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ISGAN INTERNATIONAL SMART GRID ACTION NETWORK

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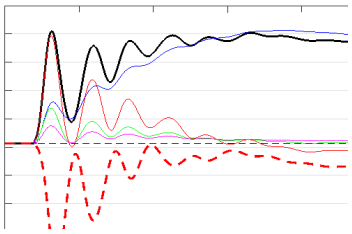
International Conference on Integration of Renewable and Distributed Energy Resources

FLEXIBILITY IN FUTURE POWER SYSTEMS

AN EVOLVING POWER SYSTEM

Trends influencing operation and planning
- Increasing the maximum utilisation level
- More distributed generation, new ancillary service solutions
- More and larger interconnections
- Power electronic interfaced devices (PEID) instead of rotating machines

Challenges to maintain secure and stable operation
- Identification of true operational state and limits
- Increasing need of information exchange
- New system and operational criteria
- Changed dynamic response



- How will a group of generators respond to a disturbance?
- What will the impact be locally and on the system?
- How to model a realistic behaviour?
- How can PEID provide optimal local and system wide support?

WHAT IS FLEXIBILITY?

Flexibility may be provided and handled by several parties, however **flexibility is lacking a common definition**! CEER propose:
Flexibility is the capacity of the electricity system to respond to changes that may affect the balance of supply and demand at all times
Flexibilities in supply, transfer, demand and storage of energy, are restricted by:
Technical capabilities – utilised for the grid and for the system & Commercial capabilities – market requirement and regulations

RATIONALE FOR FLEXIBILITY

Secure future power supply - maintaining the frequency
Cause: increased levels of weather dependent supply
- Increased thermal plant flexibility: broadening operating ranges
- Intermittent power generation flexibility: to provide balancing
- Aggregated control: multiple smaller units, including storage
- Possibilities of increased operational flexibility:
  - Min/max frequency deviation, RoCoF requirements, etc.

Secure power transfer capacity
Cause: increased system utilization
- Dynamic line rating (DLR) for over-head lines
- Dynamic rating for other assets, such as cables
- Time variable transfer tariffs to influence behavior
- Possibilities of increased operational flexibility:
  - Probabilistic reliability criteria, instead of deterministic *n-1* criterion

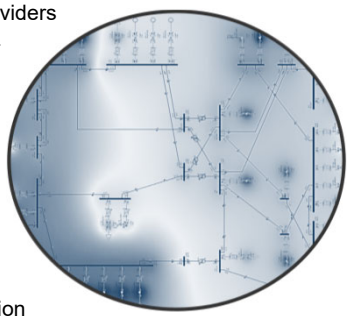
Secure future energy supply
Cause: increased levels of weather dependent supply
- Larger need for energy storages: to provide flexibility in storing energy from situations of high supply to situations with low supply
- Altering demand behavior: flexible loads following supply variations

Maintaining voltage stability and power quality
Increased PEID provides new solutions:
- Ancillary services from DG, storage and demand
- Possibilities of increased operational flexibility:
  - Broadened acceptable ranges for power quality

SELECTION OF EUROPEAN INITIATIVES FOR FLEXIBILITY IN FUTURE POWER SYSTEMS

EU-SysFlex – to identify a mix of flexibility and system services to support secure and resilient operation of the power system.

SmartNet – compares various modalities for TSO & DSO to coordinate ancillary services allowing flexibility providers to participate in real time markets. Simulations at the time horizon 2030 and technological pilots in IT, DK & ES.



FED – design of an energy market to unlock the available flexibility potential from local resources, through combination of different energy carriers (electricity, district heating and district cooling) in a single market.

ELECTRA IRP - addresses issue of deployment of RES connected at all voltage levels, establishes and validates proofs of concepts that utilize flexibility from across traditional boundaries in a holistic manner.

IES – strives to adapt and implement vendor-neutral method to achieve interoperability of ICT-systems in smart energy systems, for cost-effective integration between vendors to support e.g. flexibility providers.

NODES – development of marketplace to exploit decentralised flexibility, for entities at different levels of the power system to provide and utilise flexibility, to bridge the gap between wholesale and local flexibility markets.

HYBRIT – evolving the industrial steel production process to become fossil fuel free, utilising hydrogen production and storage, which also enable flexibility to the power system.

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This work is prepared in the framework of
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Promoting solutions to enable power grids to maintain and improve security, reliability and quality of electric power supply
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