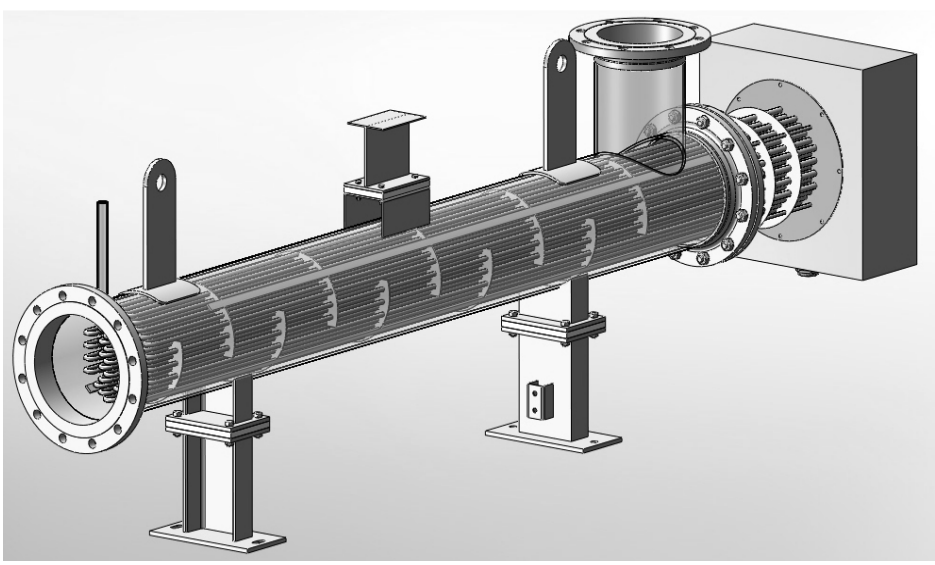
OhmEx
Industrielle Elektrowärme GmbH

Electric process heaters and Control Panels to optimize the utilization renewable energy as a balancing power capacity



Basics

The targeted integration of renewable energies and increasing energy efficiency are two important pillars of the current energy plan of the federal government. Through further development and the associated integration of renewable energies, the mix of electricity generation will experience a dramatic change. In Germany, currently holding all types of power generation such as nuclear power, coal, oil, gas - water, wind, solar and biomass power plants part of the energy mix.

Due to the increasing proportion of renewable electricity generation, the most important energy sources in the wind and sun cannot be controlled, and the displacement of the adjustable thermal power plants is the balancing of producer and consumer power are increasingly demanding. These short-term fluctuation are the creation operators face increasing problems because they must guarantee customers the power voltage and frequency. At worst, threatens the power outage.

What is rarely discussed: The load-management must keep with the operators of the network voltage and frequency stability is not limited to electricity generation, but may involve the consumer side with power. Therefore, models for load management to meet the demand side (user side) with great interest. The energy supplier has had to produce as much electricity as was consumed in the network. In future intelligent networks, consumption depends primarily on the currently available power, i.e. that large energy consumers and energy-intensive systems are preferably operated when a lot of electricity is produced. The previous principle of "consumption follows production" therefore changes in direction of "consumption follows production."

The great challenge of the increasing share of renewable energy in the energy, therefore, is to compensate the fluctuating power demand and the much more erratic wind and solar power supply. Flexible solutions for fast load change and adaptation are required by load fluctuations. These controllable power grids called Smart Grid. The main power of a smart grid is to monitor and optimize the interaction of production, storage and consumption based on timely and bilateral communication between producers and consumers.

