

# Regulation 101 Webinar

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April 25, 2017

# Webinar Format

- Regulation 101 Slide Deck
- No live Question and Answer period
- You are encouraged to email your questions to [engagement@ieso.ca](mailto:engagement@ieso.ca) or ask them in the chat box
- The IESO will respond to the questions at a later time
- The IESO can answer questions of clarification, but will be unable to answer questions that point specifically to the upcoming RFP

# Context

- This presentation provides an overview of *regulation service* and the current mechanics of the regulation marketplace as of April 2017.
- While references may be made to an upcoming regulation procurement that the IESO is planning for 2017, the primary purpose of this presentation is to provide an overview to how the market works today.
- Any information regarding the upcoming procurement will be provided during and within that process itself. This presentation is **not** meant to provide any definitive information regarding that upcoming process.

# Disclaimer

This presentation is intended as a high level overview of regulation in the province, and is being circulated for information and discussion purposes only and is not legally binding on the IESO.

The purpose of this presentation is to educate and provide guidance on what is regulation, how facilities in Ontario can provide regulation in today's market, how the IESO currently schedules regulation and similar topics. The IESO will not provide any information, summary or details, or respond to any questions or comments, during this presentation about the upcoming procurement for regulation capacity. More information about such upcoming procurement for regulation capacity will be posted on IESO's website.

Nothing in this presentation commits the IESO to proceeding with the request for proposals for regulation capacity, and the IESO reserves the right, in its sole and absolute discretion, to make any changes it deems appropriate, beneficial, or necessary to the regulation capacity procurement process or to the design or constructs of the regulation market.

# Agenda

- A Primer on Regulation
- Today's Regulation Market
- Regulation Market Payment Principles
- Testing Requirements
- Scheduling regulation from conventional resources
  - Procedures
  - Tools used in the scheduling of regulation service
- Scheduling regulation from energy storage resources
  - Background
  - Procedures
  - State of Charge Limitations

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# A PRIMER ON REGULATION SERVICE

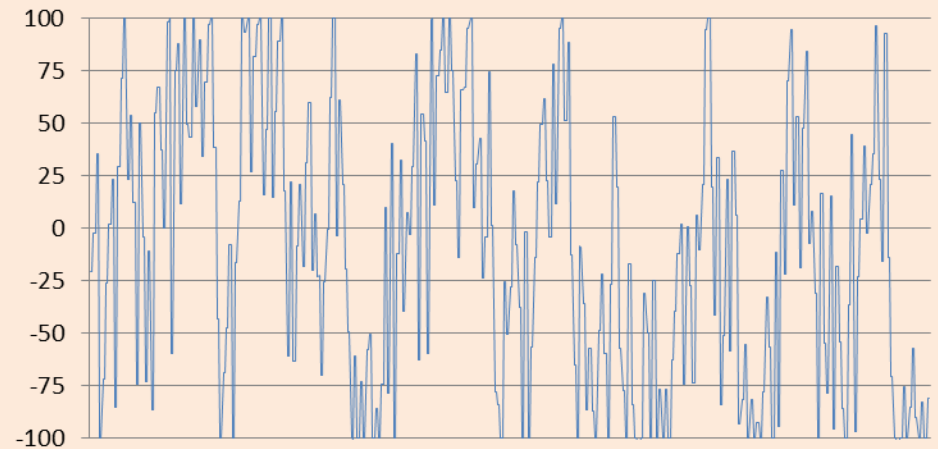
# What is Regulation Service?

- Regulation service acts to match total system generation to total system load (including transmission losses) and helps correct variations in power system frequency
- Corrects for short-term changes in electricity
- Regulation service adjusts for factors such as discrepancies between tie line scheduled vs. actual flows and load and generation dispatch deviations
- Facilities vary output automatically in response to Automatic Generation Control (AGC) signals

# Regulation – A Primer

**Official definition:** *regulation* means the service required to control power system frequency and maintain the balance between load and generation.

