:

Heating Energy: <11 kWh/a/m^2

Cooling Energy: <15 kWh/a/m^2

=>Certified passive building

Thermal insulation 26 cm, 75% heat and moisture recycling#

400 m^2 Photovoltaic with 46 kW peak (on south building side. 37.000 kWh solar energy

Environmental & Economic Sustainability

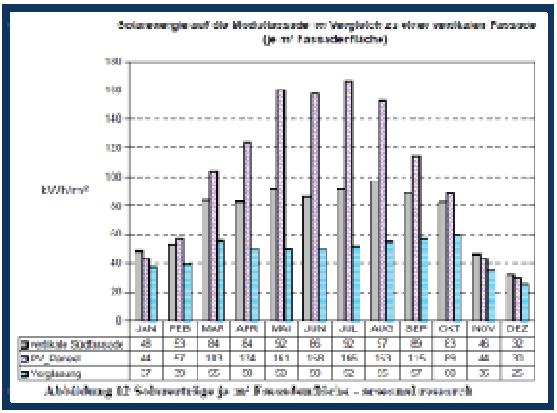
ACTIVE AND PASSIVE USE OF SUN ENERGY:

The passive thermal sun energy benefits are directly used on south facing rooms and transferred to use the energy indirectly for north facing rooms. In winter the building frontage traps the energy from the sun while in summer the frontage shades itself automatically.

On the south building side is a 400 m^2 Photovoltaic sun energy plant where around 37.000 kWh solar energy can be produced in one year.

For solar Cooling there is a 285 m^2 thermal collector for cooling and dehumidifying air.

The passive house standard makes it possible to keep energy requirements at a particularly low level. The generated geothermal energy completely covers all the heating and cooling requirements. Furthermore, a 400m² photovoltaic facility located on the south facade of the building also supplies part of the buildings total electricity requirements.



Lessons Learnt

The building is exemplary in its ability to harmonize both economic and ecological considerations in its construction.

This highly energy-efficient office building is a point of reference to increase the popularity of highly energy-efficient construction projects.

An innovative ventilation concept enables the integration of solar energy in summer by means of solar cooling (solar absorption supporting air conditioning), as well as the use of plants to ensure ecologically-friendly, controlled humidification in winter.

2.1.17 NUNCAS Spa

Description of the project

The Nuncas company manufactures products for home cleaning and care, and has always been very concerned about renewable energy sources innovation. In 2009 it won the award "Ecotech 2009-11 edition-4TH Category" for enterprises that display excellence in their eco-values.

The new building was commissioned in 2005 and represents a clear signal of the awareness of the company to take care both of health and environmental impacts. For these reasons Nuncas developed a low- energy consumption building with zero emissions, combining many renewable energy sources, as for example a photovoltaic plant composed by 264 modules of 135KW power that is able to supply the energy required by the entire building.

The finished plant is totally automatic with the possibility to check and manage in real time the use of renewable energy. Radiant tube feeds were installed over the roof covering with well water in order to avoid thermal accumulation in the summer and the sudden change of temperature between the seasons.

GBE Factory Model

The model is "passive building" – these kind of plants are designed for a low energy consumption, to be covered by renewable energy sources. The building is equipped with several renewable energy systems:

- the photovoltaic plant is composed of 264 modules of about 135 kw of power and is able to provide energy to the entire building.

- There is no heating pump
- The entire plant is completely automatic, and it is equipped with a system that is able to check and monitor the use of renewable energy for the production of electricity, heating and cooling
- Electric light is regulated by a presence detector, while natural lighting is the primary source of light
- Adjustable “skylights” serve to focus natural daylight for all the principal rooms

Quick facts

LOCATION: Settimo Milanese (Milano)

BUILDING SIZE: Warehouse surface: 5.000 sq m;

Warehouse volume: 70.000 m3; Office surface: 2.500 m2; Office volume: 10.000 m3

RENEWABLE ENERGY INSTALLED (kwe; kwth): PV plant 134,16 kwe; Heating pump 54-296 KW

TECHNOLOGY/IES: Heat pump, Circulation of well water on the roof of the building, automatic curtain/blinds adjustment, Solar panels for the production hot water, photovoltaic panels, Lighting (adjustable skylights).

SITE OWNERSHIP: Nuncas Italia

INVESTOR: Nuncas Italia

Design and construction

All year round heating/cooling of the offices:

The demand for heating and cooling across the building is achieved with a heat pump that permits the heating and cooling of the water.

However the warehouse is heated with a system of radiating panels powered by boilers, recovering the latent heat of vapor.

Natural ventilation is achieved by several openings realized in the lateral walls and all windows are equipped with thermal glasses and sunshade curtains.

Electricity needs are supported by a photovoltaic plant composed of 624 solar panels made of monocrystal silicon; every single panel is able to produce around 215W, with a total power production of 134,16 kw.

The entire plant is completely automatic, and is equipped with a system that is able to check and monitor the employment of energy sources for the production of electricity, heating and cooling. In addition electric light is regulated by a presence detector, and it is takes into account natural daylight light..

The plant is also equipped with a supervision system and a pc controller that allows a central operator to monitor and adjust the system on a 24/7 basis.

Warehouse surface: 5.000 mq

Warehouse volume: 70.000 m3

Office surface: 2.500 mq

Office volume: 10.000 m

FIT and additional benefits

The principles of economic sustainability of investment on RES is based on incentive tariff for photovoltaic system (with the rate granted in case of consumption of the energy produced on the spot: 0,36 cent*KWh, in 2007) and on credit taxation for the heating pump (55% for three years). Furthermore the energy savings will pay for the increased costs of the original build and for the control system. The actual real final market value of the building has been enhanced by the installation of these energy saving devices.

COSTS OF THE FACTORY BUILDING

The construction cost difference between the Nuncas building, compared with an equivalent traditional one built without all of these environmentally friendly measures, is about 30% more.

Economic Basis

However an economic return was not the primary reason that prompted the company to build such a building. Instead the owner of Nuncas wanted to emphasize his commitment to environmentally friendly behaviour and a comfortable working environment, that puts employees at their ease. Nevertheless, the additional investment in PV has a payback period estimated at 8-10 years, while the heat pump in less than five.

Environmental & Economic Sustainability

One of the most important results is the CO2 emissions avoided with the use of the integrated plant.

Overall, the amount of CO2 emissions reduced from the design of this building is around 302 tons per annum.

The building obtained in 2009 the certificate of a Class A Building from Region Lombardy.

CO2 SAVINGS

Summary of CO2 savings		
Description	**Annual savings (project data)**	**Actual savings (from January 2008 to the end of 2011)**
Condensing boiler	18.4	80.6
Heating pump	178.0	1247.66
Circulation of well water on the roof	2.5	7.61

of the building		
Automatic curtains adjustment	6.5	12.52
Solar panels for hot water production	0.7	2.86
Photovoltaic panels	82.1	286.33
Lighting (sky lights)	14.7	140.54
TOTAL CO2	**302.9 t**	**1778.12 t**

The actual saving values are checked and verified by electronic heat-meters supplied from Siemens for the heating pump, solar panels for hot water production and circulation of well water. The value from the instruments (Siemens) are compared with a standard installation and the results are shown in a table on our web-site.

As regards the lighting, every electrical panel is provided with multi-meters which check the electrical consumption of the lights compared with standard lighting.

As has been already said, the decision to build the new building by Nuncas with their vision of efficiency and energy sustainability goes way beyond only pure economic reasoning. We can say however, that for all companies with the spirit and foresight of Nuncas it has proven economically profitable for the direct effects of the savings achieved, the economic

incentives obtained, boost to their corporate image, improvement of the working environment and the positive involvement of the workers

Lessons Learnt

The building of Settimo Milanese, started in March 2007, hosts both the directors offices and the warehouse for the storage of finished products. It's important because it is one of the first examples of totally sustainable and self-sufficient buildings created in Lombardy. The plants have been constructed with the most advanced renewable energy sources technologies and represent a great example of a green blue energy factory. Through this project the company management wanted to emphasize the centrality of employees in corporate life and the importance of the work environment, with an important enhancement to the in companies reputation.

The building was designed with climate parameters that go back about a decade ago and that now have changed, the summer air conditioning system struggles when the outside temperatures are at their highest. This shows that even a modern high-tech innovative building must be designed so that it can adapt its functionality to future climate change and environmental modifications.

2.1.18 ZEROCENTER

Description of the project

Starting from the initial idea to invest in the building of a new commercial centre (Zero Centre), the investors considered the building of a new structure using the very best energy efficiency and heat saving solutions, in conjunction with renewable sources. The result was a commercial building of both high-tech and low power consumption with the added advantage of using as its power renewable energy

GBE Factory Model

The Shopping Centre is equipped with a centralized plant for the supply of heating and cooling. The plant is characterized by a co/tri/generation system based both on methane and on renewable energy sources (the energy which comes from renewable energy sources is superior or equal to 10% of the total energy produced).

Thanks to the wood pellet boilers and cogeneration solutions it is possible to avoid C02 emission equal to approximately 25-30% per year, and that

has allowed the building to obtain many Energy Efficiency Titles (TEE). An ESCO (Energy Service Company) built the centralized plant through project financing, together with an area "developer" (75% ESCO 25% developer). Following this ESCO started managing the plant and provides the user with both heating and cooling. The GBE factory model is "one to many", that means the management of a small local grid for the electric and thermal energy production. The chosen model creates a value chain that maintains "in balance" all the stakeholders.

Such a balance takes into account different time schedules:

1. Developer: the developer obtained immediate cost savings on the investment;
2. ESCO: the ESCO intervened only marginally during the management phase of the energy business
3. Users: the users achieved savings on management costs.

Quick facts

LOCATION: Zero Branco (TV) Italy

FACTORY SIZE: 24,000 square meters

124,000 cubic meters (gross)

CENTRAL ENERGY PLANT:

- Heat (Hot water) 2,990 kw (t)
- Refrigeration 4,840 kw (f)
- Electricity 200 kw (e)

TECHNOLOGY/IES: Co- Tri-generation (methane gas)

Renewable energy sources (pellets boiler)

ENERGY SALE TARIFF: <10% than traditional solutions

SITE OWNERSHIP: Real Estate Solution S.P.A

INVESTOR: Real Estate Solution S.P.A

ENERGY PLANT COST: around €2.7 ML

KEY PARTNERS (E.S.CO.) ASTRIM S.P.A.

CURRENT STATUS: Operative (May 2011)

SHORT RES INVESTMENT DESCRIPTION: High temperature heating generator fed by pellet boiler with a power of 300 kW(t) and a yield of 93%.

