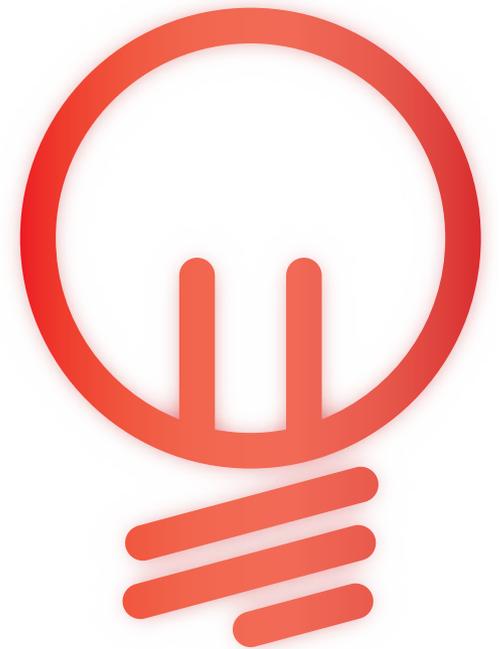


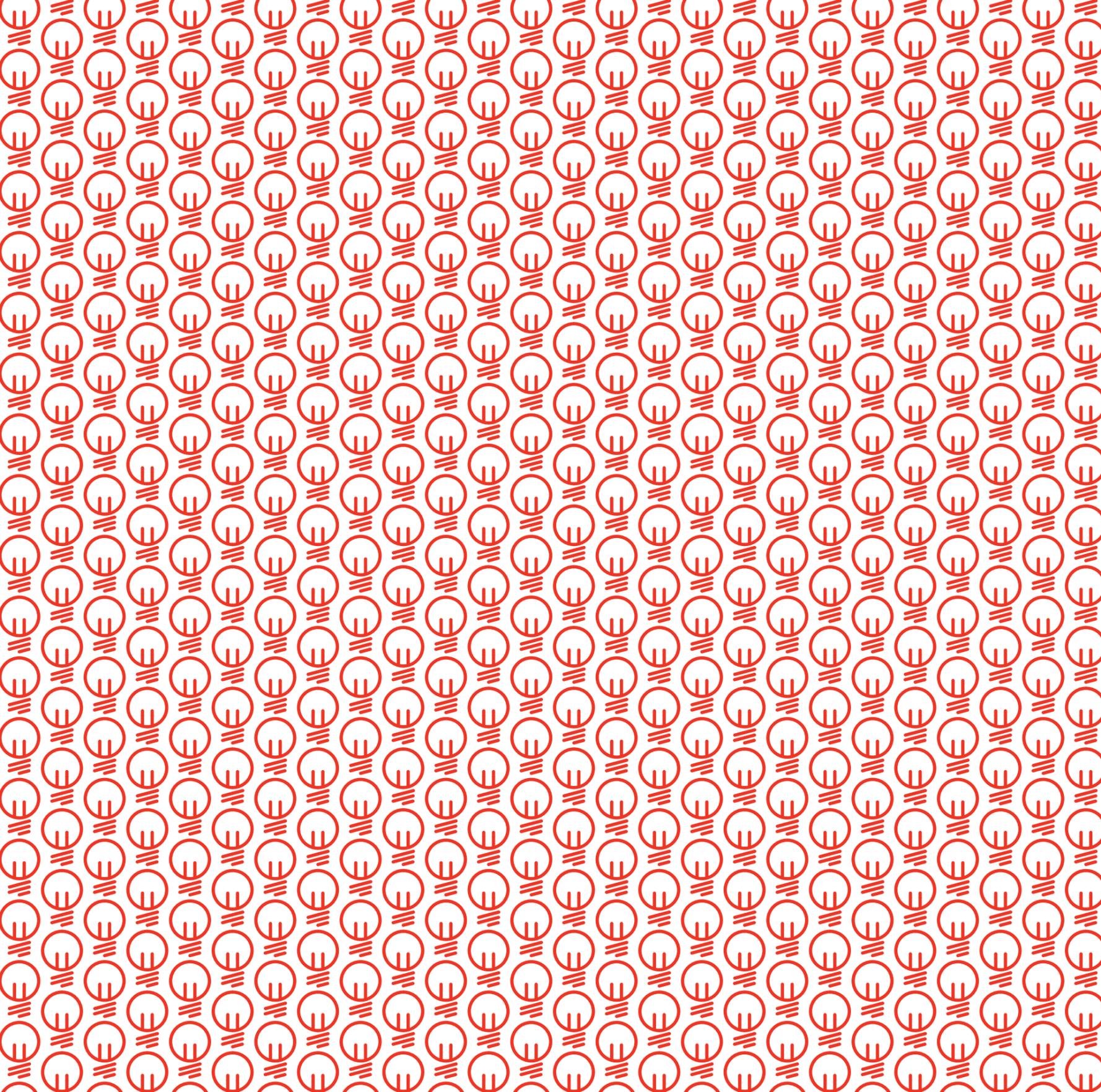


Recognizing the best energy projects from Switzerland

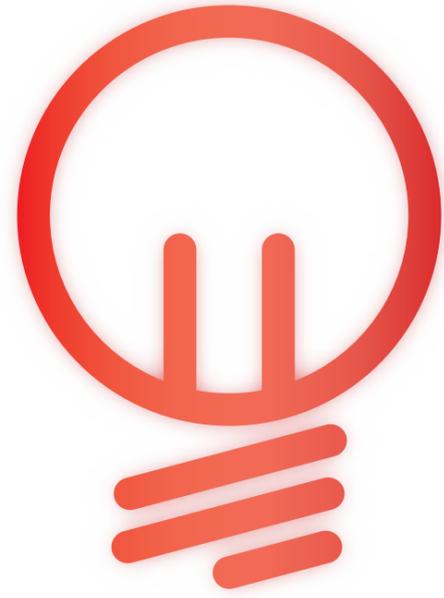
# watt d'or



Boston, Massachusetts  
Summer 2014



watt  
d'or



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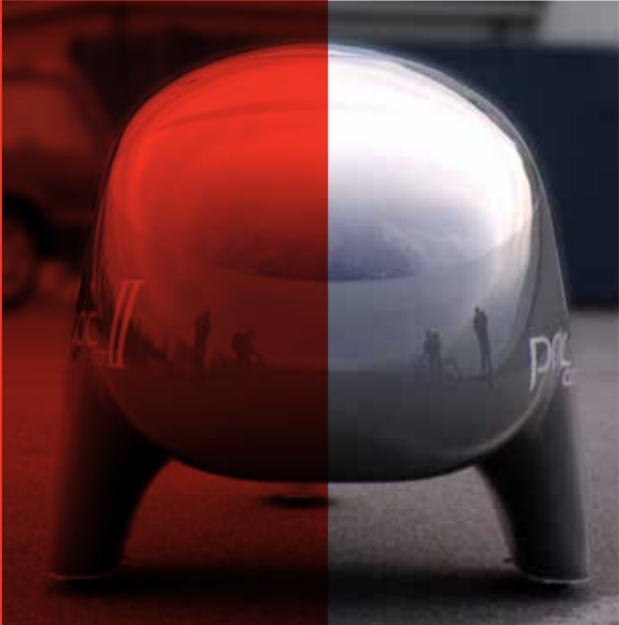
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# Presenting the Watt d'Or

The Watt d'Or award recognizes the best energy projects from Switzerland. The prize is awarded annually, by the Swiss Federal Office of Energy. Its bestowment every January marks the first national awards ceremony of the year. The winners are selected by a jury composed of energy experts in academia and NGOs, as well as from the public and private sector. This breadth in expertise gives the program a higher level of legitimacy, making the Watt d'Or the most prestigious award in the energy sector in Switzerland. The Watt d'Or is divided in five different categories: society, energy technologies, renewable energy, energy efficient mobility, and building and space. These categories are good indicators of where Switzerland's priorities stand in the energy sector.

The Watt d'Or pursues many goals: to provide award recipients with a label of quality in line with the principle of best practices and best achievement; to encourage and motivate the development of new projects within the energy industry; and to point to future trends and draw attention to the objectives of Switzerland's energy policy. As a result of the award's prestige, the Watt d'Or is also a great opportunity for the winners to gain visibility, demonstrating the significance and value of their technology to project stakeholders.

The Watt d'Or winner projects will be displayed for the first time as a traveling exhibition that will commence in Boston, and continue on throughout the United States, Switzerland as well as other countries. The purpose of the exhibition is to showcase the individual Watt d'Or award winning projects, as a means by which to create a dialogue and establish collaborations with key players in academia and the public and private sector. The hope is that the projects will spark future interactions and forge new bonds.



# Foreword

As the population of the planet increases, and the mobility of people and goods increases with it, our demand for energy and the emission of carbon dioxide are increasing in parallel. Our consumption of resources does not align with the natural resources available. If we are genuinely concerned about the welfare of our environment, of our health, and of future generations, we must all become much more efficient.

Both Switzerland and the US share the mutual objectives of lowering our carbon footprint, increasing resiliency, and reducing dependency on non-sustainable energy sources. We are committed towards improving our energy efficiency. To address this challenge, technological innovation is necessary. With government support, both countries have created the appropriate infrastructure and innovative hubs to accelerate research, development and deployment of leading-edge energy technologies. This strategy reflects the will to develop the cleantech sector, by way of leveraging the high-tech industry and developing opportunities in both knowledge-based economies.



**Mrs. Doris Leuthard, Federal Councillor**

With this in mind, Switzerland has, since 2007, recognized the best energy project in the country with the coveted Watt d'Or. This is an important recognition, one that spurs energy innovation across the country. For the first time ever, the projects awarded with the Watt d'Or will be showcased in an exhibition in Boston, Massachusetts this year. In this regard, the location of the exhibition is significant. Switzerland and Massachusetts share many similarities in terms of size, population, and lack of natural resources. The latter quality forces both states to invest in knowledge and innovation, establishing themselves as leaders in the discourse of clean energy policy. Showcasing the Watt d'Or projects in Boston is a perfect opportunity for enhancing and encouraging the dialogue and collaboration towards a greener technological development and an extension of markets between Switzerland and the US.

# Solar Impulse

Around the world in a solar airplane

For the first time in history, an airplane has succeeded in flying day and night without the use of fuel, powered for 26 hours straight with nothing more than solar energy. This flight, conducted on July, 8 2010, brought the initial phase of the Solar Impulse adventure, launched by Bertrand Piccard and André Borschberg, to a successful conclusion, demonstrating the enormous potential of technological innovation for energy savings and the potential applications of renewable energies.

The jury decided to award a special prize to this project, recognizing its outstanding technological achievements as well as its powerful symbolic value.



