

The day after: How solar can thrive in the post-net metering era

With storage, TOU rates and control tech, solar can boom in the absence of net metering and benefit utilities as well

By [Herman K. Trabish](#) | November 3, 2015

All across the nation, regulators, utilities and solar advocates are tangling over the same issue: net metering.

A solar group in Hawaii is suing the utilities commission. Ratepayer advocates and legislators from [Maine](#) (<http://www.utilitydive.com/news/maine-lawmakers-propose-groundbreaking-way-out-of-net-metering-wars/400074/>) to [California](#) (<http://www.utilitydive.com/news/as-solar-cap-looms-installers-ask-ca-regulators-for-interim-metering-measu/406074/>) are gnashing their teeth as they endure contentious proceedings on solar's value that reach no agreement.

Utility executives and solar leaders in states as different as [Vermont](#) (<http://www.washingtontimes.com/news/2015/oct/24/vermont-reaching-net-metering-cap-with-solar-expan/>) and [Nevada](#) (<http://www.utilitydive.com/news/as-regulators-act-nevada-net-metering-debate-takes-center-stage-at-las-veg/404799/>) are warning lawmakers and regulators they are dangerously near their net energy metering limits and could bring their solar industries to a dead stop any moment.

And there is no need for all this, says a Rocky Mountain Institute researcher. As states move toward finding more comprehensive valuation mechanisms for distributed generation, there are a number of ways rooftop solar can grow in the absence of retail rate remuneration that won't break utilities' finances.

If solar customers take advantage of smart, affordable technologies now available in the marketplace, all electricity users could be moved "towards a more integrated grid that reduces costs and enhances reliability for both customers and the utility," said [Rocky Mountain Institute](#) (<http://www.rmi.org/>) (RMI) Senior Associate Mark Dyson. And solar owners "can contribute to grid functions, lowering their neighbors' costs as well as their own."

With the benefits shared across the grid between solar owners, non-solar owners, and utilities, sector stakeholders may end up debating whose idea could grow distributed generation faster, rather than impeding its spread.

This is just as true in the controversy-torn [net energy metering \(NEM\) wars in Arizona](#) (<http://www.utilitydive.com/news/cost-of-service-arizonas-solar-saga-takes-on-the-valuation-question/406690/>) as it is in the Southeast where solar is just getting onto utilities' radar. But the story starts in Hawaii.

As Project Manager on RMI recent report, "[The Economics of Demand Flexibility](#) (http://www.rmi.org/electricity_demand_flexibility)," Dyson had looked carefully at how Hawaii's unique electrical situation led to the state's elimination of retail rate net metering and a lawsuit from The Alliance for Solar Choice (TASC) against the Hawaii Public Utilities Commission.

In a recent [blog post](#) (http://blog.rmi.org/blog_2015_10_16_hawaii_just_ended_net_metering_for_solar_now_what) based on the paper's arguments, Dyson explains how solar and other distributed technologies in Hawaii can be used to create "a cheaper, cleaner, and more-resilient electricity system," even in the absence of net metering.

Background: The Hawaii story

Hawaii's commission [closed the first phase of its net metering docket](#) (<http://puc.hawaii.gov/wp-content/uploads/2015/10/2014-0192-Order-Resolving-Phase-1-Issues-final.pdf>) last month with a bang, terminating retail rate remuneration for new customers and replacing it with new offerings.

A [grid-supply option](#) (<http://www.hawaiianelectric.com/heco/Clean-Energy/Renewables-and-Customer-Generation/Customer-Grid-Supply-and-Self-Supply-Programs#link2>) replaces the retail rate credit for electricity sent to the grid by customers' solar systems. The new credits for customer solar power vary across each of the state's islands, but amount to about half the retail rate of electricity.

