

# **Overview of EAI Functional Requirements for Short-Term Generation Planning**

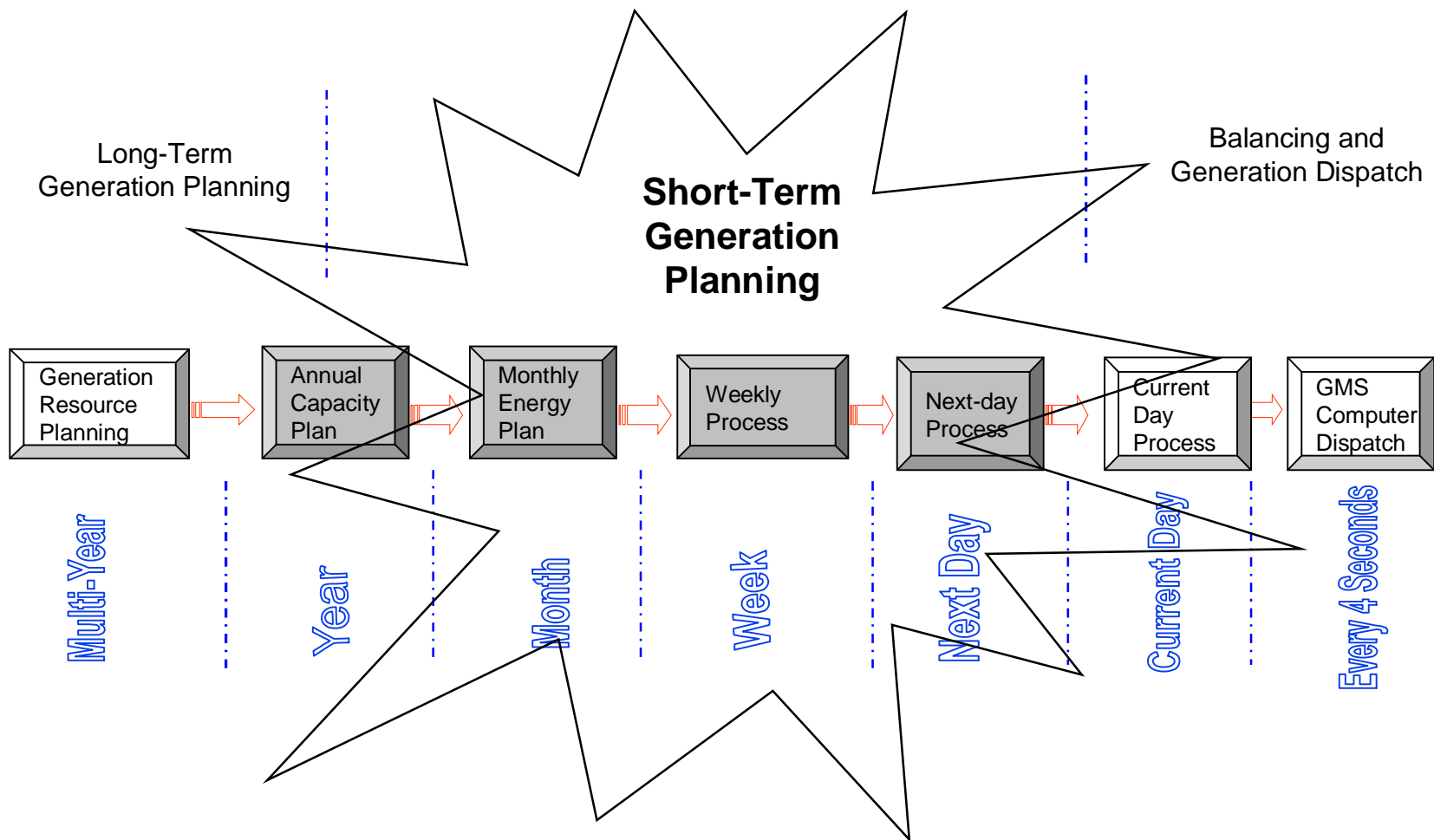
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May 5, 2010**

