Emerging energy-efficient innovations and technologies →

Starting point and challenges

Innovation is one of the key elements of the EU's renewed Lisbon strategy for growth and jobs. The EU's broad-based innovation strategy points out that our future depends on innovation in order to compete in a globalised world.
In the process of making our business environment more innovation-friendly, regional and local authorities must lead the way by adopting innovative approaches and by exploiting new technologies and procedures in local districts. New technologies can help to tap efficiency potential, for example, by making visible real-time energy consumption (smart metering). Even now, information and communication technologies (ICT) that help people to grasp the low or high energy consumption of electrical or other household appliances due to individual settings or lifestyles and thus improve energy efficiency, are still largely under-exploited in the EU as a whole, in particular in private households, but also in the public sector.
In addition, innovation policies should be further developed to better support networks and social innovation and to require collaborative, cross-sectional responses that reach out to business, public policy makers, researchers, educators, public service providers, financiers and NGOs.
The EU places special emphasis on eco-innovation, i.e. all forms of innovation reducing environmental impacts and/or optimising the use of resources throughout their lifecycle. The European Technologies Action Plan (ETAP) has a number of priorities dedicated to eco-innovation.
In addition, the European Strategic Energy Technology Plan (SET-Plan) sets out a vision of a Europe with a world leadership role and a diverse portfolio of clean, efficient and low-carbon energy technologies that can serve as a driving force for prosperity and a key contributor to growth and jobs. Investing in the development of low carbon technologies is considered as an important opportunity.
The region of Emilia-Romagna, for example, has highlighted innovation in a regional innovation policy creating an energy and environment platform, setting up innovation centres and supporting research and demonstration projects in the region.
At the same time, a number of innovative energy efficiency technologies are already available on the market and can be seen in the good practice examples in the other chapters.

Regional and local policy background

Saxony

Innovation in the energy sector is an important key for Saxony, which has a long tradition as an energy and industry region and many jobs related to these sectors. Innovation and new technologies to develop new energy-efficient products and improve the energy efficiency of products and processes are essential for Saxony to compete in the global market. On the European innovation scoreboard (EIS 2009), Saxony currently ranks among the first 15 regions. Environmental technology has become an important economic factor in Saxony; more people work in the production of solar components than in any other German state.

As a consequence of Saxony's first Climate Protection Programme, the Saxon Ministry for Environment and Agriculture set up a funding programme on immission and climate protection including the use of RES as early as 2002, which also supported model and demonstration projects on new technologies, e.g. a heat exchanger from municipal waste water. This funding programme helped to save 140,000 tons of CO_2 annually. Saxony's current Action Plan on Climate and Energy supports investment and non-investment demonstration projects in the funding guideline on energy efficiency and climate protection (RL EuK2007).

The Saxon Innovation Strategy aims at the removal of innovation barriers by taking into account the needs of scientific and entrepreneurial actors as well as the experiences and good practices of various actors. This will improve the use of funds in the region and help to develop new instruments.

The Saxon Free State supports research as a precondition for innovation. A broad range of energy efficiency solutions often develop out of research and will be tested in demonstration projects, eventually leading to the introduction of new products into the market.

A number of Saxon clusters, networks and research institutes already contribute to this strategy, and thus, to the fulfilment of Saxon climate protection goals and the creation of new jobs. In addition, a Saxon innovation committee with members of science, industry and culture was founded in 2008, in order to give new impetus to Saxon innovation policy. One of Germany's Leading-Edge Clusters, for example, is Cool Silicon from Saxony. The aim of this cluster is to build bridges between science and business and also to recognise innovation potential in order to bring it into the market.

Moreover, in 2009, TU Dresden and Fraunhofer have founded DIZEeff, the Dresden energy efficiency innovation network, which aims to strengthen innovation competence and research in the city of Dresden. One aspect of close collaboration with research institutions is the future creation of highly qualified jobs, which is a major factor for the financial support of the Saxon Free State.

Smaland (Kalmar and Kronoberg)/Blekinge

Kronoberg's regional climate and energy strategy has no specific focus on innovation or technology. However, in the past decades, regional and local policies have continuously supported innovative ideas about alternative methods for energy generation from regional biomass. This has led to new approaches that allow a more flexible use of biomass and linkage to regional development. As a consequence of this, the region was:

- First in Sweden to use biomass for district heating, using an old technology in a new way,
- First to use large scale cogeneration (CHP) in connection with biomass,
- First to set up an R & D gasification plant for the production of synthesized gas from biomass as a base for biofuels,
- First to set up a structure to implement small scale district heating (DH) plants using biomass, which resulted in more than 30 DH plants in the region today.

In addition, the region strongly benefits from the triple helix cooperation among the public sector, private sector and universities.

The region was also home to one of the first large scale solar thermal plants. It was built in the early 1980's with a surface of over 5,000 m^2. Under the regional pre-existing conditions, this technology was not successful, and the first factory for solar panels has been closed down.
In the building sector, the region has worked on several new technologies, such as:

- Heat recovery from household waste water
- Better and more developed heat exchange for exhaust air, both from heat pumps and from heat exchangers
- Better and more insulated windows with U-values less than 1 W/m^2K (overall heat transfer coefficient)
- Improved insulation for walls and roofs
- Low and controlled air leakage
- IT feedback system between tenant and energy providers (Demand Side Management, DSM)

Emilia-Romagna

The support of industrial research for the green economy sector is centred on the activities launched by the Regional Programme for Industrial Research, Innovation, and Technology Transfer (P.R.R.I.I.T.T.). These activities implement the Regional Law 7/2002, which is systematised according to the Regional Operational Programme/ERDF 2007 – 2013. The core of the region's triennial energy plan is to support activities targeted at research to meet the demands in the sectors of green economy and energy efficiency and to foster technologies, products, and management and procedural innovations that contribute to increased efficiency and save energy. These strategic actions combine competitiveness, as defined by the parameters of a knowledge-based economy, with energy sustainability – participating directly and transversally in the achievement of the objectives of the EU Climate-and Energy package for 2020.