A second, [self-supply option](#) (<http://www.hawaiianelectric.com/heco/Clean-Energy/Renewables-and-Customer-Generation/Customer-Grid-Supply-and-Self-Supply-Programs#link3>) is designed to create solar owners who do not export their generation to the grid. With it, solar owners can earn [retail rate credit](#) (<http://www.utilitydive.com/news/whats-solar-worth-inside-arizona-utilities-push-to-reform-net-metering-r/399706/>), but only when their own generation replaces utility-supplied electricity.

The TASC lawsuit (<http://www.utilitydive.com/news/hawaii-puc-chair-defends-landmark-decision-to-end-retail-rate-net-metering/407984/>) seeks an injunction against implementation of the PUC plan because TASC members believe it will severely impede Hawaii solar growth.

"These concerns are real," Dyson wrote in his blog post. "Grid-connected solar under the new tariff will be less valuable."

However, he notes, "under the [grid supply] option, solar is still a smart investment."

That point was independently corroborated for Utility Dive by Makena Coffman, associate professor of urban and regional planning at the [University of Hawaii Economic Research Organization \(http://www.uhero.hawaii.edu/\)](http://www.uhero.hawaii.edu/).

Based on the current Oahu electricity rate, an installed solar cost of \$4/watt, an average of 5 hours of daily sun, and a system life of 25 years, retail rate net metering provides a "windfall" rate of return of 18%, she said.

With the new grid credit, the rate of return is between 7.5% and 9%, depending on which island the array is located.

"That is still quite high," the professor said. "My 401(k) is not getting 7.5%. Nobody's is."

The new options, especially the self-supply choice, might also "open the door for technology and business models that leverage [demand flexibility \(http://blog.rmi.org/blog_2015_08_26_report_release_the_economics_of_demand_flexibility\)](http://blog.rmi.org/blog_2015_08_26_report_release_the_economics_of_demand_flexibility) and [battery storage \(http://blog.rmi.org/2015_10_07_year_of_the_battery_but_storage_can_do_much_more\)](http://blog.rmi.org/2015_10_07_year_of_the_battery_but_storage_can_do_much_more)," Dyson writes.

Demand flexibility can help replace NEM

Under either of the new Hawaii options, new solar owners are likely to get no more than half the value from their solar that they would have received under traditional net metering. They can export in return for credits worth about half NEM's retail rate credit. Or they can self-supply, though typical solar customers have tended to directly consume no more than about half their PV systems' output, according to Dyson.

But with [demand flexibility \(http://www.utilitydive.com/news/how-demand-flexibility-is-about-to-transform-electricity-delivery/404431/\)](http://www.utilitydive.com/news/how-demand-flexibility-is-about-to-transform-electricity-delivery/404431/), solar owners can use 90% of their on-site solar generation, Dyson believes. "They can save 33% on their electricity bill," he wrote, which amounts to "nearly 80% of the savings that the old NEM arrangement offered."

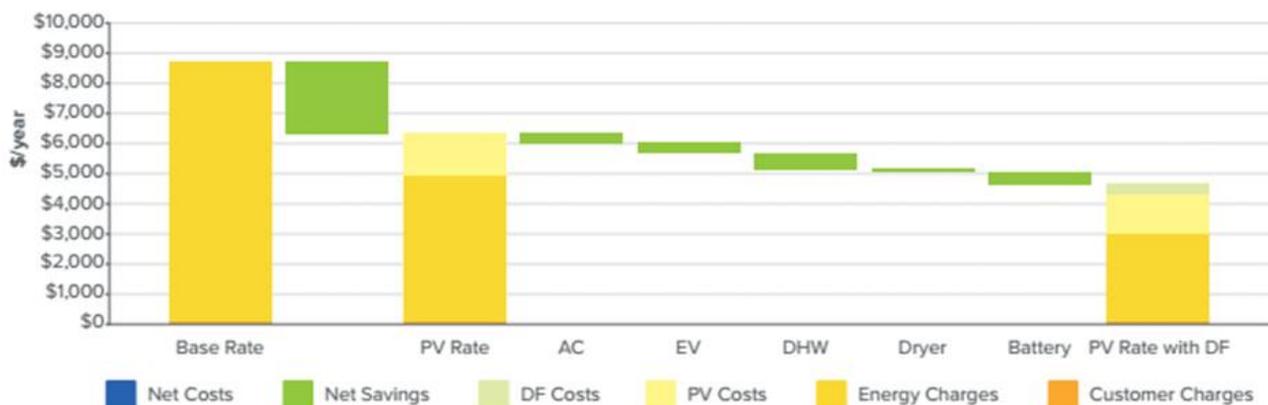
Demand flexibility, a term coined by RMI, is the use of communication and control technology, often paired with energy storage, to shift electricity use across the hours of the day. [Smart technology \(http://www.utilitydive.com/news/how-customer-empowerment-is-helping-utilities-cut-energy-fat/379561/\)](http://www.utilitydive.com/news/how-customer-empowerment-is-helping-utilities-cut-energy-fat/379561/) can now be programmed to move things like air conditioning, water heating, and electric vehicle charging to times when load is lower and electricity is cheaper.

