

THE ACADEMY
Public Power
2019 | Leadership Summit



THE ACADEMY

AMERICAN PUBLIC
POWER ASSOCIATION

Energy in 3-D

**How Decarbonization, Digitalization, and Decentralization Will
Affect the Electric Utility Landscape**

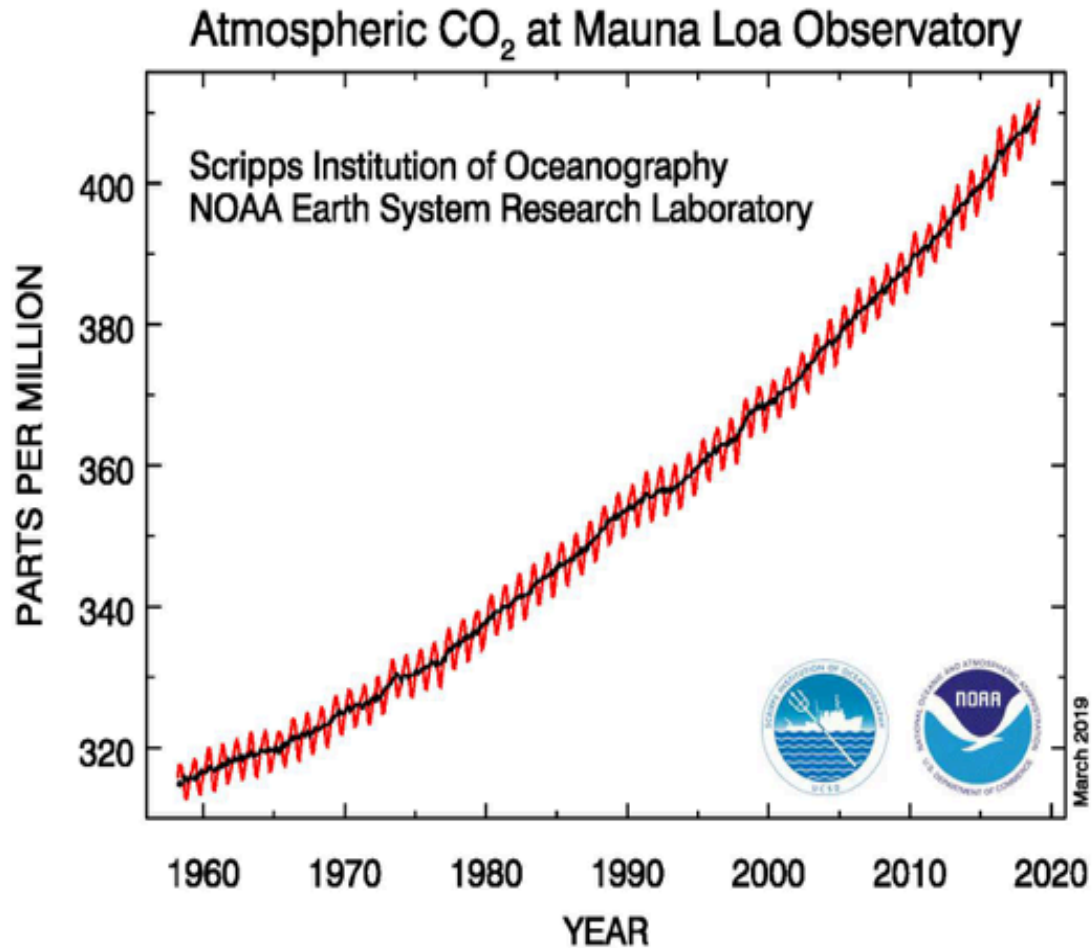
Peter Kelly-Detwiler, Principal: NorthBridge Energy Partners

Public Power Leadership Summit: San Antonio, October 2019

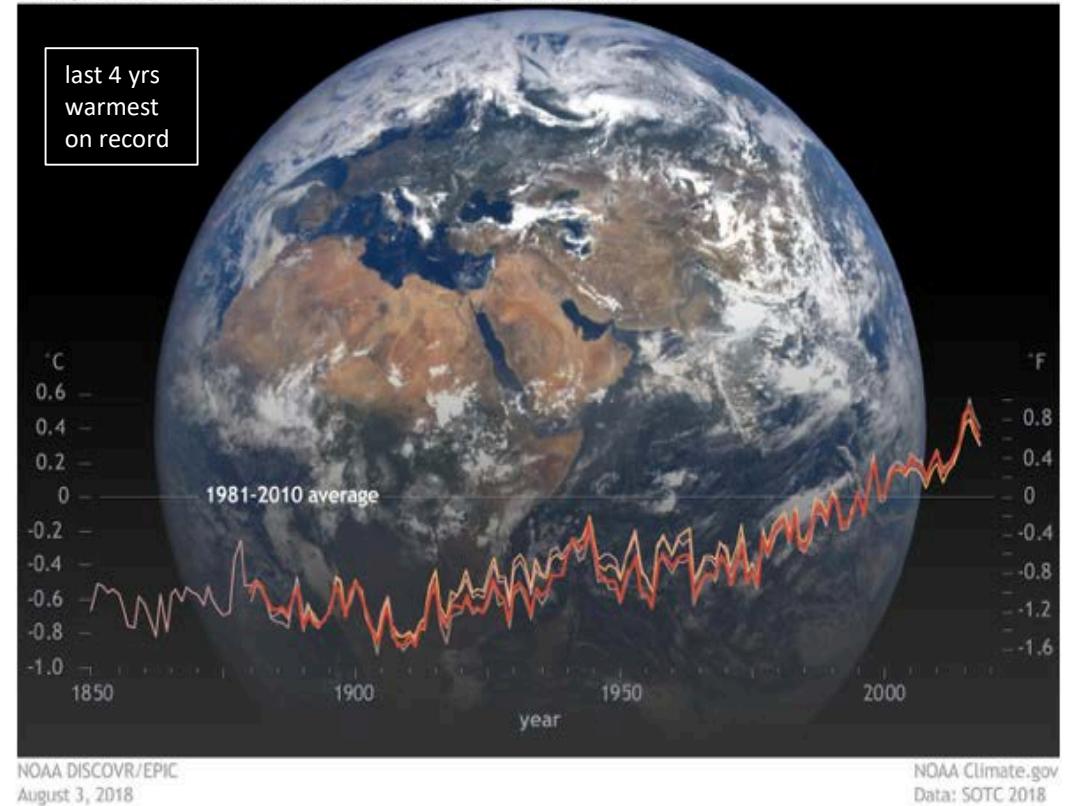
Can You Find the Power Plant?