In 2013, Solar Impulse completed its last big journey before its next major adventure: an around the world flight, slated for 2015. By flying over the United States from west to east, starting in San Francisco (CA) in May, HB-SIA successfully landed in New York two months later, stopping in Phoenix (AZ), Dallas (TX), St. Louis (MO), Cincinnati (OH) and Washington D.C. along the way. The challenges of this historic travesty has proven the reliability of renewable energies and demonstrated the team's resourcefulness. Further, the interest raised worldwide by Solar Impulse was spectacular: 8.5 billion media stories were generated during the mission. This gives a preview of the coverage that will be triggered when the plane achieves its global flight.

Solar cell covered surface

200m<sup>2</sup>

Size of the airplane

63.4m

Average power developed by each engine

10hp

Average flying speed

70km/h

After having accomplished the Across America Mission with its first airplane, HB-SIA, the Solar Impulse team is now finishing the construction of the around-the-world airplane, HB-SIB. . The time has come to raise the stakes to the next level and prepare for the first, entirely solar powered flight around the world!

Take-off speed

44km/h

Maximum cruising altitude

8,500m

Number of solar cells

11,628

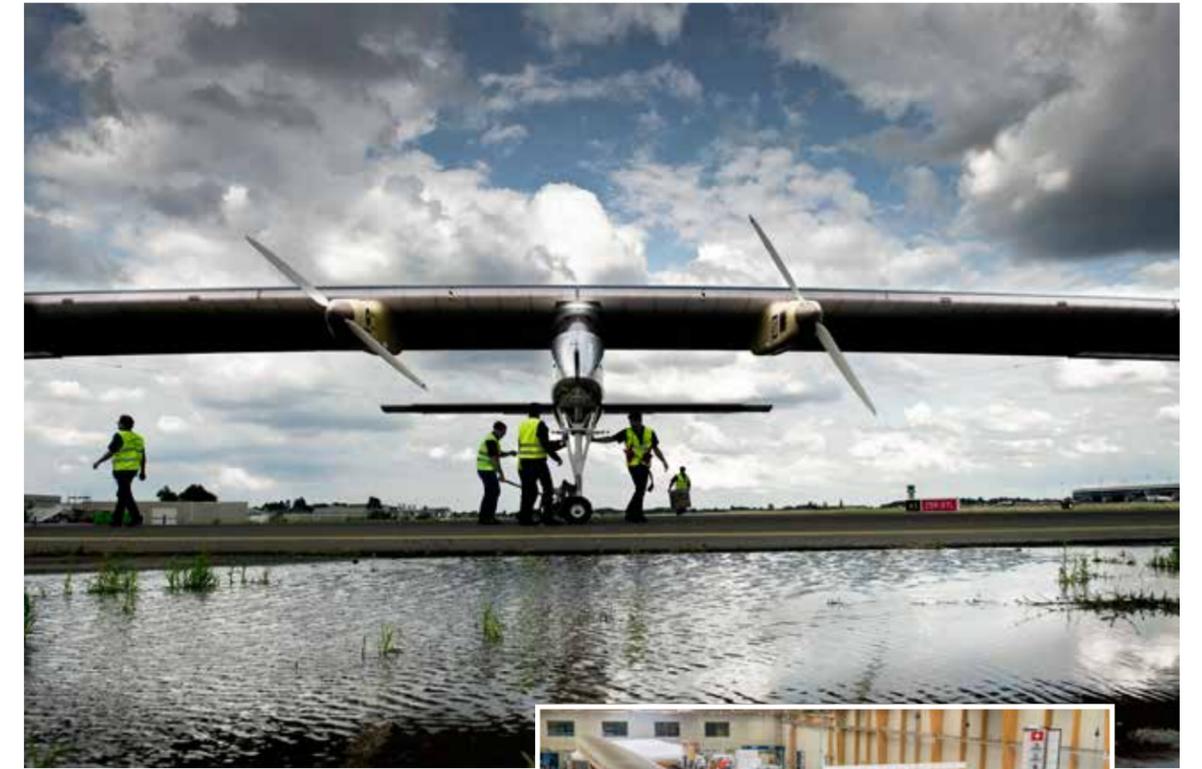
Six world records in the solar airplane category

Duration; altitude; gain of height;  
three records in Distance



solarimpulse.com

Company Solar Impulse  
Category Special Award  
Date 2011



# House 2050

Living comfortably with 2000 watts

12

This recently completed apartment building in Kriens combines low energy consumption with environmentally-friendly building materials and a high quality of living. Thanks to a thorough planning scheme, the design team reduced the embodied energy needed to build this apartment block. A high performance building envelope drastically reduces the amount of energy required to heat the interior. Moreover, the demand for warm water has been reduced through the use of shorter water pipes and water saving faucets. A photovoltaic system on the rooftop provides the electricity needed for various building services and in particular for the operation of the heat pump for the provision of heating and

hot water. All built-in household appliances surpass the requisite energy standards, and intelligent devices ensure that the electricity produced by the photovoltaic system is used locally as much as possible. These measures strongly reduce the load on the power grid.

The project has been completed and the building is fully occupied. Metrics are generated through measuring points built into an intelligent device system in order to collect data. This data can then be used as a base for comparing for future projects.

Company **e4plus + aardeplan**  
Category **Buildings**  
Date **2014**

CO<sub>2</sub> per square meter per year  
16.1 kg/m<sup>2</sup>/a

[aardeplan.ch](http://aardeplan.ch) + [e4plus.ch](http://e4plus.ch)



13



Company e4plus + aardeplan  
Category Buildings  
Date 2014



# Holzhausen

Switzerland's first six-story timber residential building

Company Holzhausen  
Category Buildings  
Date 2007

Energy related floor area  
1,964 m<sup>2</sup>  
Overall energy demand  
105 MJ/m<sup>2</sup>a  
Specific heating energy demand  
40.6 MJ/m<sup>2</sup>a  
Domestic hot water  
60.2 MJ/m<sup>2</sup>a  
Electricity demand  
118.4 MJ/m<sup>2</sup>a



Switzerland's first six-story timber structure is a residential and office building with a high level of comfort and extremely energy efficient. Excluding the staircase and the basement, a few tree trunks would suffice to construct this building. This enhances the appeal of timber as a building material, and simultaneously serves as a prime example of how the design of future buildings can ensure a high level of energy efficiency and protect the environment.

As a building material, wood possesses many positive characteristics that are relevant and ecologically sound such as: a low level of energy for production, good isolation, and a long life span to name a few. Additionally, the quality of living is higher within a wooden edifice than those constructed of other materials.

Both the offices on the ground floor and the apartments located above have been completely occupied since 2006. Today, the inhabitants of the building appreciate the character and quality of their apartments and offices.

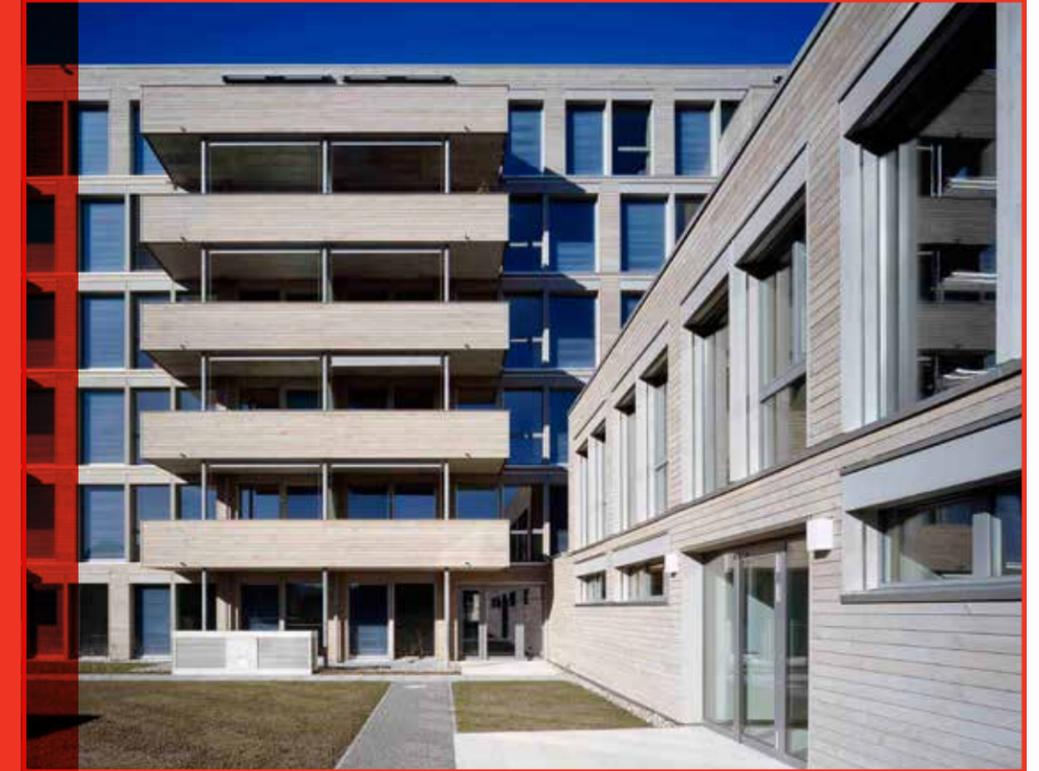


Since its completion, many more multi-story timber buildings have been erected in Switzerland, all emulating the concept of "Holzhausen". Currently, the tallest timber structure in Switzerland is the seven-story complex for Tages Anzeiger, Switzerland's largest national daily newspaper.

holzhausen.ch

allreal.ch

Energy related floor area  
20,400 m<sup>2</sup>  
Overall energy demand  
46.4 kWh/m<sup>2</sup>a  
Specific heating energy demand  
13.3 kWh/m<sup>2</sup>a  
Domestic hot water  
16.1 kWh/m<sup>2</sup>a  
Electricity demand  
17.0 kWh/m<sup>2</sup>a  
Reduction of CO<sub>2</sub> emissions  
78%  
On-site energy production, total  
547,200 kWh/a  
Photovoltaic  
164,000 kWh/a  
Environmental solar heat  
383,200 kWh/a Air heat pump +  
Waste water heat pump



The city of Winterthur developed a revolutionary 'zero-energy' apartment building, meaning that it requires no electricity from a power station. This impressive performance lies in the four criteria the engineers and architects focused on: exceptionally good insulation; efficient building service systems and active solar power production; use of ecologic materials; integrated solar window elements and in-house power generating solar

The integrated solar windows enable the building to respond to seasonal temperature change. When the sun's rays hit the windows

at a high angle during the summer, the rays are reflected, thereby keeping the interior cool. Conversely, when the sun's rays hit the façade at a lower angle in the winter, the glazing transmits the sunlight inwards, warming the interior.



