



Silent-Power, a new type of CO₂-neutral electricity generation

Silent-Power AG, the first electricity supplier that does not produce energy from large-scale centralised power plants but from thousands of mini power plants instead.

silent
POWER

Our vision is key to the prospects of the next generation

The will to care for the environment is growing worldwide. There is global warming, the predicted rise of sea levels, and CO₂ as the main cause on the one hand, and the increasing thirst for energy from the emerging markets – as well as from industrialised countries – on the other. How can the looming energy shortage be resolved?

Switzerland, Germany and Sweden are the first countries that have decided to phase out nuclear power. For Switzerland, this means that its five nuclear power plants will be taken off the grid between 2015 and 2034. Nuclear power makes up 40% of the entire electricity production in Switzerland. The gradual loss of nuclear power stands in sharp contrast to the ever-growing thirst for energy from industry and private households.

According to most forecasts, the future energy requirements will keep growing despite efficiency and saving measures, mainly because the population keeps growing. The loss of nuclear power and the associated need for replacements call for innovative solutions that can be implemented within reasonable time and that are financially viable.

When it comes to environmental pollution, nuclear power is considered a CO₂-neutral energy source, even though there are other issues, such as uranium mining and the storage of radioactive waste. The media often consider combined cycle power stations (gas combined with steam turbines) a substitute for nuclear power. Combined cycle power stations are, however, not really compatible with Switzerland's climate targets, because such stations burn the fossil fuel natural gas. Even if the high CO₂ emissions were to be compensated abroad – the best solution is still not to generate any CO₂ emissions at all. Climate targets and nuclear power should, however, not be mixed. Today less than 5% of energy demand worldwide is covered by nuclear power. Renewable energy sources are contributing the same percentage. Approximately 80% is covered by fossil energy sources, such as coal, oil and natural



Prof. Dr. sc. techn. ETH
Urs A. Weidmann
CEO Silent-Power AG

gas. However, to be honest, we should admit that once we start replacing nuclear power in Switzerland from 2015 onwards, the negative connotations of nuclear technology and the issues relating to waste storage and disposal rather than climate protection will be the motivation. The time has come to turn away from fossil energy sources and to change gradually to renewable energy sources. The technology is ready – now the politicians, electricity suppliers, researchers and the economy just need to pull in the same direction and choose a holistic, long-term approach instead of short-sighted results. We are convinced that climate-neutral production of electricity will be able to outstrip fossil fuels

as an energy source. According to the current trend in the automobile industry, more and more cars will be operated by electricity in the future. Moreover, global warming will dramatically increase the demand for air-conditioning units. Consequently, more and more electricity will be needed.

Switzerland, known as Europe's "water source," has a high percentage of renewable hydroelectric power. Almost 55% of its electricity is generated by various types of hydropower stations.

Today, we not only have a problem with the gap in the generation of electricity, but we also have a

“We do not generate electricity in the places where we consume it and we do not generate it at the time when we need it.”

problem in terms of storage and transport. In general, we do not generate electricity in the places where we consume it and we do not generate it at the time when we need it. The storage of electricity in batteries is an established technology for small consumers, such as smartphones, laptops, flashlights, e-bikes and electric vehicles. For large industrial consumers, communities with thousands of households and for the entire mobility sector, batteries are too costly.

Energy storage is the solution

Silent-Power AG believes that there is basically enough energy; it is only a question of storage and transport to direct this energy to where it is needed. The most inexpensive and economic solution is to store the energy in a chemical form, specifically in methanol. In order to convert the stored energy back into electricity, Silent-Power has developed the new Econimo-Converter. **Econimo** is an acronym of “energy converter integral module.”

“Today we not only have a problem with the gap in the generation of electricity, but we also have a problem in terms of storage and transport.”

In parallel it generates heat and electricity. The heat is used for heating and cooling buildings and the electricity is fed into the grid or is used to operate electric motors in appliances, machines and vehicles. For stationary applications, Silent-Power develops mini power plants that ensure decentralised energy supply for multi-family houses.

With this concept, Silent-Power solves several energy issues at once. Changing to the new technology is straightforward because existing structures are used. It is also financially viable due to the new, ground-breaking technology of the Econimo-Converter.