## Summary – Functional Requirements for EAI Short-Term Generation Planning

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- **A critical component of EAI’s Transition Plan will be to meet the functional requirements for the unit commitment and dispatch, wholesale transactions and fuel supply functions required for Short-Term Generation Planning.**
- **The purpose of these functional requirements is to make the short-term planning and operational decisions to deploy the EAI Generation Portfolio to provide power to meet the needs of EAI retail and wholesale customers reliably and at the lowest reasonable cost.**
- **The EAI Generation Portfolio of flexible generation supported by appropriate fuel supply arrangements is critical for effective EAI Short-Term Generation Planning.**
- **EAI will develop implementation plans to provide the facilities, staff and processes for these functions by December 2013.**
  - This will require a 2 year implementation period beginning in 2011.
- **The Short-Term Generation Planning functions, or very similar functions, will still be required even if EAI joins a Regional Transmission Organization (RTO).**
  - Some of the specifics may change, but most of the functions will still be needed.
  - There may be additional needs depending on the RTO’s market rules.

# Relationship of Functional Requirements



## Functional Requirements for EAI Short-Term Generation Planning

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- **The Short-Term Generation Planning functions are focused on planning horizons as long as a year in length and as short as the next calendar day.**
  - Routine processes are currently in place for the Entergy Operating Companies for the following Short-Term Generation Planning horizons:
    - » Annual
    - » Monthly
    - » Weekly
    - » Next Day
  - Seasonal planning activities occur on an as needed basis to:
    - » Enhance reliability
    - » Improve economics
    - » Respond to unsolicited wholesale power offers
- **Short-Term Generation Planning Objectives**
  - Reliability – provide a continuous supply of power to customers in spite of unforeseen circumstances that can disrupt production and delivery of power.
  - Economics – provide power to customers at the lowest reasonable cost while observing constraints and being ready to deal with unforeseen circumstances.

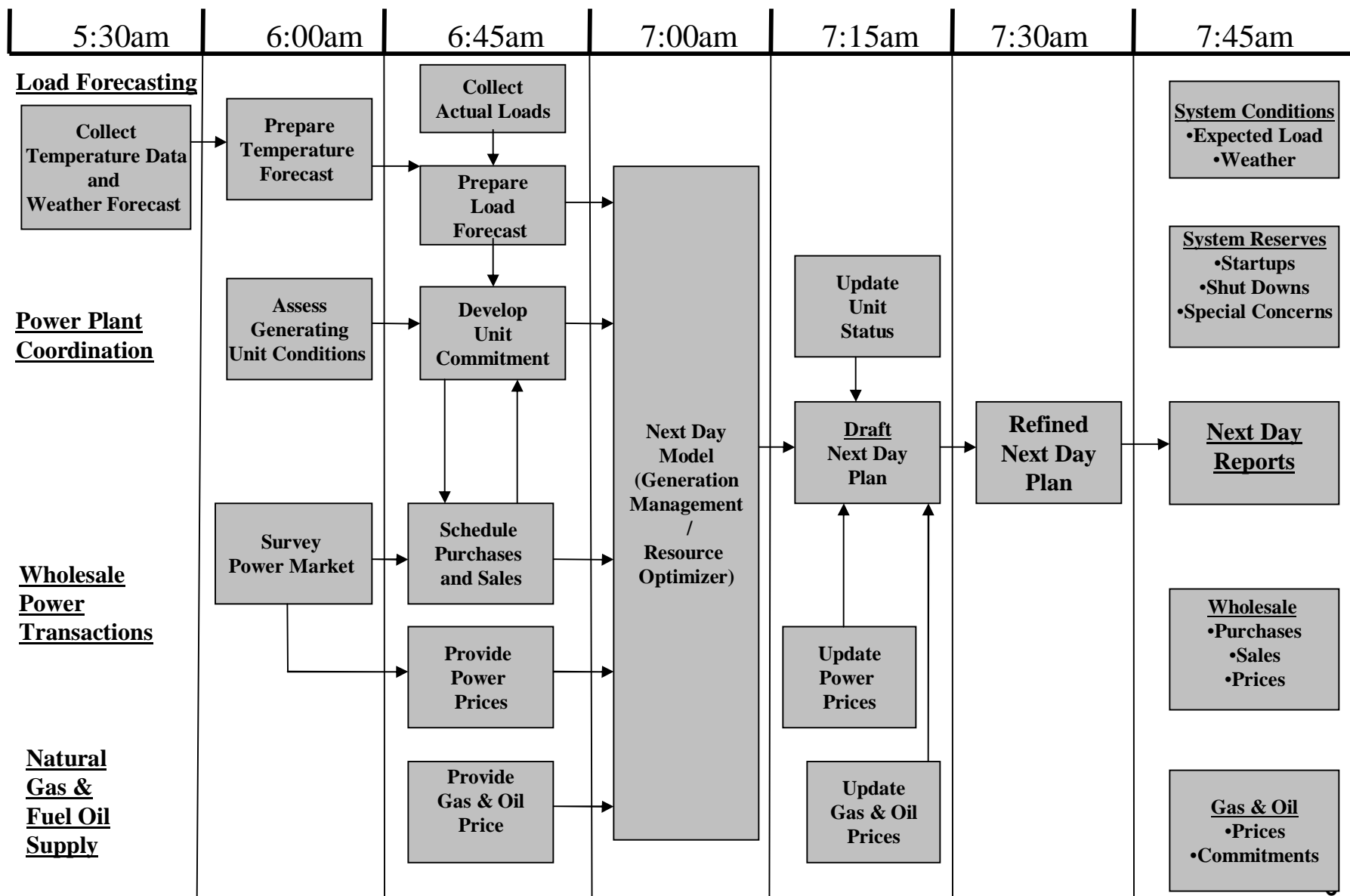
## Functional Requirements for EAI Short-Term Generation Planning

