Business models for distributed energy resources: value pricing and efficient tariff design
Scott Burger
What we will speak about today

1. The power sector is evolving…
2. What is a business model, anyway?
3. The structure of DER business models
4. Tariff design and the economics of distributed PV and storage businesses
5. Q&A
The power sector is evolving...
Today, four trends are forcing the power sector to evolve once again...

1. The power sector is decentralizing...
Many emerging resources are inherently more distributed than incumbent resources

Source: Carbon Brief, 2016. “Mapped: How Germany generates its electricity”
2. The power sector is digitizing...

Deployment of information and communication technologies is rising as costs plummet.

Average selling prices of various MEMS devices

AMI deployment as a % of metered sites in the U.S.


The MIT Utility of the Future Study
3. The resource mix is changing...

Renewable energy resources are on the rise globally

Renewable energy as a percent of electricity production

Source: MIT analysis; BP Statistical Review of World Energy data

The MIT Utility of the Future Study
4. The power sector is increasingly interconnected...
The fate of the electricity sector is increasingly tied to transportation, heat, computing, and more
What is a business model, anyways?
These four trends are placing major pressure on utilities globally – This financial pressure is spurring restructuring, new business models, and more.

Stock price relative to May 24th, 2011 %

- RWE
- E.ON
- NRG
- Exelon
- S&P 500

Source: Yahoo Finance
This pressure drives many to predict dramatic change to the business structures used to deliver energy services – This change is often depicted as being potentially disruptive or deadly.

“Regulators set rates; utilities get guaranteed returns; investors get sure-thing dividends. It’s a model that hasn’t changed much since Thomas Edison invented the light bulb. And it’s doomed to obsolescence.” – David Crane

“It would be foolish to dismiss the potential for major changes in the utility business model” – Theodore Craver, Jr.
Despite the focus on changing business models, there is still a lack of clarity around what exactly is changing – in one review, 56% of studies did not provide only a loose definition or no definition at all of a business model.
Using a simple business model framework can help us contextualize ongoing changes – Business models are not monoliths

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Distribution utility business models are fundamentally different than competitive energy service businesses – Activities, resources, costs, revenues, and, as a result, value propositions, are all regulated due to monopoly power.
The structure of DER business models
Solar PV and Solar-plus-storage business models rely heavily on value pricing – These business models reflect differing degrees of market integration.

Source: MIT Utility of the Future Study Analysis
Solar PV and Solar-plus-storage business models rely heavily on value pricing – These business models reflect differing degrees of market integration.

Source: MIT Utility of the Future Study Analysis
Energy storage is proliferating across the value chain, from the utility to the **distributed scale** – Similarly, energy storage business models reflect differing degrees of market integration.
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Source: MIT Utility of the Future Study Analysis
Tariff design and the economics of distributed PV and storage businesses
A critical feature of PV and storage business models is that their pricing is not structured to reflect underlying system costs, but to offer value relative to utility supplied power – Naturally, these systems are sensitive to utility tariff structures.

**Graph: Range of future utility prices**
- **Power Price**: $\text{c/kWh}$
- **Years**: $0, 1, 2, 3, \ldots, N$
- **Predefined future PV lease or PPA price**: $P_{PV,t}$
- **Range of future utility prices**: $P_{U,t}$

**Portfolio Average Metrics:**
- Generation: 1,391 kWh/kW
- PPA Price: $0.13/kWh
- PPA Escalator: 2.2%

"We believe that our primary competitors are traditional utilities that supply energy to our potential customers" – SolarCity 10k

Source: MIT Analysis, United States Department of Energy, Company filings
These emerging business models require the creation of a level playing field for *all* resources.

The best way to **create a level playing field** (and thus more affordable electricity) is to **dramatically improve prices and regulated charges** for electricity services.
1. Ensure that all prices and charges are non-discriminatory, technology neutral, and symmetrical.

Electricity rates should be based *only* on the injections and withdrawals of electric power – this requires the use of improved metering infrastructure.
2. Progressively improve the granularity of price signals with respect to both time and location.

- Distribution nodal LMPs (DLMPs, real & reactive)
- Intermediate DLMPs (substation/zonal/other)
- Wholesale LMPs + distribution losses
- Wholesale nodal LMPs
- Wholesale zonal LMPs

Temporal granularity:
- Time-of-use pricing
- Critical peak pricing
- Day-ahead hourly price
- Real-time spot price
3. Implement forward-looking peak-coincident network charges and scarcity-coincident generation charges to align consumer decisions with system costs.
4. Recover “residual” network and policy costs without distorting marginal consumption or production incentives
5. Carefully consider which costs are included in fixed electricity tariffs to avoid inefficient grid defection.
6. Explore new methods for addressing distributional & implementation challenges without sacrificing efficient signals that reduce costs for all

1. **Cross subsidies**: Lump-sum bill credits or surcharges can restore desired cross-subsidies

2. **Spatial and temporal variability**: Pre-payments and hedging arrangements can address bill variability

3. **Low income support**: Assistance to those that can prove need can augment subsidies built into today’s tariffs
Thank you!
Scott Burger – sburger@mit.edu