M99 methanol generates electricity and provides heating and cooling – all in one



Today, **synthetically** produced methanol is the second most-traded liquid after crude oil to be used for the chemical industry, even in everyday products such as cosmetics. Methanol is in fact poisonous (like all alcohols) but by far not that harmful like gasoline. The biggest producer of synthetically produced methanol from natural gas (methane) is Qatar followed by Trinidad.

For the production of **fully synthetically produced methanol** (CO₂-neutral), water, CO₂ from the air and electricity are required. Compared to fossil fuels, such as mineral oil, natural gas and coal, these elements are available in “unlimited” amounts. Methanol is the most simple alcohol molecule.

The next more complicated one is ethanol, the normal alcohol consumed as a beverage. Methanol will be produced **fully synthetically** and is therefore not in competition with food production.

The name of Silent-Power’s methanol is M99. The number 99 stands for at least 99% purity. M99 has similar combustion properties as petrol, diesel or kerosene; however, it burns clean and residue-free, with an almost colourless flame. M99 is probably one



The new universal fuel for the trigeneration of electricity, heating and cooling.

of the most non-hazardous fuels; it is biologically degradable and not explosive. During the combustion process, it disintegrates into the elements from which it was generated: non-poisonous CO₂ and water. M99 is a liquid that is as clear as water and, just like methylated spirit, can easily be stored and transported, even over long periods of time, without degradation or loss. Methanol can already be bought today in retail shops, in do-it-yourself shops or at chemist’s shops.

The introduction of methanol is economical. With one single type of fuel, all kinds of applications can be powered: Generation of electricity, heating and cooling of buildings, cooking, transportation with cars and even flying. M99 can fuel lawnmowers, leaf blowers, e-bikes, motorcyc-

les and backup power generators. The change from petrol, diesel or kerosene to a methanol infrastructure is simple and inexpensive. Today’s freight ships, warehouses, petrol stations and tanker lorries can be used and adapted inexpensively without a great deal of effort.

Changing to methanol as a universal energy source only requires one single distribution system, unlike today’s electricity lines, gas pipes, logistics for oil heating and the additional network of petrol stations for vehicles.

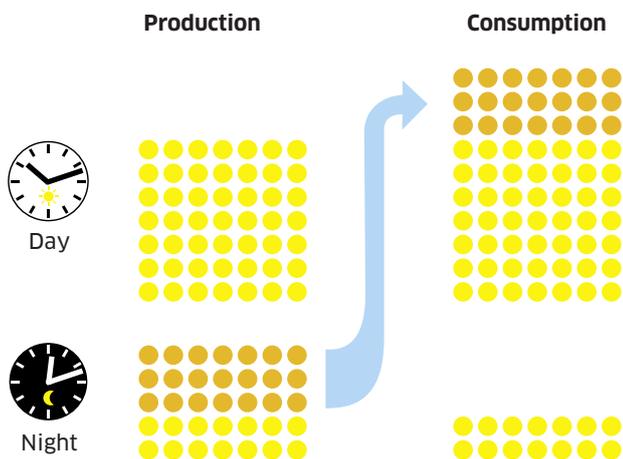
Methanol has even more advantages: It does not cause any secondary costs for society (acid rain and other environmental pollution in case of accidents, etc.), it does not require catalytic converters as do today’s piston engines in cars, and it does not require chimneys because the waste simply consists of water and non-poisonous CO₂. M99 does not require any risky additives, such as benzene, which today is added to petrol and diesel in order to improve the combustion process. Benzene is a very dangerous additive and may cause cancer.

Literature: Georg A. Olah (Nobel Prize Award 1994 in Chemistry), Beyond Oil and Gas – The Methanol Economy, Wiley-VCH 2006.



Today's power lines cannot transport any more power.

Problem 1: Energy is not produced at the same time as it is consumed



During the day, energy consumption is higher than the produced base load. At night, consumption slows down but electricity is still being generated at the same rate. This “surplus nighttime-produced electricity” is used to fill pumped-storage reservoirs. Electric power is converted into potential hydro-power. During the day, the water drives the turbines, feeding electricity into the grid when it is urgently needed.

Problem 2: Energy production and energy consumption occur in different places



Today's electricity is mainly produced centrally by large-scale power plants, e.g. nuclear power plants, hydro-, wind or solar power stations. Supplying the end consumer with electricity requires long transport routes involving high degrees of loss.