The screenshot displays the website for Soleil Lofts. At the top left is the logo "SOLEIL LOFTS" with a sun icon. A navigation menu includes "HOME", "FLOOR PLANS", "FEATURES", "GALLERY", "NEIGHBORHOOD", "RESIDENTS", "BLOG", "CONTACT US", and "FAQ". Below the navigation are three buttons: "RENT NOW" (with a checkmark icon), "SCHEDULE A VISIT" (with a calendar icon), and "PAY RENT" (with a dollar sign icon). A phone number "385-217-3967" is also visible. The main image shows a modern kitchen with light wood cabinets, a white countertop, and a central island with a sink and four grey bar stools. A living area with a brown sofa is partially visible on the left. Overlaid text reads "Luxury IS YOUR HOME" and "EXPLORE SOLEIL LOFTS". At the bottom, a dark brown banner contains the text "SOLAR POWERED & ENERGY EFFICIENT APARTMENTS IN HERRIMAN, UTAH" and "5 MW; 12.5 MWh".

Decarbonization: The Pressure Builds



Yearly surface temperature compared to average (1850-2018)



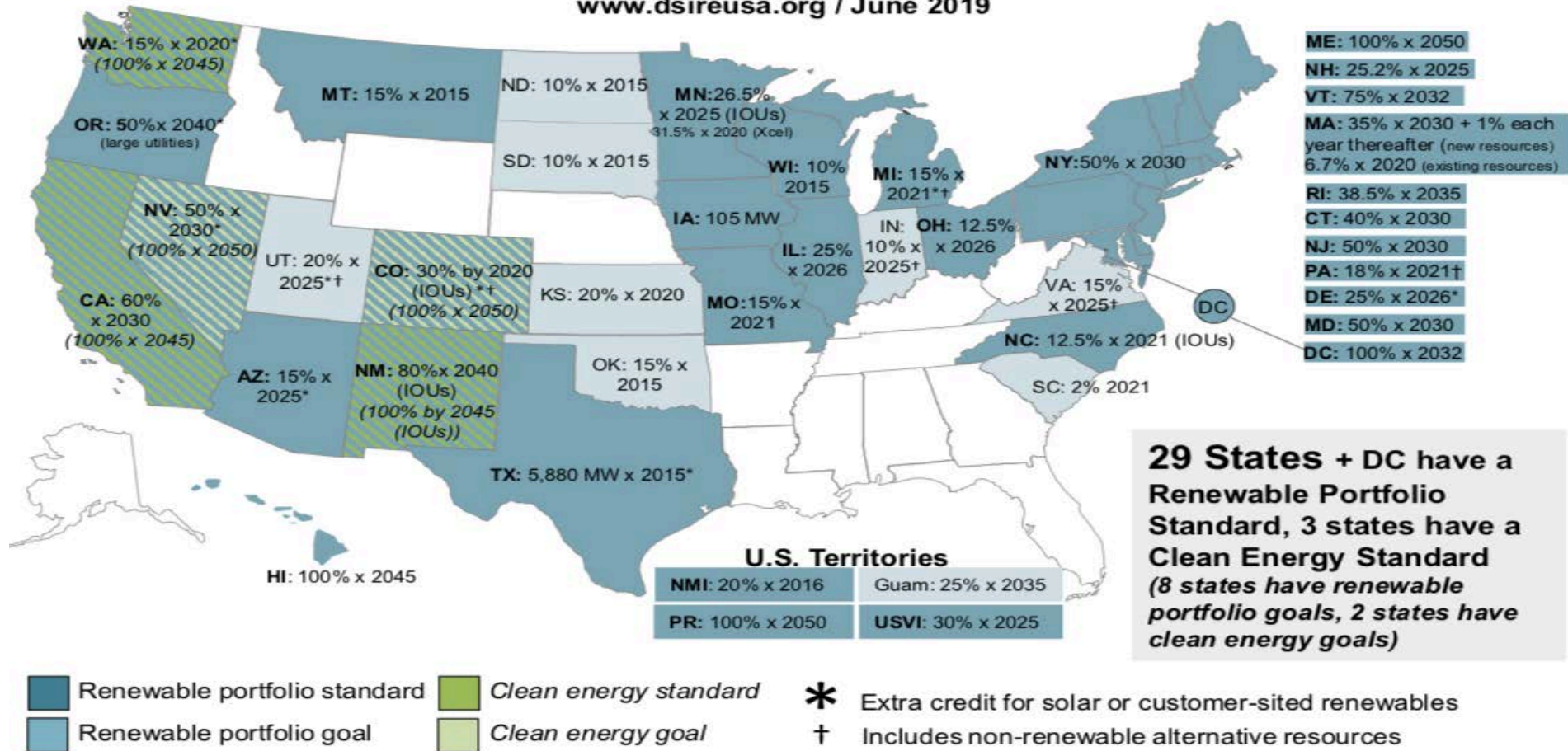
3 <https://www.noaa.gov/news/global-carbon-dioxide-growth-in-2018-reached-4th-highest-on-record>