Within the scope of the programme several activities to offer and demand research include:

- The development of a network of laboratories for industrial research and technology transfer and of innovation centres, or places in which the research activity can be applied, developing and enhancing industrial innovation and the supply of services and technological knowledge that respond to the needs of companies and are based on the technological and production issues of significant regional relevance;
- Stimulating companies to invest in research and development, and to build a deeper relationship with the university and research system and the providers of technological services;
- Supporting programmes that transfer technological knowledge and skills to companies;
- Supporting companies' development or grouping of new industrial laboratories whose purpose is to create research and development services;
- Promoting new companies or new professional businesses with a substantial technological content generated from spin offs of the research activities or other forms of economic improvement from the results of research;
- The expansion of services that support the development of research activities and technology transfer and that support the regional network of those involved in research and innovation.

Within the region's High Technology Network, a research platform relative to Environment and Energy is already active; its modern laboratories will be assimilated into the new Technopoles of Emilia-Romagna.

Haute-Savoie

The General Council of Haute-Savoie leads the way by adopting innovative approaches and by exploiting procedures in local districts: the internal team of purchasers that prepare calls for tenders are now including environmental and social clauses. In order to follow energy consumption in public buildings, the General Council of Haute-Savoie accepted the offer from EDF (Électricité de France SA) to install energy consumption metering software in every high school. This innovative system alerts the energy management team of each public building in case of dysfunction or in case of abnormal consumption.

The General Council of Haute-Savoie is also developing eco event methodology for some of its events. In this way, they hope to help local authorities to get trained and become interested in eco event methodology, in order to reduce, from the starting point of a project, the impact of their organisation's event.

Other local actors are also proposing services to enterprises: the Chambre de Commerce et d'Industrie (CCI) has been proposing energy and waste audits to enterprises and artisans for ten years.

On a larger regional scale, the region of Rhône-Alpes is implementing several policies regarding development of support networks for innovation and the environment.
As an example, the Research Cluster ENERGY Rhône-Alpes aims to unite and improve the structure of research activities in the field of energy, which is today scattered in diverse disciplinary areas (electrical engineering, materials, electrochemistry, energy, economy etc.).

To support original or pioneer initiatives in the field of eco-responsibility or adaptation to climate change, the Rhône-Alpes Council is also launching an ecocitizens Rhône-Alpes call for proposals, which has three components:

- Anticipating adaptation of climate change
- Help and support for behaviour changes
- Awareness-raising of students about environmental issues.

This call for proposals is open to associations, public housing offices, neighbourhood centres, MJC (social and youth centre), regional parks, municipalities, and inter-municipality structures holding sustainable development contracts from Rhône-Alpes.

Lower Silesia

In the Lower Silesian region, the implementation of solutions that improve energy efficiency and rationalise energy economy results from national and Voivodeship regulations. The national regulations include the Energy Law Act and a document of the Council of Ministers, entitled the Energy Policy of Poland until 2030, prepared by the Ministry of the Economy.

The Energy Law Act defines the rules of the State energy policy, terms of supply and use of fuels and energy, including heat, and the activities of energy companies and identifies the authorities responsible for fuel and energy economy. The act also transposes European regulations and directives on renewable energies into Polish legislation and provides further details.

The Energy Policy of Poland until 2030 determines that the main directions of energy development in Poland will include:

- The improvement of energy efficiency,
- The development of renewable energy use, including biofuels,
- The limitation of the impact of energy on the environment.

It is worth noting that on 11 August 2011, the new Energy Efficiency Act came into force, including the following improved measures:

- Conclusion of the agreement for the performance of works aimed at improving energy efficiency,
- The exchange of equipment, installations, or vehicles for the equivalent with low-power consumption and low operating costs,
- The modernisation of the used equipment, installation, or vehicle, aiming at reducing energy consumption and operating costs,
- The purchase or rent of energy-efficient buildings or their parts, or reconstruction, the repair of used buildings, and the thermo-modernisation of buildings,
- The preparation of an energy audit for buildings with an area exceeding 500 m^2.

The public sector entity should apply at least two of these measures and issue information about their use to their community via their website or by other means.

The Voivodeship documents and policies affecting the development of technologies and innovations in energy efficiency primarily include the Development Strategy of the Lower Silesian Voivodeship and the Lower Silesian Innovation Strategy. The objective of the Development Strategy for the Lower Silesian Voivodeship is to indicate the direction of economic and infrastructure development in the Lower Silesian Voivodeship.

The Development Strategy is also a tool to improve the living conditions of the residents of Lower Silesia. The document also includes the development of renewable energy in the Voivodeship, which provides guidelines for the municipalities of Lower Silesia.

Good practice in Saxony – Cool Silicon: Energy efficiency innovations from Silicon Saxony

The Leading Edge Cluster "Cool Silicon" is dedicated to increasing energy efficiency in the information and communications technology (ICT) sector. For this reason, energy efficiency and even zero energy solutions should be developed in the three focus areas "Micro- and nanotechnologies", "Communication systems", and "Network sensors". An important part of this project is an intense exchange of ideas and know-how between Saxon partners in different areas, as well as knowledge transfer from academia to industry. Subsidized by the Federal Ministry of Education and Research (BMBF) and the Saxon State Ministry for Science and the Arts (SMWK), the "Cool Silicon Cluster" is a well equipped research and development project of more than 108 partners, including large international semiconductor companies like Globalfoundries, Infineon and X-Fab, small and medium enterprises (SME) and 16 chairs of three Saxon technical universities.

Innovations in micro- and nanotechnology are the foundation of modern information and communications technologies (ICT). They are the engine of economic progress in leading industrialized nations, as well as in former emerging markets like Taiwan and Korea. Through strategic business development "Silicon Saxony" has emerged as a prime location for microelectronics in Europe. Currently, the only cluster in Europe that can keep up with competition from Asia is "Silicon Saxony". The microelectronic technology/ICT sector employs more than 43,000 people in the high-tech region of Dresden, Freiberg and Chemnitz.

