Rate Design in a 100% Clean-Energy Transition

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R Street

Free markets. Real solutions.

Consider the Source

- Director, Energy & Environmental Policy, R Street Institute

- Governing Body Member, Western Energy Imbalance Market

- Formerly "The Honorable Travis Kavulla": utility commissioner (State of Montana) and past president, National Association of Regulatory Utility Commissioners (NARUC)

- The views expressed here are mine alone.

Rate Design:
Why should regulators care?

▶ Bad rate design leads to individuals taking actions that may be privately profitable—
  > but which may raise the cost to society to provide a reliable, clean supply of energy

  ▶ Example #1: Demand charges that lead batteries to be deployed for a siloed use (keeping individual consumer's demand below a certain threshold), rather than for system purposes

  ▶ Example #2: Supply rates that overstate marginal cost of energy, and lead to uneconomic entry of distributed energy resources

▶ Good rate design can allow demand to play an essential role in integrating a system dominated by renewable energy

Cost structure in a jurisdiction moving toward '100%'

▶ Hawaii is not going green overnight, but it will happen relatively fast. The 25-year trajectory implies a few things are likely to happen:

- ▶ Fuel costs (variable costs) will diminish.

- ▶ Overall capital investment (fixed costs), whether HECO-led or customer-led, will increase.

- ▶ There will be more periods where the system will be oversupplied, and (unless overbuilt) there will also be more periods where energy is scarce.

Year	RPS Requirement
2010	10%
2015	15%
2020	30%
2030	40%
2040	70%
2045	100%

Rate Design at a '100%' renewable end state?

▶ If short-run variable costs were zero, customers' electricity should probably be paid for like the smartphone than the gas station fill-up

▶ It'd probably also look like the cell company in terms of system congestion management (e.g. "throttling")

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But moving to '100%' poses tricky questions on rate design

Do we want rate design to send price signals intended to accomplish investment (i.e., do we expect rate design to accomplish IRP/IGP-like objectives)?

As renewables are added, how to reflect the value of energy during the (frequent) periods of vast oversupply and other (hopefully less frequent) periods of scarcity?

Supply Pricing in a Retail-Monopoly Marketplace

▶ If HI had many sellers & buyers → Bid-based wholesale market + security-constrained network → Locational Marginal Prices → inform procurements/sales in a competitive retail environment. This structure gives rise to appropriate supply pricing in larger markets.

▶ Hawaii is not that.

  ▶ Its grids are not large and liquid enough to have a workable bid-based wholesale market.

  ▶ Many procurements made through a "planning"/RFP process – although LMP-like prices should inform those procurements

▶ A second-best option to obtain accurate, useful supply prices is a "cost-based" market. (Wolak, 2018)*

*Frank Wolak, Stanford University
"How should the Public Utilities Commission regulate the Hawaiian Electric Company for better integration of renewable energy?"

Cost-Based Market

▶ The cost of generator units to HECO is known and approved by regulator, allowing a "supply stack" to be created (periodically modified by outages, fuel price increases, etc.)

▶ A day-ahead market model can estimate consumer load in order to create a day-ahead schedule of supply resources, and a measurement of the locational marginal cost of grid-delivered energy

Supply Stack

Resource that cleared the market
Operates at full output

Resource that partially cleared the market
Operates at partial output

Resource that did not clear the market
Does not operate

Demand

Price Setter

PRICE

A B C D E F G H I J

MEGAWATTS

Source: ISO New England
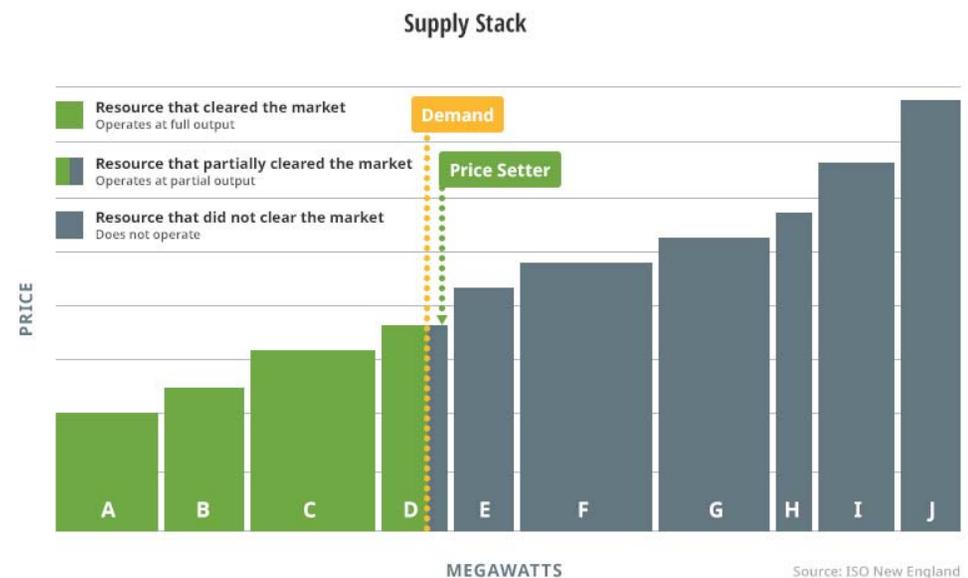
Why a 'Market' if HECO is a Monopoly?

