Why Plan for Utility-Scale PV?

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Utility-Scale PV Land Use

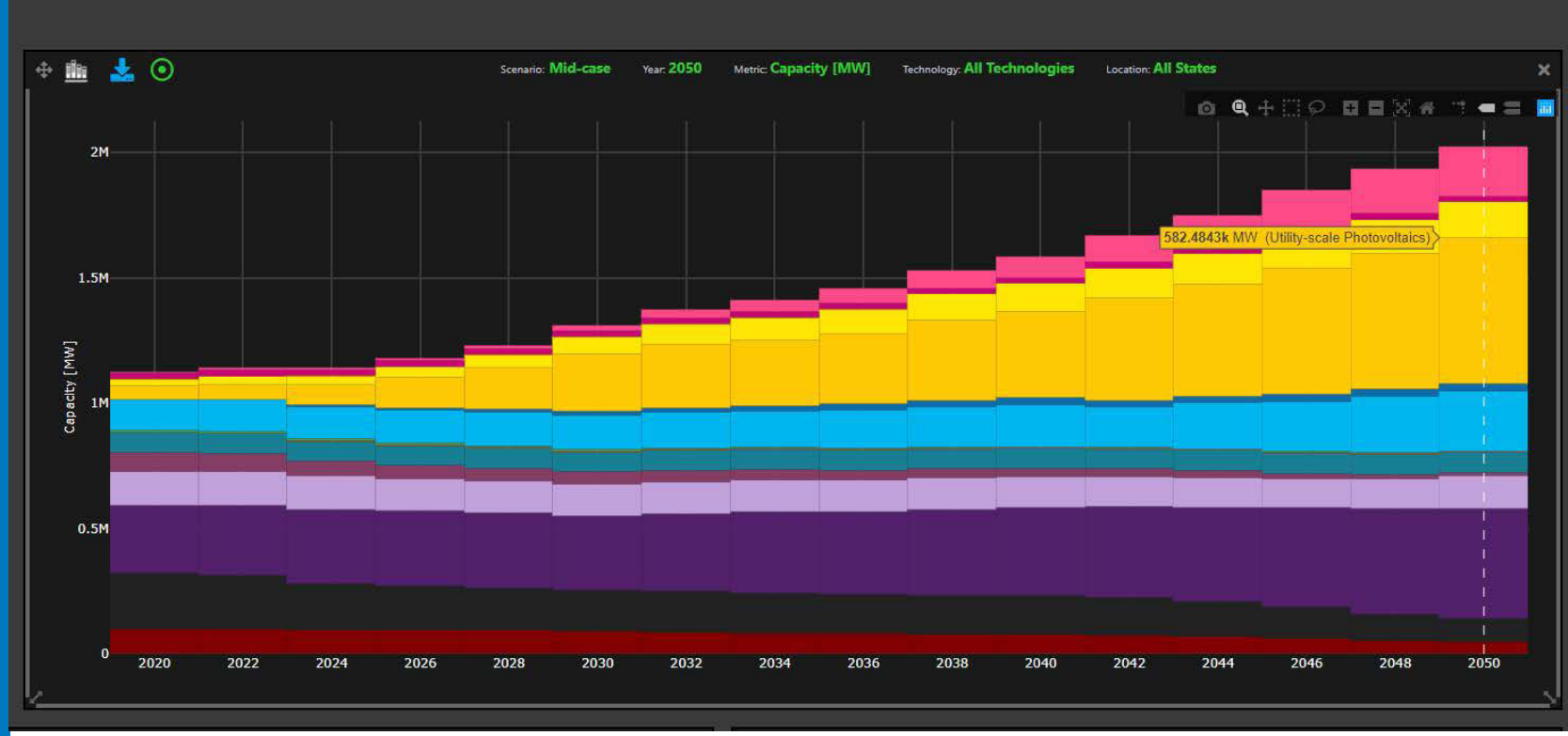
Density ranges from 5 – 10 acres/MW depending on tracking vs. fixed, environmental site design, etc.

88% of U.S utility-scale PV capacity added in 2019 employ tracking (LBNL 2020) which requires more land

Jacksonville Solar
15 MW – Jacksonville, FL
Photo: juwi Americas

Utility-Scale PV deployment projections

By 2050 under a Mid-Case, scenario, NREL's Cambium model projects a total of 583 GW of utility-scale PV in the contiguous 48 states

