Cybersecurity and Power System Planning

C1 – Power System Develoment and Economics

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For power system expertise

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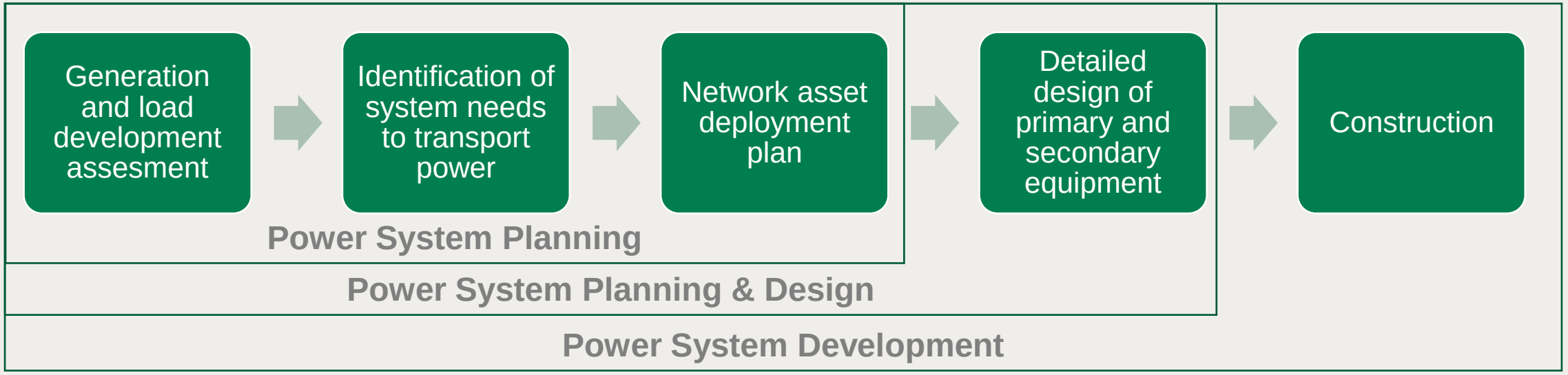
Cybersecurity in Power System Planning

- Relatively little work done on the interplay of these two subjects today.
- Cybersecurity is seen as mostly relevant for network operation but not taken into account in long-term planning, especially for bulk transmisiosn grids.
- The purpose of this session is to collect your views and obtain a good picture

Background in Power System Planning

Power systems are planned to provide a safe, reliable and cost-optimal means of transporting electricity from generators to consumers



Background in Power System Planning

Power systems are planned to provide a **safe, reliable** and cost-optimal means of transporting electricity from generators to consumers

Typical threats that are taken into account

Internal equipment failure
- Electro-magnetic faults
- Mechanical failure

External physical damage

Potential causes

Overloads	Equipment wearing	Protection system fault	Adverse weather (storms, floods)	Sabotage / diversions	Control system / algorithm failure	Accidents

Background in Cybersecurity

Control, monitoring and protection functions largely controlled by analog circuits.

A digital system run by a programmable devices has taken over analog switches and levers.

IT and OT convergence in the energy industry → common software and security systems use.

Increased cybersecurity vulnerability for the grid.

With growth in distributed RES, the power system paradigm has changed.

Energy is generated at all voltage levels. Uni-directional flows became bi-directional.

More sophisticated monitoring, control and protection systems applied.

More interfaces and systems that can become a security target.

CYBERSECURITY APPEARED AS A THREAT DUE TO

1) CONVERGENCE OF IT AND OT

2) GROWTH OF DISTRIBUTED RES

- **Example** - smart metering. The meters themselves are OT and are a part of the electricity distribution network, yet the meter data management and back office functions are IT-based applications that are closely integrated.

How the two disciplines become more integrated 1/2

Primary asset specification → Detailed design → Telecommunications (control & monitoring)

Opinions:

1. *"Power system planning process is mainly concerned with primary asset deployment planning → arguably, little value in introducing cybersecurity-related considerations explicitly."*
2. *"Integrating more disciplines at the system planning stage is not necessary. From the planning perspective, the cybersecurity threat can be treated as any other threat."*

Most grid operators are focusing on operational measures, strict authentication measures for access to infrastructure, intrusion detection systems, software upgrades, protection system enhancement (physical and IT)

How the two disciplines become more integrated 2/2

“The difference with other threats is that cybersecurity attacks have large impact potential and may affect the entire national infrastructure. Vulnerabilities might allow an attacker to penetrate a network, gain access to control software and alter load conditions to destabilize the grid in unpredictable ways”

- Additional contingencies to be foreseen?
- Additional resilience required?

1. Possibility of operating various parts of the network in **isolation to localise the threat**.

2. More **distributed networks, capable of self-sustaining**.

Example: distributed generation installations and microgrids have the potential to resist disruptions to the grid, whether from natural occurrences or cyberattacks, by continuing to generate power if the grid is brought down. Microgrids can be a partial solution to larger scale resilience as they are sized to meet the power needs of a local community or institution, and they may also be useful in a major cyber event as a staging point for power outage and recovery workers.

Open Questions and Your Views

- What are the main cybersecurity threats to be considered in medium to long-term grid expansion planning?
- Which implications cybersecurity has on long-term transmisison system planning?
- What effect cybersecurity threats have on the allocation and magnitude of investment in transmission grids?

Thank you for your attention!

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