Demand Response:
Scoping the Opportunity for Rhode Island

June 9, 2016

Providence, RI

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Background

- Synapse Energy Economics is a research and consulting firm specializing in energy, economic, and environmental topics.
- Energy Efficiency plan work in several states and Canadian provinces
- Demand Response, Energy Efficiency, and Distributed Generation in wholesale markets since 2006
- Previous career in high-technology industry

Purpose

- Provide background on current status of DR in Rhode Island
  - Existing Demand Response providers focus on larger customers: chain supermarkets, schools, hospitals, industrial facilities, etc.
  - Wholesale market opportunities are returning with lower costs and higher prices
  - Backup generation will need air emission controls
  - This market sector has a known, proven solution for load reduction.
    - Because customers are known and active, should respond to new types of DR: storage, load shifting, consumption to absorb renewable energy
    - Is there a role to assist Larger C&I customers in finding those partners?
  - Opportunities to explore are the Residential and Small C&I sectors
- Assist EERMC in framing the discussion around DR as part of LCP
  - No clear existing model for success
  - Key drivers
  - Grow the market, anticipate technology adoption rates
  - Making decisions under uncertainty for multi-year planning

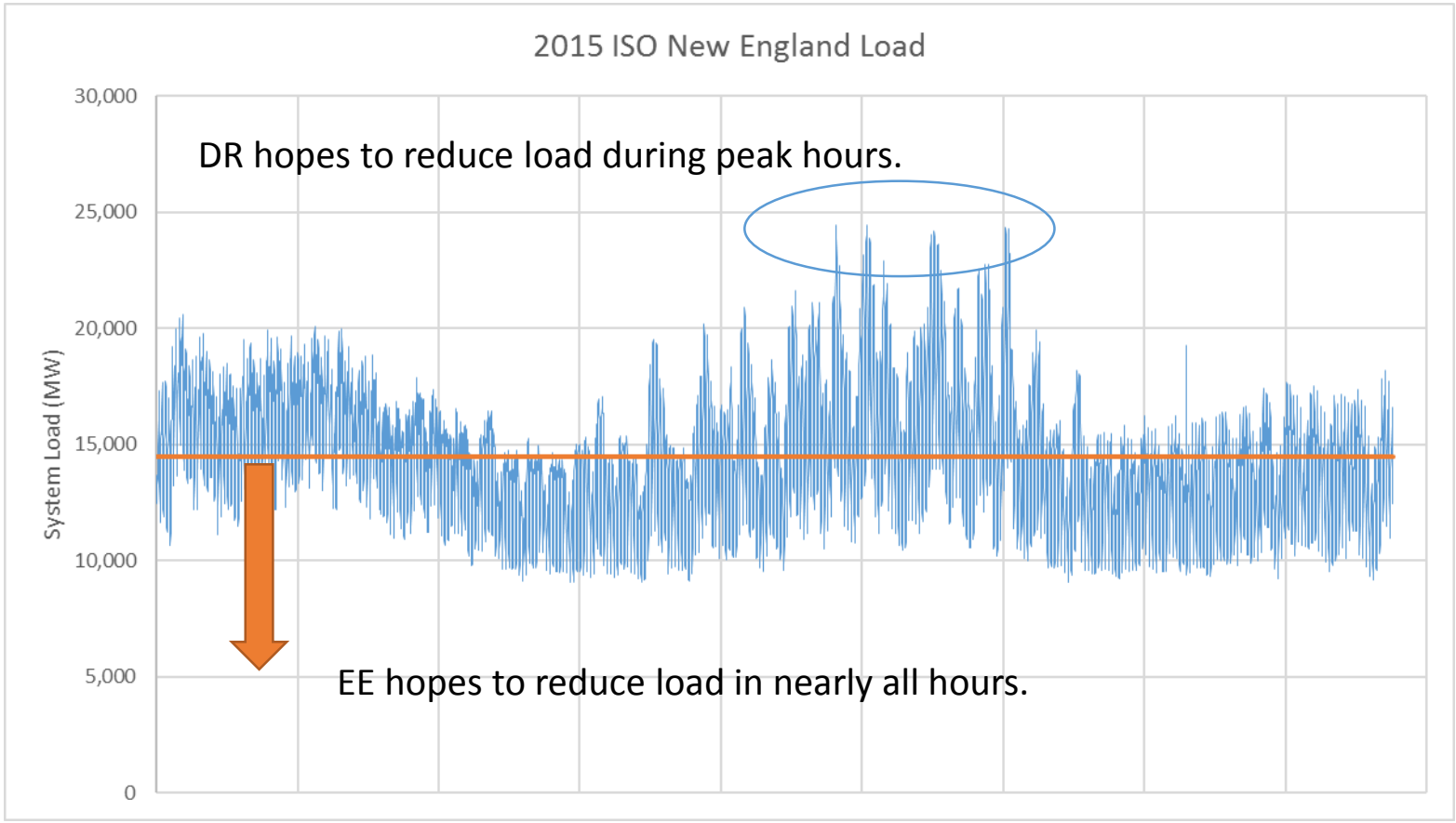
Barriers to EE also apply to DR

- Bounded Rationality
- Lack of Awareness
- Lack of Information and Training
- Lack of Capital or Financing
- Uncertainty and Risk Avoidance
- High Transaction Cost
- Split Incentives

