

Overview of System Operations

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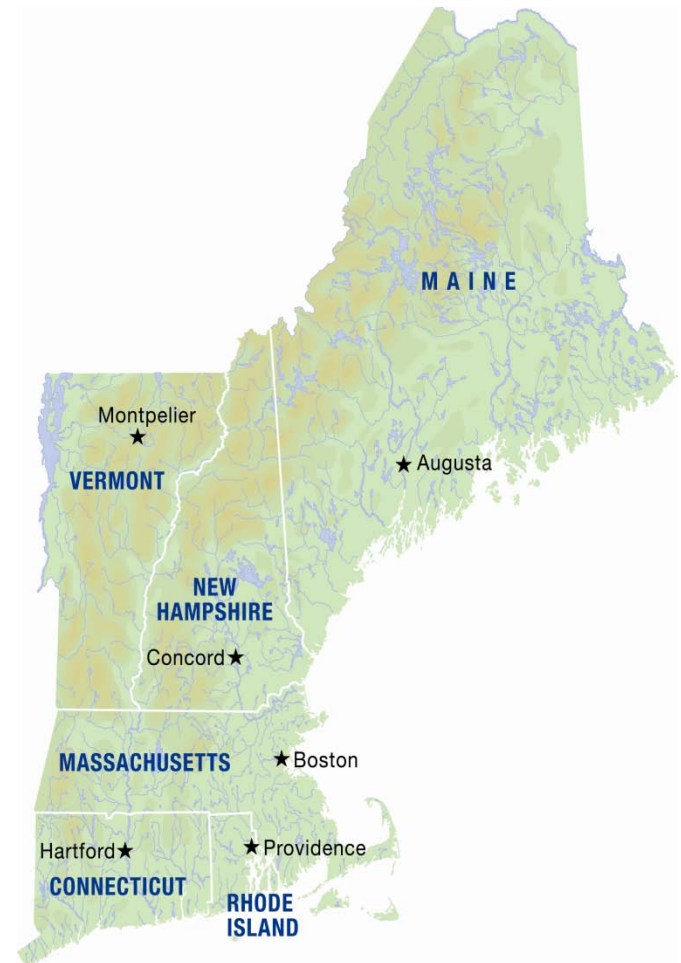
Objectives

- At the completion of WEM 101 you will be able to:
 - ✓ List primary responsibilities Operations.



New England's Electric Power Grid at a Glance

- 6.5 million households and businesses; population 14 million
- More than 350 generators
- Over 8,000 miles of high-voltage transmission lines
- 13 ties to electricity systems in New York, Québec, and New Brunswick
- More than 31,000 megawatts of total supply
- 1,200 MW of Demand Response
- System peak:
 - Summer: 28,130 MW (August 2006)
 - Winter: 22,727 MW (January 2004)
- More than 400 participants in the marketplace
- \$7.3 billion electricity market (2010)



A Day-to-Day, Minute-to-Minute Operation

- Forecast both short- and long-term needs
- Monitor and control bulk power system in real-time
 - Dispatch of generation, demand response, and external sales/purchases to meet load and reserve requirements
 - Monitor and control transmission system to conform with established reliability standards (thermal, voltage, stability limits, etc.).
- Coordinate and approve generating and transmission facility outage requests to assure reliable system operation



Reliability Standards Guide Power

System Operations and Planning

With the Federal Energy Policy Act of 2005, reliability standards are mandatory and non-compliance is subject to penalty

- **North American Electric Reliability Corporation (NERC):** Reliability Standards for North America
- **Northeast Power Coordinating Council (NPCC):** Criteria for design and operation of interconnected power systems in the Northeast
- **ISO-NE:** Operating Procedures for the New England bulk power supply system