<https://www.ncei.noaa.gov/news/reporting-state-climate-2018>

State Activities Increasing in Response

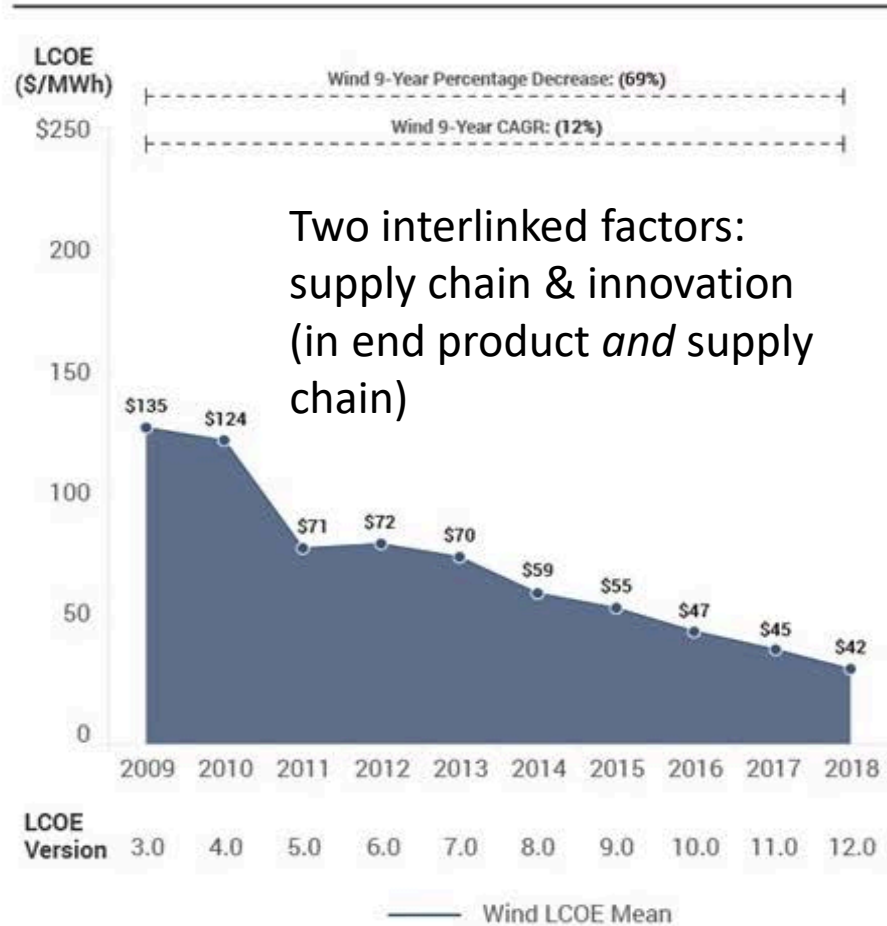
Renewable & Clean Energy Standards

www.dsireusa.org / June 2019

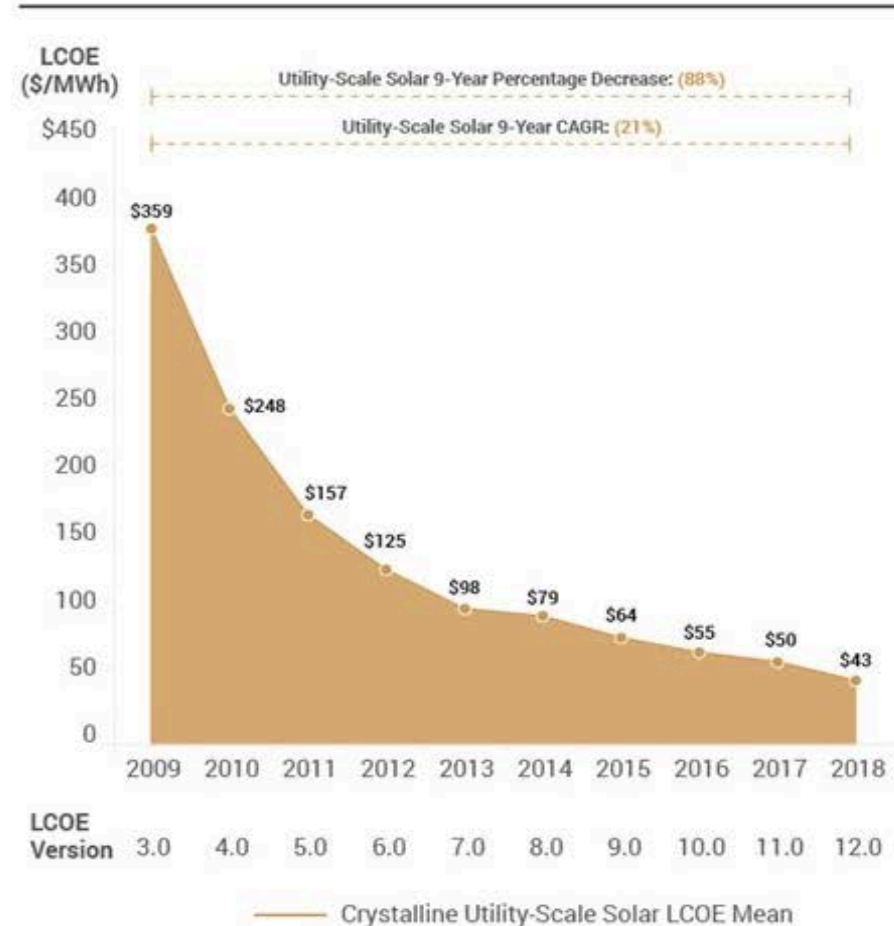


The Technologies Also Respond

Unsubsidized Wind LCOE

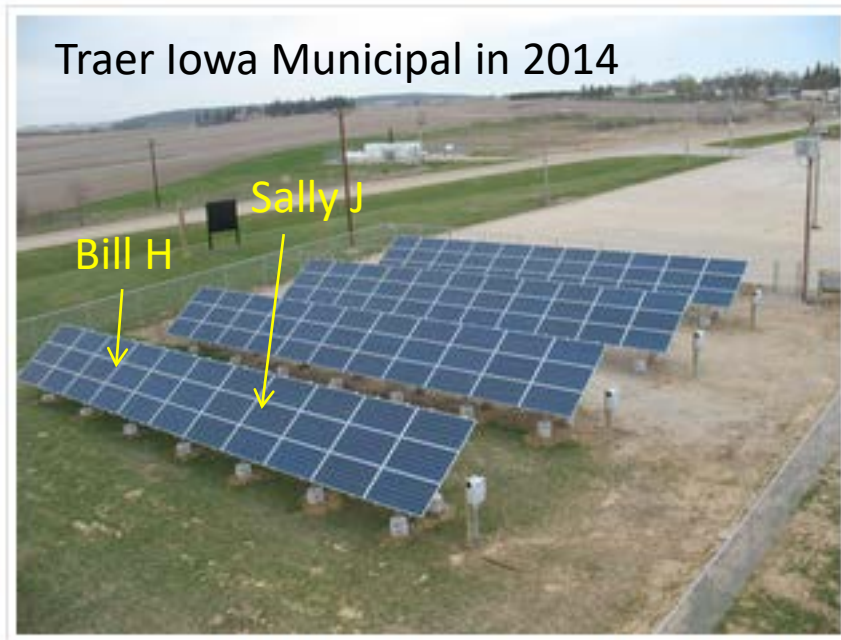


Unsubsidized Solar PV LCOE



Solar Becomes Increasingly Viable

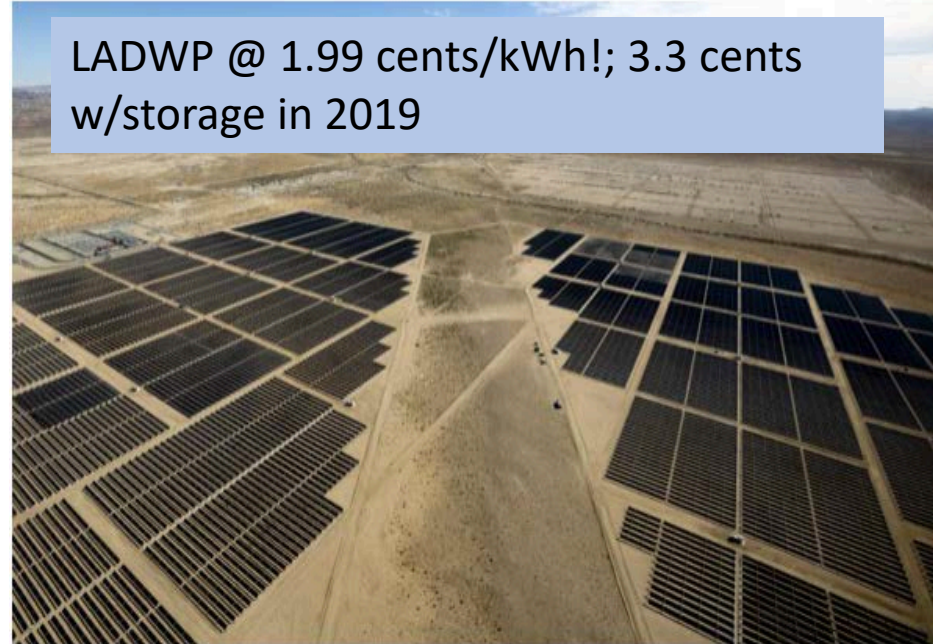
From 4 kW community solar to...



Traer Iowa Municipal in 2014