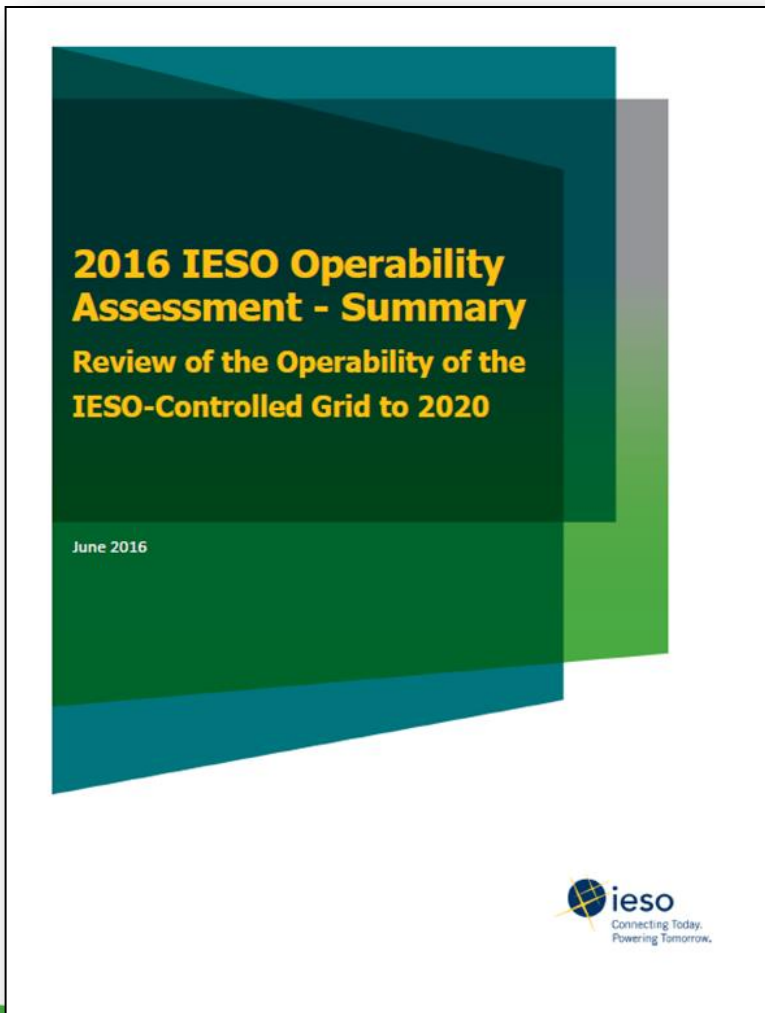
A sample of today's regulation signal  
(up and down, 2-second response)



- Regulation is governed by applicable NERC and NPCC standards, the IESO Market Rules
- Today, both the sources and needs for regulation are changing



# IESO Operability Study 2016



- Ontario is experiencing the global trend of accelerating growth of renewables as the cost of these technologies begin to fall
- The uncertainty in the output of the variable generation also increases the need for more regulation services

# Regulation and Automatic Generator Control (AGC)

- The terms, “*Automatic Generator Control*” (AGC) and “*regulation*” are often used interchangeably
- More precisely however, AGC is the **process** by which *regulation* service provided.

**Official definition:** *regulation* means the service required to control power system frequency and maintain the balance between load and generation.

**Official definition:** *automatic generation control* or AGC means the process that automatically adjusts the output from a generation facility that is providing *regulation*;

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# TODAY'S REGULATION MARKET

# Regulation Background – Technical Specs

- Ancillary services may be provided to the IESO only by registered facilities
- Minimum of  $\pm 100$  MW of regulation service must be scheduled at all times under the IESO Market Rules
- Minimum overall ramp rate of 50 MW/minute must be maintained by the fleet under the IESO Market Rules
- Individual resources may have ramp rates lower than 50 MW/minute as long as overall fleet that has been dispatched meets ramp rate of 50 MW/minute
- Regulation Service is scheduled in one hour increments
- Facilities must have the capability to receive a signal once every 2 seconds
- Refer to Market Rules Chapter 5, Section 4.4 for more details