Silent-Power solves all the important energy supply issues

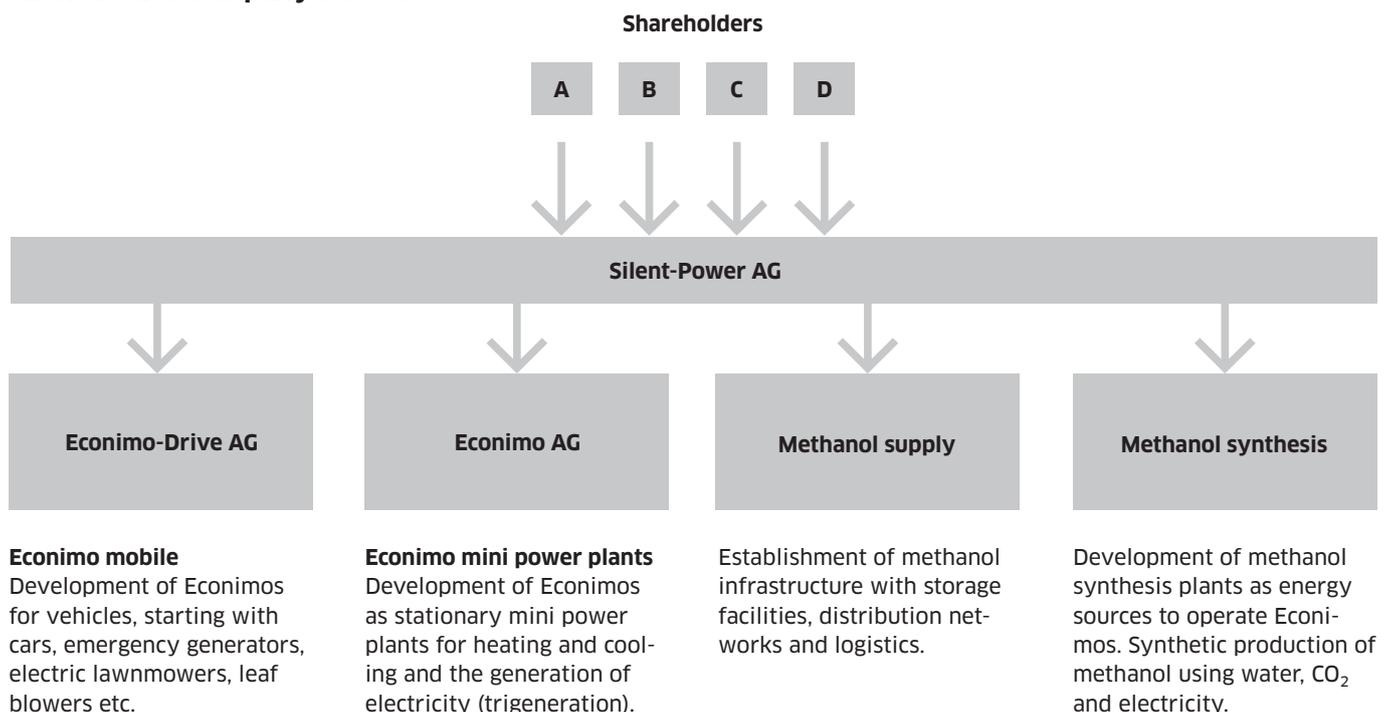
Silent-Power AG makes it possible to convert electricity into methanol and methanol back into electricity. The fuel called M99 can be stored and distributed to the consumers through the usual supply channels. The conversion of methanol into electricity is provided by new Econimo-Converters.

Silent-Power's energy concept is convincing due to five significant advantages:

1. The conversion (electricity - methanol - electricity) is CO₂-neutral; there are no environmental issues involved.
2. The electricity can be converted into chemical energy in the form of methanol. M99 can be stored and transported over long distances using existing distribution channels. High-voltage power lines involving a high degree of loss are no longer required.
3. Consumers obtain electricity directly from the Econimo-Converter when they actually need it. In the mobility sector, electric vehicles can be operated with M99 instead of batteries.
4. Apart from batteries, only Econimos can provide full power output within seconds at the push of a button!
5. Unlike today, where the consumer obtains electricity from the power grid, petrol from petrol stations, and heating oil and natural gas through other channels, only one logistics system is required for all these different energy needs. The overall energy balance is better, and losses due to storage, conversion and transport are minimised.

