Paris Session 2022 - Key Takeaways

C1 – Power System Develoment and Economics

cigre

For power system expertise

Maksym Semenyuk - DNV

Key Takeaways – Preferential subjects and report topics

PS 1 - SYSTEM TRANSITION RESILIENCE & ASSET MANAGEMENT RESPONSE

- Application of advanced mathematical methods for predictive maintenance
- Asset management digitalisation
- Expansion planning considering resilience enhancement

PS 2 - ENERGY SECTOR INTEGRATION AND TACKLING THE COMPLEXITY OF MULTI-FACETED NETWORK PROJECTS

- System coupling and system planning (gas, heat, electricity)
- Storage systems in the power system
- Interconnection
- (Offshore) HVDC grids
- Demand response

PS 3 - PLANNING UNDER UNCERTAINTY AND WITH CHANGING EXTERNAL CONSTRAINTS

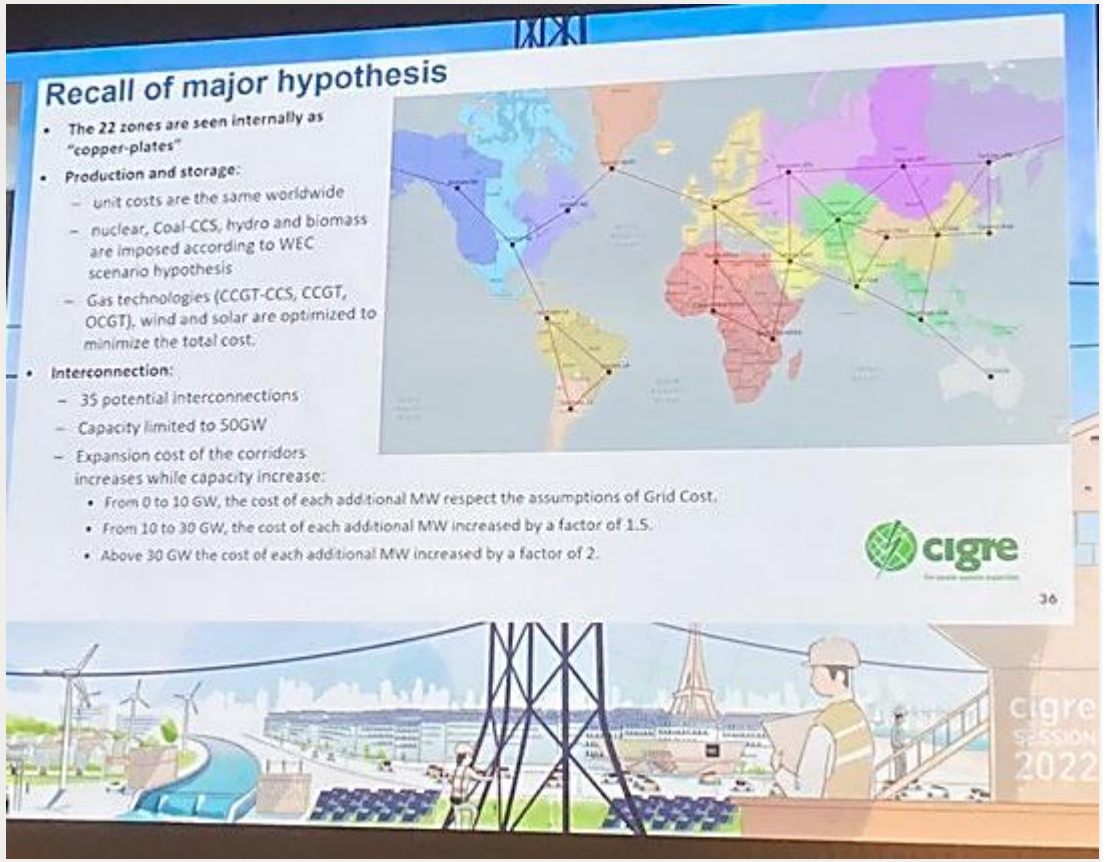
- Grid capability assessment
- Long-term load forecasting
- Effects of COVID pandemic on load
- Inclusion of storage into grid capability assessment