Also apply to Demand Response

- Some barriers greater or lesser depending on customer (size, market, etc.)

Roles of DR and EE



"Peak hours" can mean many different things, such as New England system coincident peak load, local coincident peak load, high price hours, or something else.

Lots of Acronyms, No Clear Path

- AMI, TOU, CPP, PTR, DLC – an acronym soup of related activities, all of which are applicable and aimed at mass-market peak load reduction
- This is HARD. Many, many pilots of all of these (and more) around the country. Nobody has figured this out, yet. Pilots emerge, evolve, and find either mixed results or moderate success.
- From Rocky Mountain Institute, May 2016
  - "4%: Just 5 million out of 128 million residential utility customers in the country are enrolled in time-based rates." (p.18)
  - While enabling technology clearly helps, "There is conflicting evidence on the impact of passive technology, but active technology has proven to consistently and significantly improve peak load reduction" (p.42)
  - "Peak Load Reduction: This has been heavily studied. Results show a wide range of impacts, depending on the design of the [time-based] rate."

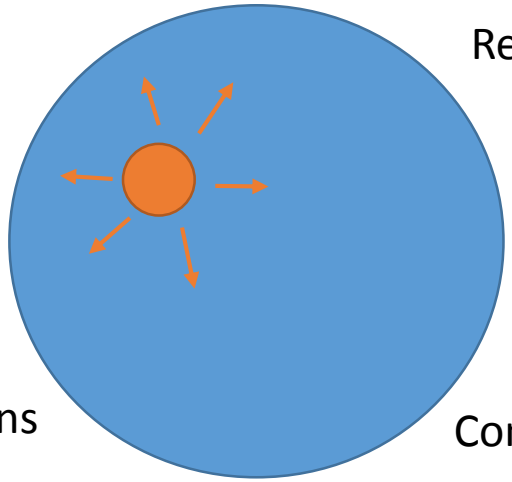
- James Sherwood, et al. A Review of Alternative Rate Designs: Industry experience with time-based and demand charge rates for mass-market customers. (Rocky Mountain Institute, May 2016), http://www.rmi.org/alternative_rate_designs.