Design and construction

Starting from the initial idea to invest in the building of a new commercial centre, the best energy solutions have been used, in order to create a high-tec building based on renewable energy sources. The best model to supply the anticipated demand for heating and cooling across the building has been chosen. Particular attention was paid to primary energy transformation, hence the plant is composed of:

- Hot water heater powered through a battery
- Water refrigerator system with EER value >6,0
- Evaporative tower with fluent temperature
- Electric/ thermal tri- generation
- Renewable energy sources (pellet boiler)

Plants Solution used:

- Maximization of primary energy transformation process: natural gas and electricity

- Distribution of heat transfer fluids with a 4-pipe system
- Adoption of thermal jumps to reduce the fluid mass
- Plants Solution employed:
- Maximization of primary energy transformation process: natural gas and electricity;
- Distribution of heat transfer fluids with a 4-pipe system;
- Adoption of thermal jumps to reduce the fluid mass;

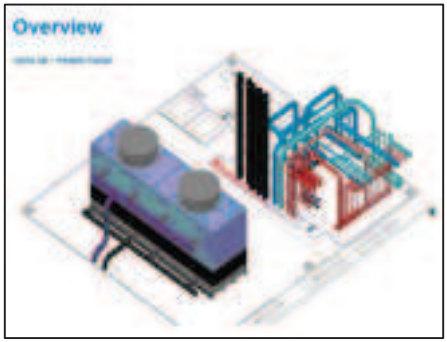
The technology core is composed of:

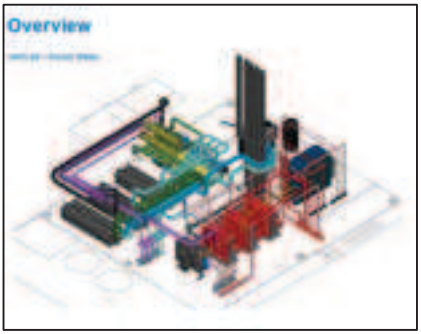
- Thermal power plant gas based: equipped with 3 hot water heaters (fed through methane) - Total power: 2.800 kw
- Thermal power plant based on renewable energy source: equipped with 1 hot water heater (fed through pellet) - Total power: 300kw(t)
- Cogeneration plant: Equipped with 1 co-generator with high performance (fed through methane gas)
- Total power: 200kw
- Total power (recoverable): 290kw
- Central cooling equipped with 3 group

EXPECTED ENERGY PRODUCTION

Thermal energy: 900.00kwh/year

Cooling energy: 2.400.000kwh/year





The technology core is composed of:

- Thermal power plant based on gas: equipped with 3 hot water heaters (fed through methane)

  Total power: 2.800 kw

- Thermal power plant based on renewable energy sources: equipped with 1 hot water heater (fed through pellets)

  Total power: 300 kw (t)

- Cogeneration plant: Equipped with 1 high performance co-generator (fed through methane gas)

  Total power: 200kw

  Total power (recoverable): 290kw

  Central cooling equipped with 3 groups

Expected energy production

Thermal energy: 900.00kwh/year

Cooling energy: 2.400.000kwh/year

FIT and additional benefits

Thanks to the high efficiency co-generation plant it was possible to obtain Energy Efficiency Titles (TEE) which consist of 100 Tep per year (around 12,000 Euros per year), and a tax break on natural gas supply.

Economic Basis

The initial investment is higher than traditional build by about 10%/15%, and is estimated to be in the region of 2.7 million Euros. In regard to the supply of energy for the shopping centre, the investment delivers savings of 30% more than a traditional solution. In addition the signing of a long-term contract by the users, allows ESCO to deliver energy bills 10% lower than standard ones.

The business plan is highly planned, and includes several phases:

- Architectural sizing;
- Energetic sizing;
- Necessary technical power sizing;
- Production technological model, regulation, and energy vectors distribution;
- Definition of a business model shared by the participating partners (developers and ESCO)
- Definition of a business plan.

Environmental & Economic Sustainability

The technological solutions chosen are some of the best mixes existing. The total amount of CO2 emissions saved is around 400 Tons per year.

Economic sustainability is based on the following considerations.

The initial investment for the energy production and distribution network, that achieves the metering equipment at the users (of approximately € 2.7 ml cost), is higher by 10% to 15% compared to conventional distributed solutions with small utility bills. This additional cost is outweighed by the fact that the solutions adopted will, as regards the energy supplied to the users of the Zero Center by the ESCO, deliver a cost saving of approximately 30% compared to what would have been expected with conventional solutions. This fact, coupled with the signing of contracts for deferred delivery of energy by the end user, enables the ESCO to pay the investment made in a reasonable time and to charge tenants of the Zero Center with rates for the sale of heat and refrigeration less than 10% those resulting from traditional technological solutions.

Lessons Learnt

The results both from a technological and environmental point of view show that it is possible to merge different kinds of energy sources, traditional and renewable ones, in order to create elegant solutions both for users and the environment.

Some pearls of wisdom:

"The best energy savings are from energy not consumed ..."

"Following a modification to improve efficiency, if there are economic savings, there is definitely at its foundations energy savings, but the opposite is not always true ... "

1. "It is necessary to get specific knowledge (experience required) on how to combine energy efficiency solutions with renewable energy sources, in order to reach the goal of zero emissions…."

2.1.19 SCHÜCO ITALIA

Description of the project

For its new headquarters in Padua, Schüco Italia, a leader in the field of envelope construction and energy efficient solutions for the exploitation of solar energy, has changed an obsolete and energy-intensive building into a facility that has obtained the "CLASS A" award, using Schüco systems. With avant-garde architecture the building is a real life example of successful industrial '80s building conversion and recovery. The new Schüco headquarters saves over 50% in terms of energy requirements through heating and cooling, approximately 440,000 kWh (170 tons of CO2 avoided every year). The building also produces energy thanks to a 540 kWp photovoltaic system and other "Schüco Made" solutions like the" solar cooling", a cooling system that uses hot water produced by high efficiency solar panels, a geothermal system made by 7 drills 80 meters deep and supported by solar thermal collectors, as well as a photovoltaic system on the roof able to meet the energy needs of the entire building (offices and warehouses) with a production of about 630,000 kWh/year. Schüco used the patented E2facade to provide an efficient building ventilation and solar shading solution with a high energy performance. On the other face of the façade architectural photovoltaic panels using micro-crystalline silicon thin film have been adopted.

GBE Factory Model

Schüco shows how the new building architecture, when implementing solutions oriented to thermal insulation, efficient ventilation and careful management of the light, leads to energy savings of more than 50%, paying for the extra investment in the medium term, evaluable in +20% cost with respect to the adoption of conventional building solutions.

In addittion if you look over the 20 year life span of the building, the investment will pay back with good returns, partially thanks to the tariffs set in Italy in 2010, thanks to the techniques adopted.

Furthermore, the application of a control and communication system for the management of external heat sources (sun and soil), the light (internal and external) and internal energy use, allows to achieve high average levels of comfort and to further reduce the energy consumption with the result being able to sell back to the public grid surplus electricity generated from the renewable energy sources installed.

Quick facts

LOCATION: Padova - Italy

TOTAL AREA: 31.401 sqm

OVERALL FLOOR AREA: 20.962 sqm

OFFICE FLOOR AREA: approx 4.200 sqm

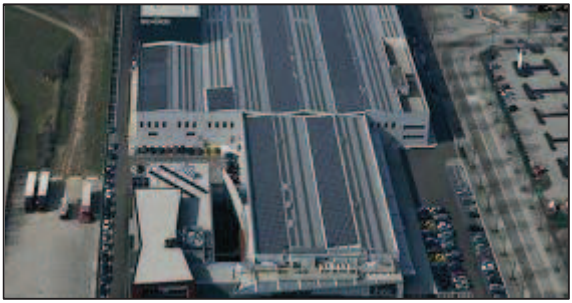
BUILDING ENVELOPE: Façade E2 (double skin, ventilation, solar shading, integration of thin photovoltaic film);

SOLAR THERMAL ROOF PANELS: 10 KWp (for geothermal plant);

SOLAR THERMAL ROOF PANELS: 36 KWp (for solar cooling system)

PHOTOVOLTAIC ROOF PANELS: 540KWp (providing energy to offices and warehouse)

ENERGETIC AWARD: Class A



Design and construction

Architectural concept: Unity despite differences. The structure consists of two parts: a new building housing offices and showrooms and the renovated warehouse. The new building is based on the existing column grid and runs parallel to the existing structure.

The façade performs important functions for the building: ideal thermal insulation, optimum natural light illumination, protection from excessive solar radiation, and other functions such as electricity generation (For the east and south façades of the new building, the multifunctional Schüco E2 Façade including the thin-film photovoltaic module ProSol TF was used). Opening, solar-shading, and thin-film photovoltaic units, as well as decentralized air-conditioning modules, are integrated into the interior. Parallel opening windows ensure optimum ventilation. The photovoltaic installation on the roof of the new building and the warehouse covers a

total area of 4,550 m² with 3,570 monocrystalline modules and a total output of 540 kWp. To integrate the on-roof system into the architecture, the modules were mounted with a horizontal inclination of 6°. The on-roof system and the window and façade modules ProSol TF integrated into the façade guarantee solar energy generation on the south façades. The thin-film photovoltaic system in the south façade is characterized by an optimum utilization of diffuse light and therefore is functional to the vertical arrangement of the façade. Geothermal energy is produced through a heat pump extracting low-temperature heat from the ground via 80 meter-deep earth sources and transfers heat to the ground, thus reducing heating and cooling energy consumption. The Schüco heat pump HPSol 17, which has an output of 17 kW, is operated by five solar thermal collectors. These collectors heat a combination cylinder that is used to produce hot water and control the thermal cycle.

FIT and additional benefits

Photovoltaic energy: YES

Thermal energy: NO.

Geothermal energy: NO

Energy efficiency: NO

Feed-in-Tariff: (€/kWh): 0.422

Tariff's bonus: (€/kWh): 0.021

Since connecting the company has produced more than 1.200.000 kWh of clean energy, avoiding more than 340.000 kg of CO2 and earning more than 550,000 Euros thanks to this PV plant .

Economic Basis

Production parameters:

Photovoltaic energy

- PBT: 7 years
- IRR: 12 %

Thermal energy

- PBT: 9 years
- IRR: 8 %

Geothermal energy

- PBT: 11 years
- IRR : 6%

Energy efficiency

- PBT: 9 years

- IRR: 8 %

Environmental & Economic Sustainability

To visibly demonstrate Schüco's corporate mission, "Energy2 – Saving Energy and Generating Energy" to every visitor, a display in the new building's entrance area shows the energy generated and the energy saved by the system in real time. The energy concept of the complex is based on photovoltaic, solar and geothermal energy, a solar cooling system, intelligent façades, and a heat pump. Another important element that reduces energy consumption is the building automation developed for system control.

Lessons Learnt

The innovative refurbishment project impressively shows how a former industrial building can be transformed into a sustainable, resource-conserving, comfortable office building. This is the future for energy-efficient construction.

By combining sustainable photovoltaic thin-film technology with tried-and-tested Schüco façade systems, Schüco opens up new possibilities for solar architecture, and sets new standards of efficiency and design.

2.2 "One by one plus"

2.2.1 SOFIYSKA VODA AD, City of Sofia

Description of the project

Sofiyska Voda JSC provides for the services water supply, sewerage and wastewater treatment in the territory of the Municipality of Sofia.

The company provides water supply and sewerage services to around 1,400,000 people in the capital city of Bulgaria. Our responsibilities comprises the operation, maintenance and management of hundreds of facilities and thousands of kilometres of water and sewerage network. Our team consists of responsible and high-qualified employees who are customer-oriented and generate investments worth millions of Euros every year for the development and future of the city.

Sofiyska Voda JSC was established in October 2000 under a 25-year Concession Agreement. Under it, the Municipality of Sofia grants under concession to the company the operation and maintenance of the water supply and sewerage system in Sofia.

Our share capital is held by the Municipality of Sofia (22.9%) and the French company Veolia Voda S.A. (77.1% of the shares).

