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Renewable Energy Sources May Drive Many Off the Grid Permanently.

As solar and battery technology improves, widespread “grid defection” may begin to set in.

Two weeks ago, Rocky Mountain Institute, HOMER Energy, and CohnReznick Think Energy released The Economics of Grid Defection, which assesses when and where distributed solar-plu--battery systems could reach economic parity with the electric grid, creating the possibility for defection of utility customers. Theresults of our analysis have been startling to many: continued rapid declines in the cost of solar and the start of the same trend for storage mean that grid parity may come much sooner than previously thought—and well within the 30-year planned economic life of typical utility investments.

This blog post explores why cost parity doesn’t necessarily equate to widespread customer defection, why defection would create a suboptimal electricity system, and why even the specter of customer defection is relevant.

We selected the pairing of solar PV and batteries—and, for commercial scenarios, the addition of diesel gensets—to explore one set of economics around the trend. There are other disruptive challenges to the grid, including grid-tied solar PV, distributed gas microturbines, and integrated resource microgrids. If anything, these multiple potential disruptors increase the urgency to plan and execute a purposeful electricity system transformation. That transformation is already under way, and the approaching date of grid parity for solar-plus-battery systems is an important consideration.

Economic parity doesn’t necessarily mean customers will defect

Our report does not predict if, when, or how many customers will choose to defect. Rather it projects the economics of several current (and possibly, accelerating) trends that are reshaping the electricity landscape: dramatically declining costs for solar and batteries; increasing customer demand for clean electricity, resilience, and other value-added services; and recent upward pressure on retail electricity prices. Ultimately, the impact of these trends depends on a number of factors, including how customers, utilities, regulators, technology providers, and society choose to respond.

The economics that were the subject of our analysis are one of many factors that influence any customer decision to defect (or not) from the grid, or even to adopt grid-tied distributed resources. Other factors customers consider include transaction costs, the relative convenience or hassle associated with the decision, upfront capital and time requirements, confidence a given solution will reliably meet their needs (including the risk that a distributed generation and storage system’s capacity would be sized either too small or too large to closely match a customer’s demand), uncertainty about their long-term electricity needs, and more. Very few customers, especially in the commercial sector, know with certainty their electricity demand for the next twenty years.

Service providers—utilities or third parties intent on winning customers over from grid-supplied

electricity—will need to create integrated service packages to overcome adoption barriers that have plagued efficiency and distributed generation providers. Regardless, in addition to the rapidly growing grid-connected distributed solar market, we've already seen early adopters working with service and technology providers either to go entirely off-grid or install grid-tied solar-plus-battery combinations that similarly impact (and reduce) their demand from the grid.

Defection wouldn't be the best outcome

Customers will make decisions that serve their best interest based on the many factors referenced above, and while for a very few defection might ultimately be the best outcome, mass defection from the grid is almost certainly suboptimal. Distributed resources such as solar and storage can generate more value and have better economics for customers and society both if they are connected to the grid. The challenge is that today's utility business models and regulatory environment don't incentivize the rapid evolution of those solutions, something that needs to change if society is to capture that value.

There is tremendous potential system value in identifying where grid-tied distributed energy resources can create new sources of value and how to access that value. But does most or all of the new value accrue to customers? Or can these resources also create important new sources of value for the grid and ultimately for society? The answer to the latter question can be a resounding yes, so any sustainable solution will need to find a way to equitably share value created through distributed investments.

So how would widespread grid defection create undesirable outcomes?

For one, large numbers of customers going it alone for their electricity generation introduces all manners of economic inefficiency. Each customer faces the risk of over- or under-investing in capacity. Over-investing especially—via necessarily larger systems sized to individual peak demand—would result in significant overbuild and sunk capital. Instead, markets (via a connected grid) provide for greater economic efficiency by allowing customers and suppliers to readily make transactions to balance their own supply and demand, including optimizing distributed generation and storage investments across larger pools of customers rather than one by one, each for their own. Grid-based solutions reduce this economic risk and allow assets to be utilized more efficiently.

For another, grid defection raises social equity concerns. With widespread defection, utilities operating under legacy business models would be forced to significantly raise retail electricity prices to recover costs of grid infrastructure. Those higher prices would unfairly burden remaining grid-connected customers who cannot or choose not to invest in distributed generation and storage, including low-income families who can't afford system upfront costs and apartment residents who logistically can't install systems.

An entirely off-grid system would only become a reality if customers are not given an opportunity to participate, through new business models, in the business of generating, storing, and balancing electricity needs. Or if customers' requirements, including for resilience and clean energy, are not being met by their central provider. That's a future that would be suboptimal for all.

Why potential defection matters—customer choice and empowerment

But if a grid-defected future is so suboptimal, why then is it so important to understand the economics of grid defection?

First, there is strikingly little quantitative analysis to inform the discussion. It's critical to know the

facts and underlying analytics to support productive conversations about how to move forward in the face of powerful trends and a dramatically shifting electricity landscape.

Second, the option to defect—whether or not it is ultimately exercised in part or in full—adds urgency for utility business models and regulations to change and identifies when scaled solutions that properly value distributed investments need to be in place. Empowered customers, ones with the ability to choose how they purchase, generate, store, and/or use electricity, have a more important seat at the electricity table. That empowered customer is a force of change.

Customers, utilities, grid operators, regulators, and technology providers must work together to develop business models that stave off the need or even desire for customer grid defection. The electricity system needs to give customers an opportunity to transact with the grid in a way that meets their desires (for clean, reliable, affordable electricity) and be compensated for any value they are able to bring to the system at large (through contributions to peak shaving, investing in local reserve supply through distributed storage, through distributed generation that can supply feeder-level power needs, and others).

Going beyond the either/or of grid-connected or grid-defected

We need not face an electricity future with an either/or dichotomy of two extremes: total utility/centralized dependence and total defection/independence. There exists another path, one in which central and distributed resources are complementary, connected and supported by a nimble grid. That's why RMI's high-renewables (80 percent) Transform scenario in Reinventing Fire envisions a future and a grid powered by equal parts distributed and centrally generated renewables.

In such a future, the utility evolves to play a critical coordination and stewardship role, one that helps balance various distributed resources and supports them with low-cost central generation. Customers, utilities, regulators, and technology providers have an urgent need to shape this future, or we could in fact run the risk of the defected extreme.

A commitment to collaboratively forging solutions

Disruptive challenges-cum-opportunities won't go away. Distributed solar PV is scaling rapidly. Battery costs are declining, with breakthrough innovation accelerating. And third-party service providers are making these systems financially and logistically accessible to bigger pools of customers. RMI's historic and current activities on energy efficiency, balance of system solar cost reduction, system financing innovations, and storage integration have helped propel the economics of distributed resources forward. An electricity future that includes significantly higher percentages of distributed renewables offers many benefits. But to access those benefits, the entire electricity system must evolve … with utilities and the grid, not in spite of them or without them.

That's why RMI is committed to collaboratively forging solutions. To achieve the optimal energy future, our Electricity Innovation Lab (e-Lab), for example, brings together utilities, regulators, NGOs, technology providers, and other stakeholders to collaborate on practical solutions to the challenges today's electricity system faces. In addition, we work hand-in-hand with these and other stakeholders on key components of an integrated solution through direct engagement. Our work on these solutions will be the focus of a forthcoming blog.

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