Training Disclaimer: *ISO New England (ISO) provides training to enhance participant and stakeholder understanding. Not all issues and requirements are addressed by the training. Consult the effective Transmission, Markets and Services Tariff and the relevant Market Manuals, Operating Procedures and Planning Procedures for detailed information. In case of a discrepancy between training provided by ISO and the Tariff or Procedures, the meaning of the Tariff and Procedures shall govern.*

October 24-26, 2023
Northampton, MA

Having a Capacity Supply Obligation
Lesson 2A: Introduction to Capacity Resources

Forward Capacity Market (FCM 101)

This presentation is based on the current information available for the rules as they are today. The information in this presentation may change based on upcoming decisions made regarding the future of FCA 19 and will be covered in future training.

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Some slides or portions of slides may be intentionally hidden in the printed and posted versions of this presentation.

Topics

Overview of Capacity Resources

- Types of resources that can take on a capacity supply obligation (CSO)
- Example showing options

Generating Resources and Demand Resources

- Market Structure
- Asset Registration
- Auditing Requirements

Introduction to Generating Resource Examples

Objectives

- Recall the different types of capacity resources
- Recognize how capacity resources are represented within the markets
- Understand the auditing requirements that affect qualification for the various types of resources

Common Acronyms

In Order of Appearance

FCM	Forward Capacity Market
FCA	Forward Capacity Auction
SOI	show-of-interest
CSO	capacity supply obligation
PFP	pay for performance
SOG	settlement-only generator
RTU	remote terminal unit
SCC	seasonal claimed capability

SQF	special qualifying facility
FERC	Federal Energy Regulatory Commission
CCA	claimed capability audit
ADCR	active demand capacity resources
DRR	demand response resource
DRA	demand response asset
DCR	demand capacity resource

Overview of Capacity Resources

What is a Capacity Resource?

A capacity resource participates in Forward Capacity Market (FCM) and is capable of providing at least 100 kW of capacity through either supplying power or reducing demand

Generating Resources	Demand Resources	Import Resources
Supply MW	Reduce MW	Supply MW from outside of New England control area

Qualification/Capacity Supply Obligation

Show-of-interest (SOI) /new resource qualification to get qualified MW

Process to qualify as a new capacity resource will be covered in *Lesson 3A: Qualification for FCA/New Capacity Qualification*

Participate in FCA and get awarded CSO

Capacity resources acquiring capacity supply obligation (CSO) through Forward Capacity Auctions (FCAs) will be covered in *Lesson 5A: Forward Capacity Auction*

A CSO is an obligation to provide capacity:

- Supply a specific amount of power, or
- Reduce demand by a specific amount

} …for a given commitment period

3 yrs.

Up and running for commitment period

To cover a CSO, underlying assets need to be represented

Capacity Resource – Fulfilling Obligations

Some Considerations to Being Ready to Fulfill Capacity Supply Obligations

Up and running for commitment period

- Construction
  - Large generators typically attain capacity supply obligation (CSO) prior to start and/or completion of construction
- Interconnection rights
- Communications and dispatch
- Registration of underlying assets with ISO

Capacity Resource – Fulfilling Obligations, *continued*

Some Requirements When Up and Running in ISO Markets

Up and running for commitment period

- Certain resources are required to offer CSO into Day-Ahead and Real-Time Energy Markets
- Auditing requirements vary based on type of resource
  - Results affect:
    - Demonstrating capacity resource commercial and release of financial assurance (Lesson 3A: Qualification for FCA and New Capacity Qualification)
    - Ongoing qualification for auctions (Lesson 3B: Existing Capacity Qualification and Qualification for Reconfiguration Auctions)
    - Significant decrease determinations (Lesson 3B: Existing Capacity Qualification and Qualification for Reconfiguration Auctions)

Capacity Resource – Generating and Demand

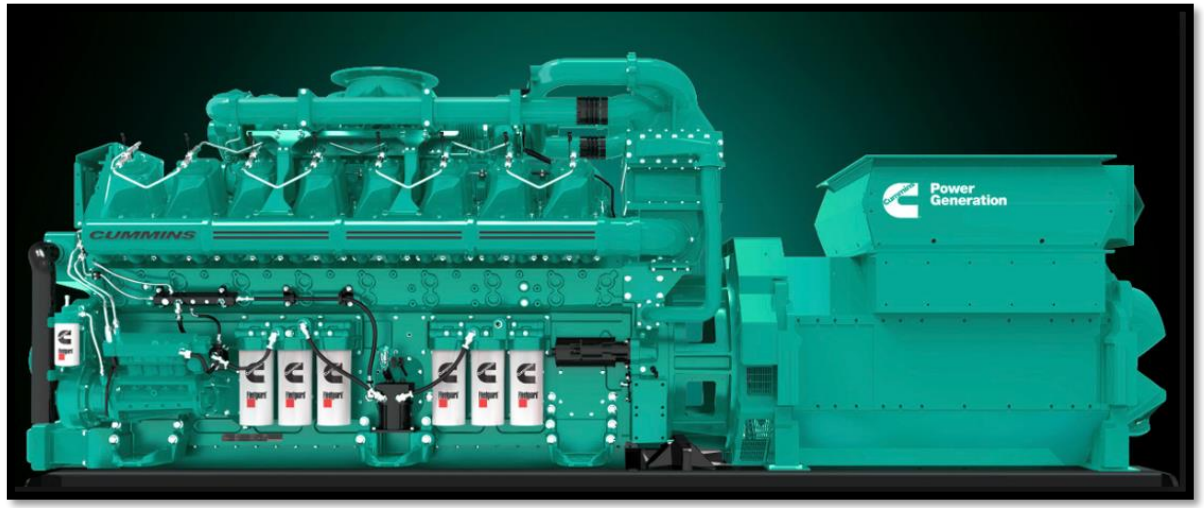
Generating Resource

Demand Resource

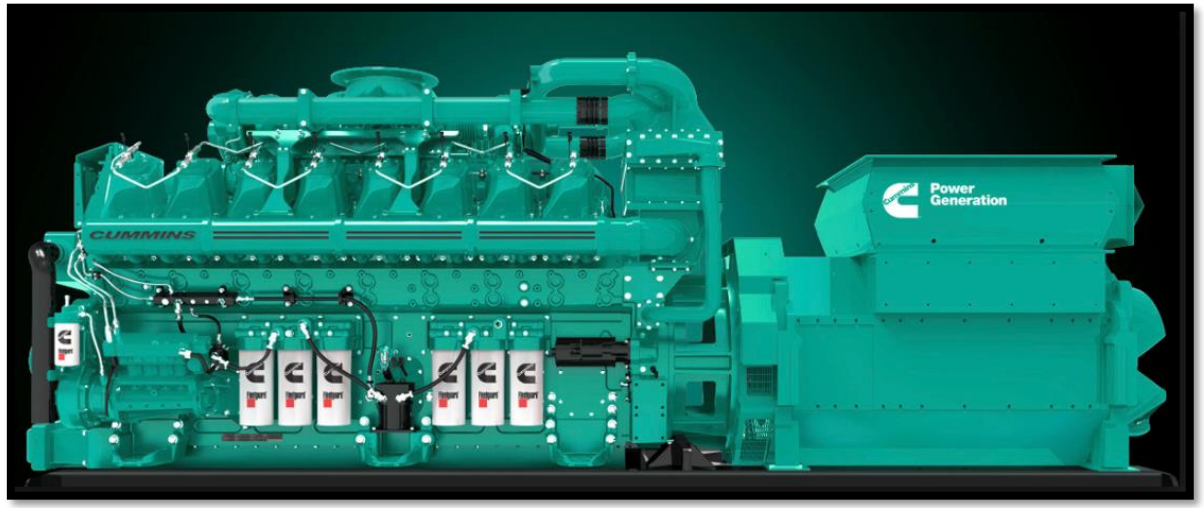
Factors that determine options for market participation:

- **What can the resource physically do?**
  - Supply power to the grid
  - Reduce power consumption from the grid
- **What are the interconnection rights?**

Capacity Resource Examples

Example 1: Generator Connected Directly to Grid	Example 2: Mill with Generation
	

Capacity Resource – Example 1 Option

Example 1: Generator Connected Directly to Grid	Option
	**Generating Resource** Participate as a generator, assuming it will have interconnection rights to supply energy

Capacity Resource – Example 2 Options

Example 2: Mill with Generation

Options

Demand Resource

Generator is used to reduce demand at the mill and mill participates as demand response

OR

Generating Resource

If interconnection rights allow for supplying energy to grid, this could participate as a generator

Fill in the blanks: **A capacity resource** is capable of providing at least ___ kW of capacity through either supplying power or _____ demand.

