Distributed Generation and the Importance of the Electric Grid

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The Edison Electric Institute (EEI) is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for 220 million Americans, operate in all 50 states and the District of Columbia, and directly employ more than 500,000 workers.

With more than $85 billion in annual capital expenditures, the electric power industry is responsible for millions of additional jobs. Reliable, affordable, and sustainable electricity powers the economy and enhances the lives of all Americans.

EEI has 70 international electric companies as Affiliate Members, and 250 industry suppliers and related organizations as Associate Members.

Organized in 1933, EEI provides public policy leadership, strategic business intelligence, and essential conferences and forums.
September 1882: Edison used a steam engine to drive his dynamo to generate direct current electric power for a central power generating station on Pearl Street in New York City. It had 85 customers and 400 lamps.

January 2013: GE unveiled a new wind turbine design, billed as “the world’s most efficient high output brilliant wind turbine”. The turbine features an integrated energy storage system. It comes with a data-driven system designed to boost efficiency and improve power output and is the first to use the Industrial Internet to help manage the variability of wind providing smooth predictable power.
Building Renewable Power

Non-Hydro Renewable Sources More than Double between 2012 and 2040

Non-hydro generation, Billion kWh

Growing New Markets

Utilities lead PV installations and integration

Installed PV capacity (MW)

Utility scale projects
- Natural economies of scale
- Can be optimally located and sized
- Cost advantages over rooftop solar
- Allow all customers to benefit

Source: SEIA, U.S. Solar Market Insight, Q3 2013; EEI
...And Making It All Happen
Transforming the Grid

- Utilities are deploying advanced grid technologies that harden the grid and enable increased penetration of renewables, demand response, electricity storage, and electric vehicles.
  - Synchrophaser technologies, automated feeder switches and supporting sensors, voltage regulators, communications equipment, smart meters, etc.

Source for Photos: Schweitzer Engineering Laboratories, AES Energy Storage, EEI
Utilities lead in capital intensity and expenditures

Customers are gaining new distributed energy resource options, including DG.

The structure and operation of distribution systems will change as “smart” infrastructures are built out and new DER technologies are deployed.

- Ultimately, power will flow in 2 directions across distribution systems.
- Supporting a safe and reliable grid infrastructure is critical to the deployment of new technologies.

Source for graphics: EPRI, *The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources*, February 2014
Factors Spurring DER Adoption and Contributing to the Transition

- Public policies
- Declining technology costs
- Customer preferences
- New models
- New technologies
- New needs and uses
The Grid at the Center of the Transition

Services and Benefits of the Grid

- Energy transfers and transactions: buying from and selling back to the grid
- Balancing supply and demand
- Voltage and frequency control services
- Energy back up

Picture: Inhabitat.com
Typical Energy Production and Consumption for a Small Customer with Solar PV

Source: Value of the Grid to DG Customers, Institute for Electric Innovation, October 2013
Current Rate Designs Work Poorly for DG

- Most rates recover a large share of fixed costs through variable use charges.
- Under most rate designs, rates to customers with DG fail to recover the right amount of fixed grid costs.
- DG customers continue to rely on the grid and increase grid costs, most of which are fixed.

Distributed Generators Do Not Pay Their Full Share of Grid Costs

Residential Cost Structure vs. Revenue Collection

Graphs based on data from an actual utility, 2010
Net Metering Does Not Align with Ratemaking Principles

What is Net Metering?
- Net metering allows customers to **offset their purchases from utilities with self-generation**.
- The credit that customers receive for their self-generation is **economically equivalent to a sale of their power back to the utility at the full retail rate**.

What is the Problem with Net Metering?
- Net metering makes the cost-recovery problem worse, **shifting fixed costs** to non-DG customers.
- Because of net metering at retail rates, net metered customers benefit from a **hidden subsidy** and do not pay their share of **fixed transmission, distribution** and other **commission-approved costs**.
- This cost-shifting raises the cost for other customers.

