Intelligent Energy Europe

P E R C H

"Production of Electricity with RES & CHP for Homeowners"

Production of
Electricity with
RES &
CHP for
Homeowners

www.home-electricity.org

Overview

European Members States must provide guaranteed access for green electricity producers to the grid including the home and small business installations –Renewable Electricity directive (2001/77/EC).

Moreover, as far as concerning the connection of electricity generation units using RES & CHP, it is critical that the future owners of these systems (owners of individual dwellings, farms or even of small business) have the appropriate information and supporting framework to help them implement their potential installations

The project deals with interconnection issues (technical, contractual, tariff rates and metering issues) for electricity generation using small RES and micro CHP applications for home and small business power solutions in EU and candidate countries.

In the framework of the **PERCH project** the following have been developed for the **Home and Small Business owners**:

- **Web site with database**
  A comprehensive web site with interactive features and mapped information for the EU-25 and candidate countries
- **Technology guides**
  Technology descriptions for PV, micro – CHP and small wind applications
- **Best practices**
  The most successful home grid connected applications in Europe, with technical information and photos
- **Interconnection guidelines and procedures**
  These will include the normal procedures for inspection and approval along with the safety and power quality requirements
- **Supporting schemes and incentives**
  Overview of the local options for financial support
- **Local contact lists and references**
  Further resources for thorough research.

Professionals and Experts benefit with:

- **Comparable National reports**
  Detailed reports that include interactive maps and tables in the web site
- **Technical information for installers and suppliers**
  Technical information is available with links for more thorough examination
- **Mapping the local market conditions through National events**
  Recording of the local market interactions concerning interconnection issues and supporting schemes
- **Exchange the experiences through a final European event**
  This will provide a platform for a debate for the policy makers

The Technologies

Micro-CHP

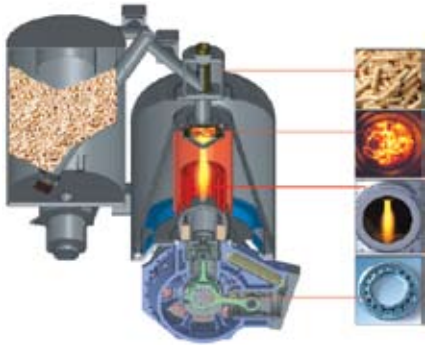
The principle of the combined heat and power generation (CHP) or cogeneration is improved fuel efficiency by producing heat and electricity simultaneously. The same amount of fuel generates more energy, and less energy is lost in comparison to conventional power plants, since the heat generated when fuel is burnt to produce electricity is captured and utilised for some useful purpose such as space heating, water heating or refrigeration.

Cogeneration is able to achieve energy efficiency from about 90 % meaning that only a 10% of the used fuel is transformed into heat loss. Cogeneration units have different sizes, ranging from an electrical capacity of less than 5 kWe (e.g. for a single-family house) up to 500 MWe (e.g. district heating or industrial cogeneration). The generation units are sited in close vicinity to the user where the heat is needed, because this reduces line losses to a minimum and puts operators in a position to open up economic profits for themselves. In this decentralised generation, often more electricity is generated than is needed by the owner himself. The surplus electricity can be sold to the local grid operator or supplied to another customer via the net distribution system (images 1, 2, 3).

CHP systems can, with the addition of a chiller, supply cooling for air conditioning systems as well as heating – such an arrangement is often called a 'trigeneration' system. A range of technologies can be applied to cogenerate electricity and heat, such as steam turbines, gas turbines, combined cycle (gas and steam turbines), Diesel and Otto Engines together with the emerging micro-turbines, fuel cells and Stirling engines, mostly used for micro CHP.

