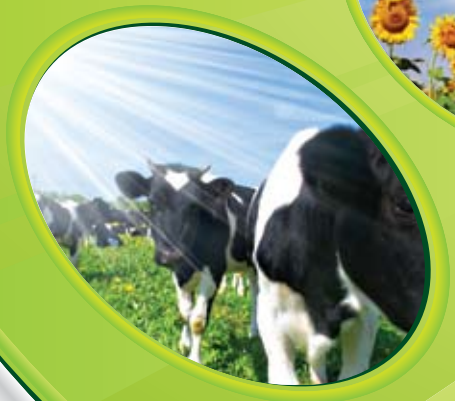
Intelligent Energy Europe

Contract N°: EIE-07-264



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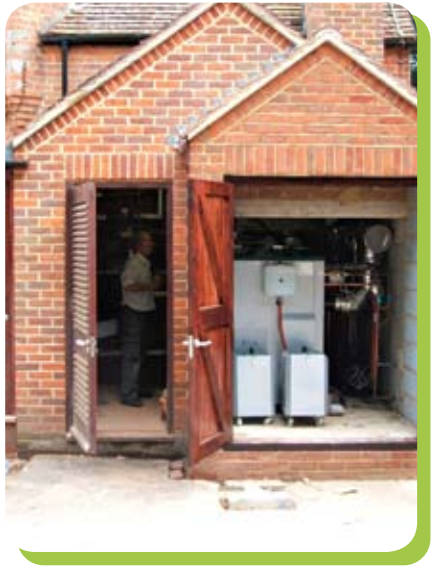
Expanding biomass and solar heating in public and private buildings via the energy services approach – Best practices

BioSolEsCo

CURRIDGE PRIMARY SCHOOL
BERKSHIRE, UK

MOTIVATION

Curridge Primary School is situated in Curridge, Thatcham, Berkshire. The building is a small primary school of approximately 100 pupils with the original building around 100 years old, there have been extensions added since then. The building is brick built construction, the original part being solid wall. The building floor area is something less than 1000 sq.m. The existing oil fired boilers were no longer serviceable and required an alternative solution in a short timescale, either like for like replacements or a biomass fuelled boiler. The local renewable energy agency TV Energy provided a feasibility study to determine whether biomass boiler supplied heat was a viable option. It was able to access funding from the regional development agency (SEEDA) to part fund the boiler cost and offer to deliver woodfuel to the boiler as part of its existing operation, and so the ESCo idea began.



ESCo MEASURES

The heating system is standard radiators throughout the building originally supplied with hot water generated by two oil fired boilers. The existing radiators are now supplied by a single biomass boiler, with an additional heat loop connected to two external pre-fabricated classrooms which were previously heated using individual LPG fuelled heater units. There were no additional measures undertaken with the exception of connecting the two external classrooms to the biomass heating system.

The investment cost was approximately £60,000 (€67,500), of which £20,000 (€22,500) was provided as a grant by SEEDA. The school through the local authority provided the equivalent sum of capital as would have been required to provide a like-for-like replacement of the oil boilers.

ACHIEVEMENTS

There were no appreciable differences in the heat consumption before and after the ESCo operation as no other measures besides the extension of the biomass heat loop were carried out. The project required a number of visits to iron out initial teething problems. It was important that the client at the start of the project understood that even though the cost of woodchip is less than the alternative heating fuel, the overall cost of operation of the boiler will be similar to the previous system. This is in order for the ESCo to recover the investment cost of the equipment through charges for heat.

The school is very pleased with the boiler and ESCo arrangement, once initial teething problems were overcome. The ESCo is happy with the operation, but it should be understood that this type of project with a small heat load requires significant grant funding in order for the ESCo to be financially viable.

HEAT SUPPLY FOR A SCHOOL CENTRE IN BAVARIA
MARKTREDWITZ, GERMANY

MOTIVATION

The municipality of Marktredwitz and the district administration operate several schools plus associated facilities such as a sports hall. Marktredwitz is a small town in Eastern Bavaria. The building complex used to be heated very inefficiently with old gas boilers that had to be replaced due to high total heating costs.

The contractor KEWOG Energie & Dienste performed a first analysis and determined the total annual heat demand of the buildings to be 3500 MWh, the primary energy demand being 4000 MWh. The analysis also revealed an energy saving potential of 33 %.

KEWOG Energie und Dienste GmbH

ESCo MEASURES

This project is one of the few contracting projects in Germany that is in full compliance with international ESCo definitions. It combines regular heat delivery contracting with guaranteed heat savings.

