
System challenges, flexibility and nuclear power

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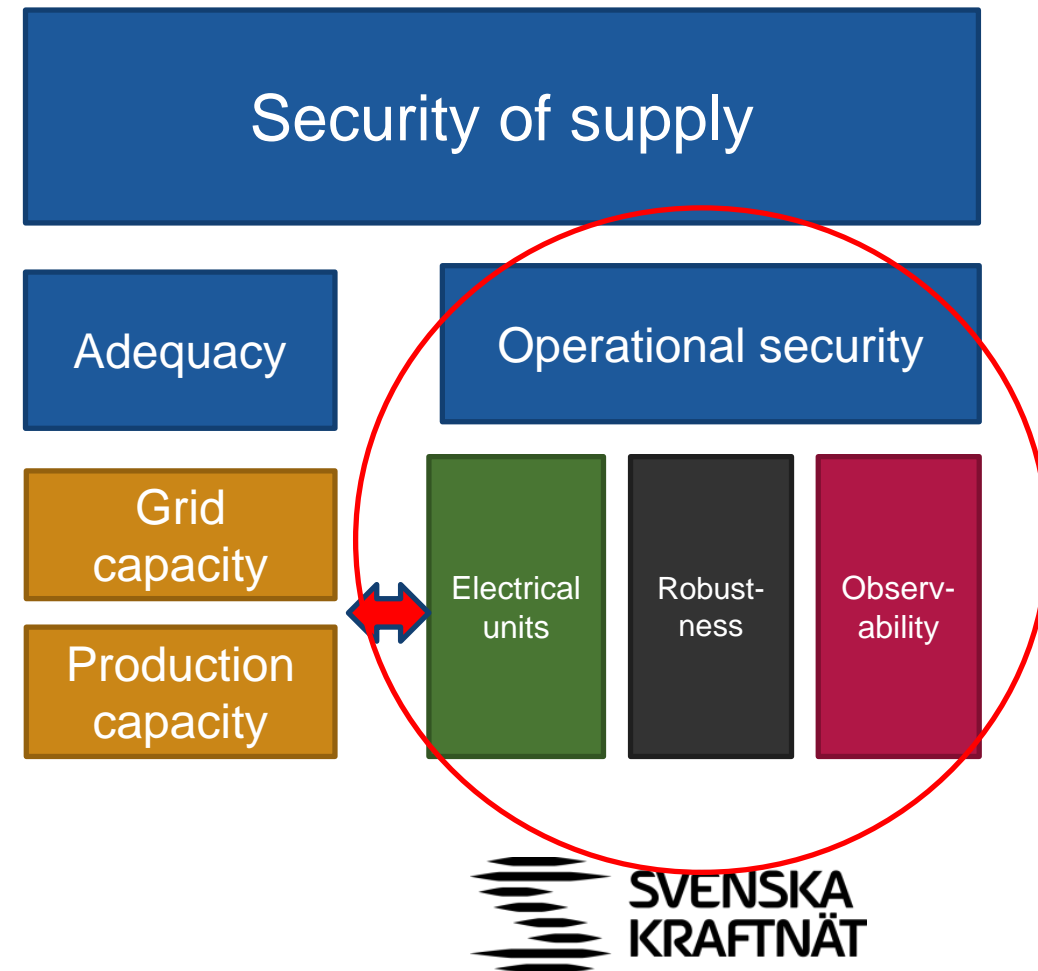
The role of a TSO – System operation