Sofiyska Voda is not the owner but a concessionaire of the water supply and sewerage assets – they are a public municipal property. All new facilities constructed with company investments are also public municipal property.

GBE Factory Model

The wastewater treatment plant (WWTP) for Sofia, treats domestic industrial and storm water coming from the city's sewerage network. The plant was commissioned in 1984 and it is currently the largest one on the Balkan Peninsula. The plant has operated continuously for over a quarter of a century and over the years it has undergone partial reconstructions and improvements, financed partly from EU funds and through the capital programme of Sofiyska Voda.

The plant is located in the lowest northern part of Sofia – Kubratovo – and covers a total area of 6,000 acres. Its designed capacity is 480,000 cubic metres of wastewater per day. Today, the average daily volume of wastewater treated at Kubratovo WWTP is around 400,000 cubic metres.

In October 2000, Sofiyska Voda JSC took over the activity of providing water supply and sewage services to the territory of the Municipality of Sofia and the WWTP Kibratovo, became part of the assets managed by the company.

At the beginning of December 2009, Sofiyska Voda JSC commissioned the largest co-generation installation in the Bulgarian water supply and sewage sector for production of electricity and thermal energy from biogas. In order to achieve this Sofiyska Voda JSC implemented an extensive investment project to modernize and renovate the current facilities and gas management in order to capture this biogas. Three co-generation units have been installed. Each of them has a capacity of 1,063 kW electrical energy and 1,088 kW thermal energy.

Quick Facts

LOCATION: Benkovski area, Sofia

PLANT SIZE (kWe;kWt): 3,189 KWe electrical energy

3,264 KWt thermal energy

TECHNOLOGY: Biogas co-generators

SITE OWNER: Sofiyska Voda

INVESTOR: Sofiyska Voda

PROJECT COST: € 2.6 million

KEY PARTNERS: European Bank for Reconstruction and Development and the United Bulgarian Bank

CURRENT STATUS: In operation

Design and construction

TECHNICAL DETAILS:

No. of Co-Generators: 3

Output of each co-generator:

Electrical energy - 1063 kW

Thermal energy - 1088 kW

TOTAL ELECTRICAL ENERGY GENERATED

2010 (January - December) – 1,117,160.3 kWh – average per month

2011 (January - September) – 999 090 kWh – average per month

TOTAL ANNUAL ENERGY CONSUMPTION

2010 (Jan - Dec) – 18,034,237 kWh

2011 (Jan - Sep) – 15,975,532 kWh

FIT and additional benefits

PARAMETERS OF INSTALLATION:

Typology and Profitability of equipment: Co-Generators with 83 % coefficient of efficiency

Installation building:

Power (kWp): 3189 kWe electrical energy

3264 kWt thermal energy

Feed-in Tariff (€/kWh): 61.02

Economic Basics

€0.8 million of the project cost has been covered under the BEERCL credit line (Bulgarian Energy Efficiency and Renewable Energy Credit Line) with funds contributed by the EBRD and the international fund for decommissioning Kozloduy nuclear power plant through the local bank partner on this credit line – United Bulgarian Bank AD. According to the mandatory procedures of BEERCL, and together with the technical project consultant Encon Services Ltd, we have developed a Rational Energy Utilization Plan. The project was finally approved by the financing bodies.

CONSUMPTION PARAMETERS

Consumer's energy cost (€/kWh) & internal consumption

Power: 3x 1,063 KW electrical energy and

3x1,088 KW thermal energy

Consumption EE (kWh/annual):

2010 (Jan - Dec) – 18,034,237 kWh

2011 (Jan - Sep) – 15,975,532 kWh

PARAMETERS OF THE INSTALLATION

Inflation on an annual basis: 3.5%

Maintenance and insurance cost: 130 K €/year

System's Depreciation charge: 10 %/year

Discount Rate: 0 %

IRAP (TAX): 10 % nominal

IRES (TAX): 17.21 % (effective for 2010)

- Pay-back period - 5 years
- Net present value – NPV - € 2 858k @ 10%
- Saved emissions of CO2/year

SAVED EMISSIONS OF CO2/YEAR

Year	tCO_2e
2007	36,213
2008	68,321
2009	100,474
2010	116,026
2011	124,700
2012	139,200

Environmental & Economic Sustainability

The co-generation turns around 83% of the energy content into efficient energy, which is about twice as much as compared to conventional plants. This means higher efficiency, hence lower price and lower pollution. The commissioning of the co-generation installation has provided environmental, economic and social effects:

• considerable reduction in costs for fuel and energy

• utilization of the waste product - biogas generated in the process of residues purification;

• reduction of the release of methane and carbon dioxide into the atmosphere, which contributes to improving the environment;

• the reduction of harmful emissions brings benefits not only to the capital's inhabitants but also contributes to environmental protection on a national and global scale;

• contribution to fulfillment of the State's obligation to reduce harmful emissions into the atmosphere in conformity with the Kyoto Protocol.

This plant carries out part of the project activities to reduce the carbon emissions according to the Reduced Carbon Emissions Sales Agreement between Sofiyska Voda JSC, the Carbon Fund of the EBRD and the Government of the Netherlands.

Lessons Learnt

The co-generation in Kubratovo WWTP is an important project for Sofiyska Voda JSC because it is further confirmation of our commitment to protect the environment. The treated wastewater of Sofia flowing into the Iskar

River, the stabilized residues which are used in agriculture and the green energy generated on site contribute to the protection of natural resources. The total benefits amount to 0.75 million Euros of saved costs of electric energy and a substantial contribution to the positive image of the company.

2.2.3 LEIBER GmbH

Description of the project

The Leiber GmbH is a modern biotech company and one of the leading producers of yeast for the food and feed sector. The company develops, produces and distributes dried brewer's yeast and yeast extract and is currently developing products for the health and cosmetics sector.

GBE Factory Model

The company installed a new waste-water treatment plant which also produces biogas. The biogas fuels a Combined Heat and Power Plant (CHP) which produces electricity and heat (CHP output: 190 kW electrical power/ 240 kW thermal power).

The company cannot not only meet its own heating needs but also sells part of the heat produced to a neighboring company.

Quick Facts

LOCATION: Bramsche/ Germany

PLANT SIZE (kwe;kwt): CHP output: 190 kW electrical power/ 240 kW thermal power

TECHNOLOGY/IES: Biogas CHP

SITE OWNERSHIP: Leiber GmbH, Hafenstraße 24

49565 Bramsche

INVESTOR: Leiber GmbH

PROJECT COST: 850,000 Euros

CURRENT STATUS: In operation

Design and construction

ELECTRICAL POWER: 1.115.000 kWh/ year

THERMAL POWER: 641.000 kWh/ year

ECONOMIC PROFITS AND ASSOCIATED COST REDUCTIONS:

FEED-IN-TARIFF: 147.000 €/ year

HEAT USED (OWN CONSUMPTION AND DELIVERED): 22.000 €/ year

SAVINGS DUE TO EFFICIENCY MEASURES: 26.000 €/Jahr

FURTHER SAVINGS (LESS CHEMICALS USED, LESS WASTED PRODUCED): 81.000 €/Jahr

ELECTRICITY SAVED: 363.000 kWh/Jahr

ELECTRICITY SAVED: 72 %

REDUCTION OF CO2 EMMISSIONS: 1.109 t/Jahr

INVESTMENT: 850.000 €

RETURN ON CAPITAL: 33 %

Fit and additional benefits

Feed-in-tariff: 147.000 €/ year

Environmental & Economic Sustainability

The company has a fully integrated approach in order to address the issues, not only focusing on renewable energy sources but also addressing the topics of waste management and the use of chemicals in the production process:

- integrated innovative waste-water treatment with lower energy consumption, less waste and therefore reduced need to use chemicals;

- utilization of the biogas produced during the waste-water treatment in a Combined Heat and Power Plant (CHP);
- Return of the electricity produced into the public grid in accordance with the regulations on the feed-in tariffs;
- utilization of the heat produced by the CHP plant in the company's own production as well as in a neighbouring plant.

Lessons Learnt

This is a good example of how different needs within a company can be dealt with: the need for a new waste-water treatment plant led to the increased use of renewable energies not only to generate electric power but also to meet the demand for heat.

2.2.4 Zimmerei Sieverke GmbH

Description of the project

Sieverke was founded in 1912 and deals in all aspects of specialised carpentery. The company employs about 40 people, mostly engineers, master carpenters and carpenters. The company develops and produces wooden products like roof structures, wooden walls, window frames and wooden bungalows. Wooden parts are produced in the workshop with CAD/ CNC assistance and are assembled on the construction site by the company's own staff.

The company installed a warm-air heating system fueled with the waste-wood produced as part of the manufacturing process.

The company cannot only meet its own heating requirements to heat the workshop, but also the commercial and residential building next to it including tap water.

The wood used as a fuel does not have to be bought, but is waste from the production process.

Quick Facts

LOCATION: Lohne/ Germany

PLANT SIZE: 400 kW/ 32.000 m^3/h

TECHNOLOGY/IES: hot-air heating system fueled with renewables (briquette)

SITE OWNERSHIP: Zimmerei Sieveke GmbH, Ing.-Holzbau, Bakumer Str. 24, 49393 Lohne

INVESTOR: Sieveke GmbH

PROJECT COST: Euro

CURRENT STATUS: In operation

Design and construction

THERMAL POWER OF THE SYSTEM: 400 kW/ 16.000 m³/h

HEAT PRODUCED FOR THE WORKSHOP: 320 kW

HEAT FOR THE COMMERCIAL AND RESIDENTIAL BUILDING: 80 kW

HEATING EFFICIENCY: about 90 %

SAVINGS DUE TO THE NEW HOT-AIR HEATING SYSTEM WITH WOOD BRIQUET: about 20.000 €/Jahr

HEATING OIL SAVED: about 25.000 liters/Jahr

REDUCTION OF CO2 EMMISSIONS: about 70.000 kg/ year

FIT and additional benefits

Feed-in-tariff: N/A

Environmental & Economic Sustainability

Pellet and woodchip heating systems are fairly common in the housing sector but not in the commercial sector with large halls and workshops. In most cases hot-air heating systems are used instead of heating elements. The company had an oil-fueled hot-air system for the workshop and gas heating for the adjacent commercial/ residential building. Both were relatively expensive.

During this time the business was growing and with this growth there was ever more wooden waste. This waste was being disposed of in containers.

The company decided to address the different problems with an all-embracing approach. They contacted a local company that specializes in hot-air heating systems and that company was able to construct a wood-fueled system to meet their requirements.

To ensure clean burning, the waste wood from the production process is chaffed and mixed to produce a homogenous fuel. At the end of this process, the briquettes produced have a moisture of between 15% – 20 % and a heat value of 4 kWh/ kilo. An automatic conveyor screw with adjustable speed transports the wooden fuel constantly from the silo to the furnace.

The air is taken in and filtered via an air-channel system before it is piped to a heat exchanger. The heating efficiency is about 90 % as air can be heated easier than water and air can be used directly for heating purposes with hardly any loss. This saves both on fuel and other costs.

Excess heat is also stored in a water-storage system that is connected with the commercial and residential building with a long-distance heating line.

In one year, the wood-working creates about 500 m^3 wood-chips (30 to 40 tons). This is equal to about 30,000 liters of heating oil.