Need for regulation

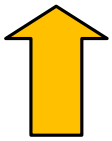
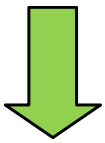
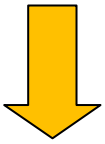
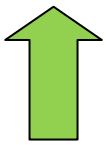
Using power management is trying to keep the power gained in power plants and power taken together with the transport losses in the balance. This follows from the physical need for electric power networks cannot store energy and therefore each time the power fed to the sum of removed from power and the power loss due to meet transport needs. Deviations from it result in AC systems in a change of frequency (i.e. 50 Hz) which is available in the AC mains uniform (synchronous): With an oversupply of power, there is a deviation of the grid frequency above the nominal frequency, with a reduced offer of a so-called under-frequency.
For regulation, among other things, the power demand forecast of all customers, so that an appropriate range of services available. Control power is then required to compensate if the actual, instantaneous power demand cannot offer the expected performance equivalent. Deviations from the actual services provided and the prognosis occur for example during power plant outages, unkept reference profiles of major consumers in the wind energy supply or power grid failures (loss of consumers) to.

Control energy and renewable energy sources

With increased use of wind energy increases, in principle, the required control performance, in particular, it increases the need for negative control power (i.e. an increase of consumption). The Renewable Energy Act prohibits the technically obvious solution, gusting at over-production at the source by shutting down the power output of wind turbines. Rather, it is a legal requirement that the total available wind power is fed into the grid and paid. It has high wind power production and low demand, partly led to negative prices for the German market in spot trading in European Energy Exchange. The exploitation of fluctuating renewable energy sources such as wind or solar energy could be increased with solutions for load

response by providing a negative system performance. The term load response a short-term, predictable change of the load (demand response) is to be understood.

Options of balancing power

Positive Control Power **Consumption > Production** **= short supply** (Grid frequency falls below 50 Hz)	**Negative Control Power** **Consumption < Production** **= overfeeding** (Grid frequency increases above 50 Hz)
Generators (i.e. power plants, diesel generators ect.)  Power performance increase or "ON"	**Generators** (i.e. power plants, Block Heating Power Plant, ect.)  Power performance lower or "OUT"
Consumer (i.e. electrolysis, furnaces, ect.)  Lower the load or "OFF"	**Consumer** (i.e. pumps, compressors, H2-electrolysis, electrical process heaters)  Increase the load or "ON"

There is a distinction between positive and negative control power. Positive control power means an increase in production capacity and / or a reduction in consumption, while a negative control power represents a reduction of generation capacity and / or increase in consumption.

Regenerative power storage

So lets the moody as the weather is available from wind power and photovoltaic systems, in contrast to conventional power plants do not produce to demand. A power supply works only if the current fed into the electricity grid corresponds exactly to the demand. The power supplies from wind turbines achieve today in some regions of Germany magnitudes that exceed the network load significantly. So where the temporary surplus renewable electricity? If the technical conditions are present, the regenerative power either to another energy source (i.e. natural gas) are used to replace or recharge a thermal storage.

At times, electricity prices are so low that a power-intensive process such as Hydrogen electrolysis, or the charging of a thermal storage tank is operated economically.

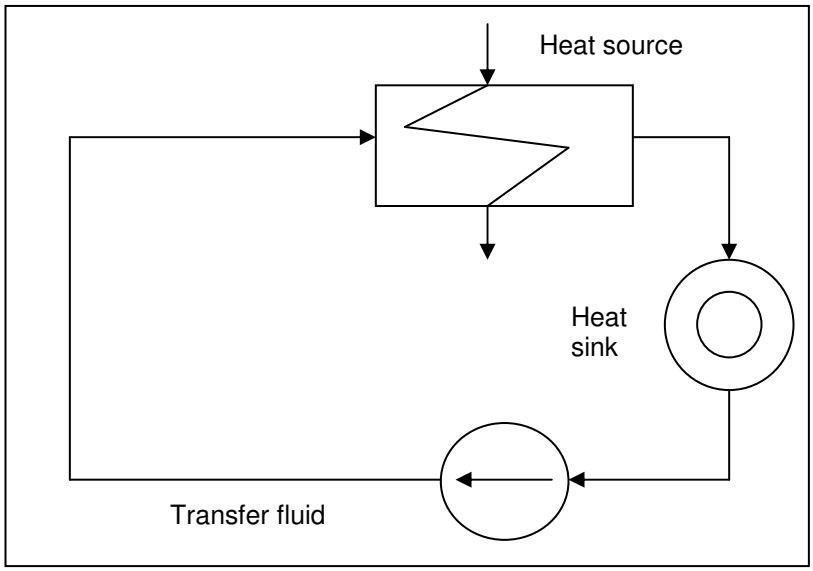
This will be followed by the electrical energy storage systems for the following purposes:

• Creation of additional electrical capacity consumption (electricity consumers as a negative control power)
• Flexible engagement (time and automated)
• Contribute to securing a stable network operation
• Sensible use of additional capacity (district heating concepts) for Renewable Energies

Starting situation (without storage system)

A heat transfer fluid (water, thermal oil, molten salt) transports heat from a heat source (generator) to a heat sink (consumer).

Requirements:
• The heat source is based (i.e. fuel gas / fuel oil.)
• The thermal output is as high (> 1 MW)



Starting situation (with storage system)

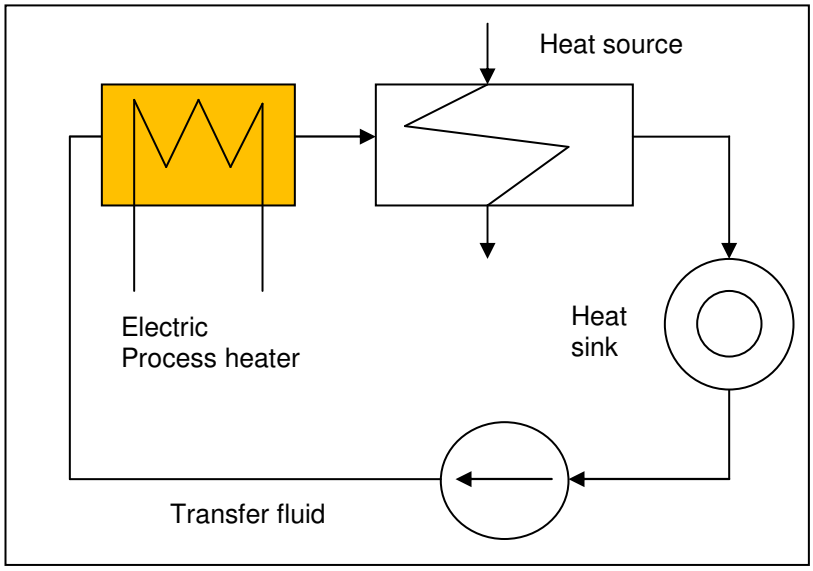
A heat transfer fluid (water, thermal oil, molten salt) transports heat from a heat source (generator) to a heat sink (consumer). Through the integration of electric process heaters creates the possibility of being able to switch on when needed, an electric customer load. The resulting capacity created is the basis for placing a negative control energy, secondary markets for a firm supply of electricity at a specified time in Germany there are also markets for the power provision (control power), which is both activated only when required at short notice. As the main market here of balancing power market is mentioned, which consists of three sub-markets for the supply of primary and secondary control power and minutes reserve. The most important feature of the sub-markets is that the power provision is already paid, so the warranty, provide the power when needed. The most important technical distinction between these types of control

power is to be guaranteed the activation time of 30 seconds for the primary control power, 5 minutes for the secondary control power and 15 minutes for the minute reserve. Here, the economic returns of the respective service provision differ considerably. The shorter the activation time, the higher the remuneration (ct / kWh).

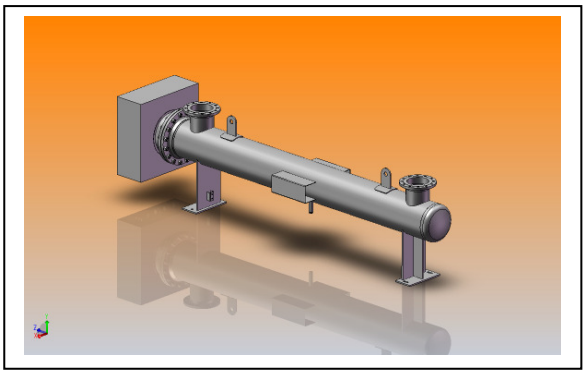
Ideally, the electric process heaters would work not only for the use in the primary-secondary control power or minute reserve market (so to speak, only as an additional benefit), but was needed for the process which would reduce the payback period for the purchase yet.

