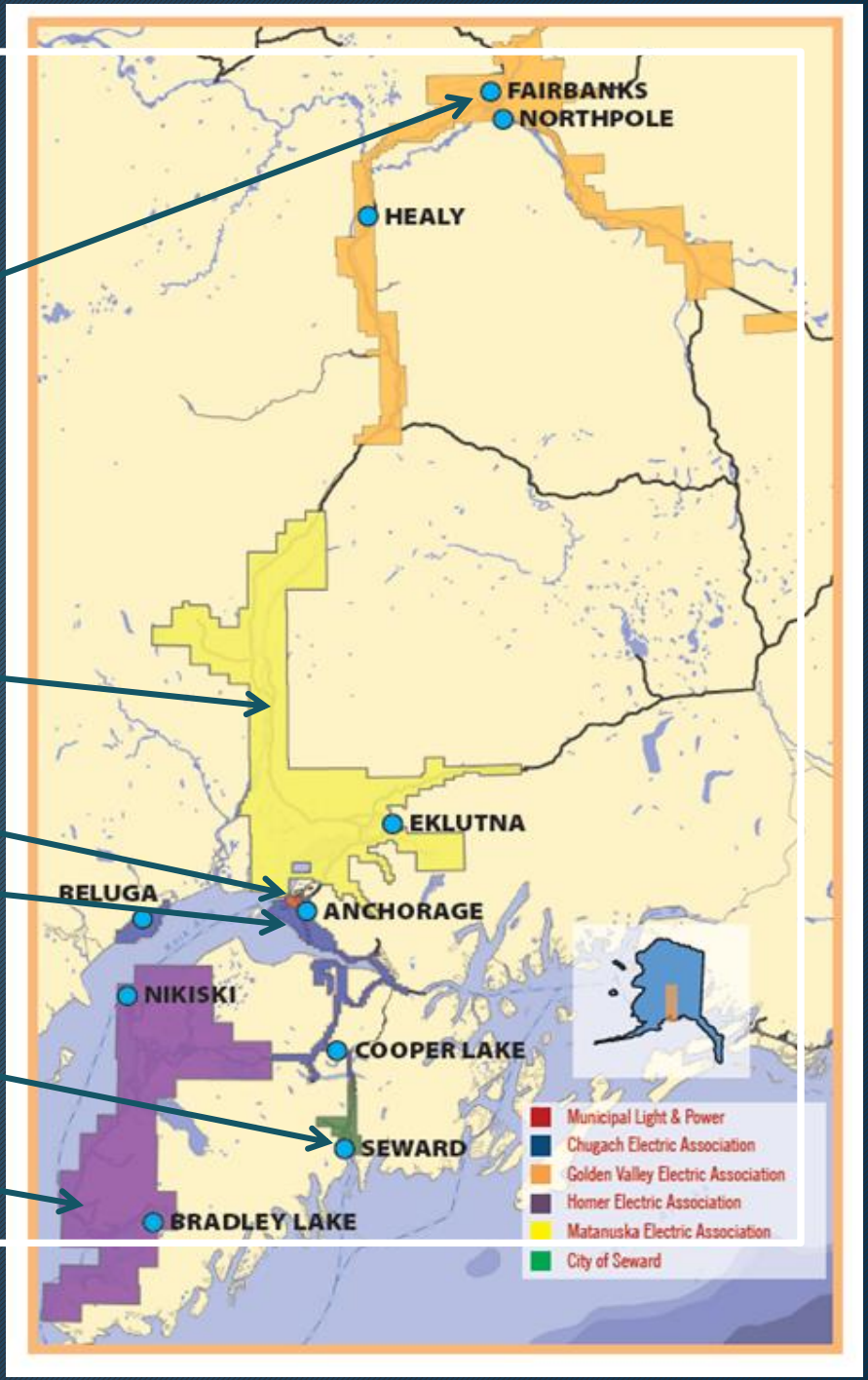
CHUGACH
POWERING ALASKA'S FUTURE

An Introduction to Alaska's Interconnected System (The Railbelt)

Railbelt Utilities

- GVEA
- MEA
- AML&P
- Chugach
- Seward
- HEA



Chugach Snapshot

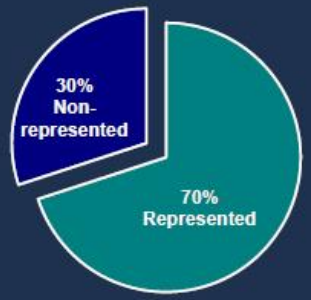
- Member owned electric cooperative
- Governed by a seven member Board of Directors
- Not-for-profit
- Regulated by the Regulatory Commission of Alaska(RCA)
- Represented and non-represented workforce
- Adopted sustainability, also known as the Triple Bottom Line(TBL), as a business management philosophy
  - TBL is a method of evaluating a business's performance using economic, social, and environmental measures