Drivers

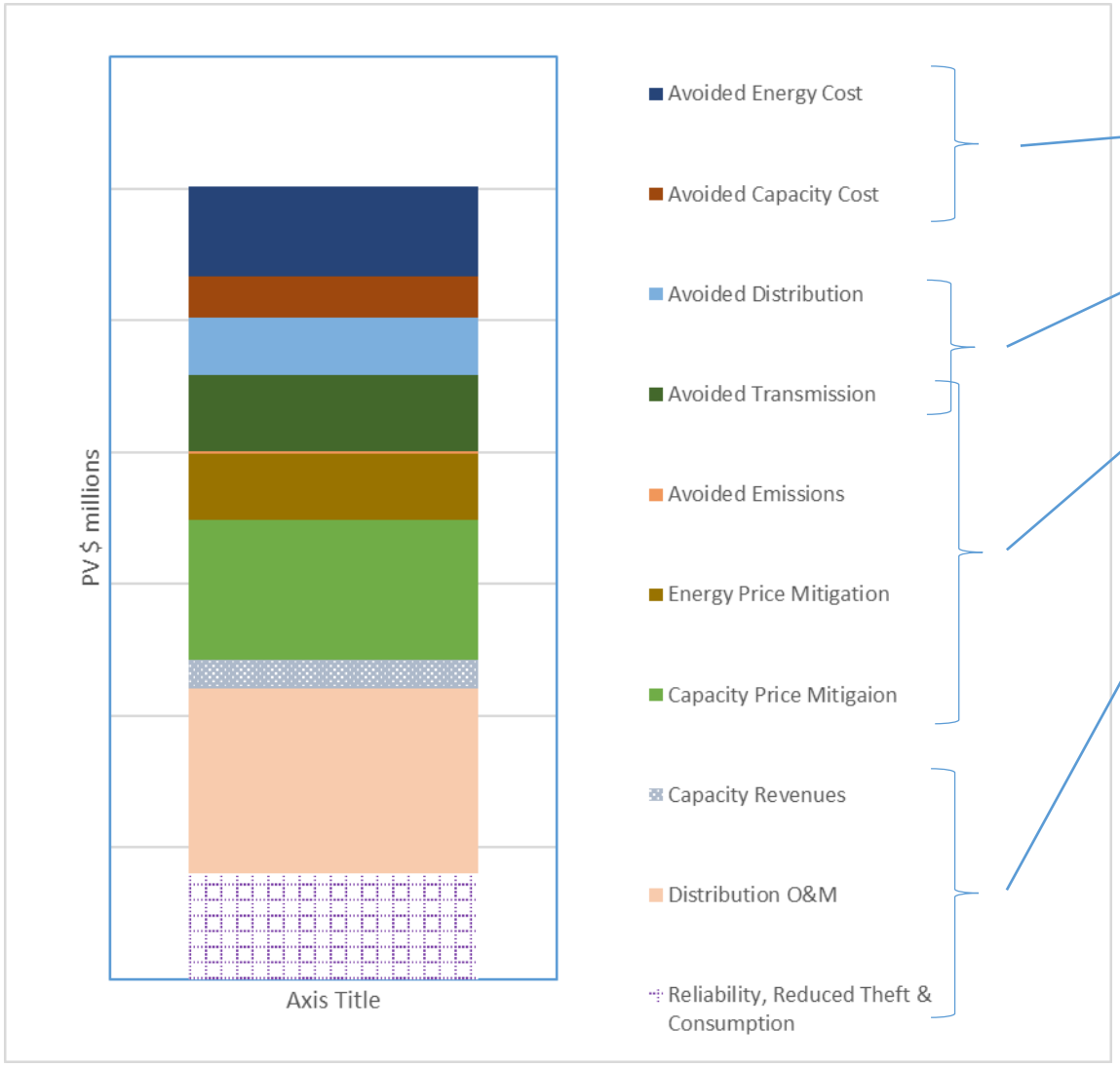
- There can be a long list of drivers for DR at smaller customer sites, including (but not limited to):
  - Reducing peak-related costs for that customer, and for all customers
    - Demand charges, transmission and distribution infrastructure, capacity, peak energy through improved load shape
  - Happy Customers! (a.k.a. Customer Satisfaction)
  - Simplicity and understandability for mass-market customers
  - Reduced emissions
  - Operational benefits (reliability)
  - Context considerations
- Group effort to decide upon the key drivers, minimize the number of them as much as possible, and weight the importance of each

Weighing Key Drivers

Add, adjust, and reorganize drivers as a group.
Then consider the strength of each versus the others.



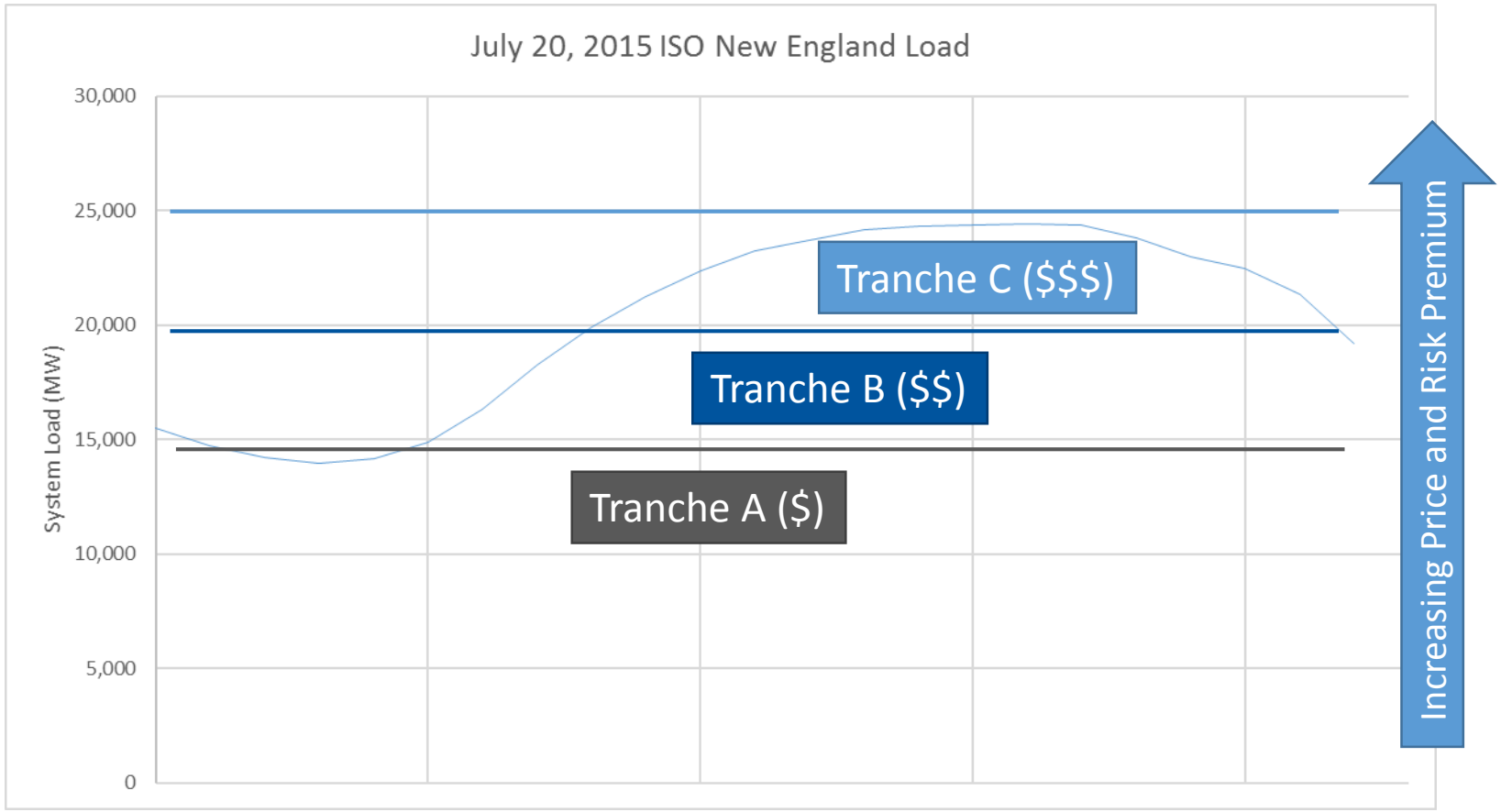
Relative Size of Potential Benefits of DR