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

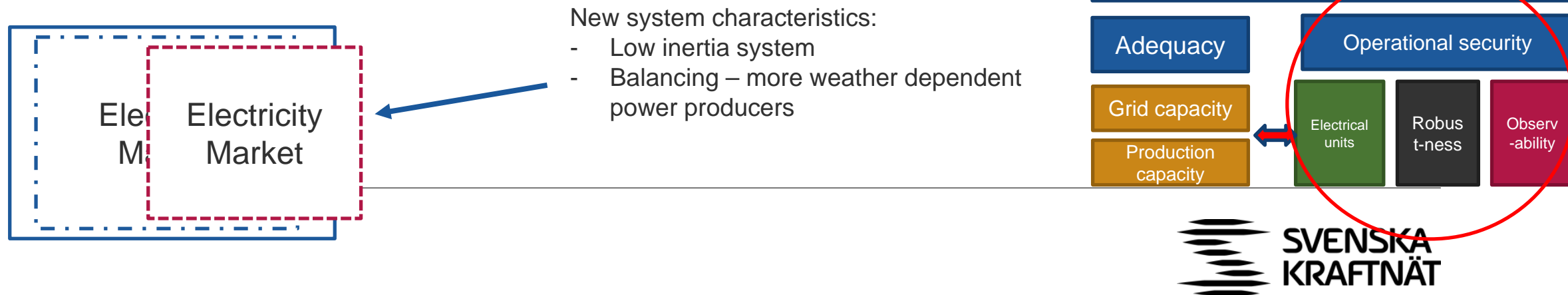
5. Restore the system after blackout

System operation shall be done to the lowest achievable cost!



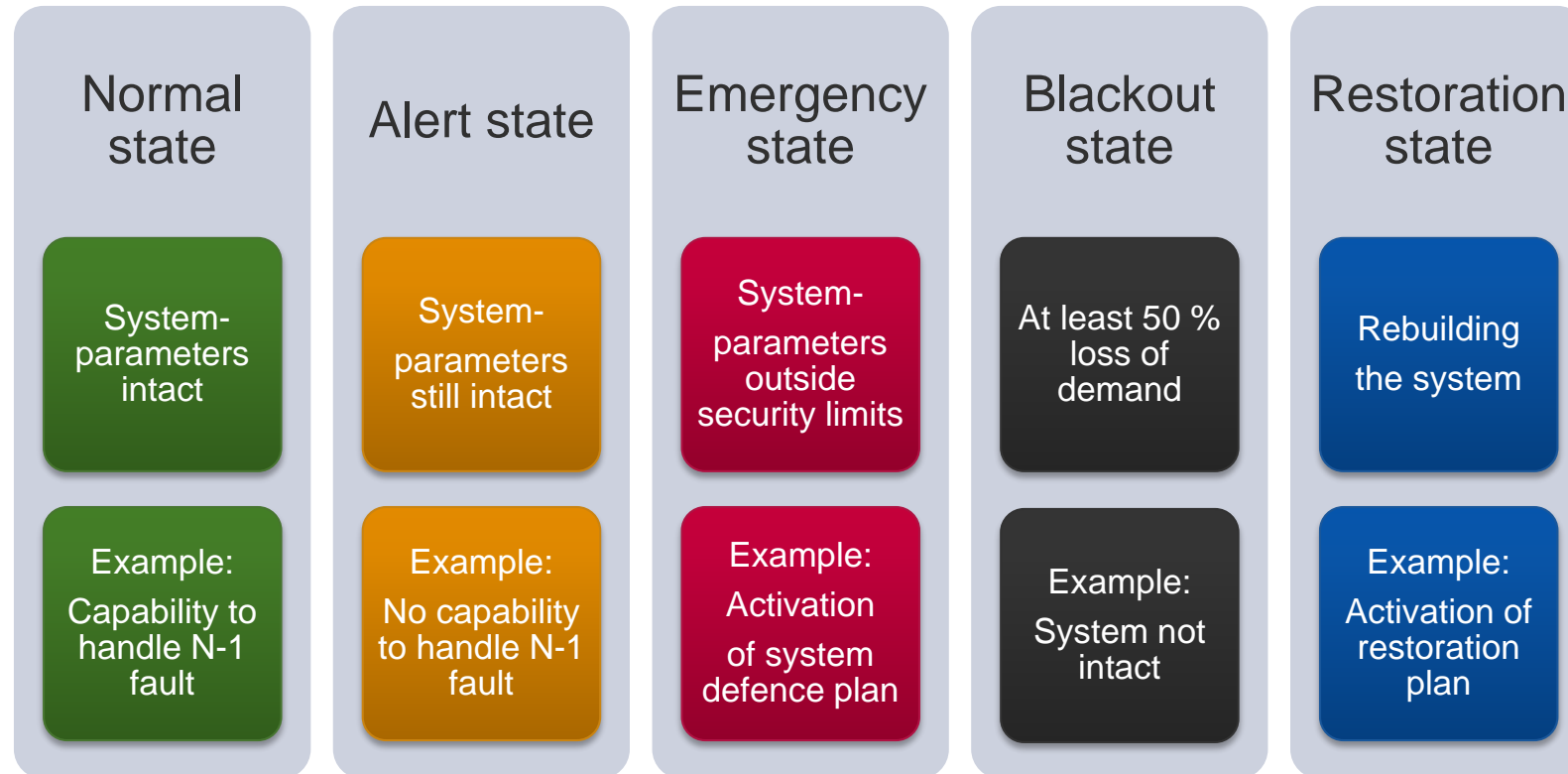
Operational security: Svk uses power system connections abilities