The community solar garden at Traer. Since this photo was taken, demand by Traer Municipal Utilities customers has seen the array grow by 50%

400 MW of solar PPA (w/200 MW/800 MWh storage



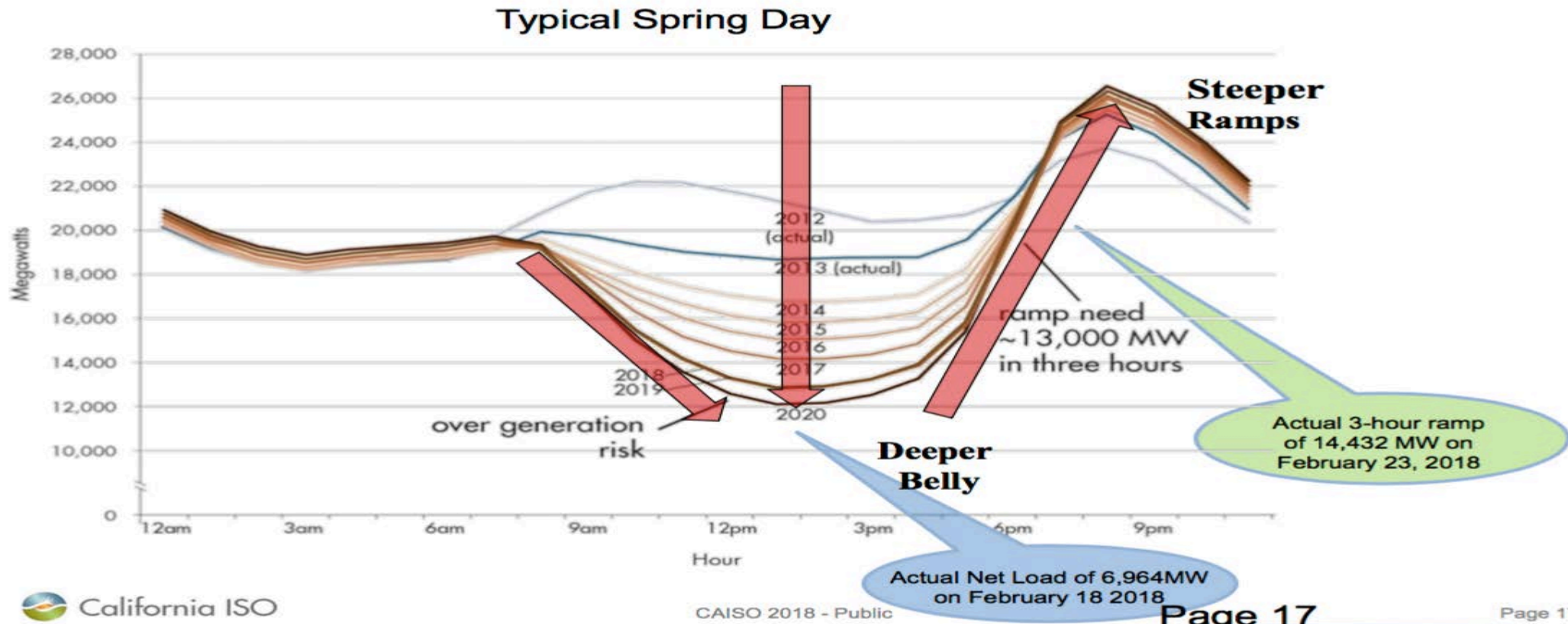
LADWP @ 1.99 cents/kWh!; 3.3 cents w/storage in 2019

The Beacon solar project in Kern County delivers electricity to the Los Angeles Department of Water and Power. The new Eland solar project from 8minute Solar Energy would be built nearby. (Mel Melcon / Los Angeles Times)