- *Benefits to*
  - *Participants*
  - *All Rhode Islanders*
  - *All New England customers*
  - *To the utility, ultimately passed on to customers.*

(Shown are Illustrative relative benefits, as described by BG&E in a recent case.)

Impact on Power Supply Price



If customers continue to see year-round flat prices, that price can be reduced by reducing load during most expensive hours.

Simplicity and Understandability

~50% of residential customers do not have a good understanding of the terms *kW* and *kWh*

Results from E Source Survey

"When we introduced common utility terms such as *demand* and *load shape*, **customers were flummoxed**."

Simplicity and Understandability

Gandalf Group 2013 Ontario Focus Groups

Widespread concern that customers do not have the **tools** to manage demand.

"There is no template for measuring maximum use that people are used to in the way they understand TOU."

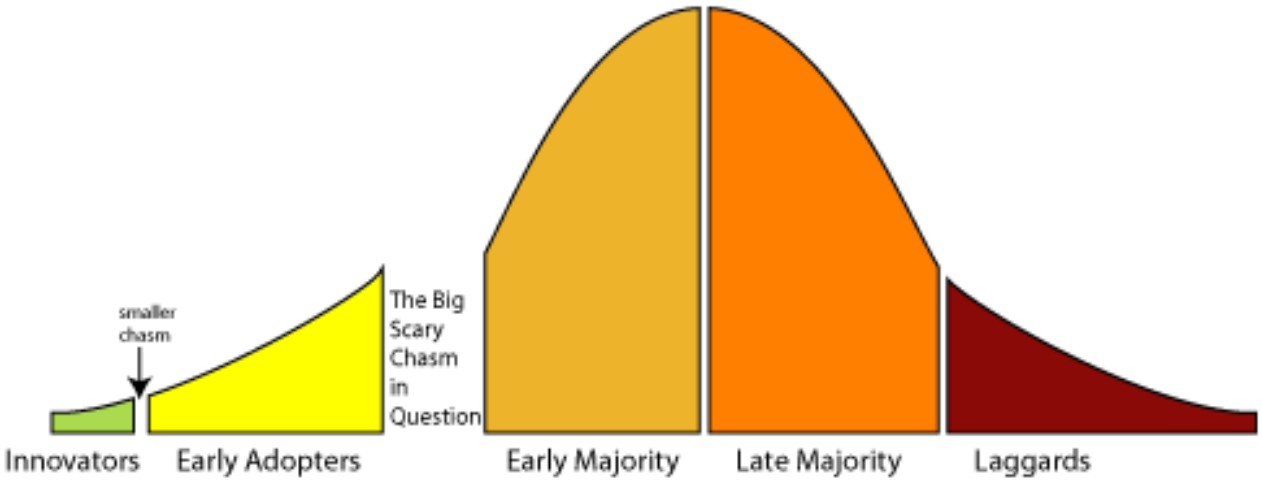
Customers also expressed concerns regarding **fairness**, specifically that "that small lapses in their conservation efforts will mean they will have to pay a high price".

