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Grid defection and net energy metering

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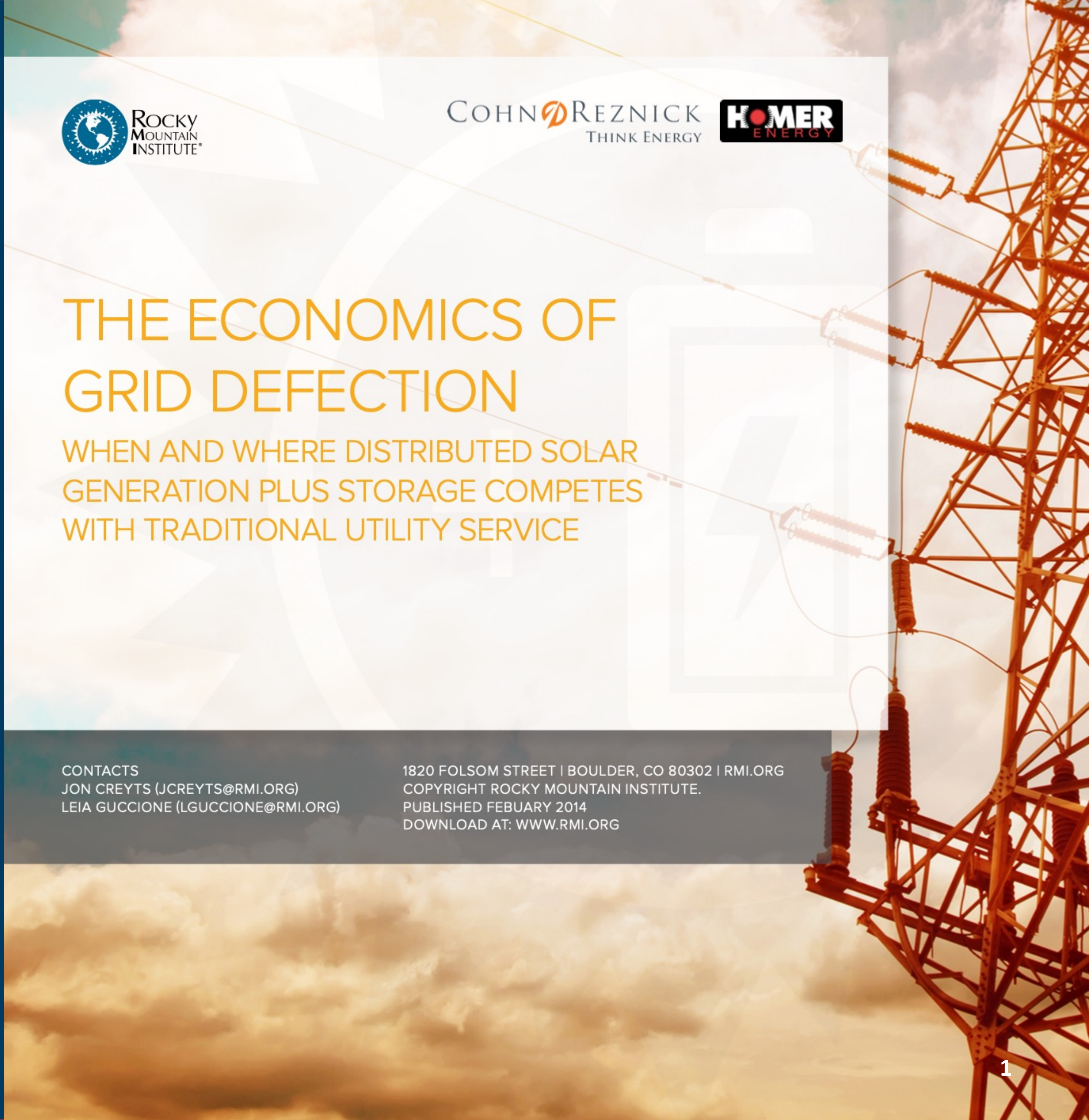
Presented to the National Academies’ Committee on the Role of Net Metering in the Evolving Electricity System

April 27, 2022



ROCKY MOUNTAIN INSTITUTE®

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THE ECONOMICS OF GRID DEFECTION

WHEN AND WHERE DISTRIBUTED SOLAR GENERATION PLUS STORAGE COMPETES WITH TRADITIONAL UTILITY SERVICE

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RMI's mission is to transform the global energy system to secure a clean, prosperous, zero-carbon future for all

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- Business Models
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- Technology
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Global Geographies

- Cities
- China
- India
- U.S.
- Developing Economies

Summary of key messages

- **RMI's 2014 study quantified the risks and impacts of "grid defection"** in an era of rising electricity rates and falling PV+battery prices, raising the specter of a dis-integrated grid driven by customer-led technology adoption.
- **Recent trends point toward "load defection" as the more likely outcome,** with material downward pressure on utility sales likely in the next 10-15 years, even if utilities sunset NEM.
- **Today, resilience risks, equity considerations, and electrification priorities are shifting the calculus** around load defection and DG compensation.
- **Going forward, policymakers should prioritize forward-looking, adaptable approaches,** consistent with other policy goals, in designing the next generation of DG compensation structures.

