Regulation Control

Regulation Services aid in the *continuous balancing of generation and load*, assisting in *maintaining interconnection frequency* at 60 Hz

Regulation is a variable amount of generation under automatic generation control (AGC) that PJM sends a regulation signal to raise or lower the resource's output to *correct for instantaneous changes in load and generation*
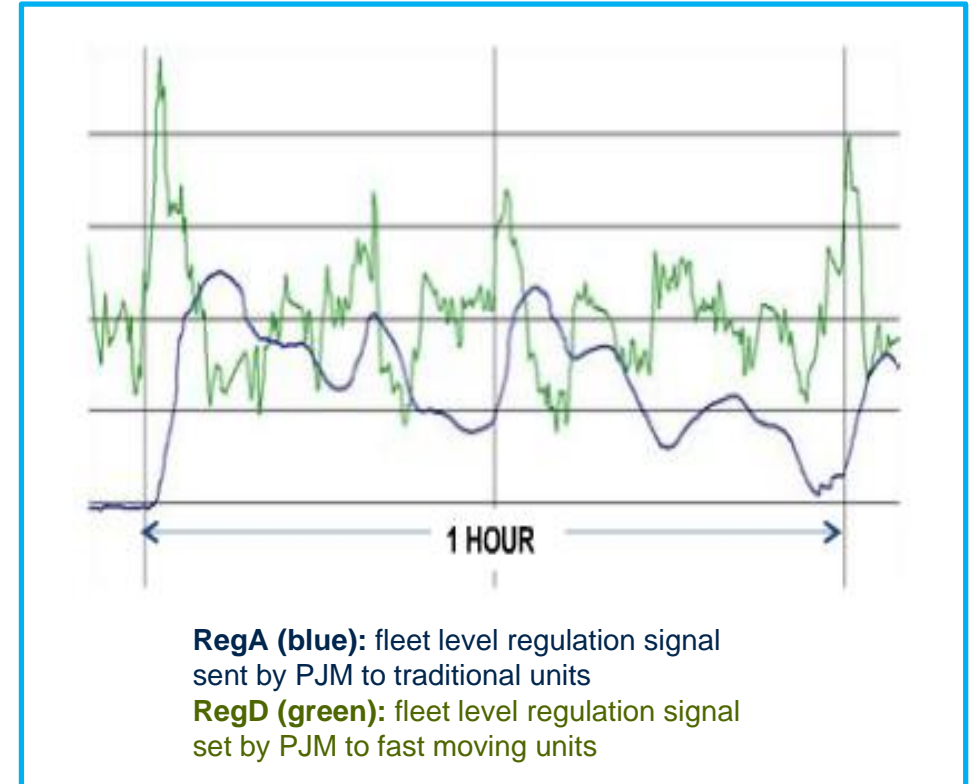
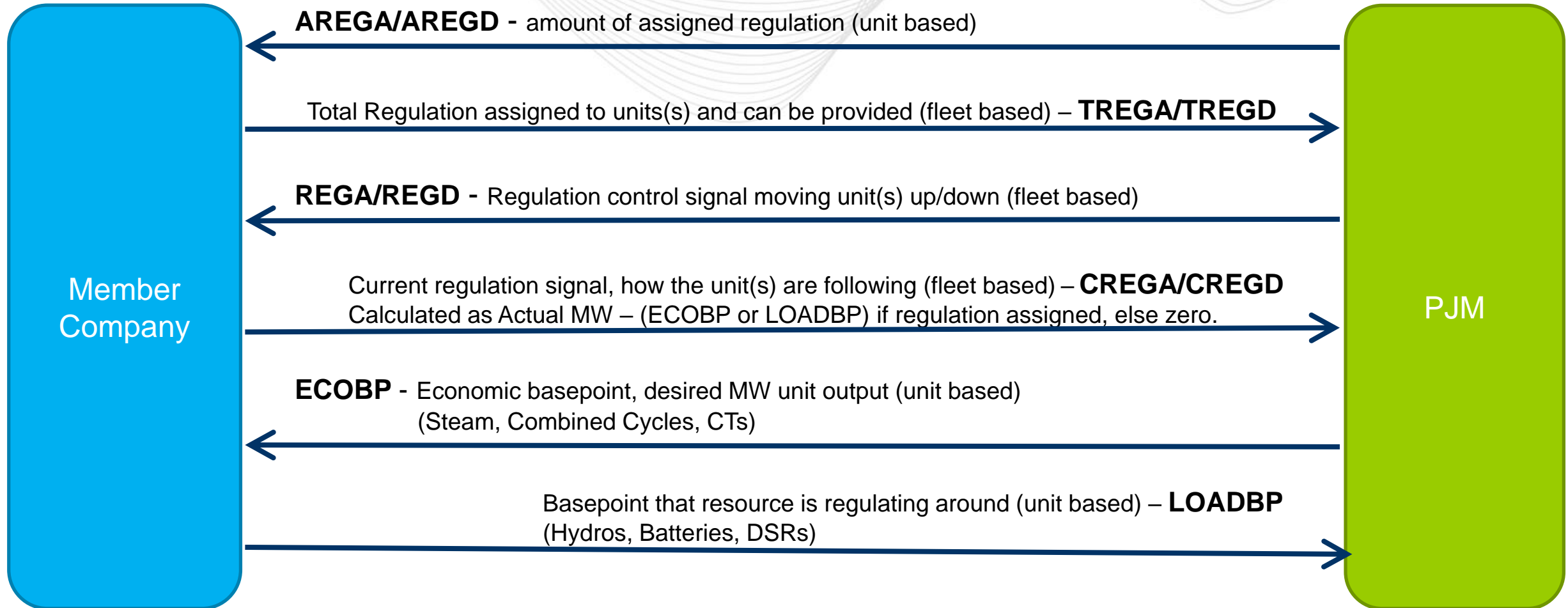PJM has two (2) fleet level regulation signals