Lessons Learnt

This example demonstrates that with careful planning, and co-operation with an external consultant – in this case the specialist on hot-air heating systems – and the will to develop new, innovative systems can help to tackle different problems with one solution. The solution leads to the tailor-made utilization of RES, helps to cut costs and is also a contribution

to climate protection. It is a rewarding solution though there are no permanent benefits like for example feed-in tariffs.

The development of the innovative hot-air system was supported by the federal state of Lower-Saxony.

2.3 "One to many"

2.3.1 Solar.nahwaerme Energiecontracting GmbH

Description of the project

Solar.nahwaerme Energiecontracting Gmbh is a subsidiary company of nahwaerme.at Energiecontracting GmbH, which is an Energy services company. It was established and operates in collaboration with local partners, and developers systems based on renewable energy sources. In the project "Wasserwerk Andritz" a large scale solar thermal plant was erected in the grounds of the local water supplier. The system supports the local heating system (LH) of the office buildings of the local water utility. The surplus heat is fed into the district heating grid (DH) of the city of Graz. With the installation of high temperature (HT) flat plate collectors, the required temperatures for district heating supply can be achieved. In the local water conservation area, enough space was available for construction of the plant.

The installed solar thermal system covers about 40 % of the heating energy requirements of the local office buildings. The largest part of the heat production however is fed into the district heating grid.

Quick Facts

LOCATION: Wasserwerkgasse 9-11; A-8045 Graz

PLANT SIZE: 3,855 sqm

TECHNOLOGY/RES: Solar thermal HT collectors

SITE OWNERSHIP: Holding Graz AG

INVESTOR: Solar.nahwaerme Energiecontracting GmbH

PROJECT COST: 1.57 Mio. €

STATE GRANTS: 550.000 €

KEY PARTNERS: S.O.L.I.D. GmbH; Holding Graz AG; Energie Graz AG

CURRENT STATUS: Operational

Design and construction

The solar plant feeds in over a heat exchanger into a storage tank with 62 m^3. As a matter of priority which serves as an inventory heat storage tank. In the case that the solar plant cannot deliver energy, the district heating as a conventional source of energy provides the storage tank. Furthermore it is planned to install a heat pump this year, which will operate, if the temperatures of the collectors fall below a reasonable temperature, because this temperature is still high enough for reaching a satisfying COP of the heat pump. Starting out from the storage tank the existing equipment as well as the new building is provided with warmth. If there is a surplus of solar energy, i.e. storage tank is fully loaded and can take no more warmed energy; the solar energy is fed directly into the district heating net of Graz. All collectors are free mounted in the area of "Wasserwerke Andritz". This large-scale solar plant demonstrates the commitment of the city of Graz to renewable energies and the further protection of the environment. This plant is the 4th solar system which has been integrated into the district heating system of Graz.

TECHNICAL DETAILS:

TOTAL SURFACE: 3,855 sqm

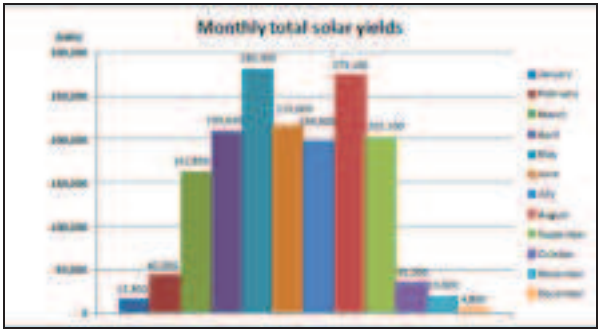
NUMBER of thermal collectors: 270

HEAT STORAGE: 62 m³

TOTAL solar yield: 1,657 MWh/year

SPECIFIC solar yield: 430 kWh/m²BRUTTO*a

MONTHLY TOTAL ENERGY GENERATED

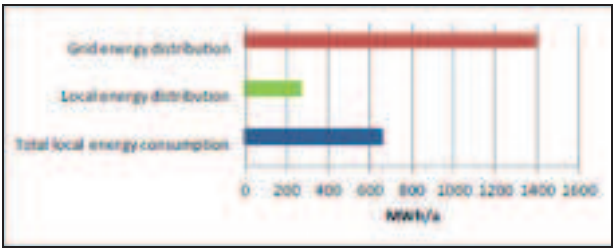


ENERGY DISTRIBUTION

Local energy consumption = 654 MWh/a

Local energy distribution = 262.3 MWh/a

Grid energy distribution = 1,394.6 MWh/a



FIT and additional benefits

PARAMETERS OF INSTALLATION:

Installation: 2nd QT 2009

Capacity [kWtherm]: 2,062.4

FEED-IN-TARIFF:

LH: 54,352 €/MWh

- Demand rate LH: 204,6 €/month
- Winter tariff: 31,51 €/MWh
- Summer tariff: 26,74 €/MWh

Economic Basics

PARAMETERS

See feed -in-tariffs.

PARAMETERS OF ECONOMIC'S SIMULATION SALE

Interest rate: 4.0%

Grants: 550,000 €

Maintenance and insurance cost: app. € 1.000

Depreciation period: 25 years

System's Depreciation charge: 4 %

Discount Rate:

LH: 0%

DH: 17.3 % (based on the winter tariff)

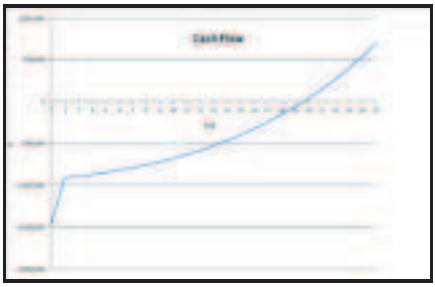
Income tax: 25 %

SIMULATION'S TECHNICALS PARAMETERS

District heating net: 84.2 % of total solar energy produced

Local heating demand: 15.8 of total solar energy produced

Solar fraction: 40 % of the local heat demand



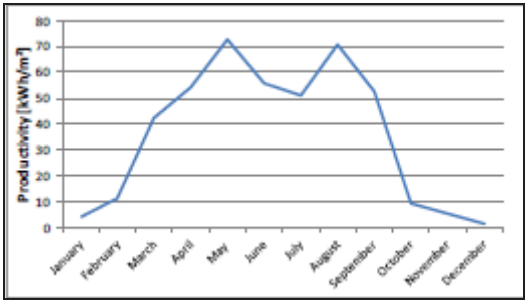
Payback period: 19.6 years

IRR after 25 years: 8.7 %

Environmental & Economic Sustainability

The measured total solar yields are shown in the table below.

	Total solar production [kWh/month]	Total solar production [kWh/brutto m² coll.]
January	15,300	4.0
February	42,500	11.0
March	162,800	42.2
April	209,600	54.4
May	280,000	72.6
June	215,000	55.8
July	196,900	51.1
August	273,100	70.8
September	202,100	52.4
October	35,200	9.1
November	19,600	5.1
December	4,800	1.2
SUM	1,656,900	429.8



TOTAL MONTHLY TREND ANALYSIS OVER THE YEAR:

Solar thermal energy is CO2-free and therefore environmentally friendly. In determining the CO2 savings the following substitute heat sources were considered: Coal power plant, natural gas power plant, gas heating plant, industrial surplus heat. The impact of the district heat amounts to 99.206 kg CO2/MWh.

Contribution to the environment		
CO_2 Savings	164	[tons CO2/year]

Lessons Learnt

This solar thermal system illustrates to us the following points:

- Efficiency of large solar thermal applications;
- Application of an ESCO model in this field of RES;
- Existing economy (also with a 17.3% lower feed in tariff compared to conventional heat sources, which feed into the district heating grid);
- Possibility of solar district heating supply;

This example demonstrates the possible use of large solar thermal plants. Due to higher feed-in tariffs in an industrial area, the payback time could be significantly reduced.

2.3.3 HTMAS

Description of the project

HTMAS is a Slovak Industrial Park, located between Banska Bystrica and Zvolen in the village of Vlkanova. It has been developed to host local and foreign companies, both for logistics and manufacturing. The Industrial Park has been designed to fully protect the environment.

Quick Facts

The HTMAS industrial park in Vlkonova opened in 2008, it invested in green energy and installed sun collectors on the rooftops of the industrial park buildings with a total power output of 855 MW/H it officially started producing electricity as of February 2010.

The Industrial park hosts in total 7 companies of various SME investors and manufacturing lines and it produces 92% of the required power.

Design and construction

The owners of HTMAS have established a local grid with 3 power supply transformers.

LOCATION OF PHOTOVOLTAIC POWERPLANT: Vlkanova, district Banska Bystrica, middle Slovakia (altitude 315 metres above sea level)

EFFECTIVE AREA OF MODULES: 6.036,87 m^2

INSTALLED POWER: 855,02 kWp

TYPE OF SOLAR MODULES: Yingli solar polycrystalline silicone (YL230P-29b)

NUMBER OF SOLAR MODULES: 3.716 pieces

INVERTORS OF ELECTRIC CURRENT: DELTA Electronics (7 x central invertor Delta CI 100; 9 x string invertor Delta SI 5000)

POSITION OF THE MODULES: 500 pieces, ground installation, orientation -5°; 716 pieces, roof installation, orientation -20°; 2.500 pieces, roof installation, orientation -5°

The owner of the solar panels is selling the majority of the power to the companies located in the park.

Economic Basics

The principal investor and owner of the park, uses the local grid to distribute electricity to all end-users in the park and 4 additional companies from the old industrial park of Vlkanova.

This year the park produced 920 MW. In 2012 the park will be constructing a new water power plant with a total installed power of 0,45 MW for the needs of the companies in the industrial park. This further investment will be repaid within 7 years.

The investor is transferring the same business model to Bulgaria and Romania in 2012.

Environmental & Economic Sustainability

CO2 reduction per year: 495.144 kg CO2.

Increased sustainability of the companies in the industrial park by minimizing the risks that could derive from the national grid.

Lessons Learnt

Installation of the roof-topped solar panels in industrial parks promotes development of self-sustaining model for the use of power from the grid. The companies in the industrial park are not dependant on any possible shortage from the national grid as well as weather changes or any other external factors that could cause any drop-offs in the utility system.

Using the local grid enables the investors shorten the period of return of the investment from 15 to 7 years.

Decrease of C2O achieved.

Developed a model of one providing power to others in a closed grid system.

2.4. "Many to one"

2.4.1. Paderno Network

Description of the project

Paderno Network is not the only example of a "many to one" GBE FACTORY. In fact here there are 5 factory owners positioned in the same area that decided to install 5 PV plants and to join them in a single grid.

This structure is installed in an industrial area near Milan where consumption of energy is particularly high.

Quick Facts

LOCATION: Paderno Dugnano (MI)

PLANT SIZE: 2.000 mq

TECHNOLOGY/RES: Photovoltaic Panel

SITE OWNERSHIP: Every single factory

INVESTOR: Every single factory

PROJECT COST: € 890.190,00

KEY PARTNERS: ForGreen Spa

CURRENT STATUS: Operational

Design and construction

After a specific study, over single roofs were installed 5 singular photovoltaic implant that produce energy not only for the production of single factory but also, thanks to a "smart grid" between factories, for the others (obviously when they need more energy than what they need).