In his analysis of Hawaii, Dyson examines a hypothetical large residential electricity consumer and follows the RMI paper in assuming only the use of [smart technologies \(http://www.utilitydive.com/news/solarcity-partners-with-googles-nest-to-integrate-smart-thermostats-with-r/385754/\)](http://www.utilitydive.com/news/solarcity-partners-with-googles-nest-to-integrate-smart-thermostats-with-r/385754/) likely to cost less than \$1,000. They would be adequate to provide demand flexibility worth, the analysis estimates, "net bill savings of 10% to 40%."

After getting half the value formerly available with NEM from rooftop photovoltaic (PV) solar, new owners need to invest in a smart thermostat to manage air conditioning, an EV charger timer, a water heater timer, a dryer timer, and [a Tesla PowerWall battery \(http://www.teslamotors.com/powerwall\)](http://www.teslamotors.com/powerwall) or comparable battery.

"Those five things take the customer from consuming 50% of their solar on-site to consuming nearly 90% of their solar on-site," Dyson said. "As a result, the customer gets about 70% to 80% of the bill savings as they got under NEM."

ANNUAL SUPPLY COST SCENARIOS FOR HECO CUSTOMER



Even under the new remuneration options in Hawaii, demand flexibility can help solar owners get nearly the same return on their solar systems as they would

under retail rate NEM.

Credit: [Dyson blogpost on Hawaii \(used with permission\) \(http://blog.rmi.org/blog_2015_10_16_hawaii_just_ended_net_metering_for_solar_now_what\)](http://blog.rmi.org/blog_2015_10_16_hawaii_just_ended_net_metering_for_solar_now_what)

But wait! More benefits for everybody

As new solar owners discover this opportunity, the commission's ruling will become, implicitly, a regulatory-imposed incentive to buy [battery energy storage \(http://www.sandia.gov/ess/cost-competitive-energy-storage-technologies/\)](http://www.sandia.gov/ess/cost-competitive-energy-storage-technologies/) with their solar purchase, Dyson said.

In what may be the most important, but [least understood part of the commission's ruling \(http://www.utilitydive.com/news/what-comes-after-net-metering-hawaiis-latest-postcard-from-the-future/407753/\)](http://www.utilitydive.com/news/what-comes-after-net-metering-hawaiis-latest-postcard-from-the-future/407753/), the regulators reprimanded the utilities for "apparent ambivalence toward establishing an effective time-of-use (TOU) rate option for DER customers" during Phase 1 of the docket. It also ordered the utilities to file a new TOU rate proposal designed on its guidance.

By providing effective price signals from the new TOU rates to go with customers' battery storage and flexibility of use, the commission "has effectively directed all future solar customers to turn their buildings into [dispatchable grid assets \(http://www.utilitydive.com/news/how-california-plans-to-integrate-distributed-resources-into-its-iso-market/401123/\)](http://www.utilitydive.com/news/how-california-plans-to-integrate-distributed-resources-into-its-iso-market/401123/)," Dyson writes.