A. 100; reducing

B. 1,000; increasing

C. 100; increasing

D. 10; reducing

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Questions

Generating Resources

Generating Resources

Supply MW

Types of Generating Resources

Intermittent resources

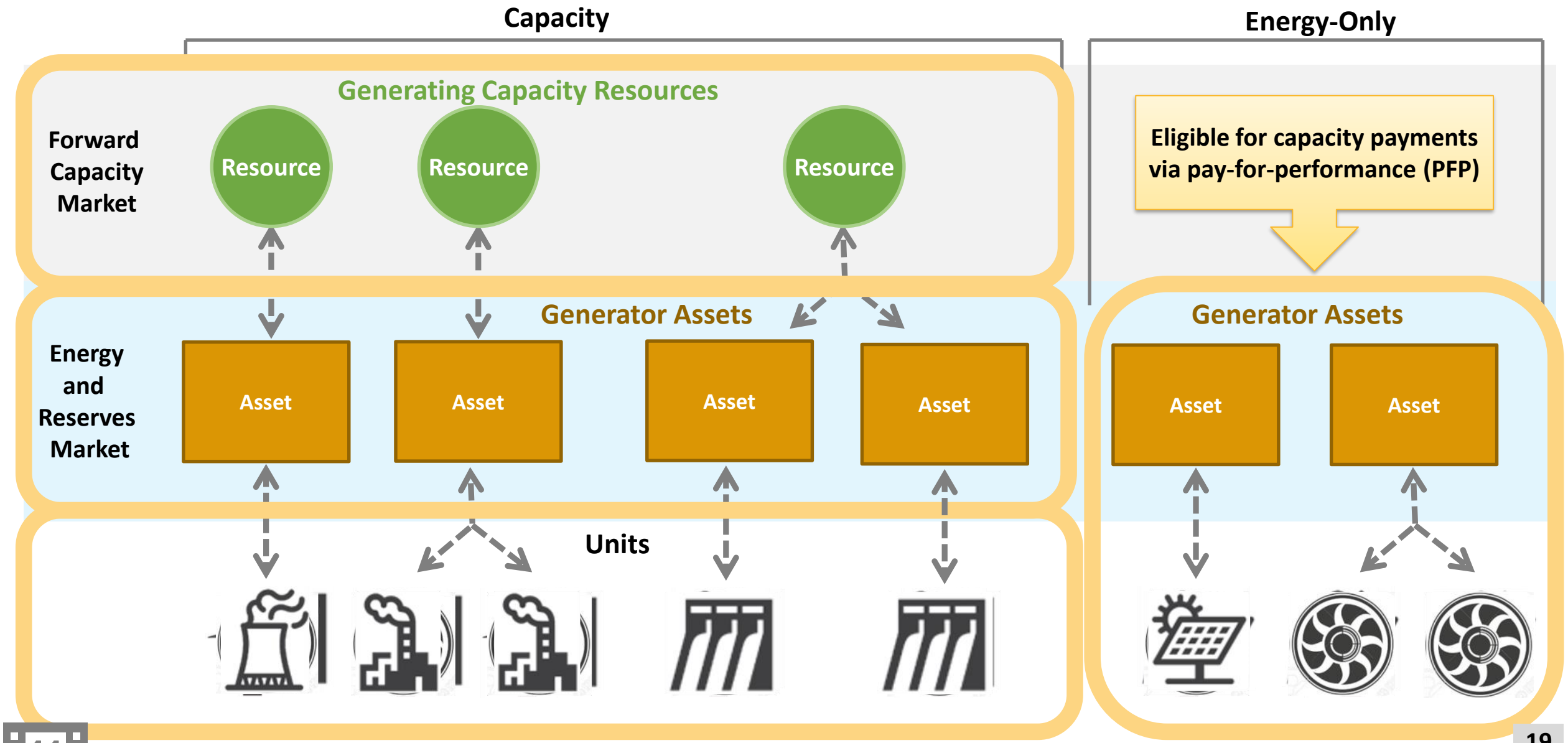
Do not have control over their net power output (examples: wind, solar, run-of-river hydro)

Non-intermittent resources

Have control over their net power output (examples: oil, coal, natural gas, nuclear, pumped storage)

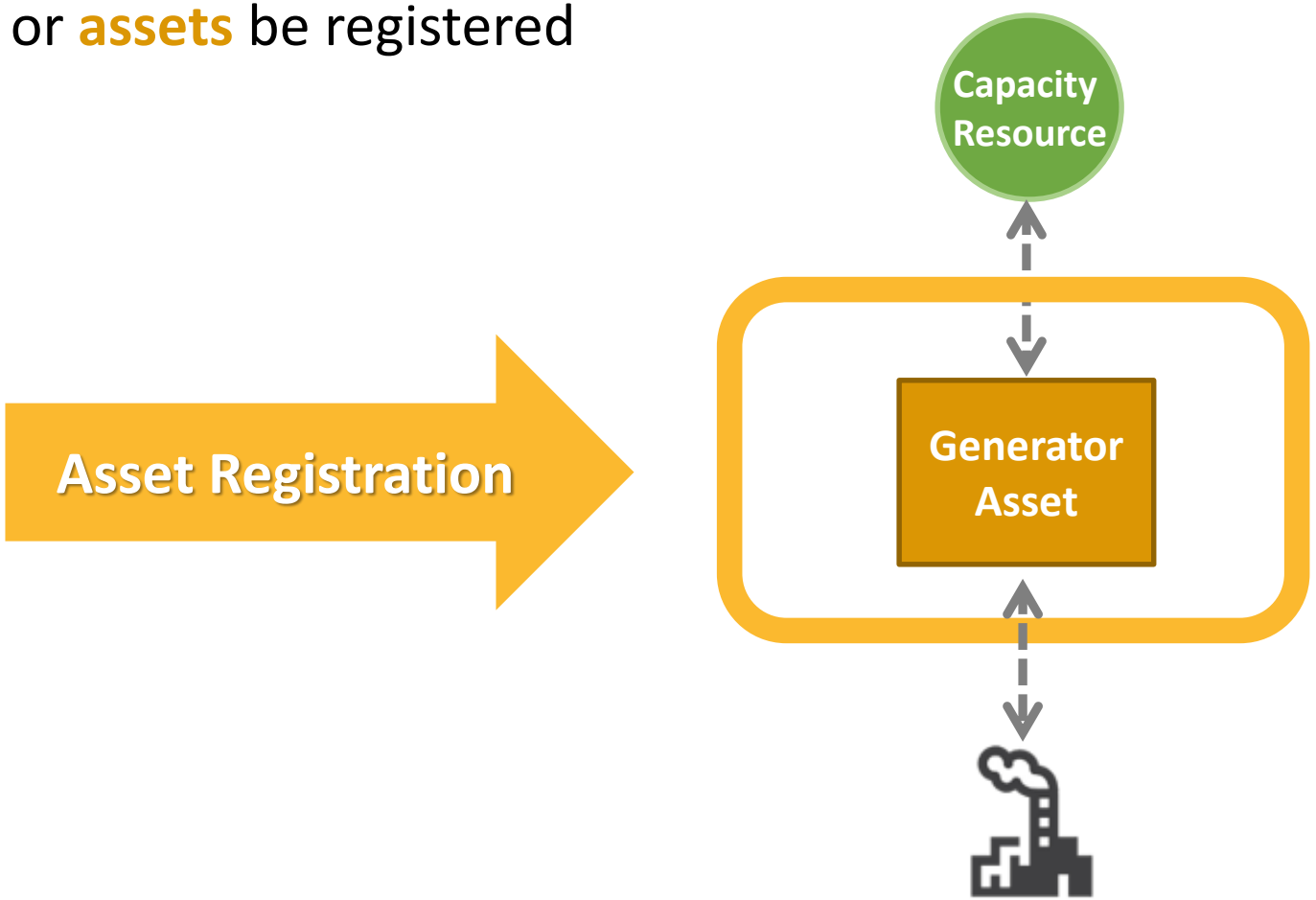
Market Structure

Generating Resources



Asset Registration

Representing a capacity resource in the energy market (in order to cover its CSO) requires that a **generator asset** or **assets** be registered



Modeled Generator or Settlement-Only Generator

OP-14 defines how a generating facility/asset must be represented based on:

- Max net output
- Interconnection voltage

Modeled Generator

OR

Settlement-Only Generator (SOG)

Modeled Generator or Settlement-Only Generator

Generating Resources

Modeled Generator

Generating facility has capability of 5 MW or greater, or any size interconnected at 115 kV or greater

- In ISO power system model
- Offers into energy market
- Dispatched and monitored

Settlement-Only Generator (SOG)

Generating facility has capability of less than 1 MW and interconnected below 115 kV

- Not in ISO power system model
- No offers
- Self-dispatch/price taker

Entitled to receive energy and capacity credit

Registration Choice

Generating facility with capability between 1 and less than 5 (4.999) MW **and** interconnected below 115 kV

Must choose Modeled or SOG

Modeled Generator or Settlement-Only Generator, *continued*

Generating Resources

Settlement-only generator can be registered in as little as five business days

- Reliability Committee approval required for SOGs greater than 1 MW
- Agenda/scheduling may take up to two months to review/approve
  - Technical working group review/recommendation

