



Forward Clean Energy Market

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Overview

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- Forward Clean Energy Market (FCEM) proposal
- Impact of clean energy timing
- Needs beyond a carbon shadow price design
- Benefits of FCEM

What are we proposing

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Forward Clean Energy Market

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- Forward market to procure clean energy delivery commitments to efficiently achieve desired carbon emission reductions.
- Several products –timing of clean energy delivery matters
 - Off-peak (often strongest wind generation)
 - Midday peak (where solar generation most prevalent)
 - Late day peak (where solar generation ramps down).
- Encourage efficient mix of clean generation resources and use of electric storage (including pumped storage hydro) to efficiently achieve carbon reduction goals.

Forward Clean Energy Market (cont'd)

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- Product requirements determined based on:
 - States' carbon reduction goals
 - ISO New England insight on clean generation profile that offers the greatest carbon reduction impact to meet those goals
- Auction timing & duration of commitment
 - Open for discussion - operate in parallel with Forward Capacity Auction cycle or shorter lead time and term
- Payment of respective FCEM clearing price for clean energy delivery and a penalty for failure to meet commitment
- Costs could be allocated to load in states with carbon reduction goals driving the purchases

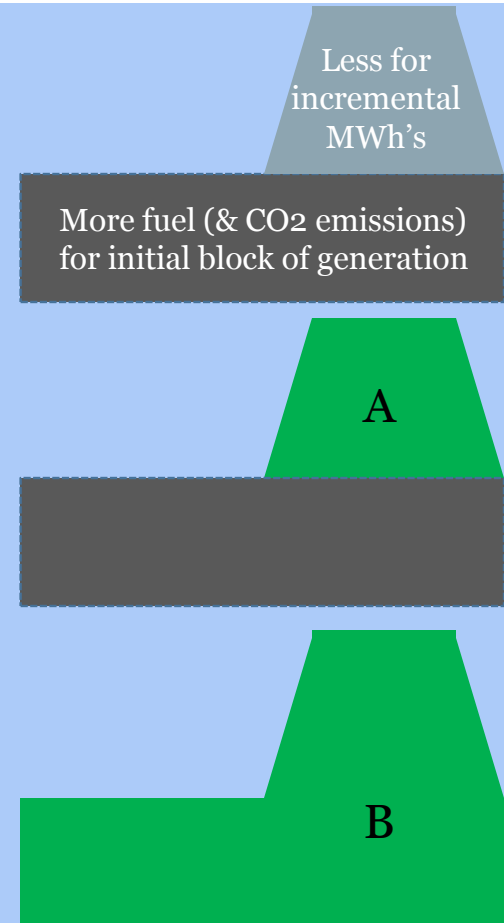
Why we are proposing it

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Greatest carbon reduction by avoiding carbon emitting resource start

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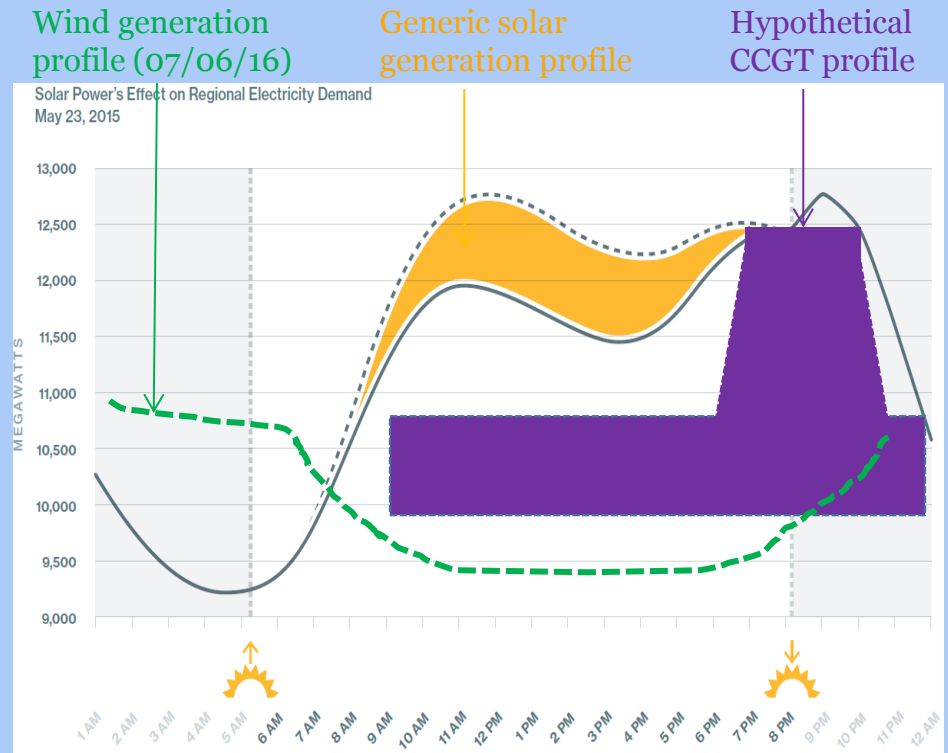
- Clean generation that does not avoid starting a carbon emitting resource only avoids its less carbon intense incremental generation (A).
- Clean generation that can avoid *starting* the carbon emitting resource avoids the most carbon intensity (B).