- > 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



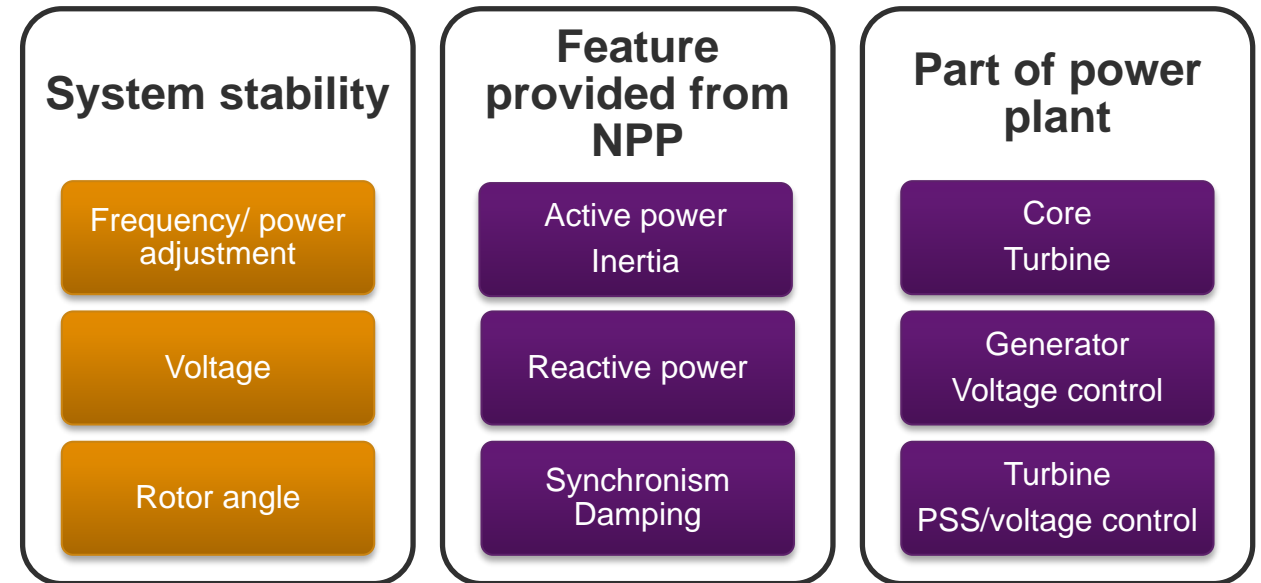
System states (A18 SO GL)