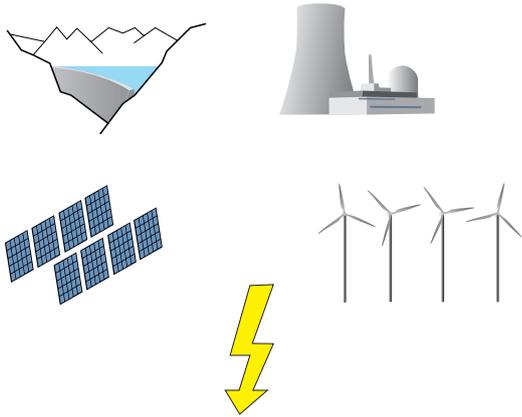
Silent-Power AG makes it possible to use electricity where it can be produced in a climate-neutral, environmentally friendly and extremely inexpensive manner. "Onsite" methanol production allows for electricity generation, storage and usage to be optimised in terms of timing and location. Participation in renewable energy plants, such as wind parks in the north and solar power stations in the south of Europe, is self-evident.

Silent-Power company structure

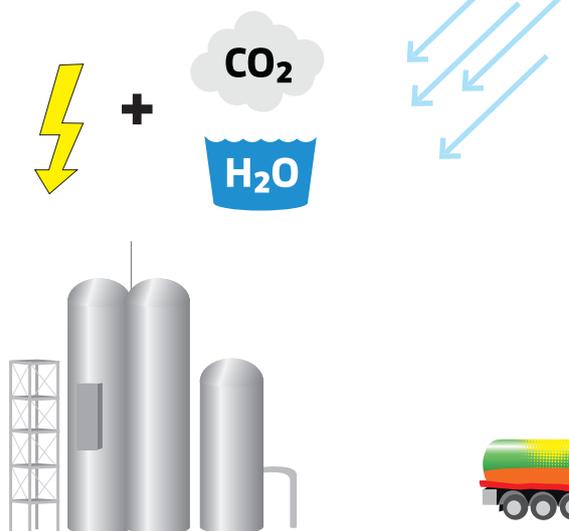


The CO₂-neutral energy concept of the future

- 1.** We generate electricity from hydropower plants, nuclear power plants and other energy sources. The basic problem is that electric power is not produced at the time when consumers need it. The second problem is the fact that most power plants are far away from consumers. Therefore electricity storage and transport are the main challenges for the future. Silent-Power solves precisely these problems.



- 2.** Electric power, CO₂ and water are used to synthesise methanol. This process can be applied in large central production facilities as well as in small, decentralised plants – precisely where excess electricity is available.



- 3.** Electric energy will be transformed into chemically stored energy in liquid form, namely methanol, the most simple alcohol molecule. Today methanol is already second on the list of the most-traded liquid worldwide after crude oil. The completely environmentally friendly methanol fuel is named “M99”, with 99 standing for 99-per cent purity.



- 4.** “M99” will be distributed by using existing distribution channels for petrol, diesel and kerosene. This means that the expensive infrastructure can be taken over using the new methanol economy. “M99” is non-explosive and burns cleanly without creating any toxic exhaust gases.



Even large units using Econimo-Drives will not generate toxic fumes, fine dust or noise!

The Econimo-Converter

Energy Converter
Integral Module





5. Our first Econimo-Converter will be realized with 20 kW electric output.

8. Converting methanol back to electricity releases all the ingredients which were necessary for the synthesis of methanol. These ingredients - water and CO₂ - are then released into the environment. In this way, the methanol cycle is closed and makes the Silent-Power concept neutral in regard to climate change.

