Green Lodges
BESEL, Spain

Summary

The aim of this project is the introduction and dissemination of RES heat and electricity applications and micro CHP systems in rural lodges. The lodges are located in areas with high environmental value so, the use of these technologies has a high interest to get environmental benefits, becoming a factor to foster the use of RES among guests. The targeted audiences are the owners of the lodges and the guests, but also suppliers, technicians etc.

The profile of energy demand of rural lodges in eight EU regions was analysed to find the most appropriate RES based system that can cover their demand. The eight regions directly involved in the project are: Asturias and Jaen, Spain (Agener, Enernalon, Besel); Walloon, Belgium (ICEDD); Greece (CRES); French Alps, France (Prioriterre), Austria (Austrian Energy Agency); Emilia Romagna, Italy (Aster); and Entre Douro e Vouga, Portugal (EDV Energia).

During the project 80 energy audits were done, 10 per region. It was also created a data base with the suppliers of equipment, installation and maintenance of RES & micro CHP systems. In most of the cases, it was concluded that although the micro CHP systems give a great technical result, economically they are not so viable without more financial supports.

End-user area
- [x] New buildings
- [x] Refurbishment of buildings
- [ ] Transport and mobility
- [ ] Financial instruments
- [ ] Industry
- [ ] Legal initiatives (regulations, directives, etc)
- [ ] Planning issues
- [ ] Sustainable communities
- [ ] User behavior
- [ ] Education
- [ ] Other

Target Audience
- [ ] Citizens
- [ ] Households
- [x] Property owners
- [ ] Schools and universities
- [ ] Decision makers
- [ ] Local and regional authorities
- [ ] Transport companies
- [ ] Utilities
- [ ] ESCOs
- [ ] Architects and engineers
- [ ] Financial institutions
- [ ] Other

Technical
- [ ] Energy efficiency
- [x] Heating
- [ ] Cooling
- [ ] Appliances
- [ ] Lighting
- [x] CHP
- [ ] District Heating
- [ ] Solar energy
- [ ] Biomass
- [ ] Wind
- [ ] Geothermal
- [ ] Hydro power
- [x] Other

Context

The “Marianneum” is a religious centre which is located on the outskirts of Vienna. The lodge is open during the whole year. The building was renovated in 1987 and has 34 guest rooms and 66 beds. The following energy systems are installed in the “Marianneum”. For heating, domestic hot water production and electricity generation a micro CHP was integrated in 2003. The installed micro CHP from Buderus Company is a modulating unit (9 – 18 kW_{el}/ 17 - 34 kW_{th}) and is fuelled with natural gas. Additionally an oil boiler with a thermal output of 116 kW is used to cover the thermal peak loads; furthermore two storage tanks with a volume of 1000 l (each) are used for the same purposes. Two heat pumps provide extra heat for the winter period. Each heat pump has a thermal output of 4,5 kW. For additional hot water production a thermal solar system with a collector area of 20m^2 was installed.

Objectives

The project aims at promoting and facilitating the use of RES & electricity applications (biomass, solar & micro CHP) in rural lodges, which are usually located in areas with high environmental value. The main objective of the project is:

- Procedure of guides, which help lodge's owners to introduce micro CHP & RES into their establishments. Step by step, pointing them out the different micro CHP & RES based systems that they could install.
- Listing of local suppliers of equipment, services and biomass fuels.
- Identification and analysis of the financing systems they can apply for in order to implement RES and micro CHP projects.
- Workshops that allow head to head contact among rural lodges owners and local providers of RES & micro CHP services and equipment, in order to encourage the implementation of RES & CHP projects.

Process

The analysis of the micro CHP system included a detailed analysis of the building, the energy demand and the assessment of the economic opportunity. All required details were collected by detailed investigations by the Austrian Energy Agency. The analysis of the energy demand was assisted by the computer program "BHKW Plan", a new software tool created for the planning of CHP systems. The following basic data were used for the analysis:

Basic Input Data		
Heated net floor area	2031	m^2
Heat required for domestic hot water	6,4	MWh/a
Electricity demand	106600	kWh/a
Climate data: Meteorological station: Vienna, Austria Sea level:171 mts		

The total thermal energy demand for heating and domestic hot water which has to be supplied by the "existing" micro CHP unit and the peak load boiler is calculated to 100,1 MWh, and the required maximum heat demand to 64 kW. The installed micro CHP system from Buderus Company is designed for a combined oriented operation mode (taking into account both the maximum electricity and heat demand). In this operation mode the micro CHP generates as much electricity as needed within the building, but only if the generated heat is required too. The total electric energy production of the micro CHP system is calculated to 42,4 MWh/a and 100 % is used in the building. Figure 1 shows the annual heat demand, a picture of the installed micro CHP system and the amount of heat generated by the micro CHP unit.