NERC
NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

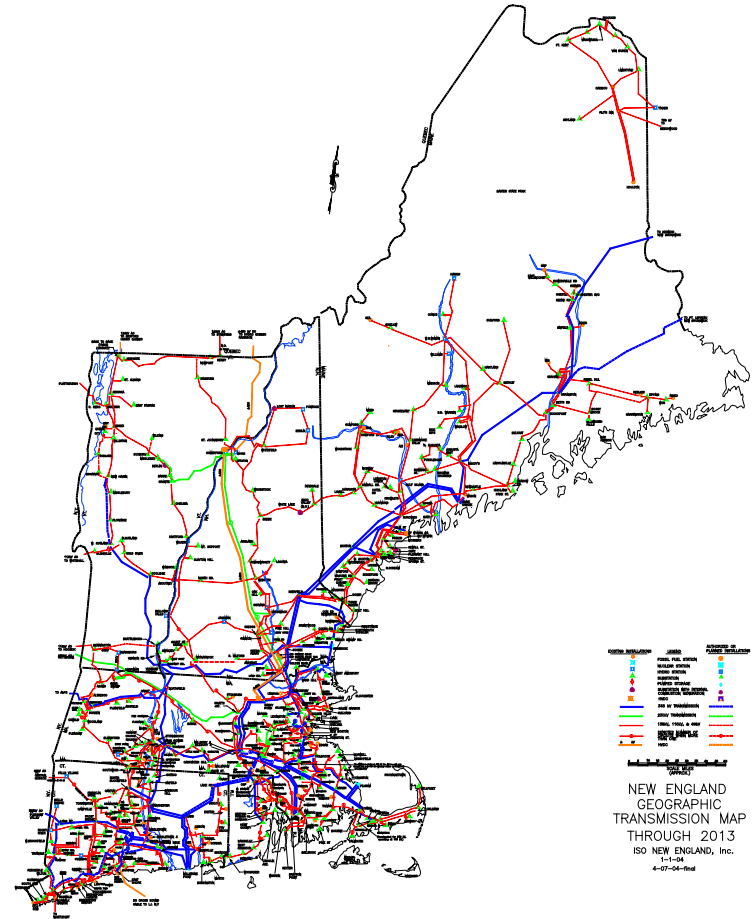


Standards are used to ensure that the regional transmission system can reliably deliver power to consumers under a wide range of future system conditions.

Central Dispatch Essential to Reliability

ISO-NE operates the grid as a single system to:

- Maintain short-term and long-term reliability throughout the region
- Operate the system in the most efficient manner
- Minimize cost of electric production in New England
- Adhere to national, regional, and local operating procedures and policies

