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 to transport even more power while maintaining system security. To make this possible, among other things, comprehensive technological and procedural enhancements are required in today's system operation. The *InnoSys system operation process* describes the necessary holistic picture for the joint application of curative and preventive measures[1].

A core result from InnoSys 2030 is:

> InnoSys opens up
> **new options for action** in a
> **holistic system operation process**

How this works technically is explained in more detail below.

Factsheet – InnoSys System Operation Process

Maintaining system security is a top priority for the transmission system operators. Therefore, they use preventive measures such as redispatch or transformer steps in the event of potential grid congestion. Due to the high coordination effort as well as technical and operational constraints, operational congestion management includes **operational planning** and **real-time system operation**. Multifaceted interactions make it necessary for curative and preventive measures to always be planned together. Therefore, curative measures must be taken into account in the entire process chain. How exactly this is done is described in three steps:
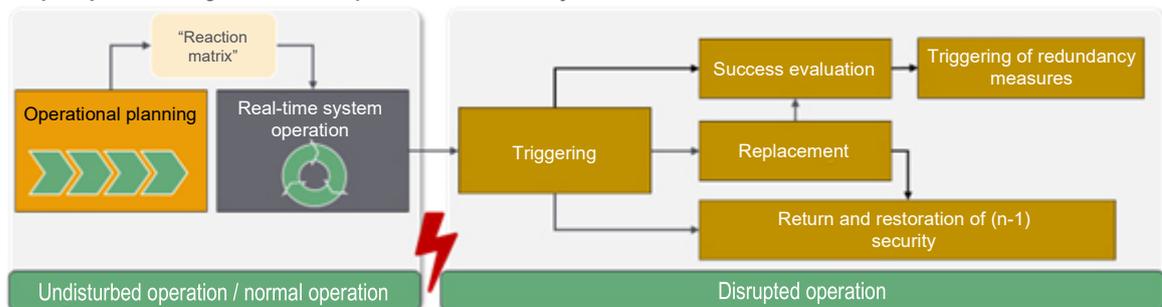
Overview of InnoSys system operation process
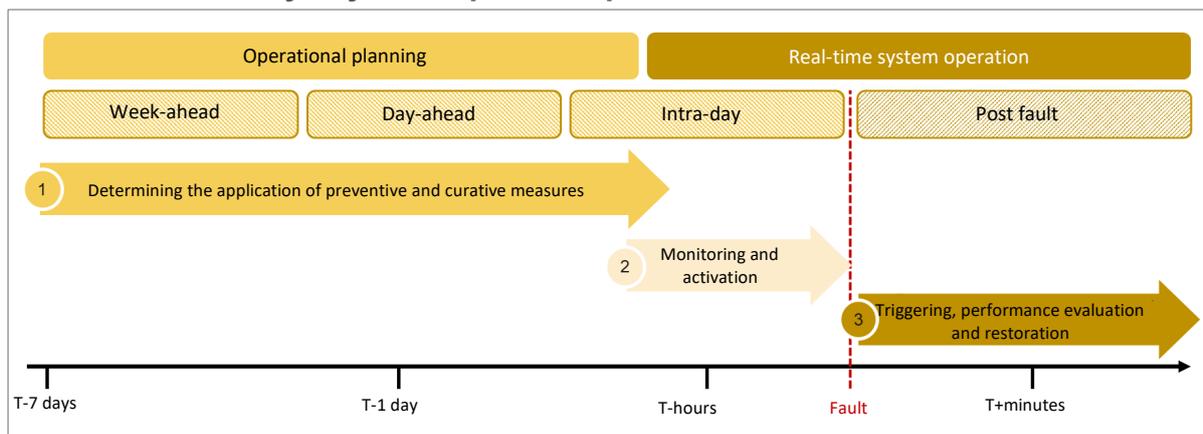
1. In **operational planning**, the joint planning of measures for the preventive and/or curative elimination of grid congestions takes place. The curative measures pre-calculated in this way are continuously updated, e.g. if the grid situation changes due to new wind forecasts. Initially, there is no triggering – this is only carried out when an actual disturbance occurs.
2. The grid operator's control system continuously checks whether the curative measures determined in the previous process steps are sufficient to be able to eliminate grid congestion in the event of a possible fault (**monitoring**). Monitoring is carried out centrally in the control system by the (n-1) security calculation. If everything works according to the concept, the curative measure can be activated, i.e. put into operational readiness (**activation**).

3. The *triggering* describes the actual use of the curative measure after an equipment failure to eliminate the grid congestion. Depending on the type of measure, it can be triggered centrally from the control system or via decentralised systems. The curative measure is successful if the loading is reduced below the permanently permissible operating current and can be reliably maintained there (*success evaluation*).

The following process sequence shows the steps to be taken from the undisturbed to the disturbed operating state. In addition to the steps of triggering and evaluating success already explained, appropriate temporary *replacement measures* and, if necessary, the **triggering of redundancy measures** must be initiated. With the *return and restoration of (n-1) security*, normal operation is finally restored.

Framework conditions for the appropriate and efficient application of curative measures in grid operations

The InnoSys system operation process is based on the following framework conditions for the appropriate and efficient application of curative measures in grid operations:

- System security must also be a top priority when using curative measures.
- The application of preventive and curative measures must always be determined jointly in operational planning and real time.
- Curative measures are triggered centrally and automatically via the control system or decentral and automatically via special protection schemes.
- For the successful application of curative measures, thermal reserves of the equipment are taken into account.
- In addition to the temporary, thermal current limits of the equipment, other non-thermal limits such as those of the protection can have a limiting effect.
- After the occurrence of a disturbance and the subsequent triggering of the curative measures, the system is in an (n-0)-secure state. Downstream, (n-1) security is restored through conventional grid security measures.

Further information at www.InnoSys2030.de

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[1] see also "InnoSys Factsheet – Mechanism of Curative Remedial Actions"