Chugach Snapshot

Fully integrated

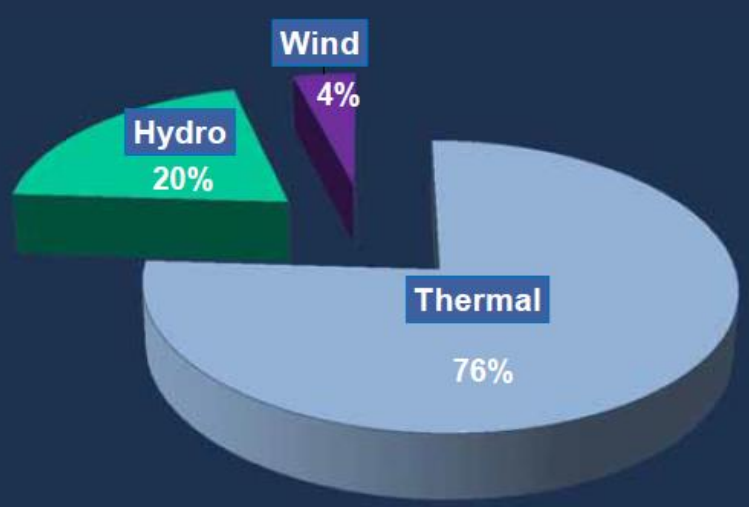
Generation **Transmission** **Distribution**

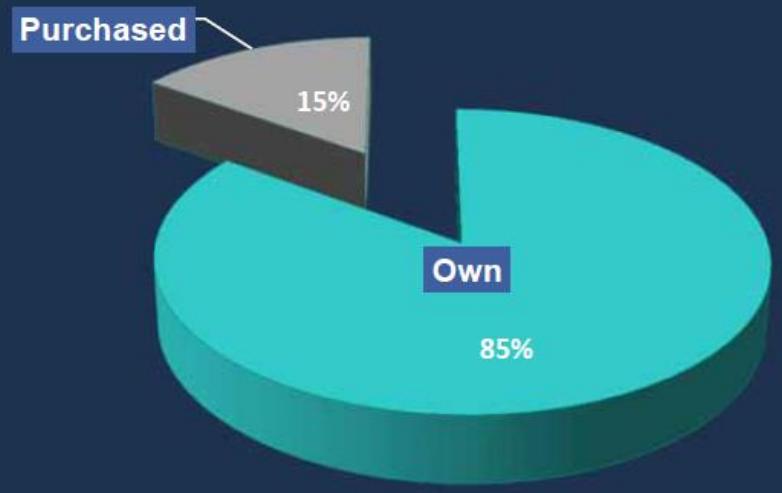
Approximately 68,200 retail members
Approximately 83,500 service locations
Approximately 290 employees



531 megawatts (MW) of thermal and hydro generation
434 miles of transmission line
1,719 miles of distribution line

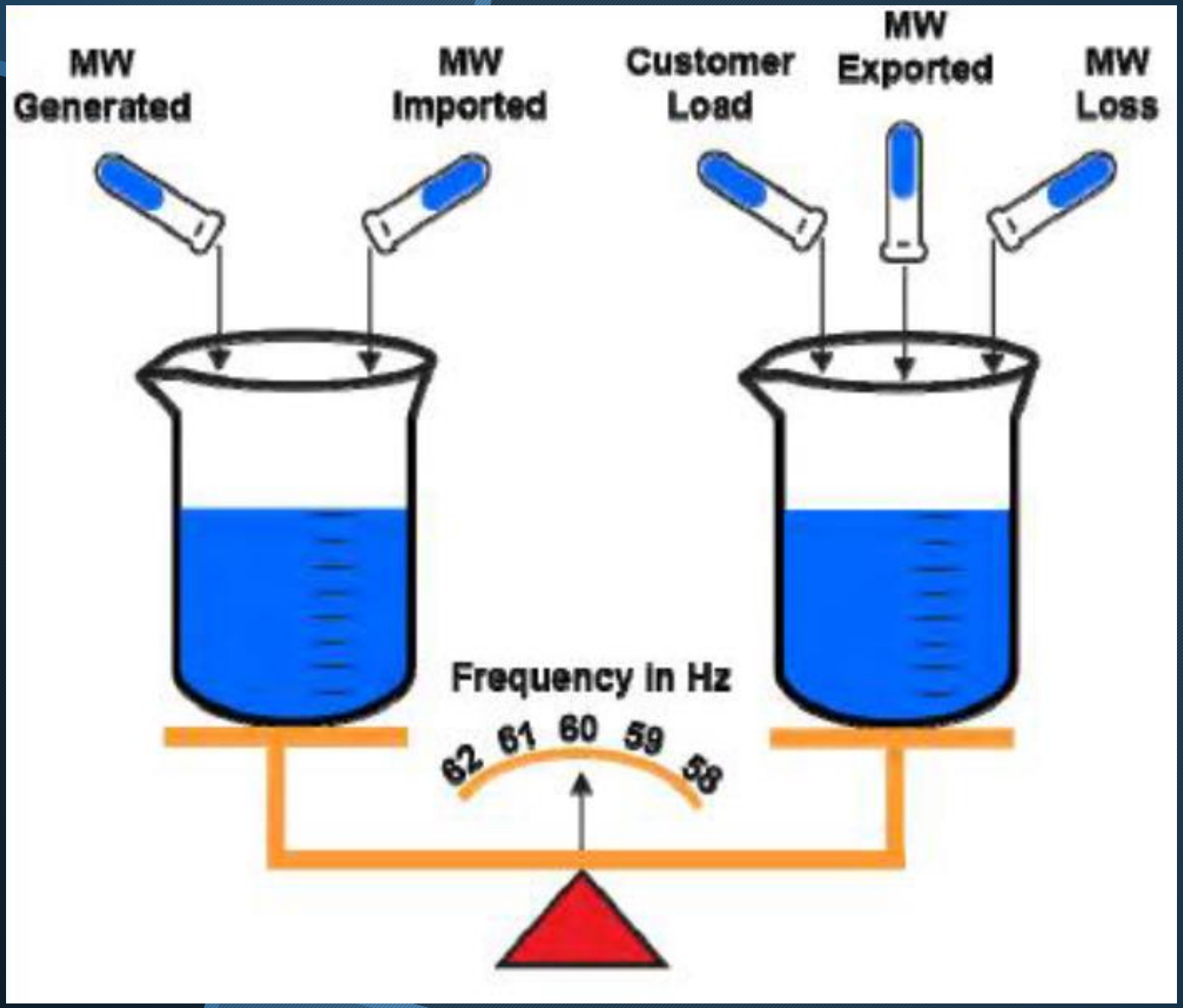
2016 Generation & Purchases (MWh)



