Time of Use Rates: Considerations for Maine

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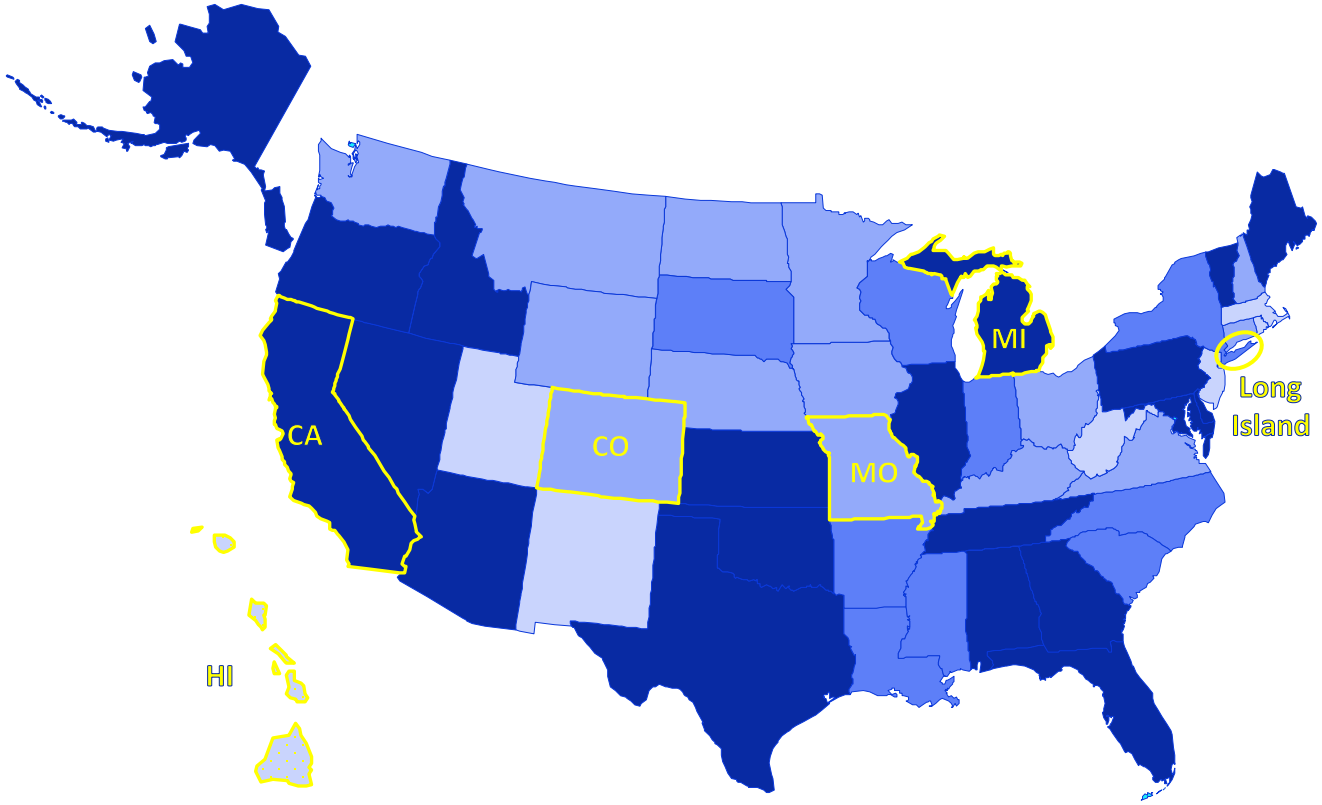
AMI is Widely Deployed, but Rarely Used for Retail Pricing



	Order	Implement
CA	2015	2018-2022
MI	2019, 2022	2021, 2023
CO	2020	2025
HI	2022	2024
MO	2023	2023, 2024
LI	2023	2024

Smart Meters Installed (%)

- 0 – 15%
- 15 – 50%
- 50 – 75%
- 75 – 100%

TOU States

- TOU Opt-Out

Smart meter penetration adapted from: Cooper and Shuster, "Electric Company Smart Meter Deployments: Foundation for a Smart Grid," Institute for Electric Innovation, April 2021, p. 3.