The [stored solar \(http://www.utilitydive.com/news/residential-energy-storage-the-industrys-next-big-thing/406789/\)](http://www.utilitydive.com/news/residential-energy-storage-the-industrys-next-big-thing/406789/) energy gives them the ability "to deliver key services to the grid — services that they would have been unable to provide (let alone get paid for) with a standard rooftop PV system alone."

There are 13 such key services provided by battery storage and they go to three stakeholder groups: customers, utilities, and grid operators, according to RMI's recently released report, "[The Economics of Battery Energy Storage \(http://www.rmi.org/electricity_battery_value\)](http://www.rmi.org/electricity_battery_value)." The services are delivered to the stakeholders at three system tiers, the transmission level, the distribution level, and customer level.

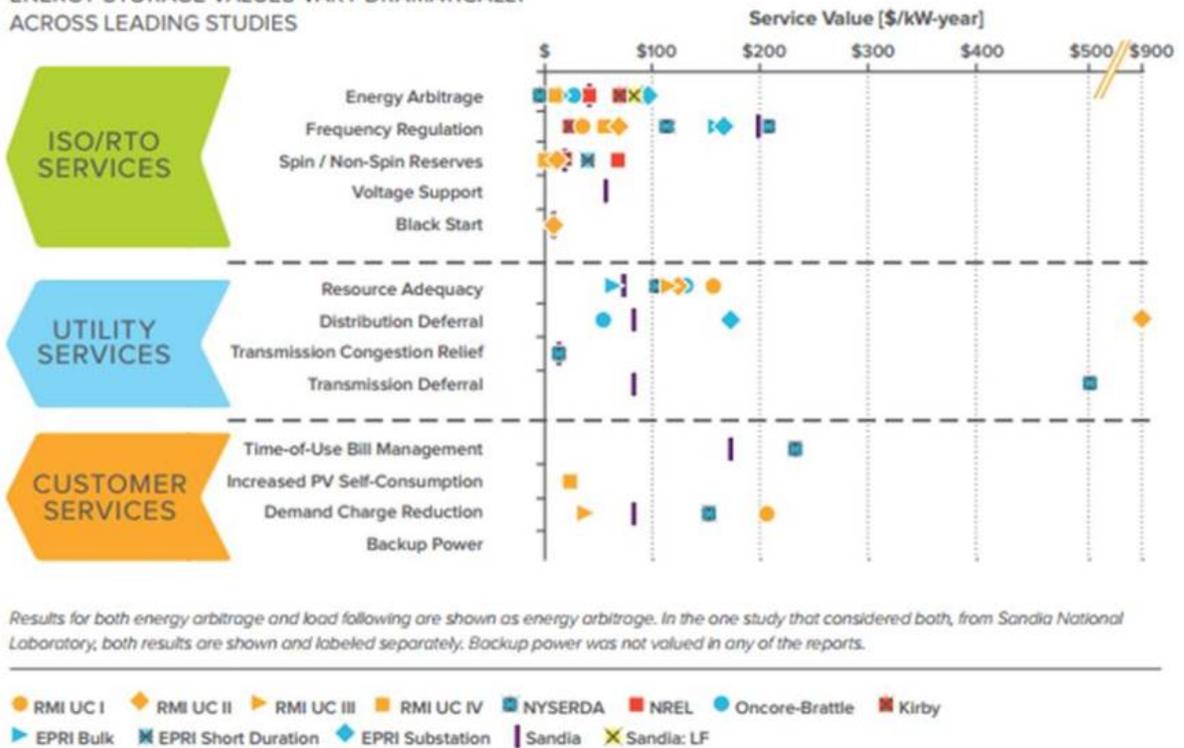
In the paper, RMI researchers drew [three important conclusions \(http://www.utilitydive.com/news/whats-the-value-of-energy-storage-its-complicated/407498/\)](http://www.utilitydive.com/news/whats-the-value-of-energy-storage-its-complicated/407498/).