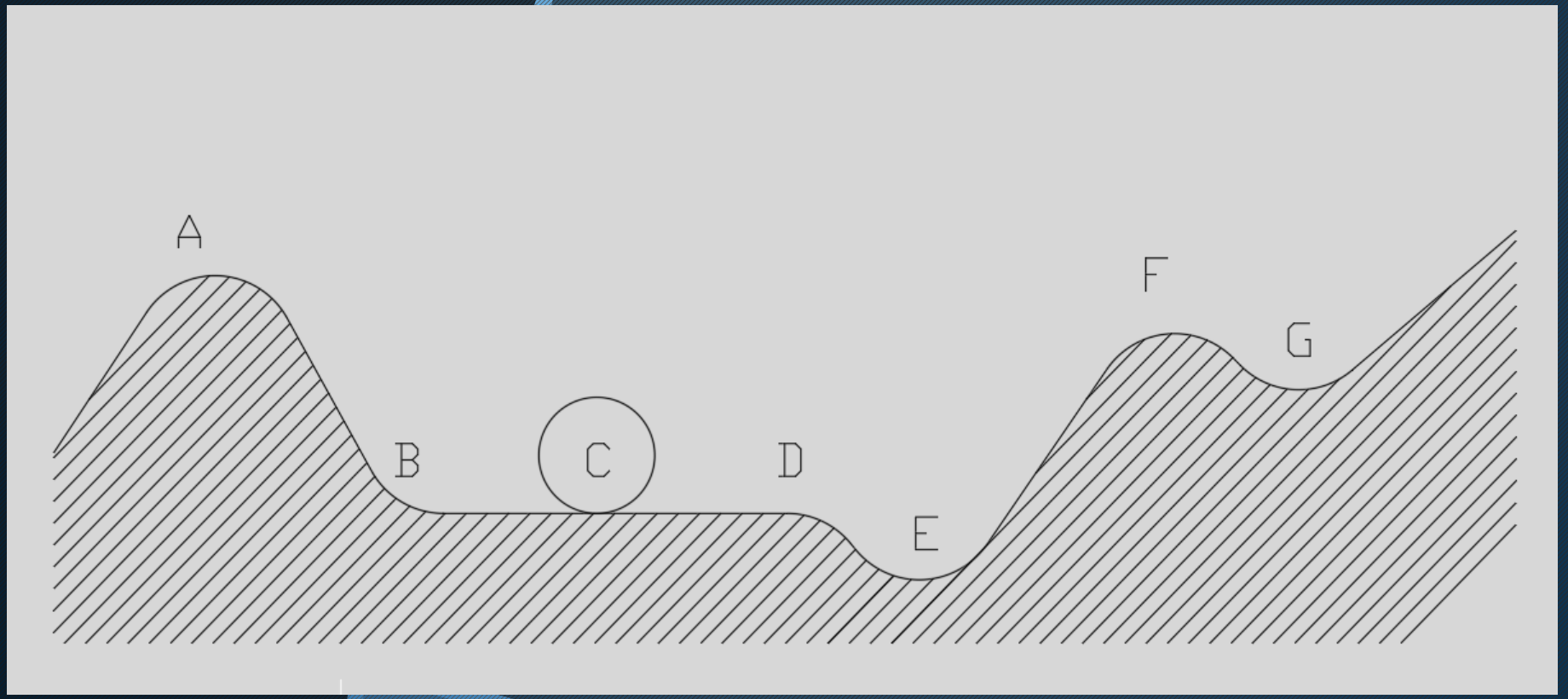


Railbelt Resiliency/Stability

- "Resilience - an ability to recover from change.
- "Stability - to restore the original condition when disturbed from equilibrium


MW Generated
MW Imported
Customer Load
MW Exported
MW Loss
Frequency in Hz
62
61
60
59
58

When is a system stable?