Technology Adoption Rate

Technology Adoption Cycle

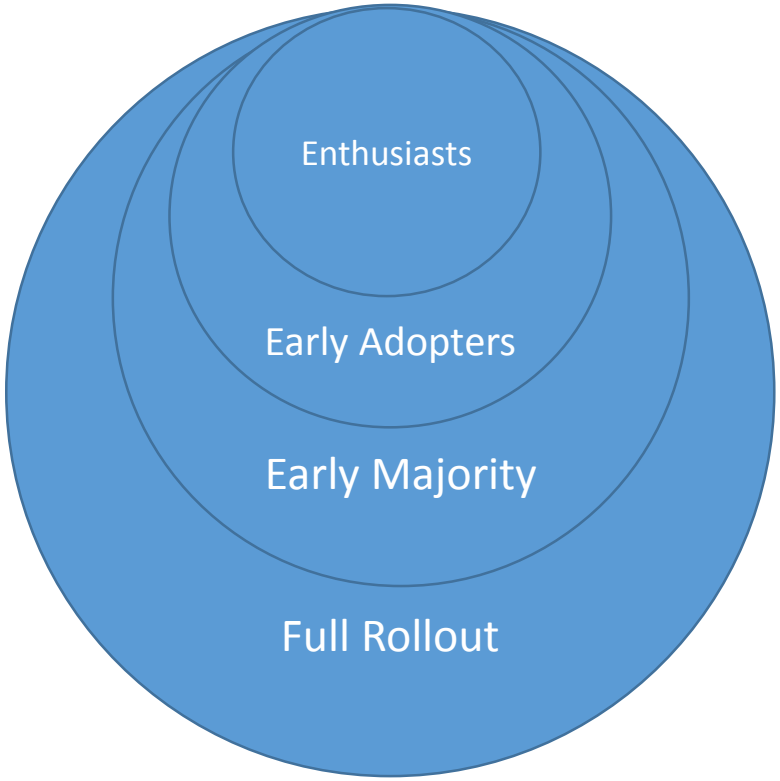
Geoffrey Moore's 'Crossing the Chasm' diagram
circa 1991

(Adapted from Diffusion of Innovations, by Everett Rogers in 1962)



Technology Adoption Circles Model

Loosely translated and then adapted …



A Tiered Rollout anticipates Technology Adoption Rate

- Enthusiasts
  - Excited about energy tech for its own sake
  - Willing to pay
  - Great source for early feedback (will be engaged) and free marketing
- Early Adopters
  - Want to put energy tech to use
  - Will pay some, but less. Want savings.
  - Hints at needs of Early Majority
- Early Majority
  - Hearing from multiple sources.
  - Need product with good user experience
  - Will be convinced by savings
  - *A different market. Tech must change.*
- Full Rollout

Goal is to grow the market for demand response.

Decisions Under Uncertainty

Can we do better than this guy?

Solution from a Decision Model

- A multi-year plan that is not static. Designed from the beginning to be altered over time.
- The best decision?

  Not quite…. Hindsight will always have been better.
- A **Decision Rule**

  Includes best decision "now" (Stage 1)