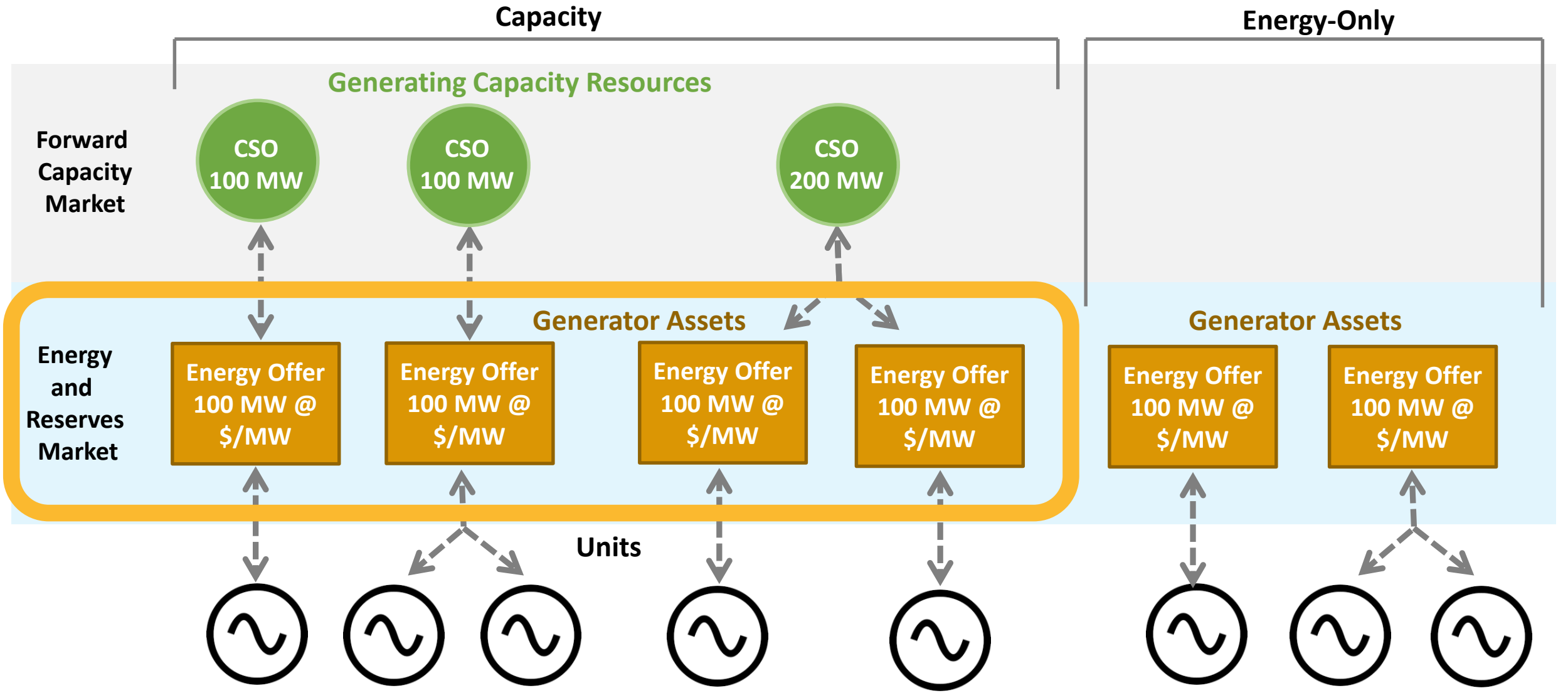
Lead times for registering a modeled generator can be extensive (1+ years)

- System impact studies (as-studied, as-purchased, as-built)
- Generator asset(s) must be preconfigured into power system model
  - Three power system model releases per year (Typically in February, May, and September)
- Telemetry infrastructure/remote terminal unit (RTU) must be ordered, installed, and tested (OP-18)
- Dispatch location must be registered with ISO New England
- Provide technical data
- Meet requirements such as voltage control, support system reactive needs, governor control
- And more…

OP-14 Technical Requirements For Generators, Demand Response Resources, Asset Related Demands, and Alternative Technology Regulation Resources and OP-18 Metering and Telemetering Criteria

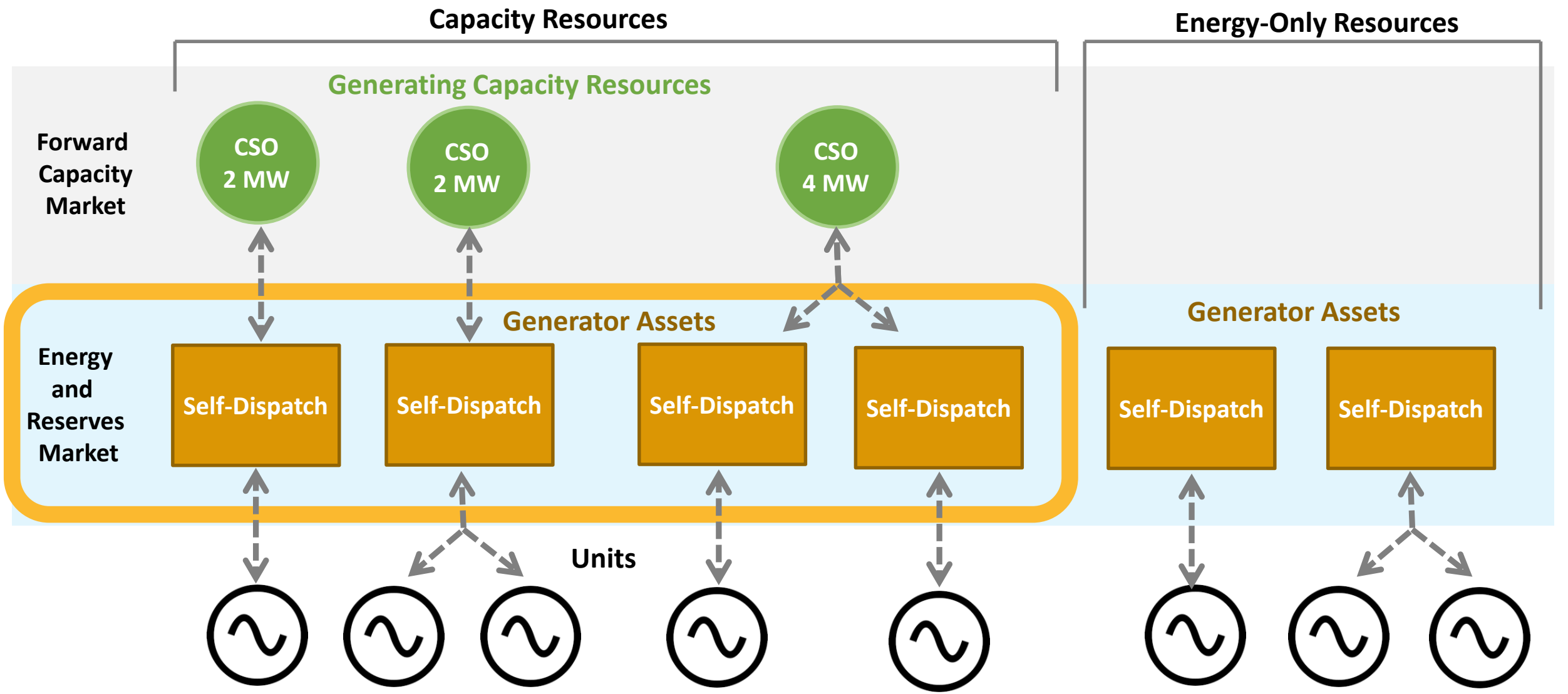
Modeled Generators Offer into Energy Market (to meet CSO)

Generating Resources



Settlement-Only Generators Self-Dispatch (to meet CSO)

Generating Resources



Registration Example

Generating Resources

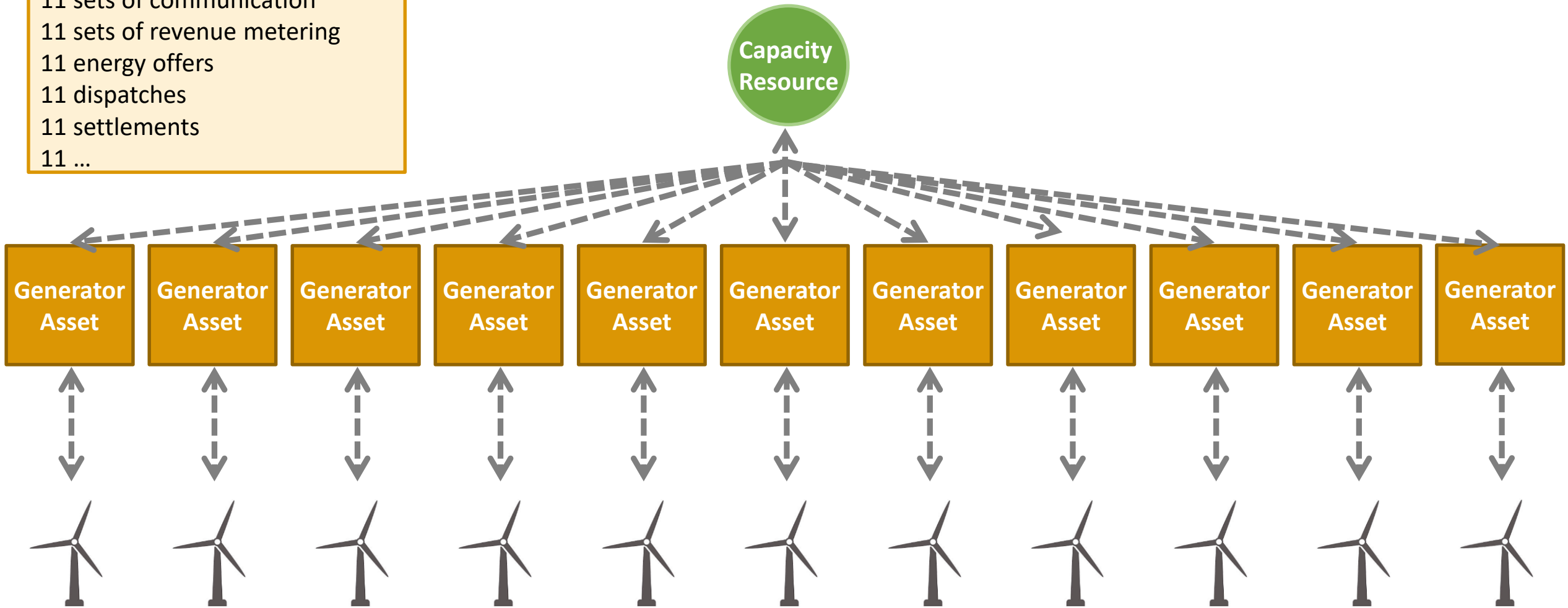
- Capacity resource initiated to build wind farm with eleven 4 MW wind turbines
- 44 MW means asset(s) must be in power system model (>= 5 MW; no choice)
- Choice on how many assets to register