Instability Triggers

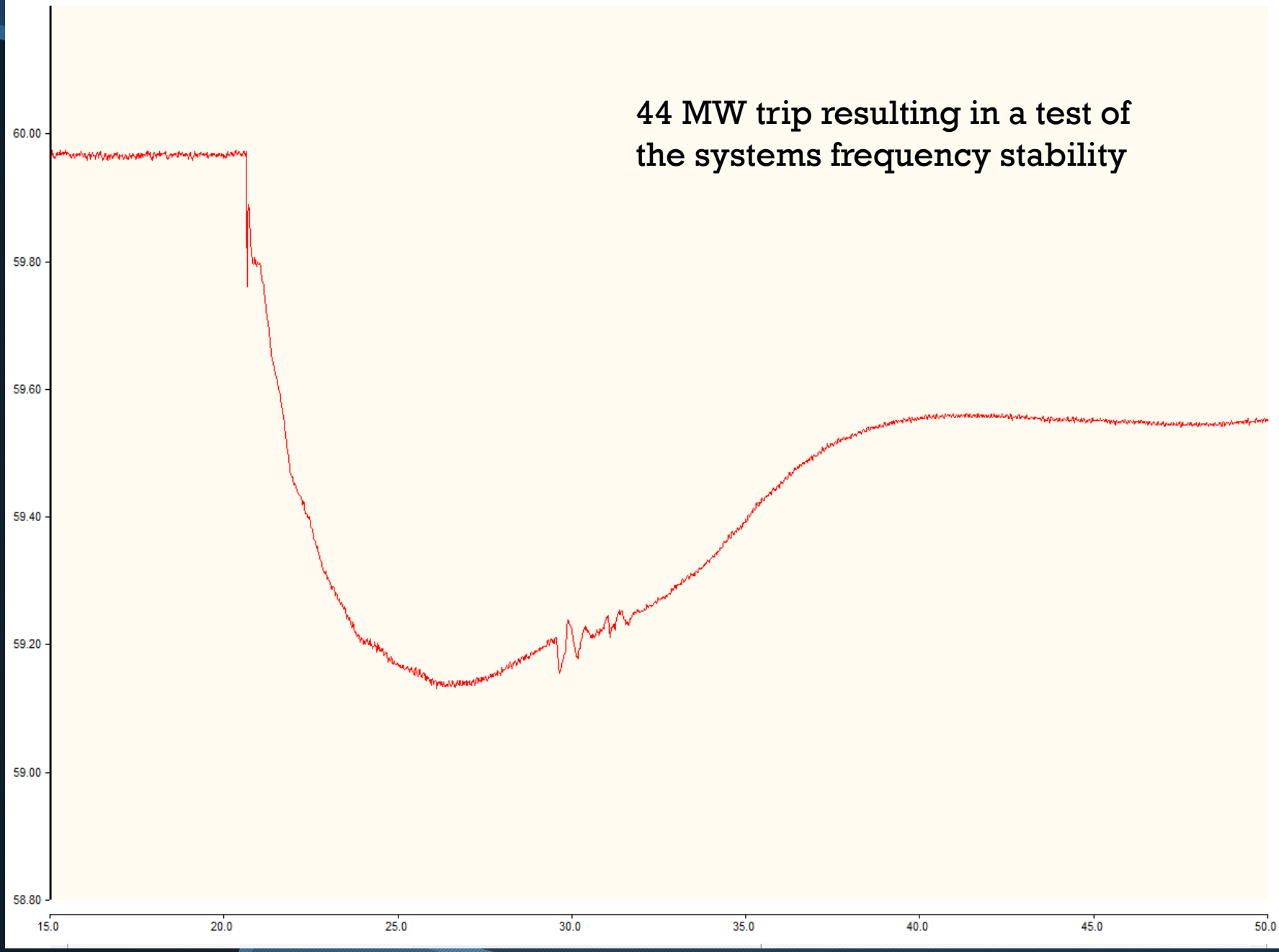
- System Faults
- Generation Trips
- Load Tripping/switching
- Any event that disturbs the balance

