

Technology Agnostic Participation Options in Electricity Markets



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Workshop

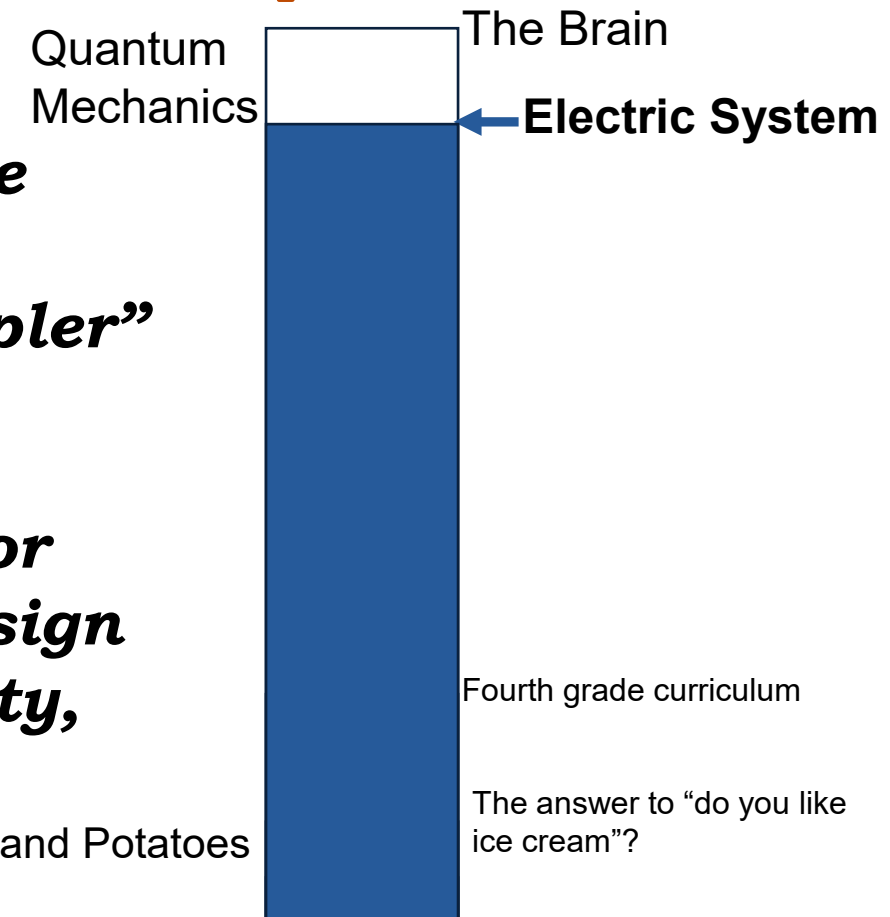
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The Simple-Meter

“Everything Should Be Made as Simple as Possible, But Not Simpler”

“Simple as possible for electricity market design starts at mostly, pretty, complex” -EE

Meat and Potatoes



Participation Model Rule-of-Thumb



If is needed for reliability

• Build it

If it improves economic efficiency

• Allow it (if priorities permit)

If it does neither

• Shelf it

If it creates inequity

• Figure out a resolution, or shelf it

If it is too complex or won't solve

• Defer it, research it

If the technology is coming soon

• Build it now

Extra, depending on
discussion



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Conventional Generator Participation Model



Participation Model Characteristics

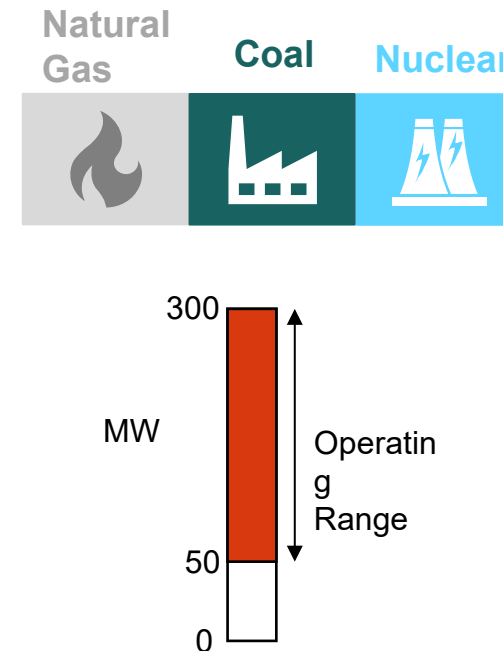
Mathematical Modeling in Market Software

