Utility Scale Battery Energy Storage System Grid Connection

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make everyday better.

Introduction

- System Strength
- Technical Performance Standards
- Generator or Load?

System Strength

- What is system strength?
- Why is it important?
- How do you improve it?

Steady-state

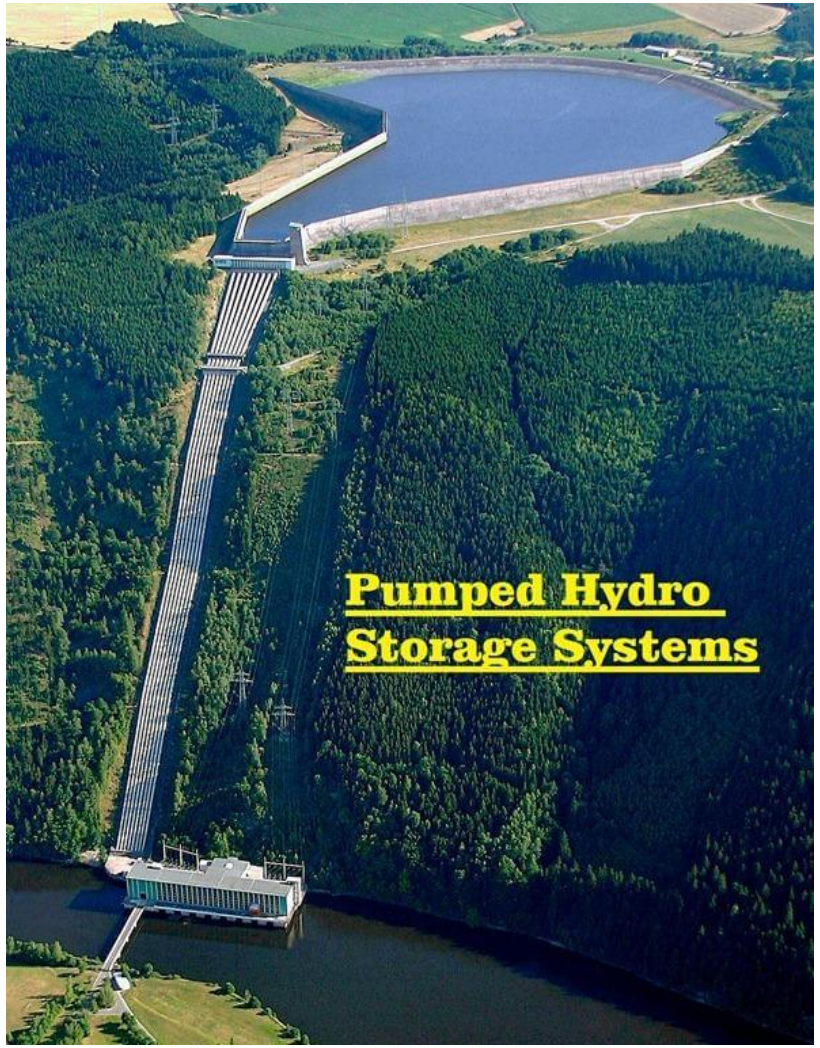
Following a disturbance