200 cities and towns have also bought 5.8 GW of wind since 1994

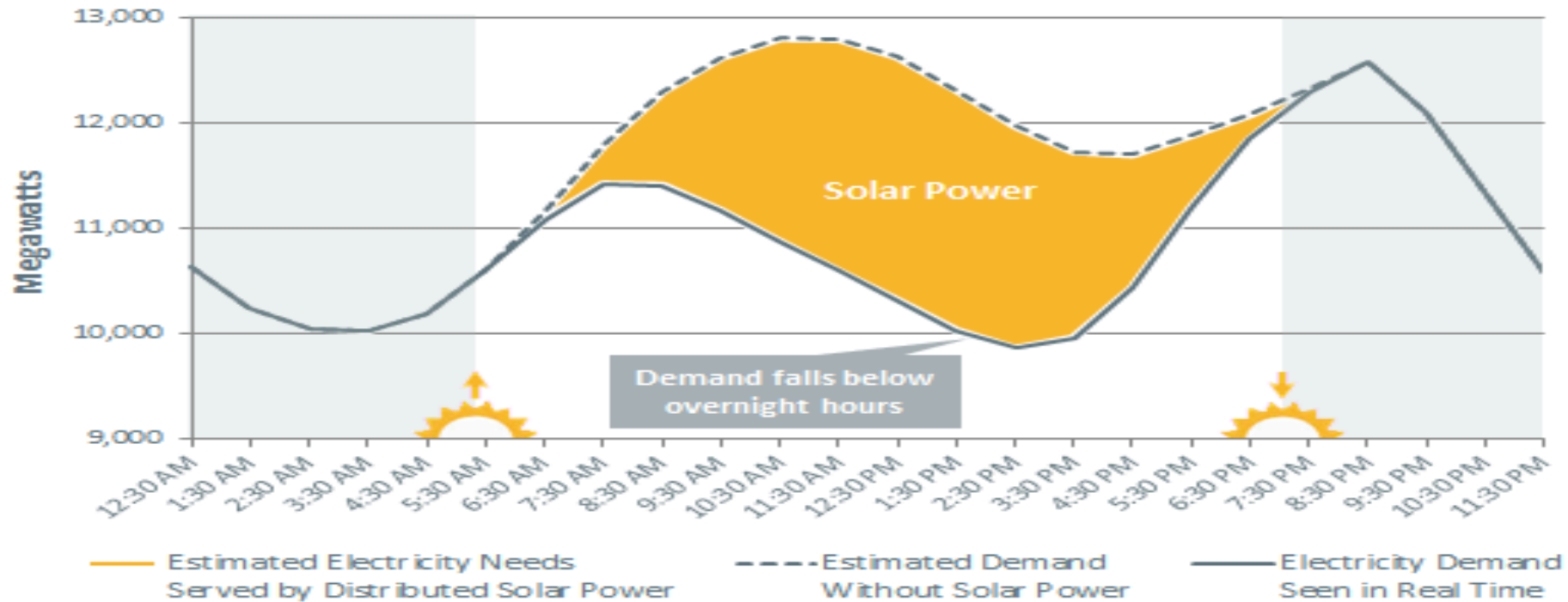
Too Much of a Good Thing?

Actual net-load and 3-hour ramps are about four years ahead of ISO's original estimate



The Duck Flies East

Historic Dip in Midday Demand Follows Record-High Solar Power Output on April 21, 2018
 A sunny spring day pushed distributed solar output to an estimated record high of 2,309 MW at 1:30 p.m. and drove down electricity demand on the regional power system. In effect, New England consumers were using more grid electricity while they slept than in the middle of the day. (Data subject to adjustments.)



Source: ISO New England

Digitalization in Solar Can Help Solve That

DIGITALIZATION IS THE NEXT STEP IN THE SOLAR INDUSTRY'S PROGRESS

From initial design to the smart inverters (and trackers, too)



Digitalization in Wind Also Improves Outcomes

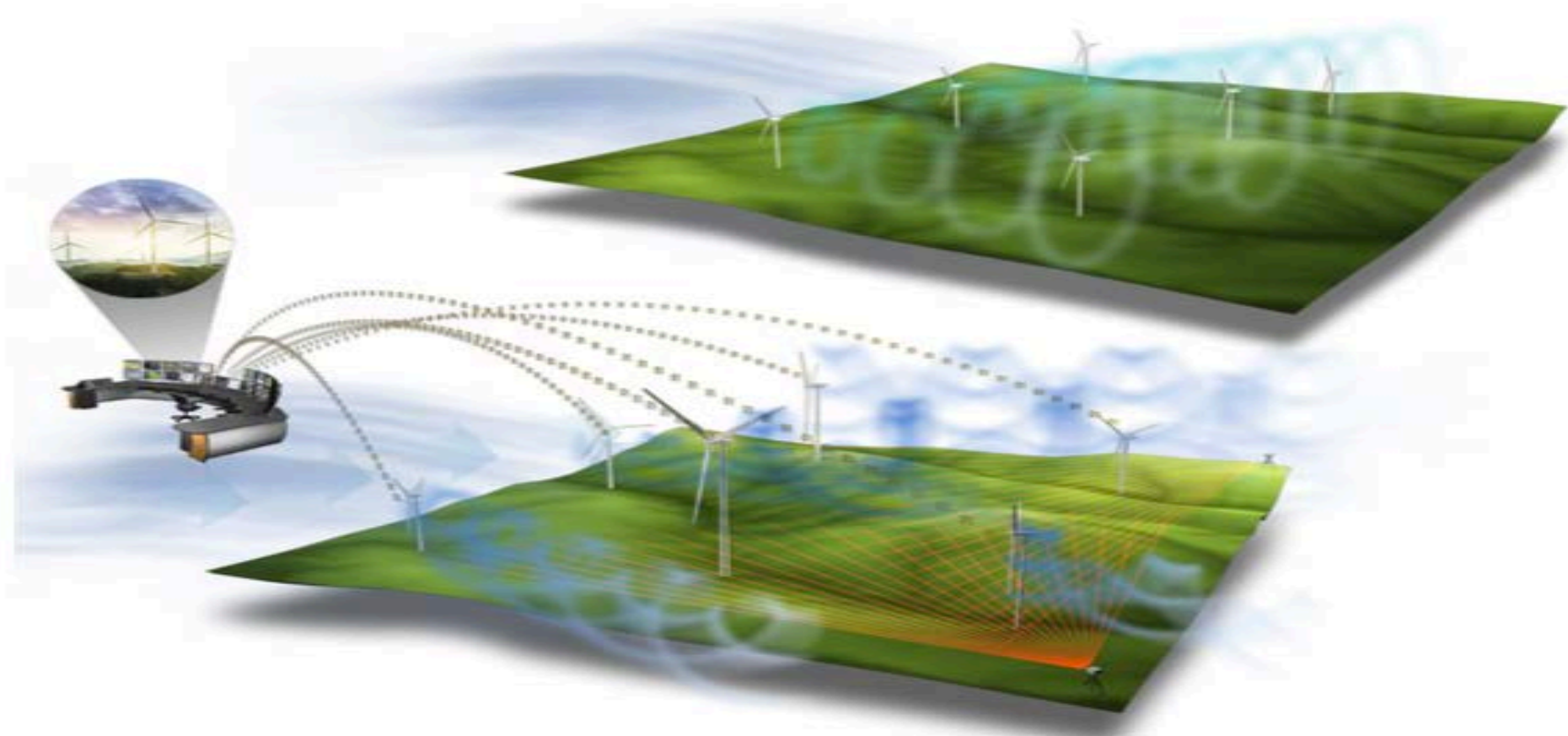


Figure 4. The wind plant of today (top) compared to the SMART wind power plant of tomorrow (bottom). Illustration by Josh Bauer, NREL

