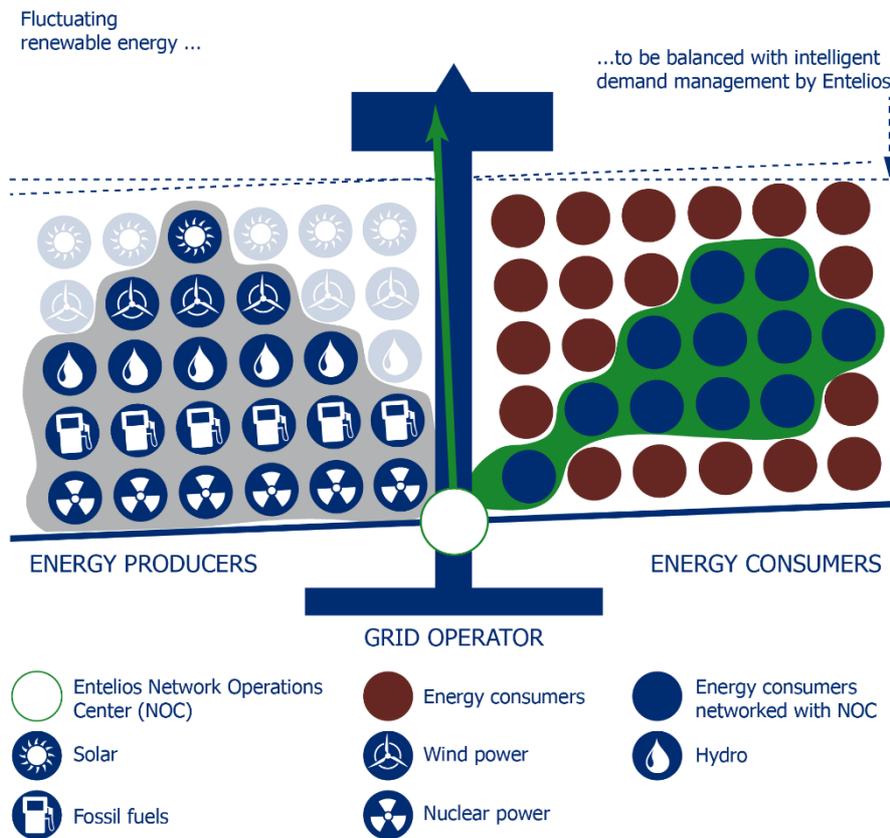


The energy revolution requires new solutions

The greatest challenge of the energy revolution is how to fulfill the requirements of the energy System of the future: security of supply, climate protection and affordability. The Energiewende, Germany’s energy Revolution, is based on the principle of energy efficiency and renewable energy sources replacing fossil fuelbased and nuclear power plants. Power from wind and sun is generated without marginal costs and is therefore fed into the grid with priority. Since this power is fluctuating and not controllable, the introduction of new market methods and smart grids is essential.

Demand Response and Virtual Power Systems

Demand Response is an automated control mechanism in power grids, by which the demand side responds to the generation/consumption balance, the grid condition or price signals on the power markets. In a wider sense, this intelligent management of decentralized loads, storage, and generation creates a virtual power system.