To secure and expand its position on the global market, the cluster needs to focus thematically. Regional assets must be better utilized for the creation of internationally recognized innovations, and those innovations must be successfully translated into production. With its strategic importance for market growth, ICT forms the dominant key market for micro- and nanotechnology. As a technology driver and high volume market, ICT sets the standards that serve as benchmarks for both development and production. However, steady growth in the area of ICT is not without consequences: by now the use of ICT systems produces the same amount of carbon dioxide as the entire emissions of civil air traffic. Energy costs for operating ICT infrastructure have also become a significant economic factor. The most urgent challenge in the field of micro- and nanoelectronics, therefore, is to greatly improve energy efficiency, especially for ICT, the industry's key branch. This is the technical, economic, and environmental goal of "Cool Silicon".

Substantial progress in this field can only be made through major innovations and new system approaches that are grounded in a combination of cutting-edge scientific research, close to market development, and world-leading "know-how" of production processes. Worldwide, no dominant cluster for the field of energy efficiency in ICT has been formed thus far. The partners involved in this leading edge cluster strategy have already taken the lead over global competition, with some of their pioneering products.

"Cool Silicon" is well positioned to seize this opportunity to massively build up the location's system competence, especially with the SMEs, in order to develop the key technologies for energy-efficient electronics and to secure them in the long run for the region, for Germany, and for Europe as a whole. Furthermore, the establishment of many new "hidden champions" will broaden the economic foundation of the area.

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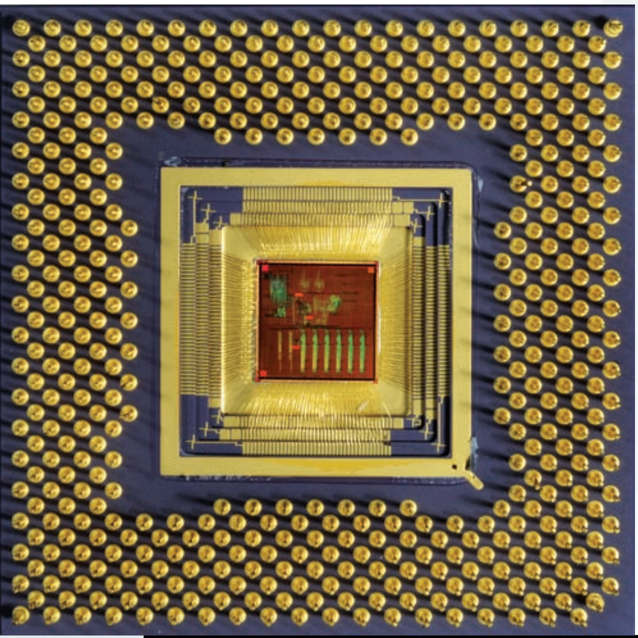
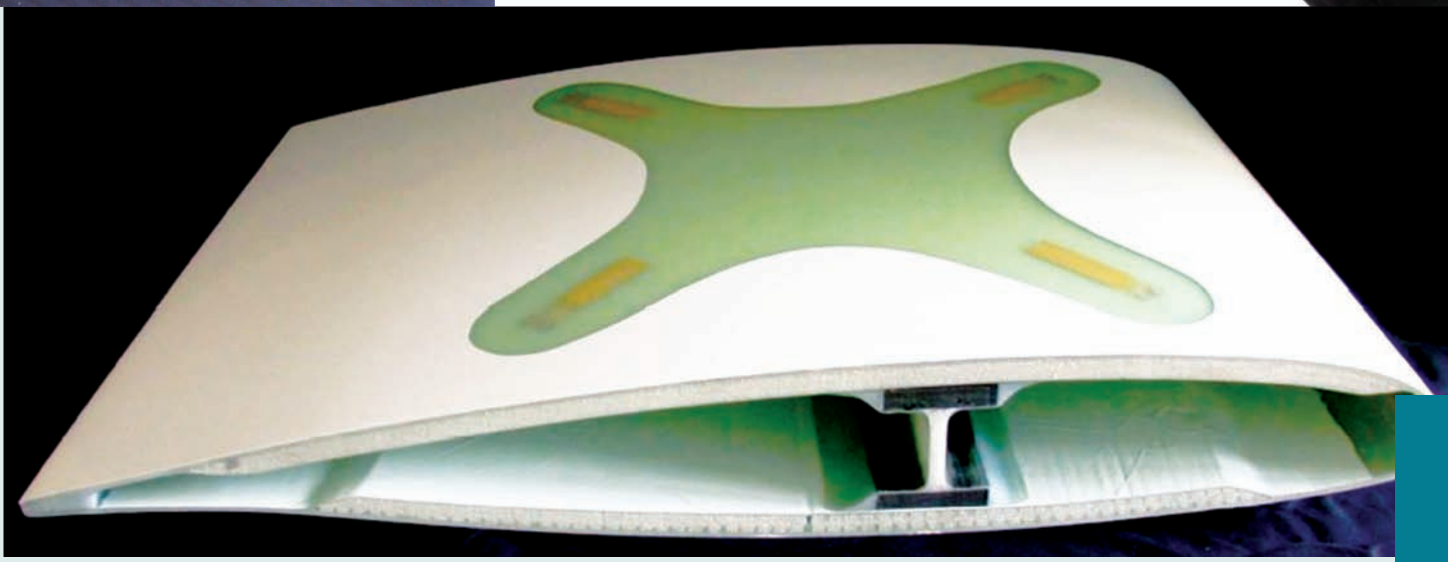
COOL SILICON
energy efficiency innovations from silicon saxony





Examples of the three working areas of Cool Silicon

The Cool Silicon working areas

Micro- and nanotechnologies

The core objective of the area 1 project partners is the development of basic technologies, analysis and production methods for the production of energy-efficient electronics and their application, in order to decrease the energy consumption of computer systems.

Communication systems

In area 2, the research and development projects are focussing on the improvement of energy efficiency in communications infrastructures and mobile devices.