- The power systems defence in depth

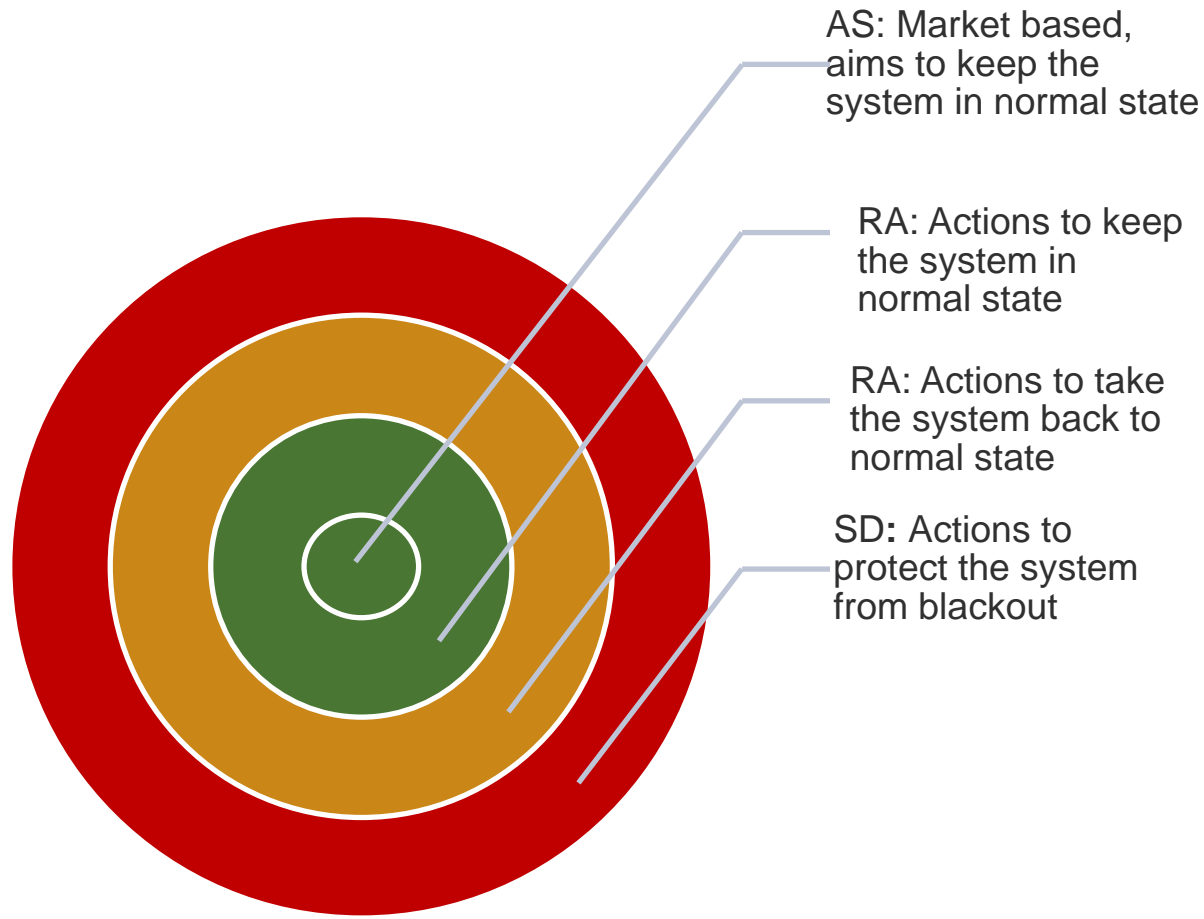


Connection requirements – the foundation of system operation

- > Svk are obligated to set up connection requirements, together with Europe's TSOs
- > The requirements states the technical abilities required for operational security
- > The requirements needs 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