Wake Steering: One Example

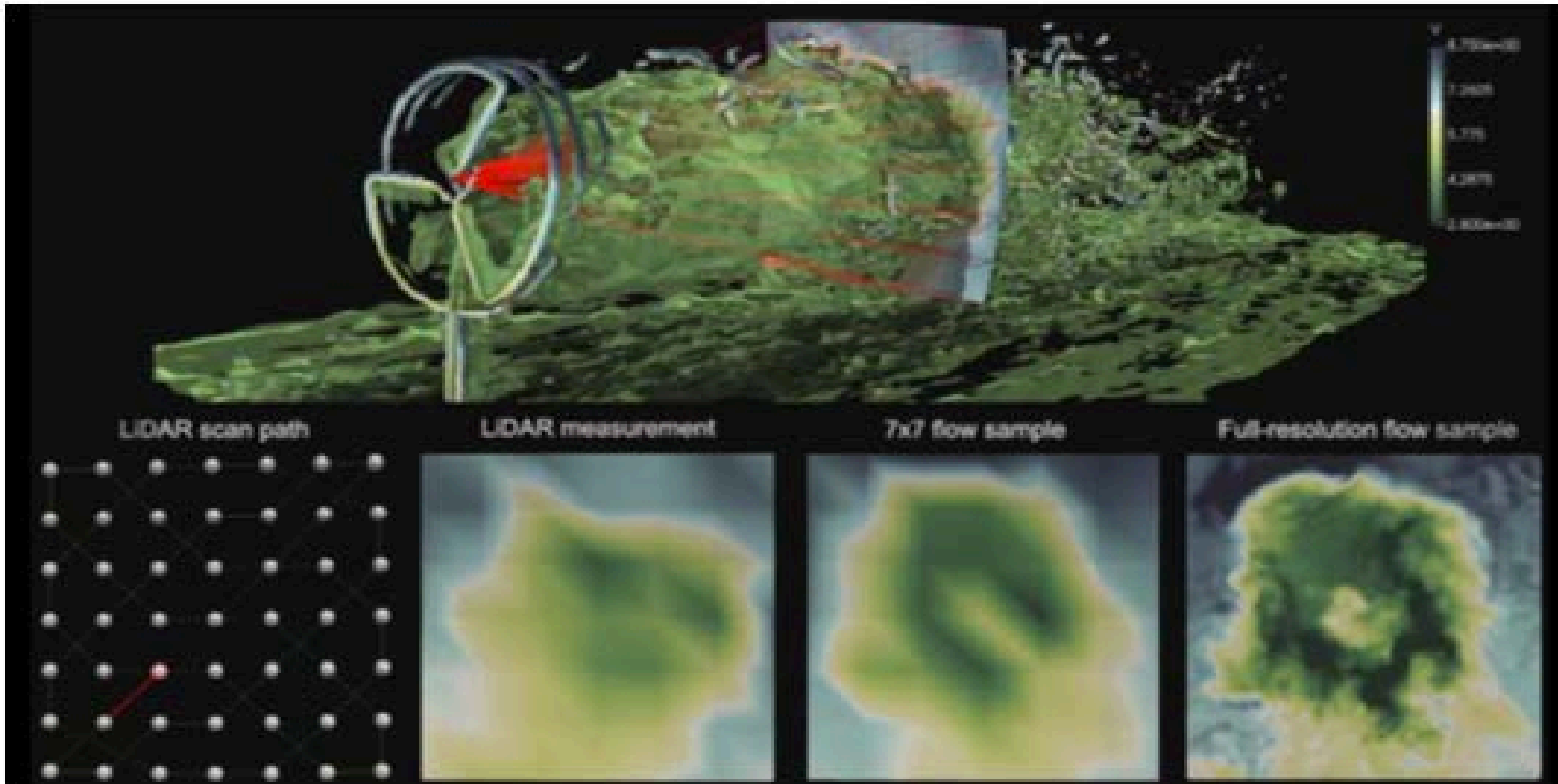
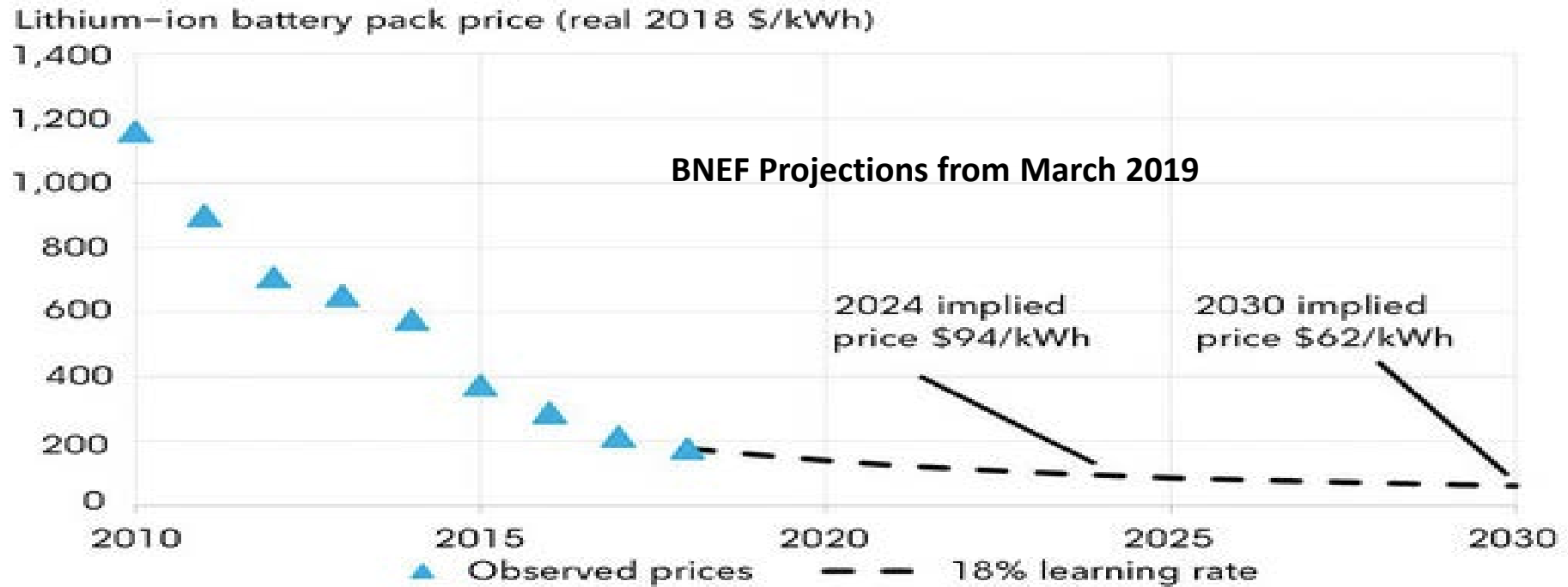


