The Economics of Distributed Generation: Separating Fact From Fiction

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Outline

- Distributed Generation Myths.
  - What are they? Why do they persist?
- What is "Economic" Distributed Generation?
  - What is the proper analytical framework for determining a "good" DG project?
- What Factors Distort the Cost-Effectiveness of Distributed Generation?
  - Why regulation still matters.
  - What are the politics of DG?
- What are the Real Hurdles Faced by Distributed Generation?

DG Myths

- There are many myths surrounding DG that are difficult to eliminate. In part, this is because insufficient attention has been paid to the actual economics of DG.
  - Focus has been on the regulatory/policy context of DG in light of electric utility restructuring.
  - That's important, but economic aspects need to be correctly linked.

- Perpetuating these myths, even to the extent they favor DG, will tend to harm the DG industry in the long run, to the extent that false or over-hyped expectations crash into reality.

DG Myths

Myth 1: DG is Cheaper than System Power.

- Fact: Most DG is more expensive than new central station generation. The smaller the DG package (e.g., microturbines, residential fuel cells, etc.) the more expensive the technology.
  - Sharply higher natural gas prices are adversely affecting operating costs because of generally high heat rates.
- Fact: Economies of scale still matter in the electric industry. They are different than in the "old days," but still exist.
- Fact: The reason that many DG applications look cheap in comparison with system power is because of erroneous comparisons between overall customer rates and DG cost.
  - This is a rate design/regulatory issue that is enmeshed in political considerations.

DG Myths

- **Myth 2: Utilities will become obsolete in the next decade.**
  - Fact: Utilities continue to provide a cost-effective and incredibly reliable service. Widespread DG applications are unlikely to provide the same reliability and cost-effectiveness, especially at the residential level.
  - Fact: Some applications for DG make sense, especially for certain customers who need higher quality and higher reliability power.
  - Fact: Not at all clear that most customers want to be in the generation business themselves.

DG Myths

- **Myth 3: DG can defer "traditional" distribution and transmission costs.**
  - Fact: In some cases, DG can defer those costs. But in all cases, deferral answers the wrong question.
  - Fact: The correct economic evaluation for DG when it is used as a substitute for traditional "poles and wires" investments is to determine the cost of meeting future (but uncertain) local area demand in the least-expected cost way.
    - This requires a more complex evaluation than simple deferral calculations, or calculations based on erroneous T&D avoided-cost calculations. (We'll discuss why those avoided cost calculations are erroneous later.)

DG Myths

- **Myth 4: Utilities should invest in DG today, even if it is more expensive that traditional T&D investments, because the latter will be "stranded" in a few years.**
  - Fact: This type of economic "logic" is sheer nonsense. Full service utilities today have an obligation to serve. Distribution utilities have an obligation to connect.
  - Fact: Regulators cannot (well, should not) play "gotcha" with utilities for spending too much today or having stranded assets in the future. Utilities need to make the best economic investments today to meet their obligations to their customers.
  - Fact: Some utilities are facing political pressure to install DG as as a "goodwill" measure.
    - Nothing wrong with this. However, utilities and regulators must decide whether the goodwill benefits exceed the additional economic costs.

What Factors Make DG "Economic?"

- **Need to Address Two Critical Issues:**
  - First, we need to define what we mean by "economic" - from whose perspective?
  - Once defined, how do we measure?
- **Defining "Economic"**
  - Economic = "least-cost" subject to well-defined reliability constraints.
    - Otherwise, "least-cost" is always "let the system fall apart."
  - DG applications must be compared on an "apples to apples" basis.
    - Important for potential customers, so they don't get unexpected cost surprises (backup charges, etc.)

Defining Economic DG

- Whose Perspective?
  - Distribution utilities?
  - Individual customers?
  - Society (regulators)?
- Perspective Matters
  - Perspective affected by the economic signals received.
  - Individual customers will base their decisions on the rates they face and the presence of so-called "net-billing" agreements.
  - Distribution utilities will want to ensure they meet their "obligation to connect" at the lowest cost.
    - May have other objectives as well, but those should not necessarily be couched in dollar terms.
  - Society (regulators) may want lowest overall costs, or wish to pursue specific policy goals.