The type installation is grid-connected and has a three-phase medium voltage connection. The panels are connected to an inverter used to exchange the power on the site.

TECHNICAL DETAILS:

SURFACE: 1.800 mq

NUMBER of thermal collectors: 1.135

SECTION	SINGLE PV PLANT	POWER (kWp)	kWh/year	kWh/kWp
1	RDM	106,04	99.500	938
2	VISMARA	36,34	34.000	936
3	BI.ESSE	19,32	18.000	932
4	SCHIAREA	57,27	54.000	943
5	NIMA ERRE	37,26	36.000	966
TOTAL PADERNO DUGNANO		**256,23**	**241.500**	**943**

FIT and additional benefits

Installation: 1nd QT 2011

Feed-in-tariff: 0.355 (€/kWh)

Economic Basics

Deciding to install a photovoltaic system, from an economic point of view, is deciding to carry out a financial investment at all of effect. This is the case where there is equity of 30% and the other 70% is from bank financing.

Economic Basics	
TIR 20 years	15,49%
TIR 25 years	15,81%
Revenues 20 years	673.251
Revenues 25 years	808.098
Payback Period	5,94

Environmental & Economic Sustainability

The totally energy production from thin network is green-energy; therefore this is a really environmental friendly system.

Contribution to the environment	
CO2 emissions avoided (ton/year)	120,2

Also the system reducing the dependency on petrol and carbon fuel.

Consumption of oil avoided	
Oil saved (barrel/year)	7.902

Lessons Learnt

This is a very interesting solar system model because it allowed the energy needs of all the factories to be met and any surplus produced to be sold back to the national grid and the resultant profit distributed to all partners in the project.

3. MARKET ANALYSIS

3.1. Austria

Description of the domain-area of intervention and reasons for this choice

The market analysis is based on four parts. The first part is an overview of the actual energy figures in Austria and Upper Austria based on official statistical data, and gives an overview about the status quo. The second part is a questionnaire that was circulated to partners of Clusterland Upper Austria and to participants of events, like business lunches and plant visits. The third part is based on information gathered from personal interviews during our regular contacts with local authorities and companies over the last year (73 interviews in total). In the fourth and final part the building of 2 focus groups is planned to concentrate on two sectors.

The questionnaire and the interviews were carried out in the sectors of food, machinery, plastics, paper and wood, chemistry and construction, because these are dominant in Upper Austria.

The two focus groups will concentrate on food and plastics, because these are industries which make intensive use of heating and cooling.

Analysis of energy consumption in domain-area

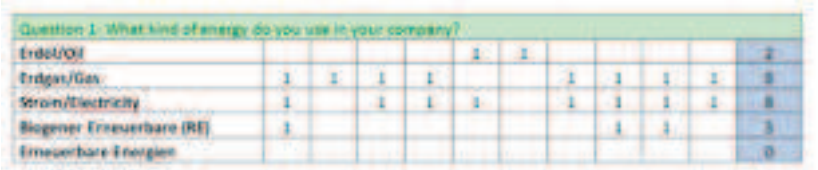
a. Based on yearly data issued by energy distributors (gas and electricity)

We can see that, with about 49,000 TJ of electricity, Upper Austria is Austria's biggest electricity consumer. Upper Austria is a very strong economic region with a very low unemployment rate. Gas consumption is

very similar to electricity consumption. Here Upper Austria is on the second level with a consumption of round 39,500 TJ gas a year. When we look at the sectors which are the largest electricity consumers, we see the manufacturing sector on the first level with requirements for 96,150 TJ electricity, followed by private households with an electricity demand of nearly 61,500 TJ. Gas consumption is nearly the same as electricity. The greatest gas consumer is the manufacturing sector followed on the second level by private households. These two consumers need more than 80% of the entire gas consumption in Austria.

b. Responses to the survey questionnaire sent to sample SMEs

Gas and electricity are the main energy forms used, RE, where used, forms only a minor part of the energy mix.



Question 1: What kind of energy do you use in your company?											
Erdöl/Oil					1	1					2
Erdgas/Gas	1	1	1	1			1	1	1	1	8
Strom/Electricity	1		1	1	1		1	1	1	1	8
Biogener Erneuerbare (RE)	1							1	1		3
Erneuerbare Energien											0

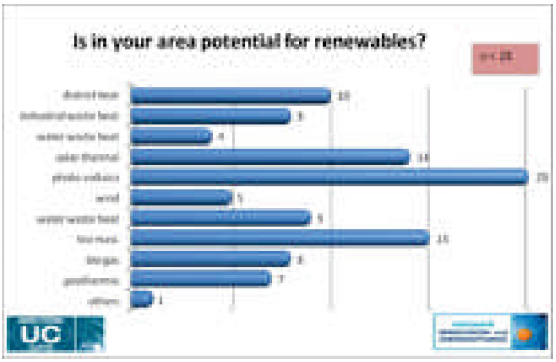
Indicators of energy consumption

The four tables give a detailed view of oil, gas, renewables and electricity for Austria and Upper Austria.

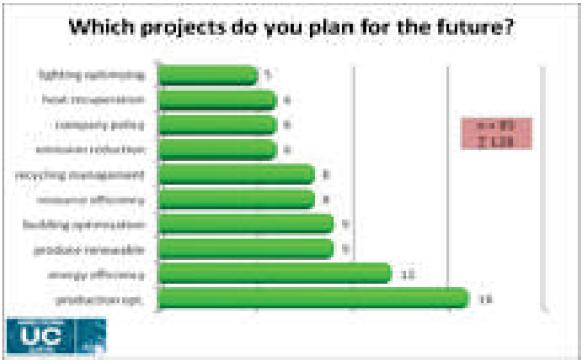
Existence and willingness of SMEs to invest in GBEFACTORY

The very interesting result of the interviews with local authorities (which give a relatively valid representation of the willingness of SMEs) was that

local authorities identify a lot of potential for renewable energy. An overview of the answers can be seen in the following graphic.



Considerations on the potential and possible early GBEFACTORY interventions of the companies, more than a third expect renewable energy as a basis for a notable part of the necessary energy supply. The technical solutions for using renewable energy were supposed to be photovoltaic, wind-energy, biomass and biogas. Energy recovery and energy efficiency will also be important.



Looking at this graphic we can summarize and see that:

1. Many companies plan projects dealing directly or indirectly with energy supplies (85 energy supply projects out of 128 projects planned in the next three years).
2. 9 projects deal directly with the production of renewable energy.
3. Energy efficiency in buildings and in production are the absolute leaders.
4. Many projects, like lighting optimization, heat recovery or recycling management, are basis projects for implementing renewable energy in the future.

The final result of the market analysis for companies so far, is an extremely high interest and demand for technical solutions for using energy efficiency and renewable energy in production buildings as well as in the production process itself.

Final conclusion

The demand for technical solutions is high and the variety of technical solutions is even higher.

This market analysis is now the basis for the creation of 2 focus groups of representative people, each focus group having a minimum of 7 participants. The goal of the focus groups are the comparisons and the conclusions that are drawn from the data collected from questionnaires and personal interviews, addressed to identifying key perceptions and awareness of the issues of GEB Factory.

3.2. Bulgaria

PRICES OF RES ENERGY CARRIERS

The preferential prices for electric energy buy-out, from the different types of plants using RES, are considerably higher than the electric energy obtained from the final supplier:

- Photovoltaic electric stations – about 5.5 times higher
- Wind electric stations – about 1.7 times higher.

With this ratio the producers' motivation, for these types of RES, is to sell the electric energy at preferential prices instead of consuming it in situ or in regions. At the same time, there is a policy of systematically reducing the price differences.

FUNDING OPPORTUNITIES

Relatively good opportunities exist in Bulgaria for funding RES projects.

- The credit line along the EBRD on energy efficiency and renewable sources – grant up to 20%.
- Bulgarian fund of energy efficiency and RES – preferential rate of interest.
- Credit lines operated by banks with grant opportunities up to 15%
- Programs under the Operational program "Development of the competitiveness of the Bulgarian economy 2007-2013" with grant opportunities up to 50%
- ESCO companies, etc.

Description of the domain-area of intervention and reasons for this choice

As a result of the preliminary analysis of the state of the RES sector in Bulgaria, the market survey is directed with priority to the following areas:

By types of RES – biomass, solar collectors for heating energy, biogas of recycled waste, thermal sources – with the greatest potential.

- Sectors – chemistry, chain stores, hotels in the cross-country section – with significant energy intensity, importance in Bulgarian economy and suitable for the project purposes.
- Regions – national scope and Stara Zagora of broad scope of surveyed entities.

The results of the market surveys in 2 aggregated focus groups are shown in the next sections:

- Industry Focus Group (chemical and processing industries - 45 enterprises - 9625 employees)
- Commercial buildings & Hotels (24 buildings - 1550 employees)

Analysis of energy consumption in the domain-area

INDUSTRY FOCUS GROUP

- Around 22% of the companies have considerable energy consumption – over 20% of the overall production costs and the application of RES to cover these costs, or part of them, would contribute to increasing the share of green energy in Bulgarian industry.

- Around 40% of the total energy consumption is electricity, and around 14 % of liquid fuels – high impacting energy carriers on greenhouse gas emissions. Enterprises using liquid fuels are serious potential candidates for GBE factories.
- Heating and domestic hot water in SMEs use in the range of 38-44% of the total consumption of heat energy – types of consumers with special priority for the GBE Factory project.
- Around 24% of the total consumption of electricity is used for heating and cooling – types of consumers with special priority for the GBE Factory project.
- Only 2 of the surveyed companies have been using RES as a measure for saving energy, resources and environmental impact over the last three years. The assessments of the introduction of RES are positive. A further 7 companies (about 15%) are planning to introduce RES and could be considered as potential GBE F.
- As a whole, the companies positively evaluate the extent of their awareness as well as the services offered by suppliers of RES.
- Among the impediments, the most mentioned obstacle is the lack of specific information (technical, expert best practice related, etc). The tasks of the GBE Factory project are meant to mainly overcome these barriers.
- All companies show interest and willingness to participate in the activities organized under the project.

COMMERCIAL BUILDINGS & HOTELS FOCUS GROUP

- The average heating area of the commercial buildings is over 5000 m2.
- The commercial centers are significant consumers of electricity – around 78% of the total energy consumption.
- Heating, ventilation and domestic hot water form a considerable share – around 23% of the total energy consumption.
- The commercial centers are serious potential candidates for the GBE Factory.
- 14 hotels have indicated interest in implementing biomass boilers for heating and DHW. The total expected cost savings are about 1,780 thousand BGN and the average payback period is about 3.6 years. The projects could contribute to a CO2 reduction of about 7590 t/year.

Existence and willingness of SMEs to invest in GBEFACTORY

The indicators of energy consumption for the 2 focus groups are shown in the following tables (market analysis report tips 18-4-2012).

