Integrating renewables into the Japanese power grid by 2030

A frequency stability and load flow analysis of the japanese system in response to high renewable penetration levels

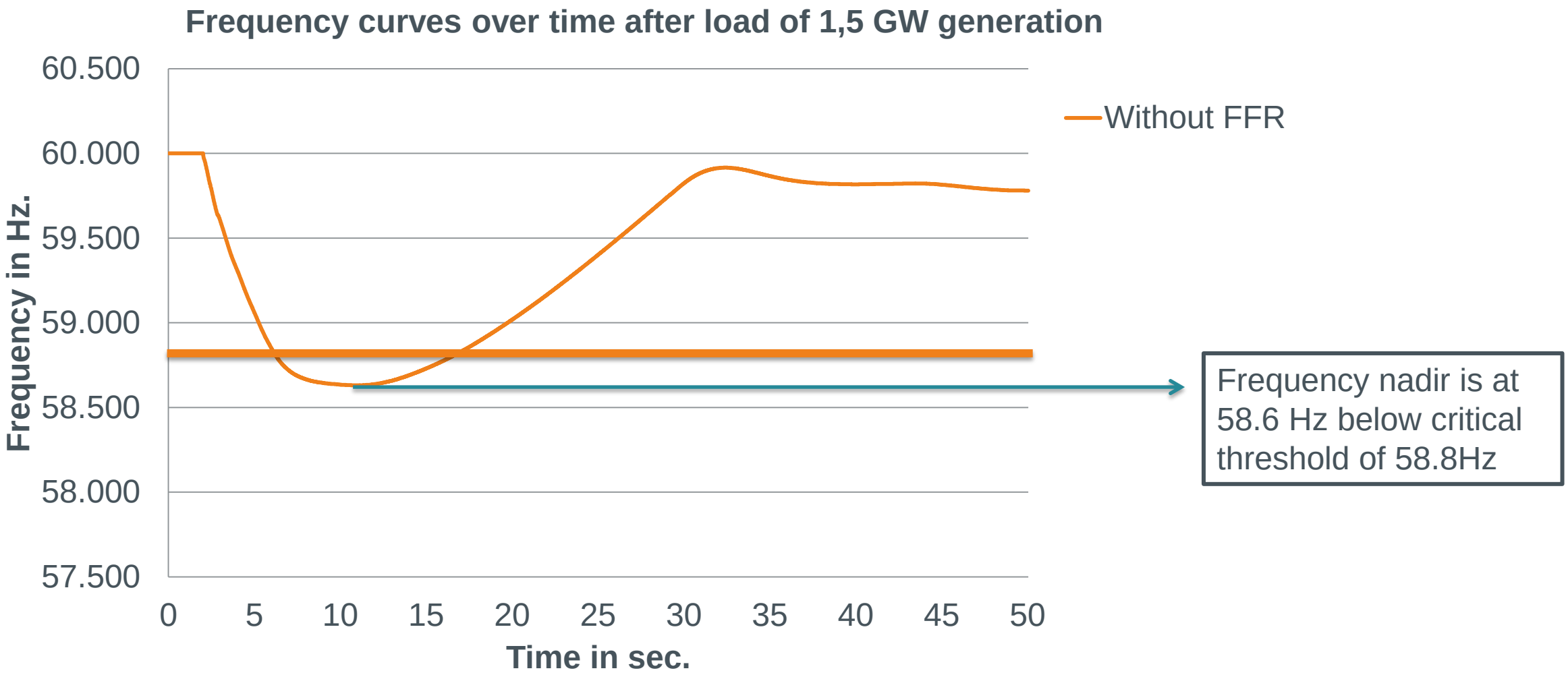
Tokyo, 17.12.2018, Peter Merk

egi elia grid international

Objectives of the Study

- Establish a reusable, sustainable and transparent tool chain for future use
- Assessment of different Scenarios for Japan 2030
  - Governmental Scenario
  - Higher RES Scenario
- Evaluate further possibilities for renewables in order to facilitate renewable integration
  - Ancillary service participation
  - **Frequency stablity participation**
- Publication of the Grid Model
- Deriving recommendations and conclusion for different Stakeholders in the Japanese power sector and encouage the public discussion.