Types

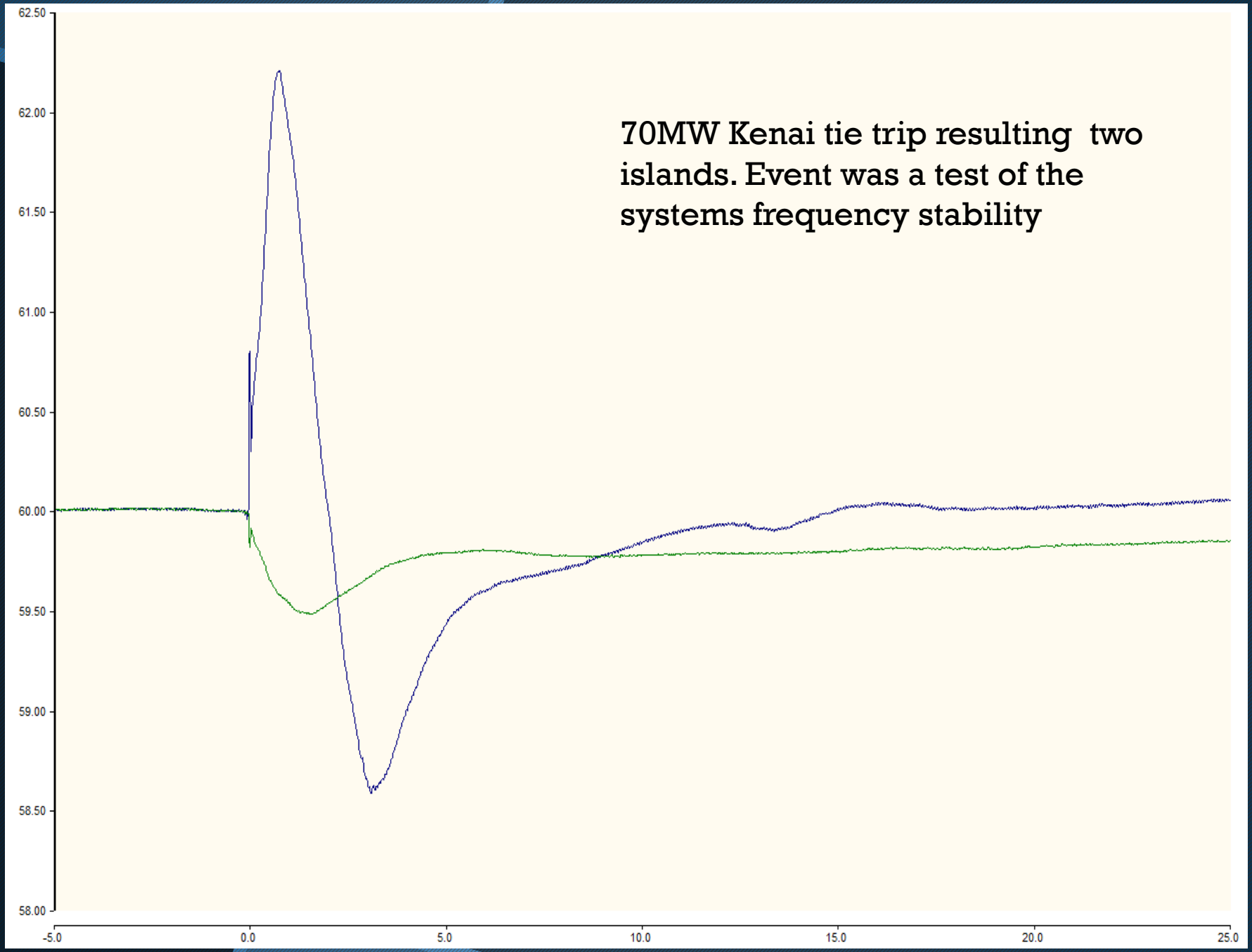
- Frequency Stability
- Voltage Stability
- Angular Stability