TODAY'S DISCUSSION

01 RMI's *The Economics of Grid Defection* (2014)

02 Updates on "load defection" and demand flexibility (2015)

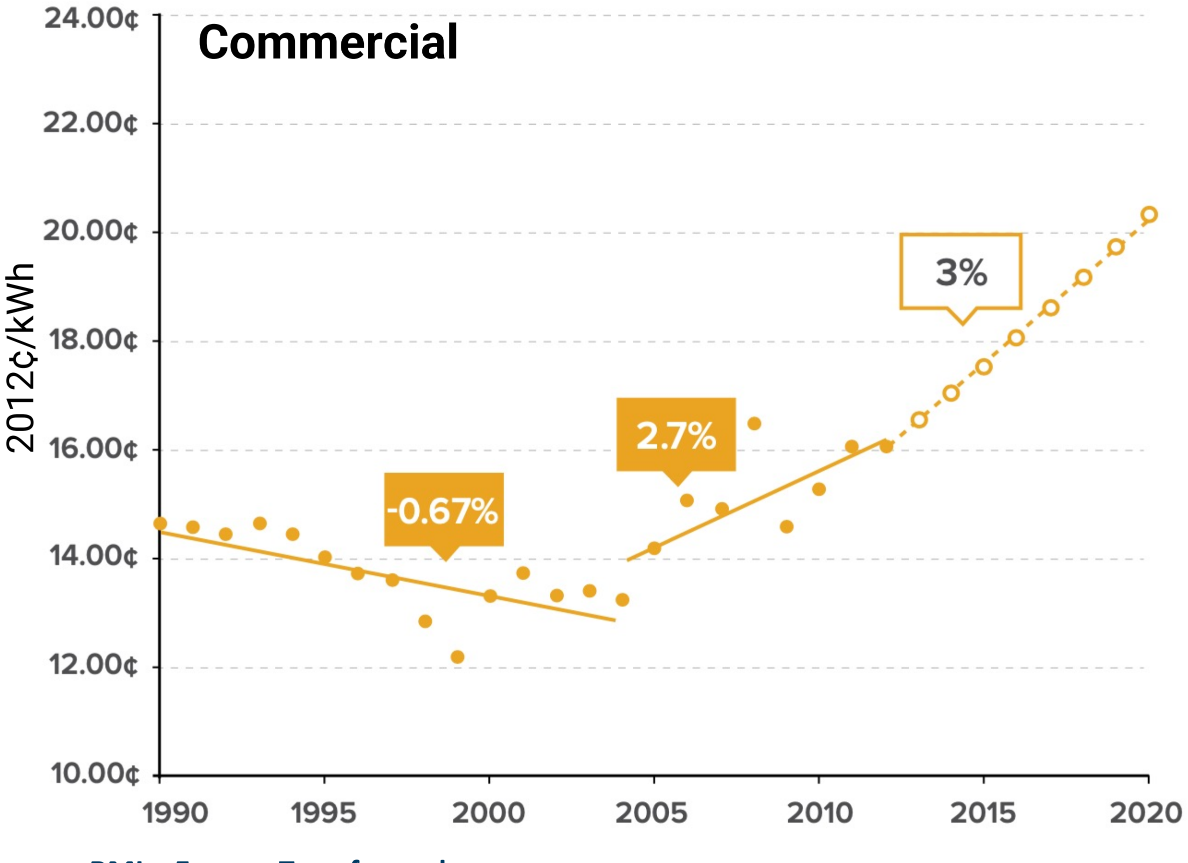
03 Recent changes and current trends

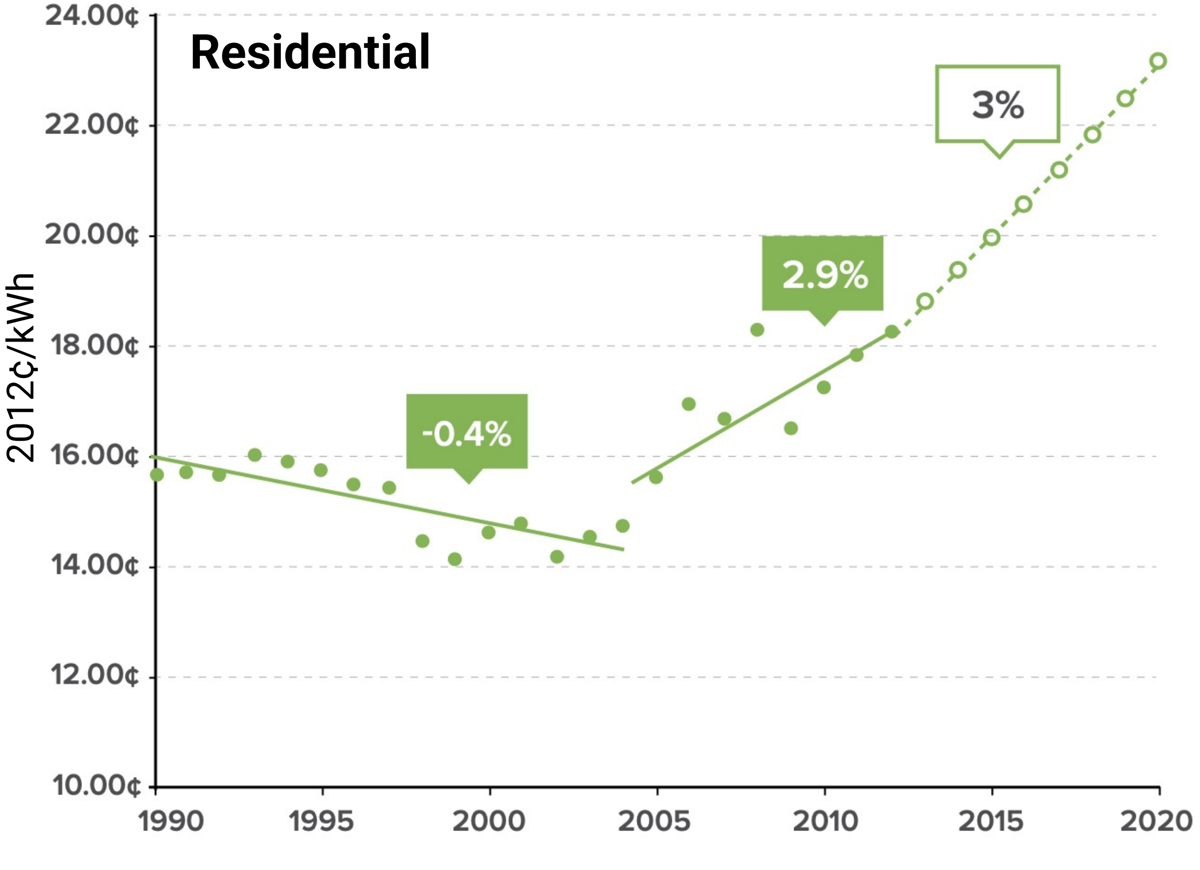
04 Reflections and implications for NEM and rate design

An expectation of structurally rising electricity prices motivated our 2014 *Grid Defection* study

