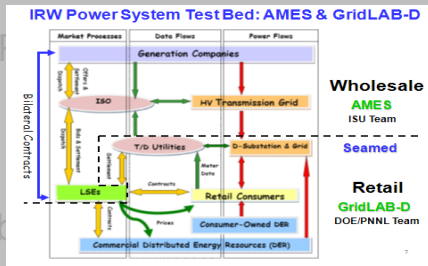
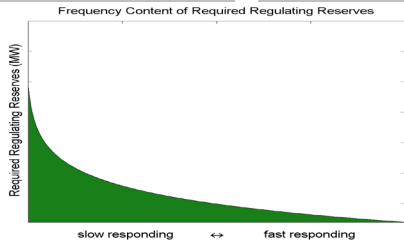


Wholesale Electricity Market Design Project



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Introduction - Motivation for a New Market Design

- Need to eliminate market bias of resource classes such as Energy Storage
- Need to accommodate new technologies, without the need to change market rules
- Move away from resource-centric markets toward service-centric markets
- Provide a greater incentive of capital funding for resources that provide needed services



Market Design Problems

- Reserve market rules assume ramp-rate constrained generators
 - Payment for regulation based on capacity
 - 10MW from coal plant and from flywheel resource compensated the same
 - Ability to follow fast signal, or accuracy of following signal, not considered
 - Payment for spinning reserve based on capacity
- Reserve market products are defined in ways that are biased against some newer resources
 - 60-minute regulation reserve duration requirement
 - Carve-outs are being implemented for storage that partially addresses problem
- No compensation for inertia, primary frequency response capability, or reactive power supply capability
 - Could pose a problem as fraction of variable generation grows
- No direct specification of amount or speed of primary frequency response required

What are we doing?

Designing a market that:

- Ensures open access for any resource that can provide services
- Does not require a resource to provide services it can not optimally deliver
- Compensates based on services provided to the grid without the need to partition the market
- Achieves resource adequacy, and meets engineering requirements for a reliable grid
- Achieves economic efficiency
- Supports market reform efforts
- Is implementable in stages; in part or in whole



Market Design Concept

- All energy and reserve products take the form of Energy Forward Contracts (EFCs)
 - EFCs are physically-covered energy obligations and options
 - Energy products take the form of EFC obligations
 - Reserve products take the form of EFC options
- ISO envisioned as a clearinghouse for EFC trades
 - Market participants can buy and exercise EFC obligations, and sell EFC options, but they cannot buy and exercise EFC options
 - ISO buys and exercises EFC options that are backstopped by LSE reserve obligations (so ISO has no financial position)
- EFC trades take place in a sequence of linked ISO-managed forward markets
 - Performance periods range from long term (multiple-year) to very short term (intra-hour)

Market Design Comparison

Old

1. System needs are identified
2. Markets are partitioned to meet system needs
3. Market asks “how much to deliver *this*”?
4. Resources make offers
5. Market optimizes a solution

New

1. System needs are identified
2. Resources state what needs they can offer and at what cost (without regards to market partitions)
3. Market optimizes a solution

Project Phases

- Year 1
 - Basic Market Structures and Design Principles

- Year 2
 - Mathematical formulations and optimizations

- Year 3
 - Market modeling in AMES – Performance testing of formulations and optimizations, including tests for possible market power manipulation

What have we done?

- Carefully reviewed reserve market procedures in all 7 operating ISOs in the U.S.
 - Often required reading of detailed business practice manuals
- Produced survey paper reviewing reserve market definitions and procedures in all 7 ISOs
 - submitted for journal publication
- Discussions with industry experts, consultants, academics
- Formed Technical Expert Committee
 - Experts from ISO-NE, PJM, KEMA
- Identified requirements that an improved market must meet
- Produced a draft wholesale market design paper to be reviewed with Advisory Board



Future Tasks

- Complete draft version of market design report
- Peer review with Advisory committee
- Revise market design based on suggestions of Committee
- Simulate market design using an agent-based test bed
- Make adjustments as required



Questions/Discussion

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