Capacity Resource

Generation Resources

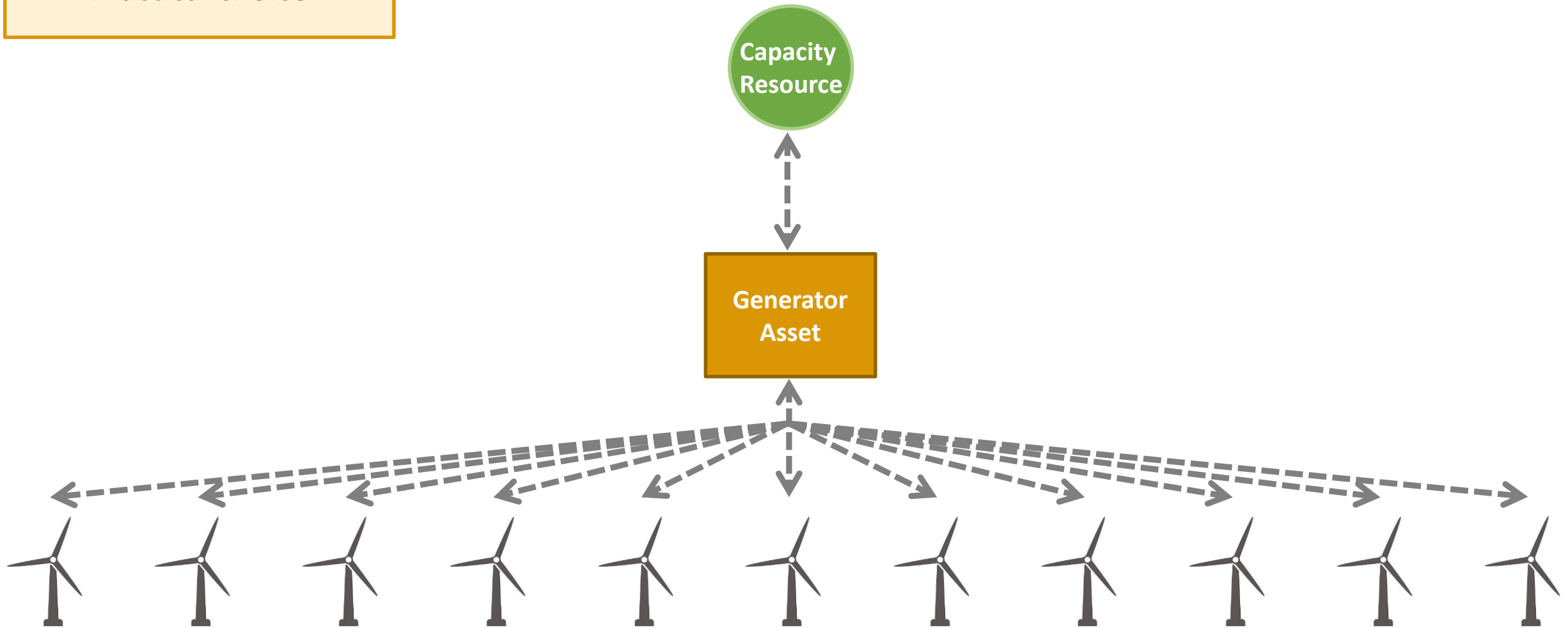
Generating Resources

Not practical:
11 sets of communication
11 sets of revenue metering
11 energy offers
11 dispatches
11 settlements
11 …



Generation Resources, *continued*

Practical choice



What must be registered and operating in the energy market to cover a capacity supply obligation (CSO) for a generator?

A. Generating resource

✓ B. Generator asset

C. Generator unit

D. Energy-only asset

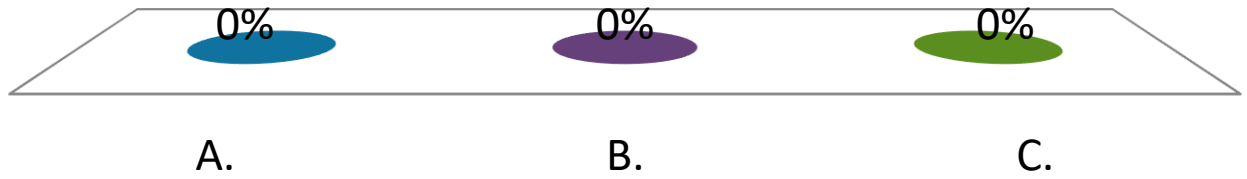
Q2 of 10

A generator capable of providing 20 MW and interconnected at less than 115 kV may participate in the energy market as a:

A. Settlement-only generator

✓ B. Modeled generator

C. Either A or B



Q3 of 10

A generator capable of providing 3 MW may participate in the energy market as a:

A. Settlement-only generator

B. Modeled generator

C. Either A or B

✔ D. It depends

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Questions

Seasonal Claimed Capability – Defined

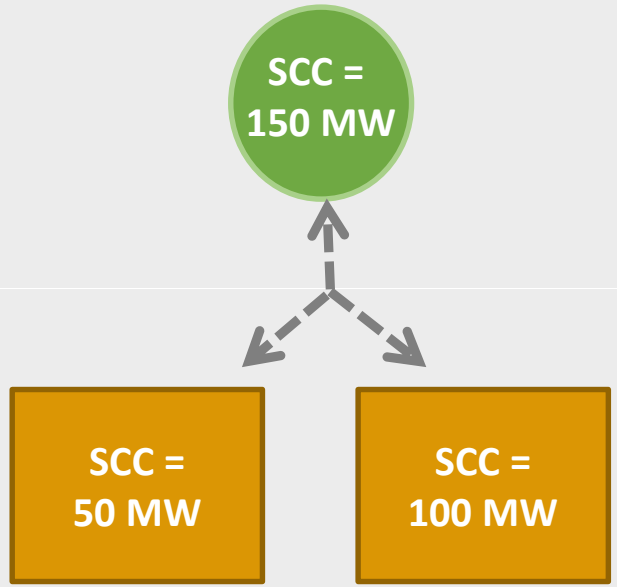
Seasonal claimed capability (SCC) is the summer or winter claimed capability of a generator asset or generating capacity resource, and represents the maximum dependable load carrying ability of the asset or resource, excluding capacity required for station use

Seasonal Claimed Capability – Determination

Generating Resources

Seasonal claimed capability (SCC) values are used to:

- Demonstrate capacity resource as commercial and release of financial assurance
- Determine ongoing qualification for auctions
- Determine significant decrease



SCC value of a capacity resource is the sum of its associated assets' SCCs

SCC values are determined for all generator assets
(regardless of participation in FCM)

Each asset/resource maintains a summer SCC and a winter SCC

Seasonal Claimed Capability – Determination, *continued*

Generating Resources

- How SCCs are determined depends on type of generator asset
- How SCCs are used in existing qualification is based on intermittent status

Generator Type		SCC Determination	
INTERMITTENT	**All intermittent**	Median net output	*Lesson 3B - Existing Qualification (Intermittent)*
NON-INTERMITTENT	**Daily cycle hydro**	Calculated using historical hydrology data	*Lesson 3B - Existing Qualification (Non-Intermittent)*
	Net-metered or special qualifying facility (SQF)	Median net output unless choose to audit	
	Other/most common (not one of the above)	Claimed capability audits	

Seasonal Claimed Capability – Intermittent

Generating Resources

Median of net output during intermittent reliability hours

October
November
December
January
February
March
April
May

WINTER

Winter SCC = Median of net output during hours ending 1800-1900*

*and any hours during scarcity conditions

June
July
August
September

SUMMER

Summer SCC = Median of net output during hours ending 1400-1800*

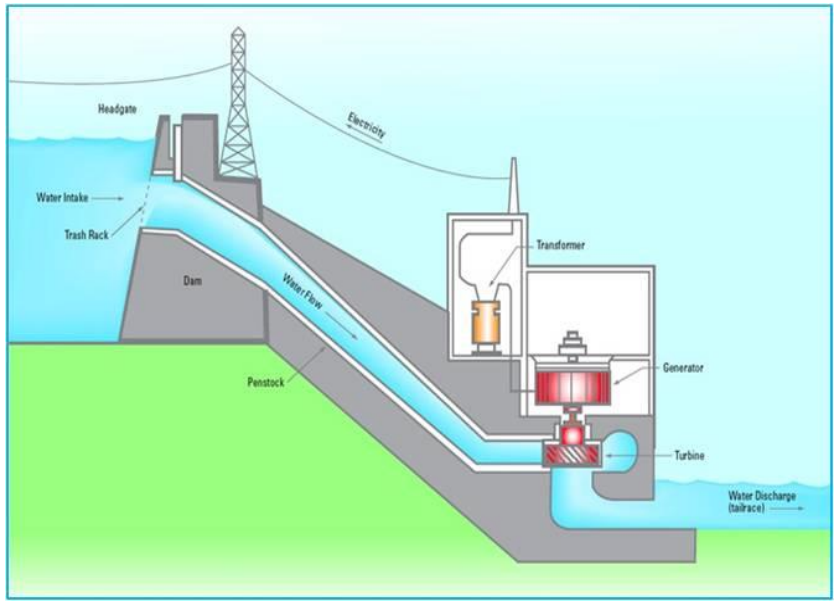
*and any hours during scarcity conditions

Seasonal Claimed Capability – Non-Intermittent Daily Cycle Hydro

Generating Resources

Based on historical data:

- Calculations utilize daily mean river flow rate data over a 20-year historical period per United States Geological Survey (USGS); updated every five years
- Average of monthly values determines SCCs
- Details are in OP-23, Appendix C