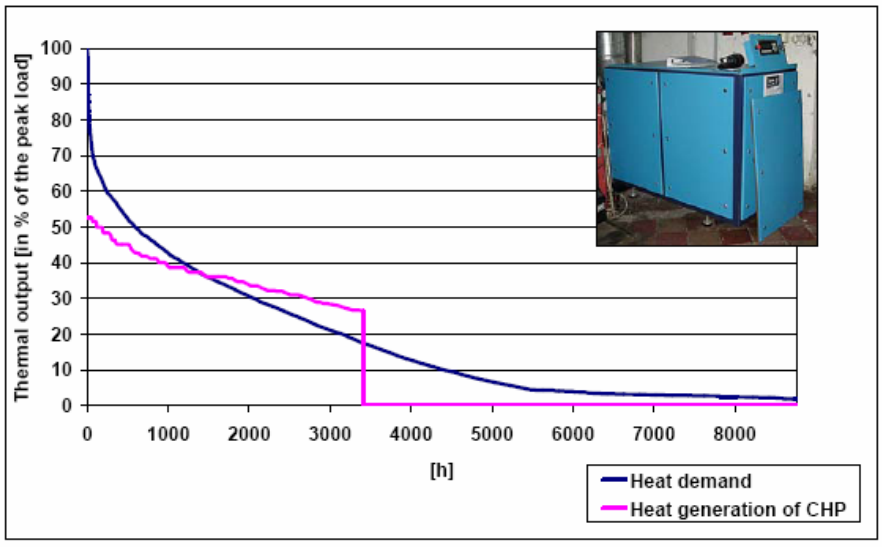

Figure 1. Annual heat demand curve (blue line) and heat generation of the micro CHP system (purple line), picture: installed micro CHP system from Buderus Company

The area in which the heat generation of the micro CHP is above the heat demand curve corresponds to the charging time of the storage tanks. The operation time can be extended by the installed hot water storage tanks (with a volume of 2000 l). Around 53 % of the maximum thermal demand is covered by the micro CHP system.

Financial resources and partners

The consortium consists as explained before on:

- BESEL (total costs: 150,67k€, 50% supported by the UE) is a private company (SME) established in 1983 and devoted to engineering and consultancy. Currently, the staff is 60 employees in five departments. Activity scope covers energy production and use (Rational Use of Energy & Renewable Energy Sources), environment, innovation management, financial engineering, and research and development of energy technologies.
- Nalón Energy Agency (total costs: 41,10k€, 50% supported by the UE) was founded by Langreo City Council and the Asturias Government, with the help of the enterprises Electra de Carbayín, Iberdrola, Bayer and Cajastur. It was founded within the SAVE II program, as a tool for the promotion of the Rational Use of Energy.
  The objective of the Agency, as it is a non profit foundation, is of a philanthropic nature, oriented towards the implementation of Renewable Energies and Energy Efficiency.
- AGENER (total costs: 37,92k€, 50% supported by the UE) is the energy management agency of Jaén province. It main objective is to improve the energy efficiency, to take advantage of local energy resources and look for the best conditions of the energy suppy, as local development element.
- The EDV ENERGIA – Associação de Energia do Entre o Douro e Vouga (total costs: 52,30k€, 50% supported by the UE) is a non profit organization, created in 2003 by one group of public and private institutions of the Entre o Douro Region region. EDV ENERGIA was constituted under the SAVE program in partnership with AGEAS the Energy Agency of Salerno. The mission of the EDV ENERGIA is to integrate practical of sustainability in the development of the region, making of the Entre o Douro Region an example of ambient protection and economic development as support to the quality of life of their citizens.
- Created in 1983, Energies Environnement 74 (total costs: 104,12k€, 50% supported by the UE) is a local energy association working under contract with the European Union (European programmes as EIE, INTERREG, etc., the French state (ADEME : National Agency for Environnement and Rational Use of Energy, and DDE : Departmental Direction of Equipment), the Région Rhône-Alpes and the Département of Haute-Savoie.
- ASTER Science Technology Enterprise (total costs: 102,13k€, 50% supported by the UE) was established in 1985 as the Emilia-Romagna Technological Development Agency, in order to promote the competitiveness of the regional productive system by means of technology transfer and innovation. Its role and mission have recently undergone a noticeable change as it was turned into the consortium involving the Emilia-Romagna Regional Government, the 4 Universities, 2 Research Centres (CNR and ENEA) as well as the main regional Entrepreneurial Associations.
- ICEDD (previously known as Institut Wallon) (total costs: 76,82k€, 50% supported by the UE) is an independent research and consultancy company, established in 1961 as a non-profit organisation, working closely with public authorities since then. It is composed of a multidisciplinary and highly qualified research and administrative staff (31 employees in 2004) providing excellent expertise in several innovative fields: non-nuclear energy, waste management, climate change, transport and mobility management, cartography and GIS, town and country planning, etc.
- Energieverwertungsagentur, the Austrian Energy Agency (A.E.A) (total costs: 186,04k€, 50% supported by the UE) was established in 1977 as a non-profit organisation. A.E.A. is the Austrian energy research and policy institution in which the federal and the provincial administration ("Bund" and "Länder" respectively) and some forty important institutions and corporations from a variety of economic sectors co-operate. The board of directors ("Präsidium") comprises the federal minister charged with environmental affairs, the federal minister charged with energy affairs and the chairman of the provincial governors. A.E.A. is the Austrian Member of the European Energy Network EnR.