Figure 2. Visualization of a simulated wind turbine wake as sampled by a motorized lidar. Image courtesy of Matthew Churchfield, NREL

Storage Becomes Increasingly Important

Lithium-ion battery price outlook



Source: BloombergNEF

And Further Facilitates the Transition

Wood Mackenzie P&R/ESA | U.S. energy storage monitor Q2 2019

woodmac.com 

U.S. energy storage annual deployments will reach over 4.5 GW by 2024

Utility procurements, changing tariffs and grid service opportunities all drive the market forward

U.S. energy storage annual deployment forecast, 2012-2024E (MW)



Source: Wood Mackenzie Power & Renewables

Municipal w/Storage in MA: 6 More To Come



Community Solar Plus Storage



First Community Solar Plus Storage Project in Massachusetts Announced for Energy Leader Sterling Municipal Light Department by Origis Energy USA

Press Release



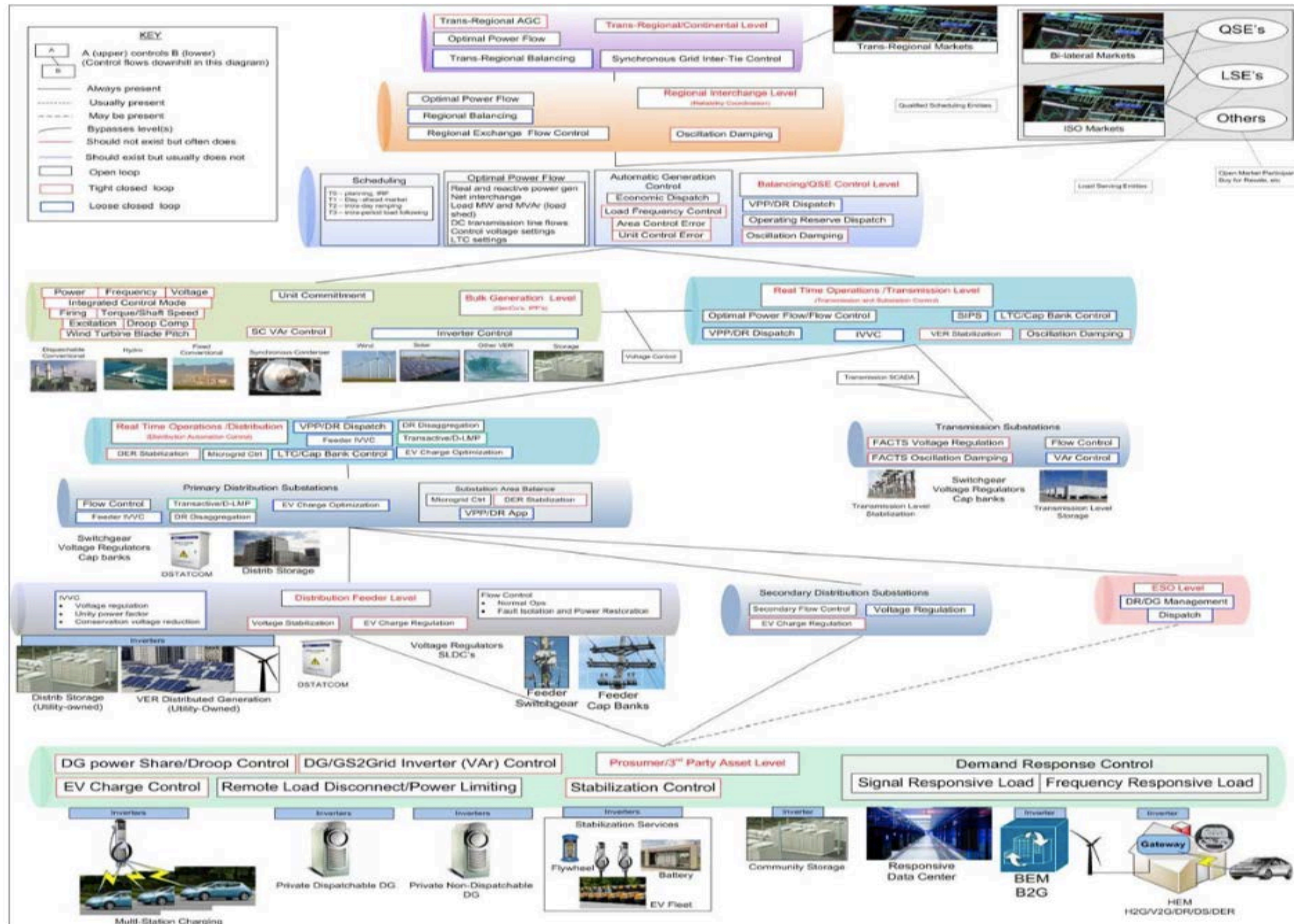
1 MW_{AC} solar rooftop installation coupled with 2 MWh energy storage system continues Sterling, MA award-winning track record of clean energy leadership in the Commonwealth

Decentralization - Glasgow, KY: Most Batteries Per Capita in U.S.