Customer Perspective

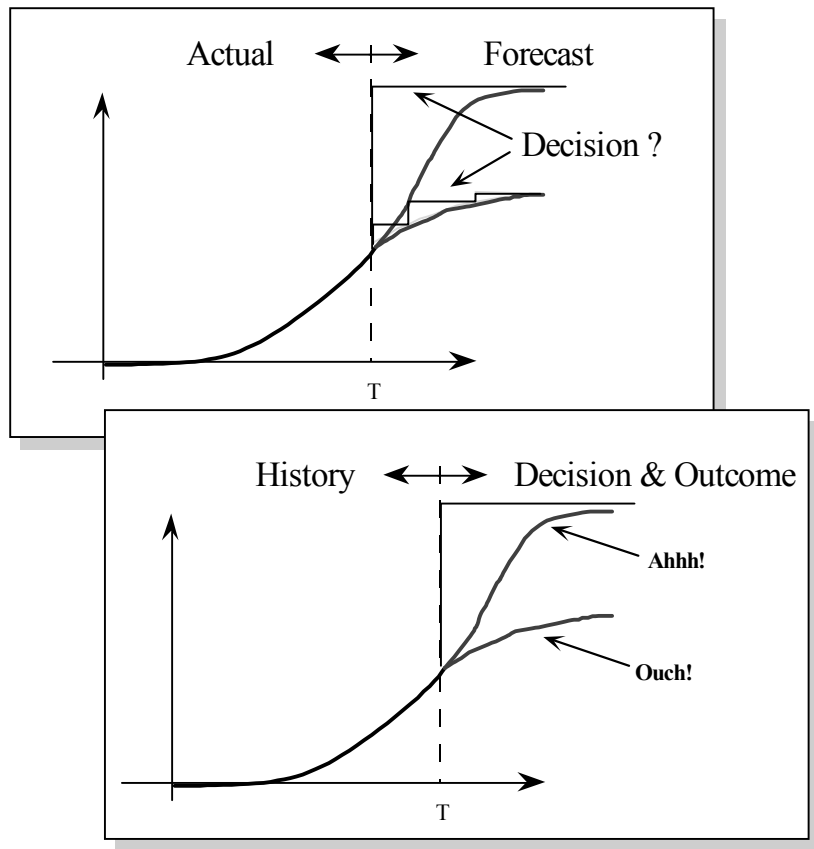
- Customers who base their decisions about DG on rates are comparing DG with overall transmission, distribution, and generation costs.
  - Net billing agreements can bias customer choice in favor of uneconomic DG, result in higher costs for other consumers (cost-shifting).
  - If customers separate from existing grid, comparison is reasonable, assuming the customer understands reliability/backup implications.
  - If customers remain on grid, will still need to pay for backup services.

Distribution Utility Perspective

- Distribution Utility Perspective
  - DG applications can serve as a source of local area distribution capacity in lieu of investments in "wires and poles."
  - How to evaluate correctly?
  - First, consider the engineering aspects.
    - Can DG applications be sited where needed?
    - Are there connection issues that will affect system reliability and safety?
    - Do customers want both DG and back-up from their local utility?
  - Second, consider economic aspects.
    - Evaluate DG equivalently with other distribution options.

Distribution Utility Perspective

- Uncertain load and lumpy investments create a planning challenge
  - Future load is probabilistic
    - can identify the potential for growth
    - but cannot always predict if and when it will occur
- The need for new capacity depends on future load growth.
- Thus investment value is probabilistic and risky.



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Distribution Utility Perspective

- To evaluate DG applications, need to consider the probabilistic impacts of uncertain future load growth.
  - If customers own DG, distribution utility faced with additional uncertainty - will customers abandon DG at a later date and come back onto system.
    - This may be a critical issue in light of increasingly volatile natural gas and electric prices. If some customers can arbitrage, then costs will be shifted onto those who cannot.
  - Want to balance economies of scale that can be achieved by larger "poles and wires" investments versus the benefits of not having unused capital resources.
  - Conclusion: load uncertainty matters!

Distribution Utility Perspective

- What about other uncertainties?
  - Electric and natural gas prices have grown increasingly volatile with the advent of industry restructuring.
  - Need to assess the impacts of these uncertainties, especially in light of the potential for DG applications to be "switched-off."
    - Raises the possibility of DG users "arbitraging" the local utility by using DG when cost is low, and relying on the system when costs are high.
  - The existence and the impacts of price volatility needs to incorporated into economic calculations and regulatory policy design.

Regulatory Perspective

- Some Common Regulatory Perspectives:
  - DG is an alternative to poles and wires investments, and an alternative to new central-station generating investments.
    - DG can defer the need to invest in new poles and wires investments.
  - There are "barriers to entry" facing DG investments.
  - DG is cleaner and more efficient than central-station generation.
  - DG is "good" because utilities can't control it and should not be allowed to own it.
  - DG is politically viable.