- The Centre for Renewable Energy Sources (CRES) (total costs: 98,55k€, 50% supported by the UE) is the Greek national centre for Renewable Energy Sources (RES), Rational Use of Energy (RUE) and Energy Saving (ES). CRES was founded in September 1987 by Presidential Decree 375/87 as the national co-ordination centre in its areas of activity; it is supervised by the Ministry of Development, General Secretariat of Research and Technology, and has financial and administrative independence. Its main goal is the promotion of RES/RUE/ES applications at a national and international level, as well as the support of related activities taking into consideration the environmental impacts, in energy supply and use. CRES' funding is mainly provided by National, European and International projects, as well as projects carried out on behalf of the industrial, hotel, and construction sector, etc.

Results

The economic evaluation includes a comparison of the “existing” micro CHP system consisting of the micro CHP unit and an oil boiler to cover the peak loads with an alternative energy system. For the alternative energy system a low temperature oil boiler with a thermal output of 66 [kW] is taken into account. The following table summarises the different cost positions of the “existing” micro CHP system in comparison with the alternative energy system.

Table 1

Profitability Calculation		Micro CHP System	Alternative Energy System
Capital Costs*)	[€/a]	2956,33	483,04
O&M Costs	[€/a]	1371,56	838,1
Fuel Costs	[€/a]	7695,44	7093,85
Total Costs	[€/a]	12023,32	7660,7
Reimbursement of tax on fuel	[€/a]	635,78	
Avoided electric energy supply	[€/a]	5510,06	
Total Revenue	[€/a]	6145,84	
Net Costs	[€/a]	5877,48	7660,7
Specific costs of heat generation after crediting electricity generation	[€/kWh(th)]	0,0587	0,0765

**) For already installed systems and components (e.g. storage tanks, boilers,…) no capital costs are calculated.*

The different cost positions and the total revenue are represented by Figure 2 showing clear advantages for the “existing” micro CHP system.