- Reg-A: Traditional Signal
  - Signal accommodates ramp-limited resources (Steam, CT, Combined Cycle, etc)

- Reg-D: Dynamic Signal
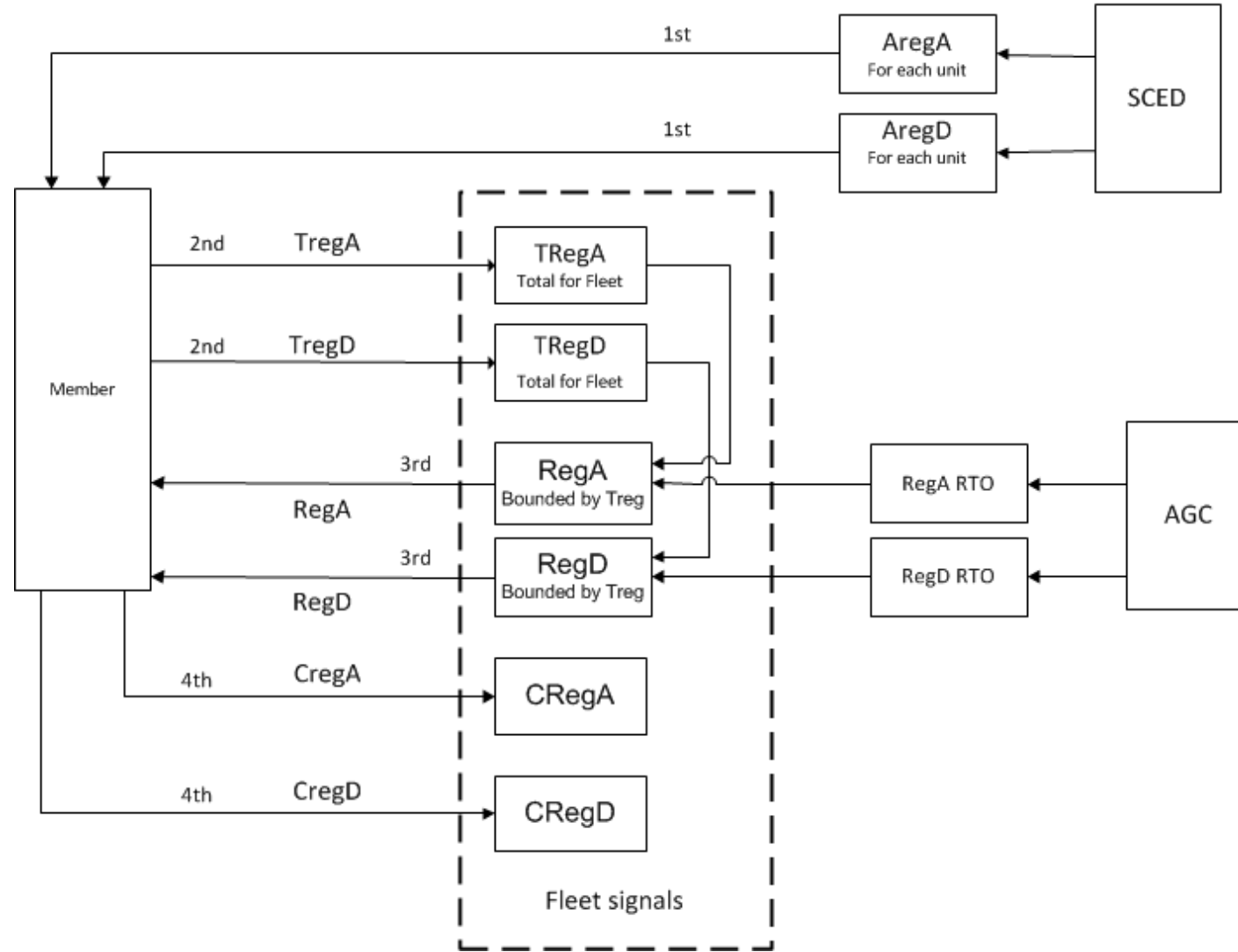 - Signal accommodates energy-limited resource (Batteries, Flywheels, Demand Side Resources, etc.)