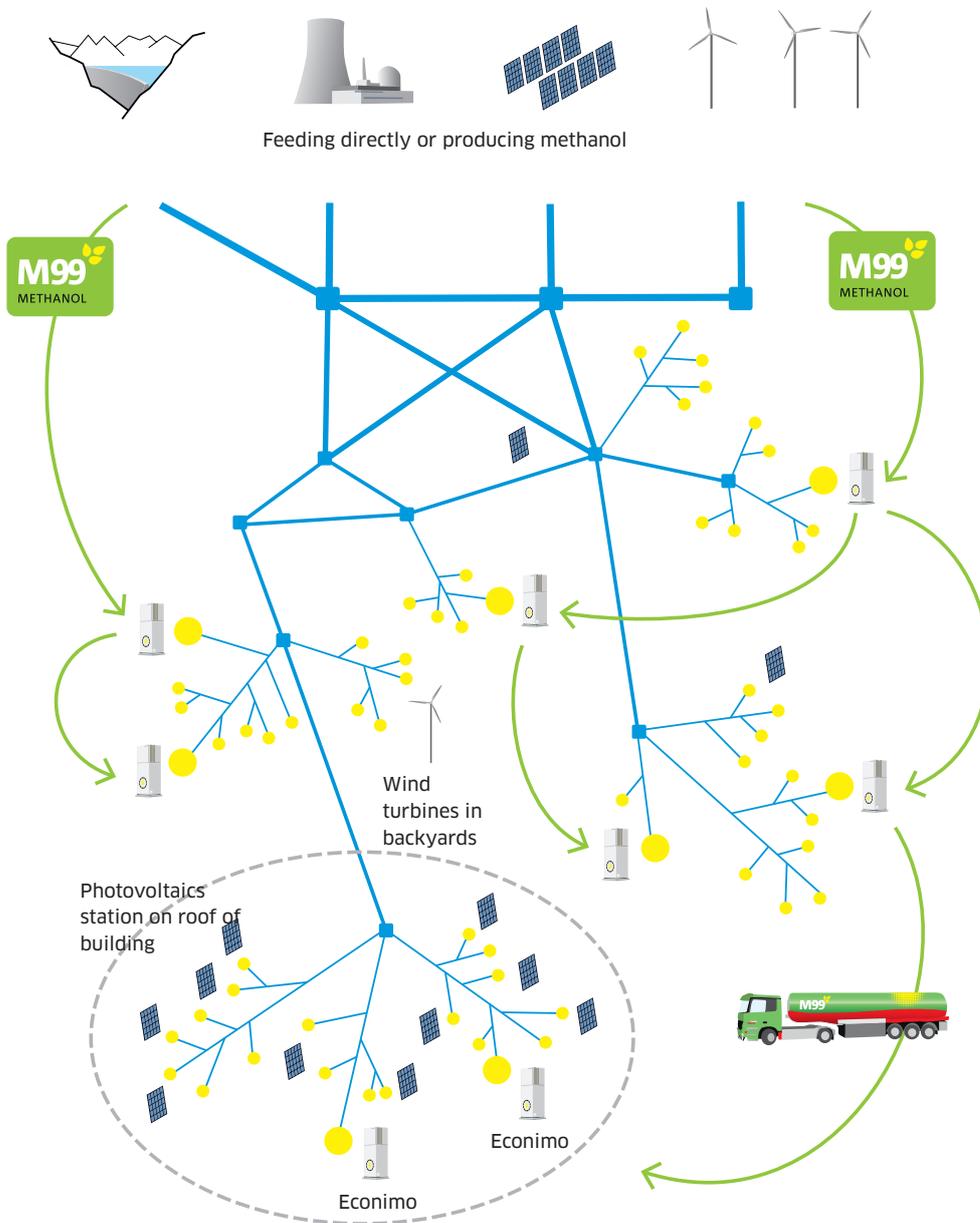
7. The new mobility has no limits: Tanks filled with methanol in combination with Econimos and electric motors will result in an environmentally friendly type of locomotion. No heavy batteries, no time-consuming recharging processes, virtually unlimited cruising range, no noise or vibrations, no toxic exhaust fumes and nearly no maintenance.

**-econimo
Stationary mini power plant**



6. The stationary Econimo mini power plant will be operated using tanks containing methanol fuel (whenever possible we will use the existing tanks of the conventional heating oil installation). The remote-controlled mini power plant supplies electricity to the utility and at the same time hot and cold water to the building. Important: The total efficiency exceeds 95 per cent!

Decentralised electricity supply with Econimo mini power plants



Today, the electricity supply is organised centrally from large-scale power plants and distributed to the various consumers. In addition, private solar and wind power stations, biomass processors and operators of hydropower stations also feed electricity into the grid. Heat is supplied through separate distribution channels, with natural gas or heating oil. At the same time, energy is supplied through a wide network of petrol stations to serve the mobility sector.

In the event of passing clouds or a lack of wind, the energy feed for an entire region can be lost within moments. In that case, Econimos start up and fill the gap in the generation of electricity in order to prevent the grid from collapsing.

Silent-Power decentralises the generation of electricity through Econimo-Converters that are located in the basement or in immediate proximity to the property. The individual units can generate electricity automatically when it is actually needed!