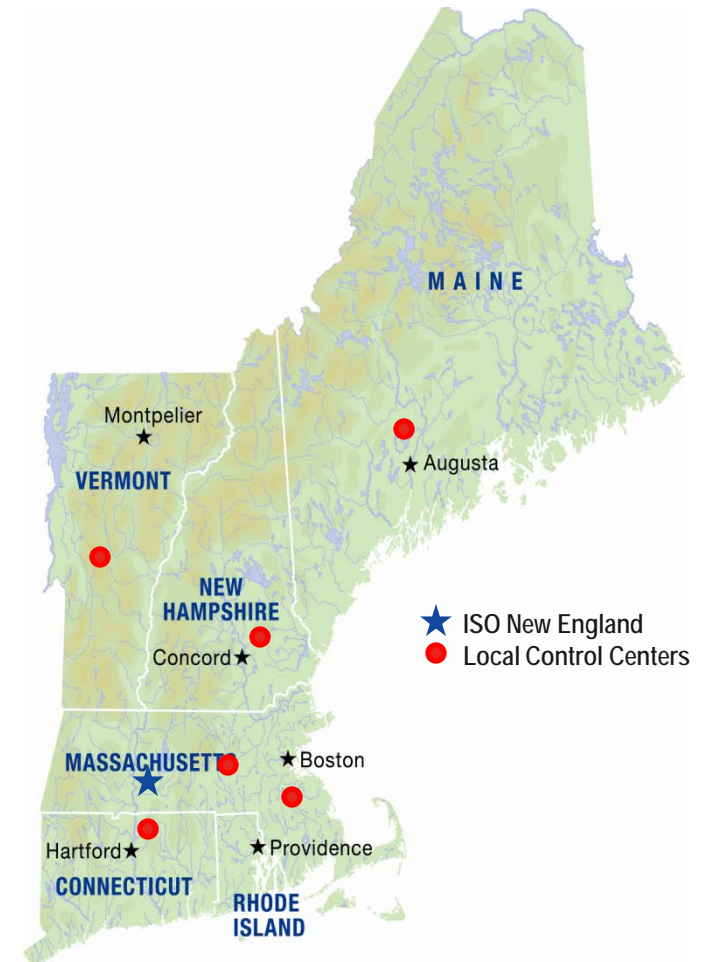


ISO-NE Relies on Local Control Centers

Operated by Transmission Owners

Local Control Centers are responsible for:

- **Reactive dispatch**, with ISO New England providing area oversight
- Implementing **emergency procedures** at the direction of ISO New England operations personnel
- Actual **switching** of transmission elements
- Hands-on **dispatch** as directed by ISO New England operations
- **Monitoring** the power system in parallel with the ISO Control Room
- All have state estimators with real-time **contingency analysis**



Maintaining Power System Control

- **Electricity** cannot be stored; therefore, sufficient generation capacity is needed for the estimated peak demand plus a reserve margin for contingencies.
- A key power system control objective is to maintain a balance in the system between load and generation, resulting in a stable system frequency.



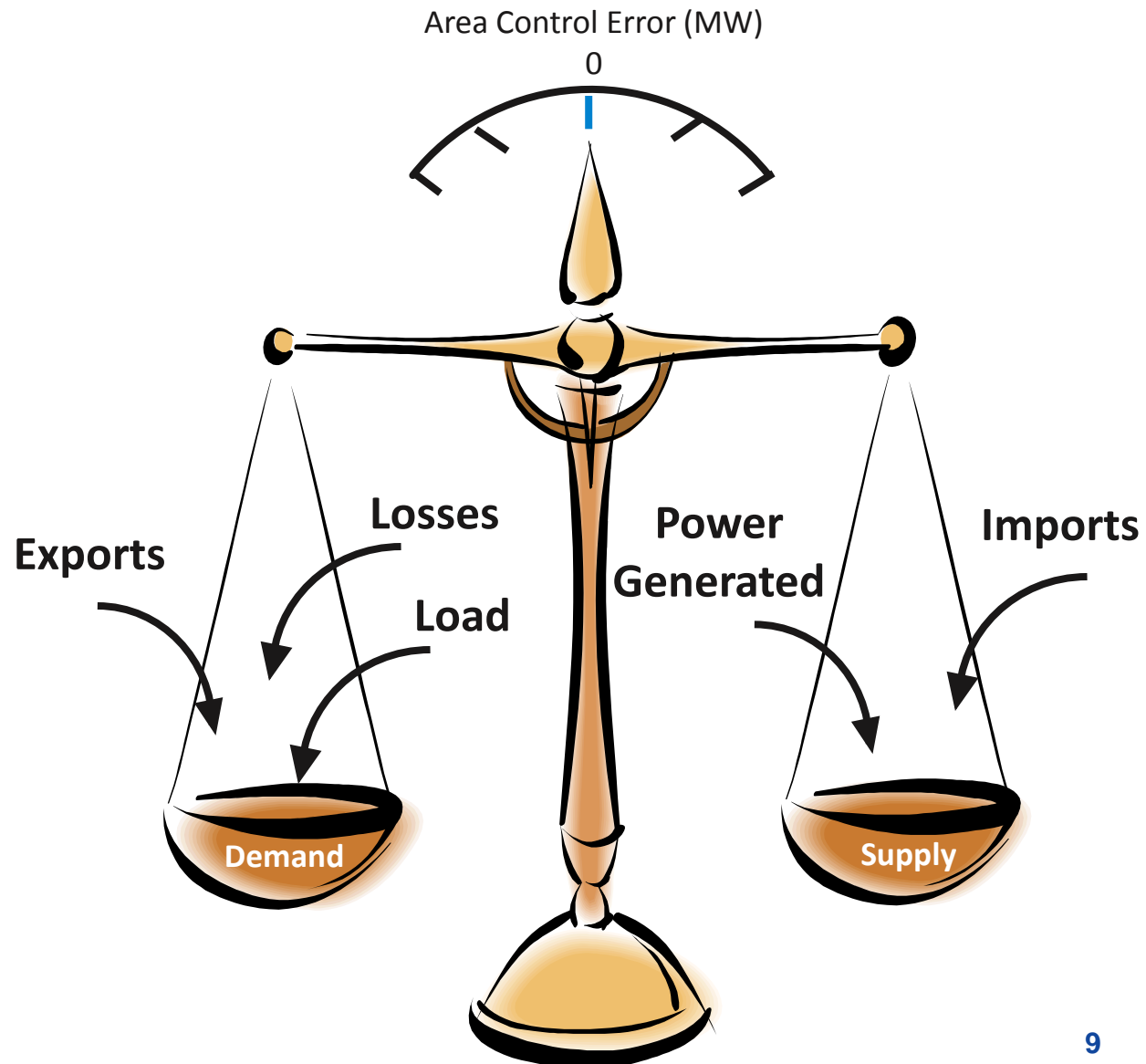
Maintaining Power System Control (cont.)