# Regulation Background – Current Fleet

- Seven generating stations and two energy storage facilities are under contract to provide regulation service
- The total contracted capability is  $\pm 289$  MW and annual payout for the service in 2015 was \$45M
- Further details are available on the ancillary services page which can be found at: <http://www.ieso.ca/ancillary-services>

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# REGULATION MARKET PAYMENT PRINCIPLES

# Regulation Service Payment Principles

- Facilities providing Regulation Service receive both Regulation Payments for the service provided and energy payments for the energy injected
- Facilities providing Regulation Service can offer incremental capacity into the energy market
- Facilities cannot participate in the Operating Reserve (OR) market for the hours during which they are providing Regulation Service
- Payments are in the form of a fixed availability payment and a variable payment – there is no pay for performance structure
- Energy consumed during the course of providing regulation service is exempted from Global Adjustment (see also, Ontario Regulation 429/04, "*Adjustments under Section 25.33 of the Act*")\*

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# TESTING REQUIREMENTS



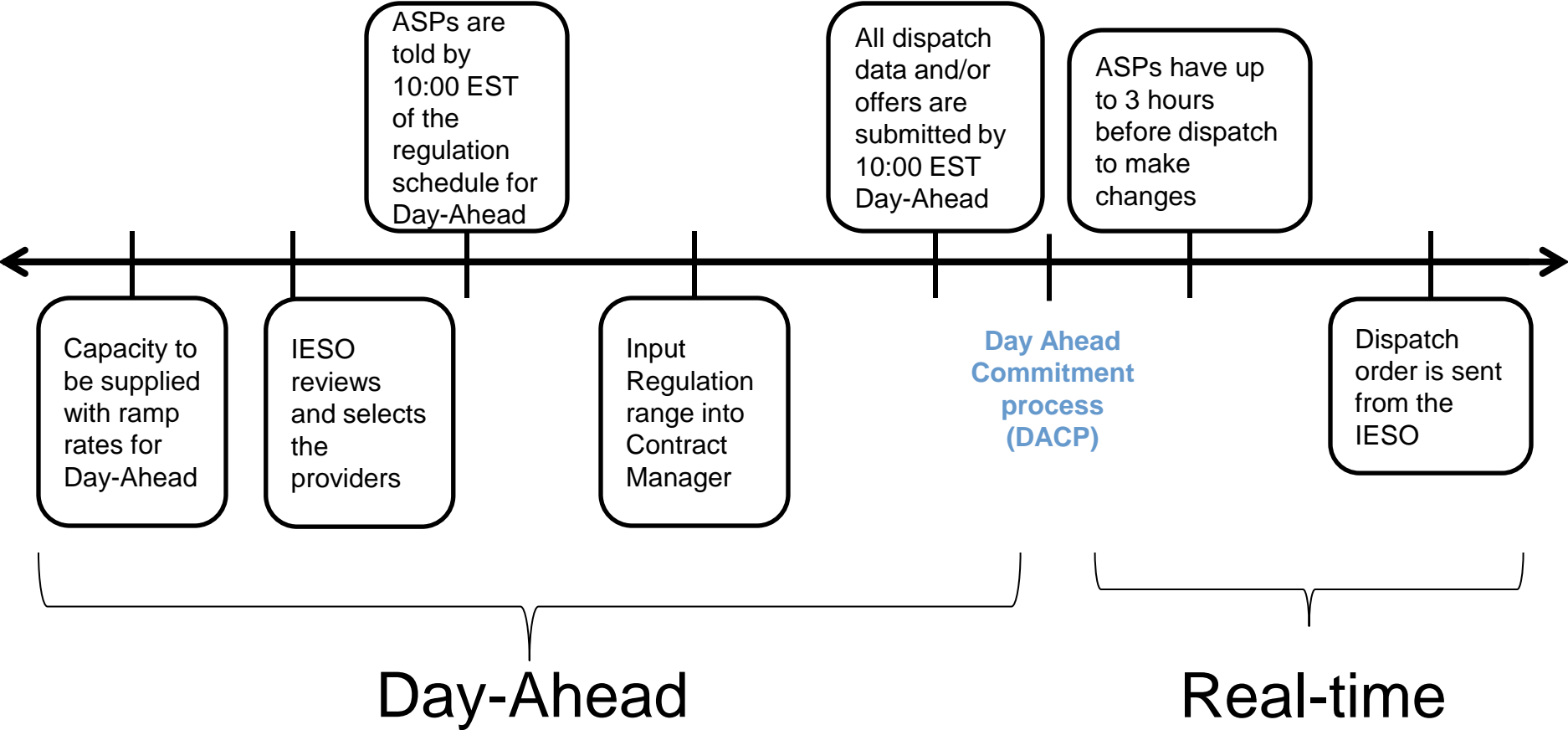
# Testing of Regulation Service (AGC)