Instead of additional large-scale power plants, the Silent-Power energy concept involves thousands of small Econimo mini power plants that generate electricity as well as cold and warm water. The inconspicuous units (less than 1.5 m in height) can be operated inside or outside of buildings. They run silently and are maintenance-free. Because Econimos simultaneously generate three types of energy, energy costs are correspondingly low. The Econimos are, moreover, controlled and monitored remotely. The property owner or property manager does not have to worry about main-

tenance or about refilling the tank. At the Econimo control centre, the M99 tank level is detected automatically and a tanker lorry will refill the units at the right time. The local electricity supply company will send the bill for electricity, warm and cold water to the consumer.

Econimo mini power plants provide a high level of autonomy by storing M99 methanol at the end consumer's premises, where electricity is then generated whenever needed. Therefore, the existing high-voltage network will not have to be expanded in the future.

The Silent-Power business model

Silent-Power AG develops, produces, installs and operates Econimos together with local utilities. They will be installed as close as possible to the end consumers, inside or outside of their buildings. Econimos generate electricity, warm water for heating and cold water for cooling buildings. Thus, customers receive a "worry-free package" covering all their energy needs.

Apart from the electricity generated by the Econimos, Silent-Power AG also sells warm and cold water to power supply companies. The latter then sell the electricity, as before, to end consumers, charging them according to the electricity metre reading, and the warm and cold water to tenants or property owners, charging them according to the heat quantity metre reading. The bill sent to the end consumer will, apart from the standard entry of "quantity of electricity purchased" also display the entries "warm water purchased" and "cold water purchased" for the respective billing period.

The prices for heating and cooling should be lower than what is charged for existing energy sources such as oil or gas heating.

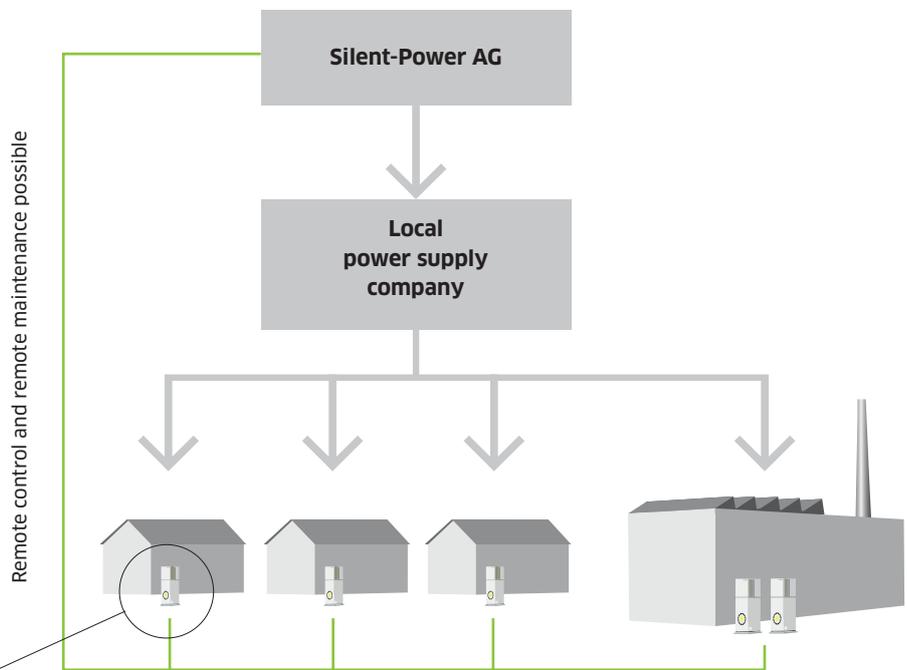
Silent-Power AG also provides maintenance and logistics services. The continuous refilling of the methanol tanks is provided by Silent-Power's own fleet of tanker lorries. The end consumer no longer has to worry about tank inspections, chimney sweeps, emission tests, leakage tests or the timely purchase of fuel. Moreover, the end consumer only pays for the energy once it has been consumed (as is currently done for electricity consumption). The Econimos can be controlled and monitored via the internet. Problems are immediately detected and corrected.

The installed Econimos remain the property of Silent-Power AG. Consequently, its own methanol sales market is protected.

Based on the lifetime of an Econimo of at least 15 years, the future income stream of Silent-Power AG is secured in the long term. First applications are scheduled for 2015. At this moment all necessary approvals will be in place. 4 Patents are protecting the know-how.