Graph based on data from an actual utility, 2011

- **Retail price:** $0.10/kWh
- **Credit:** $6
- **40 kWh**
- **100 kWh (before NEM)**
- **100 kWh**
- **$10 (before NEM)**
- **$4**

Retail price: $0.10/kWh

- **Generation Rate**
- **Subsidy paid by Other Customers**
- **Total Retail Rate**

- **Net Metering**
- **Graph**
Regulation Needs to Adapt Too

New Regulatory Policy and Rate Design Are Needed

Reform net metering policies. Adopt new approaches to designing rates for DG so that all users of the grid contribute to grid infrastructure.

Is There a Best Rate Approach for DG?

**Straight Fixed/Variable Pricing:**
Recovers fixed costs through fixed charges, and variable costs through variable, per kWh, charges.

**Buy/Sell Design:**
Two separate transactions: The consumer buys all of his/her power needs from the utility. The utility buys all of the consumer’s DG production.

**Grid payment** - Disaggregated rates, Fixed charge based tariff, Straight fixed/variable pricing
→ Charge for fixed charges separately.

**DG payment** - Feed-In Tariff, Buy-All Sell-All Tariff, Value of Solar Tariff
→ Separate payment for consumption and production.
All works!
The key is getting the *pricing* right and allowing the utility to *own* and/or *control* the siting and operations of the systems.
DG Integration Challenges

The Duck Curve - California

The Nessie Curve - Hawaii


"German customers already pay the highest electricity prices in Europe...This year, German customers will be forced to pay €20 billion ($26 billion) for electricity from solar, wind and biogas plants—electricity with a market price of just over €3 billion. Even the figure of €20 billion is disputable if you include all the unintended costs and collateral damage associated with the project... Depending on the weather and the time of the day, the country can face absurd states of energy surplus or deficit."

—"Germany’s Energy Poverty: How Electricity Became a Luxury Good,“ Der Spiegel, 09/04/2013
Lessons Learned from Germany
(and other OECD countries)

Subsidies were too generous
(Level of subsidies was too high for the market, did not follow technology cost reductions, particularly in solar power)

Growth of renewables was too rapid
(Grid and markets cannot not adjust quickly enough to the rapid deployment of renewables, particularly wind and solar)

Impacts

- Reduction in wholesale prices adversely impacts generators and the reliability of the grid
- Increase in retail electricity prices adversely impacts consumers and competitiveness
- Multiple redesigns of the incentive programs adversely impacts the renewable industry
- Additional investment needs in the T&D networks will further raise costs
Overgenerous Subsidies

Costa del solar
Germany’s:
solar PV installation cost € per KW peak
subsidy to renewables €bn

0.19 1 € 2 € 2 € 2 € 3 € 3 € 4 € 5 € 5 € 2.05 9 € 13 € 17 € 20 € 24 € 6.24

The Economist, 12 October 2012

EEG surcharge: Share of subsidy FIT paid for by customers in their electricity bills, the difference between the total FIT tariff and the wholesale price of electricity.
EEG cost per year: Total annual cost of the EEG surcharge. Total disbursements to renewable energy providers in addition to their proceeds from wholesale markets.

Source: German Federal Ministry of the Environment, Nature Conservation, Building and Nuclear Safety /
Residential Retail Prices Soared

Source: Agentur für Erneuerbare Energie (www.unendlich-viel-energie.de)
Wholesale Market Prices Plunged

Forward peak prices

“How to lose half a trillion euros”

Source: European Energy Exchange – EEX and The Economist, 12 October 2012
It is vital for our nation to have a diverse supply of safe and reliable electricity.

The U.S. electric grid delivers a valuable product essential to all Americans.

The electric power industry is leading the transformation to make the grid more flexible and more resilient to meet the growing demands of our digital society.

Everyone who uses the grid should help pay to maintain it and keep it operating reliably.

Electric rates should be fair and affordable for all customers.
Thank you!

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