Winter Months

January	February
9 MW	13 MW
March	**April**
15 MW	15 MW
May	**October**
15 MW	10 MW
November	**December**
10 MW	9 MW

Winter Average Value = 12 MW

Summer Months

June	July	August	September
14 MW	11 MW	10 MW	9 MW

Summer Average Value = 11 MW

Seasonal Claimed Capability – Non-Intermittent Net-Metered or Special Qualifying Facility

If does not audit:

- SCC set to median output during reliability hours (same as intermittent)

If performs audits, SCC is the lesser of its:

- Current seasonal claimed capability audit (seasonal CCA) value
- Current establish claimed capability audit (establish CCA) value
- Median hourly availability during hours ending:
  - 14:00 thru 18:00 – Summer (June thru September)
  - 18:00 and 19:00 – Winter (October thru May)

Net-Metered Generator

Load behind the meter (not solar billing arrangement)

A generator for which a portion of the generator's output is used by a load (other than station service) located behind the meter

Special Qualifying Facility

- Generating facility with Federal Energy Regulatory Commission (FERC) designation of special qualifying facility (SQF) per PURPA
- Register with ISO designation of SQF if power purchase agreement limits ability of lead market participant (utility) to schedule or dispatch the output

Seasonal Claimed Capability – Most Common Non-Intermittent

Generating Resources

SCC is lesser of its:

- Establish claimed capability audit (establish CCA) value
- Seasonal claimed capability audit (seasonal CCA) value

Establish CCA

Establishes the generator asset's ability to respond to ISO dispatch instructions and maintain an output level for a specified duration (1 to 4 hours depending on type of generator)

Performed when asset becomes commercial in energy market (within five business days); Then only if requested by lead participant

Seasonal CCA

Determines a generator asset's capability to perform under specified summer and winter conditions for a specified duration (1 to 2 hours depending on type of generator)

Performed on a regular basis

Seasonal Claimed Capability – Most Common Non-Intermittent

Generating Resources

Claimed capability audit (CCA) result:

- Average MW output is determined based on energy reported by the meter reader for energy market settlement
  - Should represent net output of generator at point of interconnection
- For gas turbine and combined cycle assets, results normalized for temperature (to 20˚F for winter; 90˚F for summer)

Seasonal Claimed Capability – Most Common Non-Intermittent

Generating Resources

Establish CCA

Occurs within a five business day window (following asset becoming commercial or at customer's request); sometime between 0800 and 2200

ISO will:

- Initiate audit by issuing verbal dispatch instructions to the dispatch contact ordering asset to its real-time high operating limit
- Audit will begin with first full clock hour after sufficient time has been allowed for start-up and ramping

Seasonal Claimed Capability – Most Common Non-Intermittent

Generating Resources

Seasonal CCA

Ongoing; based on temperature

Summer CCA must be conducted each capability demonstration year at or above 80 degrees (or during a summer audit window)

Winter CCA must be conducted at least once every three capability demonstration years at or below 32 degrees (or during a winter audit window)

Participant:

May choose any run meeting duration and temperature requirements, and submit within five business days (there is not a seasonal CCA dispatch)

Capability Demonstration Year
(September 1 through August 31)

- September
- October
- November
- December
- January
- February
- March
- April
- May
- June
- July
- August

Audit windows are designated in one-hour blocks if predicted temperatures are expected to be sufficiently warm or cold throughout New England for summer or winter audits; they are posted at least 48 hours in advance

Note: Failure to audit will result in SCC set to zero

Seasonal Claimed Capability – Most Common Non-Intermittent

Generating Resources

SCC is the lesser of its:

- Establish claimed capability audit (establish CCA) value
- Seasonal claimed capability audit (seasonal CCA) value

Note: For a new asset with no seasonal CCA values, initial SCCs will be the initial establish CCA values

		Establish CCA Value	Seasonal CCA Value	SCC
Asset A	Summer	52	51	51
	Winter	54	52	52
Asset B	Summer	400	0	0
	Winter	425	430	425

Audit results may affect:

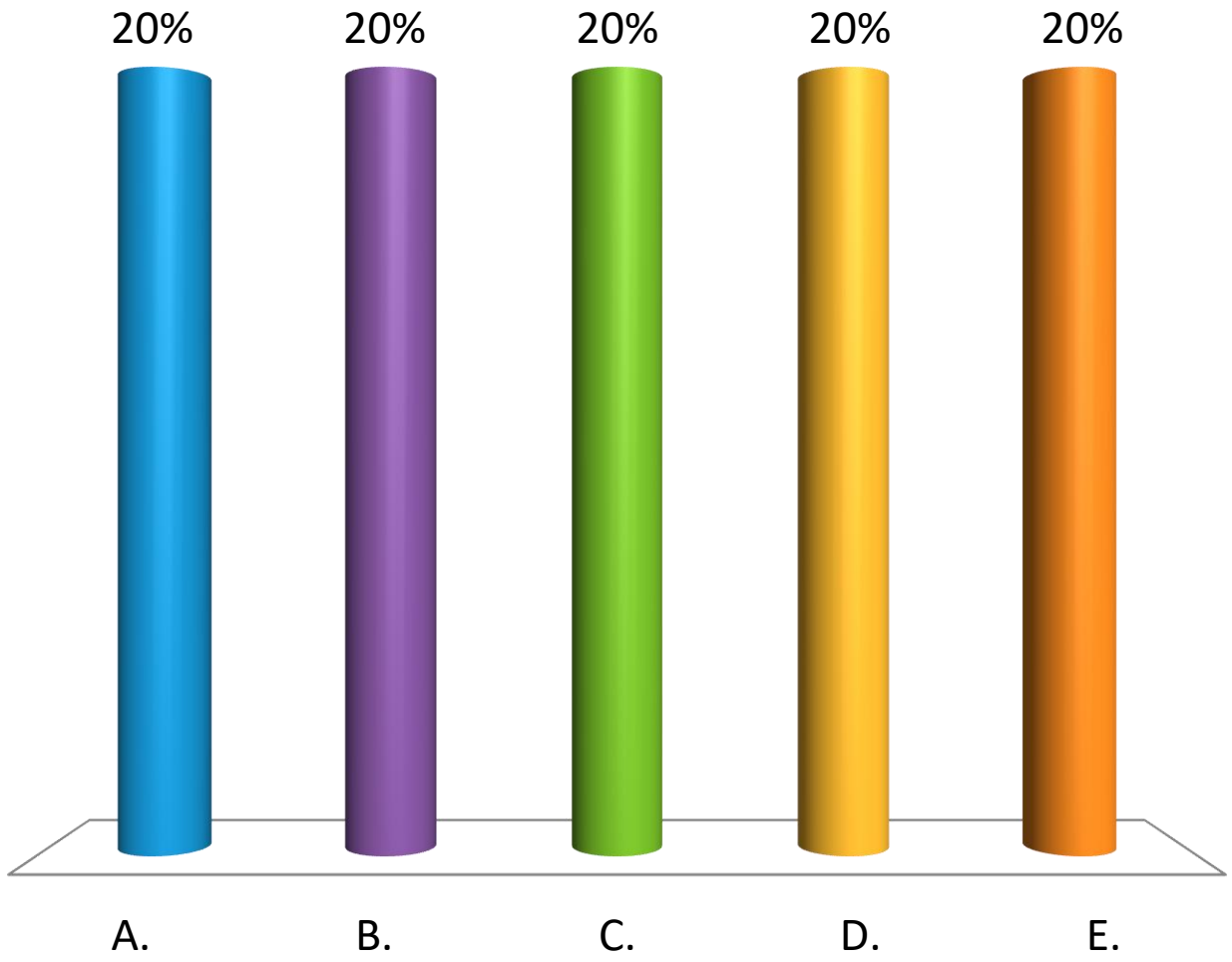
A. Release of financial assurance

B. Determination of ongoing qualification for auctions

C. Determination of a significant decrease

D. Ability to offer into the energy market

✓ E. A, B, and C



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Seasonal claimed capability (SCC) for generators is determined in four different ways, but the way those SCCs are then used in existing qualification is dependent on whether a resource is:

A. Settlement-Only or Modeled

✓ B. Intermittent or Non-intermittent

C. Alternating Current or Direct Current

D. Interconnected or Disconnected

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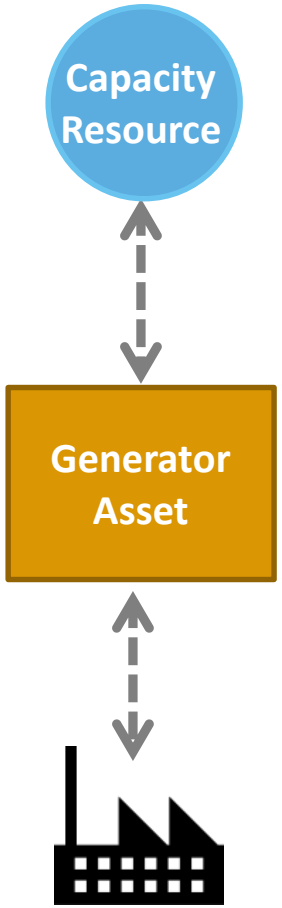
The FCM path of a non-intermittent generator …