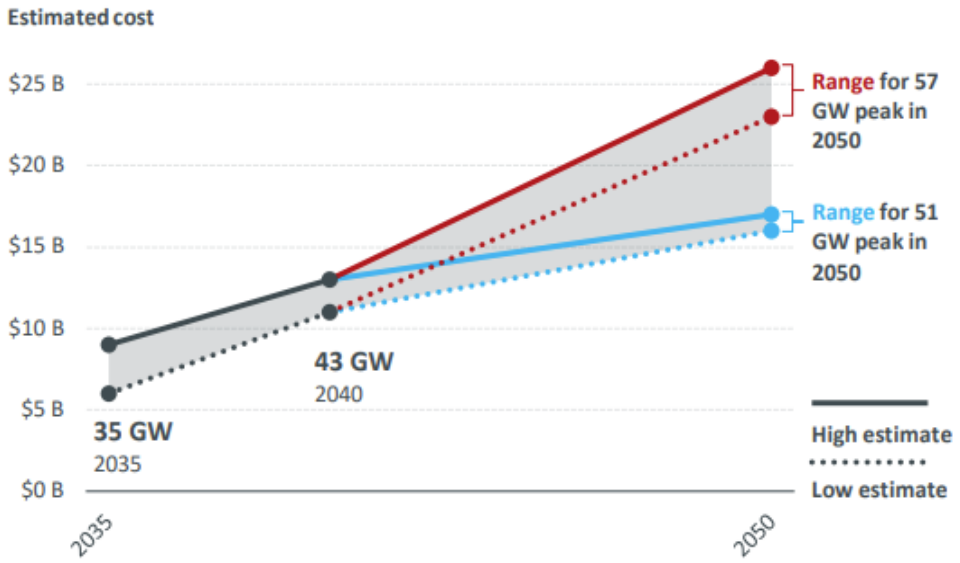
The Imperative for Time-Varying Prices

Managing Costs of Demand Growth & the Energy Transition

Demand has increasingly obvious role to play in shaping itself

- Full electrification of heating and transportation would lead to a 57GW peak for ISO-NE. (See figure to right.[1])
- Costs of transmission are even higher at margin. ($0.75B per GW of demand growth from 28GWs to 51GWs, doubling to $1.5B/GW-demand to serve the next 5GWs (to 57GWs).
- Besides Demand-Side Actions, alternative approaches to mitigate these costs would be to slow electrification or to retain more fossil peaking resources.
- "Retail rate design reduces the amount of capacity procured and triples the capacity contribution of solar in the electrification scenario." –PJM[2]

2.1 Reducing Peak Load Significantly Reduces Transmission Cost



An increasingly obvious role for an active demand side to play

1. ISO-NE, *2050 Transmission Study, February 2024.*
2. PJM, *Energy Transition in PJM: Emerging Characteristics of a Decarbonizing Grid,* May 2022.

Has the Purpose of Utility Regulation Changed?

- Cost-of-service regulation's prices tend *not* to be time-varying, and are thus attenuated from the realities of any element of service whose costs vary with time. *Can we really call this "cost-of-service regulation" at all?*

- This crude "flat" approach to ratemaking could once be defended either because there was no AMI, or perhaps because the upstream cost structure was relatively uniform. Neither of those things are true anymore.

- AMI is a massive sunk cost that, like a lot of rate base, is being under-utilized. It should be a conduit to transmit time-varying prices, and thus allow regulation to live up to its most visible and in some ways only purpose: setting prices that face demand in a manner that fairly reflects costs.

If you aren't setting rates that align with costs, are you fulfilling the mission of an economic regulator?

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In Maine, Nearly All Costs Vary with Time and Demand

- Transmission is a 12-Coincident Peak demand-allocated cost through ISO-established revenue requirements
  - MPUC retail ratemaking eliminates the demand-related nature for most customers by creating a flat price
  - Unlike other restructured states (e.g., PJM), this is a utility cost that passes through to consumer—not a supplier cost
- Distribution is a utility cost typically allocated to customer classes on the basis of their non-coincident-peak (NCP) demand
  - Again, retail ratemaking typically smooths this into a flat rate
- Energy & capacity (for non-shopping customers) is bid through SOS suppliers, who in turn procure out of the wholesale market
  - Real-time and day-ahead energy markets at ISO that periodically express significant points of volatility
  - Bilateral wholesale deals that represent load shapes or blocks but leave SOS with deviation & volumetric exposure
  - ISO-NE Forward Capacity Auction, allocated to load on 1-CP basis, with limited options to self-supply
  - As for Transmission & Distribution, utilities' SOS procurement flattens the rate, regardless of underlying volatility