The Glasgow Electric Plant Board installed Sunverge energy storage units in 165 existing homes and businesses in Glasgow, KY (pop. 14,000). The devices capture power from the electric grid when demand and cost are low, and release that power to customers when demand and costs are high, reducing the need to supply additional power from traditional power plants.

Digitalization: Accelerates Decentralization



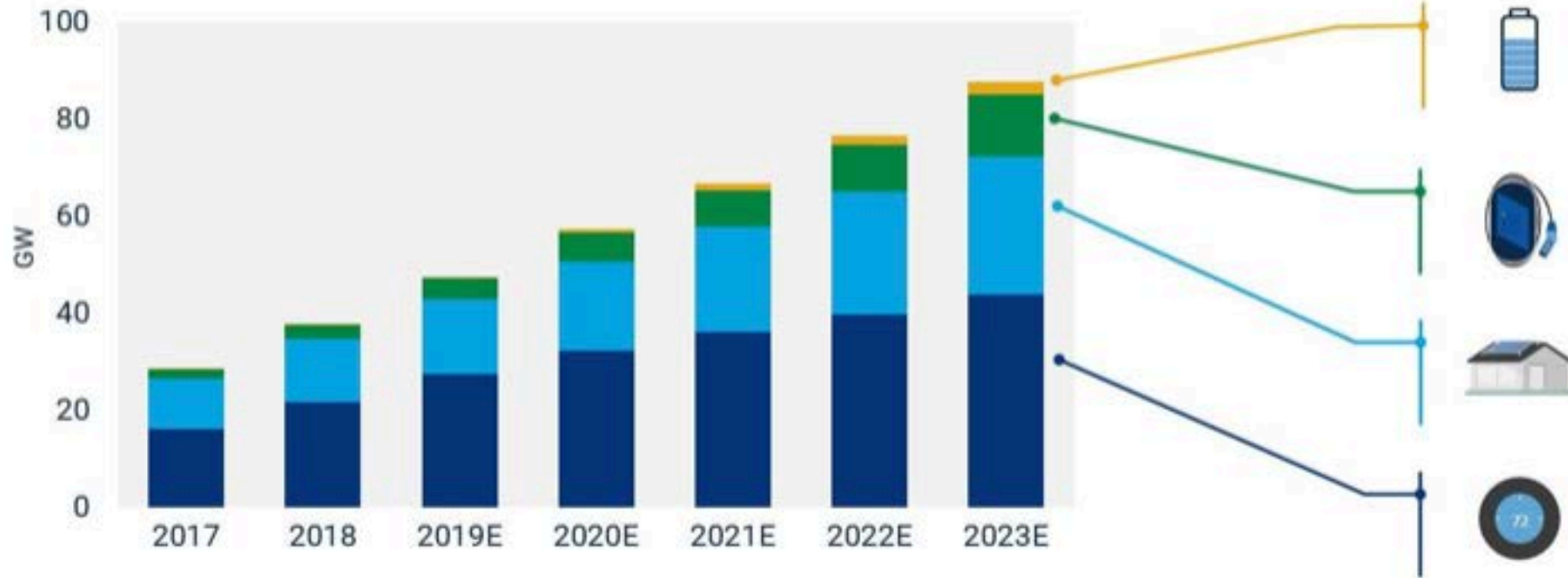
One Example: “As of May 2019, over [1.22 million EVs](#) had been sold in the United States. Predictions now estimate 20 million EVs on U.S. roads by 2030”*

Predictions of 10-20 mn devices w/in single distribution network

Intelligence migrates increasingly to feeder level

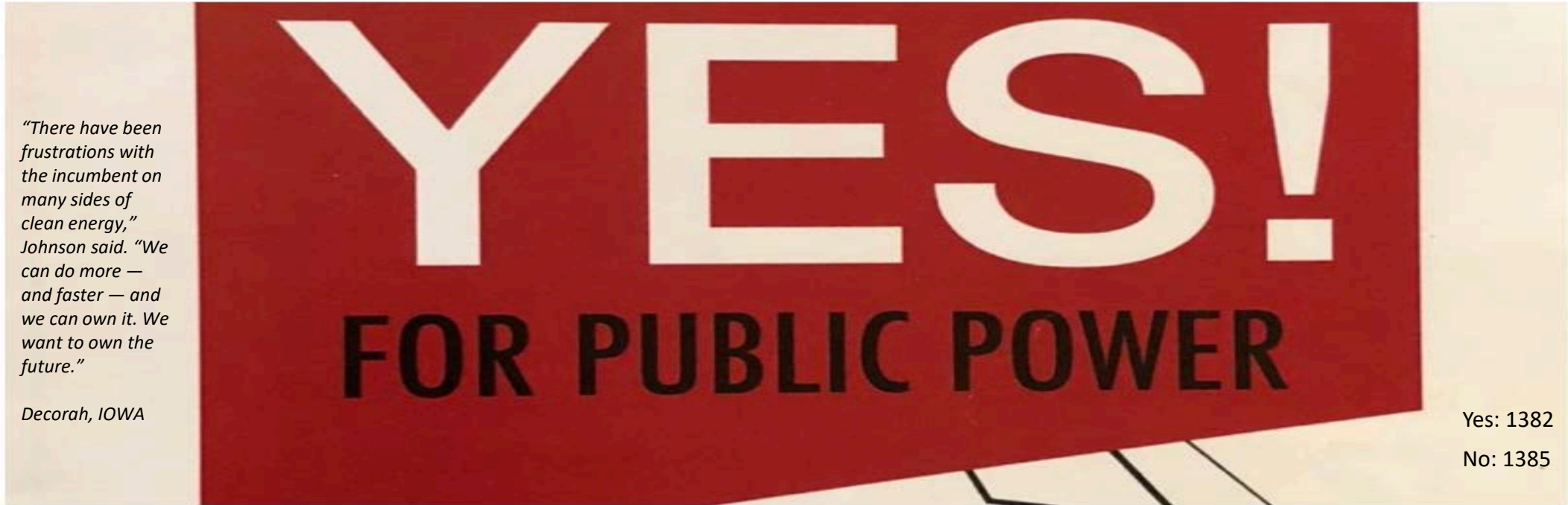
A Rapidly Growing Decentralized EcoSystem

Cumulative potential for behind-the-meter residential flexibility



Austin Energy BYOT highlights power of connectivity

Pressure to Municipalize *Partly to Accelerate Clean Power*



Vote for Decorah Municipal Utility Falls Short, But Local Energy Advocates Persist