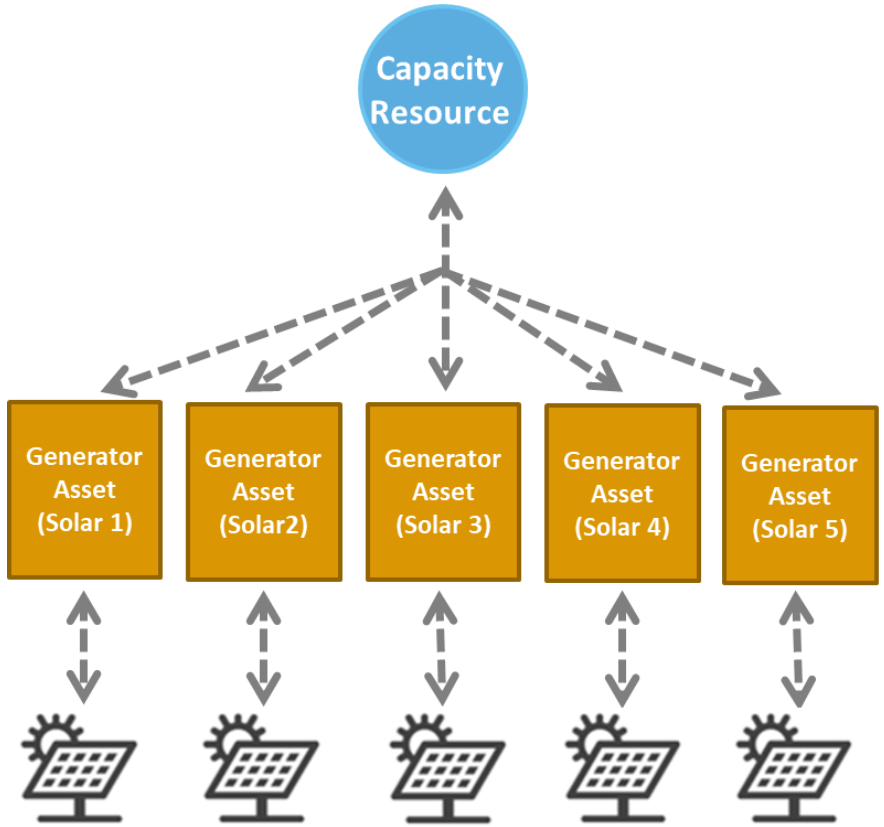


- Non-intermittent generator asset that is required to perform capability audits to determine winter and summer seasonal claimed capability (SCC) values
- Capacity resource:
  - As a new resource, in the FCA it qualified for and cleared:
    - 190 MW for summer / 195MW for winter (Lesson 3A)
  - As an existing resource, its latest qualified MWs are:
    - 180 MW summer / 215 MW winter (Lesson 3B)
- Current claimed capability audit (CCA) values and resulting SCCs:

Asset Name	Season	Establish CCA Value	Seasonal CCA Value	SCC
Power Plant	Summer	200	190	190
	Winter	200	210	200

Stay tuned for other lessons to see how this resource qualifies, participates, and settles in FCM

The FCM path of an intermittent generator …



- Capacity resource with five intermittent assets that get its SCCs set to the median output during reliability hours
- Capacity resource:
  - As a new resource, in FCA it qualified for and cleared:
    - 2.6 MW summer / 0 MW winter (Lesson 3A)
  - As an existing resource, its latest qualified MWs are:
    - 1.9 MW summer / 0 MW winter (Lesson 3B)
- Current SCCs:

Asset Name	Summer SCC
Solar 1	0.4
Solar 2	0.4
Solar 3	0.2
Solar 4	0.5
Solar 5	0.7
	2.2 MW

Summer Reliability Hours: HE 1400-1800*

Asset Name	Winter SCC
Solar 1	0
Solar 2	0
Solar 3	0
Solar 4	0
Solar 5	0
	0 MW

Winter Reliability Hours: HE 1800-1900*

Questions

Demand Capacity Resources

What Are Demand Capacity Resources?

End-use customers with a verifiable reduction in electricity consumption

Active Demand Capacity Resources (ADCR)

- Temporary reduction of load in real time when dispatched by ISO New England
- Load reduction measured at the retail delivery point
- May include various methods of load reduction

On-Peak and Seasonal Peak Demand Capacity Resources

- Permanent, non-dispatchable reduction of load
- On-peak: reduce load across predefined hours (lighting, motors)
- Seasonal peak: weather-sensitive measures (energy efficient HVAC systems)

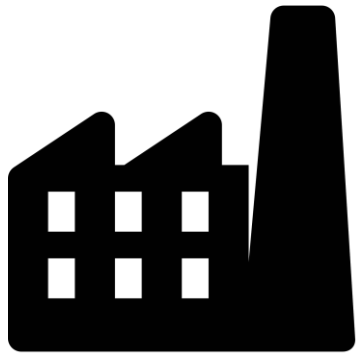
Registration

Demand Response

Typically registered by:

- Demand response aggregators
  - Register as a market participant
  - Enroll and coordinate with many end-use customers
  - Provide all metering and communication services
  - Handle all market transactions

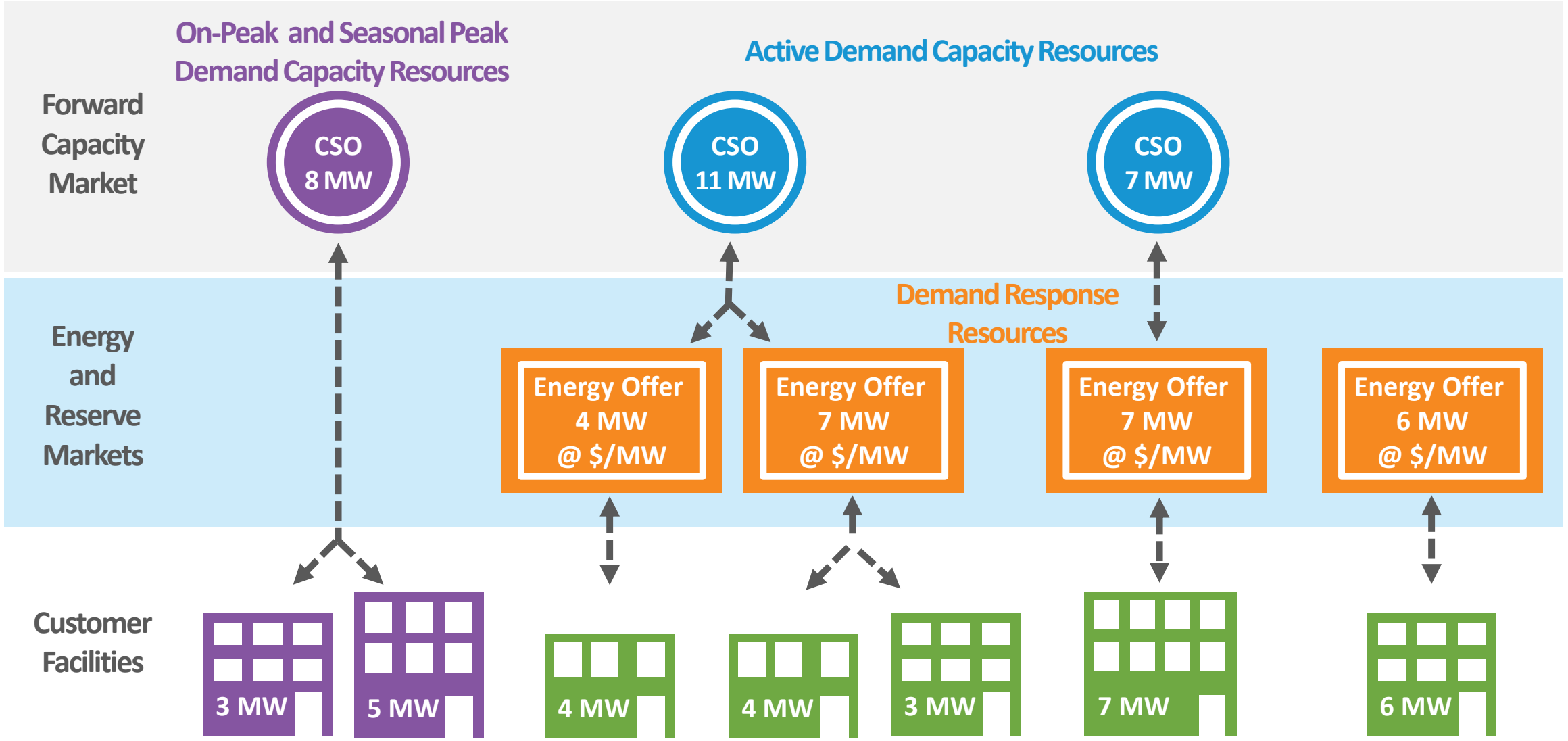
- Large facilities
  - A company that has a facility or facilities with significant load requirements may register as a market participant
  - Metering, communications, and market transactions handled in-house



- Registration can occur quickly

Demand Response Participation in ISO New England Markets

Demand Response



demand response assets — customer facilities that physically reduce their consumption of electricity

Demand capacity resources:

A. Decrease load that would otherwise have required additional generation

B. Provide verifiable reductions of load

C. May be dispatchable or non-dispatchable

✓ D. All of the above

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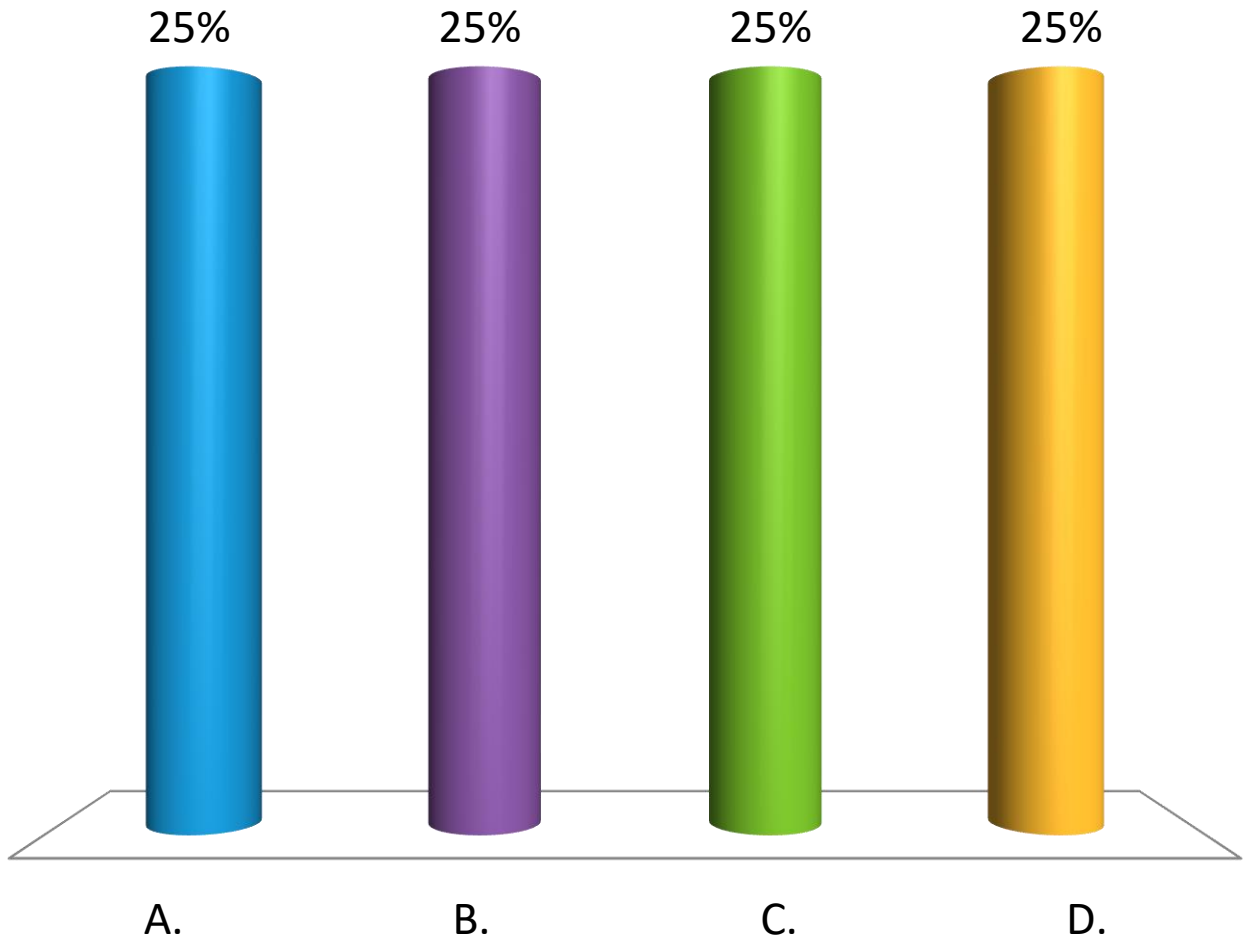
A demand response asset is:

A. Able to participate directly in the energy market

B. Able to participate directly in the capacity market

✓ C. Where actual demand reduction occurs

D. All of the above



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Auditing

Seasonal audits are required:

Audit values are used to:

- Demonstrate commercial capability (resulting in release of financial assurance)
- Determine ongoing qualification for auctions
- Determine significant decrease

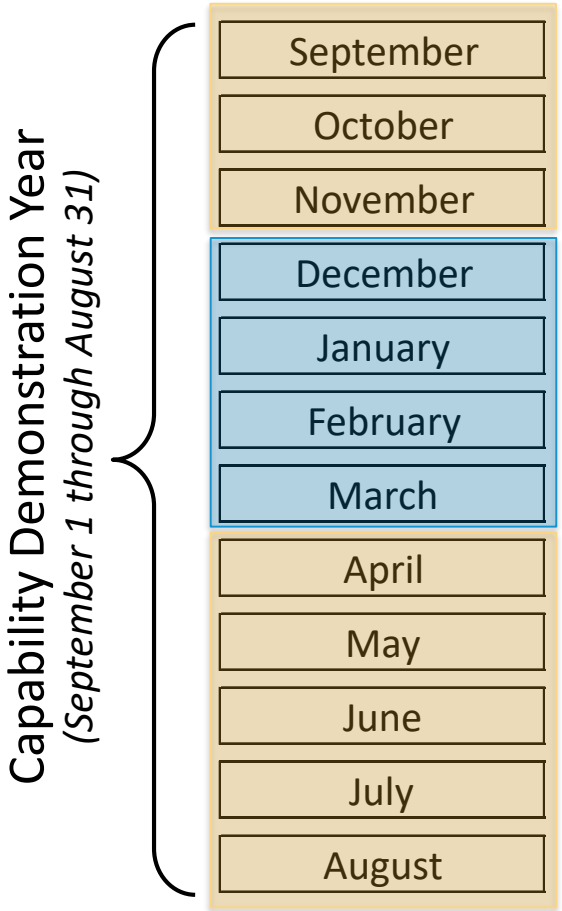
DR Category	Evaluation Type
Demand Response Resource	Response to dispatch
On-Peak or Seasonal Peak Demand Capacity Resource	Hourly reduction/output

Lesson 3B: Existing Capacity Qualification and Qualification for Reconfiguration Auction

Demand Response Resources

Audit Seasons

Seasonal audits must be conducted at least once per season in a capability demonstration year



Summer seasonal audit must be conducted in September, October, November, April, May, June, July, or August

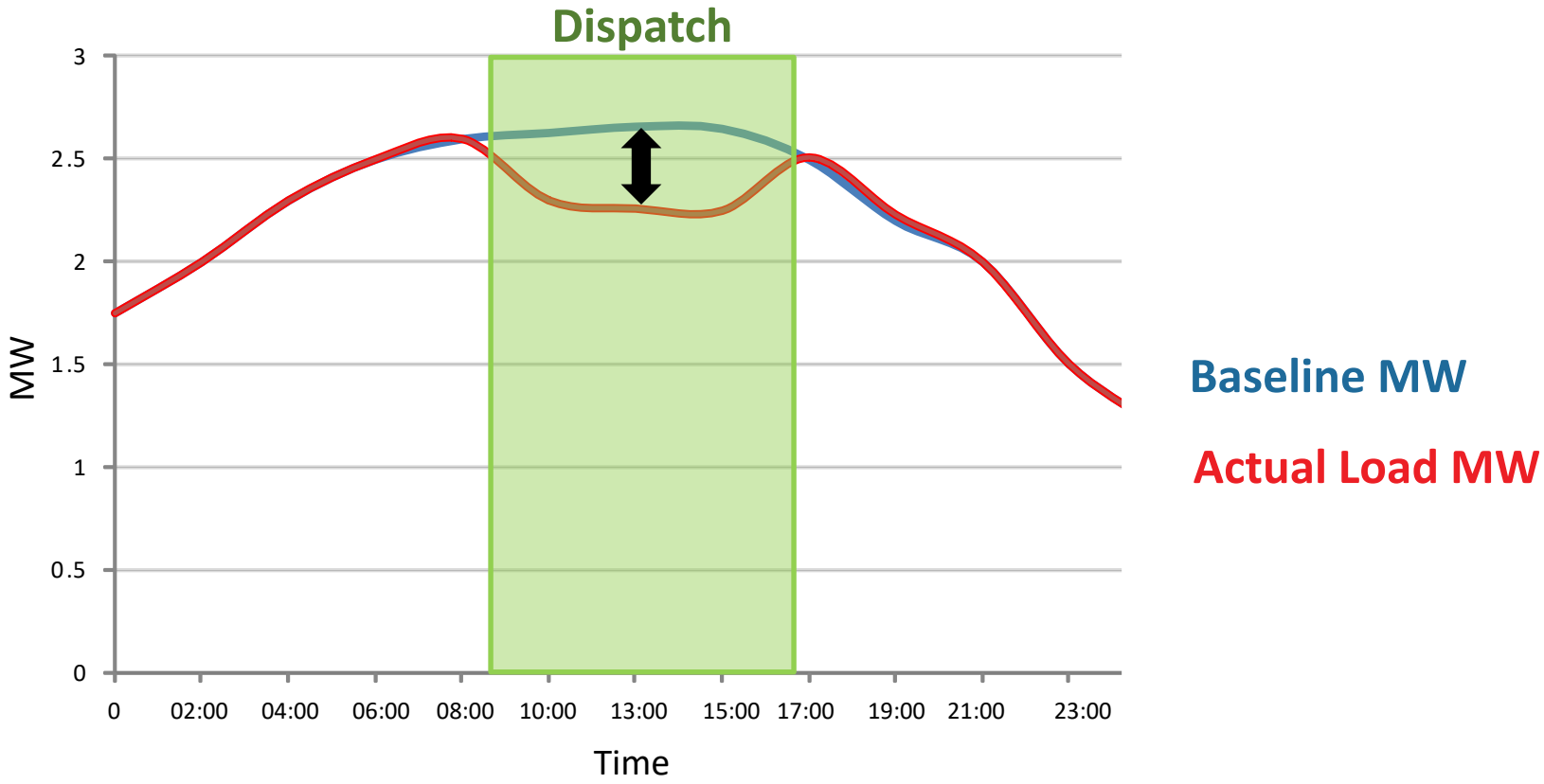
Winter seasonal audit must be conducted in December, January, February, or March

Note: A real-time dispatch by the ISO may be used as an audit

Demand Response Resources

Performance Measurement

Demand Response



Demand reduction is measured as the difference between baseline and actual load at the asset level