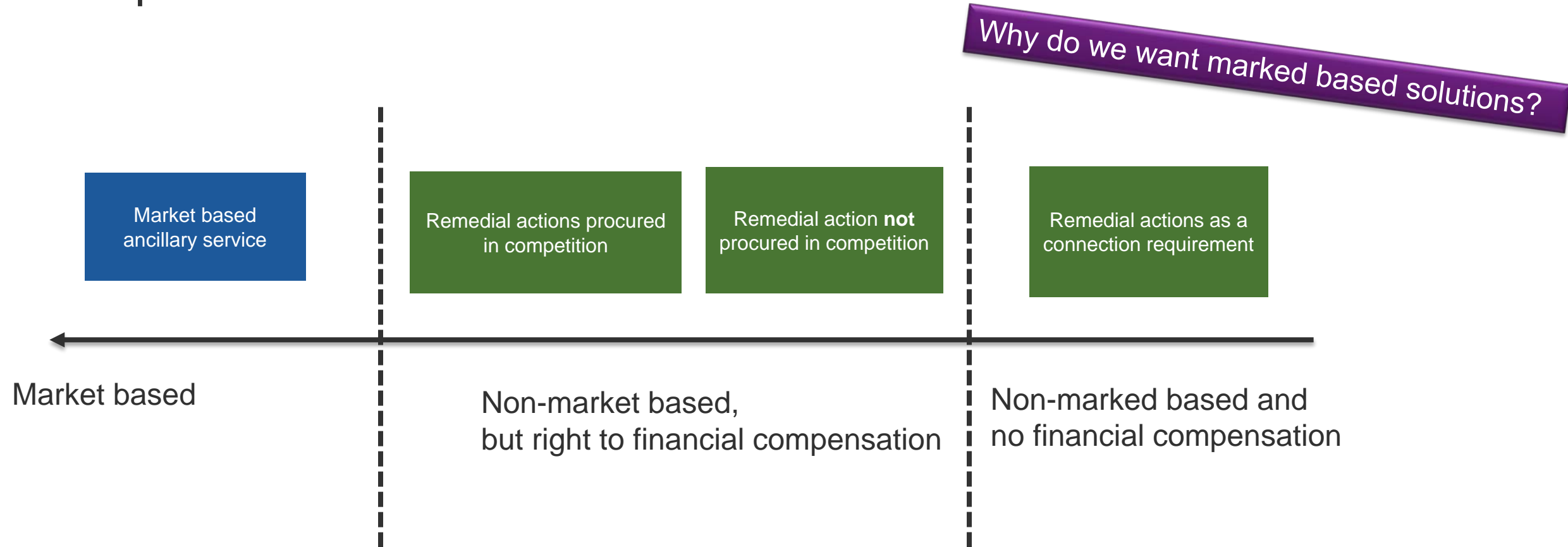


Tools: Ancillary services, remedial actions and system defence actions

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

Ancillary services and remedial actions – tools for flexibility

Example of classifications:



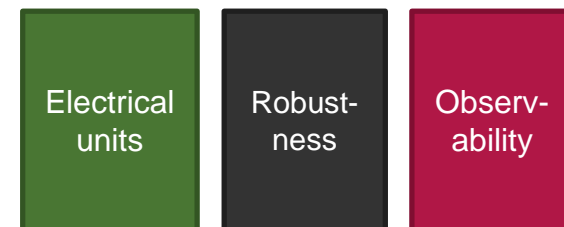
Example of operational security limits and robustness - Frequency



“Tools” :