  PLUS

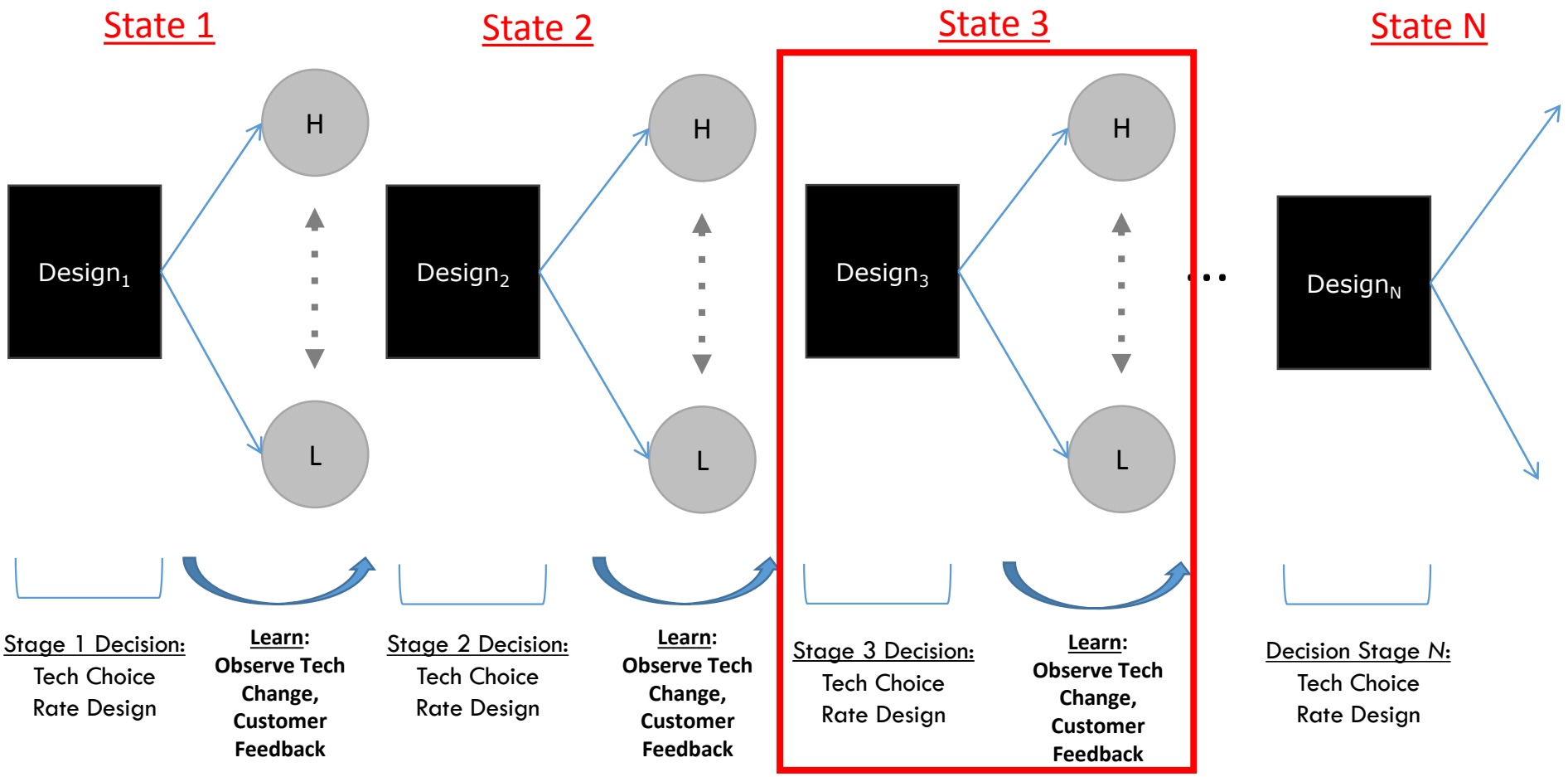
  Conditional rules for what to do later

  If we see A, do X, if we see B, do Y, etc.

  Set a plan now to handle future changes in landscape, learning, etc.
- Often suggests additional alternatives to consider

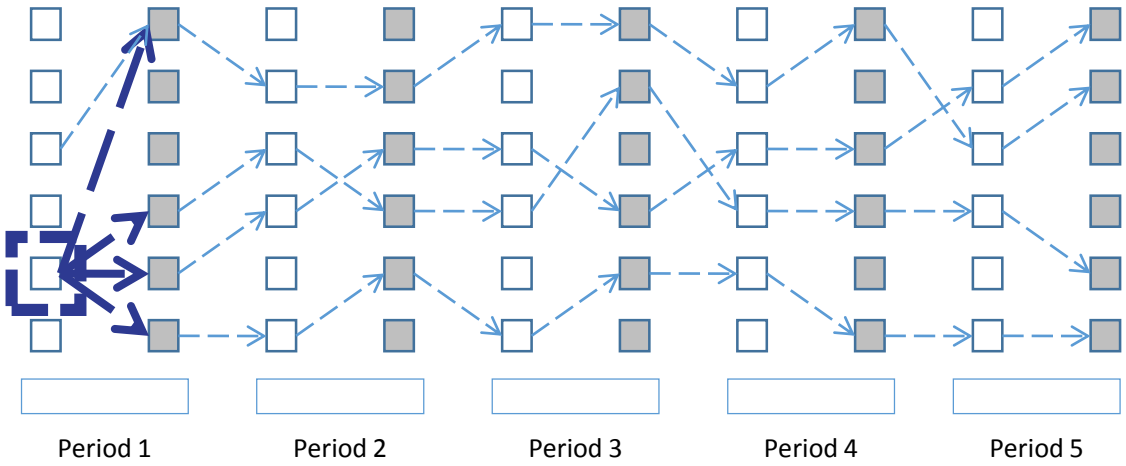
Example Problem

State Variables: *e.g., Capital Costs, Installed Capacity, Cumulative Peak-Related Costs, …*