On-Peak and Seasonal Peak Demand Capacity Resources

Audit Seasons

Demand Response

Seasonal audits must be conducted at least once per season in each capacity commitment period

Demand Resource Type	Performance Hours
On-Peak	• H.E. 14:00-17:00 (summer) • H.E. 18:00-19:00 (winter) • Monday - Friday • Non-holidays
Seasonal Peak	• ≥ 90% of the most recent 50/50 system peak load • Monday - Friday • Non-holidays • Seasonal Peak Hours are posted to ISO Express at the end of each performance month

On-Peak and Seasonal Peak Demand Capacity Resources

Performance Measurement

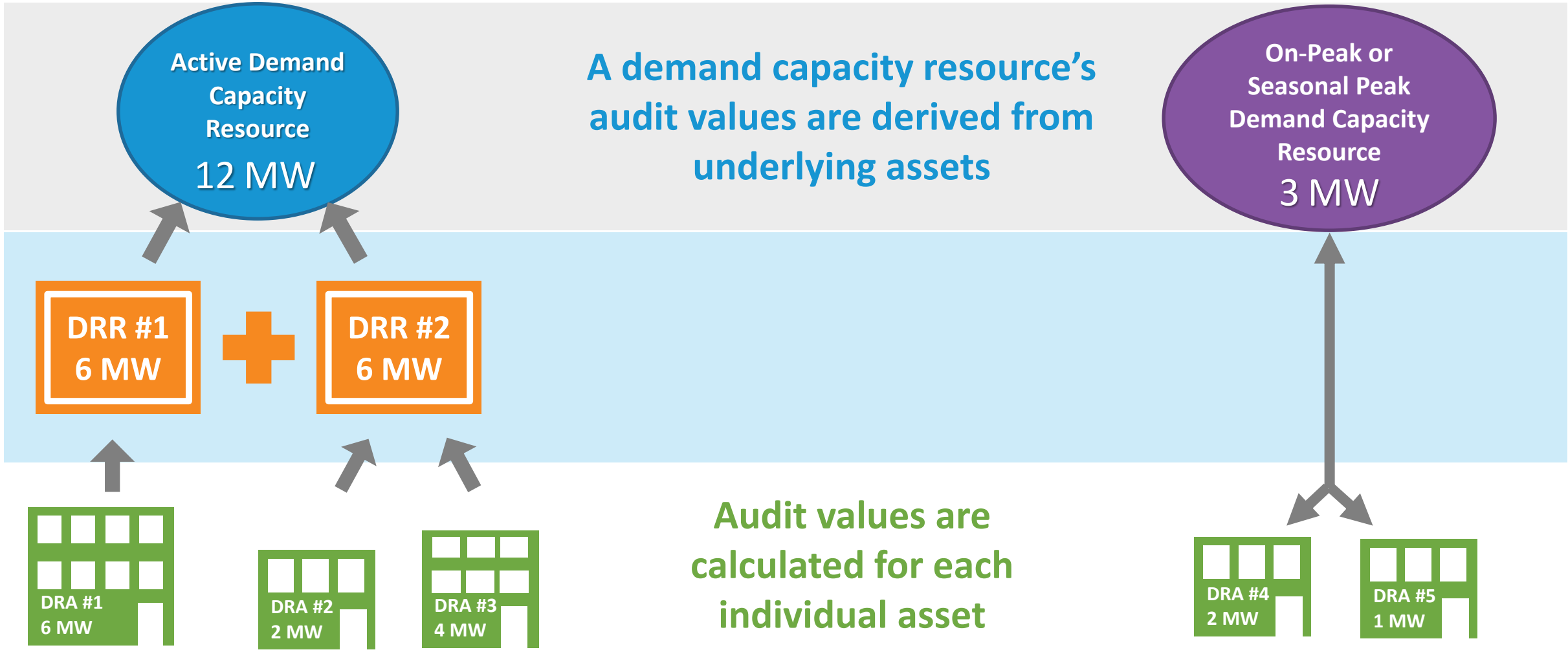
Demand Response

- **Energy Efficiency**
  - Report monthly energy reductions using an accepted measurement method
  - Demand reduction measured as average MW saved over on-peak or seasonal peak hours for month
- **Distributed Generation**
  - Report hourly distributed generation output metered values for all hours (24/7)
  - Demand reduction measured as average hourly output (MW) over on-peak hours for month
- **Load Management**
  - Report facility load reductions (+/-) for all hours (24/7)
  - Demand reduction measured as average load reduction (MW) over on-peak hours for month

Audit Values

DRR = Demand response resource
DRA = Demand response asset

Demand Response



Questions

Import Resources

Supply energy from outside of the New England control area

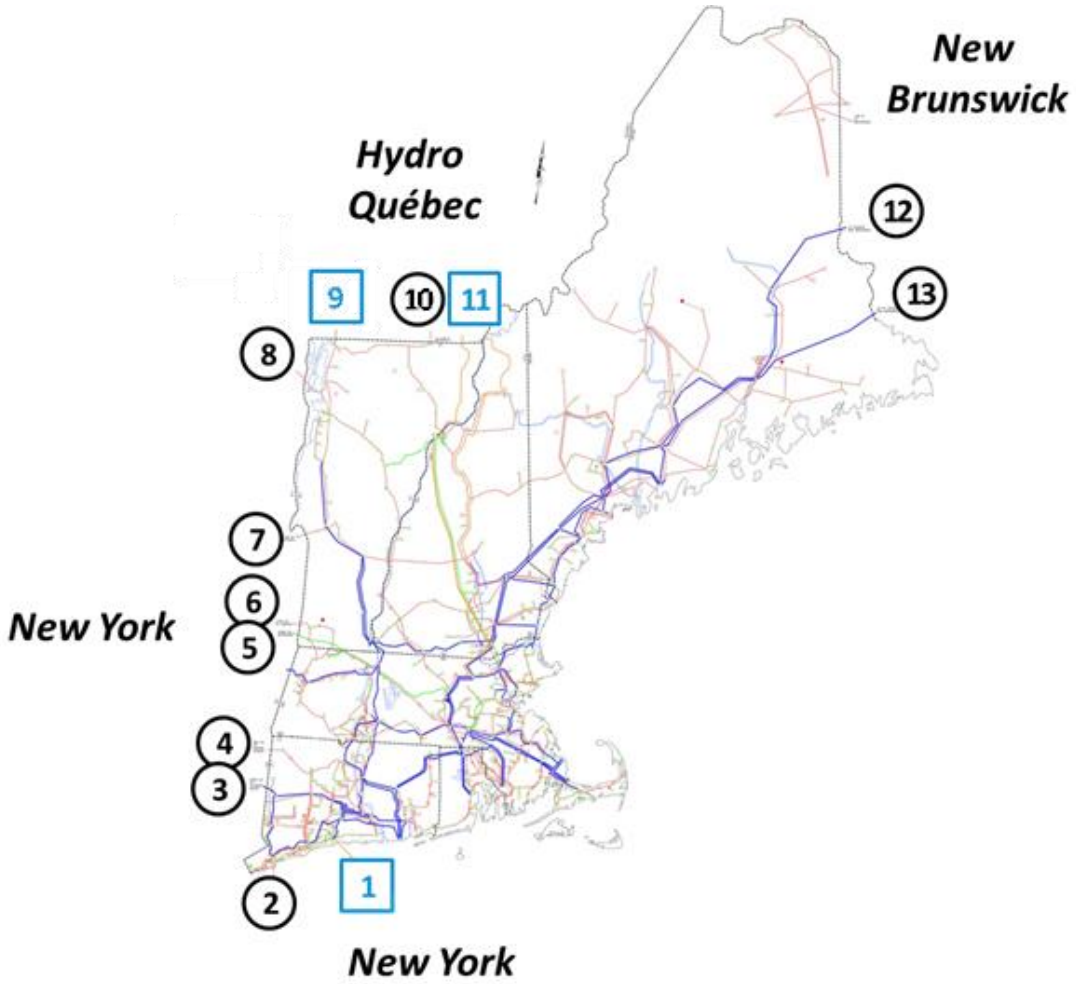
Imports

Import Resources

Can be backed by:

- Single or multiple generating resources
- External control area

Evaluated to ensure that they can meet any obligations they may take on



A manufacturing facility with a behind-the-meter generator, solar panels on the roof, and load reduction capability could register with ISO New England as:

A. A generator

B. An active demand capacity resource

C. An on-peak or seasonal peak demand capacity resource

✓ D. It depends!

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Audit values:

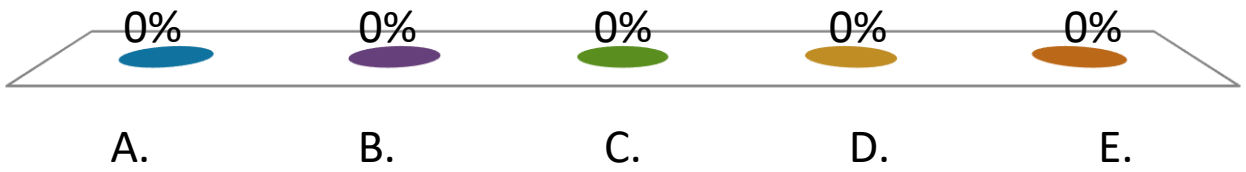
A. Are calculated according to asset and resource type

B. Must be maintained for winter and summer periods

C. Are used in the qualification process

✓ D. All of the above

E. None of the above



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Summary

In this lesson, you learned:

- The different types of resources that can provide capacity
- How these resources are represented in the markets
- How seasonal claimed capability (SCC) and seasonal audit values are determined

Questions