First, the primary services batteries are installed to meet do not use as much as half the battery life. That means there's a lot of extra capacity left over to provide grid services beyond that primary function.

Second, with current cost structures "batteries deployed for only a single primary service generally do not provide a [net economic benefit \(http://energystorage.org/energy-storage/facts-figures\)](http://energystorage.org/energy-storage/facts-figures) (i.e., the present value of lifetime revenue does not exceed the present value of lifetime costs)."

But, if those primary services require less than half a battery's life, stacking uses for them "shifts [the economics \(http://www.utilitydive.com/news/primer-the-now-and-future-impacts-of-energy-storage/407099/\)](http://www.utilitydive.com/news/primer-the-now-and-future-impacts-of-energy-storage/407099/) in favor of storage," RMI found for its third conclusion.

ENERGY STORAGE VALUES VARY DRAMATICALLY
ACROSS LEADING STUDIES



Stacking battery benefits can help make them cost effective for home users, but the value of each service is still up for debate, and varies by location.
Credit: [RMI's Battery Storage paper \(http://www.rmi.org/electricity_battery_value\)](http://www.rmi.org/electricity_battery_value)

It is likely the new Hawaii policy will drive battery deployment. If their users are able to offer a stack of [services to the grid \(http://energystorage.org/energy-storage/applications-energy-storage-technology\)](http://energystorage.org/energy-storage/applications-energy-storage-technology), like frequency response, voltage support, and distribution upgrade deferral, “the revenue associated with these additional services could further improve the economics of solar PV systems paired with smart controls and batteries,” Dyson writes.

This can happen if two possibilities are realized. First, aggregations of customer-sited DERs will need to have access to electricity markets in Hawaii to provide those services. That is not yet established.

Second, commercially available batteries will have to be able to provide those [services \(http://www.teslamotors.com/presskit/teslaenergy\)](http://www.teslamotors.com/presskit/teslaenergy). That is established, Dyson said.

Calculations in the battery economics paper were based on the 2 kW power rating and 7 kWh storage capacity rating of the [Tesla PowerWall \(http://www.utilitydive.com/news/all-you-need-to-know-about-teslas-big-battery-announcement/393175/\)](http://www.utilitydive.com/news/all-you-need-to-know-about-teslas-big-battery-announcement/393175/). To reach the conclusion that stacked services do shift economics in its favor, the researchers assigned it a practical primary use, only factoring in the stacked services when the battery was not providing that primary function. Finally, they showed the charge-discharge cycles could be managed to maximize the economic benefits from the other services without over-cycling the battery.

“If [Hawaiian Electric] took advantage of the fact that customers are going to roll [these technologies \(http://www.sandia.gov/ess/\)](http://www.sandia.gov/ess/) out to respond to their self-supply tariff and used them for grid services as well, we believe there is a very big cost reduction possibility for the HECO system as well,” Dyson said.

From Arizona Public Service to Alabama Power

The encouraging findings on Hawaii can be generally applied to other utilities and customers, Dyson said, in the sense that solar, storage and demand flexibility are [are going to be deployed \(http://www.utilitydive.com/news/esna-2015-why-energy-storage-is-key-to-a-future-with-no-more-gas-turbines/407409/\)](http://www.utilitydive.com/news/esna-2015-why-energy-storage-is-key-to-a-future-with-no-more-gas-turbines/407409/) for many reasons.

Anywhere regulators compromise the traditional retail rate NEM credit by lowering the credit value or imposing fixed or demand charges, “demand flexibility and storage can do something for the customer and something for the grid,” Dyson said. “The Salt River tariff is an example.”