Company Allreal Group  
Category Buildings  
Date 2009

## Romantik Hotel Muottas Muragl

The first plus-energy hotel in the Alps



Company **Romantik Hotel Muottas Muragl**  
Category **Buildings**  
Date **2012**

Romantik Hotel 'Muottas Muragl', located more than 8,000 feet above sea level, is known for its beautiful surroundings; and since 2011, it is also famous for being the first 'plus-energy' hotel in the Alps. Since then, the Romantik Hotel Muottas Muragl has supplied itself entirely with renewable energy; and thanks to a carefully conceived energy system, it even produces more energy than it consumes. The hotel successfully implemented a comprehensive energy concept comprising solar collectors, use of waste heat from railway operations, a photovoltaic

plant alongside the railway line and geothermal sensors. Solar collectors are producing energy for hot water and heating. Excess solar energy is stored in the thermal loop field in the ground and drawn on, when required, by means of a heat pump. Due to an enhanced isolation of the building, energy consumption has also been reduced.

This first plus energy hotel shows that it is possible to have an excellent practice energy management even in a hostile environment.

### Energy related floor area

**2,514 m<sup>2</sup>**

### Overall energy demand

**227,740 kWh/a including 22,050 kWh/a for ventilation and heat**

### Specific heating energy demand

**110,650 kWh/a (44.0 kWh/m<sup>2</sup> a)**

### Reduction of energy consumption

**208,000 kWh/a**

### Reduction of CO<sub>2</sub> emissions

**133,000 kg/a**

### On-site energy production, total

**274,280 kWh/a (Series of measurement still in progress)**

### Photovoltaics

**455 m<sup>2</sup>**

### 94,600 kWh/a of electricity

### Solar heat

**140 m<sup>2</sup> 82,080 kWh/a of heat**

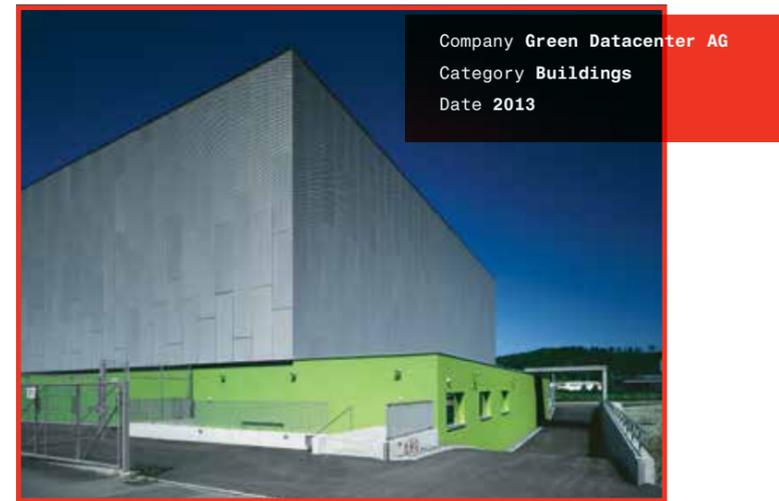
### Geothermal field

**97,600 kWh/a of heat**

[muottasmuragl.ch/en](http://muottasmuragl.ch/en)

## Green Datacenter Zurich West

Secure, advanced, innovative, and ecological



Company **Green Datacenter AG**  
Category **Buildings**  
Date **2013**

Our modern world functions to a large extent thanks to data that is stored in computer centers and sent around the entire globe in fractions of a second. An ever-increasing number of computer centers are constructed as data transmission via those centers is constantly growing. However, a data warehouse needs about a 100 times more energy than an office building of an equal size. In 2011, Green Datacenter AG opened a highly advanced and energy-efficient data center, which needs up to 20% less electricity and thus sets new standards. Thanks to the elimination of several voltage conversions, the IT equipment produces less heat and, therefore, less cooling is needed. Furthermore, the technology applied also leads to a smaller use of com-

### Total reduction of energy consumption

**Up to 20% compared to traditional data centers**

[greendatacenter.ch](http://greendatacenter.ch)

[innovationtower.ch](http://innovationtower.ch)

ponents and, simultaneously, less required space means fewer costs for investments and installations. As a consequence, the green data center is not only energy efficient, but also more cost effective than existent ones - a key competitive factor for the success of Green Datacenter AG. The first data center module started up operations in March 2011, while the construction of the second module started in July 2013. The Innovation Tower is scheduled to be completed in the spring of 2015. The Innovation Tower is an ingenious office building with six upper levels, a ground floor and a lower level, with a gross floor area of 5,524 square meters.

## Modernization of Magnusstrasse 28

Retrofitting historically preserved structures to be energy efficient



Company **Viridén + Partner**  
Category **Buildings**  
Date **2008**

The modernization of this dilapidated apartment house in Zurich is exemplary in its ability to combine preservation with technology and renewable energies. Despite the fact that the building must follow a strict preservation code, the team was able to create additional space and meet the low-energy standard 'Minergie' required for new buildings. All windows are now triple-glazed, and the roof and courtyard facades are well insulated. An air-handling system was installed, and the existing oil heating system was replaced with more sustainable wood pellet heating. Solar collectors on the roof produce the energy needed for hot water and heating. The performance results of the past few years prove the renovation sustainable.

### Specific heating energy demand

**35.2 kWh/m<sup>2</sup>/a (49%)**

### On-site energy production

**78,150 kWh/a**

### Source (solar and wind)

**17,680 kWh/a**

### Wood pellet heating

**69,310 kWh/a**

[viriden-partner.ch](http://viriden-partner.ch)

## Transformation of Feldbergstrasse

Modernizing 100-year-old apartment buildings as energy providers



Company **Viridén + Partner**  
Category **Buildings**  
Date **2010**

These two apartment buildings dating from 1896 in Basel have been retrofitted and are now at the forefront of energy efficiency, producing more energy than they consume.

To accomplish this, the following initiatives were implemented: 20 cm thermal insulation was installed within the buildings' walls; 50 cm thermal insulation was installed under the roofs; and old windows were replaced with new triple-glazed windows. In addition, a heat exchanger and thermal solar collectors produce thermal energy and warm water. A large tank installed then allows the heat from the summer to be saved until the end of November. In addition, a photovoltaic plant produces electricity to heat the buildings and operate facility equipment.

### Overall energy demand

**Before 223,000 kWh**

**After 53,000 kWh**

### Specific heating energy demand

**Before 159,970 kWh/a**

**After 11,400 kWh/a**

### Reduction of CO<sub>2</sub> emissions

**Before 72,450 CO<sub>2</sub>**

**After 8,450 CO<sub>2</sub>**

[viriden-partner.ch](http://viriden-partner.ch)

## IWB Powerbox

Heat and cooling supply for a shopping mall with neighbors' waste heat



Company **IWB**  
Category **Buildings**  
Date **2011**

The newly built "Stückli" shopping mall and business park climate is treated in a unique manner for Switzerland. The heating and cooling energy needs are met entirely by the waste heat generated through the industrial processes of the shopping mall's neighbors. The Powerbox is a custom-made energy plant, designed to optimize the use of the existing resources and to cover the heating and cooling needs of the Stückli complex. The nearby wastewater treatment plant (ProRheno) and hazardous waste incinerator (Valorec Services) produce a huge amount of waste heat, which is used in winter to heat the building. A large absorption refrigerator allows the mall and office space to be cooled during summer months. This project's success is a result of an efficient collaboration between waste heat suppliers (ProRheno and Valorec Services), the energy consumer (Stückli complex, Tivona AG), a large utility (IWB) and the project planner (Dr. Eicher + Pauli).

### Energy related floor area

**67,000m<sup>2</sup>**

### Overall energy demand

**19,000,000kWh**

### Specific heating energy demand

**145kWh/m<sup>2</sup>**

### On-site energy production, total

**waste heat recovery**

**9,700,000kWh heat**

**9,300,000kWh cooling**

[iwb.ch](http://iwb.ch)

# Joulia

A revolutionary and elegant way to save energy in the shower

20

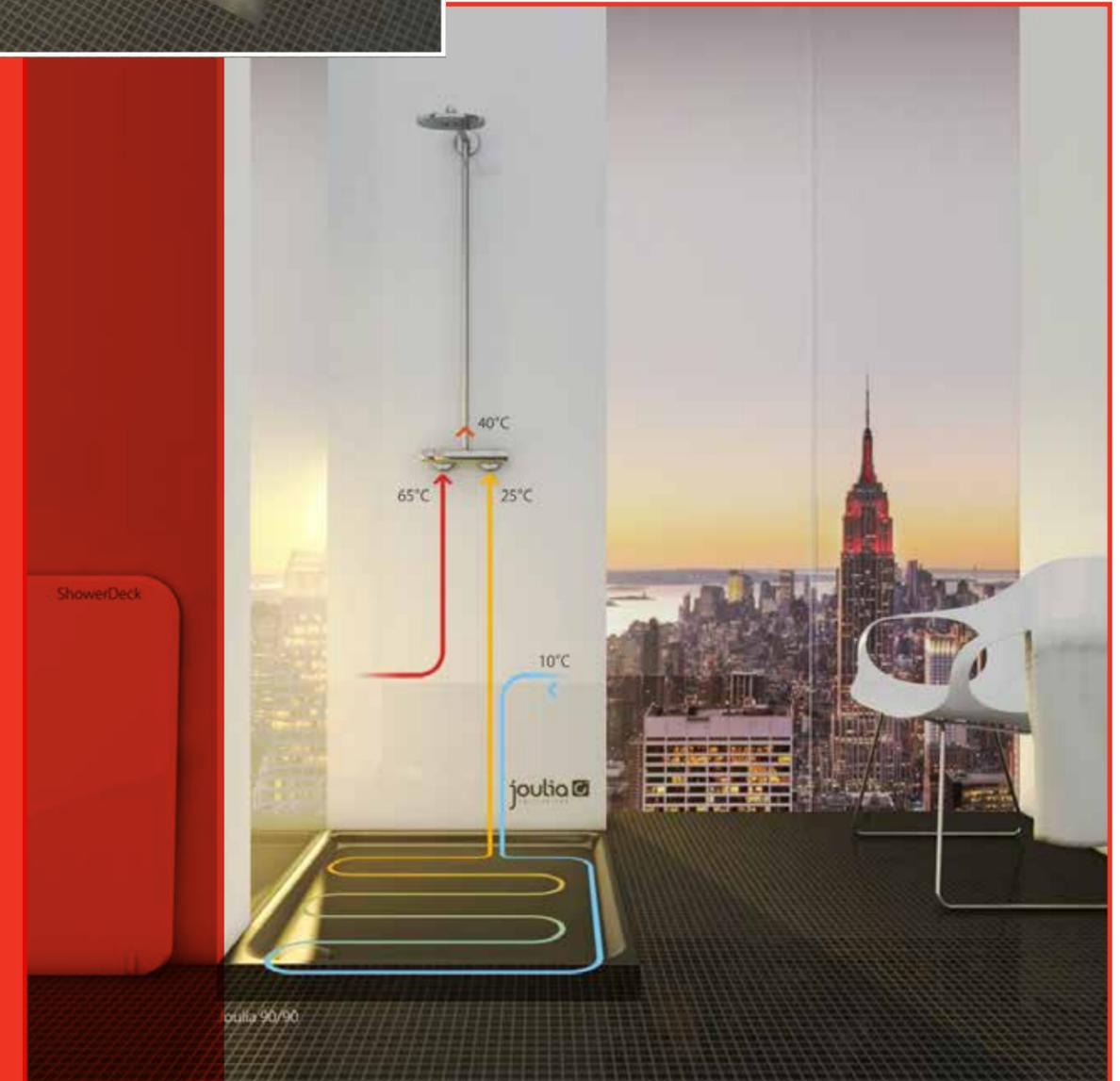
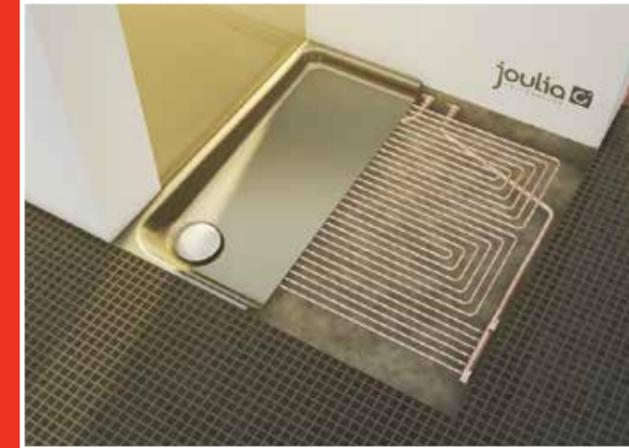
When we take a shower, enormous quantities of energy literally disappear down the drain. Each year, up to 1000 kilowatt hours (or around 200 US Dollars) per four-person household are wasted in this manner in Switzerland. But now this energy can be saved thanks to the Joulia system. It recovers heat (and thus energy) from shower water while it flows down the drain and uses it to heat up cold water. This means that less hot water is drawn from the boiler, so that the energy requirement for showering is reduced by more than 25%.