ISO unit scheduling considerations

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- ISO must commit generating resources day ahead to meet next day electric demand.
- Gaps in meeting the daily demand profile with clean generation requires more carbon emitting resources.
- Clean energy timing matters.

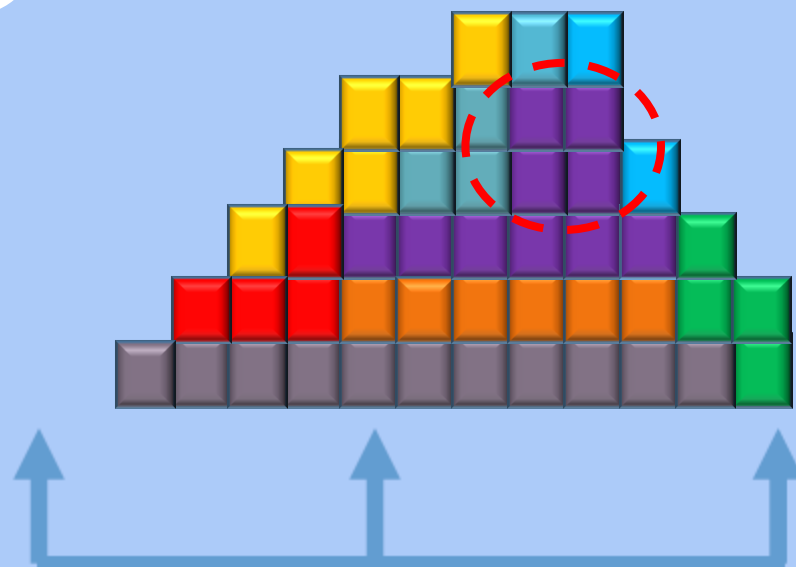


ISO-NE 2015 Regional Electricity Outlook (modified)

Matching clean energy supply to carbon reductions

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- ISO scheduling is subject to resource scheduling constraints
- Much like a puzzle, they must fit the pieces together to cover the next day load profile
- Better matches between clean energy puzzle pieces and load shape means less carbon intense resources scheduled



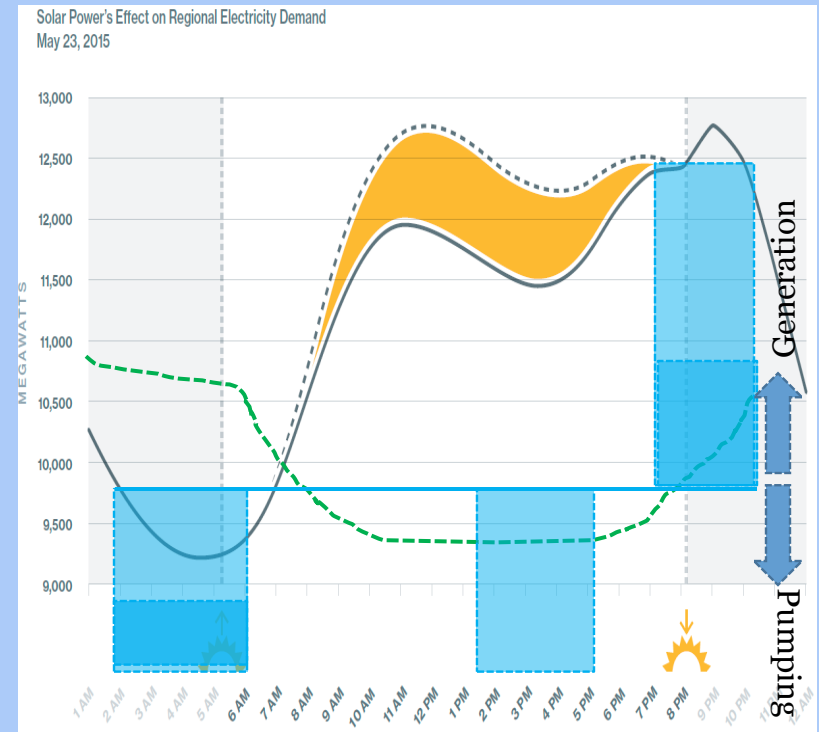
More clean energy in these hours will not prevent the start of the carbon emitting resource (purple shape)