- Market Rules Chapter 5, Appendix 5.1 sets forth Performance Standards for Ancillary Services on:
  - Regulation capacity that can be offered
  - Ramp rate
  - Capable of receiving control signal every 2 seconds
- In the contract design, Regulation Certification test consists of:
  - Raise test to verify max regulation capability and ability to ramp at stated rate
  - Lower test to verify min regulation capability and ability to ramp at stated rate
  - Communications check to ensure that dispatch instructions are received
- IESO can test facilities periodically
- Aforementioned applies to any resource that is providing Regulation Service for the IESO

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# **SCHEDULING REGULATION FROM CONVENTIONAL RESOURCES**

# Regulation Scheduling Timeline Overview



# Day-Ahead Procedures

- Each morning, Ancillary Service Providers (ASPs) tell the IESO:
  - The AGC capacity to be supplied by each facility or unit
  - Min and max limits for the regulation range
  - Ramp rates

# Day-Ahead Procedures

- The IESO:
  - Reviews the submissions and selects regulation resources for each hour.
    - The IESO may ask the ASPs to change the regulation units for reliability reasons
  - Informs each ASP before 10:00 EST of the regulation schedules for their units.
  - Inputs regulation range and units in Contract Manager after ASPs confirm acceptance of the schedules.
    - This is a constraint input into the Day Ahead Commitment Process (DACP)

# Day-Ahead Commitment Process (DACP)

- Details of the [Day-Ahead Commitment Process](#) can be found on the IESO website
- Dispatchable generators are required to submit initial dispatch data between 06:00 and 10:00 EST day-ahead
  - Must provide declaration of participant capability and intent to submit dispatch data in real-time
  - Can receive production cost guarantee if facility's real-time revenue does not cover the costs for offering regulation