Achieving Energy Balance

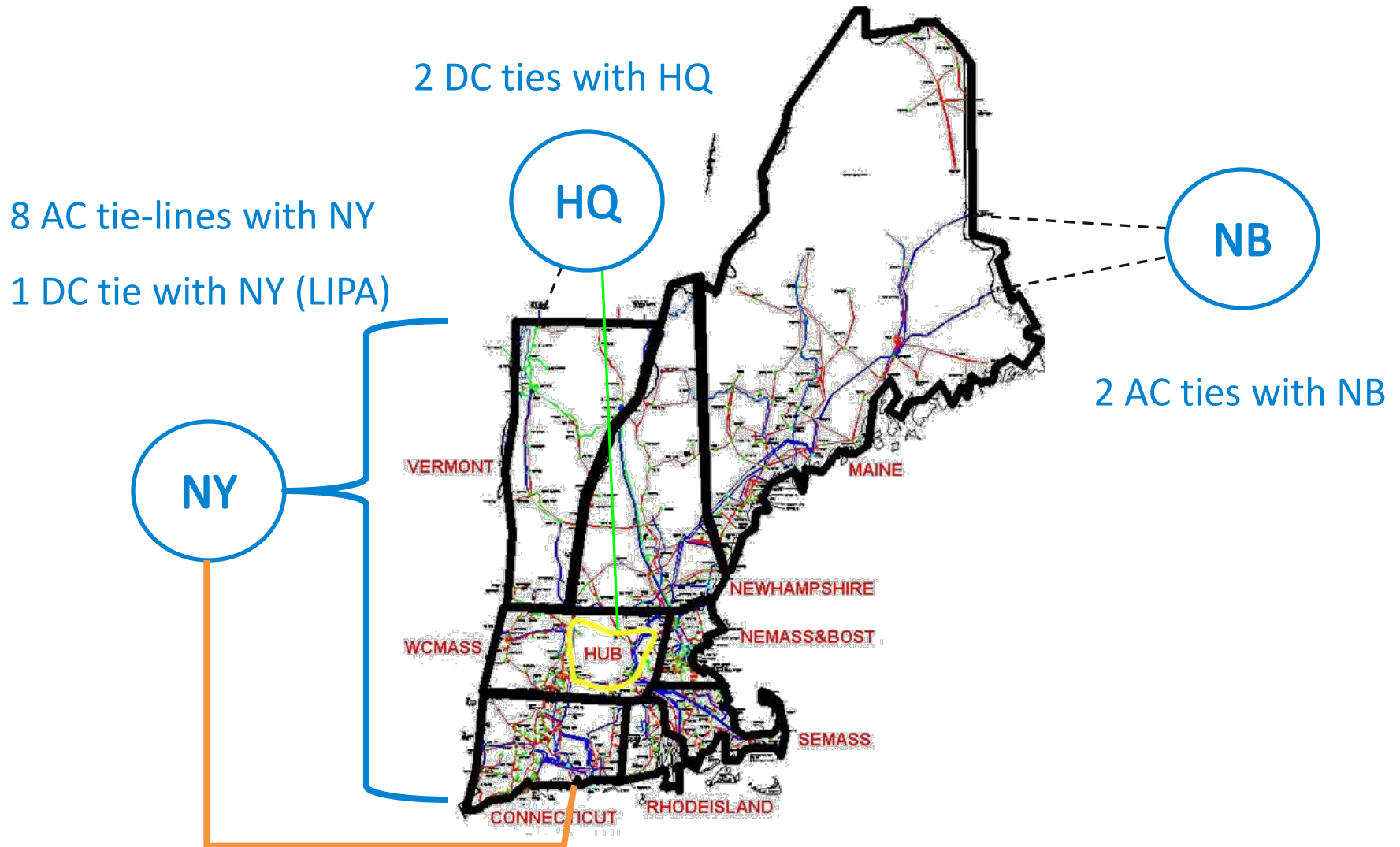
At any moment, the sum of all generation must meet the combined demands of regional electricity use, transmission line losses, and scheduled imports and exports.