Requirements:

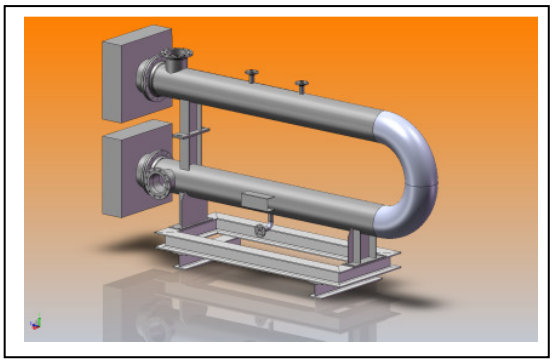
• The connection may done at any time (automated).



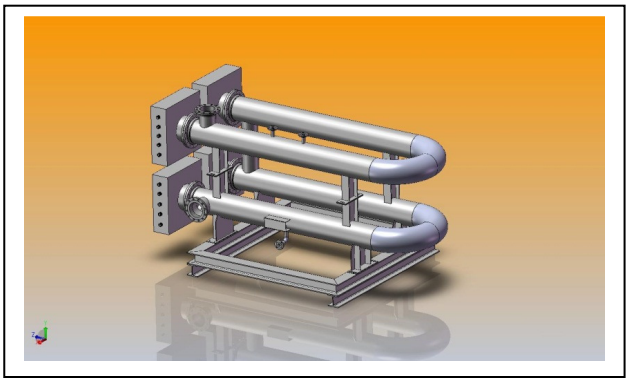
The company **Ohm**Ex was an early dealt with the subject matter described and developed appropriate solutions. We have specialized in the planning, design and execution of such electric process heaters (as a balancing power capacity) and electrical Control Panel. Together with our partners we offer you further advice on optimizing the energy industry, as well as potential studies in the industrial sector in order to demonstrate energy savings or use your existing resources more effectively. These systems are modular, so that electrical power of 15 MW (or expandable by connecting several modules) are possible.



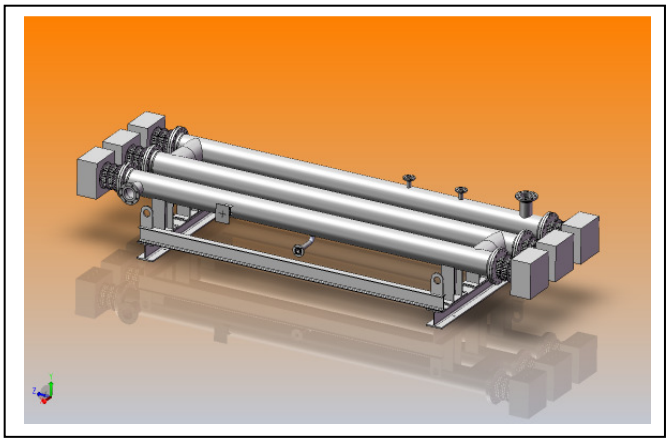
Picture 1- Electrical process heater up to 2,5 MW



Picture 2- Electrical process heater up to 5 MW



Picture 3- Electrical process heater up to 10 MW



Picture 4- Electrical process heater up to 15 MW

The technical potential of appropriate consumers (as energy) is available in Germany. These are found mainly in energy-intensive industrial sectors, i.e.

- Mechanical engineering
- Petrochemical
- Oil and gas processing
- Energy production / storage / power plant technology
- Electrical systems / hydrogen electrolysis
- Metals (aluminum production)
- Paper and glass industry

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