Synchronous Condenser

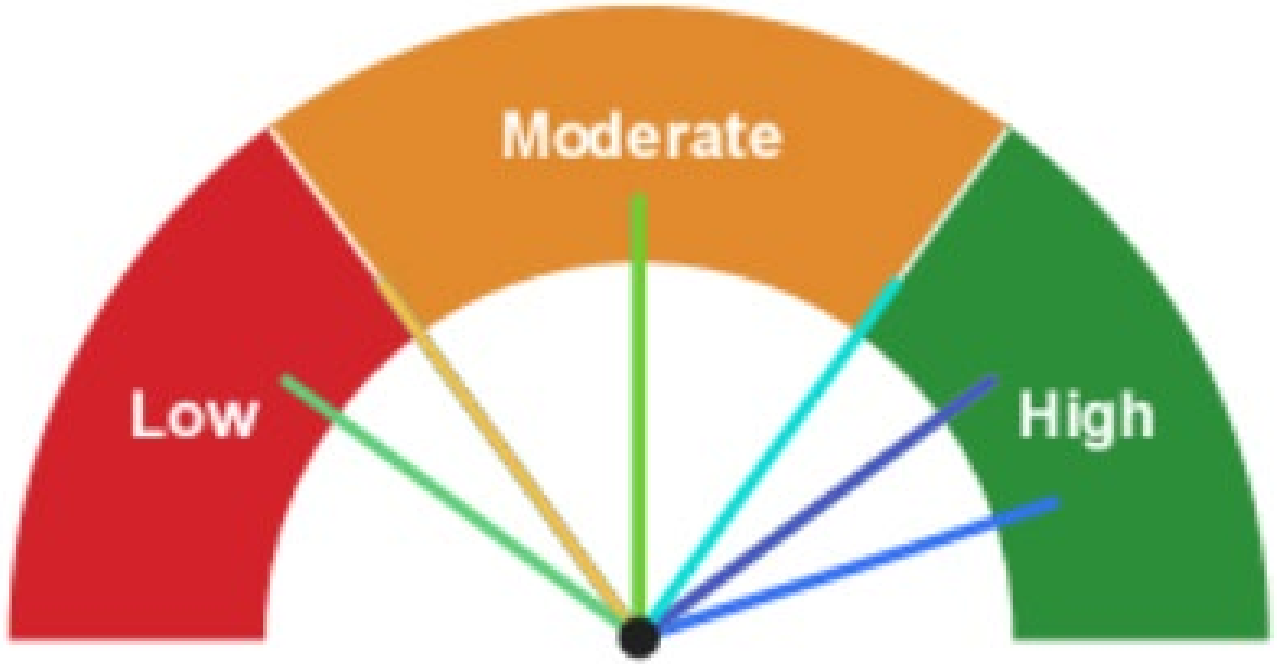
Hitachi ABB Synchronous Condenser

System Strength Remediation

- Synchronous Storage
- Special Protection Schemes
- Grid forming inverters



Technical Performance



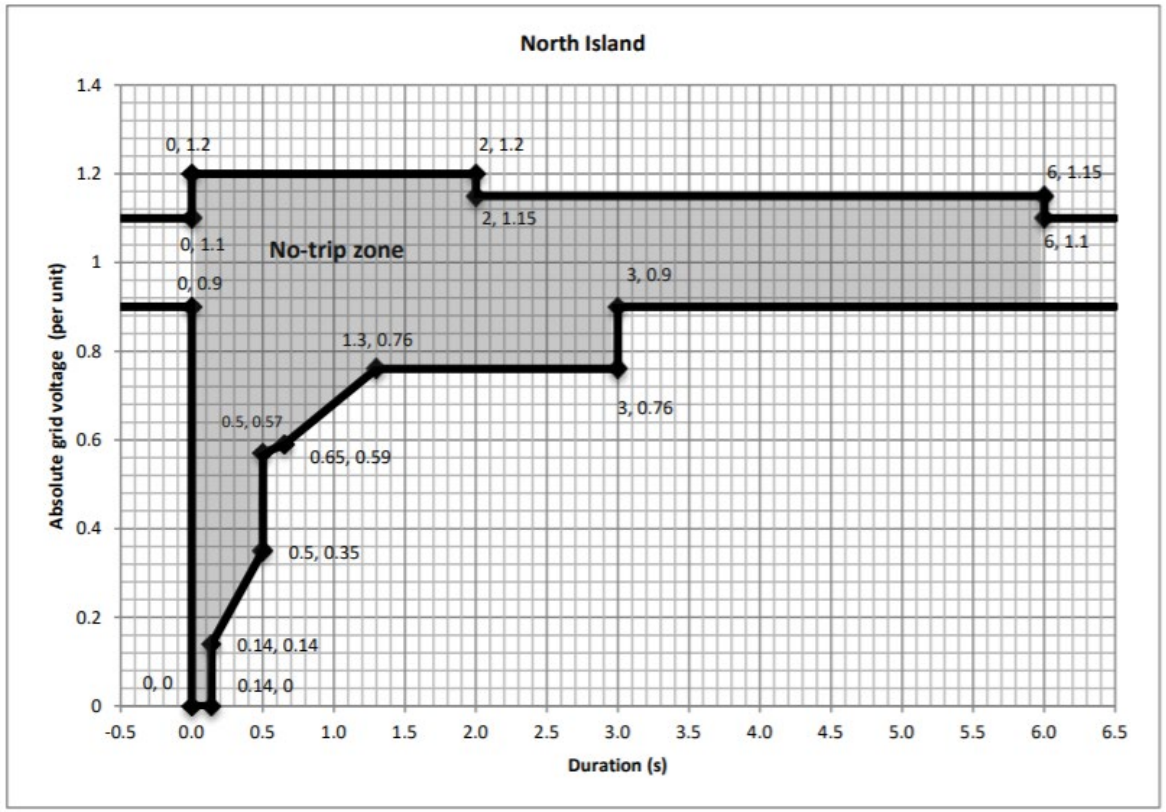
Quality of Electricity Generated

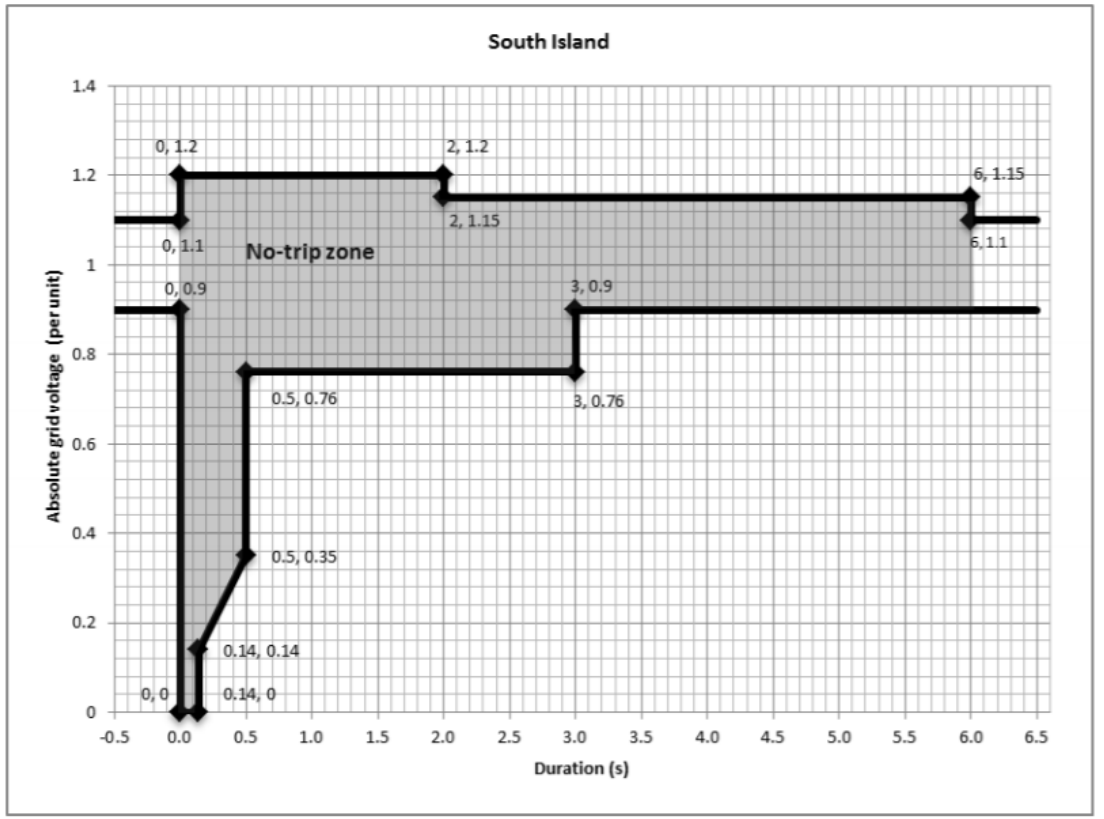
- Inverters considered to be a source of harmonic emission
- Emission limits provided by network services providers at point of connection
- In NZ, EPIC does not state limits which is both an opportunity and risk

Response to Disturbances

- Generating System Response to Frequency Disturbance
- Generating System Response to Voltage Disturbance
- Generating System Response to Contingency Events

Response to Disturbances





Generator or Load?

