

InnoSys 2030 – Innovations in System Operation up to 2030

The InnoSys 2030 research project showed how innovative system operation can enable the grid in 2030 will be able to transport even more power while maintaining system security. This can make an important contribution to reducing costly grid interventions. At the same time, the transport capacity of the grid is better utilised, which helps to ensure that more renewable energy can be fed into the grid.

A core result from InnoSys 2030 is:

InnoSys unleashes
the additional potential of our power grid and complements
the grid expansion.

How this works technically is explained in more detail below.

Factsheet – Mechanism of Curative Remedial Actions

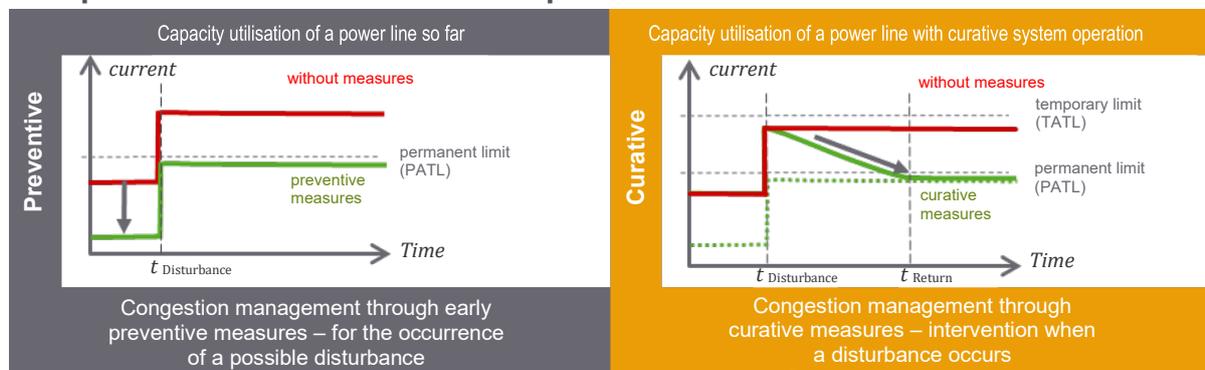
InnoSys 2030 analysed how the higher utilisation of our power grid is possible through the application of *curative congestion management*. The high level of grid and system security in the transmission system is achieved due to the so-called (n-1) principle. This means: We operate our grid redundantly. If a power line or a transformer fails, other equipment takes its place.

So far, we have achieved this high level of grid and system security through *preventive measures*. This means, for example, that we intervene in power plant dispatches with preventive redispatch even before a possible disturbance can occur in the electricity grid, in order to be on the safe side in the event of a fault. The currents of the equipment are thus below a permanent limit value (PATL¹) at all times. This goes hand in hand with the fact that valuable transport capacities are kept in reserve for rare events.

In contrast, with *curative congestion management*, a measure is only initiated after a disturbance has actually occurred. Until the curative measure is fully effective, so-called thermal reserves of the equipment take effect, which allow higher currents for a short period of time. The currents are above the permanent limit value for a short time, but below the temporary limit value (TATL²) at any time. The equipment in our grid, such as power lines or transformers, can be loaded higher for a short time.

The interplay of preventive and curative congestion management in system operation thus enables higher utilisation of the electricity grid and can help to master the transport task in addition to expanding the grid.

Comparison of the mechanisms of preventive and curative remedial actions



Framework conditions for the implementation of curative system operation

Curative system operation is a complex interaction of the most diverse elements in grid operations. The implementation is technologically very complex and associated with great challenges. Thus, grid operators must provide a comprehensive infrastructure to manage the complexity of curative system operation and make it possible in the first place. This includes adjustments to secondary technology, processes, tools and assistance systems in system operation.

Very important: As the system is utilised to a higher degree and thus brought closer to its limits, and at the same time remaining reaction times become shorter, ensuring system security continues to have the highest priority in the further implementation of the InnoSys concepts.

In addition, the regulator and legislation must create the appropriate framework conditions for higher capacity utilisation.

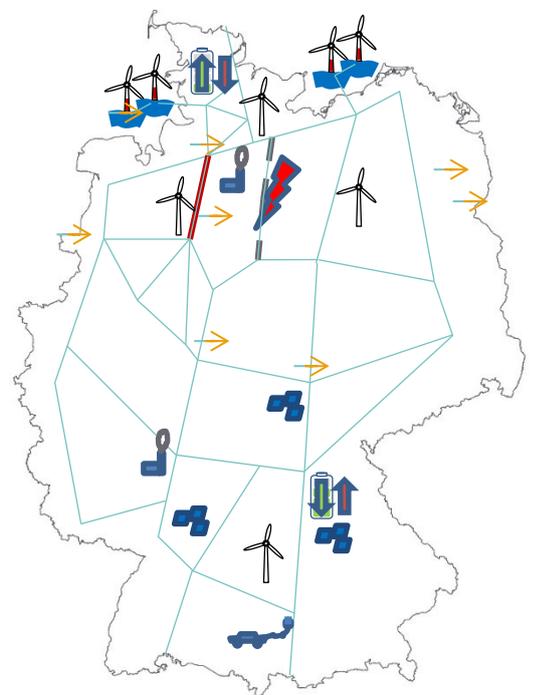
Curative measures as a tool set for innovative system operation

For the following measures, concepts for integration into curative congestion management were developed in InnoSys 2030:

- Curative adjustment of the preventive operating point of a high voltage direct current line (HVDC)
- Preventive and curative application of power flow control equipment (e.g. phase-shifting transformers)
- Grid boosters
- Curative redispatch from the distribution grid
- Preventive and curative application of topology switching measures
- Redispatch of conventional power stations with special consideration of curative operations

Example: Curative use of grid boosters

- Batteries for up and down control of active power
- Combination with other technologies e.g. curtailment of offshore wind farms
- Systemic use of several grid booster combinations



Further information at www.InnoSys2030.de

¹ PATL
(abbreviation for: Permanent Admissible Transmission Loading)

² TATL
(abbreviation for: Temporary Admissible Transmission Loading)