Electricity prices 1990-2012 and forecasts 2012-2020

TX, CA, NY, KY, HI average – 2012¢/kWh

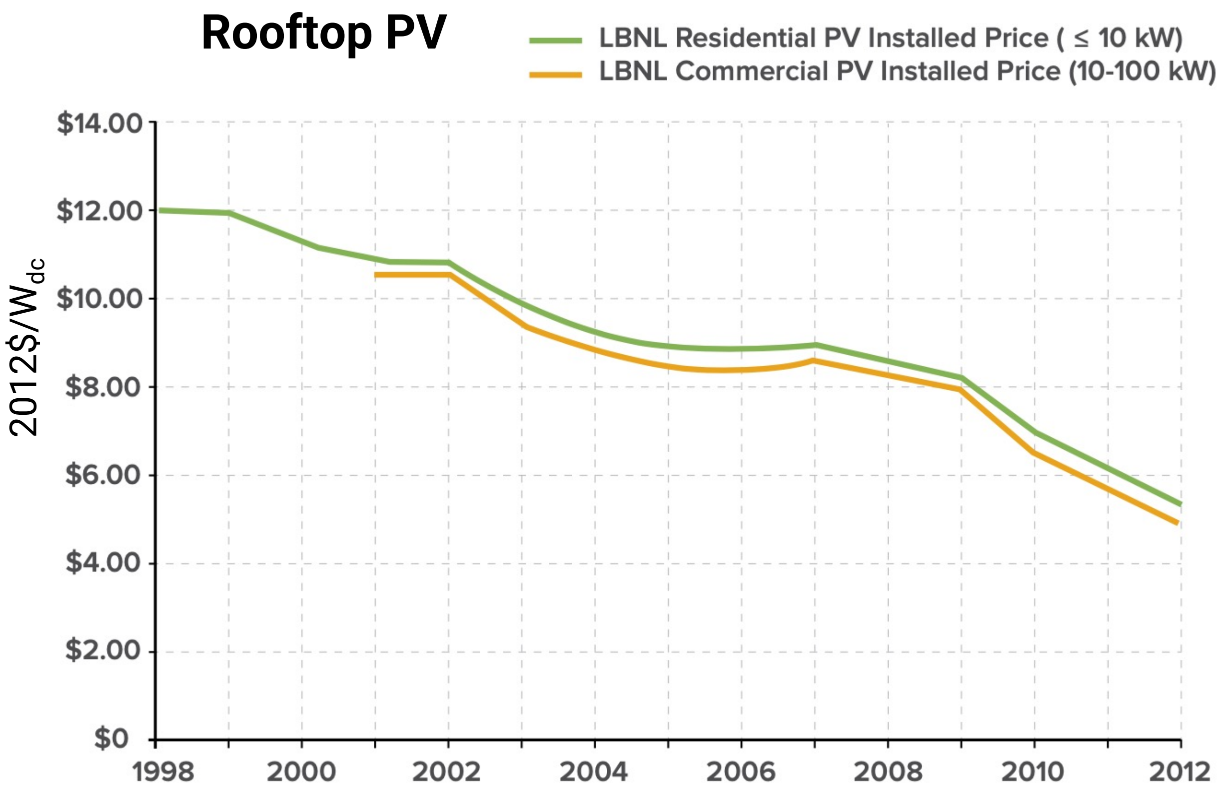


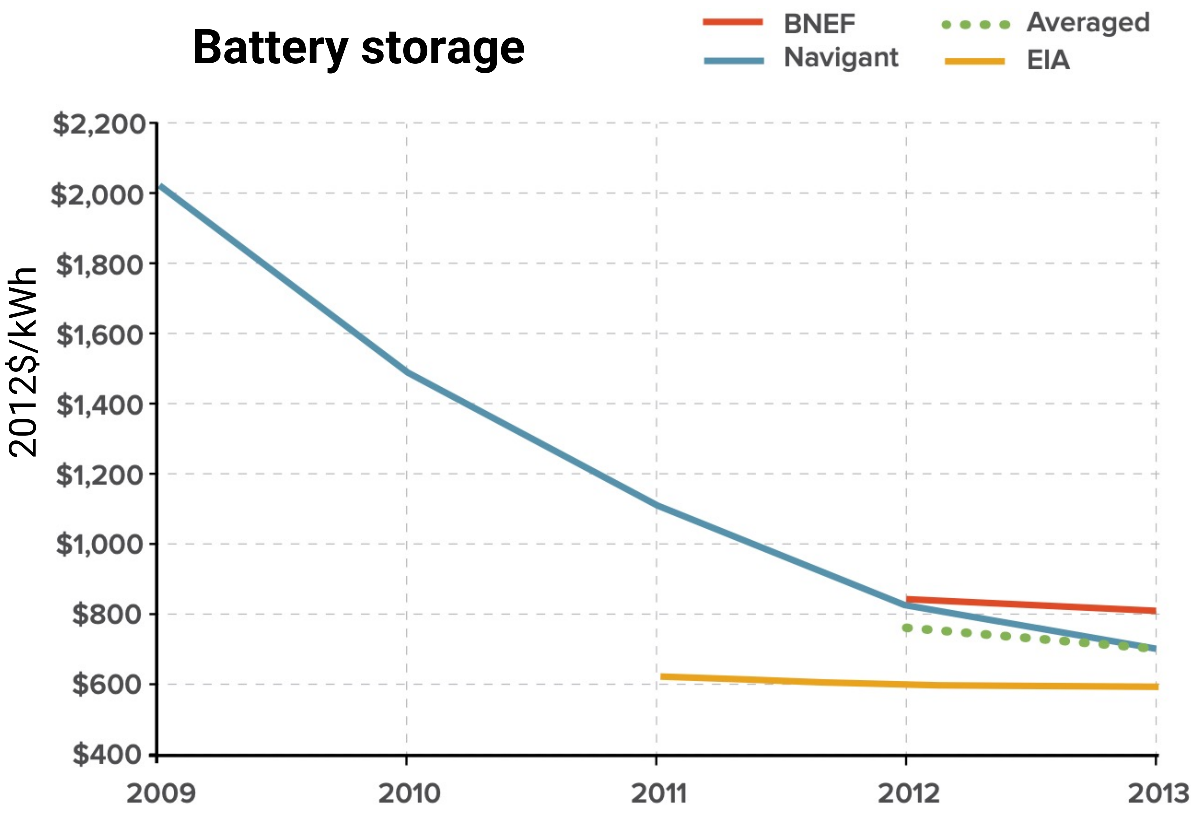


Source: RMI, *The Economics of Grid Defection*, 2014

At the same time, costs of alternative technologies were rapidly falling

Historic rooftop PV and battery storage costs

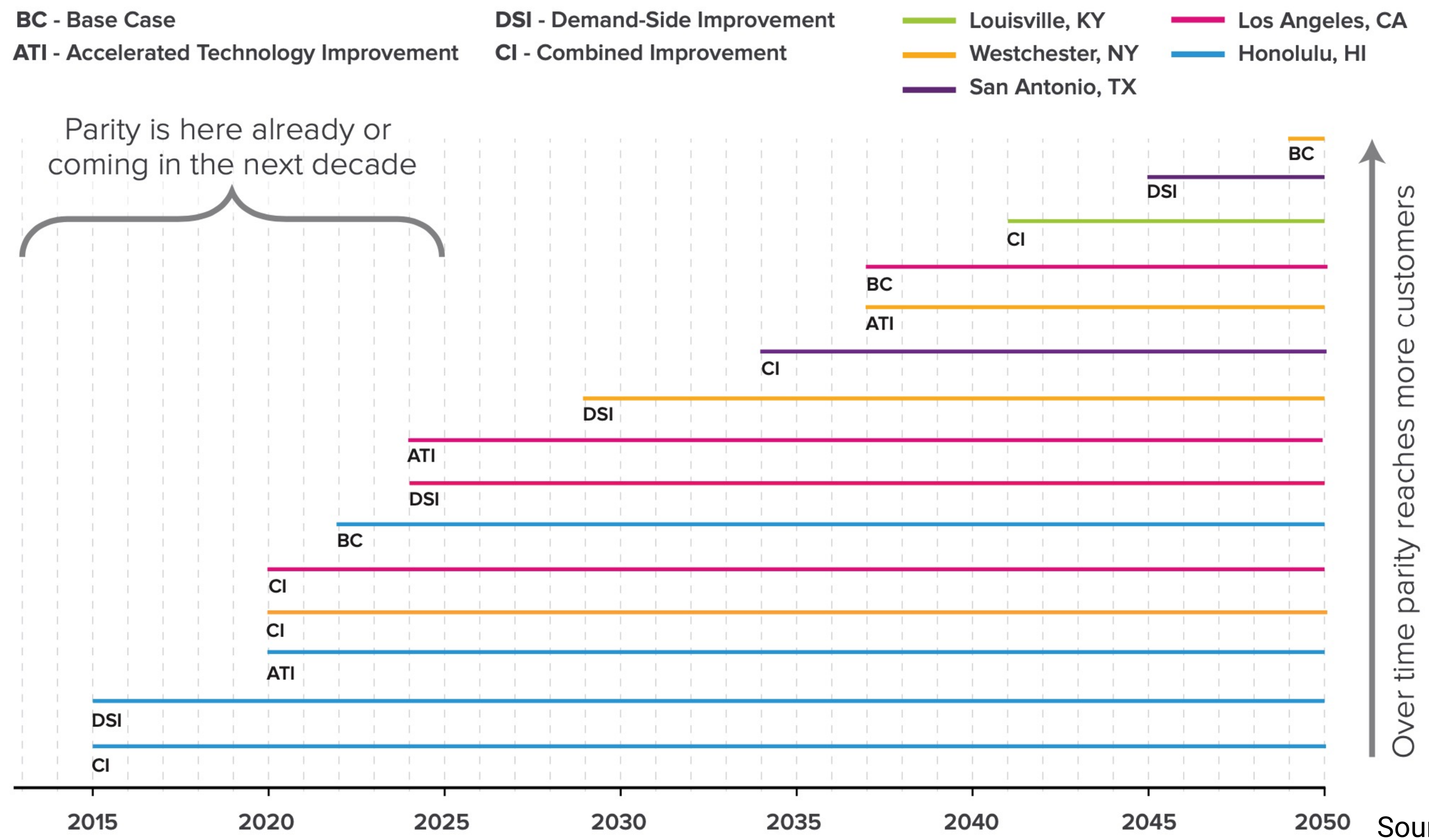




Source: RMI, *The Economics of Grid Defection*, 2014

We found varying timelines of cost parity for technical grid defection across the US

Timeline for residential customer grid defection cost parity



Source: RMI, *The Economics of Grid Defection*, 2014

- **Defection parity arrives soonest in Hawaii and California** due to higher utility prices
- **Parity timeline moves forward** with accelerated technology improvement (ATI), or demand-side improvements (DSI), or both (CI).

Even without strong near-term defection economics, implications for utilities were clear and immediate

UBS, analyst note on EV and solar [August 2014]