Frequency Curves without FFR

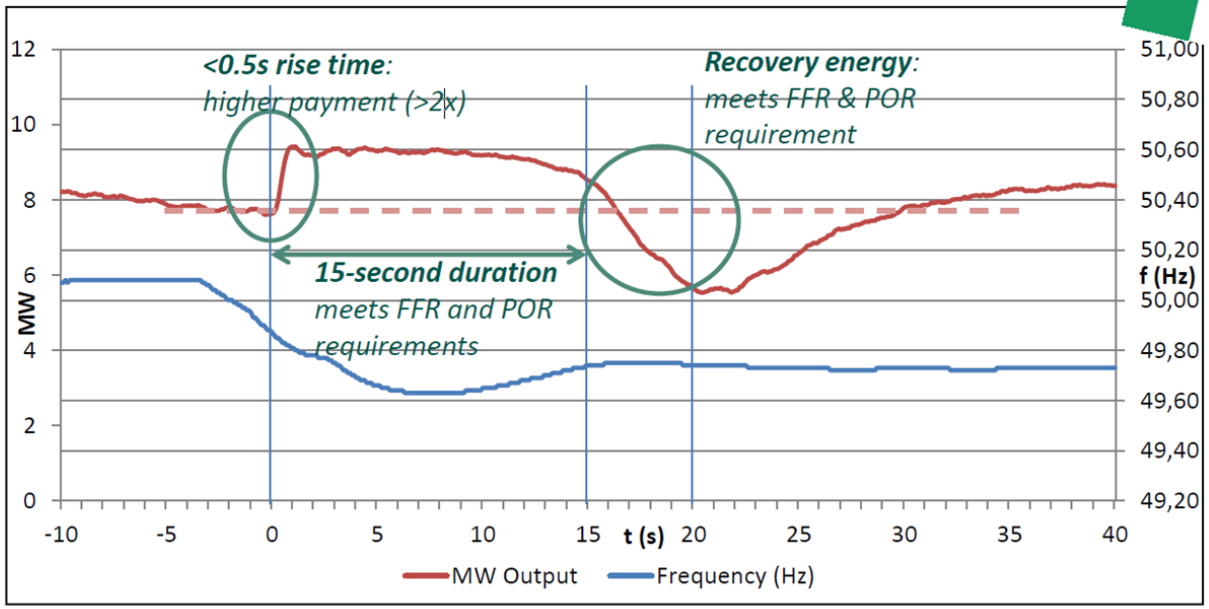


Over comming Frequency Issues

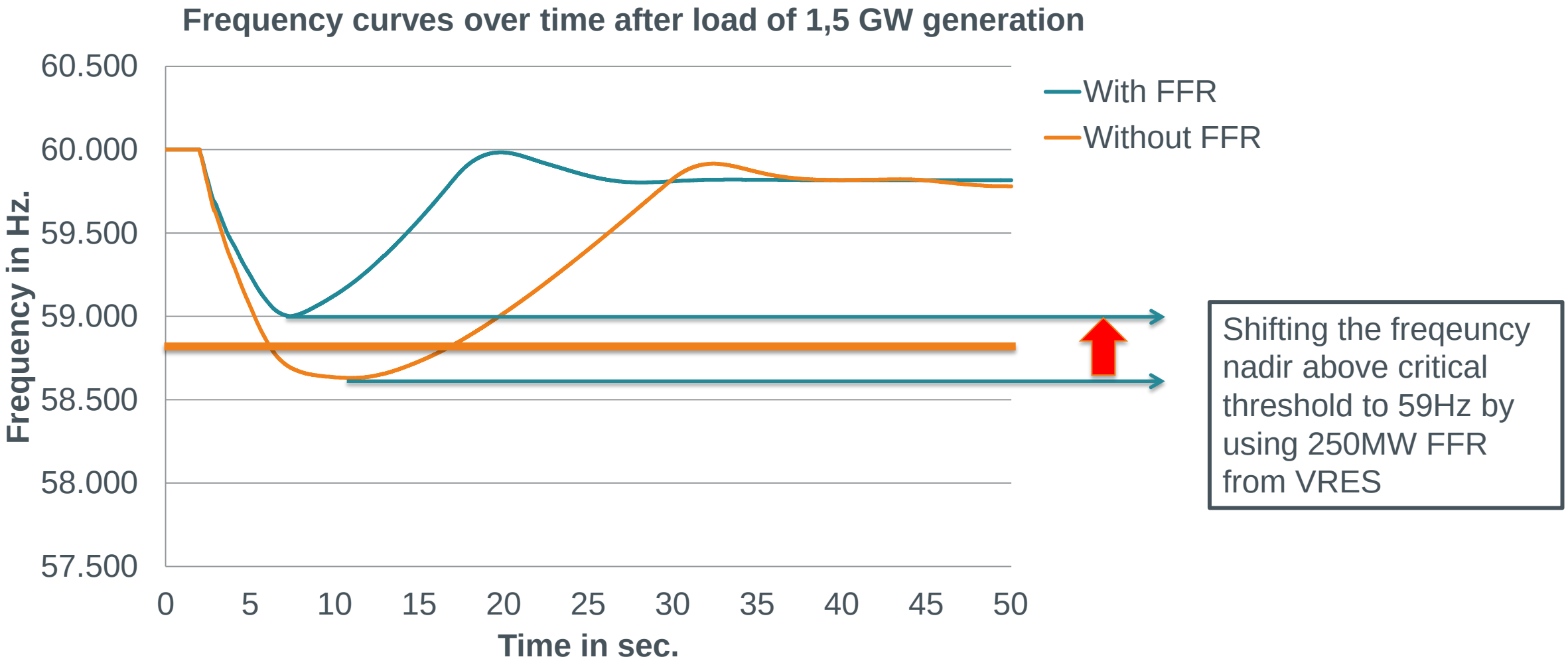
Fast Frequency Response (FFR) is a super fast (<1s) ancillary service provides/consumes power in cases of grid frequency deviations.