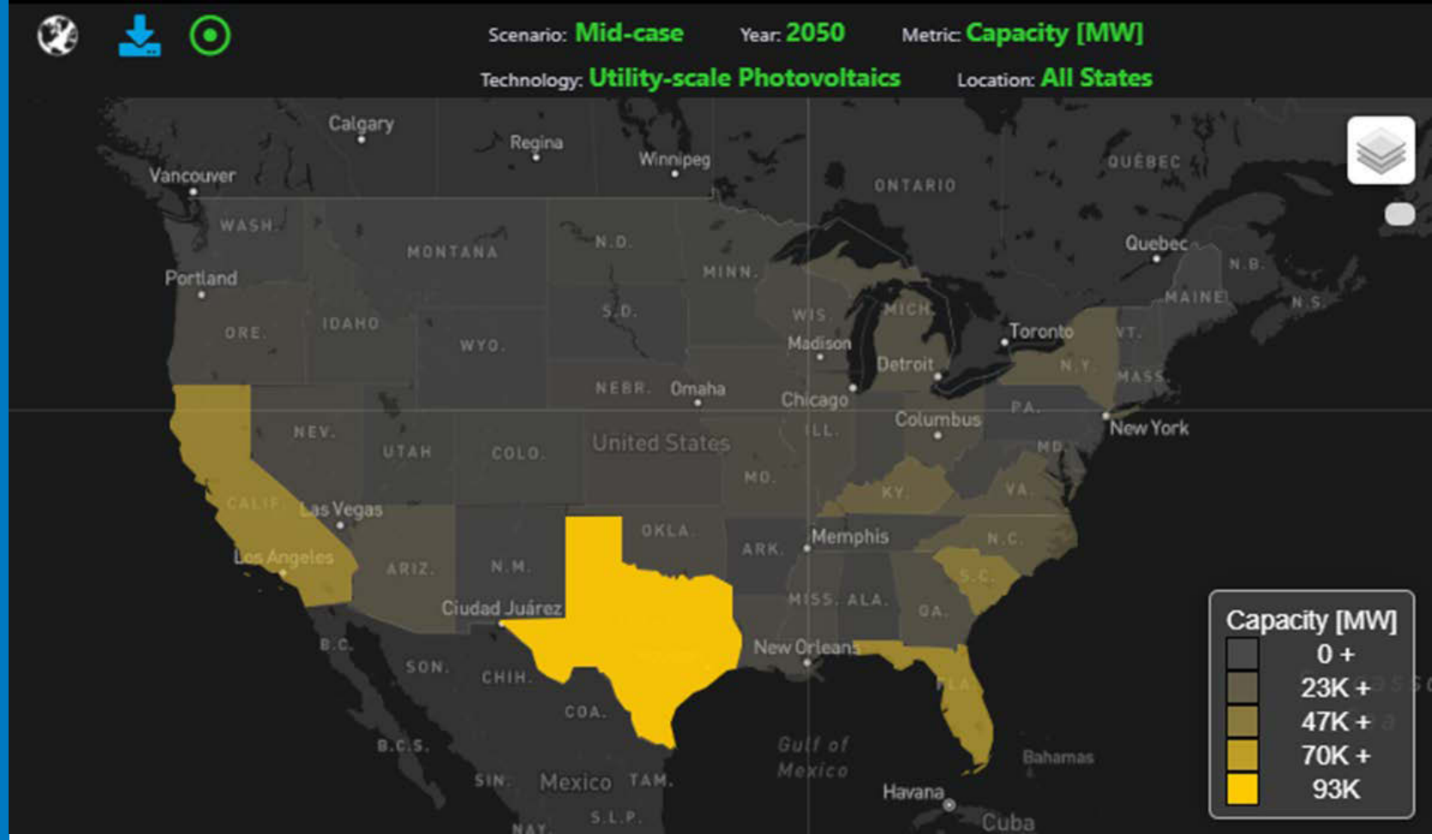


- By 2050 more capacity from utility-scale PV than any other generation technology
- 10x current deployment
- @7 acres/MW = additional ~3,684,000 acres of utility-scale PV developed between now and 2050
  - More than the land area of Connecticut

https://cambium.nrel.gov/

Utility-Scale PV deployment projections

Within states, utility-scale PV development will typically occur near transmission and distribution system substations



Utility-scale PV modeled deployment by state (Mid-Case Scenario)

https://cambium.nrel.gov/

Utility-Scale PV deployment projections

To reach 90% decarbonized electricity by 2035, the UC Berkeley 2035 Report models 466 GW of utility-scale PV