*"The expected **rapid decline in battery cost by (more than) 50 per cent by 2020** should not just spur EV sales, but also lead to exponential growth in demand for stationary batteries to store excess power."*

Barclays, Utilities Credit Strategy Analyst Report [May 2014]

"We see **near-term risks to credit from regulators and utilities falling behind the solar + storage adoption curve** and long-term risks from a comprehensive re-imagining of the role utilities play in providing electric power."

Goldman Sachs, Analyst note on Tesla stock [March 2014]

*"...decreased reliability from an aging distribution infrastructure, a broadening desire to reduce the carbon footprint, and perhaps most importantly, the **reduction of solar panel and battery costs could also work together to make grid independence a reality for many customers one day**"*

Morgan Stanley, Clean Tech, Utilities & Autos [March 2014]

*"Our analysis suggests utility customers may be positioned to **eliminate their use of the power grid.**"*

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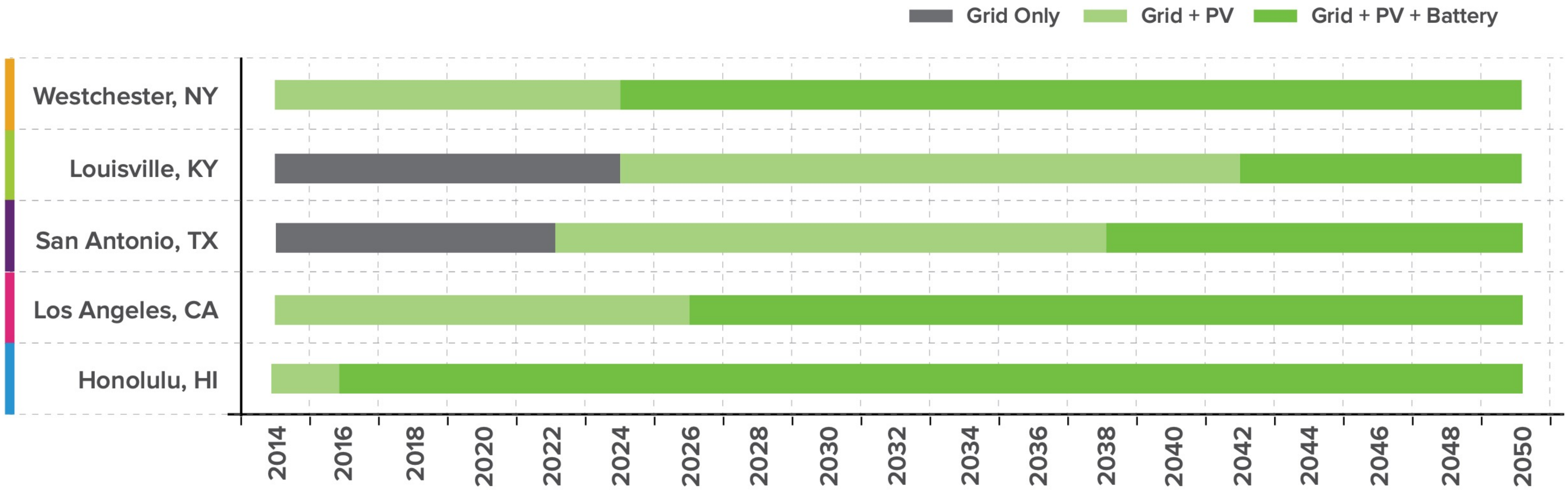
An updated study in 2015 found that "load defection" had attractive near-term economics