▶ Uses a system model to project both a Day-Ahead system (not locational) marginal cost, or λ, for each hour of next day.

▶ Customers "buy" a baseline of usage based on existing rates. They may use more than or less than their baseline usage by paying/being credited λ.

Pro tip: *call it a 'rate design tool' if you don't like the word 'market'*

As a formula....

$$\text{RTP-DA Bill}_{Mo.} = \text{Standard Bill}_{Mo.} + \Sigma \text{ Price}_{Hr.} \times [\text{Load}_{Hr.} - \text{CBL}_{Hr.}]$$

Where:

RTP-DA Bill $_{Mo.}$	=	Customer's bill for service under this tariff in a specific month
Standard Bill $_{Mo.}$	=	Customer's bill for a specific month based on usage as defined by the CBL and billed under the standard firm tariff
Σ	=	Sum over all hours of the monthly billing period
Price $_{Hr.}$	=	Hourly RTP-DA price based on marginal costs
Load $_{Hr.}$	=	Customer's actual load in an hour
CBL $_{Hr.}$	=	Customer Baseline Load shape on an hourly basis

Getting the Baseline Right

▶ The "Customer Baseline Load" (CBL) is important because it is the billing determinant for fixed-cost recovery

▶ Existing Customers

  ▶ CBL developed either actual historical metered half-hourly interval data for a customer's specific location, <u>or</u>

  ▶ from a template scaled to the actual historical monthly energy and monthly peak demands

▶ New Customers

  ▶ 100% of commercial projected load; 60% or greater of industrial customer's projected load

    ▶ Requirement to "demonstrate" actual peak load to avoid gaming

Uses of a 'Cost-Based Market'

- A price within rate design to encourage demand participation: Georgia Power has 2,400 customers on this or its HA dynamic tariff (2/3 commercial; 1/3 industrial)

  - Conceivable to have retail aggregators certified and responding to this price signal on behalf of residential customers

- Provides DERs a price signal for the economic substitution of offered generation from Day Ahead

- The market's two-part settlement (Day Ahead to Real Time) encourages forward hedging and reliability of supply, because (depending on design of IPP contracts & DER payment schemes) it is an economic resolution to generation & demand imbalances.

Some Possible Objections to this Approach

▶ It's a 100% renewable system, so it won't have any marginal costs

   ▶ Response: This is a system that is going to have huge excursions of oversupply and scarcity unless & until load is covered in each hour by 100% zero-marginal-cost resources. Is that really going to happen?

   ▶ Indeed, it may *always* have these characteristics (vacillating oversupply and scarcity) if the last increment of supply in scarcer times is price-responsive demand. Which, in a market where the value of lost load < marginal of storage storage, is quite likely.

   ▶ A postcard from the future: Imagine a Hawaii marketplace which is more a "reverse curtailment auction" than a "supply the last unit of demand auction"

Objections, Part Deux

▶ The prices won't rise high enough to get DER built

  ▶ Response: Not sure about that!

  ▶ In any case, using rate design to organically achieve significant sources of long-term supply in a monopoly market is odd, given that they are "competing" with a central procurer with a tendency to overbuild. Probably better that DER aggregators should sign contracts for energy/capacity obligations to HECO, like IPPs, and be responsible for imbalance in cost-based market's real-time settlement. (Again, using the "market" as a rate design tool.)

  ▶ If you want to "test drive" organic behavioral reactions, then relax the reserve margin in order to drive part of the portfolio to come from voluntary load curtailment/ "merchant" DER.

Finally: A Plea for Regulatory Flexibility

▶ Does every rate need to be spelled out precisely?

▶ In order to get significant DER/DR into a more predictable regime of procurement, there probably needs to be some contractual latitude on the part of HECO to achieve deals that match a customer's peculiar situation, or which relieve problematic points of congestion on network.

▶ Examples exist of customer protections in a more deregulated regime of rate design (special rates for poor or rural telecommunications customers)

Mahalo...

Questions?

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