Client and contractor decided to implement an energy performance contract based upon the heat demand baseline of 3500 MWh. KEWOG applied its Energy Balance System that includes remote controlling, optimized heat production control and the installation of efficient pumps and radiator regulation. The contractor guaranteed energy savings of 25 % against the baseline. If these savings are not achieved the contractor pays back additional fuel costs.

In addition, a new wood chip boiler with a capacity of 1000 kW was installed. An existing gas boiler (1750 kW) was refurbished and is used as peak load system. The

existing fossil fuel systems are often used to cover peak loads or as emergency systems in ESCo projects in Germany. Biomass boilers are in most cases used to cover the base load only.

Besides the new boiler, wood chip storage (250 m^3) and a heat grid were installed. Since 2007, the school centre is supplied with renewable heat derived from regionally produced wood chips.

ACHIEVEMENTS

In total, around € 1 million was invested of which around 20 % were the contractors' own fund, the rest being covered by bank loans. As it is common in PPP projects in Germany the contractor sold the claims to the bank, while the customer is committed to pay the bank without conditions. This way, very favourable loan conditions can be achieved.

The contract duration for this project was set at 15 years. During this time the client pays a basic price that covers the investment and labour costs. In addition, the client pays for the heat amounts actually consumed.

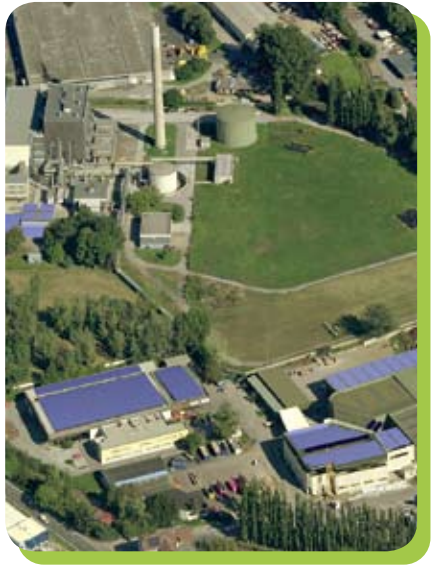
Until now, the guaranteed heat savings are achieved. The client's total heat costs (incl. capital costs) are reduced, even when compared to mere fuel costs before the project. Usually projects including the installation of new heating systems only achieve cost savings compared to an alternative project implemented by the client themselves.

KEWOG Energie und Dienste GmbH

SOLAR THERMAL ENERGY CONTRACTING FOR AEVG – ABFALL- ENTSORGUNGS - UND VERWERTUNGS GMBH (GRAZ, AUSTRIA)

MOTIVATION

The main motivation was to feed 2500 MWh/year solar energy into the district heating power plant of Graz (250 000 inhabitants). 400 tons of CO_2 per annum can be saved.



ESCo MEASURES

The ESCo Nahwaerme.at GmbH managed all energy contracting concerns. The planning and erection of the solar plant was done by S.O.L.I.D.

Nahwaerme.at provides AEVG customers with heat, carriage-free, together with all services they need, such as:

– State-of-the-art design and implementation

– Financing by experienced partners

– Sustainable fuel supply

– Heating plant operation and stand-by, around the clock

– Purchase and precise invoicing of already produced heat

– Guaranteed supply

– Fair connection costs

ACHIEVEMENTS

Three roof areas were used for the solar plant installation in the area of the AEVG, namely the garbage sorting hall, the private-delivery place -set up newly- as well as the vehicle hall. Approximately 4,948 m^2 of collector area are set up on these roofs. Several roofs are also still free for upgrading of the solar plant.

The thermal power station supplies the district heating network of the energy Graz. All over the year at least 2.5 MW were sent to the district heating system (collectors deliver up to 3.3 MW). Heat meter measure the fed energy to the network and the online monitoring via remote control assure fast reaction in case of plant failures.

The most important key factors of the solar plant:

– Collector area: 4,948m^2

– Planned maximum capacity: 6,903 m^2

– Special high temperature collectors (–120°C)

– Direct feeding into the district heating network

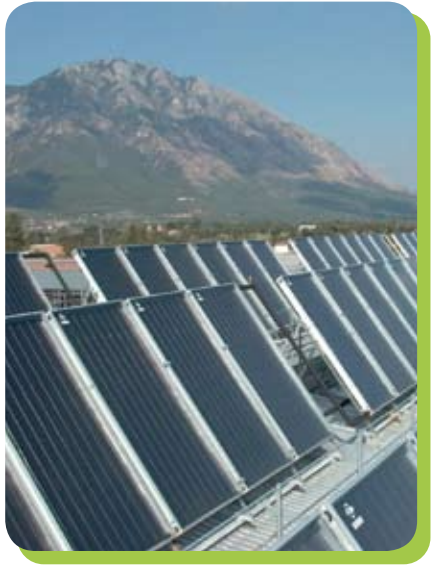
– Yield in the present development: round 1,800 MWh/year