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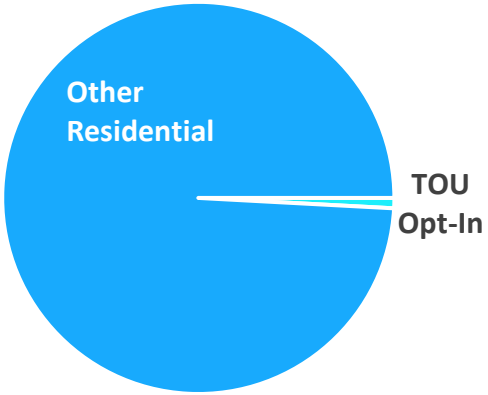
Maine's Existing Opt-In TOU Rates

Central Maine Power's residential opt-in TOU product has fewer than 5,000 customers, < 1% of total



- **Rates**
  - CMP's TOU has a ~2:1 differential for T&D costs, while SOS is priced flat. No variation in SOS, so a <2:1 differential
  - Versant's TOU is much steeper, ~9:1 and seasonal. The product is available only to customers with separately-metered DER. 488 customers were enrolled (in 2021-22 test year)
- **Structure**
  - CMP's TOU has no seasonality, but features time periods including peak & shoulder (priced the same, spanning 7 a.m. to 8 p.m.), with off-peak overnight (8 p.m. to 7 a.m.)
  - Versant's TOU has 2 seasons in addition to the 3 time periods
- A more appropriate rate design would have all transmission and distribution priced to on-peak interval, and would include supply (energy & capacity) costs

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Considerations for an Opt-Out TOU for Maine

Takeaways from Opt-Out TOU Jurisdictions

Regarding pricing

- Sending a comprehensive but easily understood price signal is crucial. “Too many one-off special-purpose rates,” observed Paul Phillips, California PUC Supervisor of Retail Rates at NARUC 2023 Annual Meeting
- When given a choice between different TOU rates, consumers *prefer* high-differential rates (MO-Evergy, by a 3:1 margin)
- Only low levels of demand activation observed from low-differential TOU designs. ~3-4:1 differential drives strong peak-demand reductions
- Most TOU are seasonal with 2-3 time periods, though recent research suggests that seasonality and >2 time periods unduly complicates TOU. Other features like a Critical Peak Price can stand in for unnecessary TOU complexity[1]

Regarding participation

- Opt-in rates show extremely low levels of enrollment
- Low-income customers sometimes carved out; when present, they show outcomes equally favorable to general population (MD pilot) and sometimes a higher level of demand adjustment (CA)

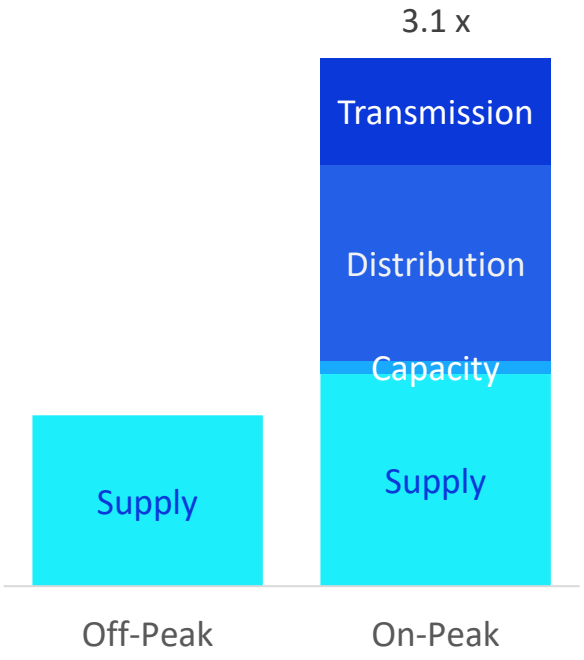
Regarding roll-out

- Education, bill presentment, graphical representation of TOU are important. Education campaign should happen at same time as utility system upgrades, possibly saving years
- Political blowback possible, even likely – but diminishes once TOU established. Need clear reasoning for why Opt-Out TOU being established