1 WhisperGen microCHP

2 Solo Stirling 161



3 Sunmachine

Use of micro CHP units in the electrical power range 1 – 5 kWe for Berlin

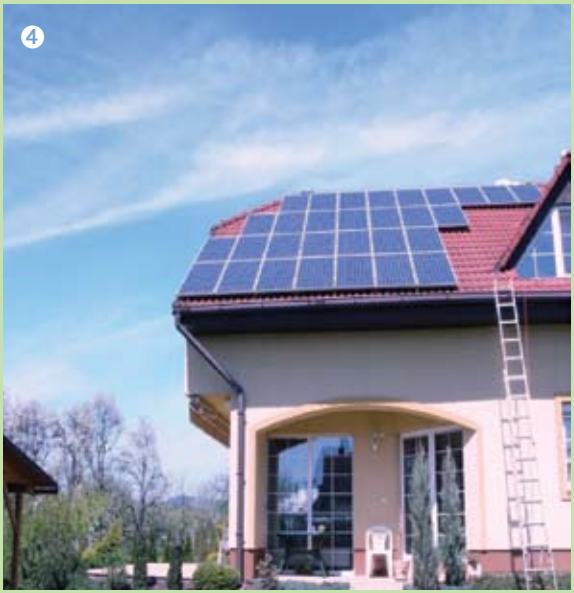
Photovoltaic

The energy of the sun can be used to produce electrical energy. Photovoltaic is the technical term for the conversion of sunlight into electrical energy by the use of so-called PV or solar cells. By connecting single PV cells to modules, PV units are created that can be used to generate electricity from a few up to 100 Watts of direct current (DC). Apart from using this electricity to power electrical equipment, an inverter can transform the direct current into alternating current (AC) which can be fed into the electricity grid (image 4).

PV systems can be operated as stand-alone solutions, however, grid-integrated systems are experiencing global growth at the current state.

Until now, nearly 90% of all PV cells have been made of crystalline silicon, which was field tested over several decades. But there has been technical development lately and so-called thin-film cells are seen as a future option as well.

These thin-film cells can be produced at lower cost since they are much thinner than the cells made from crystalline silicon (image 5).



PV in house in Březová, The Czech Republic. Installed capacity of 4,35 kWp
Source: Hitech Solar s.r.o.

A Photovoltaic system of 6KW power in domestic house at Voula region in Athens city
Source: Data energy

Cost reductions from both increased manufacturing volume and such improved technology are expected to continue to drive down cell prices in the coming years to a level where the cells can provide competitively priced electricity on a large scale.

Costs for PV systems depend on different criteria like size, type of PV cell and state of the building in question. The size of the system complies with the amount of electricity required, but the majority of domestic systems are installed with a capacity between 1.5 and 3 kW. Solar tiles are more expensive than conventional panels and panels that are integrated into the roof cost more than those that are mounted on top. PV systems are ideally used for a building with a roof or wall that faces within 90 degrees of south, as long as no other buildings or large trees are taking away the sunlight. If the roof is in shadow, the output of the system diminishes.

Small Wind

Wind is created by the unequal heating of the Earth's surface by the sun. Wind turbines convert the wind energy into mechanical power that runs a generator to produce clean electricity. Today's turbines are versatile modular sources of electricity. Their blades are aerodynamically designed to capture the maximum energy from the wind. The wind turns the blades, which spin a shaft connected to a generator that makes electricity.

Wind turbines for a residential application typically range in electrical output capacity from 500 watts up to 10 kilowatts. In general there are two types of small wind systems: stand-alone units and grid-connected (image 6).

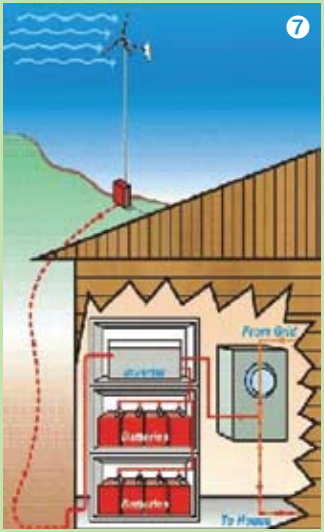
Hybrid system with 1,5 KW wind turbine in a house in Grammatiko, Greece
Source: Alexakis Energy

Stand-alone systems

Small wind turbines are in use to generate electricity for charging batteries to run small electrical applications.

Grid-connected systems

The output of a small wind turbine can be directly connected to the existing grid. The energy generated by the homeowner's turbine can be used to reduce the need to buy energy from the local utility. The value of avoided electricity purchases is generally significantly higher than the value that can be obtained from exporting power to the grid. The interconnection with the distribution grid has to meet a high technical standard and therefore the cost of incorporating power import and export metering and approved electrical protection equipment can be high (image 7).



Small wind systems consist from the wind turbines (rotor with two or three blades that rotates a shaft and a connected generator and a tail which keeps the blades facing the wind), supporting tower (in a height of 4 to 6 meters for home applications) and charge controller/inverter.

Interconnection rules

Interconnection rules of small systems comprise the procedural, financing and technical rules that must be met in order a small electricity generation unit of a home or small business owner to be connected to the electricity grid.

In all countries, the organizational and technical rules are determined by national institutions and comprise national standards regarding the operation of electricity supply and distribution grids and the installation of electrical plants. They should comply with the respective European standards.