Frequency Stability

44 MW trip resulting in a test of the systems frequency stability

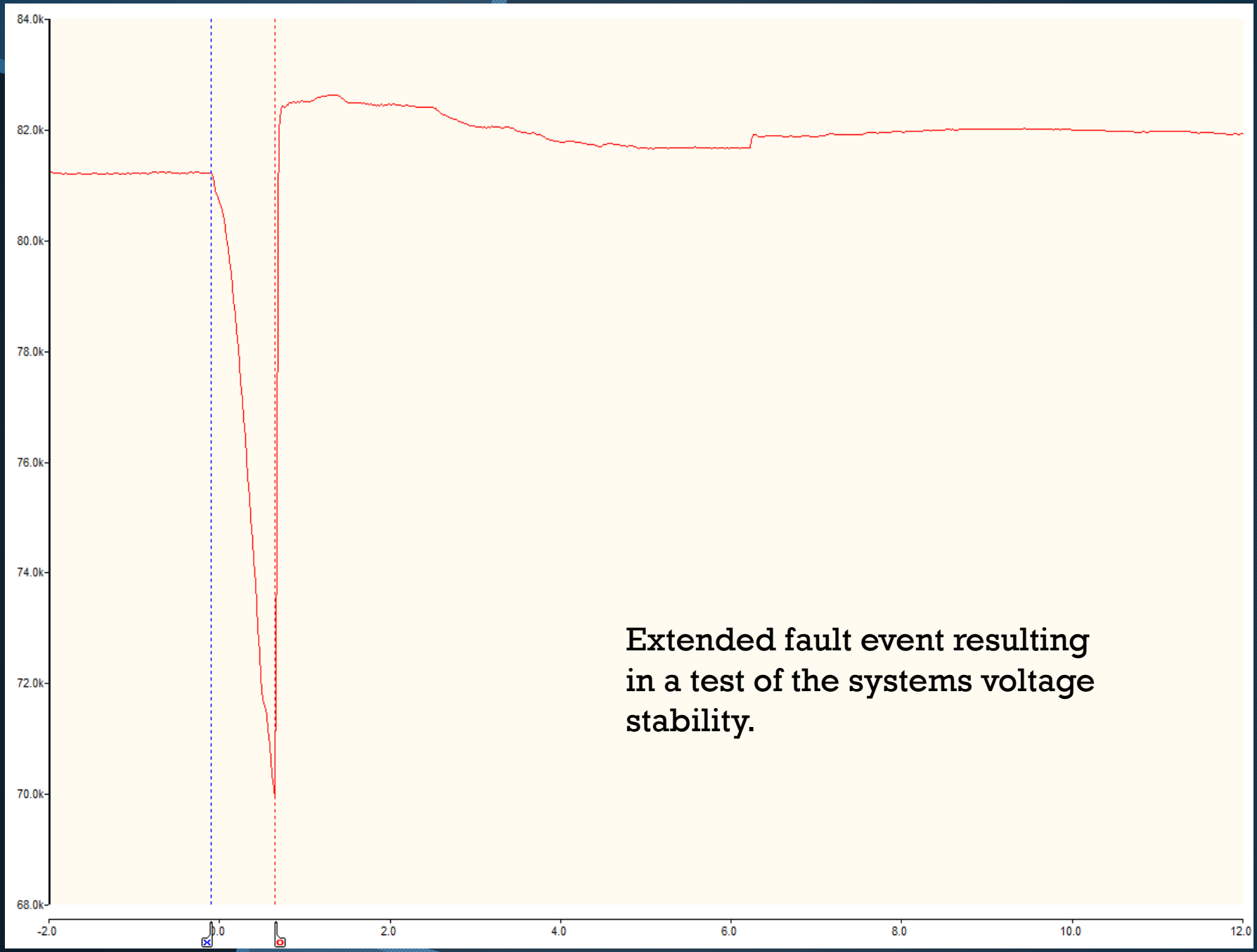


Eastern (EI)	Western (WI)	ERCOT (TI)	Québec (QI)	Units
2,483	1,344	807	620	MW/0.1Hz