– Operation since 2007

PIETRO RADICI SPA
AIROLA (BENEVENTO), ITALY

MOTIVATION

"Pietro Radici Spa" is a company situated in Airola (Benevento), a small town in the southern part of Italy. The company manufactures carpets. The cleaning of carpets is done by steam production at high temperatures. The company utilizes two methane boilers at 840 and 395 kW for ambient heating and solar collectors for the production of heat at low temperatures. In order to minimize the costs, of fossil fuels, the solar plant was designed so as to cover all energy needs. Expenditures of the solar thermal plant were reduced by 5% by ESCo operation.



ESCo MEASURES

Energy was to be produced by installing a thermal solar system with 108 solar collectors on a 268.6 m^2 surface, a 3000-litre boiler for thermal heating and two boilers for producing hot water at 85°C of the steam phase. The plant is able to work throughout the year. Since heating bodies are installed in the floors, heat is diffused to the entire internal environment.

ACHIEVEMENTS

The project was carefully designed and realized by ESCO "Costruzioni Solari". The total investment was estimated at 120.000 €. Following project implementation, savings are estimated at 96.000 € per year. The lesson learnt from this experience is that in the summer thermal energy abounds and should be used to cool the building.

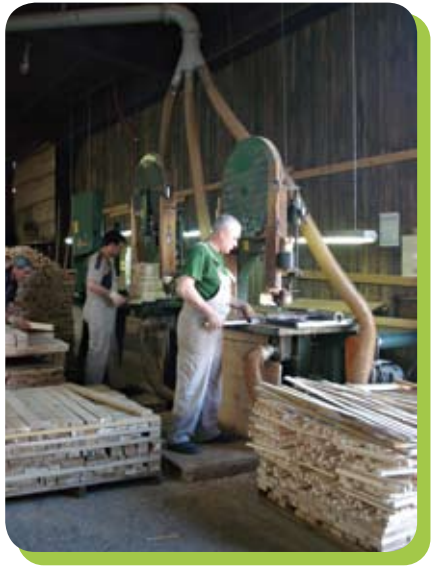
The client, "Pietro Radici s.p.a.", is satisfied with the service as until now the solar system has been operational.

For the realization of the solar thermal plant in this building ESCo "Costruzioni Solari" was awarded the prestigious prize "Premio all'Innovazione Amica dell'Ambiente" in 2005.

COGENERATION IN STRIZIVOJNA HRAST FACTORY
STRIZIVOJNA, CROATIA

MOTIVATION

Strizivojna Hrast Ltd is situated in Strizivojna, a small town in the Eastern part of Croatia. The company is a manufacturer of wood parquet flooring and produces 1.2 million sq.m. of parquet per year. The company is run as a family business and, with 360 employees, is the major employer in the community.



At the present situation, electricity needs for the existing production of Strizivojna Hrast Ltd can not be met through the available distribution grid, due to the limited capacities of the local grid and existing transformer. For this reason, the major part of the needed power is produced by the plant's own diesel aggregates. This situation is not a viable long-term solution for the business. Principal power consumer in the plant is process machinery. Main consumption of the heat is done in the product drying facilities, plus some space heating in the winter period. Moreover, the company is planning to expand its present product drying capacities, for which additional heat production is needed.

ESCo MEASURES

Energy production is expected from the new cogeneration, which will replace the existing diesel generators and boilers for heat production. When this equipment will be replaced by a modern cogeneration unit quite significant energy efficiency gains will be achieved. For the planned biomass-fired cogeneration plant, two main purposes are envisaged: the supply of power and heat to the parquet floor production process, and the sale of the excess electricity to the national electricity grid.

Large quantities of the available wood waste from the production are available for the energy use. Currently, dry sawdust is converted to briquettes that are exported, wood chips and other wood waste is sold to third parties and the rest of the wood waste is land filled. The company has decided that cogeneration capacity will be based on 42000 m^3 of wood. Installation of the cogeneration plant will secure sufficient energy supply to expand current production and supply 100% feedstock (wood waste) for cogeneration unit.

The plant will be able to work in four operating modes, considering also the seasonal changes. Besides the nominal mode of operation, the plant design also regards the winter mode of operation (peak power), with 3 MWe power output from the generator, summer (max condensation) mode, with 2.86 MWe output, and technical minimum mode, with 1.36 MWe power output.