Net Metering

Net metering is the most simplified type of connection to the electricity grid that compensates the generation of the producer with his electricity consumption. This connection allows the individual producer to sell his excess generation of electricity to the grid, or to offset the consumed electricity in another time. The range of application of net metering rules varies significantly in European countries.

Financial and supporting schemes

The supporting financial schemes can be divided into two categories:

- Purchase of electrical energy from RES-electricity producers on preferential prices; and
- Subsidizing the installations for green electricity.

Safety and power quality requirements

For operational and safety reasons, all the systems have to meet specified national and European standards that ensure the good operation and the safety of the system and grid operators. Common applied European and International standards are the EN 50160 and IEC 61000. These mixed with National Standards and rules from the electricity companies and grid operators comprise the framework for safety and power interconnection rules for each European country.

Usual safety equipment is a disconnection switch accessible to the grid operator.

Moreover the voltage range of AC, the range of frequency and the power factor of the generation installations must be between acceptable values.

Data and national reports are available for Bulgaria, Czech Republic, Croatia, Cyprus, Estonia, Finland, Greece, Germany, Italy, Lithuania, Poland, Portugal, Slovakia, Austria, Denmark, France, Hungary, Ireland, Sweden, Latvia, Romania, Spain, United Kingdom and Belgium.

For further information, please visit:
www.home-electricity.org

PERCH Project conclusions

The main issues of the interconnection to the grid of small RES-E and micro-CHP sites that must be resolved between the owner, the utility and the permitting authorities are:

- Introduction of "Simplified Rules" for getting licenses and permissions for interconnection.
- Transparent and fair regulation of the relations between the investor and the grid operator.
- The distribution of expenses for the interconnection should be objective and justified.
- The organization and technical rules are determined by the national institutions and comprise of national standards regarding the operation of electricity supply, distribution grids and the installation of electrical plants, differ from country to contry.
- Development of the grid infrastructure and obligation for priority interconnection of RES-E and micro CHP plants to the grid.
- Incentives for the grid operators for active involvement.

The development of small RES-E and micro CHP applications varies between the European countries. In some countries, the application of RES-E and micro CHP is just starting and they have no rules for the interconnection to the electric grid. In other countries simplified rules are adopted for the interconnection of RES-E and micro CHP to the grid.

All the above mentioned points and conclusions will be presented and discussed in National and European level in the PERCH relevant events.

PERCH European and National Events

The **PERCH National events** are to be organized in:

- Bulgaria
- Czech Republic
- Germany
- Greece,
  and
- Portugal

Meet local providers, installers, investors, representatives of regulatory authorities, electricity companies, experts, in the PERCH national events.

For further details about dates, places and venues please contact your local project partner.

In the PERCH European event, experts, regulators, representatives of electricity companies, equipment providers and developers will exchange their experiences and discuss the next steps for future actions.

PERCH final event will be organized on 14 October 2008, in Prague, Czech Republic.

For more information, please visit project site: www.home-electricity.org

Perch

Intelligent Energy Europe

Coordinator

CRES – Centre for Renewable Energy Sources
19th Marathonos Ave., 19009 Pikermi, Greece, www.cres.gr
Contact: Mrs Vassiliki Papadopoulou
Tel:+30 210 66 03 310, Fax: +30 210 66 03 302
E-mail: kpapad@cres.gr

Partners

Berlin Energy Agency
Französische Straße 23, 10117 Berlin, Germany
Contact: Mr. Nils Thamling
Tel: +49 30 29 33 30-38, Fax: +49 30 29 33 30-99
E-mail: thamling@berliner-e-agentur.de

CITYPLAN Ltd
Jindřišská 889/17, 110 00 Praha 1, Czech Republic
Contact: Mr. David Pech
Tel: (+420) 221 184 205, Fax: (+420) 224 922 072
E-mail: david.pech@cityplan.cz

ISQ, Instituto de Soldadura e Qualidade
Portugal
Contact: Mr. Norberto Joaquim Pereira
Tel.: 351 21 422 81 00, Fax: 351 21 422 81 20
E-mail: NJPereira@isq.pt

Sofia Energy Centre (SEC)
37 Galichitsa str., entr. 2, 1164 Sofia, Bulgaria
Contact: Mrs. Violetta Groseva
Tel.: (+359 2) 962 8443, Fax: (+359 2) 962 8447
E-mail: vgroseva@sec.bg

Perch