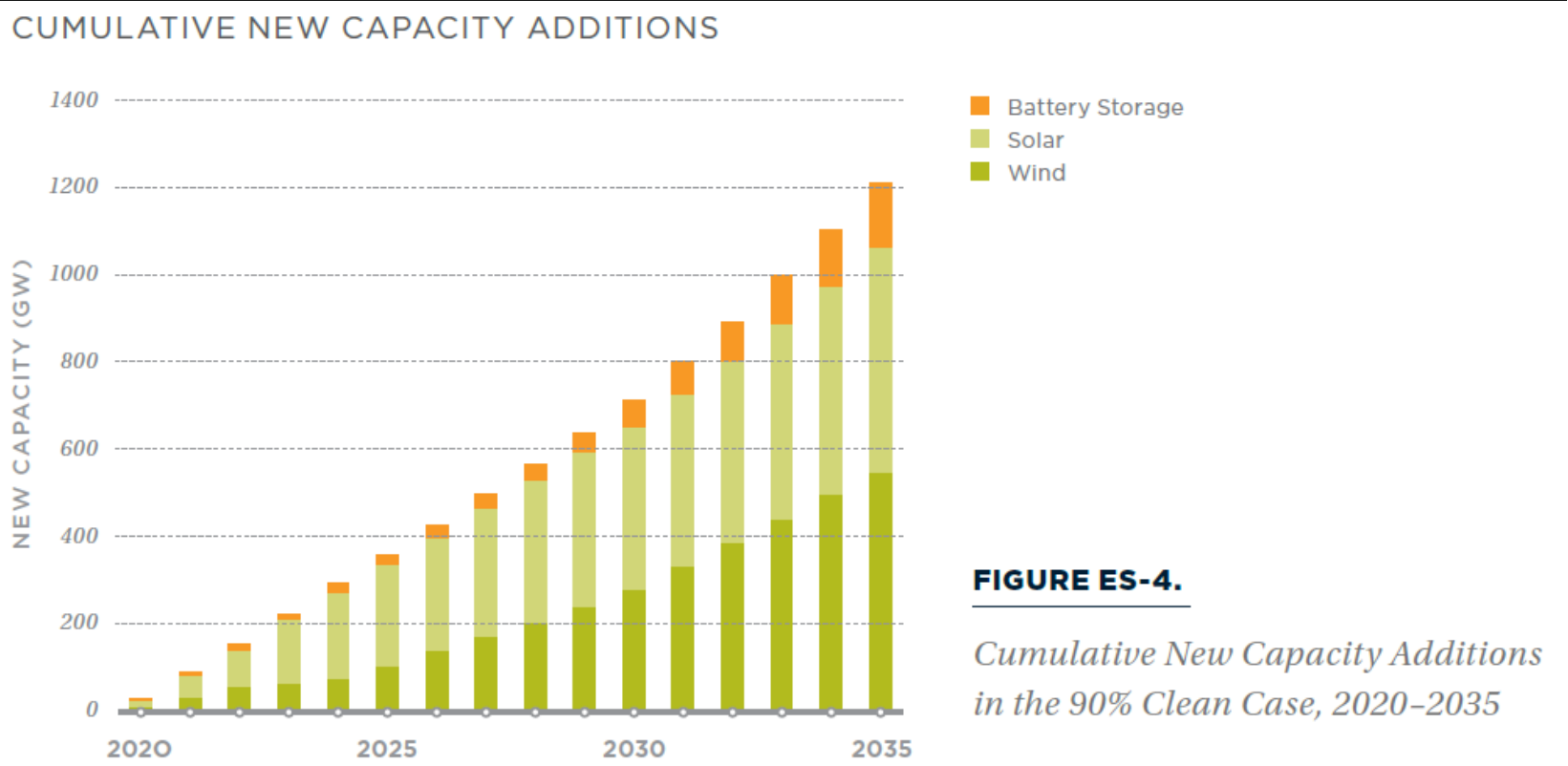
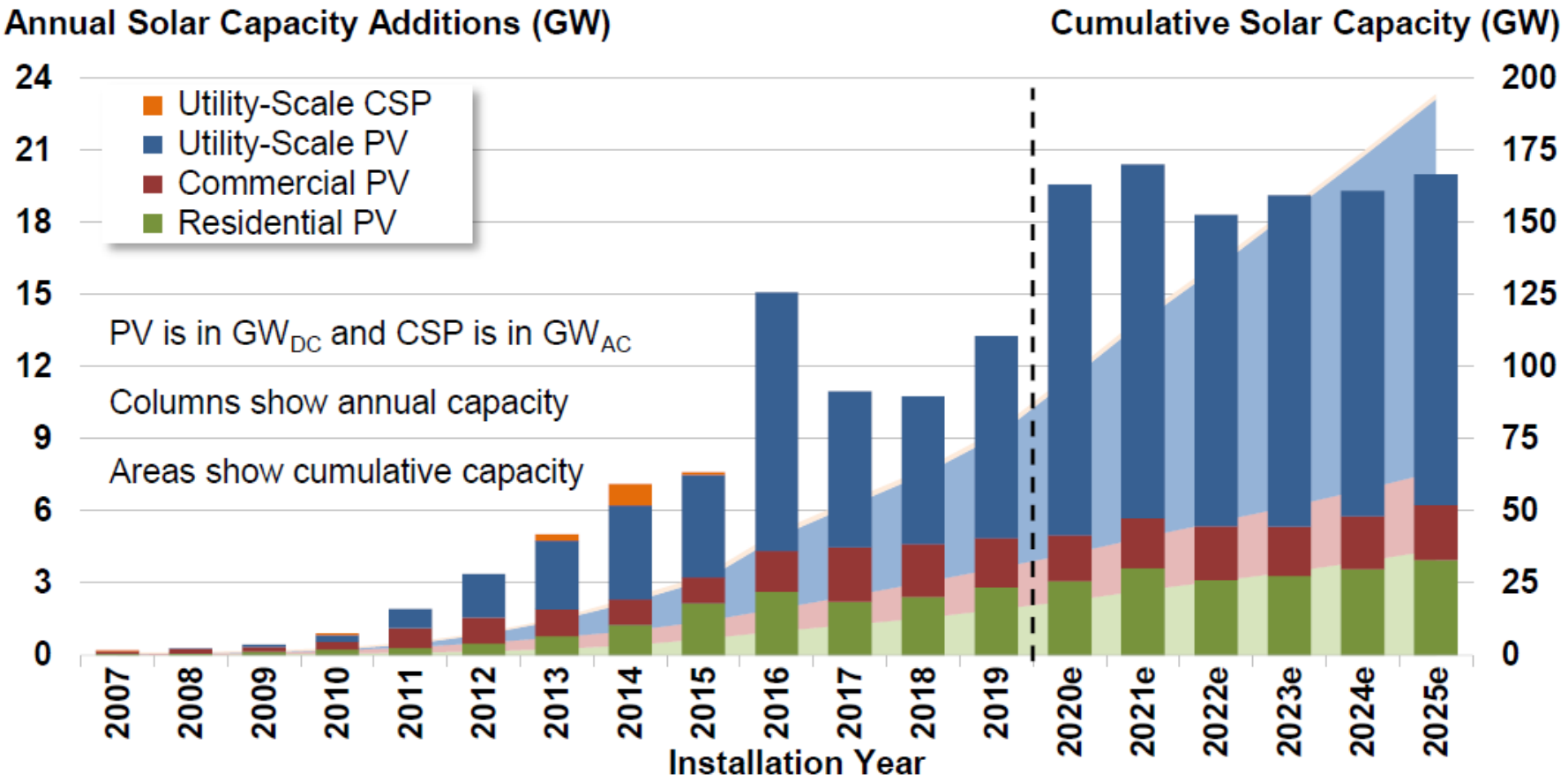