Supply of Econimo tanks with M99 methanol



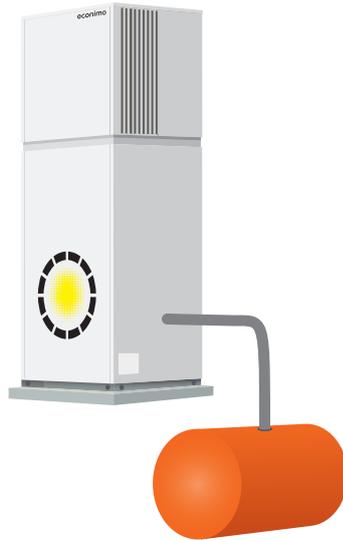
-econimo
Mini power plants

Initial applications

In the synthesis process, M99 methanol is produced completely synthetically from electricity, water and CO₂. M99 can be easily stored and distributed to consumers through the usual distribution channels. The conversion of M99 into electricity takes place in the new Econimo-Converters that supply electricity for all kinds of electric drives.

-econimo

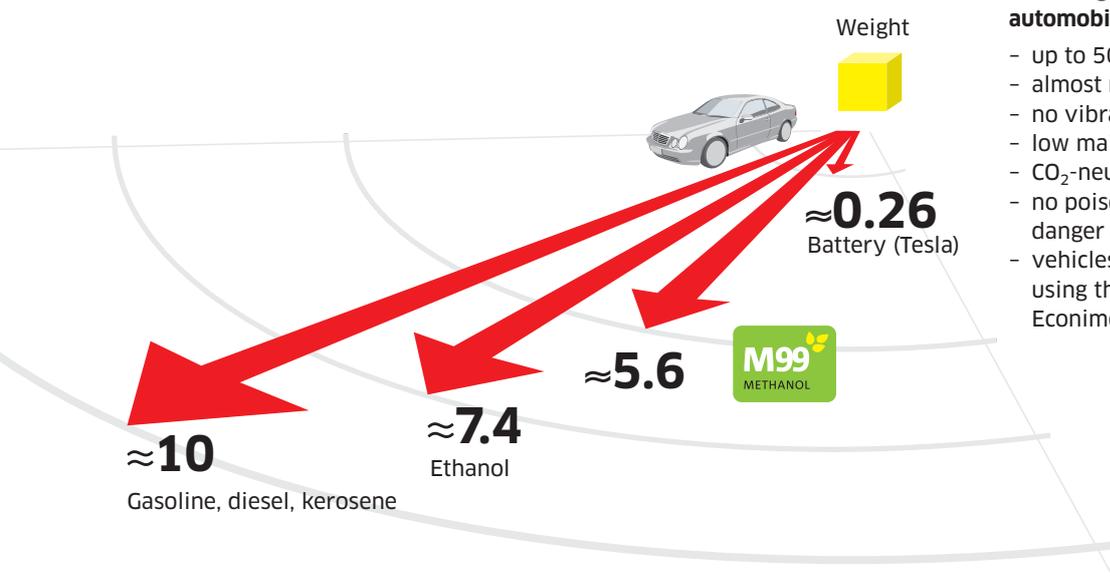
Mini power plants



Advantages compared to existing decentralised heat and power generation units and all other kinds of power plants:

- up to 50% lower investment costs (mass production)
- almost noiseless
- no vibrations
- no chimney required
- CO₂-neutral, no fossil fuels
- can be operated with M99 methanol
- no poisonous exhaust fumes
- no danger of explosion
- usable throughout the year thanks to warm and cold water production