Timeline of cost-optimal electricity supply sources for residential customers

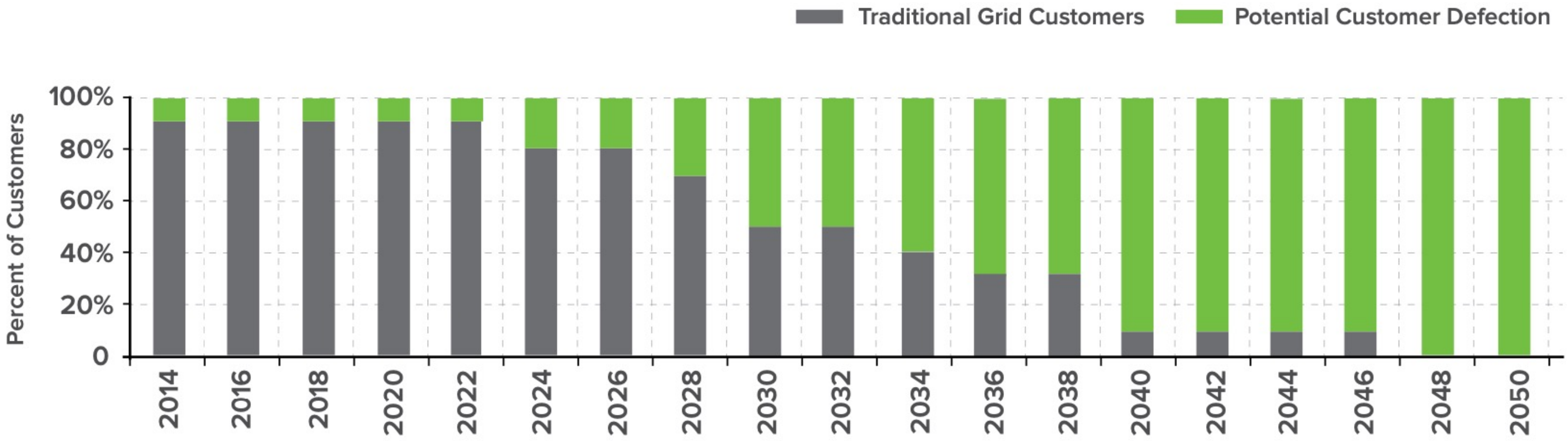


Note: Assumes no net metering or other export compensation

Source: RMI, *The Economics of Load Defection*, 2015

Utilities could see a significant fraction of customer electricity sales erode by 2030

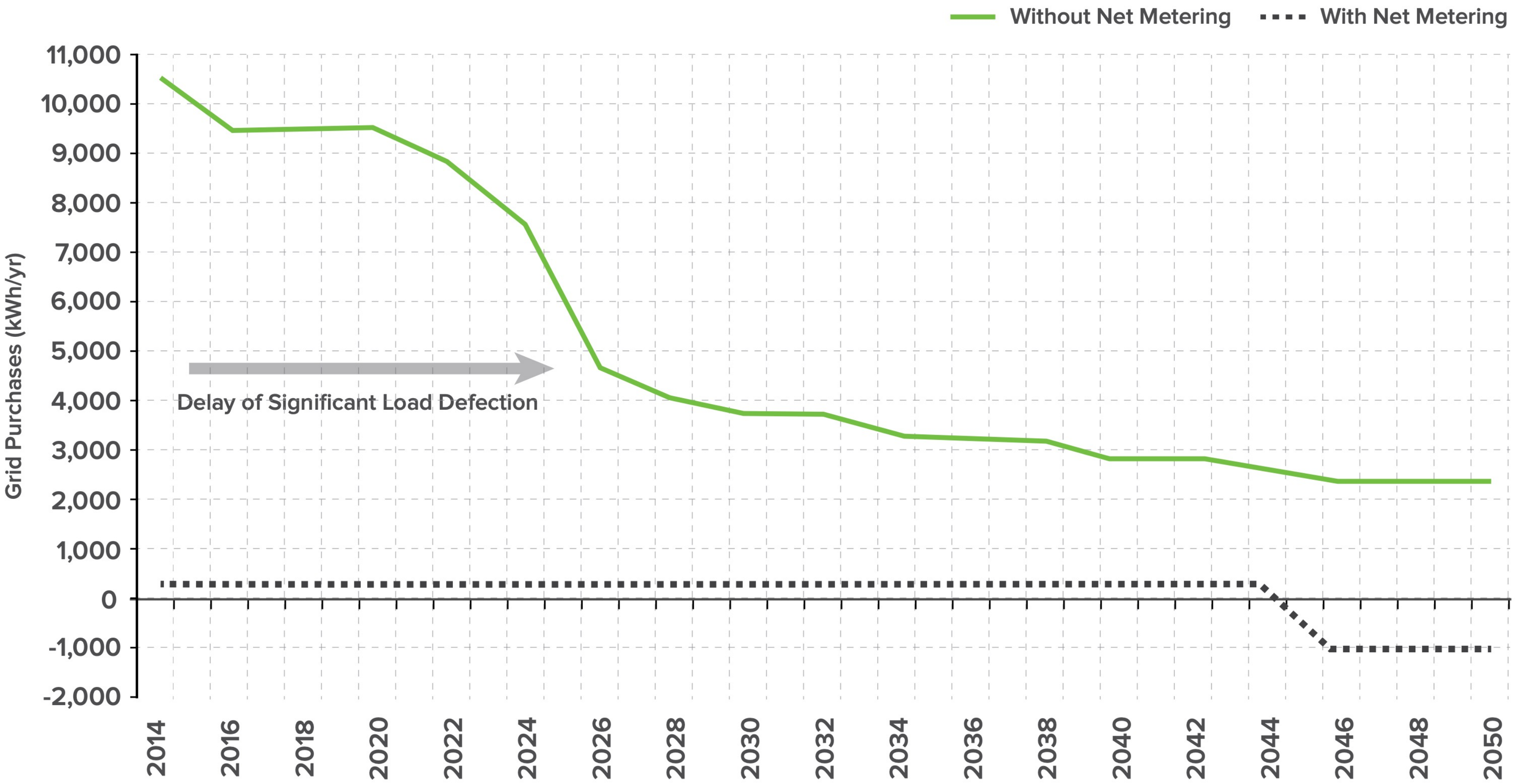
Impact of load defection on utilities' residential electricity sales - Northeast U.S.