# Real-Time (Current Day) Procedures

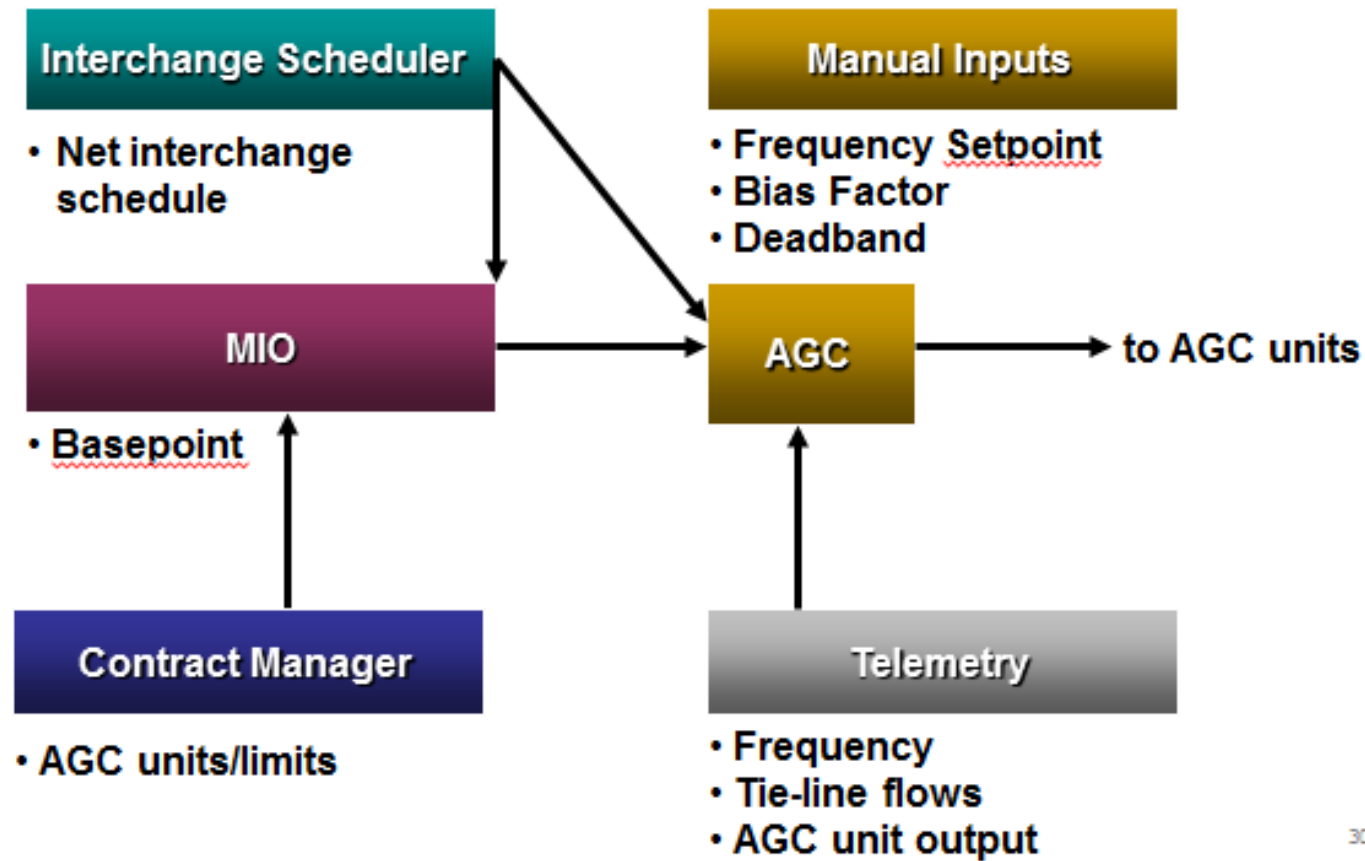
- The ASP may change the regulation schedule up to 3 hours before the dispatch hour under certain circumstances and must confirm this change with the IESO
- Similarly, the IESO tries to inform the ASPs of any needed changes at least 3 hours before the dispatch hour (longer if fossil unit start-up period is greater than 3 hours).

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# **TOOLS USED IN SCHEDULING REGULATION**