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- **The primary responsibilities of the Short-Term Generation Planning group include the following:**
  - Forecasting Short-Term Load
  - Power Plant Coordination
  - Soliciting/Price Discovery for:
    - » Wholesale Power Transactions (purchase and sales)
    - » Natural Gas & Fuel Oil Supply
      - ◆ Natural gas transportation and commodity
      - ◆ Fuel oil transportation and commodity
  - Implementing Short-Term Generation Plans
    - » Scheduling power plant start-ups and shutdowns
    - » Purchasing/selling wholesale power, natural gas and oil
- **Other responsibilities**
  - Coordinating operations with transmission and power plant personnel to ensure overall system reliability
    - » Scheduling outages of generating units
  - Responding to unforeseen equipment outages, weather events, etc.
    - » Triggers a new round of planning

# Functional Requirements for EAI Short-Term Generation Planning

## Next Day Planning Process Flow

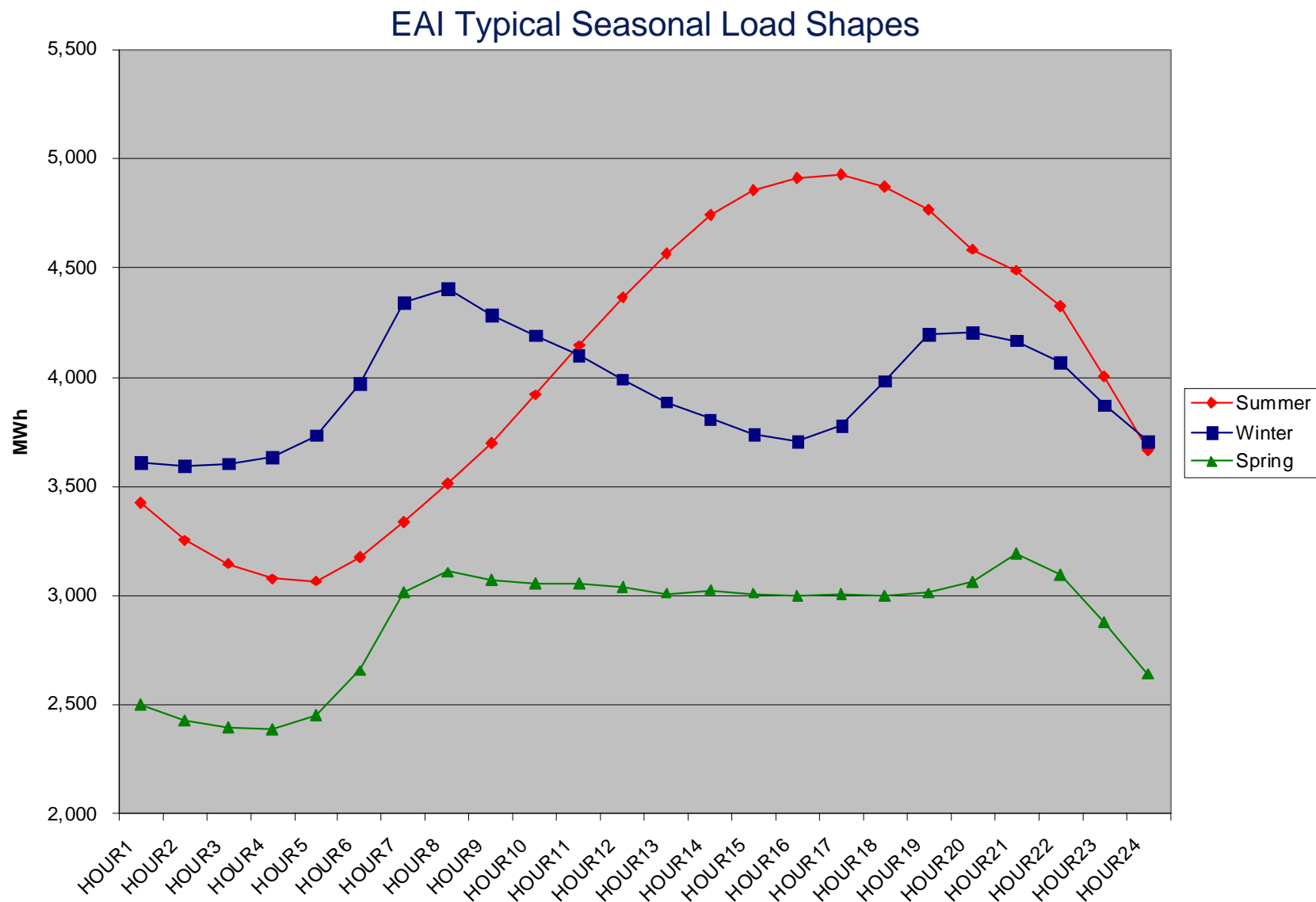


## Functional Requirements for EAI Short-Term Generation Planning Load Forecasting

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- **Load levels vary each day from a minimum level to a maximum level**
  - Minimum loads typically occur at night during spring, summer and fall.
  - Minimum loads sometimes occur during the afternoon during winter.
- **Load levels vary throughout the year. Maximum load levels or peak loads are highly correlated to temperature. The peak load of the year typically occurs in the summer.**
- **Daily peak loads can occur in the morning, afternoon or evening depending upon the season.**
  - High summer temperatures cause high air conditioner use with peak loads in the afternoon.
  - Cold winter temperatures cause high use of space heating with peak loads in the morning or evening depending how cold it is and the daily maximum and minimum temperature.
  - Mild temperatures during the spring and fall result in evening peaks caused by lighting and other non-space conditioning uses of electricity.
- **Temperature forecasts need to be updated daily to produce load forecasts that are reasonably accurate for Next Day Planning.**
  - Temperature forecasts tend to be accurate for only a few days into the future.
  - “Normal” weather is used for planning for periods more than a week into the future.