FIGURE ES-4.

Cumulative New Capacity Additions in the 90% Clean Case, 2020–2035

- Average of 32 GW solar added/year
- Of the 505 GW, 39 GW is distributed, customer-sited, 466 utility-scale
- @7 acres/MW = additional ~3,264,000 acres of utility-scale PV developed between now and 2035
  - More land area than Connecticut

https://www.2035report.com

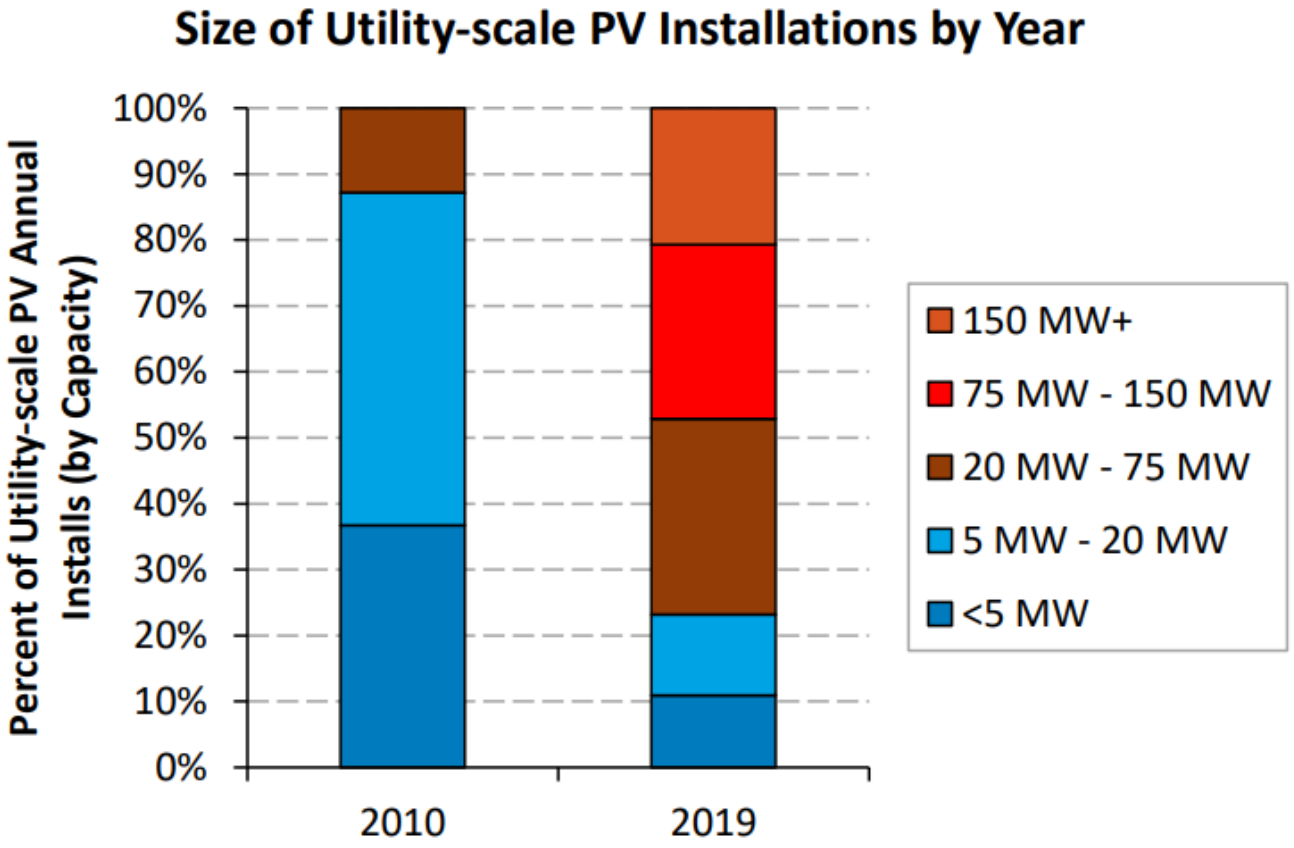


Sources: Wood Mackenzie and SEIA (2010-2019), IREC, Berkeley Lab.
Note: Wood Mackenzie and SEIA's definition of utility-scale PV capacity differs from LBNL both in size thresholds and treatment of project phase completion.

https://emp.lbl.gov/utility-scale-solar

PV Installations by Market Segment

Average System Size Increasing



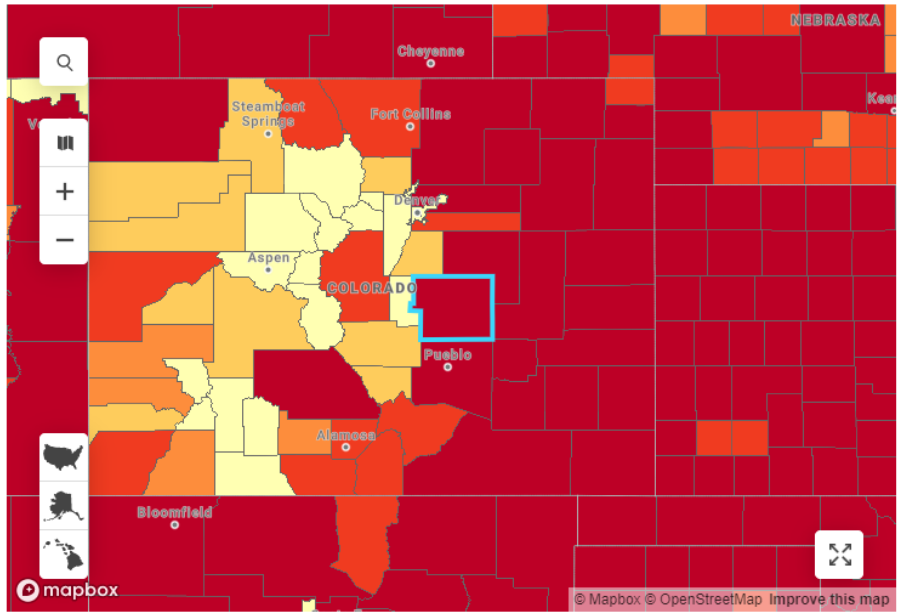