# AGC Tool Interactions

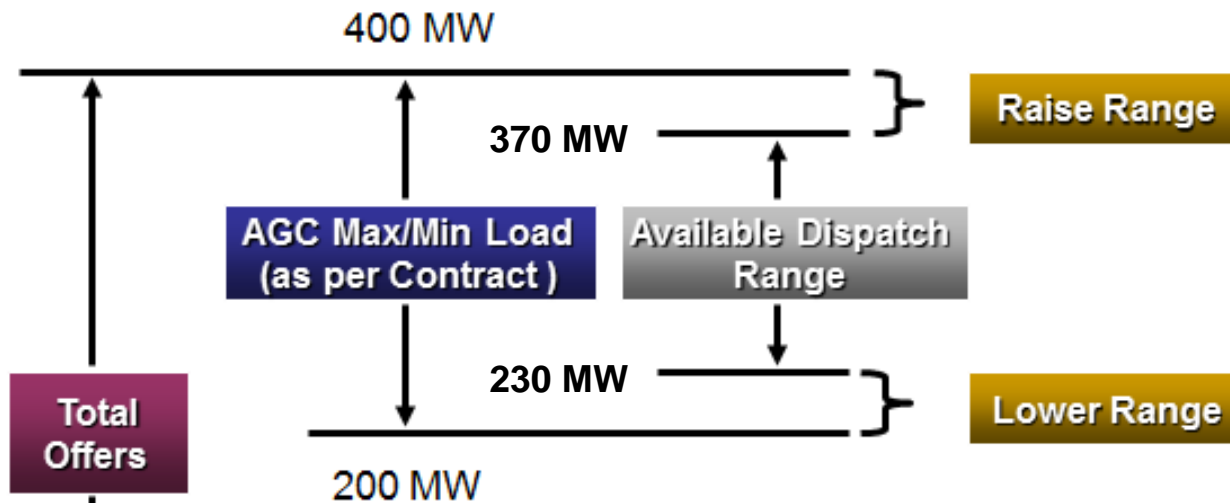


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# Dispatch Scheduling and Optimization (DSO) Economic Calculation

- DSO (using Multi-Interval Optimization MIO) calculates the economic dispatch for regulation units the same way as for all other units
- An economic dispatch target is calculated for each unit or aggregate (depending on contract terms)
- Respects the upper and lower limits based on regulation contracts to ensure regulating room is left on the plant or unit.
- Passes the result to the AGC package in SCADA
- The AGC package also gets the upper and lower limits of each unit/aggregate along with its ramp rate

# AGC Example



- Assume 30 MW regulation available on this unit.
- Dispatch algorithm base point must fall within the range 230 – 370 MW.

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# **SCHEDULING REGULATION FROM ENERGY STORAGE RESOURCES**

# Background

- Currently the IESO Market Rules do not have a formal definition of energy storage resources, nor are storage-specific characteristics of facilities registered in the IESO-administered markets.
- In the meantime however, interim arrangements have been made to accommodate storage resources for the provision of regulation

# Guiding Principles

- ASP responsible for indicating operating range, available regulation capacity and other technical factors – like any other type of resource.
- Manual selection of basepoints due to present technical limitations of DSO
- State of Charge (SOC) managed by market participant
- Ancillary Service Provider (ASP) never obligated to operate a storage facility in a way that might damage equipment or jeopardize safety