Mapping Extent of Planning Period

- Appropriate and desirable to plan, even with lack of information about the future
- Majority of uncertainties can be anticipated, weighed, and incorporated into a decision tree plan
- Some drivers can be eliminated straight away – either inconsequential or constant over time, in all states
- Plans can be sequenced. For example, one plan for pilot period, followed by another for the implementation period



Selectively sampling through most promising decisions and uncertainties

Takeaways

Summary

- Nobody has this figured out yet
- Focus on Residential and Small C&I Sectors
- Decide upon key drivers
- Grow the Market with attention to technology adoption rate
- Use methods from Decision Making Under Uncertainty to guide multi-year plan for pilots and implementation
- Suggested starting point:
  - Some form of time varying rate available on opt-in basis
  - Technology to provide information and control usage
    - Direct load control if assurance of load reduction is a key driver
  - Offered as opt-in to Enthusiasts and then Early Adopters
  - Adapt and expand year by year as technology improves and adoption broadens

Additional Considerations

- Combined with peak-focused EE
  - Incentives or measures above and beyond what is already part of LCP
- Build and offer a capacity resource. Offer at price required to recover costs. May or may not clear, but if it does, go build it! Small additional cost to customers (just planning costs).
- Preparation for system need such as LNG availability issues (Yemen pipelines, Spring 2014)

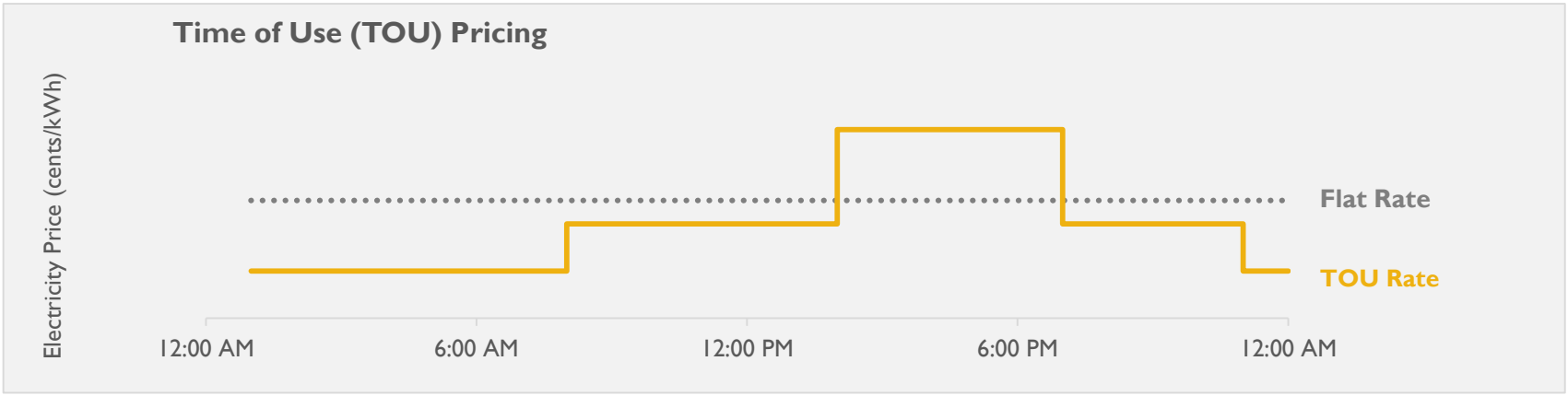
Additional Background

Principles of Rate Design

Revenue Adequacy & Stability	Opportunity to recover allowed revenues; stability in revenues from year to year.
Efficient Price Signals	Send appropriate price signals to ensure efficient resource usage • *Don't create the need for more capacity unless the value of it exceeds the cost of adding it.*
Fairness	Rates should apportion costs fairly; avoidance of undue discrimination
Stability of Rates	Changes should be gradual
Practical Considerations	Simplicity, understandability, acceptability

These must be balanced, as they may be in tension.

Rate Alternatives: TOU Pricing; CPP



CPP pricing is in effect only for "critical event" days when the system is most stressed.