- From 2010 to 2019, average system installation size grew from:
  - 5.0 kW_{DC} to 7.7 kW_{DC} for residential
  - 70 kW_{DC} to 212 kW_{DC} for non-residential
  - 5 MW_{DC} to 27 MW_{DC} for utility-scale.
- The number of smaller utility-scale PV systems hides some of the shift in focus to very large utility-scale plants.
  - In 2010, only 13% of PV systems built were above 20 MW_{AC}, with the largest system 30 MW_{AC}. In 2019, however, two-thirds of the utility-scale capacity installed came from systems above 20 MW_{AC}, with the largest system at 250 MW_{AC}.

Slide from Q4 2019/Q1 2020 Solar Industry Update, Sources: Wood Mackenzie, Energy Information Administration

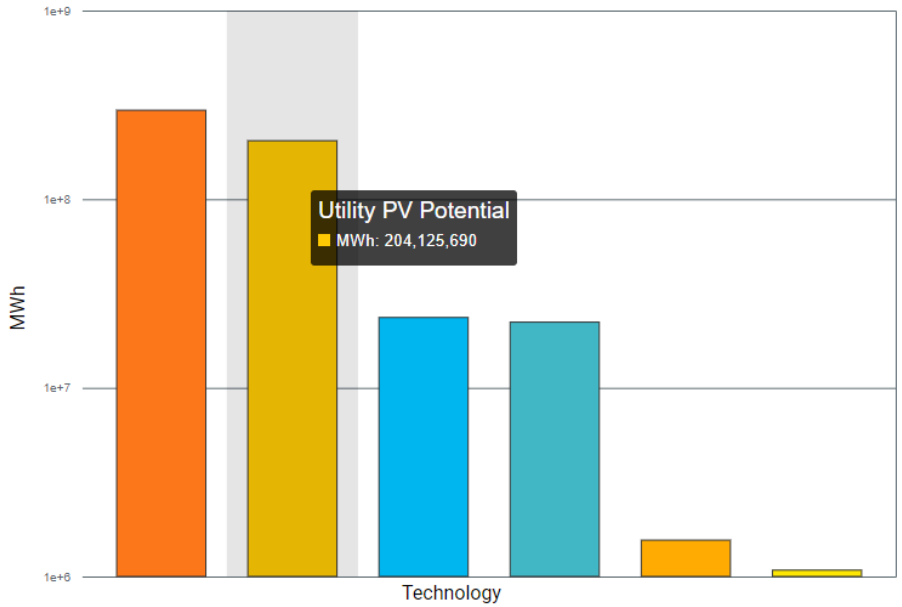
Localized Utility-PV Generation Potential