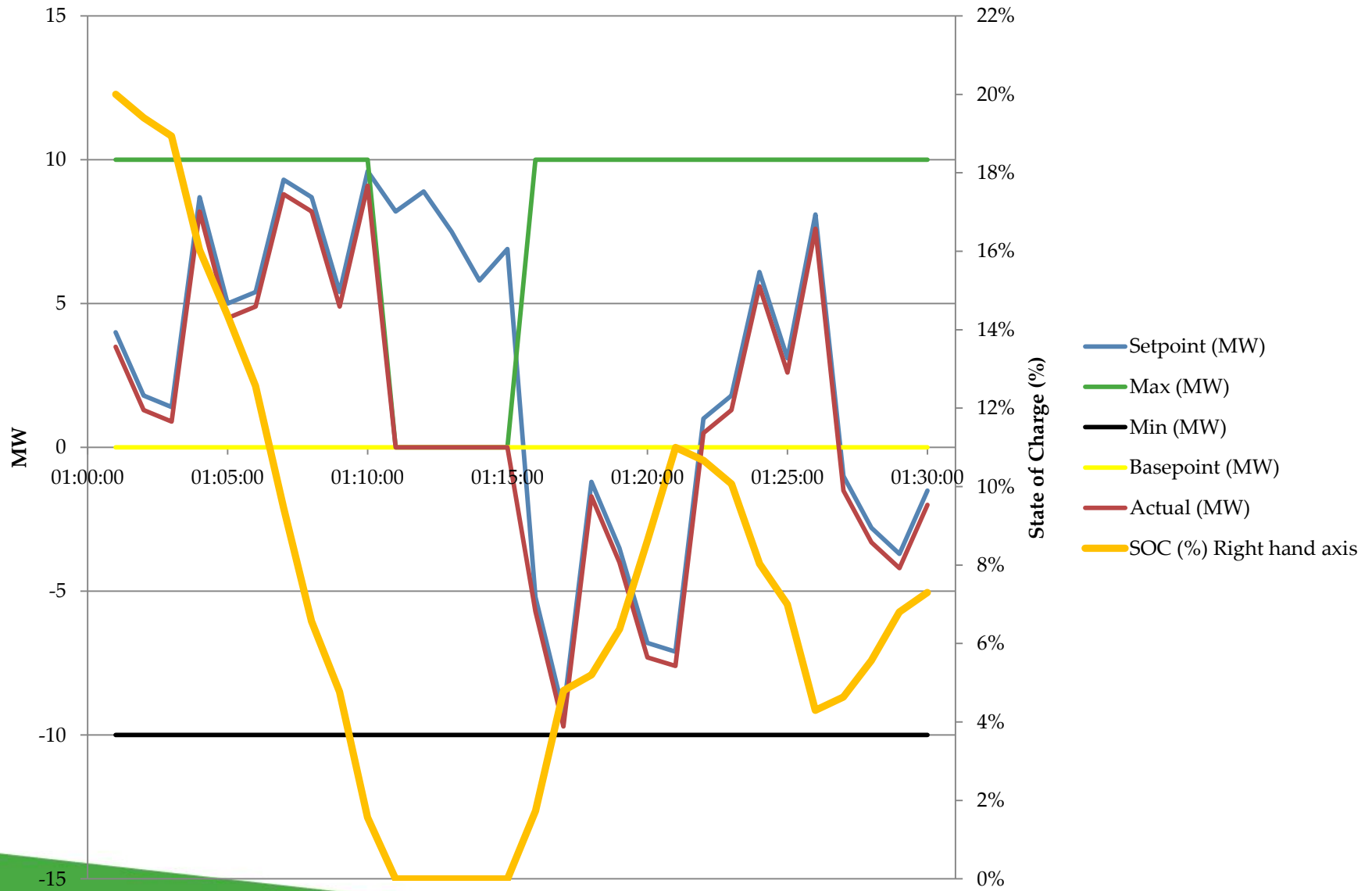
# Energy Storage – Interim Scheduling Arrangements

- Energy storage devices provide regulation service whenever they are available
- Energy storage devices are required to provide their day ahead hourly forecasted availability
- The IESO assesses the projected Day-Ahead regulation capacity indicated by the ASP with the regulation that was actually provided in Real Time
- Energy storage devices do not submit bid/offers into the Day Ahead Market and therefore are not dispatched by the DSO
- Energy storage facilities receive an AGC signal that takes into account their minimum/maximum capability

# State of Charge Limitations

- Regulation signal may be biased in either positive or negative direction based on system conditions
- This may impose limitations for energy limited facilities to provide regulation service
- When a facility becomes charge limited, it is expected to only be able to respond to the regulation signal in one direction i.e. up or down
- The facility is not financially penalized for this limitation





# In Summary – Conventional vs. Storage Devices providing Regulation

Conventional Resources	Energy Storage Resources
<ul style="list-style-type: none"><li>• Modelled in the Dispatch and Scheduling Optimization Engine</li><li>• Receive an energy dispatch and a regulation set-point</li><li>• Selected in the Day-Ahead timeframe</li></ul>	<ul style="list-style-type: none"><li>• Provide estimated day ahead schedules</li><li>• Are not modelled in the DSO</li><li>• Operate on availability basis</li><li>• May become charge limited over the course of the hour</li></ul>

**Thank you!**