With the planned cogeneration plant, the company has obtained the status of the eligible power producer, legally set for power production from renewable sources and cogeneration, which will enable it to sell all of its excess electricity to the grid at a favourable price.

ACHIEVEMENTS

The project was carefully prepared and planned by HEP ESCO under the ongoing cooperation programme with the World Bank. The total investment is estimated at 113.9 million HRK (15.6 million Euros). The procurement was done according to World Bank procedures requesting competitive tendering. The project implementation was initiated in 2009 and required equipment is ordered. It can be expected that the plant will be fully operational by the end of 2010.

After the project implementation, savings are estimated at 19.723 mil HRK (2.701 mil Euros) per year. Moreover, due to replacement of diesel oil and electricity from the grid with the renewable energy source, the annual emission reduction is estimated at app. 6.1 kt CO_2.

The client, Strizivojna Hrast Ltd, is satisfied with the service because HEP ESCO performed all activities related to development and financing of the project without any initial investment from the client. The whole procedure is conducted "open book" with the client actively participating in the project.

ENO ENERGY COOPERATIVE, FINLAND

MOTIVATION

Eno is situated in eastern Finland. The weather in eastern Finland is continental with a clear distinction of the four seasons. The heating season lasts for approximately 9 months. Eno is a very rural area and has many forests and lakes. The local forest owners held meeting with the municipality of Eno officials and the Forestry Centre of Eno to further develop the idea of forming a cooperative which would sell heat to the municipality. The municipality saw the importance of such activities to the local economy. The Eno Energy cooperative was founded in 1999 by 12 founder members. Their objective was to manage and utilise their own forests in their own community and at the same time earn some additional money.

ESCo MEASURES

The first heatplant was built in 2000 when Eno Yläkylä heatplant was built. Yläkylä heatplant is owned by the municipality of Eno (nowadays Eno is part of the city of Joensuu) and the Cooperative operates the heatplant and is responsible for the delivery of fuel (woodchips).

Uimaharju heatplant was built in 2002 and Eno Alakylä heatplant was built in 2004. Both heatplants are owned by the Cooperative. The Cooperative also owns the heating network of the Alakylä heatplant.

The heated buildings of the Yläkylä heatplant are junior and secondary school, library, sport center and parish meeting hall. The amount of heat sold annually is 2 100 MWh, which equals to app. 3 400 loose-m^3 forest chips per year. The capacity of the forest chip boiler is 0.8 MW and backup fuel is heating oil.

Heated buildings of the Uimaharju heat plant are junior and secondary school, health care center, superstore and nine terrace house companies. Amount of heat sold annually is 5 600 MWh, app. 10 000 loose-m^3 forest chips per year. The two forest chip boilers' capacities are 1.0 MW and 1.0 MW and oil is used as a backup fuel.

The Alakylä heatplant heats are the municipal office building, health centre, fire station, old people's home, business premises and eleven terraced houses. The amount of heat sold per year is 6 200 MWh, and it uses about 11 000 loose-m^3 forest chips per year. There are two forest chip boilers with capacities of 0.8 MW and 1.2 MW. Oil is used as a backup fuel.

These three heat plants generate heat for 254 300 building m^3. The total amount of heating pipes is about 7000m (6 100m owned by the Cooperative, 900m owned by city of Joensuu).

ACHIEVEMENTS

The cooperative operations include heat production but no energy savings. Even so, the shift from using oil as a fuel to using wood chips as a fuel brings economic and environmental benefits to the region.

Using forest chips instead of heating oil means that more money stays in the region. District heat is cheaper to the customer when the heat entrepreneur is using forest chips as fuel instead of the heating oil and price of the heat is much more permanent. The price of the heat is confined to an index-linked price basket which consists of the prices of competitive fuel prices (e.g. heat oil, sod peat, average price (from whole Finland) of forest chips). Using forest chips employs constantly. Procurement of forest chips employs forest owners, forest workers, chipping entrepreneur, delivery entrepreneur and the heat plant workers.

Advantages for the environment and forest management are significant. As a result from using forest chips instead of using heating oil, the carbon dioxide emissions will reduce. Forests are producing more timber and landscape looks nicer when small size extra trees are harvested and used as a fuel. The bottom ash from the boiler can be returned to the forest as a fertilizer. As a matter of fact, wood ash is very good fertilizer for the forest. In 2009 the total amount of heat production will be about 14 000 MWh and the amount of used chips about 24 000 loose-m^3. All three forest chip boilers are manufactured by Vaasan Kuljetuskanavat LTD. Annually about 1.6 million litres of heating oil is replaced using local wood energy. Using 24 000 loose-m^3 forest chips means 4 million kg reduction of carbon dioxide emissions compared to using 1.6 million litres of heating oil. The cost of the 1.6 million litres heating oil is over 1 000 000 €. When replacing that amount of oil with forest chips, the money from fuel procurement and selling of heat will stay in the region. The total employment effects of using the forest chips with this consumption rate are between 7-10 man-years (5 direct from operations).