Note: One or more units can be assigned to a specific Fleet. And since Fleets are linked to a specific regulation zone, all units assigned must also be in the same regulation zone.

RegA (blue): fleet level regulation signal sent by PJM to traditional units
RegD (green): fleet level regulation signal set by PJM to fast moving units

AREGA/AREGD - amount of assigned regulation (unit based)

Total Regulation assigned to units(s) and can be provided (fleet based) – **TREGA/TREGD**

REGA/REGD - Regulation control signal moving unit(s) up/down (fleet based)

Current regulation signal, how the unit(s) are following (fleet based) – **CREGA/CREGD**
Calculated as Actual MW – (ECOBP or LOADBP) if regulation assigned, else zero.

ECOBP - Economic basepoint, desired MW unit output (unit based)
(Steam, Combined Cycles, CTs)

Basepoint that resource is regulating around (unit based) – **LOADBP**
(Hydros, Batteries, DSRs)

Member Company

PJM

Regulation Control Point Signal Flow

Regulation Point Definitions

SCED Control Points:

- **ECOBP** (GENECON) – Is the Economic Base Point in MWs that will set to the desired MW output of the Generator unit when in the economic market. For Wind farms it is the unit cap for MW output.
- **ECOMIN** (GENMINEN) – This is the economic minimum MWs that the unit will generate and is just the value that the Generator operator enters into Markets. The value is in MWs
- **ECOMAX** (GENMAXEN) – This is the economic maximum MWs that the unit will generate and is just the value that the Generator operator enters into Markets. The value is in MWs
- **UNITDISPMODE** (GENRUNR) – This is the UDS dispatch reason for the unit being brought on line. It is an integer between 0 and 37 that is used with a look-up table to let the generation operator know why the unit is being called on by PJM or the company. The look-up table can be supplied by PJM upon request.
- **AREGA or AREGD** (AREG or AREGD) – This is the amount of assigned regulation in MWs that a certain generator is assigned, if it is participating in the regulation market. Not sent if the unit does not regulate.
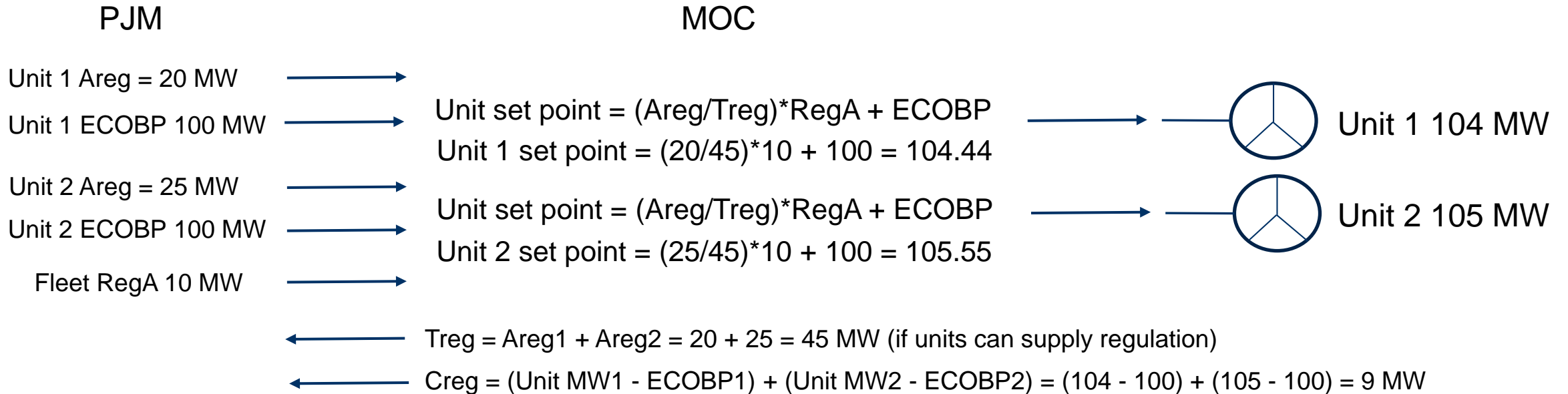
AGC Fleet Control Points:

- **TREGA or TREGD** (TREG/GENATREG or TREGD/GENDTREG) – Total regulation, this is the summation of the units assigned regulation fleet that also takes into account if the unit/units can supply the amount of regulation assigned. This point is calculated by the member and sent from the member to PJM.
- **REGA or REGD** (REGA/GENAREGA or REGD/GENDREGD) – This is the fleet control signal that will move all the units in that fleet up or down. This point is sent from PJM to the member.
- **CREGA or CREGD** (CREGA/GENACREG or CREGD/GENDCREG) – Current regulation is how well the fleet is following the REGA or REGD control point. This point is calculated as Actual MW – (ECOBP or LOADBP) if regulation assigned, else zero. This point is calculated and sent from the member to PJM.