Bidding Parameters

Service Eligibility

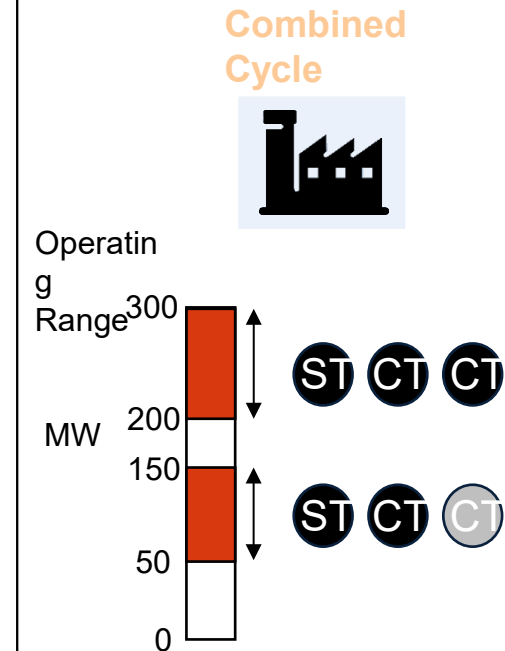
Other participation rules

Conventional Generator



- Min and Max operating range
- Ramp rates
- Startup time, startup cost, minimum up time, minimum down time
- Need commitment variables
- Fuel-based operation
- Generally eligible to participate in all ISO services

Multi-Stage Resource



- In addition to bidding parameters of Conventional Generator, it may need transition costs, transition times, operating parameters in different configurations, etc.

Emerging Technology Participation Models



Variable Energy

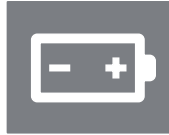
Renewables



- Weather-based operation
- Maximum available output variable with time
- Needs forecasting: Day-ahead and real-time
- Non-dispatchable or dispatchable up to their available output
- Commitment-related bidding parameters unnecessary
- Currently not eligible for reserves in most ISOs

Electric Storage

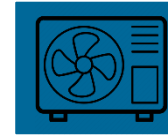
Battery Storage



- Injection and withdrawal
- State of Charge (SOC) constraints
- Self SOC Management: must bid in a way that ensures its capability
- ISO SOC Management: ISO models and manages SOC in market software
- No commitment-related bidding parameters

Demand Response

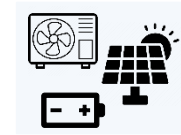
Demand Response



- Demand reduction with respect to a baseline
- Different compensation rules (e.g., Order 745 in FERC-jurisdictional ISOs)
- Allow for aggregation of load-side resources

DER

Distributed Energy Resources



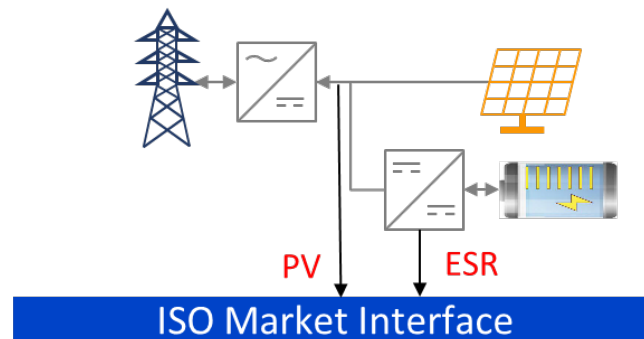
- Allow for Aggregation of distributed energy resources
- May include different resource types with injection, withdrawal, and demand reduction capabilities
- Complications with certain types of resources