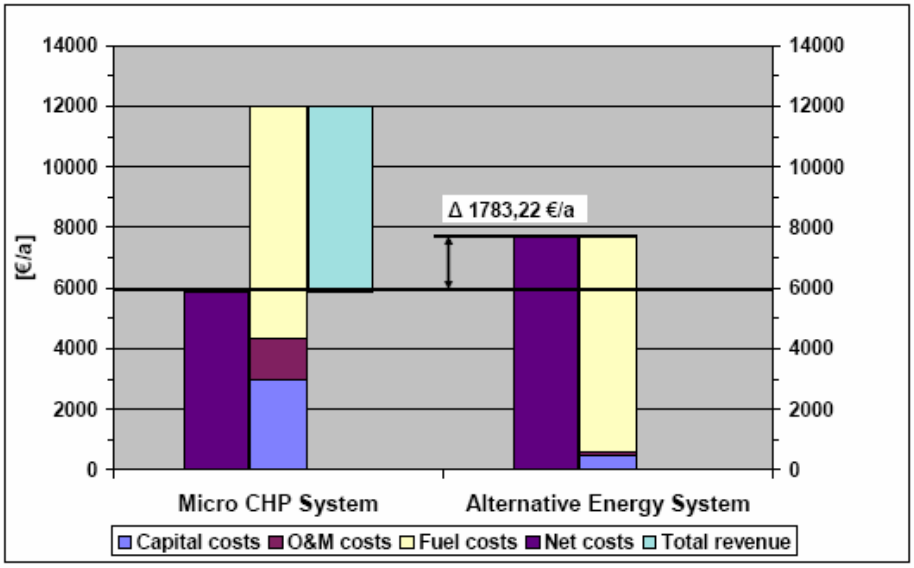

Figure 2. Profitability calculation of “existing” micro CHP system in comparison with an alternative energy system

Pay-back period

Information concerning the pay-back period is based on a dynamic calculation. Figure 3 shows the development of the accumulated discounted cash flow. The payback period for the investment in the installed micro CHP system is 7,2 years.

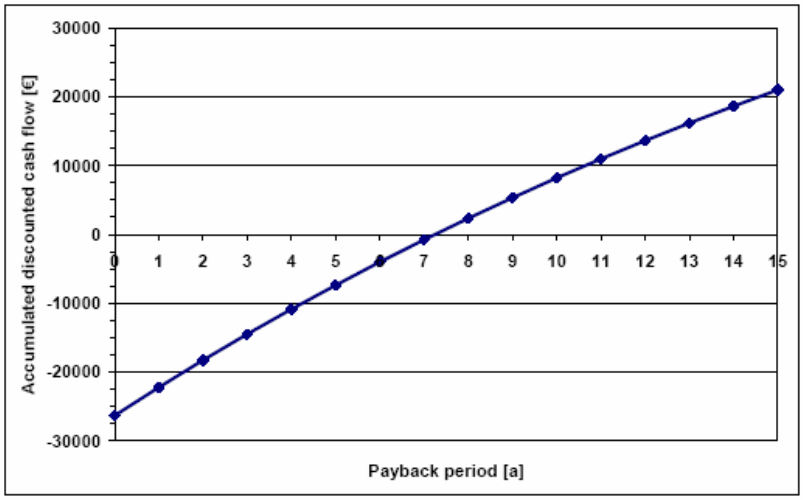

Figure 3. Development of the accumulated discounted cash flow.

Lessons learned and repeatability

The analysis of the energy situation shows that the “existing” micro CHP unit represents a good technical and economic solution. The micro CHP supplies almost 40 % of the electricity demand of the building. Due to the frame conditions in Austria and due to the energy situation at the “Marianneum” the deployment of the micro CHP system shows an economic efficiency which leads to a pay-back period of 7,2 years. The reasons for this good pay-back period are:

- High tariff for the electric energy supply
- Significant amount of avoided electric energy supply from the grid
- Subsidy of 30 % for investment and installation costs of the micro CHP system
- Reimbursement of tax on fuel used for the micro CHP unit

Before installation of a CHP these factors should be taken into account. As it is said, the most important factor that makes this technology economically viable is the big amount of avoided electric energy supply from the grid and of course the high tariff for the electric energy supply.

With the execution of all the tasks programmed in the project, the consortium has obtained several global conclusions, apart from the individual ones of each region involved. The main conclusions obtained are the following:

- There are big differences between the typologies (size, buildings type, etc) and use, which leads to a very wide range of energy demand patterns, especially in the demand profile along the day, month and year.
- There are not services and equipment suppliers near the areas in which the rural lodges usually are. This problem becomes bigger with the lack of knowledge of these technologies by the owners of the establishment.
- Because of the different conventional energy costs, from one region to the other, the micro CHP’s profitability is not guaranteed, even if it is, in most of the cases, the technical one.
- There are a lot of administrative barriers when the owners want to implement the installation, delaying the submission and implementation of the installation.

- There is a gap in the mechanisms of financing. In fact, those mechanisms do not exist, with the exception of the public ones. These mechanisms should be defined for the increase of the installations based in renewable energy sources and micro CHP systems.

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