State and Local Planning for Energy (SLOPE) https://gds.nrel.gov/slope/

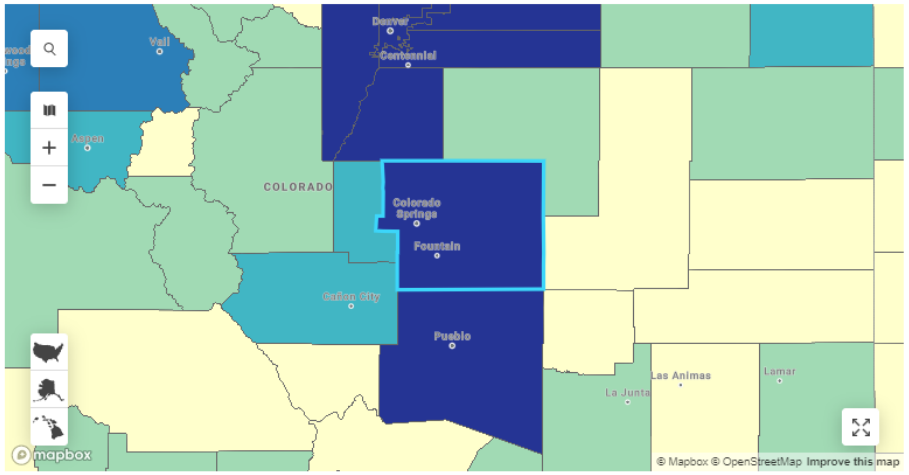
Modeled Annual Technical Generation Potential - Utility PV



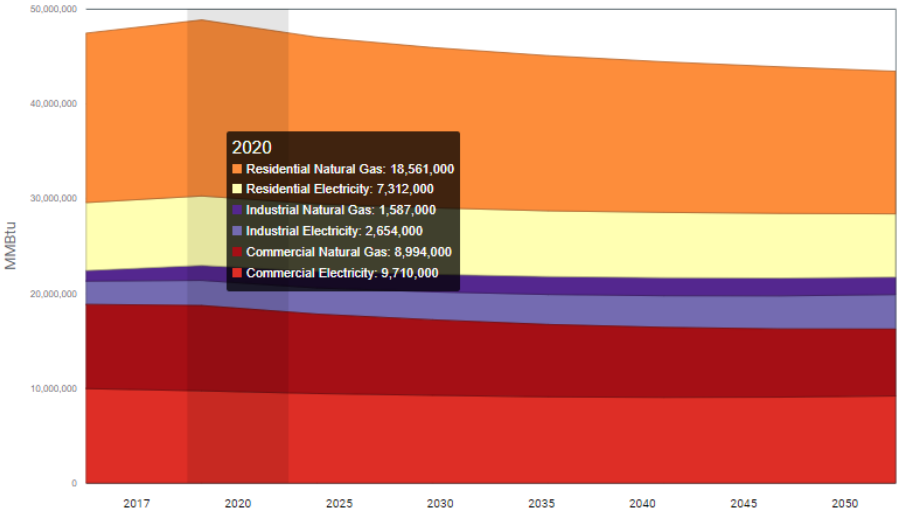
Annual Technical Generation Potential - Multiple Technologies



Aggregate Electricity & Natural Gas Consumption by County



Projected Energy Consumption by County, Business as Usual Case



Map Legend

(MMBtu)

10,350,000 +
4,168,000 - 10,350,000
1,857,000 - 4,168,000
721,000 - 1,857,000
0 - 721,000