Industry Focus Group (chemical and processing industries - 45 enterprises - 3625 employees) - final summary information

Type of RES	Oil (liquid fuel)	Carbon gas (natural gas)	Carbon electricity (electricity)	Renewable energy	Total	Indicator
	264000	1 375 900	1 322 200	466 900	3 128 400	*Absolute value (Mwh/year)*
	8.4	37.8	42.3	11.7	100.0	*Percentage value (%)*
Company's Energy Needs	27429	123171	137571	38857	323028	*Indicator: (Kwh/year/employee)*
	0.023	0.048	0.086	0.017	0.173	*Indicator: (Energy cost (€)/unit of turnover (€))*
Type of RES	Solar	Biomass/Biogas	Wind	Geothermal	Total	Indicator
	600	399 000			399 600	*Absolute value (Mwh/year)*
Company's renewable energy produced	0.1	99.9	0.0	0.0	100.0	*Percentage value (%)*
	2	1			13	*Number of installation*
Expected RES new	23	9			34.0	*Number*
installations due to the GBI FACTORY project activity	1000.0	4000.0			6000.0	*(Mwe/year and MWh/year)*

Commercial buildings & Hotels (34 buildings - 1530 employees) - Market Analisys - final summary information

Type of RES	Oil (liquid fuel)	Carbon gas (natural gas)	Carbon electricity (electricity)	Renewable energy	Total	Indicators
	10 509	21 584	4 917	200	39 210	*Absolute value (Mwh/year)*
	26.8	54.9	12.7	0.5	100.0	*Percentage value (%)*
Company's Energy Needs	6700	13890	4465	129	25297	*Indicator: (Kwh/year/employee)*
	0.0181	0.0231	0.0127	0.00027	0.0841	*Indicator: (Energy cost (€)/unit of turnover (€))*
Type of RES	Solar	Biomass/Biogas	Wind	Geothermal	Total	Indicators
	200	0			200	*Absolute value (Mwh/year)*
Company's renewable energy produced	100.0	0.0	0.0	0.0	0.0	*Percentage value (%)*
	0				14	*Number of installation*
Expected RES new installations, due to the GBI-F project activity	2	7			9.0	*Number*
	200.0	8000.0			8200.0	*(Mwe/year and MWh/year)*

3.3. Germany

Description of the domain-area of intervention and reasons for this choice

For the purposes of the GBE Factory market analysis, high-energy consumption sectors have been analyzed among the main sectors that represent the industrial structure of the German Region of Brandenburg. The market analysis covers the Bundesland Brandenburg area. Brandenburg measures 29,478.61 sq.km with a population of 2.497 million. Brandenburg surrounds the German Capital Berlin (another 3.5 million inhabitants).

The market analysis should discover suitable sectors to be chosen for further GBE-factory activities; meet the needs and interests of the stakeholders and lead to 2 focus groups covering 7 companies.

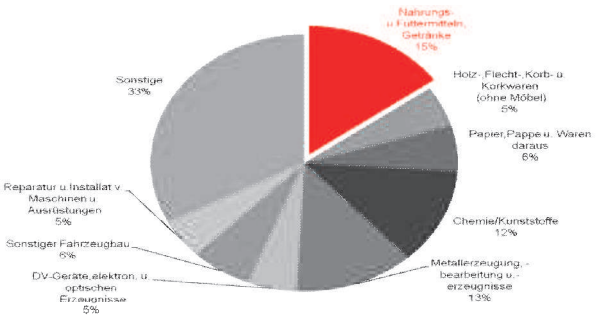
In particular, the focus was put on Hotels/SPA centers and on food-processing companies as very appropriate for GBE-FACTORY interventions. Stakeholders in these branches have already shown interest in being approached by the GBE-factory project. Other representative sectors that are also characterized by very high energy consumption (i.e. Metal, Chemistry, Paper production) have not been selected however, either because they are already provided with similar solutions or because they are already well structured internally and do not need external consultation.

Analysis of energy consumption in domain-area

a. <u>From yearly data issued by energy distributors (gas and electricity)</u>

Energy consumption and intensity in Germany are split into different sectors, Metal, Chemistry but also Paper, which, in absolute figures, dominate energy consumption in Germany and Brandenburg (Frauenhofer/Statistische Bundesamt/Amt für Statistik Berlin-Brandenburg).

Better data for Brandenburg were not available. Therefore three local experts (Clustermanager Energy, Energy Technology Initiative and Bioenergy Promotion) were interviewed in order to identify which sectors could be most suitable in Brandenburg.



Source: Amt für Statistik Berlin-Brandenburg

It turned out that the Metal, Chemistry and Paper sectors were NOT recommended because either they have extensively investigated the issue in the past and have already implemented solutions or are rather too big for asking / demanding external advice.

The recommendation was to focus on the Food Industry (characterized by high energy intensity with absolutely high figures of energy consumption) –

some companies have already shown an interest, and Tourism - in terms of Spa baths and hotels (a hot topic in this sector).

b. Responses to the survey questionnaire sent to sample SMEs

FOOD INDUSTRY

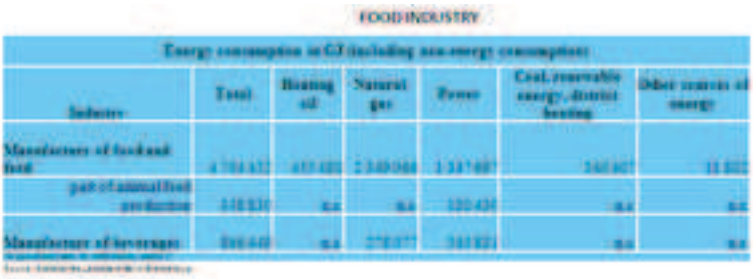
General optimization potential, mostly in cross-section techniques: i.e. compressed air, refrigeration, air-conditioning, lighting, cleaning.

Higher energy efficiency through waste recycling (such as a biogas plant).

TOURISM INDUSTRY

Primary energy demand in Spas. High heat demand in the sauna, in swimming pools (continuous evaporation of the water surface), hot water for showers. Power consumption and hot water requirements during summer months. Possible Improvement: relatively simple measures can generate 50% energy savings (i.e. pool cover, demand controlled ventilation, energy saving circuits, insulation, etc.). Possible measures in almost all the areas: electrical engineering, heating, ventilation, water, the building itself.

Indicators of energy consumption



Manufacture of food and feed	Energy consumption in GJ
Slaughtering and meat processing	709 413
Fruit and vegetable processing	375 671
Milk processing	398 760
Grain mills, manufacture of starch and starch products	843 877
Manufacture of bakery and pasta	634 369
Manufacture of other food	1 403 530
Manufacture of animal feed	338 830
overall	**4 704 452**

Source: Statistisches Landesamt Berlin-Brandenburg

TOURISM INDUSTRY (Wellness +SPA Centres)

Adventure and Leisure

Thermal / Thermal brine bath

both

Spas distributed evenly over Brandenburg
Adventure and water parks primarily near Berlin and in South Brandenburg

Typical power consumption of a bath (built after 1990)

	kWh per m² of water
Heat	1.500
Power	1.300

Source: Böttcher 2009

Energy Consumption in hotels and restaurants

Company type	Companies in Germany*	Energy consumption per operation per year (kWh)	CO2 emissions per farm per year (in tons)	Total CO2 emissions per year (in tons)
1+2 Stars Hotels	793	294.425	105	83.265
3 Stars Hotels	4.845	372.727	134	649.230
4 Stars Hotels	2.293	1.653.000	658	1.508.794
5 Stars Hotels	134	5.746.000	2.342	313.828
Bed&Breakfast	16.675	219.295	84	1.400.700
Pensionen	6.049	150.065	54	326.646
Summe	30.789			4.309.463

Calculations are based on estimates of average values of the energy campaign Hospitality
* Non-classified hotels according to the classification DEHOGA hotel are not included in the number
Source: Deutscher Hotel- und Gaststättenverband e.V. (DEHOGA)

Existence and willingness of SMEs to invest in GBEFACTORY

The optimization of energy costs is an ISSUE for all the interviewed companies: 19 out of 20 of the interviewed companies need enhanced energy efficiency (exception: 1 new Spa bath).

Higher relevance is given to “energy efficiency issues” than to “renewable energy issues”.

Most companies consider the energy source as secondary; the price is the critical factor, especially for SMEs. Larger SMEs mainly have active energy management, and they are often already in an advanced stage of process optimization.

Many Food Processing companies are involved in cluster and network activities, therefore they already receive multifaceted advice and information.

The production process in manufacturing companies is often very complex, therefore specialized and technical solutions are more important than standard advice.

Final conclusion

Energy-saving measures can easily lead to considerable improvements, especially for Hotels/SPA facilities and for food processing companies. In the first case, the public image is also a concern. Going green is very important for this kind of activity.

The analysis produced 4 categories of investigated firms:

Category 1: Companies / Spas without urgent needs (satisfactory energy-situation in the company, energy advice and support already secured, implementation of optimization measures in the near future unlikely, efficiency measures to be carried out without external help).

Category 2: Companies / Spas: measures for energy-optimization have already been designed, financial support needed to implement them (need for advice on subsidies, i.e. local specialists ZAB, Zukunft Agentur Brandenburg).

Category 3: Companies / Spas: measures for energy optimization have already been planned but not yet decided in terms of time and specific measures. Companies are reluctant to implement Res solutions; difficulty in finding individual appropriate technical and legal advice. Through the

mediation of ad hoc specialists for each company's need, the implementation process could be promoted.

Category 4: Firms that have recognized the need for energy optimization of their business for a long time, however the practical ideas for solving the problem are only just in the initial stage.

Companies in this category expressed the highest need for support.

In particular, 9 companies were recommended for assistance.

3.4. Italy

Description of the domain-area of intervention and reasons for this choice

The wood and furniture sector has been selected because of its historical openness in Italy to reusing waste materials and by-products of their productive process. In this sector moreover there are some companies in which the cost of energy consumption on turnover is highly relevant.

In Friuli Venezia Giulia the cluster count 750 companies and other 600 companies are located in the Veneto region.

The wood and furniture cluster of Livenza (covering an area between the Veneto region and the Friuli-Venezia Giulia region in North East Italy), stands out for its attention to environmental aspects and the certification of raw materials according to various standards (FSC, PEFC and other), as well as the management of by-products. The Livenza cluster has been one of the first to receive an EMAS certification in Italy. This analysis builds upon a Map of the environmental situation and of the energy consumption carried out in 2010 by ASDI (Industrial Development Agency of the cluster), Federlegno Arredo (sectorial association of wood and furniture), Green&CO2 e SPIN 360 (to ESCO companies), on a panel of 88 companies representing the productive mix of the cluster with 21 directly audited companies.

Analysis of energy consumption in domain-area

The 88 companies analysed overall account for the following figures:

	Numero	Mln KWh	Mln €
Companies	88		
Total turnover			1.167
Total employees	6.385		
Consumption energy/year		160	
Costs energy/year			20

Considering that the quotas of kWh of energy produced by different energy sources calculated by ASDI are the following:

- electrical energy 45%
- natural gas 10%
- heating oil 7%
- wood powder 38%

The importance of electrical energy is evident, used by companies both for productive processes and general services (lighting, aspiration, compressed air,). The quota of consumption of wood powder coming from waste materials is also relevant, and is used mainly for heating the production departments. It is probable that the quota of energy produced by burning BTZ oil will decrease in time, in an inverse proportion to the expansion of the natural gas network.