1. Andrew Hinchberger *et al*, *The Efficiency of Dynamic Electricity Prices*, Working Paper 32995, National Bureau of Economic Research, September 2024. https://www.nber.org/papers/w32995

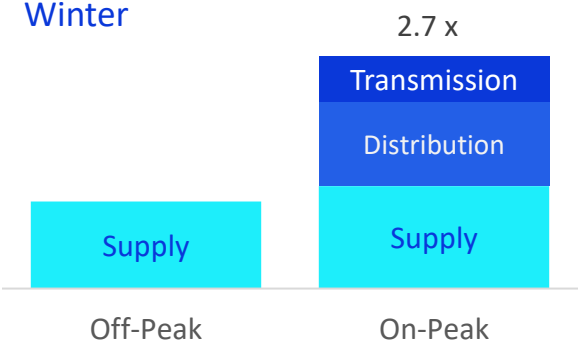
What Could a TOU Rate Look Like in Maine?

Annual

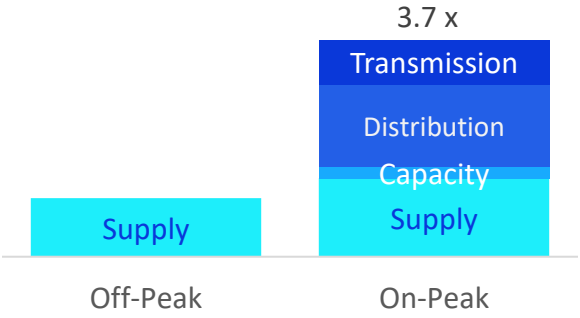


- An annual product matching SOS procurement (left) vs. seasonal product (right)
- Supply prices based on monthly average day-ahead prices for on-peak and off-peak for years 2018-2024 from ISO-NE
- On-peak hours 7am-11 pm: this wide parameter based on wholesale market on/off-peak trading—but could (should?) be changed
- Capacity prices from average of monthly rates from 2023-2026 from ISO-NE for Maine and allocated to on-peak summer hours
- Transmission and distribution prices from Central Maine Power but allocated exclusively to on-peak hours

Winter



Summer



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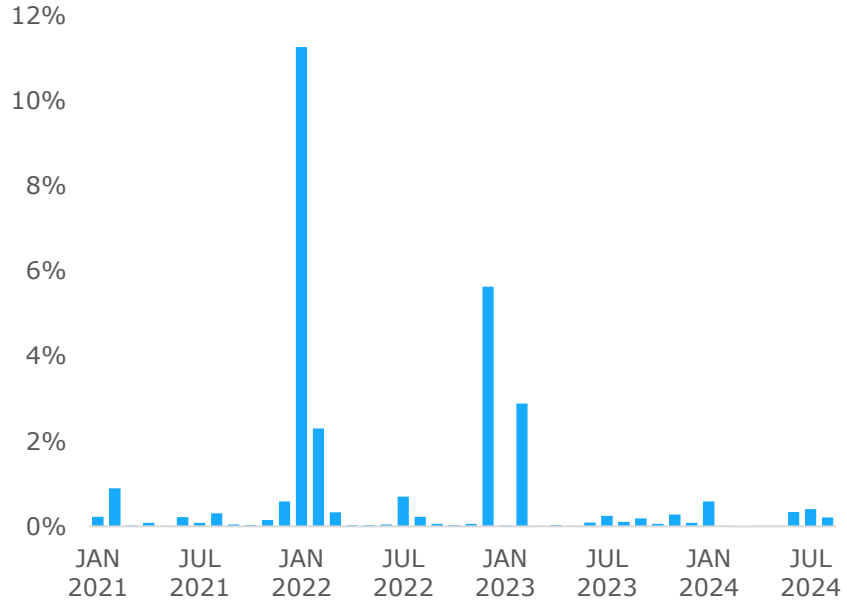
Critical Peak Pricing (or Peak-Time Rebates)

- TOU generally a fit for the wider trends of system costs, but unlikely to cover dramatic excursions that last only a few hours in wholesale energy pricing
- For these excursions, a Critical Peak Price or Peak-Time Rebate could be useful
- ISO-NE has some observed scarcity pricing, historically indicated when power plants running on diesel (either because gas is expensive and/or constrained, and when load is high)