Network sensors

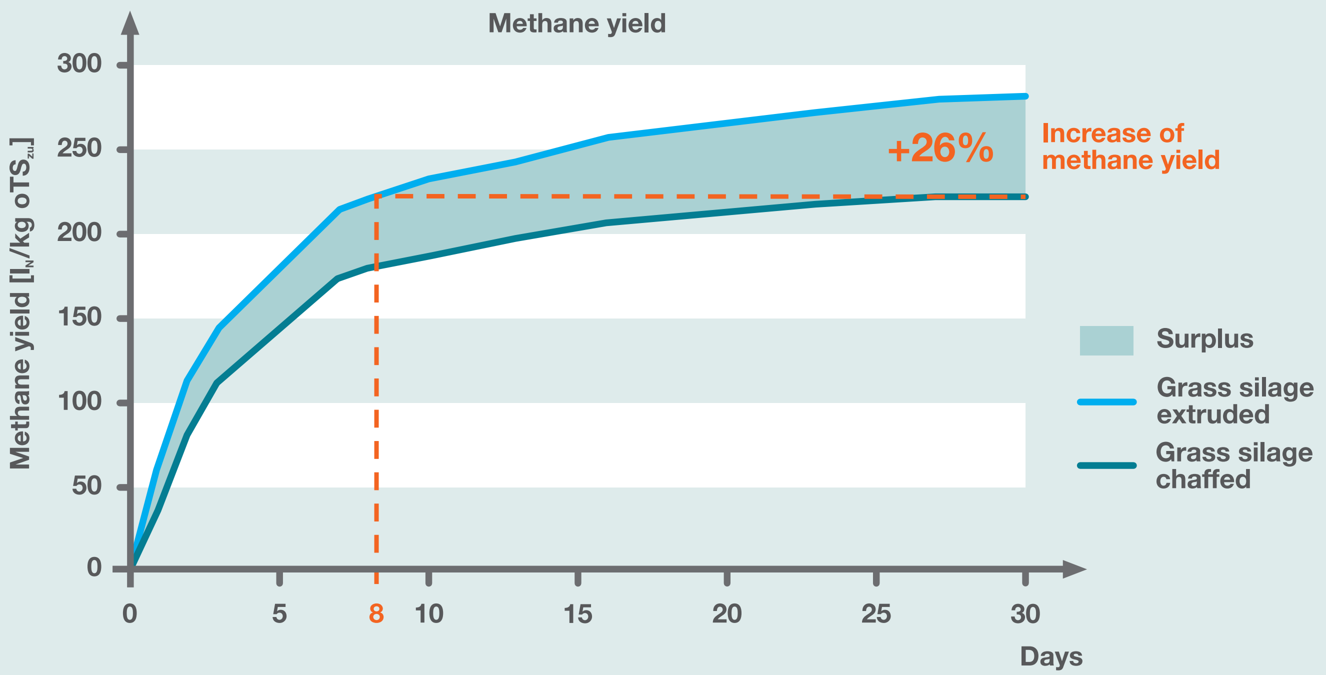
The project CoolSensorNet is the lead project of area 3. It conducts research on the whole electronic chain's specific requirements, including sensors, analogue electronics, A-D converters, processor systems and the telemetry unit.

Good practice in Saxony – Bioextrusion to make biogas production more efficient

In Saxony, the medium-sized company Lehmann Maschinenbau GmbH has developed a technology to increase biogas yield in biogas plants and to allow the use of straw, grass, materials for landscape conservation (mulches), dung and other materials for the production of biogas that could not, or to a very limited extend, be used for biogas production until now.

During the process of bioextrusion the organic substrate is pre-treated by a hydro-thermal extraction process. The surface of the organic material and, therefore the bioavailability, are increased due to cell disruption by means of bioextrusion (patented procedure) and the hydro-thermal decomposition involved. This process requires the application of mechanical energy (friction, squeezing, crushing) and an alternating pressure load and relief of the material with the positive result of interfacial mechanisms and disintegration, in order to achieve higher decomposition rates.

Fermentation of grass silage



	Biogas yield	Methane yield	Methane level	Increase of Methane yield	Increase of Biogas yield
Biogas yield	496,08 l_N/kg oTS_{zu}	279,70 l_N/kg oTS_{zu}	56 Vol. %	26%	29,5%

Bioextruder

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The decomposition allows shorter dwell times for an equal or better degree of putrescence of the digestate substrate (the solid material remaining after the anaerobic digestion of a biodegradable feedstock) and consequently, higher throughput (higher digester load). The component substances cellulose and hemicellulose become available to methanogenic bacteria thus allowing the use of fibrous materials for biogas production. Apart from the described process, the developed technology provides such further process units as drying, compacting or pelleting of the organic substrates to optimise its use for biogas production.

Besides the fact that biogas production becomes more efficient through bioextrusion, the technology allows use of organic substrates such as wheat straw that are not regarded as being as competitive to food production, in terms of land use as, for example, sweet corn.

Good practice in Smaland (Kalmar and Kronoberg)/Blekinge – Demand Side Management in buildings