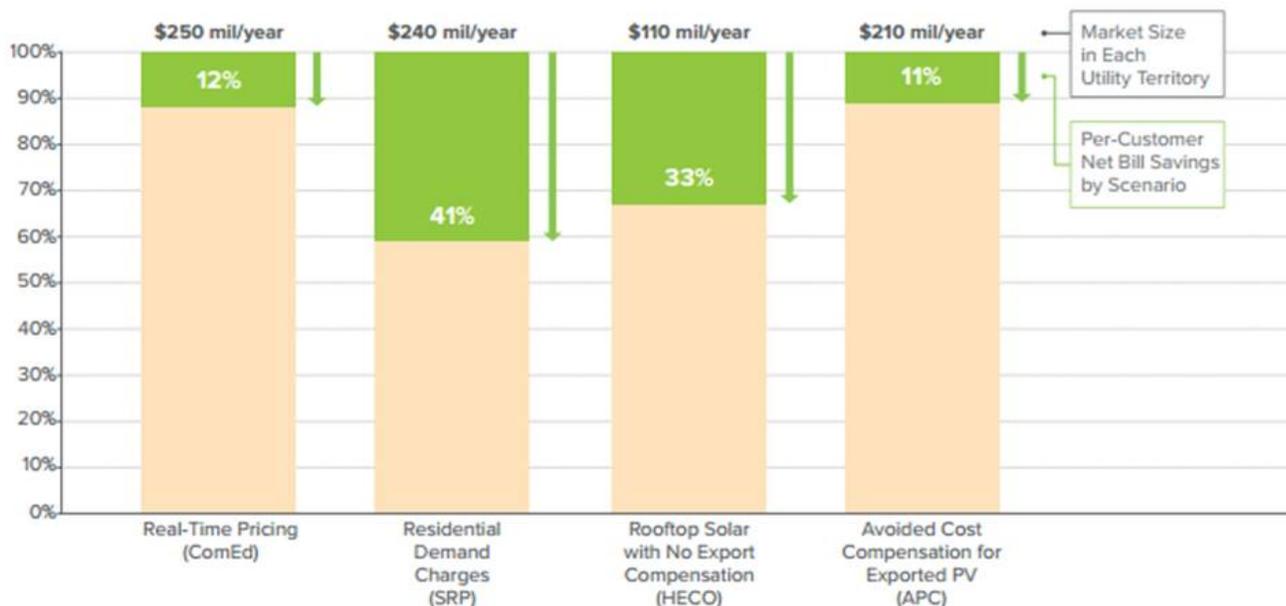
Arizona’s [Salt River Project imposed a mandatory peak demand charge \(http://www.utilitydive.com/news/why-srps-controversial-demand-charge-unlocks-a-huge-opportunity-for-solar-/372548/\)](http://www.utilitydive.com/news/why-srps-controversial-demand-charge-unlocks-a-huge-opportunity-for-solar-/372548/) on solar customers earlier this year that significantly diminished the value proposition of adding residential solar. But, “by coordinating the operation of major loads

to avoid high peak demand during the 1 p.m. to 8 p.m. demand charge window, the [demand flexibility] combined control strategies are able to cost-effectively reduce peak demand by 48% on average each month,” RMI calculates.

Such demand flexibility practices can lead to a net bill reduction for solar owners of \$1,100 per year, making solar only 2% more costly than grid electricity. It is a cost premium that is likely to soon turn into a discount if the 1% to 2% per year rise in the retail electricity rate continues.

DEMAND FLEXIBILITY ANNUAL POTENTIAL BY SCENARIO

DF GENERATES SIGNIFICANT PER-CUSTOMER BILL SAVINGS (%) WITH LARGE AGGREGATE MARKET SIZES (\$ FOR EACH ANALYZED UTILITY TERRITORY)



It's not just Hawaii: RMI says demand flexibility can help solar thrive in multiple service territories, with or without net metering.

Credit: [RMI's Demand Flexibility paper \(http://www.rmi.org/electricity_demand_flexibility\)](http://www.rmi.org/electricity_demand_flexibility)

Utilities across the country are asking regulators to reduce the NEM retail rate credit to their avoided cost price, a rate design [Alabama Power \(http://www.utilitydive.com/news/alabama-powers-plan-for-500-mw-of-renewables-approved-by-regulators/405037/\)](http://www.utilitydive.com/news/alabama-powers-plan-for-500-mw-of-renewables-approved-by-regulators/405037/) (AP) now uses. In addition, the utility imposes a \$5/kW monthly capacity charge on solar and other types of distributed generation.