Storage can move clean energy across hours

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FCEM will signal an efficient mix of clean energy resources and storage to meet the demand profile.

FCEM will value electric storage (including pumped storage) ability to move off-peak (or midday peak) emission-free generation to serve late day peak needs.

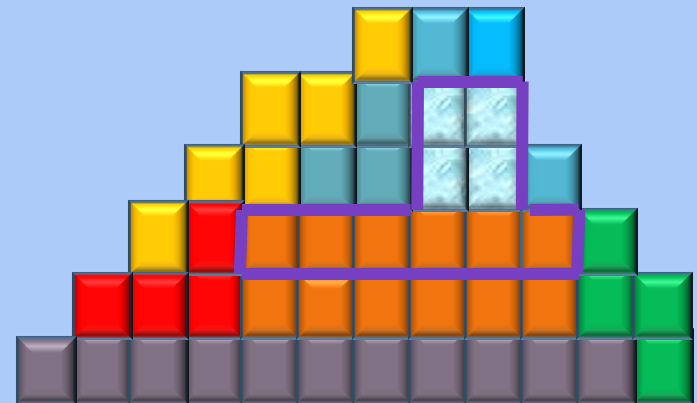
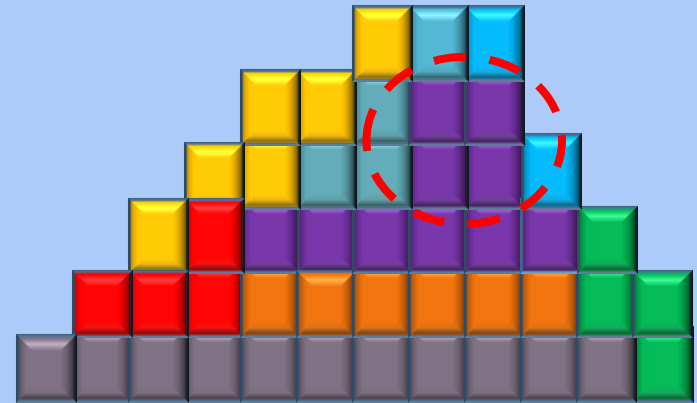


ISO-NE 2015 Regional Electricity Outlook (modified)

Clean energy supply tailored to carbon reductions

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- Storage for later release permits flexible clean energy dispatch
- Clean energy pieces can now be fit together to displace the start of carbon intense resources
- Greater carbon reduction impacts with storage



Can a carbon shadow price alone achieve this?

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A carbon shadow price is helpful but not sufficient

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- Energy clearing prices under a carbon shadow price (“CSP”) would generally reflect the carbon intensity of the incremental loading of on-line carbon emitting resources (area A on slide 7), *not the higher carbon intensity minimum loading level committed for multiple hours.*
- The result is the full emission-avoidance value of new clean resources or storage may not be fully reflected in CSP energy prices alone.
- Further, the ISO-NE energy market software can miss potential storage economics. It does not couple the charging (storage) and discharge (generation) of storage resources. The storage owner must do that by estimating charge (pumping) and discharge (generation) pricing, levels and timing. The uncertainty involved in these decisions inevitably leads to missed storage opportunities.

Conclusion

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- The proposed Forward Clean Energy Market offers:
 - an efficient market signal for clean energy resource developers
 - an efficient market signal for storage, including increased use of existing storage capability
 - an efficient market mechanism to cost effectively achieve carbon reduction goals
 - price discovery for the cost of carbon used in a CSP design