The Joulia shower is suitable for use in new buildings as well as for retrofits; and it can be installed in place of a conventional shower tray. The only additional installation required is the connection of the cold fresh water pipe to the heat exchanger. Furthermore, this reduction in the demand for hot water can translate to the use of smaller boilers in each household.

Company **Joulia**  
Category **Energy Technologies**  
Date **2013**

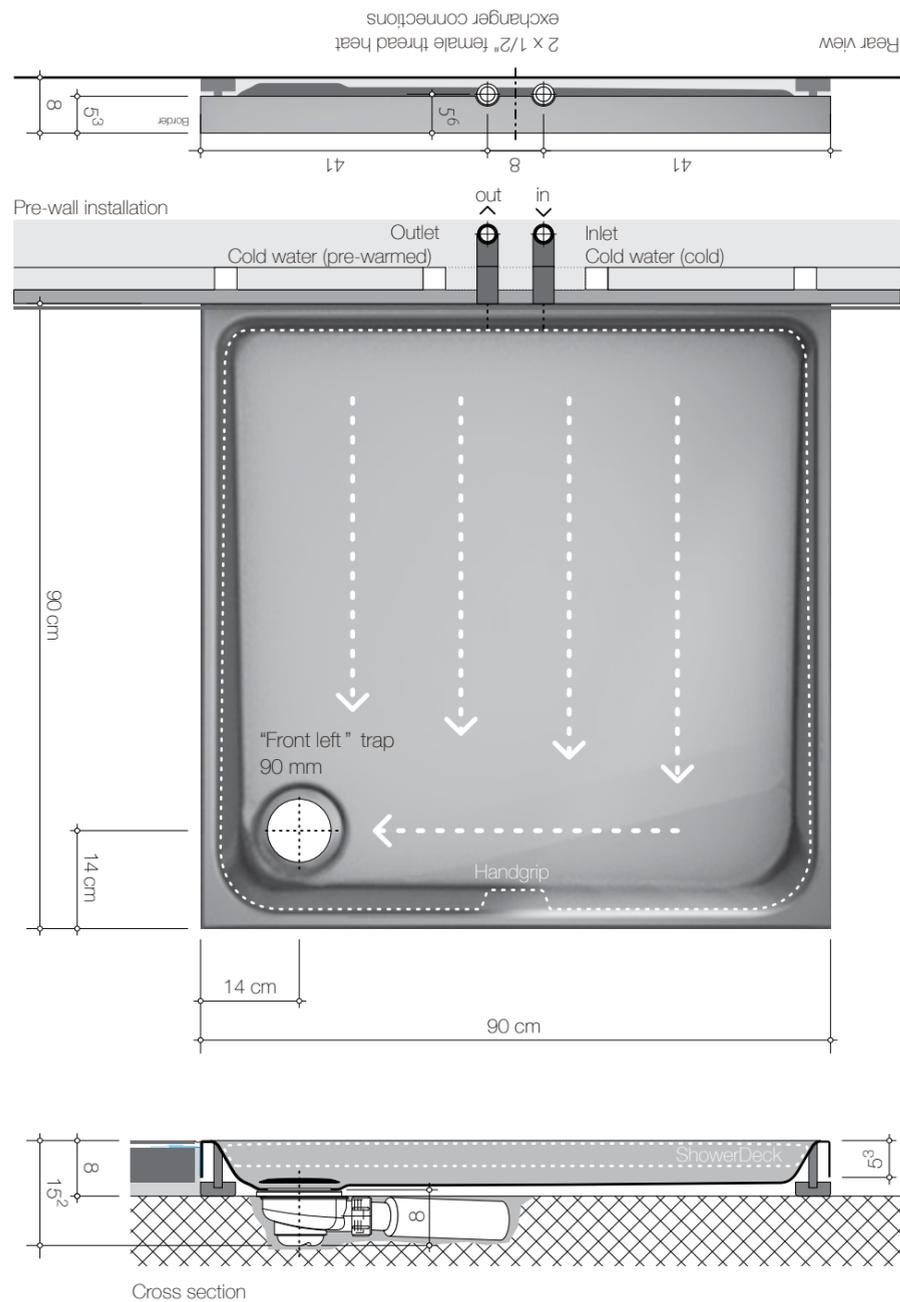
Reduction of energy consumption  
Up to 1000 kWh power saved per year in a four person household (Assuming four people taking daily showers at 8 minutes each with a 3.2 gallon shower head), compared to approximately 3,600 kWh regular

Reduction of CO2 emissions  
Up to 600 kg CO<sub>2</sub> emissions per year (based on European electricity mix)

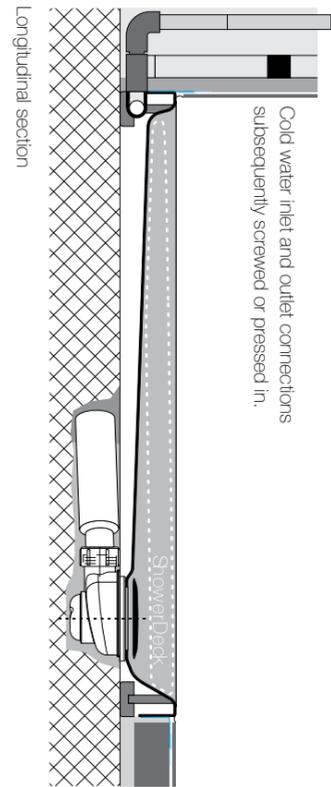


[joulia.com](http://joulia.com)

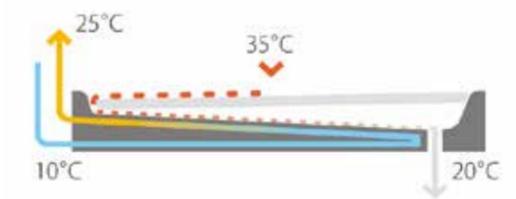
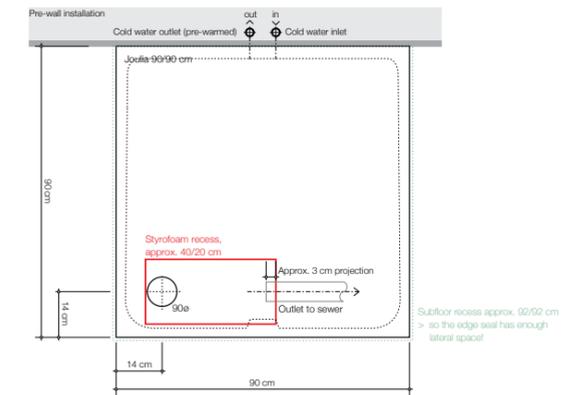
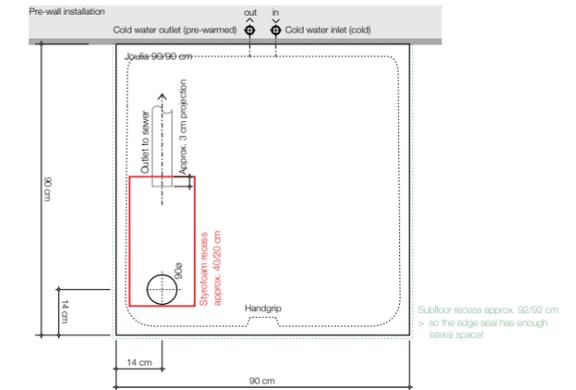
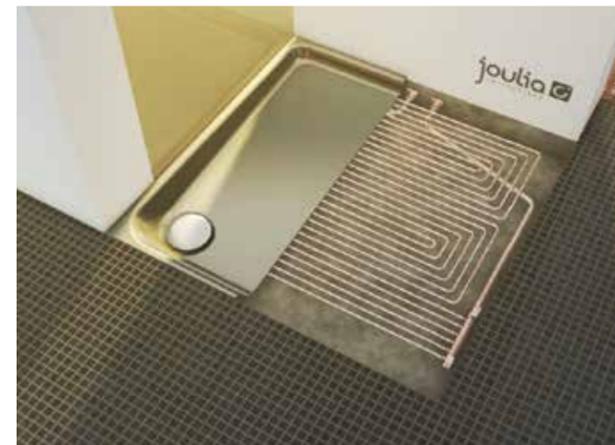
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Company **Joulia**  
 Category **Energy technologies**  
 Date **2013**