When analysing the costs coming from the energy consumption of the 88 companies, we see instead that the weight of electrical energy is the most relevant, while the costs linked to wood powder are irrelevant (a by-product available any way from the companies' activities):

- electrical energy 88%
- natural gas 6%
- heating oil 6%

- wood powder 0%

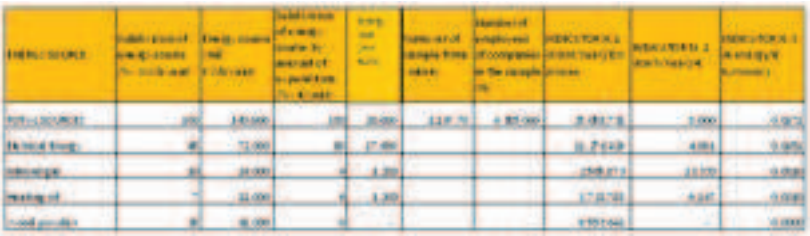
Considering the new rates of incidence of the cost of the various forms of energy, it seems that it is the electric power which determines energy costs, and therefore interventions for energy saving and for the installation of renewable energy sources should be promoted in this direction.

Indicators of energy consumption

Given the data of paragraph 2), it is possible to calculate the following absolute values regarding the energy sources used:

ENERGY SOURCE	Subdivision of energy source (% - KWh/year)	Energy source (min KWh/year)	Subdivision of energy source by amount of expenditure (% - €/year)	Costs of Energy (min €)	Notes
TOTAL SOURCES	100	268,000	100	20,000	
Eletrical Energy	45	117,000	88	17,6	
Natural gas	10	26,000	0	1,20	
Heating oil	7	18,200	0	1,20	
Wood powder	38	98,800	0	0	

Using the data shown in TABLES 1 and 2, it is possible to calculate the following indicators:



While the indicator N.1 (KWh/year per employee) can be considered as meaningful also for heterogeneous companies, the indicators per unit of turnover are more representative when considering homogeneous companies.

From an analytical calculation, ASDI has detected that the weight of energy costs per unit of turnover decreases with the increase of the company's overall turnover. This is determined by:

- the reduction of the specific energy costs (for bigger amounts of energy purchased, lower is the price per kWh)
- optimization of the use of energy (big machineries usually have better performances than smaller ones).

ASDI has pointed out two kinds of observations:

- a high indicator n°3 corresponds to companies with particularly energy intensive processes like varnishing or plastic processing
- a low indicator n°3 corresponds to companies with low energy consuming processes like trading or stump processing.

Considering then the different incidence of thermal and electrical energy, ASDI highlights how the expenditure for electrical supply is comparable to the one for thermal supply for the companies which have a lower turnover, while when the turnover grows the incidence of expenditure for the electrical supply grows in respect to the latter. This confirms the relevance of the cost of electrical energy for companies with higher consumption, in particular for those which process furniture components and hence have thermoplastic processes which are energy-intensive.

As mentioned the FACTORY TEAM GBE then proceeded to examine the 88 questionnaires and to calculate the surfaces of the roofs of the companies in order to calculate a useful indicator to assess any possibility of installing photovoltaic on the roof. In TABLE 4 the calculated covered surfaces are reported by type:

Covered surfaces	Covered surfaces	Extension (sqm)	Number of companies	Remarks
Total surfaces		1.113.212,81	88.00	
	Production activity	424.891,70	88.00	
	Offices	44.000,00	88.00	
	Showrooms	23.992,41	82.00	about 30% of the sample uses showrooms
	Others (e.g. factory stores...)	618.269,70	60.00	mostly stores

The coverage indicators expressed in "square meters per firm" can then be calculated.

Type of covered surface	INDICATOR N.1 average covered surface (sqm) per company	Total covered surface (sqm)	Remarks
Total covered surface	12.600,196	9.687.689.176	
Production activity	6.987,868	5.280.537.230	
Offices	500,000	375.809.699	
Showrooms	865,043	648.785.250	
Others (e.g. factory stores...)	5.971,165	4.428.356.750	
			Total number of cluster factories: 750

Existence and willingness of SMEs to invest GBEFACTORY

On the 13th of March 2012 a Focus Group was held in the frame work of the GBE FACTORY (www.gbefcatory.eu) at the premises of the Livenza cluster, to assess the projections elaborated in the analysis. The Focus group was composed by representatives of Unioncamere del Veneto, lead partner of GBE Factory, of ASDI, of GreenCO2 (the ESCO company which carried out the investigation on the 88 companies) and of companies from the cluster. During the focus group the considerations explained below were discussed and assessed.

As reported above, the cluster includes more than 750 companies in the Friuli Venezia Giulia region, with 13.000 employees. Using the indicators concerning the kind of energy source coming from the data of the 88 investigated companies, an estimation of the overall energy consumption of the cluster can be done as follows.

ENERGY SOURCE	INDICATOR n°1 (kWH/year)/employee	ESTIMATION OF TOTAL ENERGY SOURCES OF THE LIVENZA CLUSTER (kWH/year)	notes
TOTAL SOURCES	25.058,73	325.763.508,22	
Electrical energy	11.276,43	146.593.576,70	
Natural gas	2.505,87	32.576.350,92	
Heating oil	1.722,70	22.396.241,19	
Wood powder	9.553,60	124.197.337,51	
			OVERALL NUMBER OF EMPLOYEES: 13.000

Considering that on average a kW of installed electrical power in companies of the cluster may correspond to 2.500 kWh consumed each year, and calculating a 20% overpower, the average installed electrical power in the cluster can be estimated in 70 MW, for an average value of about 100 KWe per company.

Bearing in mind that many companies use wood powder for heating the buildings and for some phases of the industrial process, de facto generating renewable energy, an area of potential development for passing from fossil fuel to less impacting sources of energy is the one that currently is covered by heating oil. Heating oil is used in the companies of the cluster is mainly used for the same scope of wood powder, that is air conditioning of the offices and hot water, as well as during the summer when the boilers remain turned off. If we assume that we substitute all the thermal energy produced currently through heating oil with heat pump systems (air, water, geothermal) instead of 1.510.000 kg of low sulphur oil 5.510.000 KWH would be used, with consequent reduction of CO2 and relevant expenditure savings. The hypothesis made by ASDI is that by substituting the all the boilers of 82 companies, we would obtain the following figures:

ENERGY SOURCE	CURRENT SITUATION	SCENERY WITH HEAT PUMPS
CONSUMPTION	1.510.000 kg Low Sulphur Heating Oil	5.510.00 kWh (el)
PRODUCTION	13.775.800 kWh (th)	13.775.800 kWh (th)
COST	1.057.00 euro	828.000 euro

Such energy could double if the projection is extended to all the companies of the cluster. Moreover, electrical energy could be supplied nearly all by PV installations (see abundant availability of roof surfaces), reaching nearly the complete substitution of heating oil with RES sources. In fact for its nature, the furniture sector is characterized by companies that use a lot of covered surface. Applying to the whole cluster the coverage indicators calculated for the 88 companies, the following overall covered surface can be estimated:

TOTAL COVERED SURFACE	INDICATOR n°1 AVERAGE COVERED SURFACE PER COMPANY (sqm)	TOTAL COVERED SURFACE (sqm)	notes
TOTAL COVERED SURFACE	12.930,15	9.482.499,18	
production units	6.987,88	5.240.157,25	
offices	503,09	375.809,66	
show-rooms	866,07	646.781,27	
other (e.g. warehouses, ...)	5.971,11	4.478.981,71	
			OVERALL NUMBER OF COMPANIES OF THE CLUSTER 750

Considering the analysis of the 88 companies which took part in the survey, there are only 3 with PV plants, all of around 200 KWe per plant,

notwithstanding the fact that on the cluster's buildings surface there are more than 9 million free square meters.

If only 10% of the covered surface were used for installing PV plants, it is possible to estimate a potentiality for new installations of about 90 MWe. This installed capacity could cover all the demand of electrical energy of the sector, which we estimated in 70 MWe.

The fact that there is so much available surface and so few PV installations is also due to the fact that the buildings are usually old and would require very expensive reinforcing interventions in order to host polycrystalline PV panels. Many roofs are moreover irregular and not looking South, resulting from an increase in the volumes of the buildings carried out gradually in time, without particular attention to the development of surfaces.

Solar thermal plants are not present among the 88 companies, but this is explainable because the companies use wood powder for producing heat.

In all the considerations made above, the following real costs of energy for the Livenza cluster have been taken into account:

Energy source: €/kWh

- Electrical energy: 0.15
- Natural gas: 0.05
- Heating oil: 0.06
- Wood powder: 0

Finally it must be highlighted that the study carried out by ASDI took in consideration especially the potentialities for energy efficiency with reference to production and air ventilation, showing how interventions on

the motors and on the alternators can lead to relevant savings with returns in terms of PBT of a few years.

Final conclusion

The conclusions regarding the potentiality for GBE FACTORY interventions are the following:

- A part from the energy efficiency interventions, there is space in the cluster companies for further increasing the use of "production by-products", mainly wood powder, in order to produce both hot water and energy for air conditioning and electrical energy through ORC boilers;
- The cluster could network a group of small entrepreneurs producers of wood powder and make them part of an organization for managing a centralized co-generation plant, fed by wood powder produced by the members or by external actors, located in the same industrial area, so to produce electrical energy to be fed in the grid and heat to be used on the companies located nearby the co-generator;
- Substituting heating oil with heat pump systems could bring to relevant economic and environmental benefits (such practice is partially already started by some companies that installed high performance gas boilers and also heat pumps);
- Solar PV should be taken more in consideration given the abundance of roof surface available, and often 100% disused. Solar PV could be used in some kind of companies which are

particularly energy consuming (printing/processing of plastic or materials) with the mixed formula of on the place consumption and giving to the grid the exceeding energy;

- Small PV plants could also be considered in combination with heat pumps.

Concluding, the Livenza cluster could avail itself of a mix of technologies that include:

- plants for the production of thermal and electrical energy fed by wood powder (boilers, co-generators,…);
- heat pumps (air, water, geothermal) generally matched with the plants at point 1) above;
- roof PV plants of medium dimensions (<1 MWe connected to the grid) and of small dimensions (inferior to 200 KWe) also combined with heat pumps.

3.5. Slovakia

Description of the domain-area of intervention and reasons for this choice

These strategic analyses are processed on the basis of existing data from distribution companies, the national statistical office, the national energy efficiency agency, the national energy regulation authority, interviews and focus group meetings with experts in the field of energy services/distribution and production, questionnaires from companies experienced in the installation of RES technology.

The major sources of RES in industry are in the timber and wood processing sector, including pulp factories and thermal power plants, replacing fossil fuel boilers with new ones run on wood chips/sawdust. However, natural RES sources with great potential in all the sectors of industry, services and trade are the following: solar, geothermal energy and biomass, as well as hydraulic. Therefore the largest energy producers/distributors (thermal plants) and energy utility companies are the biggest investors in RES technology, however mostly based on biomass or biogas. Greater quantities of vapour gas waste in the metallurgy and refinery sectors are the subject of cogeneration units for the production of heat and power.

Biomass used as a source of power in the food and beverage sector, however these initiatives are random and there is not a model for the sector in question. Solar collectors have been introduced as an additional source of electricity, mainly in one-two hotels and two industrial parks, however large companies and commercial zones are not focused on this type of RES. Most factories in heavy industry are trying to install modern co-generation units running on vapour gas or new boilers using biomass. So

far, commercial and logistic parks are not making advantage of these types of energy and power sources.