Oil-fired generation as a % of total supply in ISO-NE 01/2021 to 08/2024



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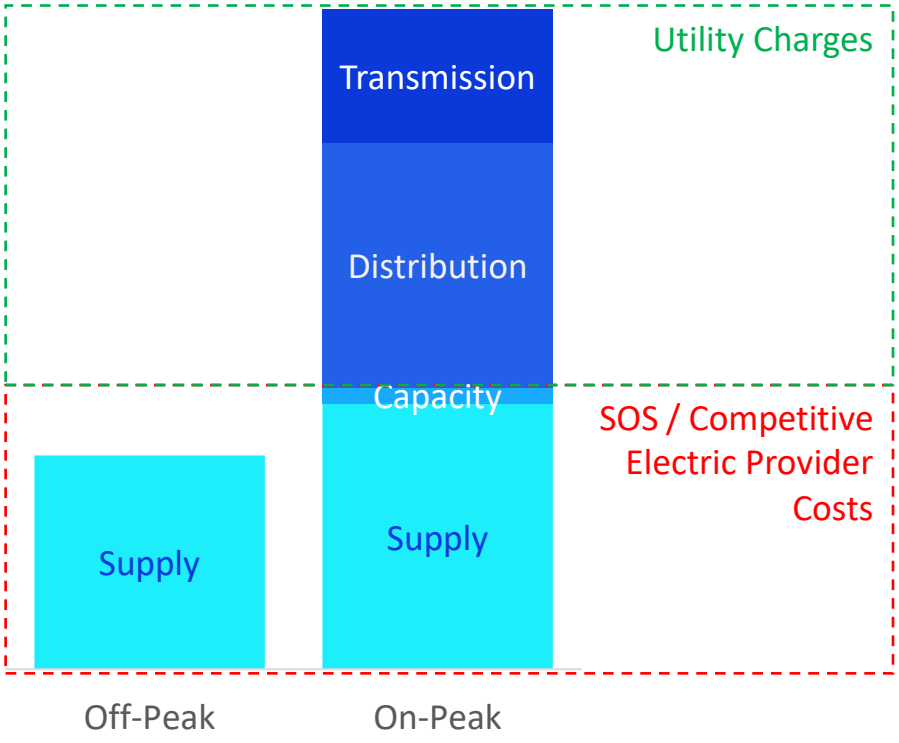
Creating the Conditions for VPPs to Capture TOU Value



- Often left undiscussed in rate design discussions is how to ensure a third-party marketplace develops to encourage *automation* in responding to retail price signals
- One way of doing this is to have all time-varying rate elements the responsibility of a single party, for any given customer. This overcomes the problem of split incentives (see left)
- Stacking these values leads to outcomes where SOS providers may have hedges with VPPs and not just wholesale suppliers; and where CEPs find it more attractive to have product offerings that integrate VPP

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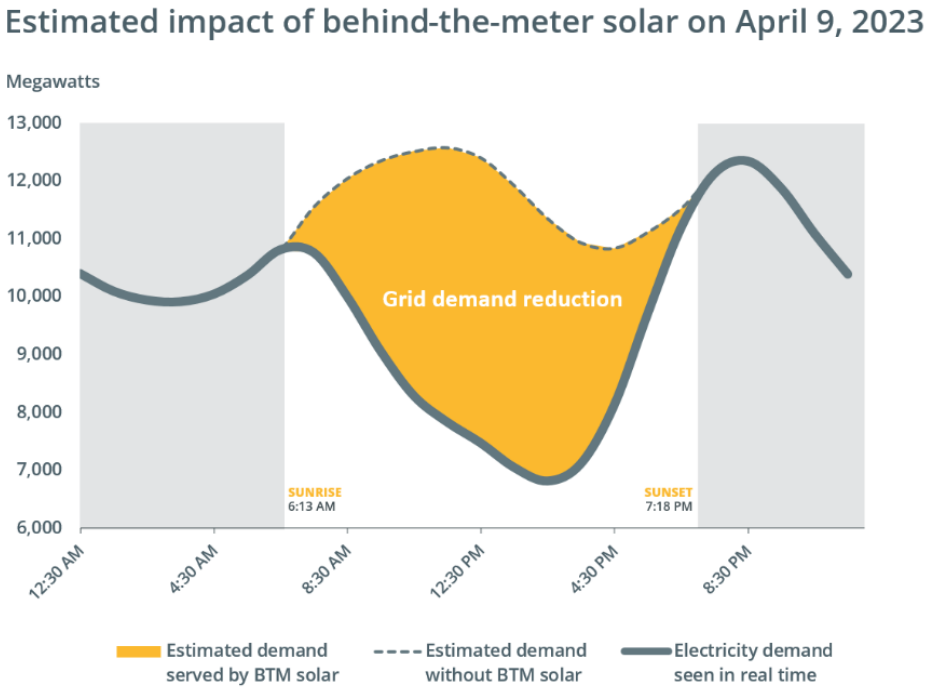
Policy Details: Time Periods (Tiers) of TOU Rate Design