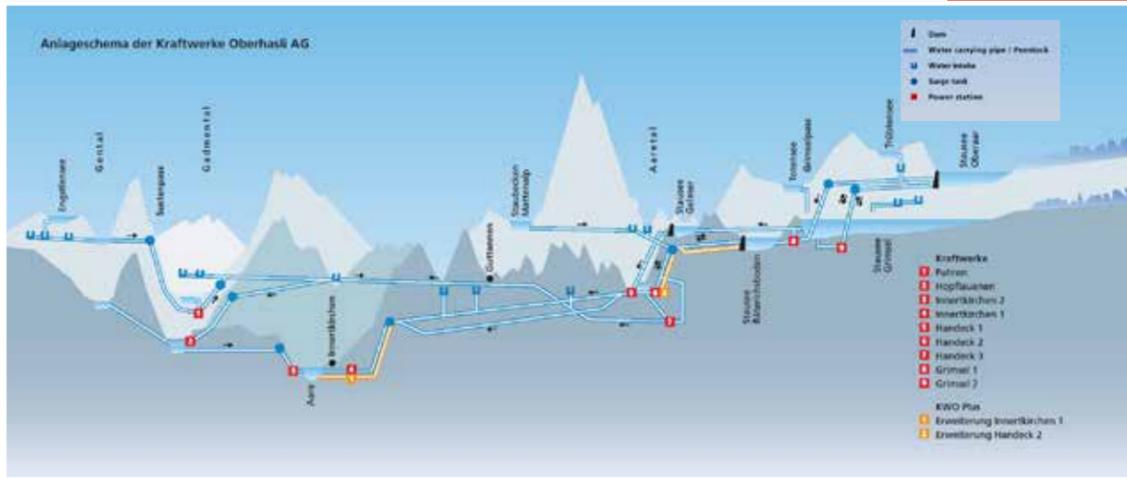
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# Variable-Speed Storage Pump

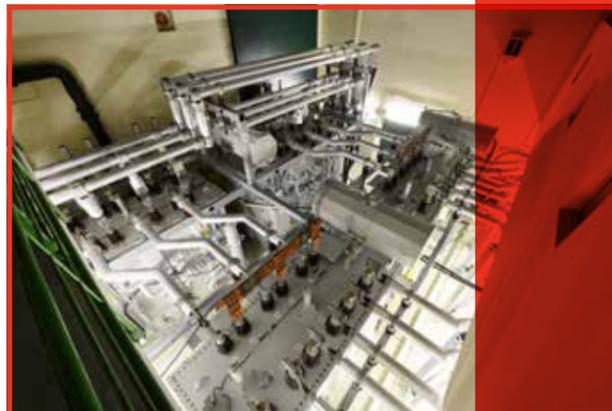
100 MW Full-Size Converter in the Grimsel 2 Pumped Storage Plant

Company **KWO**  
Category **Energy Technologies**  
Date **2014**



Switzerland's solution to balance power supply and demand is to pump energy, in the form of water, uphill – up the mountains - when demand is low and to let it flow downhill when demand is high to generate electricity. The hydroelectric power company of Oberhasli (KWO) introduced an innovative system which enables the optimization of high-performance storage pumps while still guaranteeing the stability of the electricity network. The key element of this new system is the Varspeed, the world's most powerful

frequency converter. While conventional pump storage power plants can be switched on or off without having the ability to adapt to the power of the pump, the storage pump in this new system can operate with variable performances. Fluctuations of supply and demand in the electricity grid can now be balanced rapidly and efficiently.



Possible variation of frequency  
**44-51 Hz (compared to standard of 50 Hz)**  
Possible variation of number of rotations  
**680-765 rpm (compared to standard: 750 rpm)**  
Possible variation of performance  
**60-100 MW (compared to standard of 86 MW)**

[grimselstrom.ch](http://grimselstrom.ch)

Company **EAWAG Forum Chriesbach**  
Designing a sustainable office building for water research



Company **Eawag**  
Category **Energy Technologies**  
Date **2007**

This 92,000 SF office building for the Swiss Federal Institute Aquatic Science & Technology uses only one third the energy of a conventional building. Its concept pushes the forefront of sustainable design to new limits. Designed by Bob Gysin + Partners, the building's features include: high performance structural cladding, an efficient ventilation system, a blue glass facade that blocks the sun's rays in summer and transmits them in the winter, a daylit atrium with skylights, and a photovoltaic system, which provides one-third of the building's electricity.

Energy related floor area  
**11,170 m<sup>2</sup>**  
Overall energy demand  
**412,100 kWh/a**  
Specific heating energy demand  
**73,800 kWh/a**  
Domestic hot water  
**29,300 kWh/a**  
On-site energy production, total  
**116,600 kWh/a**  
Solar  
**26,400 kWh/a heat; 74,200 kWh/a electricity**

[forumchriesbach.eawag.ch](http://forumchriesbach.eawag.ch)

Company **Electricity Production Using a Gas Pressure Reduction Generator**  
Natural gas expansion turbines with cogeneration plant



Company **GVM**  
Category **Energy Technologies**  
Date **2010**

Gas pipelines transport gas under high pressure from its origin to Switzerland. However, for distribution to the end user, pressure must be decreased. A lot of energy is released in the process of transforming high pressure gas from the transmission line to low pressure gas for the distribution to end users. Fortunately, this energy is not lost, but can be recovered! The plant in Oberbuchsitzen makes this energy available in the form of electricity. Thanks to the latest technology that includes high speed rotors and a highly efficient electrical frequency converter and magnetic bearing, the Oberbuchsitzen plant is able to obtain high levels of efficiency. Two other power plants are planned near major cities in Switzerland.

On-site energy production  
**2,500,000 kWh/a**  
Peak production  
**711kW**  
  
[www.gvm-ag.ch](http://www.gvm-ag.ch)

Company **Suction Tube ECOrized**  
Sustainable savings in ring spinning



Company **Rieter AG**  
Category **Energy Technologies**  
Date **2013**

For many years, the most energy-efficient spinning machines in the world have been manufactured by the Swiss engineering company Rieter AG in Winterthur. Thanks to its development of the suction tube "ECOrized", Rieter AG has now succeeded in reducing the energy consumption of its machines by up to 10 percent. On a spinning machine each spinning position currently features a suction opening for extracting ends down and hard ends. Rieter has now found a very efficient solution – a suction tube with a flap which opens fully only when necessary. With this device implemented on each and every ring spinning machine across the globe, it would be possible to save more than six billion kilowatt hours of electricity globally.

Reduction of energy consumption  
**30 kWh per year and suction tube compared to the former suction tube**  
Savings  
**\$3/a/tube**

[www.rieter.com](http://www.rieter.com)

# PAC-Car II

Eco-marathon vehicle sets a new benchmark in fuel consumption

26

PAC-Car II is a fuel economy vehicle powered by a fuel cell. This project demonstrates what can be accomplished in the optimization of a car. The engineers of ETH Zurich paid attention not only to the design and aerodynamics of the car, but also to its materials and engine system.

In 2005, PAC Car II set a new, unprecedented world record for the most energy-efficient driving. Extrapolating the fuel consumption of a 20 km competition, PAC-Car II covered

a 5385 km distance with the energy equivalent of one liter of gasoline. Moreover, the PAC-Car II design not only requires less energy, but can also operate on clean energy with its fuel cell system. While most of the other fuel economy vehicles burn fuel in an internal combustion engine, PAC-Car II uses a fuel cell to convert hydrogen to electricity to run its electric motors. This leads to a more efficient and silent operation with cleaner emissions—since the only by-product of the PAC-CAR II is water.

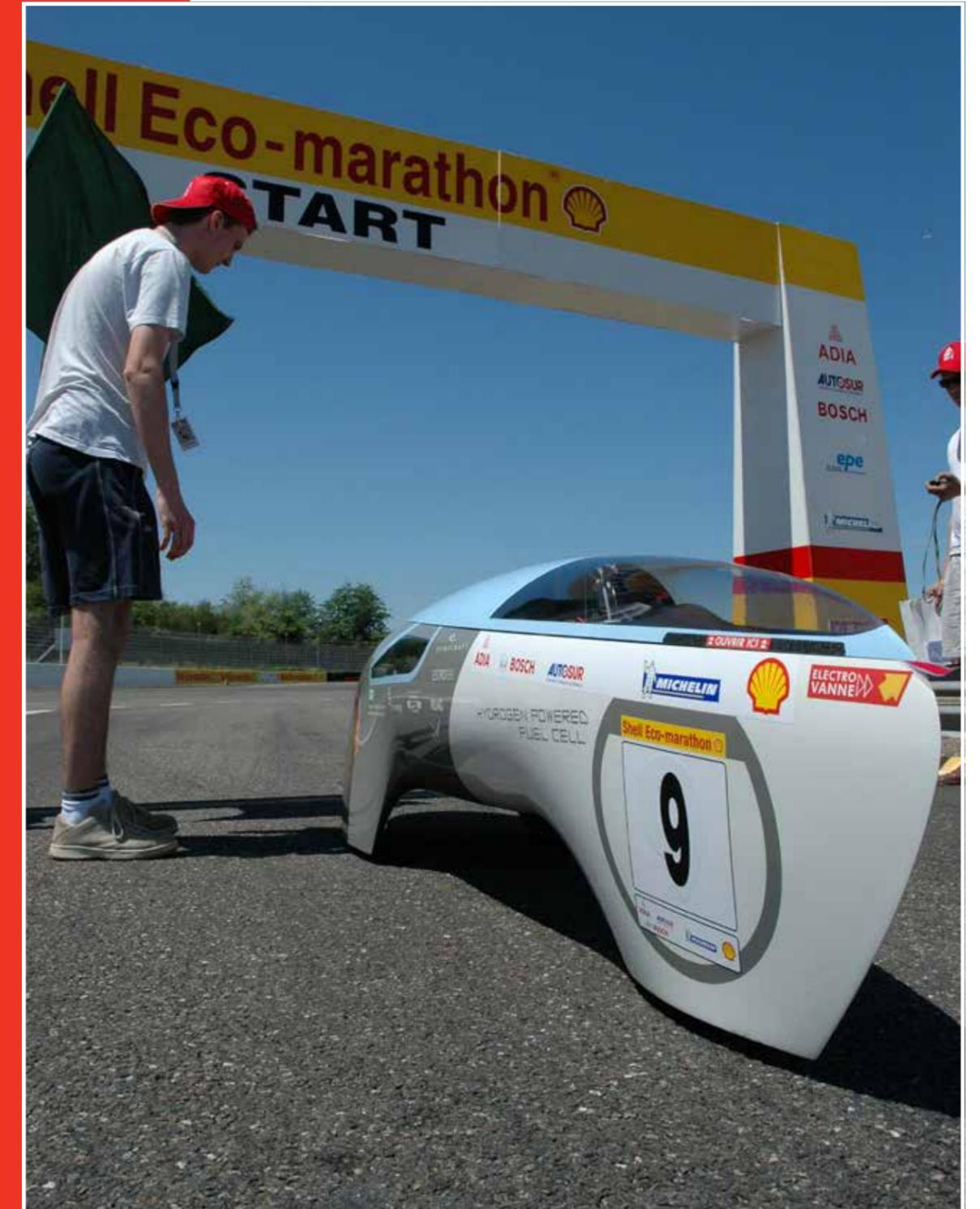


Company **ETH Zurich**  
Category **Energy-Efficient Mobility**  
Date **2007**

Guinness World Record  
Pac-Car II set the record for the most fuel-efficient vehicle: 15,212 mpg on the Shell Eco Marathon in the Michelin Technology Centre, Ladoux, France on 26 June 3005