Comparison of energy content in kWh per kg



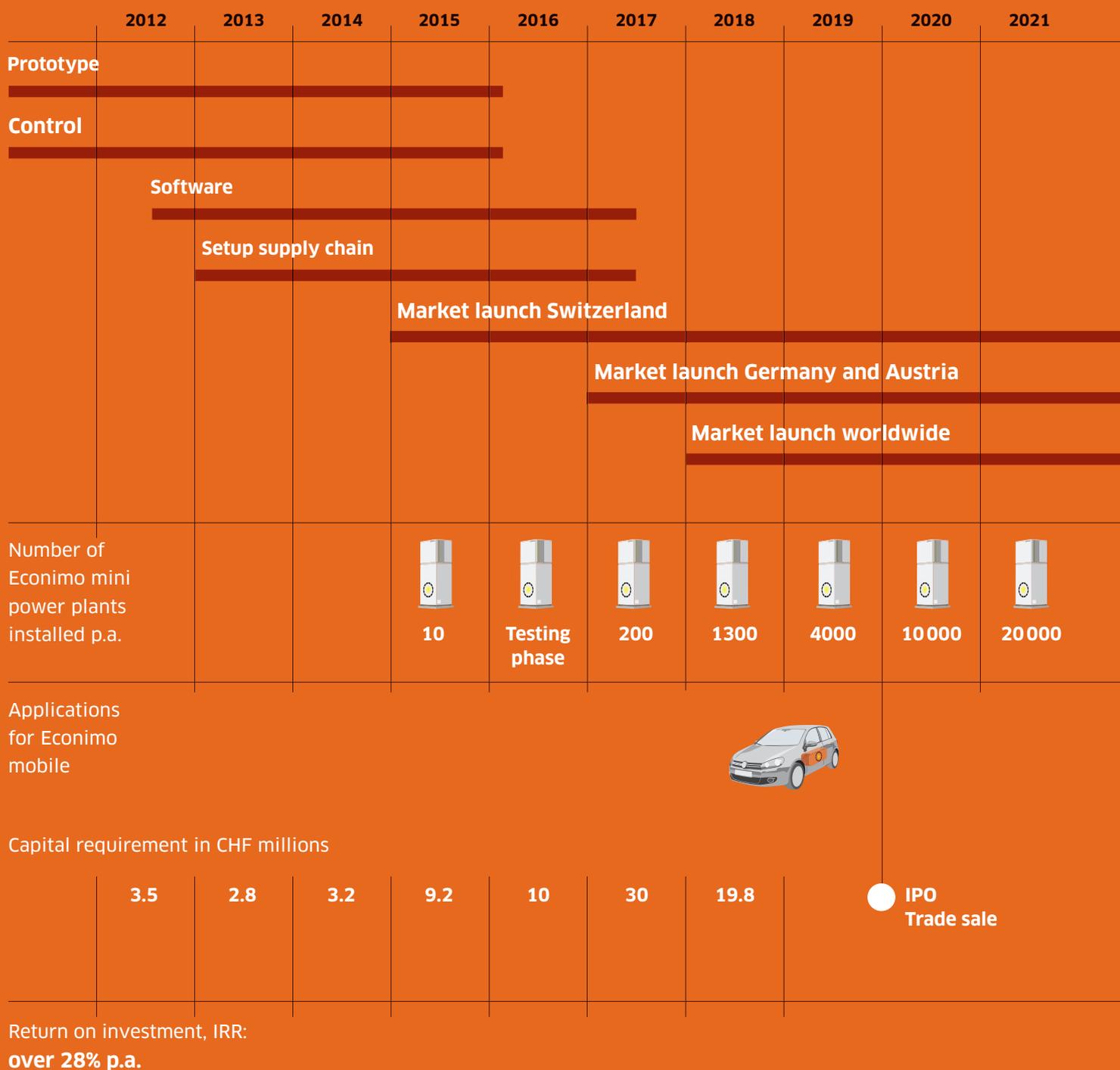
Econimo vehicles have significant advantages compared to existing automobiles:

- up to 50% lower investment costs
- almost noiseless
- no vibrations
- low maintenance
- CO₂-neutral
- no poisonous exhaust fumes and no danger of explosion
- vehicles can be heated and cooled using the waste heat from the Econimo

The best available Accu today can be found in the car Tesla. But the ratio is still nearly 40 times worse than gasoline!

The prospects of Silent-Power

Silent-Power AG was established in 2002 with the goal of solving existing problems on the energy market with new high-tech possibilities.





Management team

Headquarters and laboratories
of Silent-Power AG, Econimo AG and
Econimo-Drive AG in Cham (since 2002)



**Prof. Dr. sc. techn. ETH
Urs A. Weidmann**
CEO & Inventor



Dr. Reto Holzner
Chief Scientific Officer



Thomas Hegg
Chief Financial Officer



Hans Strasser
Chief Operating Officer



Enjoy the brief video
of the Econimo-Converter

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Silent-Power AG
Gewerbstrasse 11
CH-6330 Cham
Switzerland
Tel. +41 41 740 66 16
Fax +41 41 740 66 17
www.silent-power.com
urs.weidmann@silent-power.com