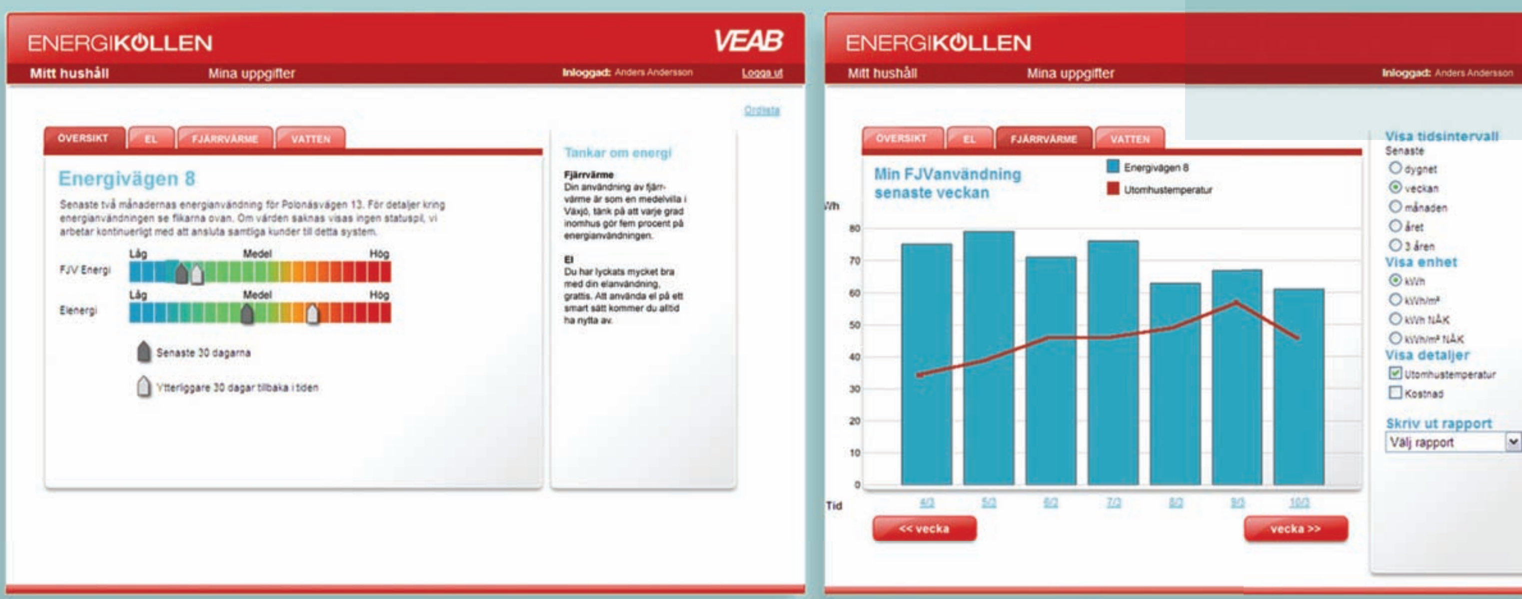
Within the EU-project SESAC, several research studies have been carried out on Demand Side Management (DSM) and on potential cooperation between energy companies and tenants to reduce energy.

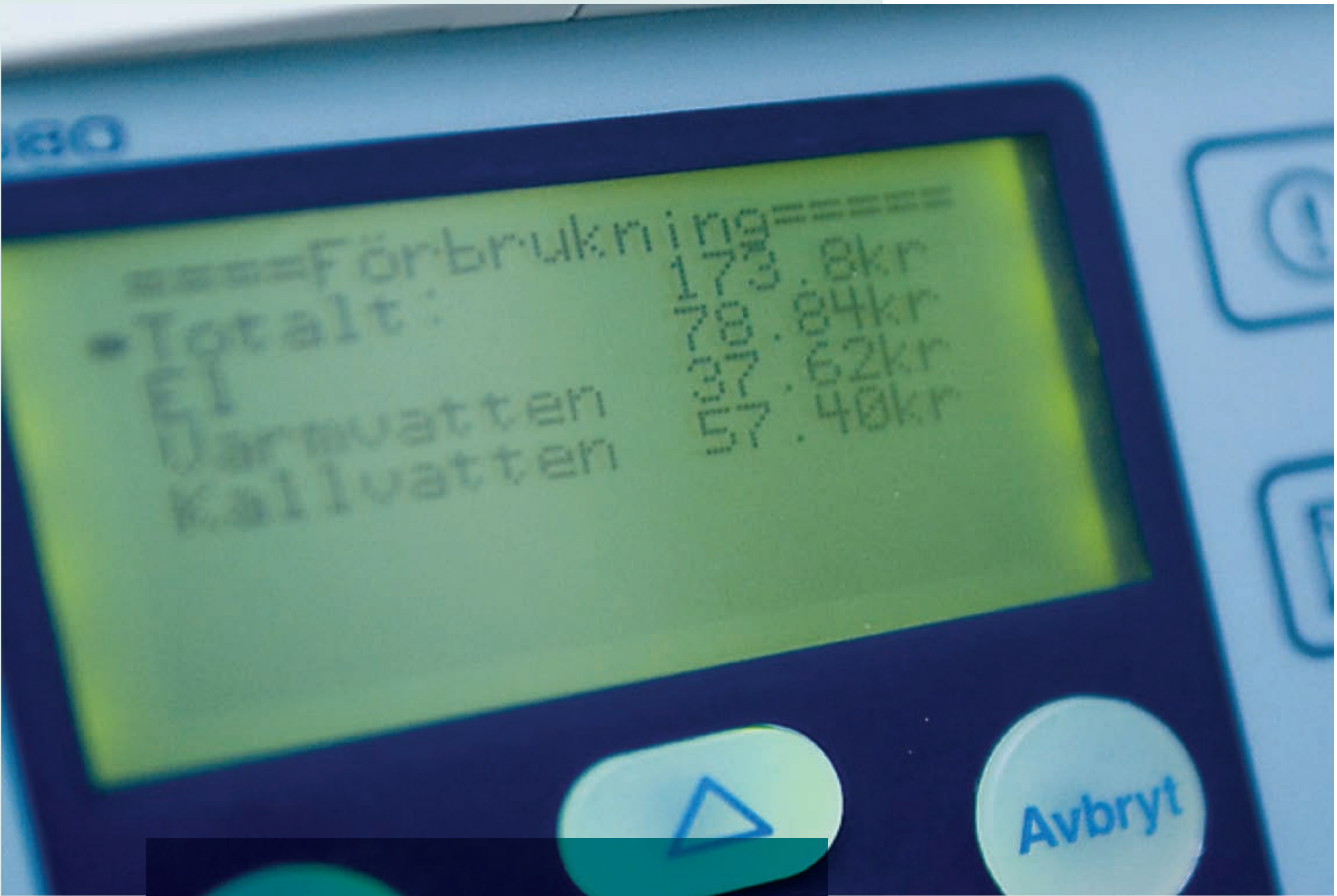
Changing people's behaviour greatly affects the possibility of saving energy. The SESAC project aims at saving ten percent of energy by achieving desirable energy-efficient behaviour from tenants. A Demand Side Management (DSM) method has been developed and is being used with tenants to create good preconditions for changing tenant behaviour. It is of great importance to understand the correlation between lifestyle and consumption for DSM methods to be successful in saving energy.