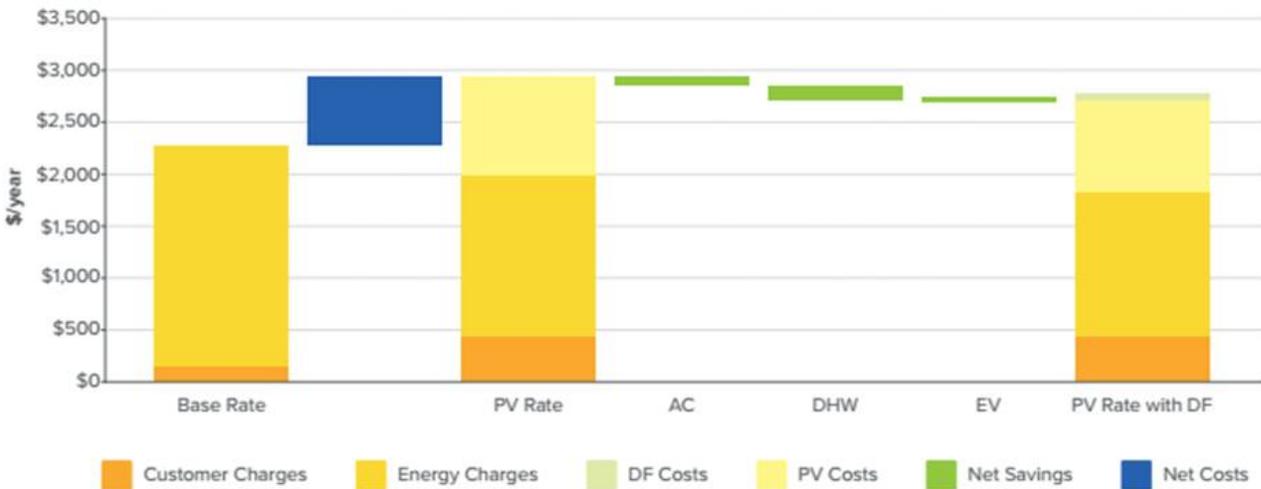
“Its [retail rate \(http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a\)](http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a) is about \$0.11/kWh but the utility only pays about \$0.03/kWh for exported PV energy,” Dyson said.

Even so, “We found that Alabama Power's customers can use demand flexibility tools to reduce their bills by around 11%,” Dyson said.

While the practices don't completely make up for the disadvantages imposed on distributed generation by Alabama Power's rate structure, it does move the point at which distributed solar reaches grid parity in the utility's territory by 3 to 6 years, RMI calculated.

Between the [price drops for solar \(http://www.seia.org/research-resources/solar-market-insight-report-2015-q2\)](http://www.seia.org/research-resources/solar-market-insight-report-2015-q2) and the price increase for retail electricity, solar without demand flexibility would reach parity by 2022; with it, parity comes between 2017 and 2019, the RMI researchers concluded.

ANNUAL SUPPLY COST SCENARIOS FOR ALABAMA POWER CUSTOMERS



Alabama Power's customers can use demand flexibility tools to reduce their bills by around 11%, RMI calculated.
Credit: [RMI's Demand Flexibility paper \(http://www.rmi.org/electricity_demand_flexibility\)](http://www.rmi.org/electricity_demand_flexibility)

There is some doubt about whether the Tesla battery is ready now to take this work on.

"The Tesla 7 kWh battery costs \$7,000 installed and is meant to be cycled daily," [Tucson Electric Power's Carmine Tilghman \(http://www.utilitydive.com/news/whats-solar-worth-inside-arizona-utilities-push-to-reform-net-metering-r/399706/\)](http://www.utilitydive.com/news/whats-solar-worth-inside-arizona-utilities-push-to-reform-net-metering-r/399706/) recently told Utility Dive. "And Tesla's 100 kWh commercial system costs \$25,000 plus about \$25,000 to install. Will a residential customer spend \$50,000 to get off the grid to save a \$150 per month?"