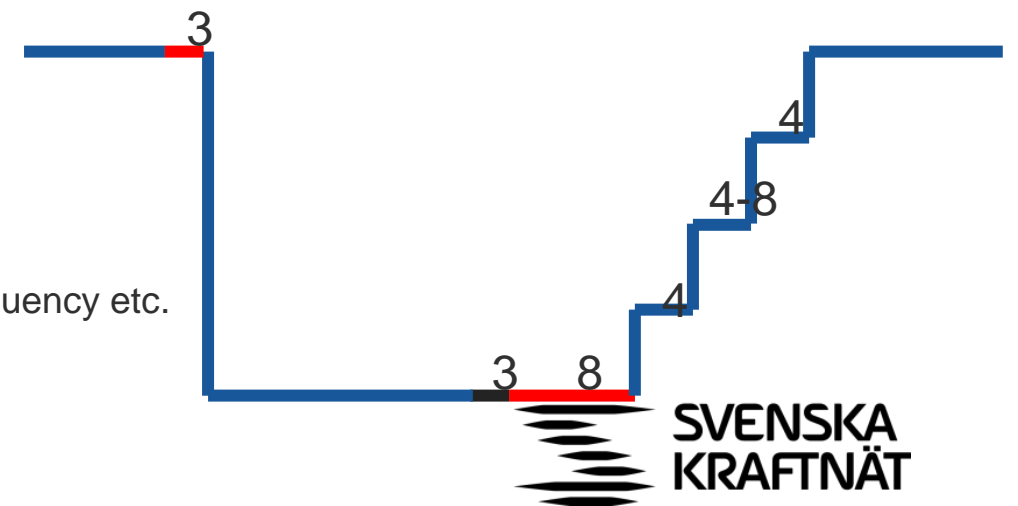
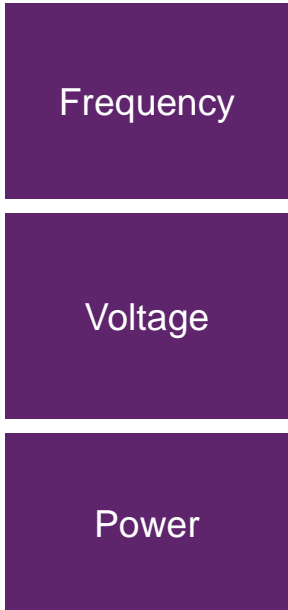
- 1) **Normal state** – ancillary services
FFR, FCR and FRR market based ancillary services
- 1) **Alert state** – remedial actions
same abilities as normal state, but different response and activation req.
- 3) **Emergency state** – system defence
LFSM-O and LFSM-U
LFDD (AFK)

Criteria for changing system states:



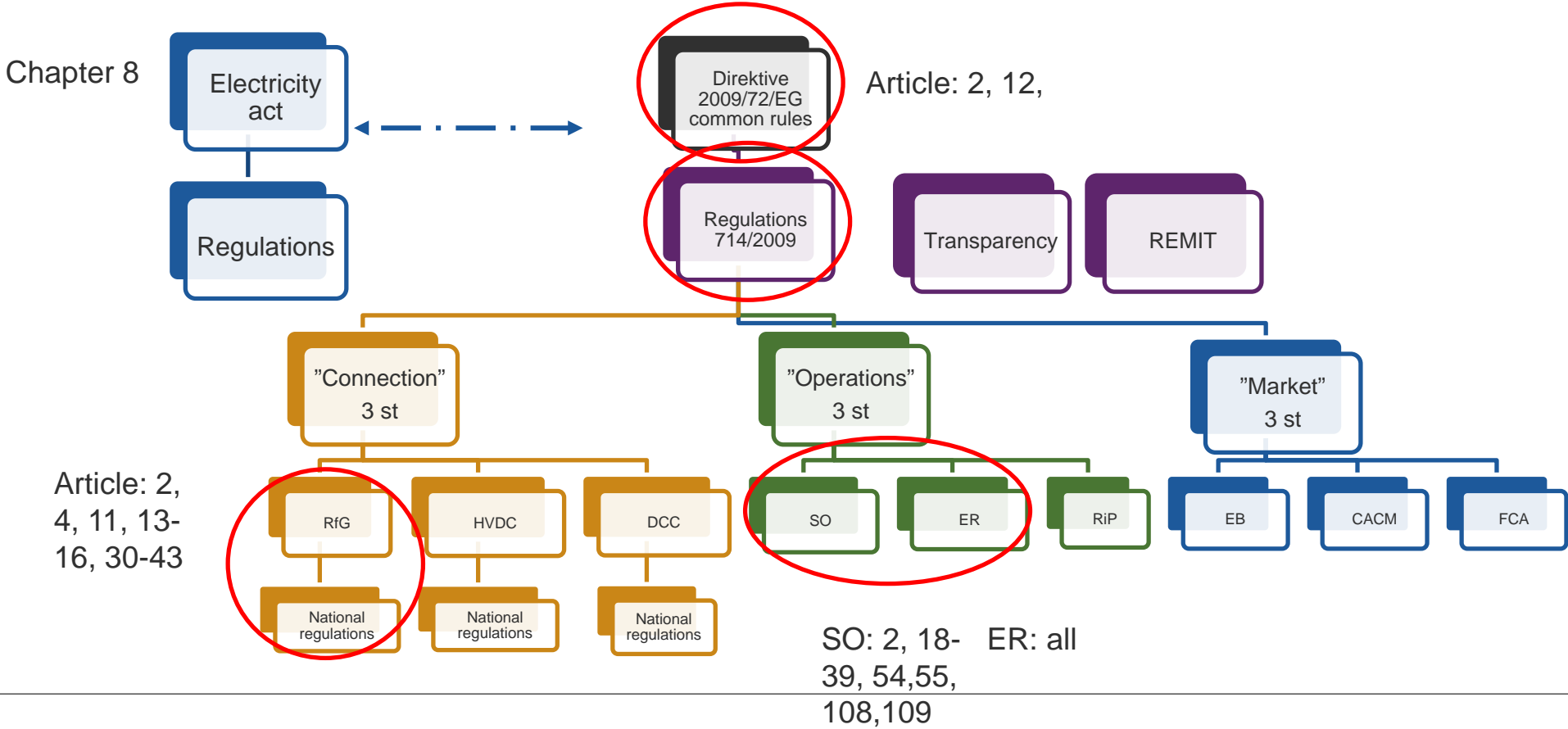
NPP and flexibility

- > 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.



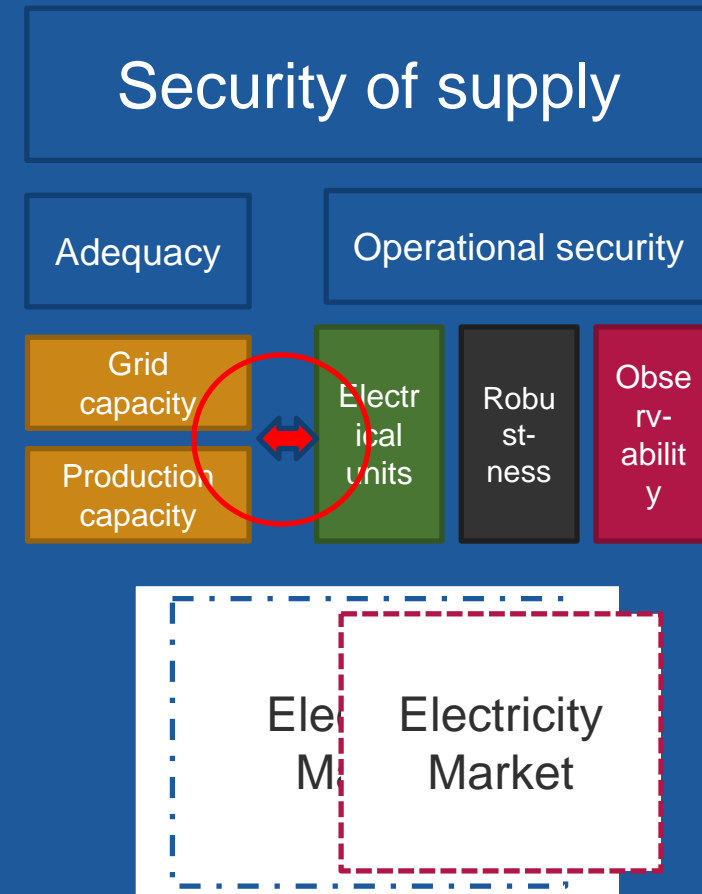
Striving for change – responsibilities

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!



[NPP report](#)

[NAG](#)

[System states](#)

“To lead change – you need to be the change”

Thank you for your attention!

Questions?

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