Note: In U.S. markets, traditional reservoir hydropower typically offer energy in a similar way to thermal resources but with daily energy limits. In IESO, there are certain parameters to reflect connected hydro facilities

Hybrid Participation Models

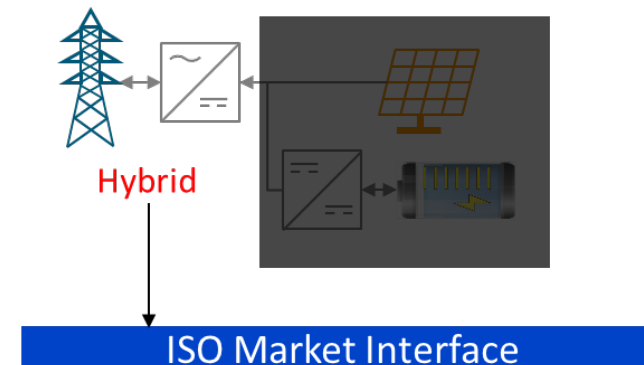
Option A: 2R Independent *Co-located* Model

Separately represent each resource, with minimal changes to existing market designs



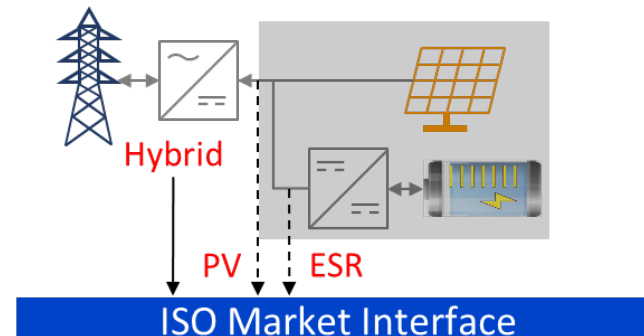
Option B: 1R Self-Managed *Hybrid* Model

Single offers and operating parameters allows participant bidding strategy flexibility



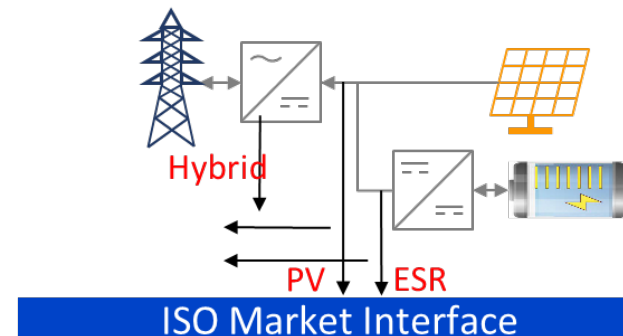
Option C: 1R ISO-Managed-Feasibility *Hybrid* Model

Add telemetry requirements to allow ISO to limit infeasible schedules during critical times



Option D: 2R Linked *Co-located* Model

Add linking constraint to increase ISO's and asset's ability to operate and represent the resource's dependencies



*figure illustrates dc-coupled strategy for demonstration purposes

Ancillary Service Compensation



- Some reliability attributes are not currently incentivized
- Sometimes auctions and market-based pricing for certain services may be impractical
- Prioritization of market design and software changes also key
 - It cost money to develop, discuss, test, implement, and administer new designs

Reasons why a market product may not be implemented	Example
Too complex to design (e.g., software complexity)	Volt/VAR support
Too specific to certain local areas (little to no competition)	Volt/VAR support
System inherently has more than sufficient amounts of the service	Synchronous Inertia
Costs for the service may be small, so cost of administrating market product may outweigh benefits	Black start (restoration) service
A specific resource requirement rather than a system-wide need	Low Voltage Ride Through

The examples are used for illustrative purposes only and the reason may not be necessarily true for each example in each region.

Markets are not needed for every service!



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THANK
YOU