Apartments are equipped with four systems for individual measurement that are used to create an incentive for tenants to lower their energy consumption. Three apartment types in the SESAC project are equipped with a display mounted in the apartment in order to make energy consumption visible to tenants. Tenants of one type of apartment (EnergiKollen) can see their energy consumption online.

Energy consumption of electric appliances is 2 – 42 % lower and hot water consumption is 35 – 70 % lower than in reference apartments. Cold water consumption and heat for space heating and ventilation are also lower.

Online and hardware measurements system for electricity, heating, domestic hot and cold water





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The installation of meters, the presentation of consumption in the flat, either by display or by website, as well as consumption-based billing are substantial and necessary steps to obtain these good results. For additional motivation, energy-saving competitions are also being organised within EnergiKollen.

The efforts to decrease energy consumption even more by DSM have been successful for the individuals that were involved in the competitions, but the participation rate has been too low to see any overall effect of the competitions.

Good practice in Emilia-Romagna – Energy and Environment Platform for Energy Efficiency

Background

The High Technology Network of Emilia-Romagna, promoted and coordinated by ASTER, is made up of Industrial Research Laboratories and Innovation Centres in an infrastructural network distributed over ten regional Technopoles and organised in six thematic platforms.

In the Technopoles, activities, services, and structures will be created and housed to serve the purposes of industrial research and technology transfer, as well as to serve as incubators for company creativity. Provinces and municipalities contribute to the necessary investments, since the creation of the Technopoles will serve as a driving force for the economy of the host territories.

The Technopoles will host 46 institutes (35 research structures and 11 innovation centres) subdivided into 66 operational units, which will belong to one of the six platforms:

- Agriculture and Food
- Construction
- Energy Environment
- ICT and Design
- Mechanics Materials
- Life Sciences

Objectives

The Energy and Environment Platform (ENA) has the objective of creating and transferring technologies and innovative methods for environmental quality control and management and optimisation of resources. It is directed at bodies and organisations set in place for monitoring and protecting the environment, "green" companies engaged specifically in the production of technologies and in offering environmental services, the energy production chain, including energy produced from renewable sources, and companies from all industries interested in minimising their environmental impact.

Description

The ENA Platform possesses the special characteristic of confronting the research on energy issues at the system level, also paying particular attention to the environmental implications tied both to the supply of raw materials (ex. biomasses) and to the impacts of energy systems taken as a whole. Other platforms include the vertical expertise that completes the framework of skills necessary for research in the energy industry, from the single component to the system and to its context: mechanical, installation, electromechanical, and ICT skills.

Results

The ability of the Energy and Environment Platform to operate in industrial research is proven by the number and the value of the contracts signed. In less than one year, the value has reached nearly 6 million EUR, of which approximately 25 % comes exclusively from nonsubsidised investments.

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Working areas of the Energy and Environment Platform

BIOMASS

- Analysis of environmental sustainability and economy
- Energy Balances and CO_2
- Available potential assessment identification bio-districts
- Biomass characterisation
- Models for assessment and mapping of biomass availability

BIOFUELS

- Optimisation of production and quality of non-food cultivation for the production of biofuels
- Planning
  - Identification, characterisation, and optimisation of mix
  - Planning and innovation for the transformation process
  - Energy Balances and CO_2
  - Use in vehicles and non-industrial building services
- Pilot production installations
  - Analysis of the thermodynamic, fluid dynamic, and kinetic data
  - Shaping of the process in the installation
  - Sizing and optimisation of the installation
  - Integration with existent installations

WIND

- Blade
  - fluid dynamic analyses and design, materials
- Foundations and tower
  - structural analysis (static and dynamic), materials (corrosion, covering, non-metallic)
- Aero generator
  - Boss and transmission reduction gear, orientation and breaking systems (HW and controls) car and rotating electricity
    Analysis of environmental sustainability and economy
  - Energy Balances and CO_2
  - Available potential assessment identification bio-districts
- Balance-of-system (BoS)
  Inverters, grid protections, wind farm management and monitoring systems, connection to the grid (connection and management of electrical charges)

ENERGY EFFICIENCY OF THE BUILDINGS

- Energy diagnosis
  energy diagnosis protocols, energy simulations in quasi-static and dynamic fields, fluid dynamic analyses, identification of the strategic paths
- Instruments for the orientation of planning
  Integrated strategies for intervention envelope technologies, installation technologies, green integration, envelope-installation integration, installations from renewable energy sources
- Effectiveness assessment
  energy simulations in nearly static and dynamic fields, energy simulations in dynamic fields of power parks, effectiveness of plant coverage, fluid dynamic analyses, cost-benefit analyses

HYDROGEN

- Production
  electrolysis of water (PEM, alkaline, vapour) steam reforming methane, ethanol, natural gas partial non-catalytic oxidation of hydrocarbons gasification and pyrolysis of biomasses fermentation/digestion photo-biochemical processes thermal decomposition of water
- Storage and distribution
  cryogenic technologies compressed hydrogen metallic and chemical hydride storage systems carbon nanotube storage
- Use
  electrochemical systems, fuel cells, combustion systems (internal combustion engines, turbines, etc.)

PHOTOVOLTAIC

- Basic modules for the production of electricity (thin film, inorganic thin film, organic cells, thermo photovoltaic, nanotechnologies for the active layer and the incident solar spectrum)
- Concentrated solar power technologies (optical systems and cells)
- Materials for backfilm and covering, materials for concentration
- Balance of System (inverters, control unit and controls, grid protection)
- Optimisation and integration of the systems

Good practice in Emilia-Romagna – Smart Grid and the need for changing the current paradigm of energy use in industrial manufacturing

Background

The Smart Grids European Technology Platform defines Smart Grids as "electricity networks that can intelligently integrate the behaviour and actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economical and secure electricity supplies".