Limit Relationship for Regulation
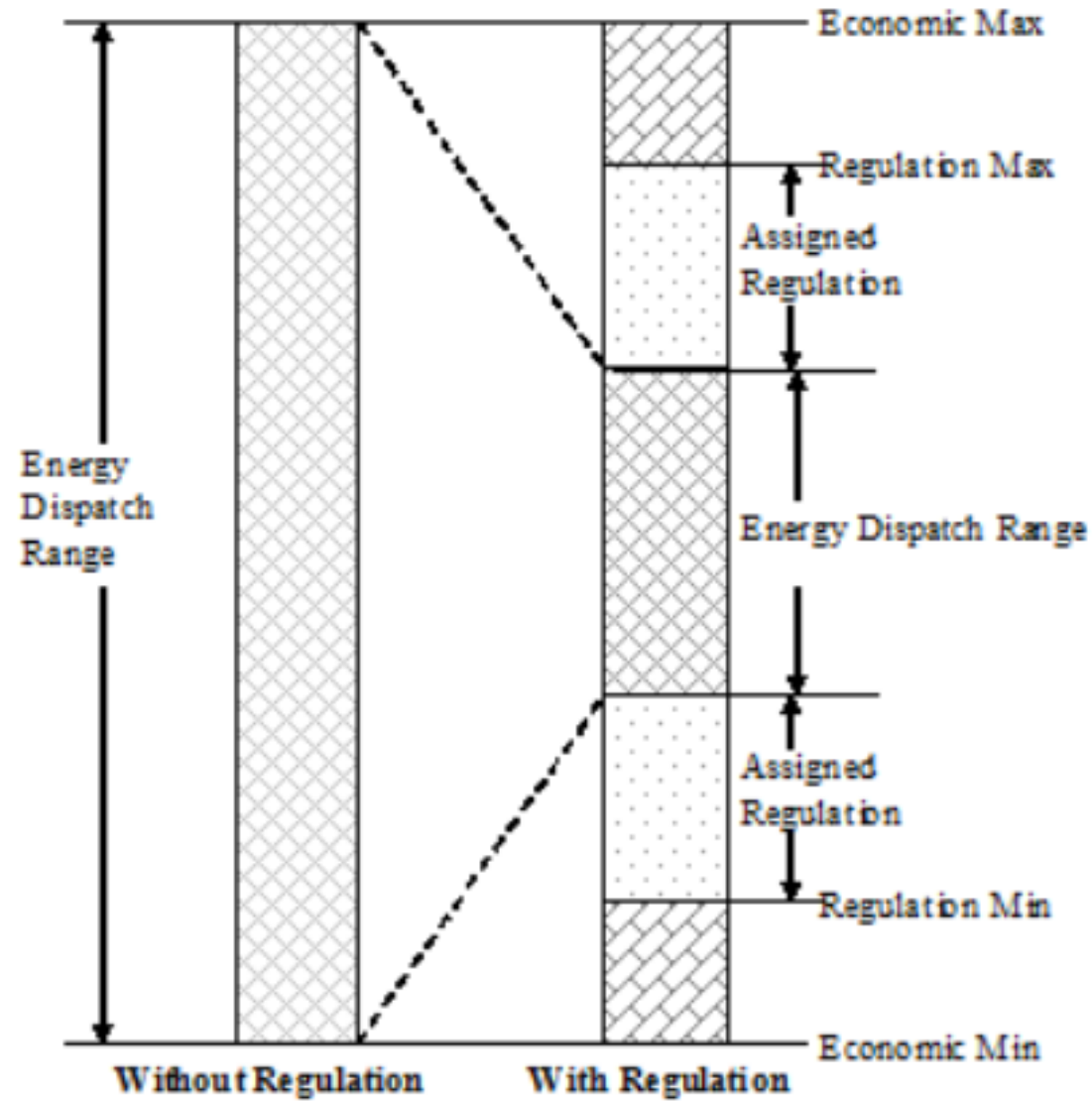
Regulation Example

- If you have two units in a fleet with unit 1 having 20 MW of assigned regulation (Areg) and unit 2 having 25 MW, both with an Economic Basepoint (ECOBP) of 100 MW, with a Fleet RegA Control Signal of 10 MW.

PJM

MOC

Unit 1 Areg = 20 MW

Unit 1 ECOBP 100 MW

Unit set point = (Areg/Treg)*RegA + ECOBP

Unit 1 set point = (20/45)*10 + 100 = 104.44

Unit 1 104 MW

Unit 2 Areg = 25 MW

Unit 2 ECOBP 100 MW

Unit set point = (Areg/Treg)*RegA + ECOBP

Unit 2 set point = (25/45)*10 + 100 = 105.55

Unit 2 105 MW

Fleet RegA 10 MW

Treg = Areg1 + Areg2 = 20 + 25 = 45 MW (if units can supply regulation)

Creg = (Unit MW1 - ECOBP1) + (Unit MW2 - ECOBP2) = (104 - 100) + (105 - 100) = 9 MW

PJM Manuals: http://www.pjm.com/documents/manuals.aspx

- Manual 11 Section 3: Overview of the PJM Regulation Market
- Manual 12 Section 4.4: Regulation
- Manual 12 Section 4.5: Qualifying Regulation Resources
- Manual 28 Section 4: Regulation Accounting

Ancillary Services: http://www.pjm.com/markets-and-operations/ancillary-services.aspx

- Regulation Testing Signal Data
- Historical Regulation Signal Data