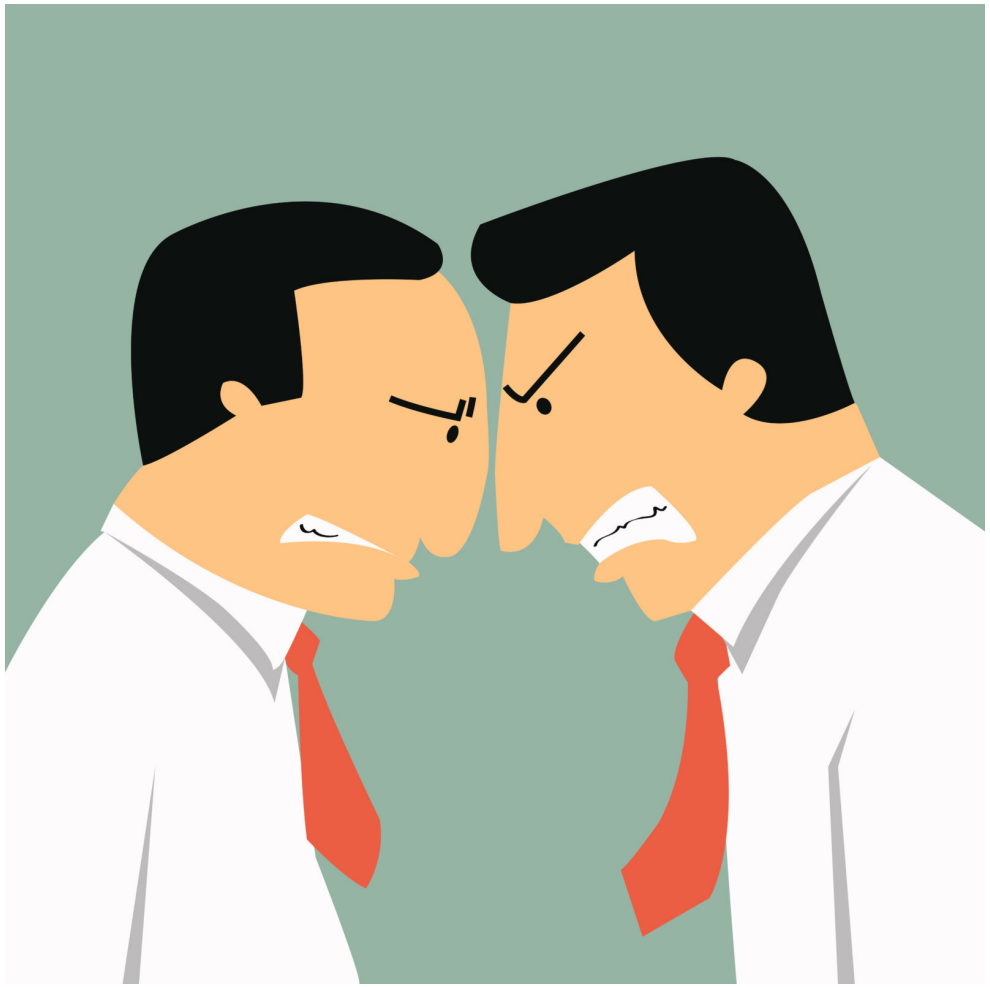
Hornsdale Battery Reserve – South Australia

- Generating system considered to be a load when importing power i.e charging
- Generating system considered to be a generator when exporting power

Generator or Load?

- Power Factor
- Balancing of load currents
- Voltage fluctuations
- Harmonics and voltage notching
- Load shedding facilities

Generator or Load?



Summary

- System strength shortfall is becoming an increasingly common problem
- Ride through capability during contingent events is challenging
- Generator vs Load

Questions