But Tesla CTO JD Straubel said recently the company expects to get to a price of [\\$100 per kWh \(http://www.utilitydive.com/news/eei-2015-why-elon-musk-thinks-the-future-is-bright-for-utilities/400469/\)](http://www.utilitydive.com/news/eei-2015-why-elon-musk-thinks-the-future-is-bright-for-utilities/400469/) for lithium ion energy storage batteries by the end of the decade. And Tesla CEO Elon Musk said the company expects to produce 50 GWh worth of battery packs annually by 2020.

And even if Tesla's product is not up to the task, a slew of competitors are coming out of the woodwork with their own home storage and control systems. New entrants like [Orison \(http://www.utilitydive.com/news/plug-and-play-storage-startup-orison-seeks-to-challenge-tesla-in-residential/405143/\)](http://www.utilitydive.com/news/plug-and-play-storage-startup-orison-seeks-to-challenge-tesla-in-residential/405143/) and [SimpliPhi \(http://www.utilitydive.com/news/taking-aim-at-tesla-ca-storage-firm-simpliPhi-launches-new-battery/405463/\)](http://www.utilitydive.com/news/taking-aim-at-tesla-ca-storage-firm-simpliPhi-launches-new-battery/405463/) have unveiled storage products, hoping to cut into the nascent market, and the most recent, Enphase, [announced \(http://www.utilitydive.com/news/new-enphase-solar-storage-product-combines-monitoring-control-in-a-single/408350/\)](http://www.utilitydive.com/news/new-enphase-solar-storage-product-combines-monitoring-control-in-a-single/408350/) an all-in-one home solar, storage and energy control product late last week.

Getting rates and regulation right

The new policy in Hawaii could lead in two directions, Dyson writes. The first is full grid defection.

"Customers could begin cost-effectively defecting from the grid entirely," he wrote. "This is a real possibility: SolarCity has announced an [off-grid, solar + battery solution \(http://www.solarcity.com/residential/backup-power-supply/off-grid-solar\)](http://www.solarcity.com/residential/backup-power-supply/off-grid-solar) for Hawaii customers."

That is not the way to "a cheaper, cleaner, and more-resilient electricity system," he adds. "The rapidly-evolving, high-PV situation in Hawaii provides opportunities for demand flexibility and battery storage to lead towards a more-integrated grid that reduces costs and enhances reliability."

To get there, Dyson says, [rates and tariffs \(http://www.utilitydive.com/news/a-good-rate-design-is-hard-to-find-experts-push-utility-solar-compromise/405894/\)](http://www.utilitydive.com/news/a-good-rate-design-is-hard-to-find-experts-push-utility-solar-compromise/405894/) and utility policies must be implemented "to take advantage of the capabilities of customers' distributed energy resources (DERs)."

Real time pricing, time of use pricing, and other dynamic use pricing are [rate strategies that capture the value \(http://www.utilitydive.com/news/how-rate-design-can-save-utilities-from-the-solar-death-spiral/402205/\)](http://www.utilitydive.com/news/how-rate-design-can-save-utilities-from-the-solar-death-spiral/402205/) of flexibility and storage and lead toward that integrated grid, he said.

“What we don’t want to see are rate policies that encourage customers to leave the grid entirely either through high fixed charges or changes to NEM that don’t pay customers what their solar is worth.”

With the right tariffs and programs that integrate customer resources, Dyson said, customers could use their demand flexibility to lower their own bills, lower their neighbors’ bills, and benefit the grid.

The challenge — a common one in the utility sector — remains getting the power companies and their regulators to catch up to the pace of technological change.

Top Image Credit: [Flickr user ConceptJunkie \(https://www.flickr.com/photos/conceptjunkie/210545595\)](https://www.flickr.com/photos/conceptjunkie/210545595)

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