System challenges, flexibility and nuclear power

Energiforsk conference 24th of January 2019

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The role of a TSO – System operation

6. Adapt the control systems
   1. Balancing production and consumption
   2. Maintain voltages throughout the power system
   3. Control power flows and avoid congestions
   4. Maintain the rotor angle stability

5. Restore the system after blackout

System operation shall be done to the lowest achievable cost!
Operational security: Svk uses power system connections abilities

> System challenges in the Nordic power system changing the technical characteristics

> Svk needs to be more active to maintain and monitor the technical boundaries and keep the system in normal state

> The system needs to adapt to the “new normal” – flexibility is needed

> Technical abilities from all connecting parties in the system: producers, grids and consumers

New system characteristics:
- Low inertia system
- Balancing – more weather dependent power producers
System states (A18 SO GL)
- The power systems defence in depth

Normal state
- System-parameters intact
- Example: Capability to handle N-1 fault

Alert state
- System-parameters still intact
- Example: No capability to handle N-1 fault

Emergency state
- System-parameters outside security limits
- Example: Activation of system defence plan

Blackout state
- At least 50% loss of demand
- Example: System not intact

Restoration state
- Rebuilding the system
- Example: Activation of restoration plan
Connection requirements – the foundation of system operation

- SvK are obligated to set up connection requirements, together with Europe's TSOs.

- The requirements state the technical abilities required for operational security.

- The requirements need to align with the design and use of remedial actions and ancillary services.

- Applicable for all system states!
Ancillary services and remedial actions – tools for flexibility

Tools: Ancillary services, remedial actions and system defence actions

Aims to keep, or take back, the power system to normal state

AS: Market based, aims to keep the system in normal state

RA: Actions to keep the system in normal state

RA: Actions to take the system back to normal state

SD: Actions to protect the system from blackout
Ancillary services and remedial actions – tools for flexibility

Example of classifications:

- Market based ancillary service
- Remedial actions procured in competition
- Remedial action **not** procured in competition
- Remedial actions as a connection requirement

Why do we want marked based solutions?

Market based

Non-market based, but right to financial compensation

Non-marked based and no financial compensation
Example of operational security limits and robustness - Frequency

“Tools”:

1) Normal state – ancillary services
   FFR, FCR and FRR market based ancillary serveries

1) Alert state – remedial actions
   same abilities as normal state, but different response and activation req.

3) Emergency state – system defence
   LFSM-O and LFSM-U
   LFDD (AFK)

Criteria for changing system states:
NPP and flexibility

> Historical: design and construction of Sweden's NPPs was done between 1960-1980 and flexible operation was performed

> Changing power system characteristics and requirements and introduction of the energy market – optimization for base load operation

> Handling changes: Knowledge is the key

> NPP report

> New normal and NPPs: Focus on NPPs abilities

  > R&D projects

  > Implementation projects; Inertia 2018/2019, Measures to handle over-frequency etc.
Striving for change – responsibilities

Direktive 2009/72/EG
Common rules

Regulations 714/2009

"Connection"
3 st

RfG
National regulations

"Operations"
3 st

SO
ER
RfP

"Market"
3 st

SO: 2, 18-39, 54, 55, 108, 109
ER: all

Electricity act

Chapter 8

Regulations

"Connection"
3 st

RfG
HVDC
DCC
National regulations
National regulations
National regulations

Article: 2, 12,
4, 11, 13-16, 30-43

Article: 2, 12,
4, 11, 13-16, 30-43

SO: 2, 18-39, 54, 55, 108, 109
ER: all

Some suggestions - FYRP
Conclusions – managing system challenges

> Ancillary services and remedial actions are tools to keep the power system in normal state

> Market, Market based and non-market based....?

> New ancillary services and remedial actions need to be justified from operational security perspective

> Include, involve and open up for more types of producers and consumers

> Less margins “smaller box” - SvK needs to “step in”

> System responsibility 2.0 – more interaction with stakeholders

> Enhanced openness and transparency – system challenges affects the whole system!
"To lead change – you need to be the change"

Thank you for your attention!

Questions?

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