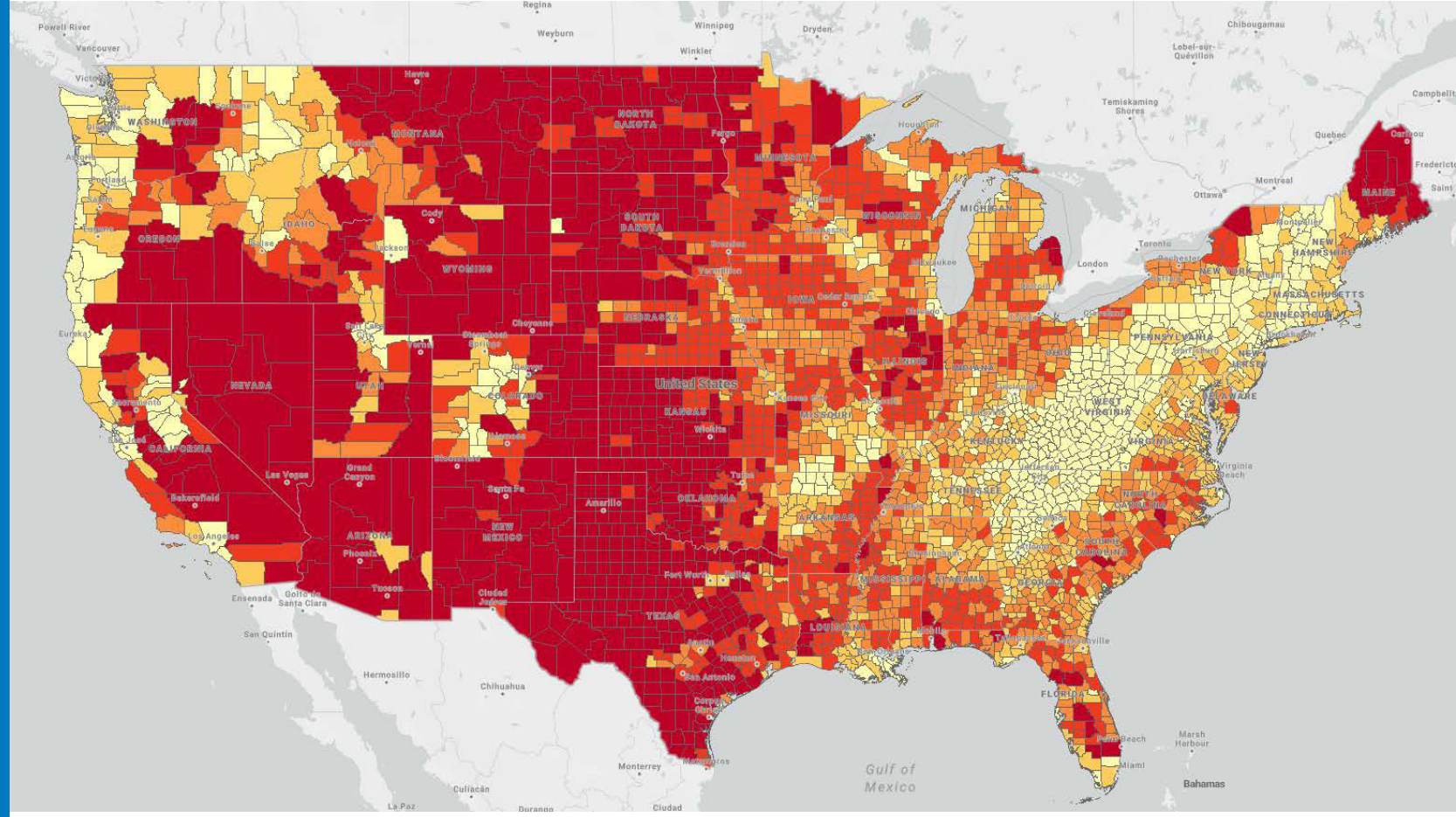
Data Filters

Commercial Electricity
Commercial Natural Gas
Industrial Electricity
Industrial Natural Gas
Residential Electricity
Residential Natural Gas

Utility-Scale PV Generation Potential

Comparing SLOPE modeled electricity consumption for each county with the technical generation potential in each county, we found:

- Utility-scale PV technical generation potential could cover an average of 59,254.3% of electricity consumption, and
- Residential and commercial rooftop PV technical generation potential could cover on average 45.2% of electricity consumption



Map Legend

(MWh)

- 93,232,660 +
- 55,107,860 - 93,232,660
- 33,598,300 - 55,107,860
- 12,366,850 - 33,598,300
- 0 - 12,366,850