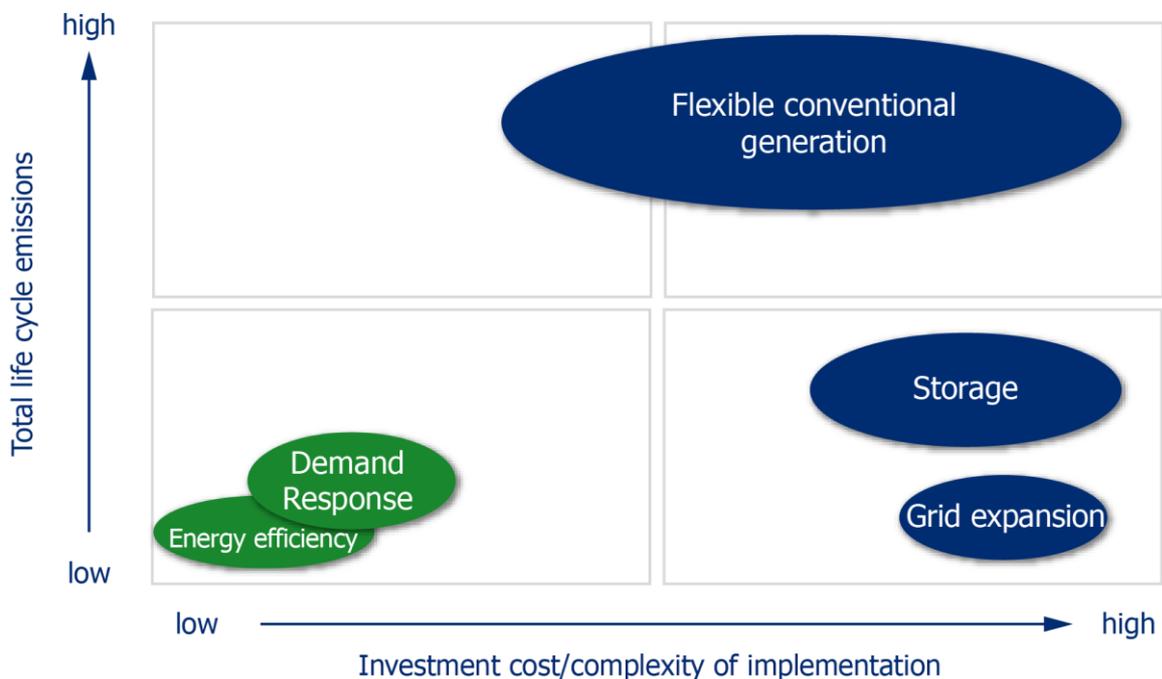
Demand Response balances supply and demand

The balance of supply and demand

Demand Response and Virtual Power Systems constitute a new method of balancing power generation and power consumption. For short-term curtailment events, up to 9 gigawatts of conventional power plants could be replaced by Demand Response from Germany's industrial and commercial sectors alone. In the U.S., Demand Response is already an established and proven technology for grid stabilization.

Demand Response is one of five pillars of the energy revolution

In an article published in December 2011, the German Federal Minister for the Environment, Nature Conservation and Nuclear Safety defined the five pillars of the Energiewende, Germany's energy revolution: flexible generation, grid expansion, storage solutions, energy efficiency and Demand Response. Compared to the other options, Demand Response is the fastest, cheapest and greenest infrastructure investment.



Five pillars of the energy revolution

Benefits of Demand Response

Since Demand Response utilizes infrastructure that is already paid for and installed at participating industrial plants, it can contribute to grid and price stability in an environmentally friendly, cost efficient and fast way.

The adjustment of demand together with intelligent management of decentralized generation plants reduces the overall required generation and grid capacity while increasing competition on the regular power and balancing power markets. The added value from the commercialization of aggregated flexibility has significant benefits for participating plant operators:

- The largest industrial power customers participate in the new German Demand Response program according to the Regulation on Interruptible Loads (Verordnung zu abschaltbaren Lasten — AbLaV).
- Power retailers, utilities and industrial plant operators optimize their balancing groups, reduce balancing power costs, and participate in the balancing power market.
- Direct marketers pursuant to the EEG market bonus scheme generate additional revenue through a flexibility bonus and in the reserve power market through the intelligent management of renewable energy assets (biogas, wind and photovoltaics).
- Grid operators accelerate the integration of renewable energies into the power grid.

EU Energy Efficiency Directive

The European Union has identified Demand Response as an important building block for the energy System of the future. Enacted in December 2012, the EU Energy Efficiency Directive (2012/27/EU) explicitly emphasizes Demand Response.

Demand Response is more than conventional load management

Conventional load management limits the peak power usage or supports load shedding in a bilateral agreement with a grid operator. The objective in these scenarios is to reduce grid charges.

Demand Response is different: It systematically exploits all flexibility potentials in an automated way to provide ancillary services to the power grid. Individual peak power limits are also observed through the use of real-time and rule-based software systems.

The growing share of fluctuating renewable energy in the power grid reduces the significance of rigid load curves in favor of flexible ones. Every modern optimization method must observe current grid and market conditions.

Demand Response is an evolution of Virtual Power Plants

Demand Response utilizes the demand and supply flexibility of loads, decentralized generation and storage assets. The objective of this approach is to generate pure flexibility for the energy system.

Until now, the concept of a Virtual Power Plant has focused only on decentralized generation and has not included interruptible loads and process storage. However, a pool of interruptible loads can be a significant addition to an existing virtual power plant. Entelios therefore talks synonymously about Demand Response and Virtual Power Systems.