BIOMASS BOILER STATION FOR HEATING A BLOCK OF FLATS TOWN OF HASKOVO, BULGARIA

MOTIVATION

A block of flats is situated in the town of Haskovo, South–East Bulgaria. The total heated space of the building is 5,466 m^3 and the total built area of the building is 1,899 m^2. The private building was constructed as a four-storied building, a monolith construction with the highly efficient heat insulation type EPS with a 5-cm thickness and the new 3 camera PVC framework. The doctors' and dentists' offices are situated on the first and second storey of the building. Apartments are situated on the last two storeys. The total number of specialized offices is 20, while the total number of apartments is 14. Separate building premises are heated individually, mostly by insufficient electricity heating devices. High electricity costs and low temperature comfort to the 79 inhabitants of the building were the reason for seeking opportunities for energy efficiency improvements and decreasing heating costs. The block of flats consumed about 265 MWh electricity annually, i.e., EUR 18,519 per year, exclusive of VAT.

ESCo MEASURES

The project envisaged the delivery and installation of a biomass hot water boiler of the Marina CSA – 300 type with a total heat capacity of 300 kW. The biomass boiler is designed for burning wood chips in a highly efficient combustion process. The biomass boiler efficiency is 91%. The combustion process is regulated automatically. A wood chips warehouse, a fuel feeding system, an ash cleaning system and a heat accumulator having a capacity of 6 m^3 were also installed. All facilities are equipped with control and safety valves as well as with control, measuring and automated

devices. An energy audit was conducted. The technical and financial calculations of ESCo operation were done. The ERATO offered to office and apartment owners ESCo operation through energy contracting for the sale of thermal energy. Energy is measured through a certified gauge. The price of consumed thermal energy per 1 kWh is 30% lower in comparison with the price per 1 kWh generated by electricity. With the signed contract the owners of offices and apartments will be guaranteed temperature comfort and normal working and living conditions throughout the heating season.

ACHIEVEMENTS

The project was successfully prepared and implemented by ERATO under BEERECL – Bulgarian Energy Efficiency and Renewable Energy Credit Line Facility for Bulgaria sponsored by EBRD. The project was completed in 4 months and ESCo operation started in November 2008. Total project costs amounted to EUR 138,816 exclusive of VAT out of which 90% were bankable loans and 10% ESCo`s self-financing. Annual consumption of wood chips burnt by the water heating boiler is 91 tonnes. Electricity consumption by circulating pumps and the electrical mechanisms serving the facility automation is 8.2 MWh/yr. Annual operational costs of the heating boiler facility at the boiler station amount to EUR 5,720. As a result of ESCo operation annual energy savings of 21 MWh or cash savings of EUR 12,778 exclusive of VAT are expected. The annual combustion of 91 tonnes wood chips shall replace 265 MWh of electricity. This substitution results in a reduction of annual CO_2 emissions of 209 tonnes. The customer - block of flats is satisfied with the proposed energy service because ERATO performed all activities related to the development and financing of the project without any investment from the customers.

BIOSOLESCO PROJECT

The BIOSOLESCo project focuses on a relatively new approach, energy service companies (ESCos) emerging as a way to increase the uptake rate of biomass and solar heat projects in larger buildings in the public and private sector. ESCos are companies that provide a full range of energy services with repayment in generated savings. They offer a complete package, from design, finance and installation to operation, including maintenance and fuel supply.

RATIONALE

Since the type of ESCo for delivering renewables is relatively rare, this approach is poorly understood. Thus, the project will analyse issues central to ESCo establishment, such as investment models, contracts and other relevant issues with regard to which information is limited and dispersed in the EU. This work will also deepen our understanding of the hurdles which ESCos are faced with and will provide information on ways of overcoming such hurdles in practice.

At the moment, the perceived risks and uncertainty decrease the prospect for switching to sustainable methods of either generating or using renewable energy. It is envisaged that by managing these risks, the ESCOs of this kind will bring about a change in the perceptions of potential recipients.

OBJECTIVES

This project will expand the use of biomass and solar heat in both the public and the private sector through:

- Improved understanding of the approaches adopted by ESCos and promotion of this newly acquired knowledge among the EU biomass heat and solar thermal industries and potential users.
- State-of-the-art exemplary energy services implementation in the use of biomass heat, solar heat or biomass+solar in participating Member States.

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