# Functional Requirements for EAI and AECC Short-Term Generation Planning Load Forecasting



## Functional Requirements for EAI Short-Term Generation Planning

### Short-Term Generation Planning Constraints

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- **Resources must be scheduled to serve the load plus operating reserves in each hour.**
  - Operating reserves are:
    - » Comprised of regulating reserves and contingency reserves.
      - ◆ Regulating reserves come from generators that follow moment-to-moment changes in load to keep generation and load balanced.
      - ◆ Contingency reserves come from generators that can ramp up quickly to replace energy from a generator that has a sudden mechanical breakdown.
    - » Needed because of uncertainty.
      - ◆ Actual load will be different than forecasted load.
      - ◆ Power plants and other resources may not operate as planned.
      - ◆ Transmission system may not operate as planned.
- **Power Plants typically have constraints or limitations associated with their operation that must be observed to ensure a feasible plan.**
  - Typical Power Plant constraints:
    - » Minimum load
    - » Maximum load
    - » Ramp rate
    - » Time to start up
    - » Minimum time to run after being started
    - » Minimum time to be off after being shut down

## Functional Requirements for EAI Short-Term Generation Planning

### Short-Term Generation Planning Constraints

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- **Fuel supplies typically have constraints or limitations that must be observed to ensure a feasible plan.**
  - Typical Natural Gas constraints:
    - » Pipeline delivery rate minimums and maximums
      - ◆ Hourly, Daily, Weekly, Monthly and Annual
  - Typical Fuel Oil and Coal constraints:
    - » Delivery rates
      - ◆ Typically delivered by truck, rail or barge
      - ◆ Elapsed time from purchase to receipt
    - » Storage volumes
    - » Transfer rates to and from storage
    - » Any constraints on fuel supply that are more limiting than the Power Plant constraints will result in additional constraints on the Power Plant operation.
- **Purchased Power typically has constraints.**
  - Typical Purchased Power constraints:
    - » Size (MW)
    - » Shape (number of hours)
    - » Reliability (firm versus non-firm)
- **EAI/AECC Power Coordination agreement has been interpreted to require EAI to operate EAI and AECC resources to serve the combined EAI and AECC load, which affects short-term generation planning.**