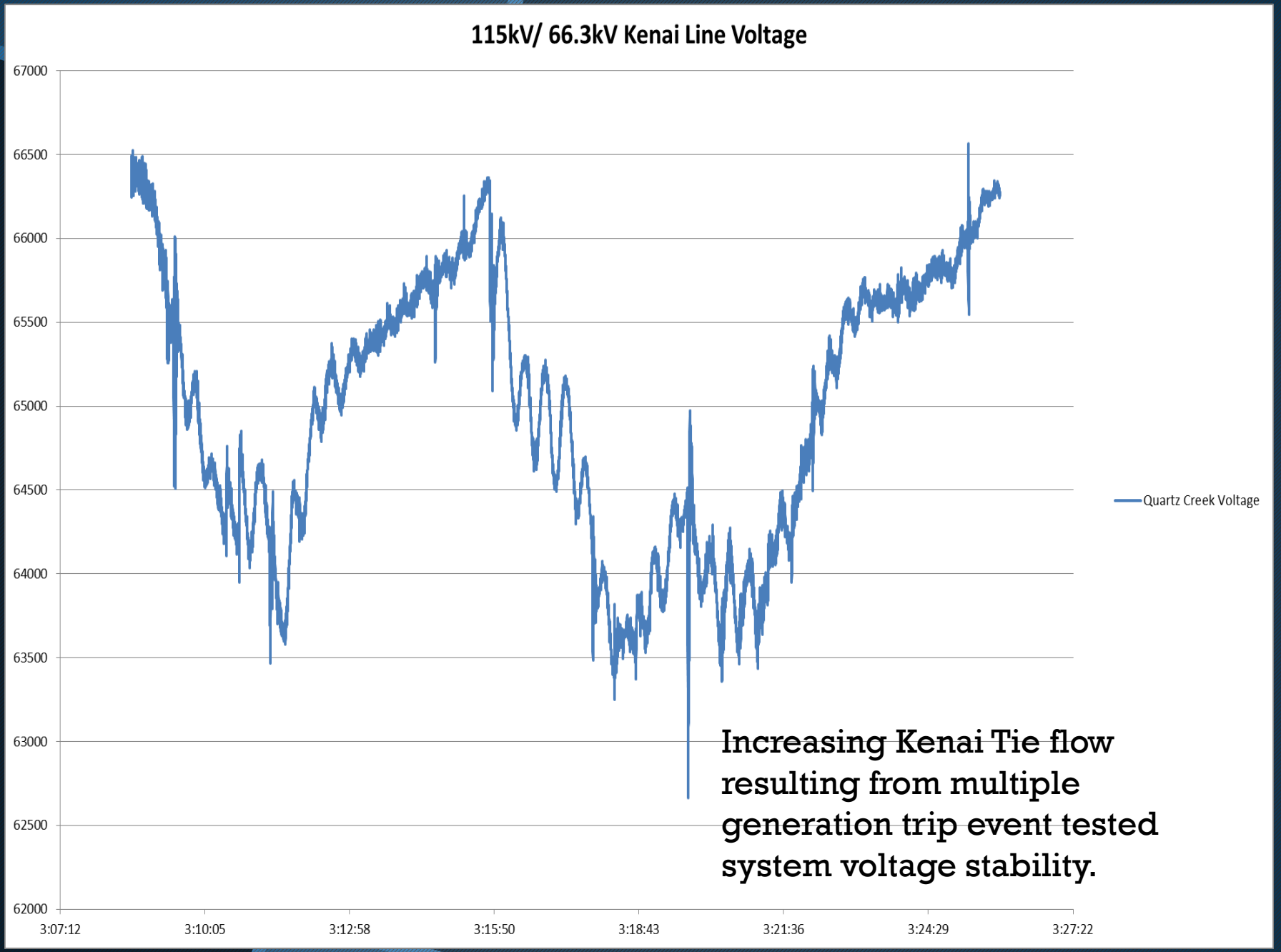


70MW Kenai tie trip resulting two islands. Event was a test of the systems frequency stability

Voltage Stability

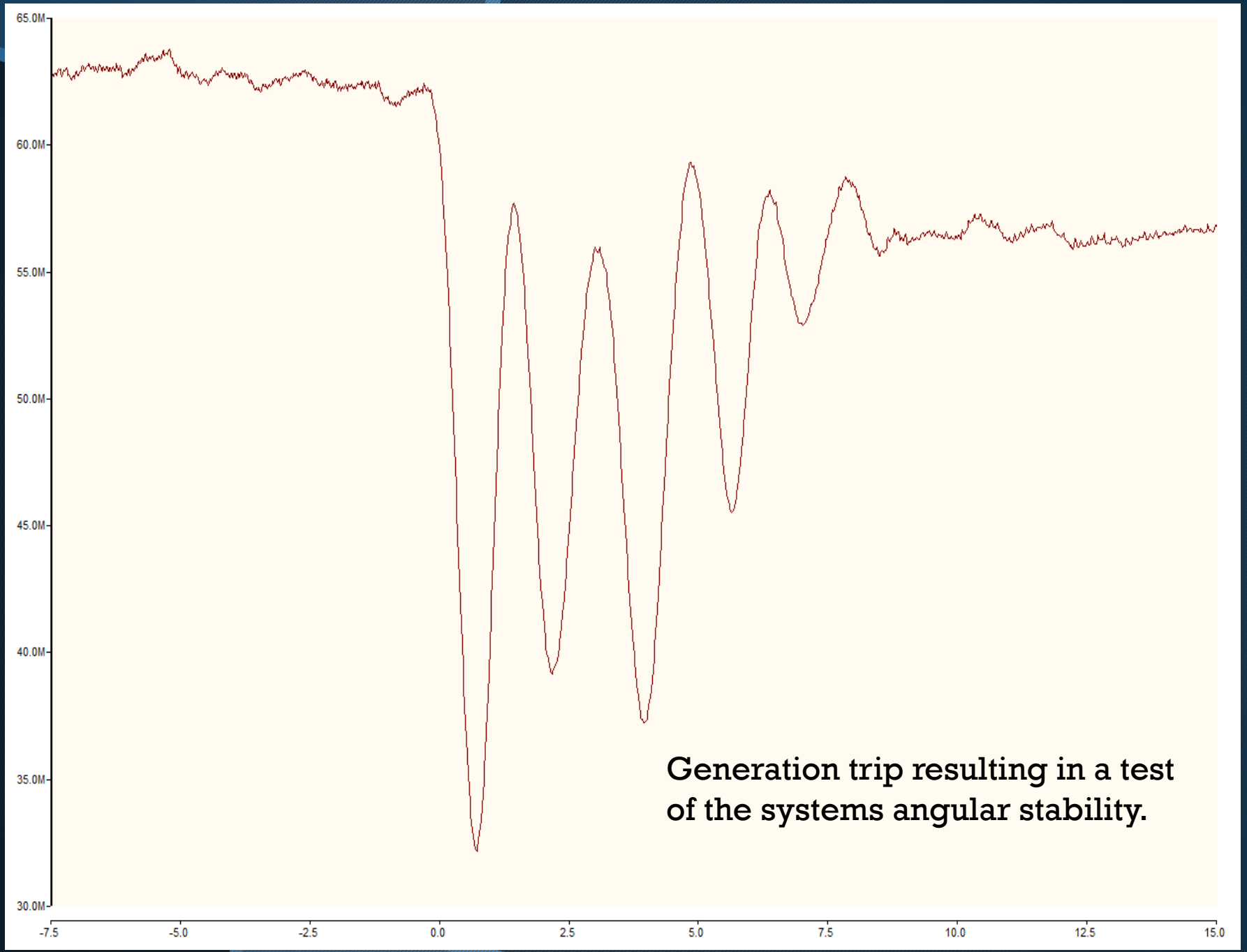


Extended fault event resulting in a test of the systems voltage stability.