https://gds.nrel.gov/slope

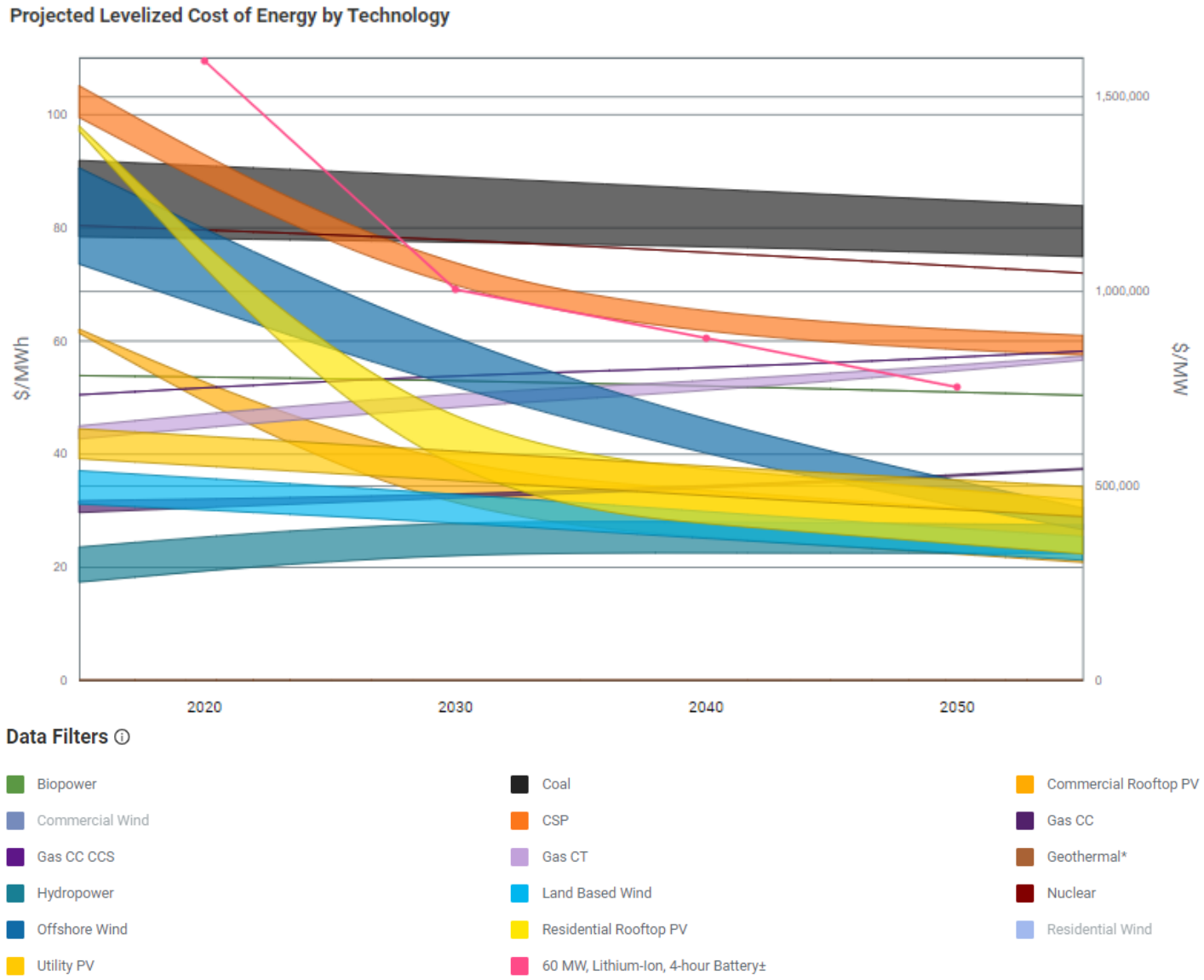
Utility-PV Cost Declines

Utility-scale PV levelized costs are a third to a quarter of the costs of residential rooftop PV

Utility-scale PV costs have fallen 70% since 2010 (LBNL 2020)

Projected Levelized Cost of Energy (LCOE) for Texas

(State and Local Planning for Energy (SLOPE) Platform)



https://gds.nrel.gov/slope

PV Generation & Cost Comparison

Metric	Residential Rooftops	Hypothetical 1 MW tracking site
Capacity	1,000 kW	1,000 kW
# Systems	100	1
Annual Generation (kWh)[1]	~1,259,000	~1,585,000
Capital Cost	~$2,401,000[2]	~$1,300,000[2]

[1] Generation from PVWatts for building rooftops and single-axis tracking system in Kingston, NY
[2] Capital costs reflect Annual Technology Baseline 2021 mid-case overnight capital costs for Chicago, IL. 1 MW tracking costs reflect a projected capital cost of $1.30/W, which falls between the $1.04/W for utility-scale (23 MW) and $1.58 commercial scale (300 kW) PV costs modeled for Chicago, IL

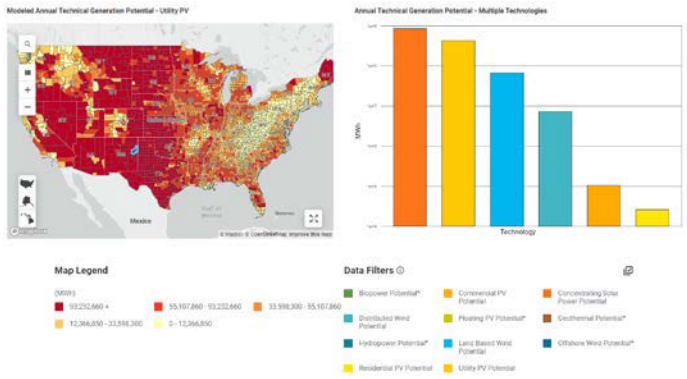
Photo: NREL

Resources

Technical assistance and designation program

Extended until May 2022

https://solsmart.org/



State and Local Planning for Energy (SLOPE)

https://gds.nrel.gov/slope/

InSPIRE-Innovative Site Preparation and Impact Reductions on the Environment (for PV)

https://openei.org/wiki/InSPIRE

Are You Solar Ready? Seven steps to successfully manage large-scale solar development

https://www.planning.org/planning/2020/mar/are-you-solar-ready/

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The data, results, conclusions, and interpretations presented in this document have not been reviewed by technical experts outside NREL or the Office of Energy Efficiency and Renewable Energy.