Regulatory Perspective

- DG and Deferral of T&D Investments
  - Deferral of poles and wires investments is a potential implication of evaluating DG economics. Should not be an economic goal.
  - Models to evaluate the deferral benefits and compare to a traditional expansion plan for a deterministic forecast of future area load growth are wrong!
    - Generally, models determine avoided cost of transmission and distribution on a per-kW basis.
    - Flawed, because distribution investments are "lumpy." Need to compare the direct costs of the investment alternatives.

Regulatory Perspective

- Barriers to Entry
  - DG, like DSM, faces "barriers to entry." Therefore, needs to be subsidized, encouraged by regulations favoring its installation, etc.
  - This reasoning is based on a flawed definition of "barriers to entry."
    - Higher cost is not, in itself, a barrier to entry.
    - Because I cannot afford a Mercedes/Lexus, etc., does not mean those manufacturers face "barriers to entry" compared with Ford.
  - Barriers to entry are factors that prevent firms from entering a market as they would be expected when current prices are <u>above</u> costs. Costs above price ≠ entry barrier.

Regulatory Perspective

- DG is cleaner and more efficient than generating alternatives.
  - Determining environmental impacts is complex.
  - Location of DG near or within population centers can exacerbate DG's environmental costs.
  - Local siting regulators may be at odds with utility regulators over siting of DG.
  - DG applications such as microturbines usually have higher heat rates (sometimes much higher) than larger units. Less fuel efficient, unless linked to co-generation.

Regulatory Perspective

- Political Viability of DG
  - DG is sometimes perceived as a politically astute investment.
    - Provides "local" benefits – e.g., jobs for installers, keeps dollars within the community rather than flowing to large impersonal utilities.
    - Provides a measure of competition for those same utilities.
    - Reduces the need to install "ugly" poles and wires.
  - DG may be perceived as politically viable, but:
    - If it does not perform as advertised, political benefits will vanish, especially if DG is used to defer T&D investments necessary for maintaining reliability.
  - Political viability will ultimately depend on pregnant chads and Newton's Revised Third Law:
    - "To every reaction, there is an equal and opposite lawsuit."

Market Distortions and Hurdles Faced by DG

- Although definition of barriers to entry is often used incorrectly, there are some regulatory issues facing DG applications that present hurdles.
  - Multiple regulators
    - DG must address both utility and land use/environmental regulators' concerns.
    - Often at odds with one another.
    - Cannot let utilities and DG developers get stuck in the middle. Especially true for regulated utilities who must meet obligations and make "prudent" investments.
    - Need clear guidelines for siting applications. What will be allowed and where?

Market Distortions and Hurdles Faced by DG

- Ownership concerns.
  - Are there legitimate antitrust issues that arise if DG is allowed to be owned by utilities?
  - Are owners using distribution investments to cross-subsidize other products & services in unregulated markets?
  - Are owners using exclusionary practices?
  - Is local area market power an issue, because of constrained local area distribution capacity?
  - Are there legitimate system reliability and control issues if DG is operated by third parties and customers?

Market Distortions and Hurdles Faced by DG

- Resolution requires, in part, a clearer definition of the "obligation to connect."
- Working definition:
  - "Ensure that market transactions between generators/retailers and customers are not inhibited, while preserving the overall safety and reliability of the entire distribution system."
  - Need to define reliability standards in order to determine an appropriate least-cost strategy.
- Ultimately, need to clarify the role(s) of DG.
  - Will it be used primarily to generate electricity or will it be used primarily to provide distribution capacity?
  - If it is to provide both, how will the costs and benefits be allocated?

Conclusions

- To be successful in the long-run, DG applications need to be economic.
  - Avoid common myths that will increase overall costs and reduce future system reliability.
  - Clarify the role of local distribution utilities and their obligation to connect.
  - Determine in what context DG applications will be used:
    - Generation or local area capacity?
  - Clarify customer roles and responsibilities for system back-up, safety, and reliability.

Conclusions

- Use the correct economic tools to evaluate DG economics:
  - Incorporate uncertainty and perform probabilistic analyses.
  - Do not use "avoided cost" models to evaluate the "deferral benefits" of DG.
  - Do not use bad economics to mask other legitimate policy goals.
- Eliminate the conflicting roles of regulators.
  - Cannot hold utilities and developers to both utility and environmental regulators who are at odds with one another.