Reduction of energy consumption  
24%, won 2nd place in the 2005 competition  
Reduction of CO2 emissions  
100%, no CO2 is emitted

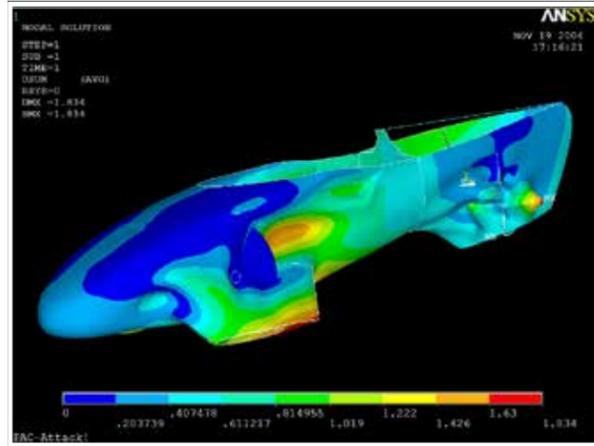
[paccar.ethz.ch](http://paccar.ethz.ch)



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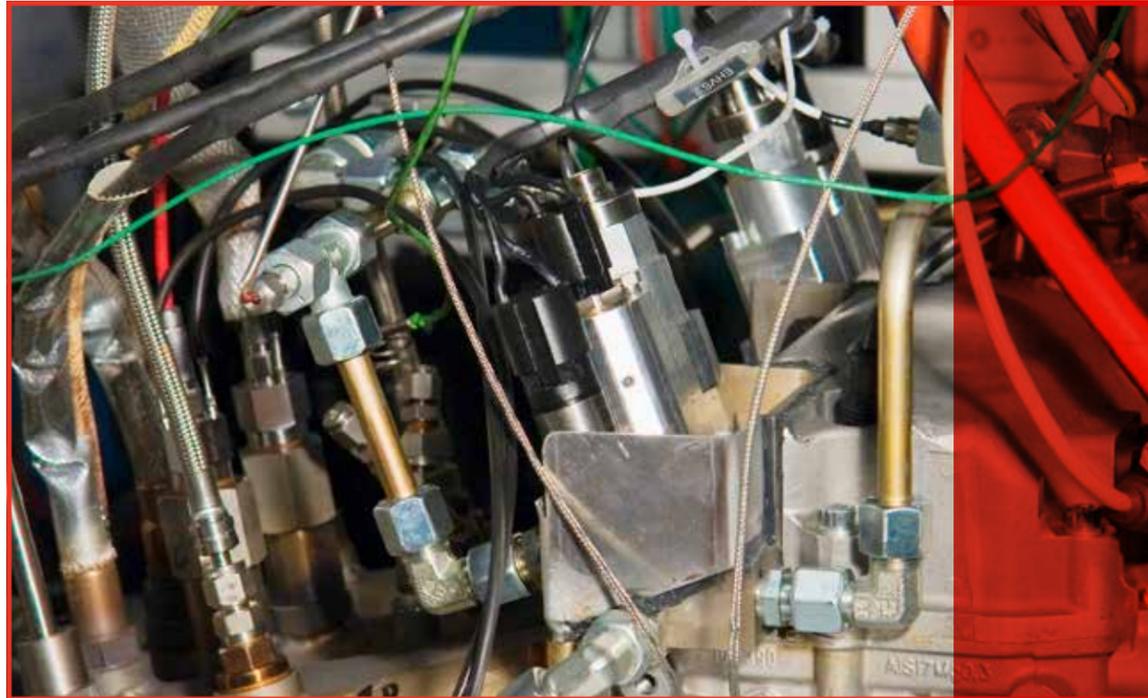
Company ETH Zurich  
 Category Energy-Efficient Mobility  
 Date 2007



# Hybrid Pneumatic Engine

Cutting consumption with a hybrid pneumatic engine system

Company IDSC of ETH Zurich  
Category Energy Efficient Mobility  
Date 2010



Reduction of energy consumption  
30% compared to vehicles of the same design and power equipped with gasoline engines

Reduction of CO2 emissions  
30% compared to vehicles of the same design and power equipped with gasoline engines

The Institute for Dynamic Systems and Control (IDSC) of ETH Zurich developed the first low-cost, hybrid pneumatic engine system. The new engine system costs only 20 % more than a conventional engine, but consumes up to 30% less fuel than the latter. In similar fashion to the popular hybrid electric engine system already widely used, the pneumatic engine system also benefits from possibility of recuperation, the elimination of idle losses, the shift of the operating point, and the downsizing of the combustion engine (allowing the swept volume to become smaller). The hybrid pneumatic engine concept developed by IDSC uses compressed air as an energy buffer, and allows for the substantial downsizing of the engine. These two measures lead to an increased efficiency and an excellent driving capacity of the automotive propulsion system. It is anticipated that hybrid pneumatic vehicles will be more

cost effective to operate than hybrid electric vehicles as a result of it requiring no batteries or electric motors.

The ETH team of mechanical engineers is currently developing a more cost-effective way to realize the hybrid pneumatic engine system.



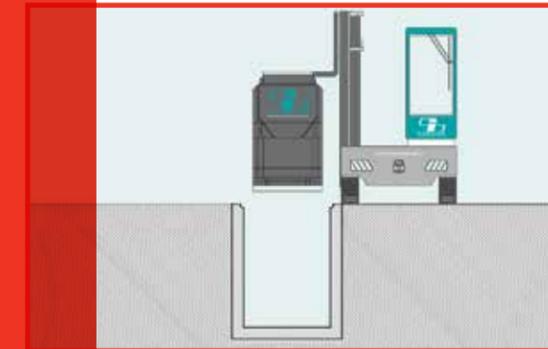
[hpe.ethz.ch](http://hpe.ethz.ch)

[system-alpenluft.com](http://system-alpenluft.com)

Reduction of energy consumption  
80%  
Reduction of CO2 emissions  
95% (depending on the electricity production)  
Reduction of low noise level  
Silent waste disposal at night is possible

# Alpenluft Waste Disposal System

A silent and emission-free waste disposal system



provide the electricity required for powering the loaders. Thanks to the availability of different modules, the waste disposal system can be customized. The loading vehicles themselves are part of a modular system that can pick up different kinds of container modules, available in different sizes and for different uses.

The system has been fully implemented in Zermatt since October 2013, and a new, energy efficient side loader (with stronger motors, and lighter, higher electric tension) has been in use since May 2013. In addition, 6 compacting-containers have been used daily in the highly popular Jungfrauoch / Kleine Scheidegg area since April 2013. Furthermore, conversations to conduct a pilot test of the Alpenluft System within an urban area are currently in the works.

The air has suddenly become a lot cleaner in Zermatt lately. The renowned tourist destination has introduced a brand new method of disposing waste that significantly reduces energy consumption, CO2 emissions, and noise levels for the region. To accomplish this, the municipality utilizes easily maneuverable, energy-efficient electric side-loaders for transporting waste. Micro-compacting containers compress the waste immediately on site, thereby reducing the number of journeys required for unloading. Two hydropower plants operated by Zermatt Electricity Works

Company System-Alpenluft AG  
Category Energy Efficient Mobility  
Date 2012

# Flyer E-bikes in Swiss Resorts

E-Bike rental network for tourism

Company **Biketec AG**  
 Category **Energy Efficient Mobility**  
 Date **2009**



Energy consumption per distance  
**1kWh / 100km**  
Equivalent: 1dl of gasoline per 100km  
Savings in energy consumption  
**68 times less than the average**  
(gasoline) consumption of a car  
Reduction of CO2 emissions  
**-100%, Green Energy Mix, no fossil-based energy production used**

Biketec AG started its success in 2003 when their energy-efficient electric “Flyer” bicycles entered the market. In 2004, they began offering the bikes through as a rental service in the most touristic regions of Switzerland. In addition to these rental stations, the company opened several service stations where the batteries for the e-bikes could be switched, if necessary. This concept granted the “Flyer” cyclers a greater autonomy in use. Since 2008, the Flyer rental network has expanded widely, and now it is possible to traverse the whole of Switzerland with the rental “Flyer” bikes.

Switzerland and an E-Bike Service is available for multiple day trips. One of the flagship projects in development in this network is the “Herzroute” (heart route). Within the next two years, this bike route will start at the Lake of Geneva and end at Lake Constance. The route over the different regions of Switzerland offers a more than 250 mile ride.

The more than 12,000 E-Bike rentals placed per year demonstrates the overwhelming success of this project for sustainable tourism and business development.

The project is now fully implemented and a cooperation with Swiss rental bike provider, “Rent a Bike”, has been put in place. This partnership allows the Biketec AG bicycles to be present at the key train stations in



flyer.ch

# Natural Gas-Diesel Hybrid Engine

A hybrid electric vehicle powered by a natural gas-diesel engine

Company **IDSC at ETH Zurich**  
 Category **Energy Efficient Mobility**  
 Date **2014**



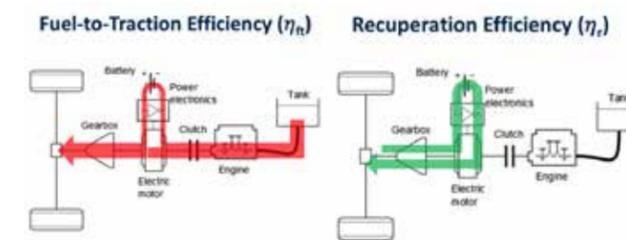
Researchers at ETH Zurich developed a hybrid electric powertrain with a natural gas-diesel engine that reduces the CO2 emissions of a vehicle to almost one half that of a state of the art car. Natural gas produces up to 25% fewer CO2 emissions in comparison to burning diesel or gasoline fuel. Instead of using a spark plug, the natural gas-diesel injects a small amount of diesel as an ignition source, which then leads to a

highly efficient combustion. The combination of this efficient engine with a smaller electric motor leads to the substantial reduction CO2 emissions. Thanks to the similarities of this system to that of existing technologies, the natural gas-diesel hybrid can be implemented quickly, with the additional cost for doing so remaining moderate.