Analysis of energy consumption in domain-area

Energy intensity of the technologies used

In terms of energy consumption by conversion to electricity consumption turnover compared with Slovakia, the technologies used in the BBSK economy are, on average, very outdated. As the table below shows, energy consumption in the last five years is approximately the same, but compared to the national average is almost threefold. The diameter of the SR worsens, especially on the high consumption bulletin board.

Power consumption (by agriculture, forestry, transport, industry and construction) of MWh / 1 million Sk per year turnover Slovakia 10.2%, BB 27.7%.

Economic geography of the region

Regional seat: Banska Bystrica

Total Area: 9,455 km2

Number of Towns: 24

Number of municipalities: 516

Population: 660,000 inhabitants

Number of districts and their administrative centers: 13.

The region of Banská Bystrica lies in the center of the country and it borders on Hungary in the south. Part of this border coincides with the

River Ipel. The natural symbol of the region is the River Hron. Presently, the most relevant business activities in the region of Banská Bystrica are the mining, engineering, food, dairy, pharmaceutical, wood-processing, glass and ceramic industries. In relation to industrial production, the region of Banská Bystrica can be divided into the more industrialized northern part (comprising the districts of Banská Bystrica, Zvolen, Ziar nad Hronom and Detva), where the engineering, wood-processing, chemical and pharmaceutical industries are, and the agricultural southern part (the districts of Rimavska Sobota, Lucenec, Velky Krtis, Krupina, Revuca) focused on dairy products, crops and the food industry. The economic structure of Banská Bystrica has been following a steady shift from the industrial to the service sector over the past 15 years. Presently, the most relevant sectors in the region of Banská Bystrica are the mining, engineering, food, pharmaceutical, wood-processing, glass and ceramic industries.

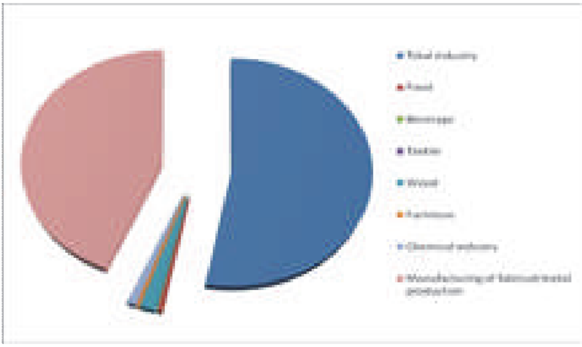
In relation to industrial production, the region of Banská Bystrica can be divided into the more industrialized northern part (comprising the districts of Banská Bystrica, Zvolen, Žiar nad Hronom and Detva), where the engineering, wood-processing, chemical and pharmaceutical industries and mining prevail, and the agriculturally-focused southern part (the of districts Rimavská Sobota, Lucenec, Velký Krtíš, Krupina and Revúca).

According to the National Statistical Office, at the end of 2010 there were on average 135,015 actively employed people with a prevailing occupation in industry (28.2 %), public authorities and social services (14.5 %) and education (12.3 %). Industrial firms employ 38,071 employees, most of

them occupied in the metallurgy – manufacturing of metal and construction materials.

<u>Industrial consumption of electricity a year 3143134 MWh, heat – 2560152 GJ</u>

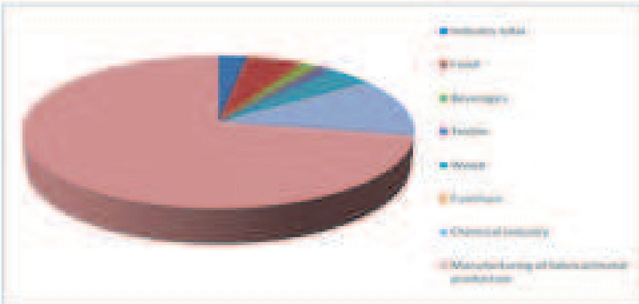
Industry sector	Consumption of electric power in MWh based on statistical data from 2010	Share in %	Consumption of heat in GJ based on statistical data from 2010	Share in %
Total industry	[illegible]		[illegible]	
Food	[illegible]	[illegible]	[illegible]	[illegible]
Beverage	[illegible]	[illegible]	[illegible]	[illegible]
Textile	[illegible]	[illegible]	[illegible]	[illegible]
Wood	[illegible]	[illegible]	[illegible]	[illegible]
Furniture	[illegible]	[illegible]	[illegible]	[illegible]
Chemical industry	[illegible]	[illegible]	[illegible]	[illegible]
Manufacturing of fabricalp/metal production	[illegible]	[illegible]	[illegible]	[illegible]



<u>Examination of the consumption of natural gas for industrial sector at regional and provincial level</u>

Total consumption of natural gas by all industries of BB region – 278418 m2, 9560390 GJ, biogas – 2930 m2 or 60854 GJ

Industrial sectors	Natural gas MJ/GJ	Share in %	Propane-butane MJ/GJ	Share in %	Biogas MJ/GJ	Share in %
Industry total	[illegible]		[illegible]		[illegible]	
Food	[illegible]	[illegible]	[illegible]	[illegible]	n/a	n/a
Beverages	[illegible]	[illegible]	[illegible]	[illegible]	n/a	n/a
Textile	[illegible]	[illegible]	[illegible]	[illegible]	n/a	n/a
Wood	[illegible]	[illegible]	n/a	n/a	n/a	n/a
Furniture	[illegible]	[illegible]	n/a	n/a	n/a	n/a
Chemical industry	[illegible]	[illegible]	[illegible]	[illegible]	n/a	n/a
Manufacturing of fabricat/metal production	[illegible]	[illegible]	[illegible]	[illegible]	n/a	n/a



Indicators of energy consumption

Indicators	Measures
Tep/€; not	Not measured
Tep/unit of product;	Not measured
Tep(or KWh)/employee;	Not measured
Share on electricity power consumption	84,99
Share on heat consumption	20,17
Share on fossil source (natural gas)	33,25
Share on employment	28,2 %

Existence and willingness of SMEs to invest GBEFACTORY

In the process of developing the market analysis, the Italian-Slovak Chamber of Commerce identified major sectors of economic activities in

the region of Banska Bystrica using energy-demanding technology and representing traditional industrial sectors in the region:

- Food production and distilleries/beverages
- Chemical industry
- Manufacturing of metal and construction materials

We have studied the energy-demands of 15 major producers in Banska Bystrica, representing almost 100% of the aforementioned sectors, and we have examined the energy performance of three firms using RES technology for the production of power and heat for their own use and for neighbouring companies.

The selected sectors are the highest consumers of electrical power with a share of 85% and heat consumption of 20%, therefore investments in energy production technology based on RES are of great importance. However further investments of RES in industry shall be properly analysed and audited in terms of financial efficiency, economy of scale and legal environment.

Apart from the major industrial sectors, the region of Banska Bystrica is populated by dozens of industrial parks hosting suppliers for the aforementioned sectors. Amongst the most active are the Vlkanova Industrial Park and the Ziar Industrial Park, both entities use solar collectors for producing electricity.

The Banska Bystrica region is in first place in the production of solar power, is a second major producer of biogas power, as well as a leader in installed capacity of hydraulic power plants and amongst the first 3 top regions of Slovakia using CHP on RES.

Name	Industrial Sector	Place
Food Industry		
TAURIS, a.s.	Potravinárska	Rimavská Sobota
Pivovar STEIGER a.s.	Pivovar Steiger	Vyhne
EKOREZ, s.r.o.	Chalupkova	Banská Bystrica
Mäspoma, spol. s r.o.	T.G.Masaryka	Zvolen
DRU, a.s.	Strážska cesta	Zvolen
Metalurgymical industry and Chemical Industry		
Železiarne Podbrezová, a.s.	Kolkáreň	Podbrezová
Slovenské magnezitové závody a.s. Jelšava	Teplá voda	Jelšava
SLOVMAG a.s. Lubeník	Lubeník	Lubeník
Nemak Slovakia s.r.o.	Ladomerská Vieska	Ladomerská Vieska
Slovalco, a.s.	Priemyselná	Žiar nad Hronom
TUBEX SLOVAKIA, s.r.o.	Partizánska	Žarnovica
TUBAPACK, a.s.	Priemyselná	Žiar nad Hronom
Reisner & Wolff Slovensko s.r.o.	Križovatka	Banská Štiavnica
KNK - výrobné družstvo	Huta	Lubietová
Neuman Aluminium Fliesspresswerk Slovakia, s.r.o.	Partizánska	Žarnovica

Banska Bystrica region is on first place in production of sun power, a second major producer of power on biogas as well as a leader in inastalled capacity of water power plants and amongst first 3 top regions of Slovaia using CHP on RES.

	BA	TR	NR	TT	PP	KE	ZZ	Banska Bystrica
Sun	233	1110	3027	384	713	1210	344	4280
Water	15507	34467	62459	391291	36220	34139	204777	102178
Biomas	29 202				71391	92240	110425	48490
Biogas	8156	12081	6857	1231	723	2811	3658	8299
Wind		5 140		1 196				
cogeneration co-ree	11794.1	53 130	305285	8404	18977	311121	109516	121773

Final conclusion

- Potential for installing CHP Technology on RES, due to the fact that there are many companies with large capacities and heavy

electricity consumption, see the table below of the 20 largest companies

- Potential for using waste from the production
- Potential for installing proper Technology
- Large chemical and metallurgical players
- A lot of thermal and mineral Spas in the leisure industry
- A lot of wood waste and wasted lands that could be used for producing biomass (plots used to be part of the mine industry in the region)
- Potential for developing and testing new Technology – discussed models of dust waste from wood
- Existing models of all types of RES – hydraulic, solar, biomass, biogas, vapor gas cycle
- Strong economic parameters
- Strong potential for research and development capacities – specialized universities in forestry, chemical engineering and electrical subjects

Conclusion

The outlined Business Models offers the general vision on the ways in which it is possible to organize and implement a GBE FACTORY. The collected best practices show real examples of how these models can be implemented in different countries and geographical conditions. Finally, the market analysis allows us to take into consideration specific market situations in the five member countries of the Project.

This market analysis is ongoing and will continue to be carried out in accordance with strategic market requirements and its impact for regional or national economies. We hope that this complete Guide will offer the information and stimulus required for a wide-range of similar examples throughout Europe's many markets.

The GBE Factory project aims at accelerating the deployment of bio-sources (Green), such as biomass, bio fuel, biogas and¨ or from other major natural sources (Blue) arising from the sky and the earth, such as sun, wind, the earth′s crust for heating, cooling and electricity production in new or rehabilitated commercial and industrial buildings.
In this way GBE FACTORIEs can not only be self-sufficient industrial\commercial energy buildings, tending to zero emissions, but also real RES generation plants, that can share renewable electricity and thermal energy with the surrounding industrial or commercial area.
GBE FACTORY will represent the transition from fossil fuel warehouses to second generation industrial or commercial buildings.

Picture Kilkis, Thessaloniki (GR)
Henning Larsen Architects take the ugly grind out of industry with this handsome solar panel factory in Greece. Commissioned for Kilkis, an industrial area north of Thessaloniki, the factory′s dual purpose as a production facility and office space required a comfortable, practical, and sustainable design. Like other Henning Larsen projects, such as the Campus Roskilde and Energy Flex house, the 100,000 square meter facility rises to the challenge by marrying passive design and modern technology to create a factory that is almost entirely self-sufficient.

Image credits courtesy of Henning Larsen Architects