

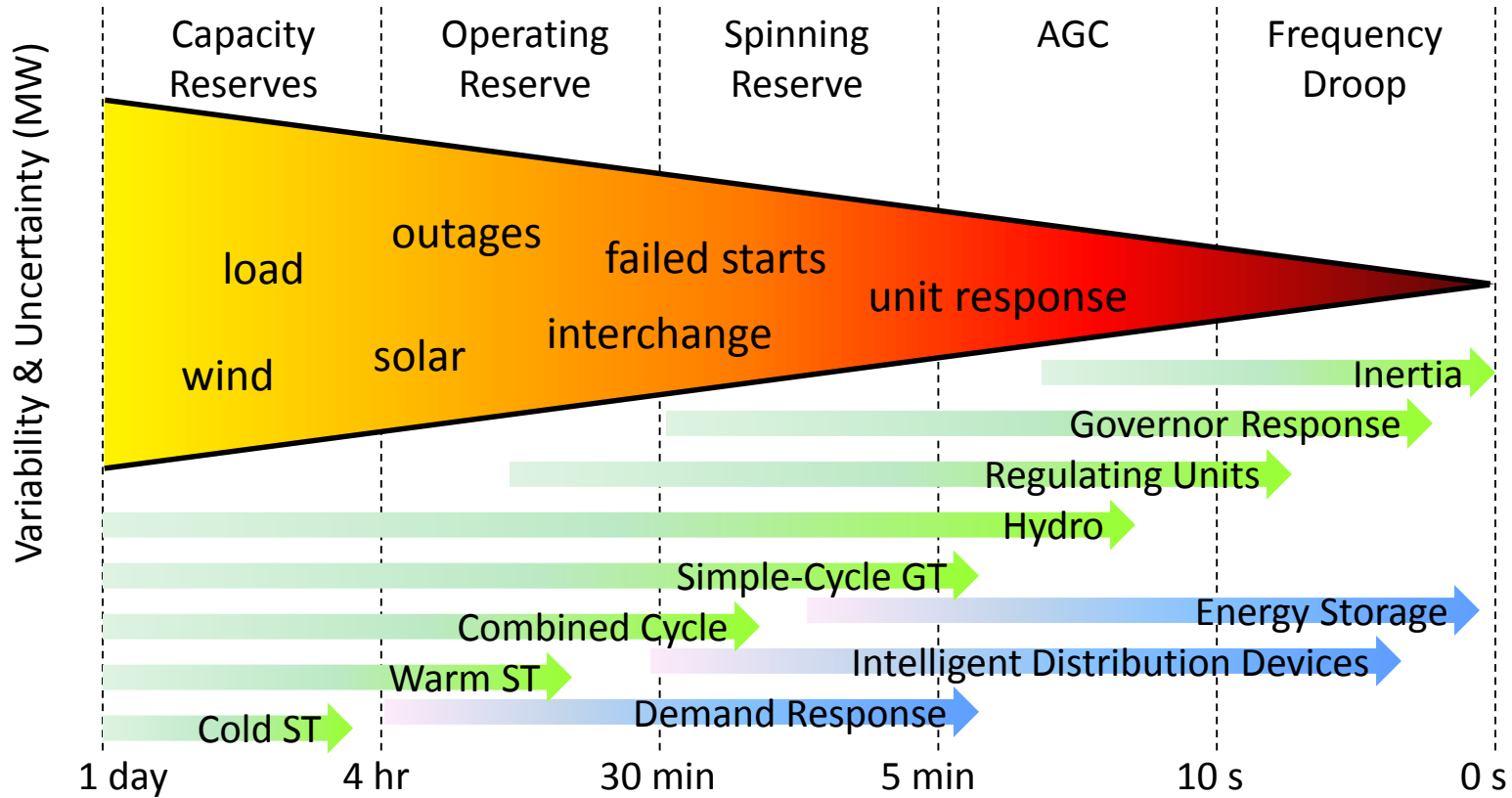
Innovative Methods to Improve Flexibility

*UVIG 2018 Fall Technical Workshop
Wednesday, October 3, 2018*

Russ Philbrick

Polaris Systems Optimization

The Need for Flexibility



Storage: Looking For the Holy Grail?



