Workshop 5: 100% Decarbonization. What is needed to completely turn off thermal power plants for 100% RES secure system operation?

EU and national strategy, policy and regulation

EU Green Deal | Fit-for-55 | REPowerEU

Renewable energy Directive (2018/2001/EU) , Electricity Market Directive (EU/2019/944), Regulation on internal market for electricity 2019/943

Guideline on electricity transmission system operation 2017/1485

Network code on Demand Connection 2016/1388 | Network code on requirements for grid connection of generators 2016/63

Grid system services

1 Frequency regulation
- **A** primary
- **B** secondary

2 Voltage regulation

3 System inertia

4 Short-circuit capacity

5 Demand modulation (secondary control)

Upgrade of existing generation plants

- TPP - should be more efficient and decarbonized (renewable fuel, or couple with battery)
  - Issue with funding
- Hydro power plants can provide **1, 2, 3 and 5**
  - with synchronous condenser capability(SC) can provide **4**
- Waste incineration plants can provide **2 and 3**

Innovative technology

- PV and wind can provide **3**
- Battery Electricity Storage Systems (BESS) can provide **1A and B and 2**
- Pumped hydro can provide **5**
  - with variable frequency pumping can provide **1B**
  - with SC capability can provide **2, 3, 4**
- Synchronous Condenser can provide **2, 3, 4 and 5**
- Mechanical storage
- Hydrogen

Sector coupling

- Heating/cooling systems
- (Waste)water and waste systems
- Transport
  - Vechicle 2 Grid

Optimal system planning

- System analysis and planning
- Forecasting tools
- End-of life and circularity

Investment

Upgrade of existing grid and generation plants
Implementation of innovative technologies
Public and private funding

Clean Energy for EU Islands

- TPPs provide to islands stability, adequacy and security of supply
- Grid codes made based on the systems with TPPs
- Grid forming standards
- Grid stability toolbox
- System inertia missing is the main issue with RES

- Improvement of control of EMS
- Use of biofuels to decarbonise existing thermal generation
- Planning of use of technologies aligned between TSO and DSOs

- Control of distributed RES generation should be made possible
- BESS coordinate with hydro and other RES
- EU funding for innovative technologies

- demand management of large consumers (industry etc.) is not new
- V2G can be used for frequency regulation but data management should be done locally
- Combined Heat and Power (CHP)

- Techno-economically optimal planning should involve all stakeholders
- Resilient to extreme weather conditions
- Market on the islands - hard to organize
- Easier planning for bundled systems currently

Examples presented

Faroe islands
French islands, La Reunion
Eolian islands, Minori island
El Hierro, Canary islands
Gran Canaria, Canary islands
Sao Miguel, Azores
Madiera
Porto Santo
Tilos
Kodiak island, US
Orkney islands
Maui, Hawaii