The evolution of the current electricity grids towards this new model is necessitated by different factors:

- Liberalisation of energy markets and unbundling of the old monopolistic operators obliges managers to enhance the capability of the different parts and of the multiplied actors of the electric system to work together to assure reliability, security and quality of electric supply.
- The need for sustainable development demands improved efficiency, cutting down CO_2 emissions and use of fossil combustibles, and enhancing the diffusion of use of renewable energy sources.

Objectives

The traditional electricity grids are not able to fulfil the above mentioned requirements, since they are designed as monolithic systems, in which electricity flows only from a bulk generator to passive consumers, with limited information flows and with static management of generation and consumption.

Instead:

- Improving efficiency demands a transformation in the role of the passive consumer into an active consumer, aware of his/her consumption and able to manage it according to when energy is available;
- Reductions in CO_2 emissions and diffusion of use of renewable sources call for transformation of the distribution grid from a passive grid to an active one and implementation of bidirectional communications between the new figure, the pro-sumer (producer-consumer) and the other actors of the grid (for example, distribution management systems, electricity markets, and such new actors as Aggregators, which aggregates and coordinates a certain number of pro-sumers and/or active consumers).

It is evident that all these demands require the implementation of ICT layers inside the old electricity grid to make it "smart".

The building of these levels should lead to the construction of secure, robust, reliable and interoperable communication architectures able to connect all the devices, the software tools, and the actors that will take part in the Smart Grid. Sometimes this architecture is referred as the Internet of Energy.

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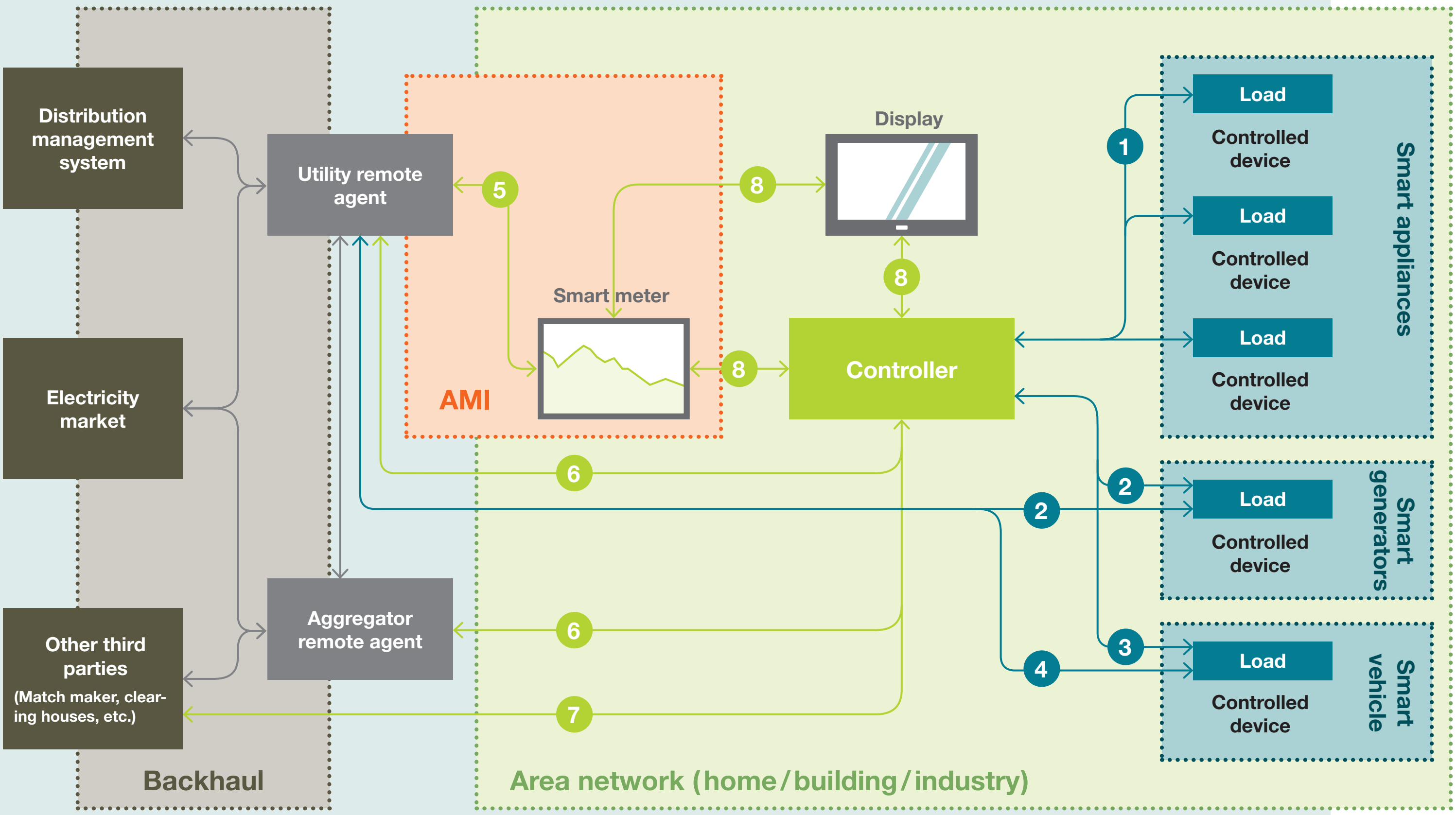
Distribution management system



1 ZigBee | Z-Wave | KNX | Home Plug | BacNet | Lon Works | oBIX | ISO/IEC 18012 | AS 4755.3.1.2008

2 IEC 61850-7-420

3 ZigBee Smart Energy 2.0 | SAE J2931 | Draft result of PAP11

4 ZigBee Smart Energy 2.0 | SAE J2931 | Draft result of PAP11 | IEC 61850

5 ANSI C12.22 | M/441 | Open Meter | DLMS| EMD | EDINE

6 OpenADR | Open ADE | Energy Interop | EMIX | Electric M&V | CME (only Aggregator Remote Agent)

The research project ARTISAN

The regional CROSS-TEC Laboratory (set up by ENEA inside the Techno'pole of Bologna) is coordinator of a FP7 project: ARTISAN (Energy-aware enterprise systems for low-carbon intelligent operations).