It is important, but it will not address all challenges

A Range of Services are Needed

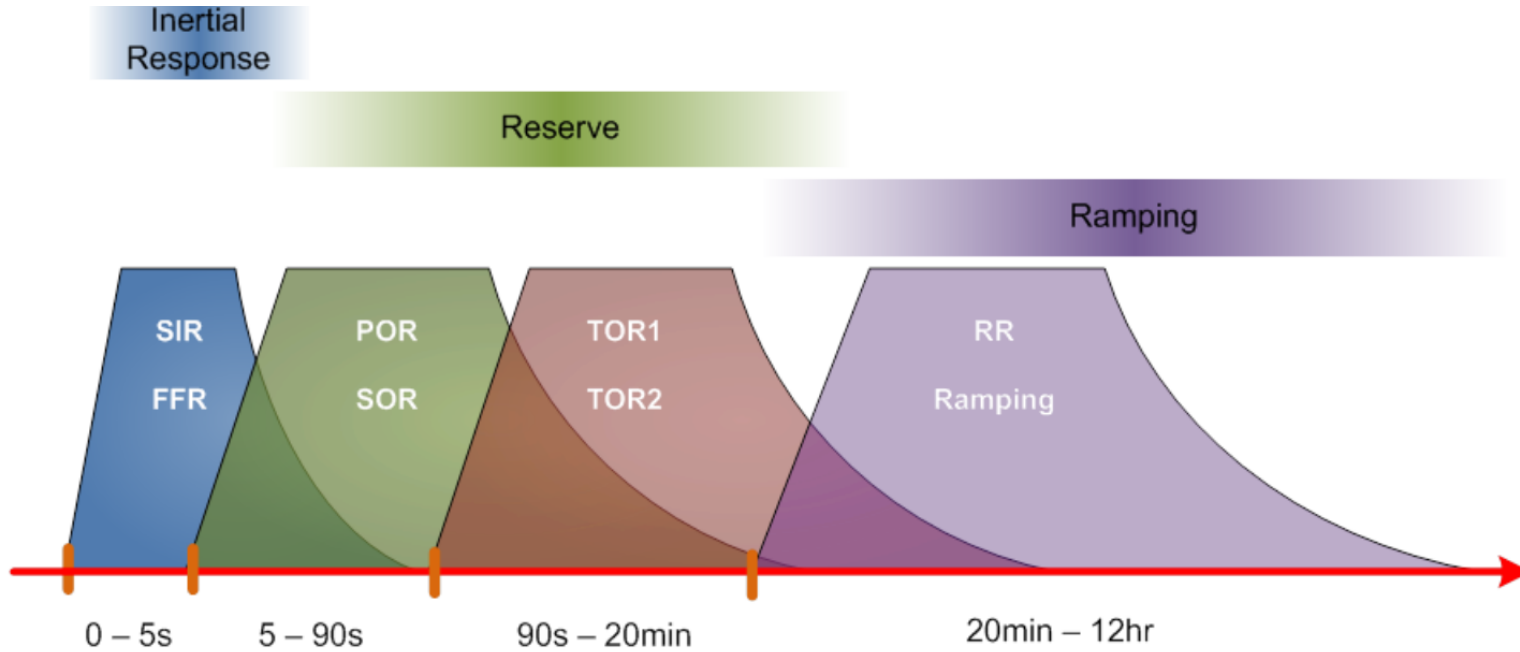
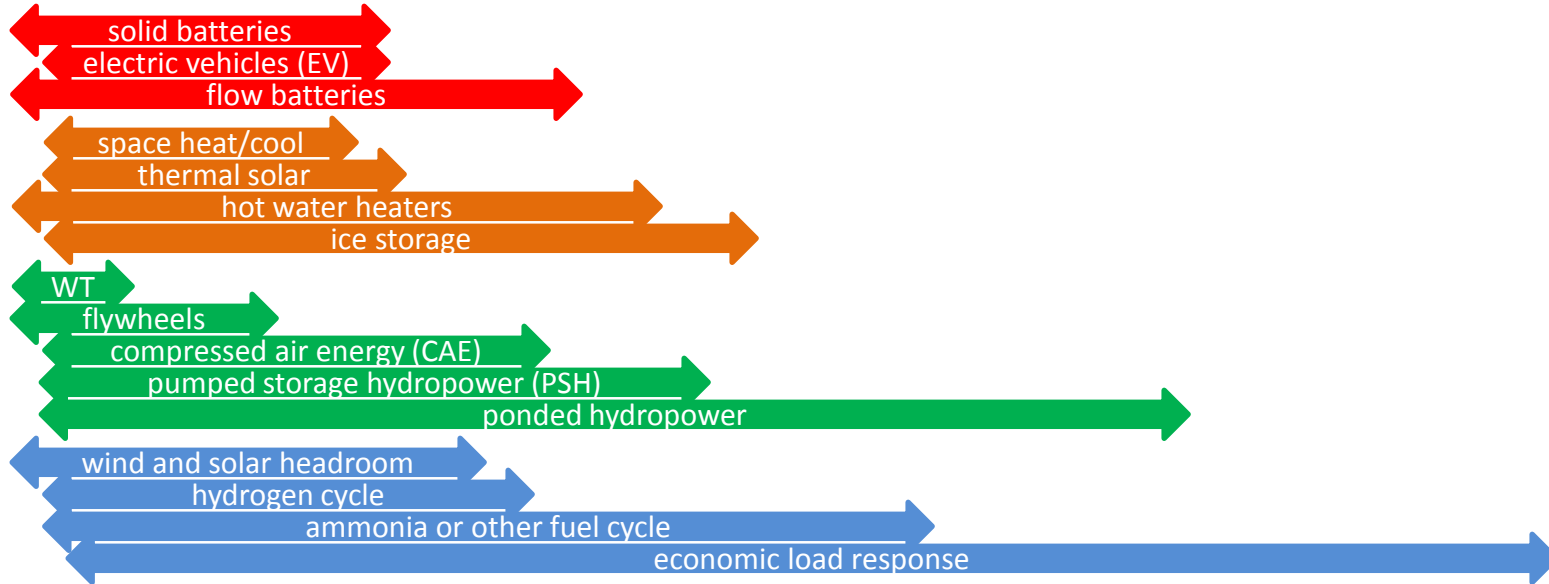
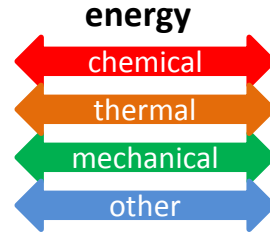


Figure 1: Frequency Control Services (Source: EirGrid)

The Hard Problem is Long-Term Flexibility



sec min hour day week season



Pool Pumps for Peak Shaving and Valley Filling

- **Bob Moyer**, *Vice President – Asset Management*, **Rainbow Energy**, St Augustine, FL

Enhanced Hot Water Heater Control

- **Ken Schuyler**, *Manager, Renewable Services*, **PJM**, Audubon, PA

Power to Gas

- **Ken Dragoon**, *CEO*, **Flink Energy Consulting**, Portland, OR

Smart Thermostats

- **Sam Shrank**, *Strategy and Finance Lead*, **Tendril**, Boulder, CO