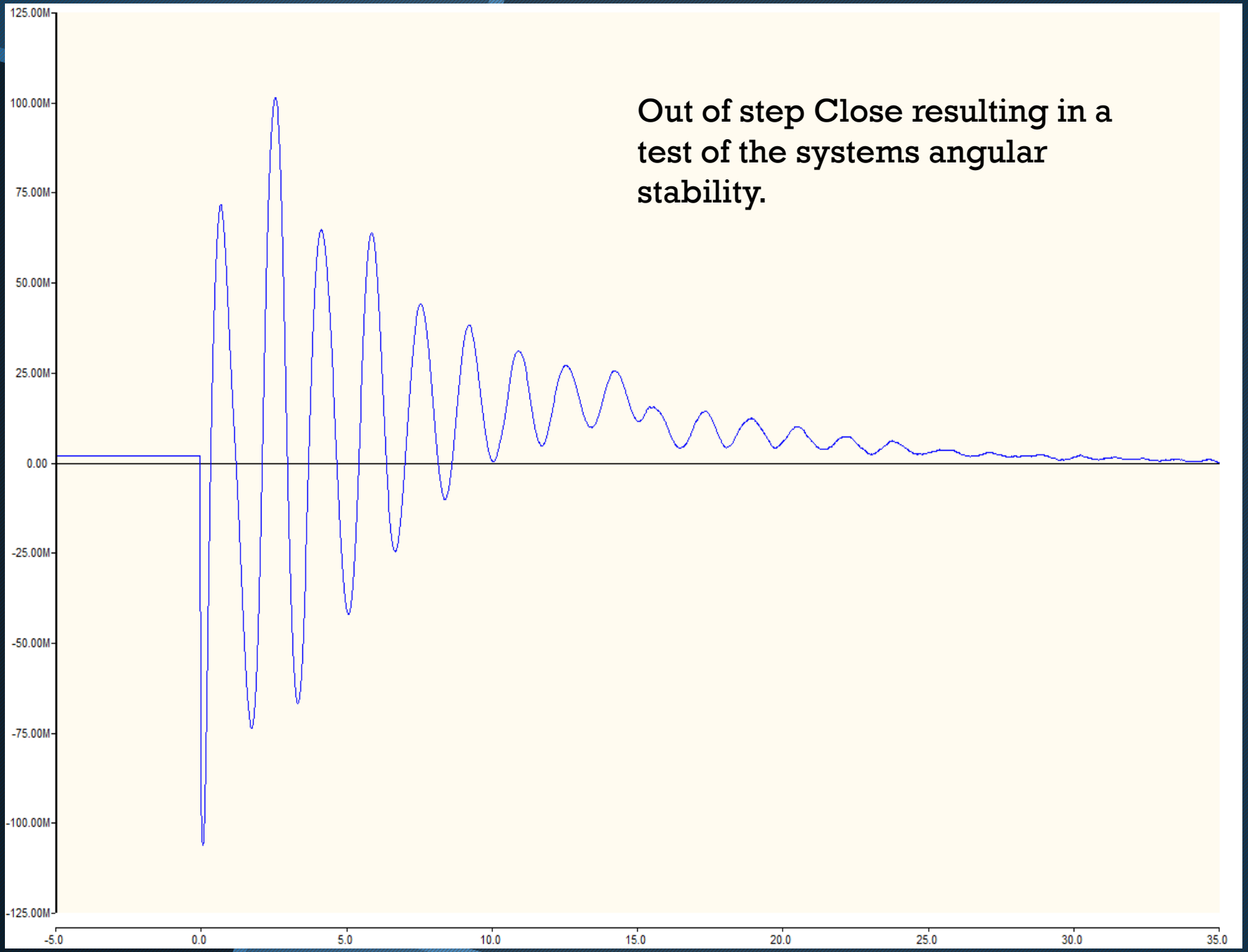


Increasing Kenai Tie flow resulting from multiple generation trip event tested system voltage stability.

Angular Stability



Generation trip resulting in a test of the systems angular stability.



Out of step Close resulting in a test of the systems angular stability.

How to increase stability?

- ✓ Control the magnitude of the event
- ✓ Control the duration of the event
- ✓ Control the initial state of the system

Railbelt projects increase stability

- 230 kV Transmission
- Install SVC
- UFLS system
- Generation Settings

Chugach Resiliency Effort

- Governor Tuning
- Large Scale Battery