Paris Session 2022 - C1 Dutch contribution

- Two papers
- **PS2 - Compatibility & interoperability framework to facilitate the step-wise organic development of multi-terminal HVDC grids.**
  (C.A. PLET1 , D. VAN HERTEM2 , C. BRANTL3 , M. WANG2 , H. EVANS4 , J.N. MOORE7 , C.T. NIEUWENHOUT5 , A ARMENI6 1 DNV; 2 KU Leuven; 3 RWTH Aachen; 4 CarbonTrust; 5 RU Groningen; 6 TenneT; 7)
  - Describes the boundary conditions for a successful development of a multi-vendor-multi-terminal HVDC grid which may be operated by several operators and owned in parts by different owners.
- **PS3 - The Gridmaster-toolbox, a step towards a new infrastructure planning paradigm.**
  (H.A.M. WURTH1 , J.N.G. VAN DINTHER1 , J.H. KWAKKEL2 , I. NIKOLIC2 , J.J. STERINGA3 , R. CALON4 , W. ZAPPA4 , A.M. VAN VOORDEN5 , C.J.H. KRUIP6 , M.G. VALIES7 1 Siemens Nederland N.V.; 2 TU Delft; 3 N.V. Nederlandse Gasunie; 4 TenneT TSO; 5 Stedin Group; 6 Quintel Intelligence B.V.; 7 SmartPort)
  - Proposes a multi-nodal approach to decision making by the introduction of a "Gridmaster" tool. The methodology assists in decision making for investment in energy infrastructure capacity. It is proposed as a stress test for investment plan options between a wide possibility of scenarios.
  - Contribution during GDM by Ton Wurth (Siemens)

Paris Session 2022 – Personal take aways

- Traditionally for C1 a lot of focus on interconnectors and large transmission corridors
- Tutorial: “Global interconnected and sustainable electricity system: effects of storage, demand response and trading rules”
  - A pre-feasibility study on the relative impacts of storage, demand response and interconnectors on a global decarbonised system with large amounts of RES. Approach: modelled the globe as 22 nodes, with own demand and production mixes and patterns.
  - Objective: assess how additional storage, DSF and interconnectors affects the Total Annual Cost (EUR/MWh) and CO2 emissions (Mt/yr)



Paris Session 2022 – Personal take aways

Techno-economic optimisation	Cross-border trading enablers	Coordination and institutional prerequisites
• Combination of flexibility means is needed • DR and storage may have global impact on RES integration but are expensive • Interconnectors allow to exploit complementarity of load and generation profiles across regions • Interconnectors provide security and stability benefits • Cost of interconnectors is negligible compared to the cost of generation and fuel, while the impact on decarbonisation is massive	• Political will and intergovernmental agreements • Gradual evolution of the market model from long-term bilateral contracts to more complex capacity allocation based on the energy market settlement • Alignment of codes and standards. • Coordinated settlement and payment, as well as charging. • Institutional arrangements	• Political support for large projects • Legal risk minimisation and investor protection • Access to the grid, ownership, operation and maintenance • Harmonised transmission tariffs and remuneration frameworks • Regional coordination between institutions enabling cooperation of TSOs and utilities • Regulatory harmonisation

Emphasizes the important role that C1 study committee has in developing the know-how on expanding the transmission grid quickly, in a cost efficient and coordinated way, taking into account regional specifics and developments.

Paris Session 2022 – Personal take aways

Situation

- Today's networks are at their **limit**
- Energy system develops **simultaneously in multiple vectors**
  - high voltage transmission
  - medium voltage transmission
  - hydrogen
  - heating
- To keep up with the development in RES generation and demand, the **scale of investment** in the infrastructure needs to grow by several times

Challenges to be addressed

- How to **invest wisely** and **avoid stranded assets**?
- How to invest just enough and **minimise societal costs**?
- How to **coordinate multiple vectors**?

Preferential subjects C1 2024

PS1: **Steering the Energy Transition: cooperation, achieving top-down targets through bottom-up investment decisions**

Interconnections & System Integration

- Governance of the different sectors of the integrated energy system, role of system operators, role of regulation & markets; achieving public targets through private investments, coordinated decision-making processes and international cooperation
- Power-to-Gas & Hydrogen as energy carrier and as long-term storage; energy efficiency & infrastructure efficiency in the interconnected electricity/gas/hydrogen system; large interconnection projects
- System aspect aggregation of the electrification of transport, industry, and buildings: conditions and barriers, role of stakeholders in the End-to-End system

PS2: **Flexibility as pivotal criterion for system development**

Grid Planning & System Development

- Including in the planning process the flexibility options both within and outside the grids; non-network-assets and non-electric solutions: Storage, Demand Response, Energy Communities, behind-the-meter resources
- Matching flexibility needs with flexibility sources: market design evolution, value of various flexibility products, optimal flexibility portfolio; prioritization of sector coupling initiatives; role of forecasts of demand and variable generation
- Storage device evolution, technical & economic performances, short/medium term measures for balancing the grid, and managing the energy system in the longer term, including thermal & molecular long duration energy storage

PS3: **Resilience as pivotal criterion for system development**

Asset Management & Economics

- Metrics and criteria to plan resilience and strength of the future power system; flexibility means as enhancers also of resilience
- Optimal planning and efficient use of resilience measures: risk assessment, prevention, mitigation, adaptation, re-start measures
- Resilience improvements from grid architecture and grid components: including the role of power electronics control and grid forming features, smart load shedding, and fast restoration methods


Thank you for your attention!
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