Reduction of energy consumption  
**30% Compared to the best available gasoline engine (Downsized with cylinder deactivation)**

Reduction of CO2 emissions  
**48% Compared to the best available gasoline engine (Downsized with cylinder deactivation)**

idsc.ethz.ch



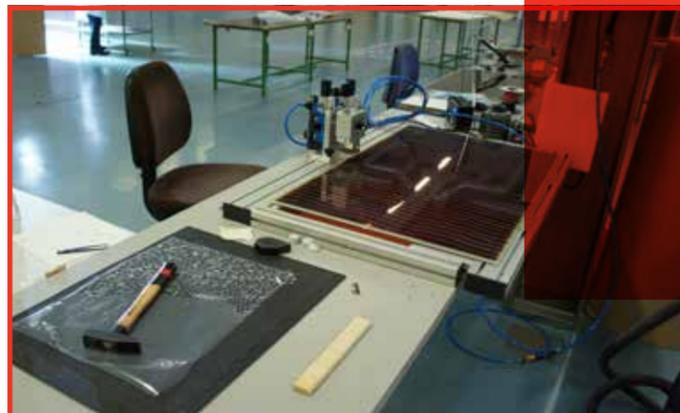
Energy production  
45 kWh/m<sup>2</sup>

Four to eight months to produce energy needed to manufacture



Dye-sensitized solar cell technology has been in existence for over 20 years. Glass2energy SA is the first company to bring this technology to production maturity. In a process very similar to plant photosynthesis, the dye-sensitized cells, also known as Graetzel cells, absorb daylight and generate excited electrons. The advantage of this technology lies in its ability to function with diffused light, and this allows the system to remain efficient regardless of orientation. This also results in a more consistent production of electricity, throughout the day, that is less sensitive to weather fluctuations when compared to conventional crystalline cells. The payback time of a module is less than eight months, and its production requires virtually no toxic or rare materials. The cells are capable of transmitting light even when colored, and as a result, this affords architects and

engineers the possibility to use the technology on different applications, such as facades and glazing. Since the spring of 2013, the dye-sensitized cells have been on display at the Geneva International Airport in the form of a photovoltaic balustrade.



Company **glass2energy**  
Category **Renewable Energies**  
Date **2014**

## SwissFarmerPower

The processing of biomass into renewable energy and fertilizer

Company **SFPI**  
Category **Renewable Energies**  
Date **2010**



The biogas facility, 'SwissFarmerPower', was the largest utility of its kind when it was brought into service in 2008. Since then it has been converting biogenic waste to biogas, which can then be used as a CO<sub>2</sub>-neutral motor fuel for gas-powered vehicles. A total of 72 farmers are currently involved in the operation of this plant, which cost 22 million Swiss francs to build. Up to 45,000 tons of liquid and 16,000 tons of solid biogenic waste are being processed in this facility annually.

On-site energy production  
**22,000,000 kWh**  
Amount of substituted fossil fuels  
**2.2 million liters of diesel**

The biogas facility relies solely on biogenic waste, which cannot be used in other manners. As a result, this means there is no competition between the biogas facility and food industry.

The system currently operates at full capacity and is providing the return originally estimated. However, several investments were necessary in order to achieve these benchmarks.

Reduction of CO<sub>2</sub> emissions  
**3000 tons / year**  
**sfpinwil.ch**

## Biomass Centre in Spiez

The materially and energetically optimized recycling of separately collected biomass



Company **Oberland Energie**  
Category **Renewable Energies**  
Date **2012**

Waste wood plus organic waste translates to electricity, steam, heat, and compost. The Biomass Centre in Spiez is turning this concept into a reality thanks to a cleverly conceived recycling system. Oberland Energie AG is now helping save hundreds of thousands of liters of heating oil, and is also producing top quality compost. The Biomass Centre consists of a fermentation facility, a composting

Energy production from biogenic waste  
**3,500 MWh energy**  
**4,000 MWh heat**  
from residual wood  
**34,000 MWh heat**

plant and a heating system that uses waste and residual wood. About 20,000 to 30,000 tons of biogenic waste is processed annually at the facility in Spiez. The facility was developed and constructed together with Dr. Eicher+Pauli AG, a consulting company specializing in energy and construction planning.

Reduction of CO<sub>2</sub> emissions  
**12,000 tons CO<sub>2</sub>**  
**oberland-energie.ch**

# 2050 Energy Concept Cubed

Long-term, clean energy for heat supply, electricity, and mobility

Company City of St. Gallen  
 Category Society  
 Date 2012

Reduction of CO2 emissions (goal)

Decrease of CO2 emissions from 6 to 2.2 metric tons and energy consumption from 5000 to 2000 Watt per head. Total primary energy consumption is going to be reduced from 3000 GWh to 1600 GWh.

Renewable energy production, total (goal)

Renewable energies are going to represent half of the total primary energy consumption (700 GWh)

– from geothermal plant (goal)

150 GWh, 25% of the renewables energies

- from water power 370 GWh (proportional to the city's share of the Swiss population)
- from solar power 60 GWh
- from biomass 60 GWh



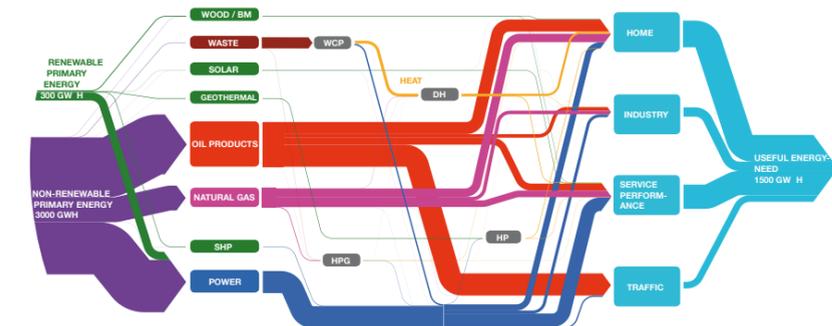
With its “2050 Energy Concept Cubed” (EnK3 2050) and a geothermal energy project, the city of St. Gallen is paving the way for a new dimension in the future of energy supply.. The integration of heating, electricity and mobility as well as their mutual dependencies forms the basis for the updating of the city's energy supply. Nuclear power is going to be replaced by renewable energies and heat energy coupling. Thanks to the renovation of existing buildings and the application of the latest standards for new buildings, the city aims to reduce the energy consumption of buildings to meet the requirements of a 2000 Watt society.

With its scenario calculator, the city is able to test the effects of its policy in advance. This allows continuously monitoring of energy logistics and maps to economic terms.

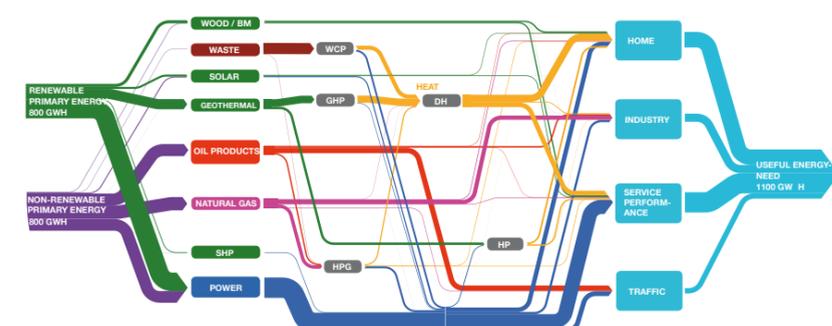
The implementation of this energy concept was decided by the local government. It includes a plan of 150 actions concerning the three topics: heat supply, electricity supply and mobility. Some of these projects have already started; others are planned or are being verified. To ensure tangible results, the city has developed control software and has decided to report on the progress of the project every four years.

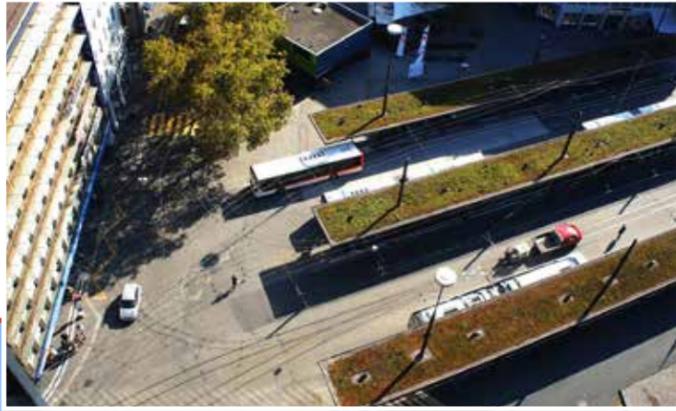
Furthermore, the city is implementing a new policy which strives to reduce the quantity of motor cars and to replace gas powered vehicles with electric ones. Moreover, public transportation as well as pedestrian and bicycle pathways will be expanded.

Energy Flow 2010



Energy Flow 2050





Company City of St. Gallen  
Category Society  
Date 2012



**Energiestadt** GOLD  
St. Gallen  
european energy award

# Gordola Sustainable Water Supply

Big water savings, few investments



40

The city of Gordola has achieved its objective of reducing both peak and baseband water consumption within its municipality. Through an intelligent multifaceted strategy, the water consumption per inhabitant in Gordola is now the lowest in Switzerland. The project also drastically reduced the amount of funds the city has to spend on its infrastructure.

Phase one of the project consisted of a pipeline analysis, which, with the help of new detection technology, identified water leaks in the network. This enabled a reduction in the amount of water loss below grade. In phase two, a 250.8 meter-long, pressurized line was installed to supply a backpressure

turbine – the first in Italian Switzerland. As a final component, a mass marketing campaign educated residents about sustainable water consumption. In 2013, the city began the next phase of the project: a series of field tests conducted with ten smart meters that will allow it to monitor and detect leaks located inside of buildings selected.