- In general the service can be provided by **many different technologies**, including wind, solar, batteries, demand side response or synchonious condensors.
- In many power systems, especially electically isolated systems this is already **state of the art**. This includes for example the UK, Ireland, Texas (Ercot / US).

FFR Test in Ireland 2017, Enercon wind trubine

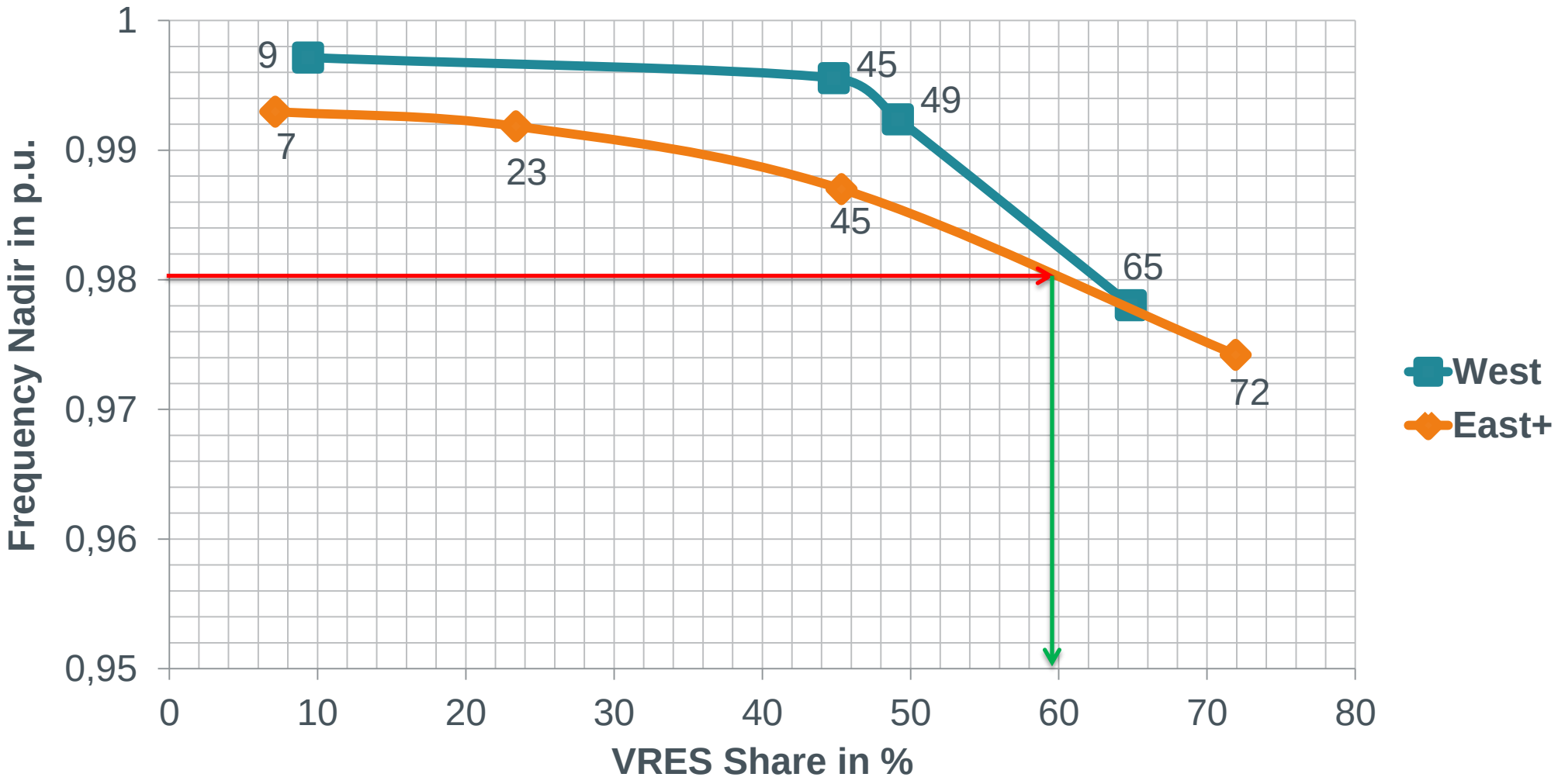


Frequency Curves with FFR



Shifting the freqeuncy nadir above critical threshold to 59Hz by using 250MW FFR from VRES

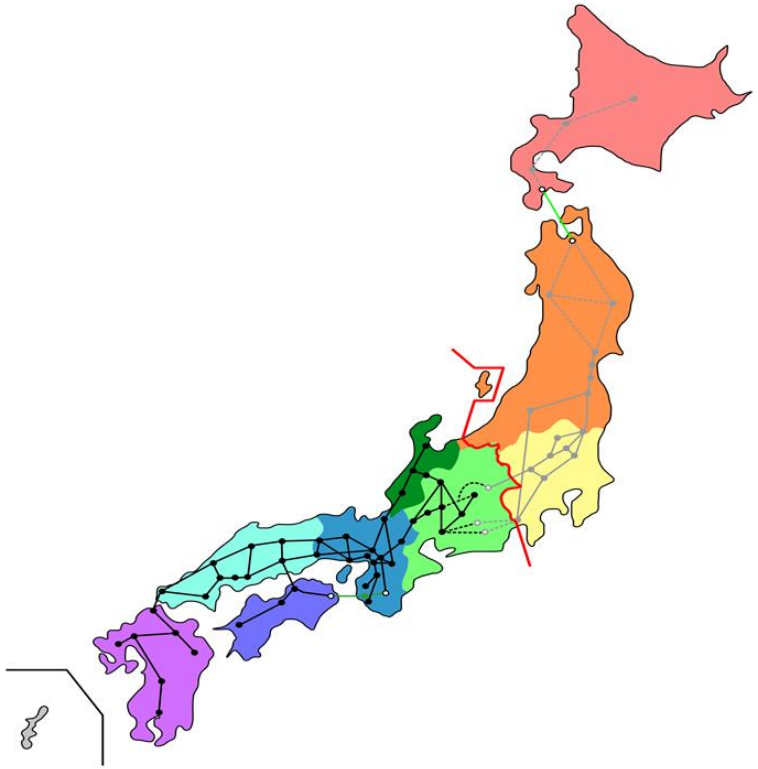
How far can we go considering FFR and stability limits?



How is the grid loading affected impling higher shares of RES?

More renewables don't necessarily mean more congestions – Location is Key

EPCO Region	Loading Tendency	
	Western Synchronous Area	
Kyushu	Increasing	
Chugoku	Increasing	
Kansai		Decreasing
Hokuriku		Decreasing
Chubu		Decreasing
Shikoku	Increasing	
	Eastern Synchronous Area	
Tohoku	Increasing	
Tokyo		Decreasing



Recommendations

Volatile Renewable Energy Source such as wind and solar PV can be part of the ancillary service concept in transmission and distirbution grids. However all sides need to work together to make this happen:

Policy and regulating bodies

- Implement a non-discriminated framework for renewable integration

System Operators

- Make renewables part of the ancillary services concepts. Use them as competitive technology in order to reduce costs for ancillary service procurement.

Renewable Developers

- Anticipate requirements needed for grid services and explore further services renewables can provide

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