Source: RMI, *The Economics of Load Defection*, 2015

Ending net energy metering delays, but does not avoid, economic load defection

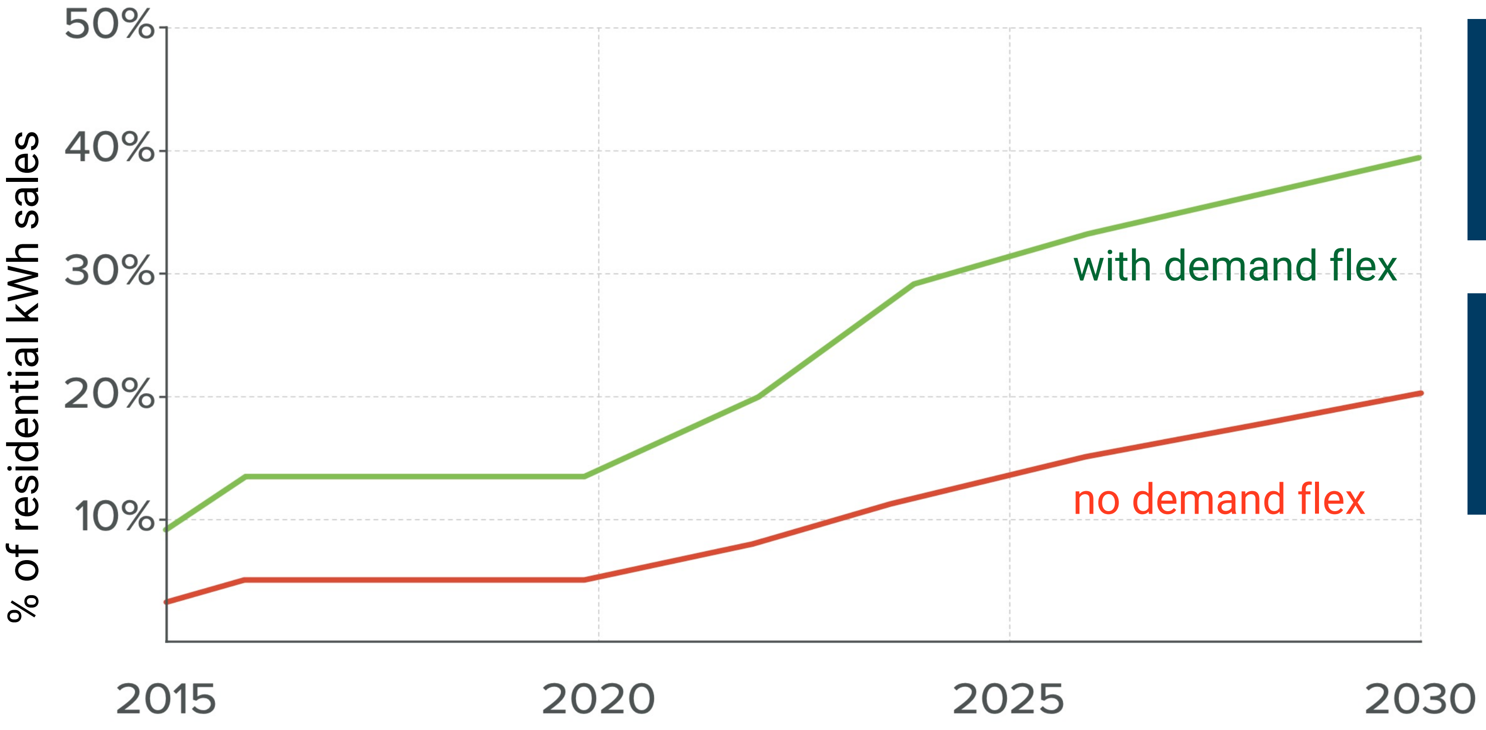
Net grid purchases with and without NEM – NY residential customer



Source: RMI, *The Economics of Load Defection*, 2015

Demand flexibility can similarly accelerate near-term utility sales erosion if NEM sunsets

Economic load defection for U.S. Northeast residential customers



Demand flexibility – e.g., timed EV charging, air conditioning setpoint adjustments, water heater cycle timing, etc. – can double the amount of load cost-effectively served by self-supply solar PV.

~20% of residential electricity could economically be served by rooftop PV by 2030 if NEM sunsets and PV export is compensated at locational marginal price.