Company City of Gordola  
Category Society  
Date 2009

Reduction of energy consumption  
630,000 kWh/year  
Reduction of CO2 emissions  
Equivalent of about 40,000 liters of oil  
On-site energy production  
250,000 kWh/year  
Reduction of peak water consumption  
From 3400 mc/day (1997) down to 1800 m<sup>2</sup>/day (2013) but with 20% more inhabitants and industrial activities

gordola.ch

Society

textilpflege.ch

# Resource Efficiency in Dry Cleaners and Laundries

Optimizing resources for the laundry business

Reduction of energy consumption (potential)  
Approximately 100gw  
Reduction of CO2 emissions (potential)  
Approx. 40,000 tons  
Reduction of water usage  
400,000 m<sup>3</sup>



41

In Switzerland, many cleaning companies outsource operations to neighboring countries, such as Germany, France or Italy as it is less expensive. To remain cost-competitive, a new handbook for dry cleaners and laundries has been set up to help businesses save up to 25% of resources (energy, water, gas etc.). Due to specific processes required, the laundry business is a very energy- and resource intensive industry. Twenty experts have carefully analyzed treatment processes and found numerous recommendations, which show measures to enhance resource efficiency and to lower energy consumption. On the basis of this manual, dry cleaners and laundries can find out where process optimization, technical retrofits, certain standards for new purchases or heat recovery measurements should be conducted. In addition

to this manual, there are two web-based applications available, where companies can check their energy-saving potential and, in a second step, anonymously compare their performance to competitors. High-resource efficiency means lower energy consumption, and thus lowers costs, and is also important for sustainable management of the company.

The project is fully operational at the moment. There are discussions between the Swiss and the German Association of Textile Care to collaborate in this benchmarking project.

Company Association Textile Care Switzerland VTS  
Category Society  
Date 2014

# Closing Remarks



Energy is one of the unique fields that requires a close collaboration between the public and private sectors, researchers and entrepreneurs, engineers and policy makers. Moreover, it is a topic global in nature where all these entities must work collectively and collaboratively to find solutions. As a scientific consulate, swissnex Boston is a knowledge hub that connects these players together especially in terms of higher education, research, innovation, and policy making. It's natural to see swissnex work on energy topics and take on exciting projects such as Planet Solar, a Swiss catamaran that runs exclusively on solar energy and now the Watt d'Or exhibition, a retrospective designed in close collaboration with the Swiss Federal Office of Energy.

Eight years ago, when the first Watt d'Or were awarded to excellent energy projects in Switzerland, the topic of energy was at the bottom of the

political agenda. Today, energy is one of the hottest issues, and justifiably so. Thus the retrospective on eight years of Watt d'Or tells many stories: about the ever more rapid development and market penetration of innovative energy technologies, about the success strategies of the pioneering companies and users and about the rising interest in energy related policy topics. The Watt d'Or exhibition not only displays the recent history of a sector on the move, it also gives us a notion of the next chapters that we can write together.

Every year, since its creation, the Watt d'Or has increased its importance in the energy landscape, and has raised interest from multiple countries. To this end, the exhibition serves as an agent to stimulate cooperation between Switzerland and the USA: sharing expertise, developing new technologies, improving energy efficiency and finding new market opportunities.

## **Marianne Zünd**

Head of Media & Politics Department,  
Swiss Federal Office of Energy

## **Felix Moesner**

Consul / CEO of swissnex Boston,  
The Consulate of Switzerland



# Units and Definitions

Abbreviation	Type	Definition
		<u>The International System of Units (abbreviated SI from French: Le Système international d'unités) is the modern form of the metric system and is the world's most widely used system of measurement, used in both everyday commerce and science. It comprises a coherent system of units of measurement built around seven base units, 22 named and an indeterminate number of unnamed coherent derived units, and a set of prefixes that act as decimal-based multipliers. It is part of the International System of Quantities.</u>
kWh	<u>Energy</u>	The kilowatt hour, or kilowatt-hour, (symbol kW·h, kW h or kWh) is a unit of energy equal to 1,000 watt-hours, or 3.6 megajoules. If the energy is being transmitted or used at a constant rate (power) over a period of time, the total energy in kilowatt-hours is the product of the power in kilowatts and the time in hours. The kilowatt-hour is commonly used as a billing unit for energy delivered to consumers by electric utilities.
m	<u>Length</u>	The metre is the fundamental unit of length in the International System of Units. Originally intended to be one ten-millionth of the distance from the Earth's equator to the North Pole (at sea level), since 1983, it has been defined as "the length of the path travelled by light in vacuum during a time interval of 1/299,792,458 of a second."
km	<u>Length</u>	1000 metres. One kilometer equals 0.621 miles. One mile = 1.609 metres.

m <sup>2</sup>	<u>Area</u>	The square metre is the SI derived unit of area, with symbol m <sup>2</sup> . It is defined as the area of a square whose sides measure exactly one metre. The square metre is derived from the SI base unit of the metre, which itself is defined as the length of the path travelled by light in absolute vacuum during a time interval of 1/299,792,458 of a second.
kg	<u>Mass</u>	The kilogram or kilogramme is the base unit of mass in the International System of Units and is defined as being equal to the mass of the International Prototype of the Kilogram (IPK). The international pound, used in both the Imperial system and U.S. customary units, is defined as exactly 0.45359237 kg, making one kilogram approximately equal to 2.2046 pounds.
Joule	<u>Energy</u>	The energy required to lift a small apple (with a mass of approximately 100 g) vertically through one metre of air.
Megajoule	<u>Energy</u>	The megajoule (MJ) is equal to one million (10 <sup>6</sup> ) joules, or approximately the kinetic energy of a one-tonne vehicle moving at 160 km/h (100 mph).
CO <sub>2</sub>	–	Carbon dioxide (CO <sub>2</sub> ) makes up the largest share of "greenhouse gases". The addition of man-made greenhouse gases to the Atmosphere disturbs the earth's radiative balance. This is leading to an increase in the earth's surface temperature and to related effects on climate, sea level rise and world agriculture.

# Notes

# Acknowledgements

Marianne Zünd, Head of Media & Politics Department at Swiss Federal Office of Energy (SFOE), and Felix Moesner, Consul / CEO of swissnex Boston, the Consulate of Switzerland jointly led the discussions for the realization of the world premiere of the Watt d'Or exhibition during the past two years.

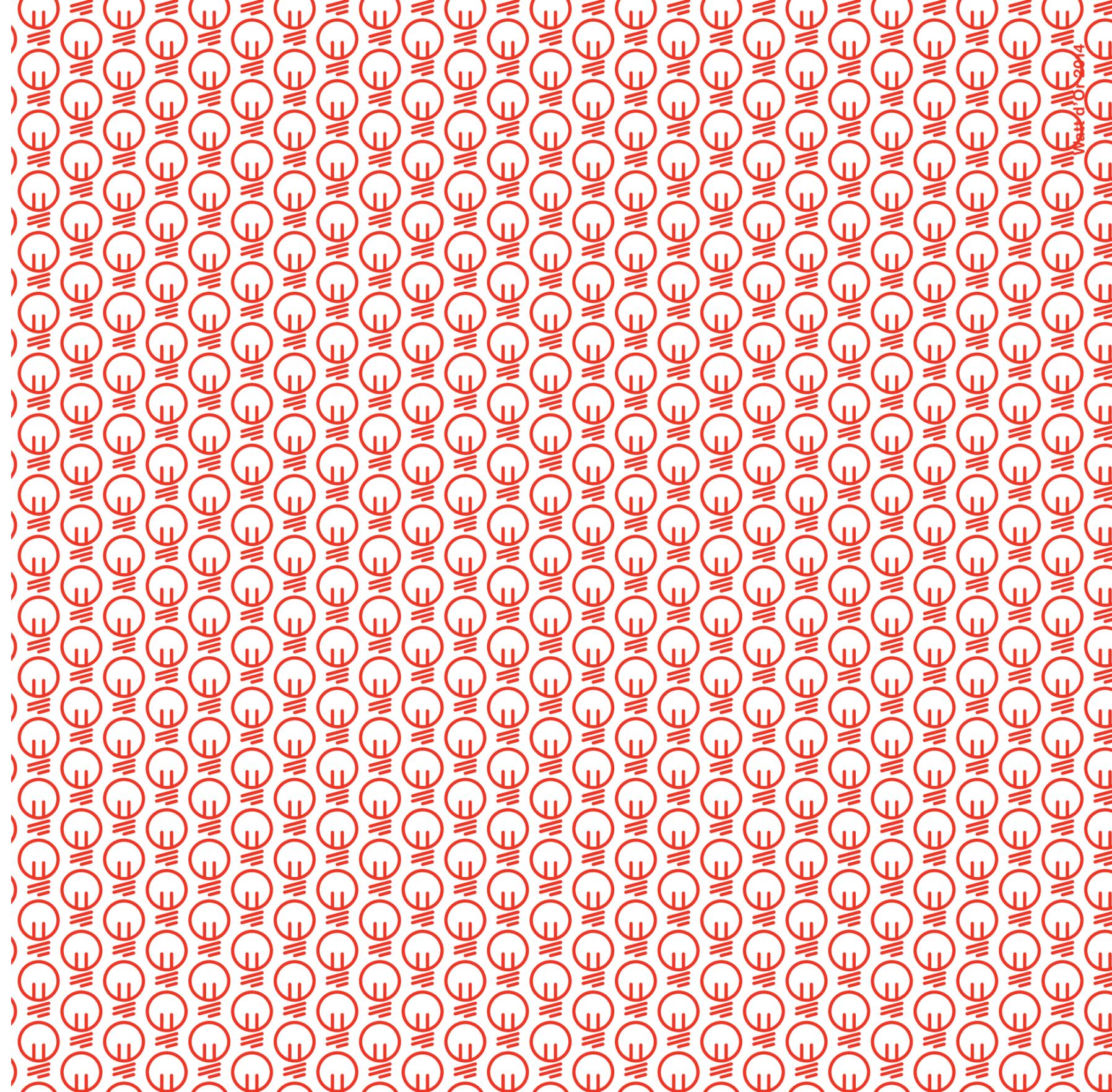
Both, SFOE and swissnex Boston would like to thank the following parties for their contributions that led to the Watt d'Or Exhibition.

We thank the recipients of the Watt d'Or award for their great vision, hard work and achievements in bringing to fruition such innovative and unique energy projects. We thank them as well for their cooperation with the SFOE and swissnex Boston in the creation of this exhibition and catalogue.

Thank you to Northeastern University, University President Joseph Aoun, and Campus Curator, Bruce Ployer, for their generosity in hosting the first stop of the traveling Watt d'Or exhibition.

And, finally, thank you to the swissnex Boston team, in particular to junior project leaders, Arnaud Pincet, Kevin Baltus and Andrea Möller, for their excellent work in realizing this event.

Design and curation by



swissnex  
boston  
Consulate of Switzerland



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

**Swiss Federal Office of Energy SFOE**