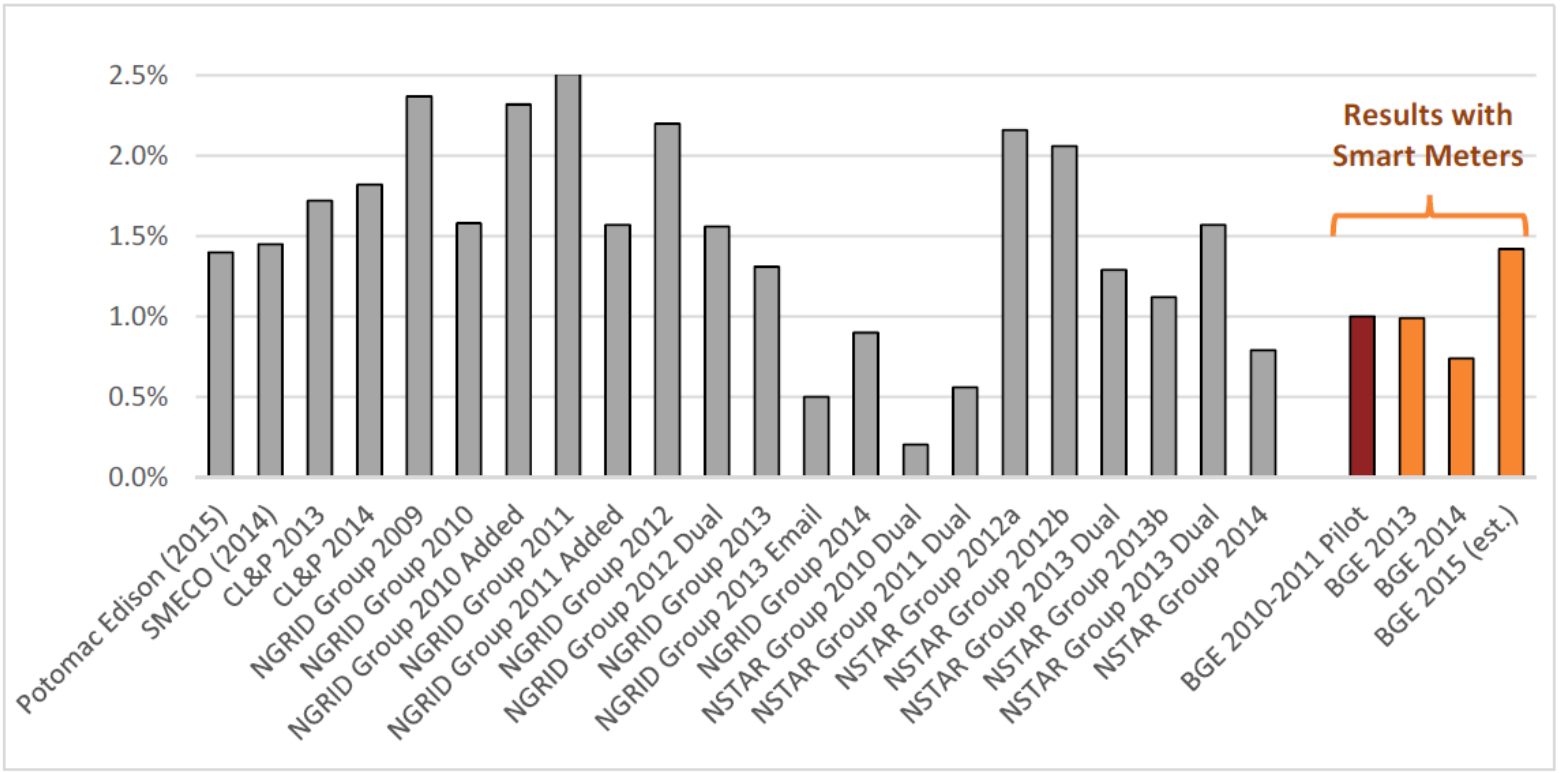
Ability to Monitor & Respond

- Technologies that allow customers to monitor their demand and automatically respond are not yet widespread.
- Without automatic technology, a customer has little ability to know whether they are close to setting a new peak, and little ability to easily manage that demand.
- Will low income, elderly, non-English speaking customers purchase and install such tools?

9312A Residential Demand Controller.
Pricing information is not readily available.

BGE Home Energy Reports (HER)

Figure MPC 4. Comparison of BGE Savings with Savings of Utilities without Smart Grid Initiatives



Source: Testimony of Max P. Chang. Figure MPC 4. Case 9406. 8 Feb 2016.

Do demand charges work?

- According to a recent report, only **3** studies have quantified peak reduction from a demand charge, but they are limited in their usefulness, because:
  - Two of the studies are nearly ***40*** years old, and the other one is from Norway (with a very different climate)
  - All three studies had very small sample sizes (ranging from 40 to 443 participants)

In short, we don't really know!

Source: Rocky Mountain Institute (2016) A Review of Alternative Rate Designs

Acceptability of Demand Charges

- Only 25 utilities currently offer demand charges.
- For most of those utilities, enrollment is quite low (<1%).
- Where offered, energy-only time-of-use rates are generally preferred to demand rates.
- Demand charges may appeal to a small subset of customers (e.g., large residential customers with ability to control key end-uses).