## Functional Requirements for EAI Short-Term Generation Planning Short-Term Generation Planning Implications

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- **Feasible Short-Term Generation Plans to meet EAI's daily load throughout an annual period will require resources:**
  - With a daily “operating range” from EAI's minimum load to EAI's peak load.
    - » Several thousand MW on many days
  - That can provide regulating reserves to meet EAI's regulating reserve requirement.
    - » Several hundred MW
  - That can provide contingency reserves to meet EAI's contingency reserve requirement.
    - » About 1,000 MW

## Functional Requirements for EAI Short-Term Generation Planning

### Short-Term Generation Planning Challenges

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- **Challenges to EAI Short-Term Generation Plans:**
  - EAI has a large proportion of nuclear generation at ANO and Grand Gulf (~2,200 MW).
    - » Nuclear units operate best at full load and don't contribute to operating range, regulating reserves or contingency reserves.
    - » ANO 2 is very large relative to the overall EAI load, establishing the ~1,000 MW contingency reserve requirement.
  - EAI has a limited amount of “intermediate” and “peaking” generation – also known as “flexible capability.”
    - » Ouachita 1 and 2 ~500 MW combined cycle gas turbine
      - ◆ Contributes to operating range, regulating reserves and contingency reserves.
    - » Other Gas/Oil capacity ~1,200 MW operational; ~500 MW non-operational
      - ◆ Natural Gas pipeline constraints are significant and severely limit the ability of many EAI power plants to contribute to operating range and contingency reserves.
      - ◆ Only 1 operating unit can contribute to regulating reserves.
    - » Hydro capacity ~200 MW
      - ◆ Flexible, but too little to make a major contribution.

## Functional Requirements for EAI Short-Term Generation Planning

### Short-Term Generation Planning Challenges

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- **Challenges to EAI Short-Term Generation Plans (continued):**
  - EAI has a large amount of coal-fired generation at White Bluff and ISES (~1,200 MW).
    - » These power plants can contribute to operating range, regulating reserves and contingency reserves.
      - ◆ Using these coal-fired power plants to provide operating range, regulating reserves and contingency reserves means they will produce less energy, which will raise cost to customers.
  - EAI has a number of large power plants that require scheduled maintenance from time to time. These maintenance outages are usually scheduled during the lower load periods in the spring and fall.
    - » An unscheduled outage of a large power plant at the same time a scheduled outage of another large power plant is occurring might deplete EAI's resources.
    - » Multiple scheduled outages at the same time may not be possible.
  - During low load periods EAI may have more generation than load and may have to sell power at a loss to keep generation and load balanced.

## Functional Requirements for EAI Short-Term Generation Planning Overcoming Short-Term Generation Planning Challenges

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- **General strategies for overcoming Short-Term Generation Planning challenges:**
  - EAI may need to enhance the existing generation fleet.
    - » Consider extending the operating life of units currently considered for deactivation.
    - » Reactivate units currently deactivated.
    - » Improve the operating characteristics of existing units.
  - EAI may need to add new power plants to its generation fleet.
  - EAI may have to make new arrangements with gas suppliers, gas pipelines, and gas storage providers to provide additional operating range, regulating reserve and contingency reserve to all of its generation fleet.
  - EAI may have to rely on Purchased Power to supply operating range, regulating reserve and contingency reserve.
  - EAI may consider entry into a reserve sharing pool to mitigate the contingency reserve burden of its large generating units.

## Functional Requirements for EAI Short-Term Generation Planning What if EAI Joins the SPP RTO?

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- **If EAI joins the SPP RTO:**
  - All of the Short-Term Generation Planning functions needed for EAI to develop and implement Short-Term Generation Plans, or functions similar to those, are still required.
  - Many new systems and processes will be required to enable EAI to make the correct decisions regarding actual day-to-day participation the SPP RTO market.
    - » The current SPO RTO market is limited to “economy transactions” achieved by a coordinated dispatch of generating units participating in the market.
    - » The market protocols for the SPP RTO “Day 2” market are still being developed.