- Wholesale energy markets in New England specify on-peak (conventionally, 7 a.m. to 11 p.m.) and off-peak (11 p.m. to 7 a.m.) periods. These could establish the time periods of the retail TOU rate
- Alternatively, Maine customer-class load shape should drive definition of time periods
- The Commission could skate to where the puck is heading, targeting future system load shape as defining the TOU time-period parameters (see right)



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Policy Details: Differentials (Ratios) Between On-/Off-Peak Periods

- Commission could specify differentials (e.g., 3:1) based on a combination of its own ratemaking practices and forward-looking observations. Then through SOS bidding, the pricing of these on-/off-peak periods is established, but coheres to the pre-specified differential. No retroactive adjustment needed.

- Commission could do as above, but allow adjustment based on actual realized load. Problematic, as it shifts risk to customers and creates an SOS that does not lend itself to apples-to-apples comparisons or the appropriate valuation of VPPs.

- Alternatively, could allow SOS bidders to create their own differentials, but these may not ultimately reflect the likely real-time dynamics of grid as suppliers enter into more intermediate hedges. Multiple bidders with non-aligned differentials could frustrate a comparison, or at least introduce a variable that depends on Commission's judgment on demand elasticity to compare them.

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Policy Details: Seasonality in TOU Rate Design

- SOS currently an annual product
- Transmission is a 12-CP product (allocated across all months)
- Distribution Non-Coincident Peak for certain customer classes likely already occur during winter
- ISO-NE capacity is a 1-CP product, set currently by a summer month. With electrification, peak likely will move to winter peak after a period of potentially moving back and forth. Additionally, capacity product may become seasonal (ISO targeting 2028) and more of a prompt, rather than forward, auction.
- It would be administratively simpler, easier for customers to understand, and, again, likely 'skate to where the puck is headed' to have an annual paradigm…
  - So long as CPP is available to capture excursions where TOU pricing may have been seasonally flattened by annualizing the rate

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Policy Details: Critical Peak Pricing / Peak Time Rebate

- SOS suppliers or another party could have a limited option to call a “Critical Peak Price” or “Peak Time Rebate” in order to reflect significant excursions
  - Critical Peak Pricing is a higher, temporary rate that drives greater demand response. It will provide higher revenue to SOS
  - Peak Time Rebate, meanwhile, is a rebate tied to demand reductions relative to a baseline. It will provide less revenue to SOS
  - SOS would be expected to build the revenue effects of either program into its bid, offset by expectations of demand elasticity and resulting cost reductions

- Important to clearly understand the incentives at play—if SOS had role of both calling and collecting revenue, it would presumably do so to the maximum limit, so if SOS-deployed, some objective criteria would need to apply. Similarly, if called by a utility, a set of objective criteria to guide calls would be important

- Criteria for call might include prices (> X$), incidence (no more than Y calls per month or year), other factors involving resource mix (diesel on margin or diesel >Z% of supply mix)

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Conclusion: 3 Ingredients for a Successful Time-Varying Rate in Maine

1. An Opt-Out TOU to capture the long-run and repeatable short-run marginal cost variations in transmission, distribution, energy+capacity pricing costs

2. A Critical Peak Price / Peak Time Rebate to capture real-time excursions in energy costs

3. Making Load-Serving Entities (SOS and CEPs) responsible for all costs, not just energy and capacity, to create more opportunities for VPP/load automation

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