Tools to accomplish this include:

- Economic Dispatch
- Regulation



Operation of the Power System with Tie Lines



Lowest Cost Resources Selected for Dispatch

- Resources are dispatched in the order of lowest to highest offer price (Economic Dispatch).
- Objective is to minimize the total cost of producing electricity while keeping the system in balance and maintaining security.
- Transmission constraints help maintain security by limiting the transfer of energy and result in price separation.



Economic Dispatch

- Least cost generation to supply system load.
Total Production Cost for the Control Area is the sum of all generator MWs x LMP.
- Electronic Dispatch: ISO New England sends Dispatch Instructions to generators.
 - Desired Dispatch Points (DDP) in MW and LMPs at each generator node that has a Remote Terminal Unit (RTU)
- Generator dispatch means giving them instructions to raise, lower, or maintain their output.

ISO New England's Control Room

- State-of-the-art control room that provides “air traffic control” of the power system
- Centerpiece is the 12 ft. x 47 ft. dynamic display board
- Allows wide-area dynamic view of neighboring operating areas in the Northeast
- Dynamic visualization tools for monitoring the health of the power system



Control Room Operators



Operations Training Programs

Initial System Operator Training Program

- Six month standardized training program
- Classroom, simulator, and OJT segments
- NERC Certifications to the level of Reliability Coordinator
- Two day evaluated simulator exercise to “qualify” as an operator



Operations Training Programs

System Operator Continuing Training Program

- Designed for On-Shift Control Room System Operators at ISO (System Operator, Senior Operator, Shift Supervisor)
 - Provides at least 120 hours per year of continuing operator training, with a goal of 160 hours per individual to ensure their operating proficiency
 - Meets needs identified by NERC, NPCC, and improvements identified by qualified industry and ISO personnel
 - Provides at least five days per year of training and drills using realistic simulation of system emergencies.



Operations Training Programs

Customer

Supply Resource Operator Training (SROT 101)

This course is for Supply Resource operational staff (including Designated Entities and Demand Resources) and provides information about the dispatch process and procedures used under both normal and emergency system conditions.

Target Audience: This course is for those who are responsible for dispatching and/or operating generation resources (Designated Entities and Demand Resources).

Offered online via ISO-TEN

Operations Control Performance and Reporting

- Monitor control performance compliance (i.e., regulation requirements)
- Track disturbance control performance (i.e., 10-minute reserves and reportable event recovery)
- Monitor and coordinate inadvertent energy payback
- Event analysis and reporting
- Project support
 - Micro AGC and Smart Grid ancillary services