Source: RMI, *The Economics of Demand Flexibility*, 2015

TODAY'S DISCUSSION

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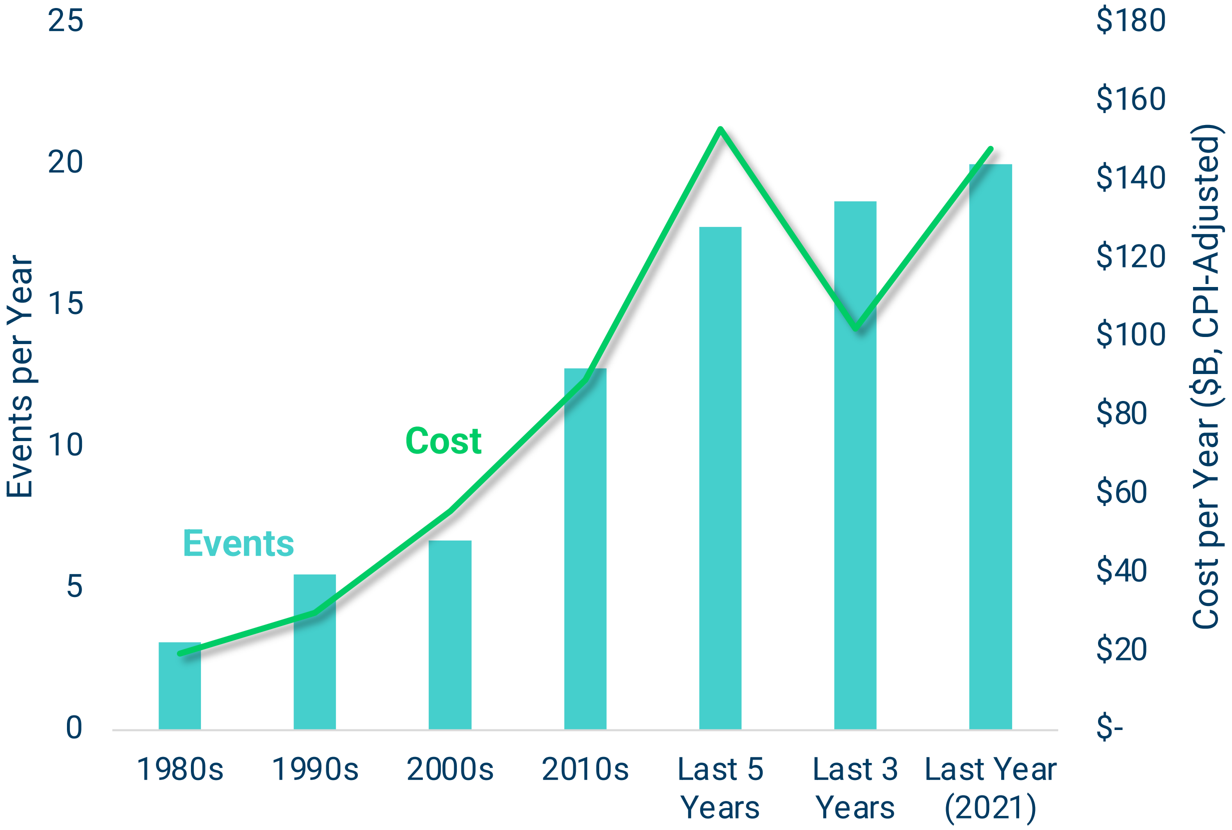
Increasing frequency of U.S. billion-dollar natural disasters that threaten the grid

Growth in U.S. Billion Dollar Disaster Frequency and Cost



Billion-dollar disasters include: drought, flooding, freeze, severe storm, tropical cyclone, wildfire, and winter storm

- Resilience challenges emerging across U.S. regions from a range of weather events, leading to anecdotal evidence of load or grid defection
- Prospect of rising rates to address resilience challenges shifts economics toward defection
- Limited comprehensive data on number of grid defectors due to these concerns

Source: NYTimes, 2022

Source: NOAA U.S. Billion-Dollar Weather and Climate Disasters (2022)

Rising inequality motivates focus on equity in utility regulation, including DG compensation

DG compensation and rate designs must take the needs of environmental justice, overburdened, and underserved communities of color into account:[1]

- **Affordability** – overburdened and underserved communities of color face an affordability crisis, rising rates, economic insecurity
- **Unique Needs** – majority renters; typically in old, multifamily, or mobile housing; capital, credit, and ownership barriers.[1]
- **Outages** – Extreme weather events and planned power shutoffs disproportionately impact these communities.[2]

Traditional NEM design alone has not done enough to adequately reach EJ communities. In California, 11-12% of households on NEM rates live in disadvantaged communities even though these communities are 25% of the state's population.[3]

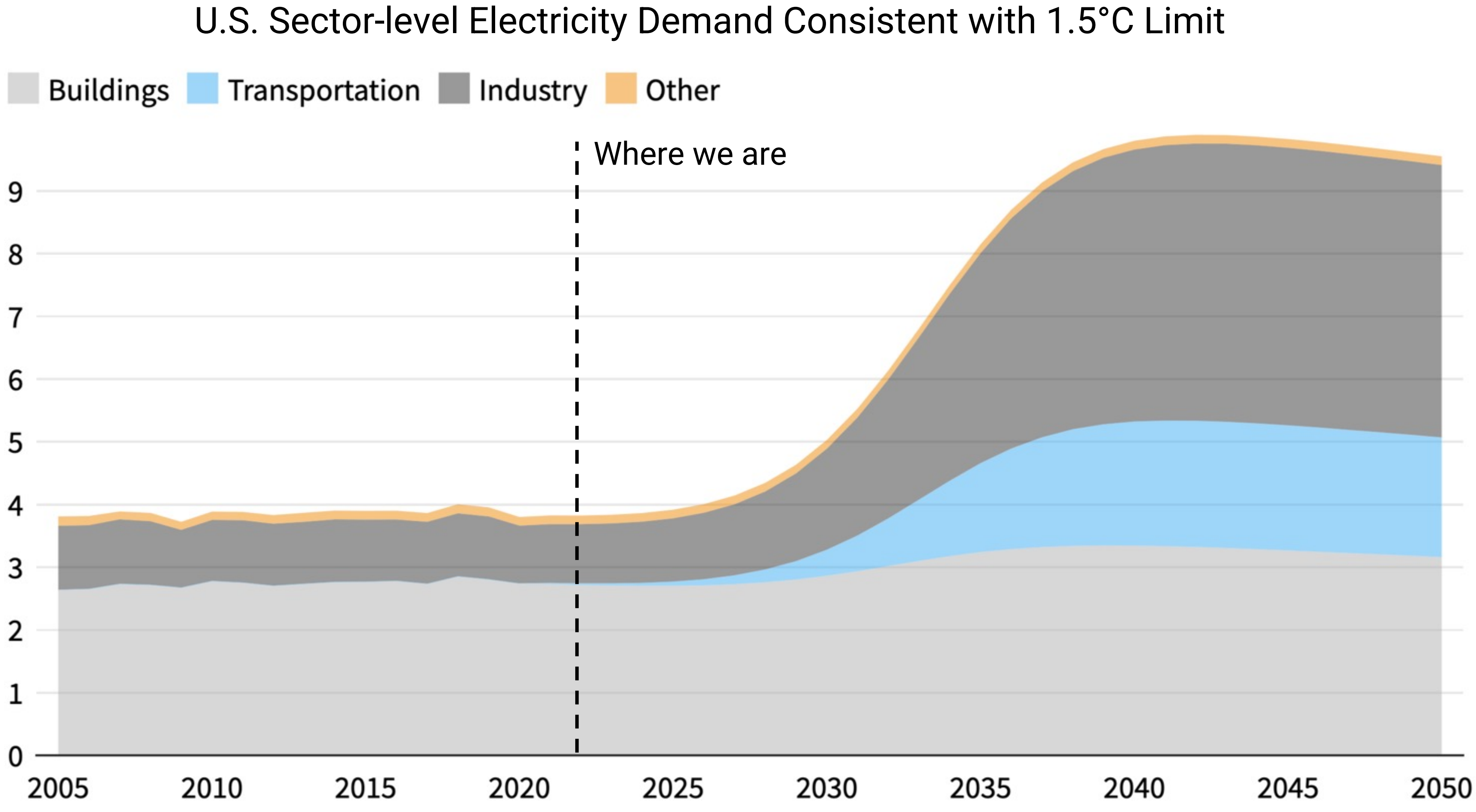
SOLUTIONS MUST:

- Include rate protections to ensure affordable energy access
- Prioritize protecting communities from climate disasters
- Target clean energy investments in EJ communities
- Meaningfully engage communities in rate design and investments to understand unique community needs and context

Image: Hurricane Harvey: Flooding pounds Houston as storm sits in southeast Texas | CNN

Sources
1 CalEJA, Energy Justice Statement on Rooftop Solar and Distributed Generation in California
2 Texas Tribune, 2021; CalMatters 2019
3 California Public Utilities Commission. Net Energy Metering 2.0 Lookback Study. January 2021, p. 37

High electricity rates will act to deter the dramatic levels of electrification investment consistent with 1.5°C warming limit



- 1.5°C-aligned scenarios consistently show the need for ambitious escalation of electrification
- DG compensation policies must consider the incentives created for electrification and demand flexibility
- While building up demand flexibility and energy efficiency can lower system costs, rates alone cannot bear the costs of electrification: state and federal policy is needed

Source: RMI Scaling US Climate Ambitions to Meet the Science and Arithmetic of 1.5°C Warming

TODAY’S DISCUSSION

What should DG compensation achieve?

Principles:

1. Compatible with other policies
2. Forward-looking
3. Adaptable

Principles *are design parameters to consider during mechanism development*

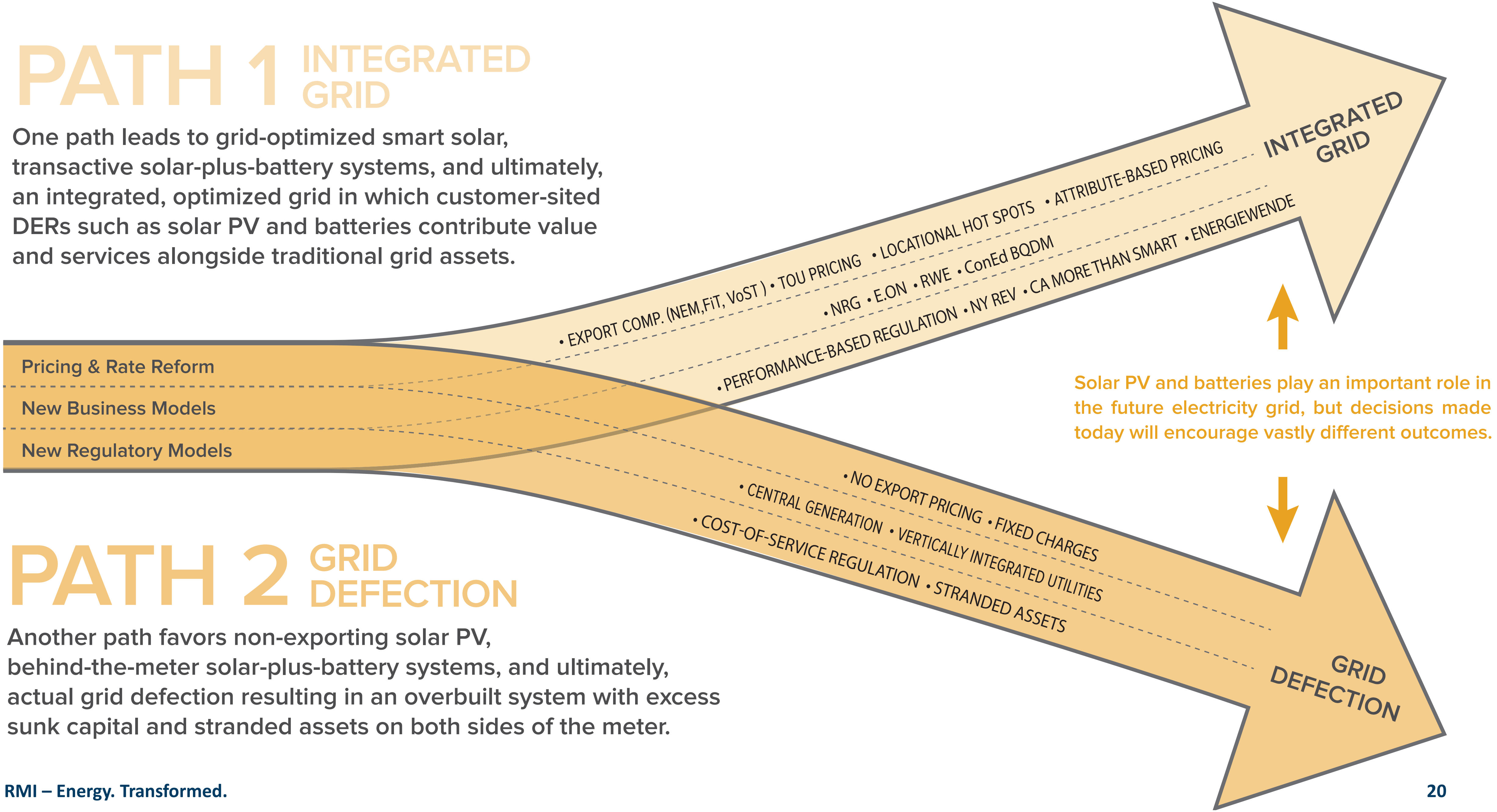
Goals:

1. Reduce GHG & pollutant emissions
2. Support customer choice
3. Promote local economic development
4. Reduce utility disincentives to embrace DG
5. Be simple, predictable, and manageable
6. Promote cost-effective DG deployment
7. Be fair to DG and non-DG customers

Goals *describe what compensation mechanisms should achieve (sometimes in tension with each other—may require balancing and tradeoffs)*

PATH 1 INTEGRATED GRID

One path leads to grid-optimized smart solar, transactive solar-plus-battery systems, and ultimately, an integrated, optimized grid in which customer-sited DERs such as solar PV and batteries contribute value and services alongside traditional grid assets.



PATH 2 GRID DEFECTION

Another path favors non-exporting solar PV, behind-the-meter solar-plus-battery systems, and ultimately, actual grid defection resulting in an overbuilt system with excess sunk capital and stranded assets on both sides of the meter.

Thank You!

Questions?

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