The project aims at stimulating the European textile industry to employ real time energy consumption indicators in both its day-by-day operations and business partnerships, supporting operations and decisions in the supply chain through information related to the energy/environmental “identity” of processes and products.

ARTISAN will provide, among other things:

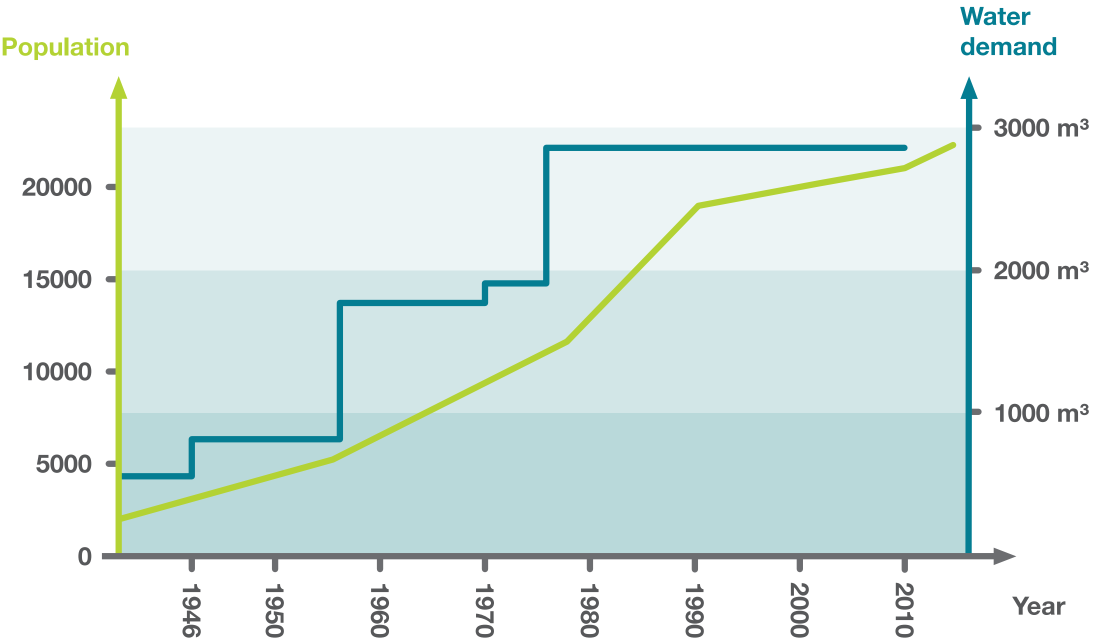
- Decision Support Systems that fit in with enterprise decision processes, such as:
  - Dynamic electricity pricing
  - Energy consumption indicators
  - Internal energy production (if any)
- Services for energy and emissions trading arising from more accurate energy forecasts, both to the single enterprise and to the entire supply chain.

Thanks to ARTISAN, textile enterprises could become active consumers, integrated with the electricity markets and able to provide the distribution management systems with reliable forecasting of their consumption. Therefore, these services will help enterprises to act as active users in the upcoming smart electricity grids.

Good practice in Haute-Savoie –
The tank of the Ardosières in Chatel

Chatel is located in Haute-Savoie in Abondance Valley, around 40 km from Thonon-les-Bains (Southern shore of Lake Léman). It is one of the 14 ski resorts that form the “Portes du Soleil” domain that adjoins Switzerland. It sprawls across 7,954 acres, between altitudes ranging from 1,053 m to 2,432 m. The population varies from 1,300 permanent inhabitants to more than 20,000 people during high season in winter.

Water demand / population



Water demand in Chatel has greatly increased over the last 40 years

To cope with the extra water demand, the municipality built a 300 m³ tank in 2002. The topographical constraints are marked, since the tank has been set up at an altitude of 1290 m, on a steep slope over 40 % of which is covered in snow for more than half of the year.

The water that is collected is quite risky as far as bacterial content is concerned, due to the pastures upstream. UV radiation treatment and a little chlorination are enough to treat the water, but an electrical installation is needed. However, this place is too far away to be connected to the electrical network.
Therefore, it has been decided to produce electricity from the energy created by the water coming into the pressure tank.

The municipality chose a system of microturbines, as springtime in Ardoisières has quite reliable characteristics:

- Constant and sufficient rate of water flow all year long:
  - Minimum 16 m^3/h
  - Maximum 30 m^3/h
- Altimetrical position allowing gravity distribution:
  - Altitude of the tank: 1,300 m
  - Average altitude of the network: 1,200 m

The turbine's brand is IREM ECOWATT:

- Net power: 300 W
- Single-phase voltage: 220 V
- Pressure at normal speed: 0.9 bar
- Fixed injectors whose openings are set at 4 litres/second

The electricity produced feeds the equipment for the water treatment, the lighting of the premises when visited, as well as the equipment for teleprocessing.

The intended operation for the installation is the following:

- If the rate of flow available is lower than the minimum necessary for the turbine to work, the turbine stops.
- If the rate of flow available remains between the minimum and maximum necessary for the turbine to work, all the water passes through the turbine.
- As soon as the rate of flow available gets higher than the maximum for the turbine, the excess water goes through a bypass located above the normal flow going into the turbine network, and is then poured into the tank. This equipment renders the water potable, by making the appropriate treatments with a completely autonomous system.

The cost of the equipment and work on the microturbine amounted to 13,200 EUR, while the network connection was valued at 90,000 EUR.

Further information
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Hydro power with micro water turbine in Chatel