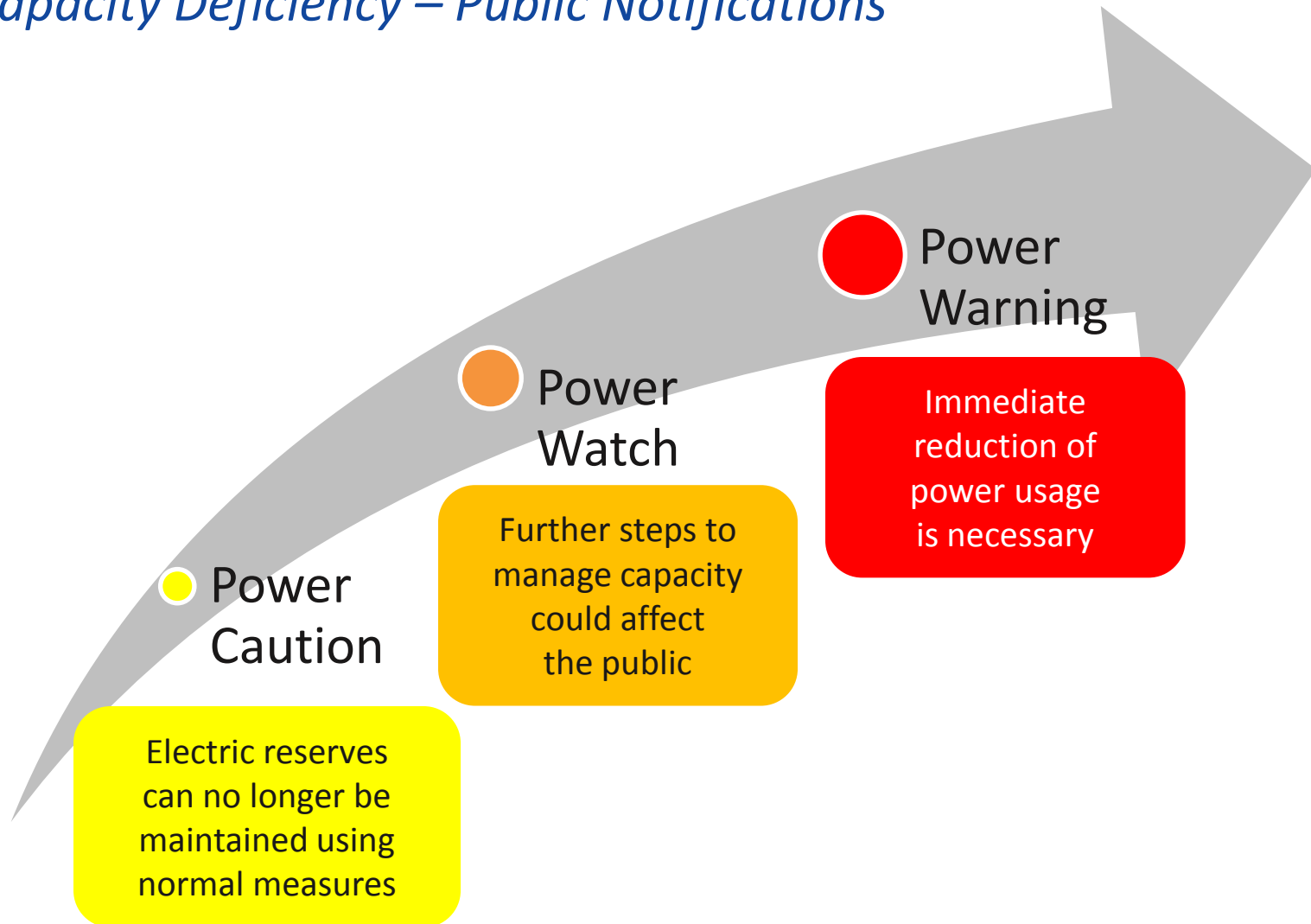


ISO Operating Procedure (OP-4)

- Purpose
 - Replace/maintain energy in the New England system when generation reserves are deficient.
- What we need:
 - Make available any MWs that require emergency actions to provide
 - Make offline resources available ASAP
 - AVOID anything that might jeopardize your output

Abnormal / Emergency Situations

Capacity Deficiency – Public Notifications



Abnormal / Emergency Situations

OP 4 Actions

