The Known Unknowns

New York Energy Forum

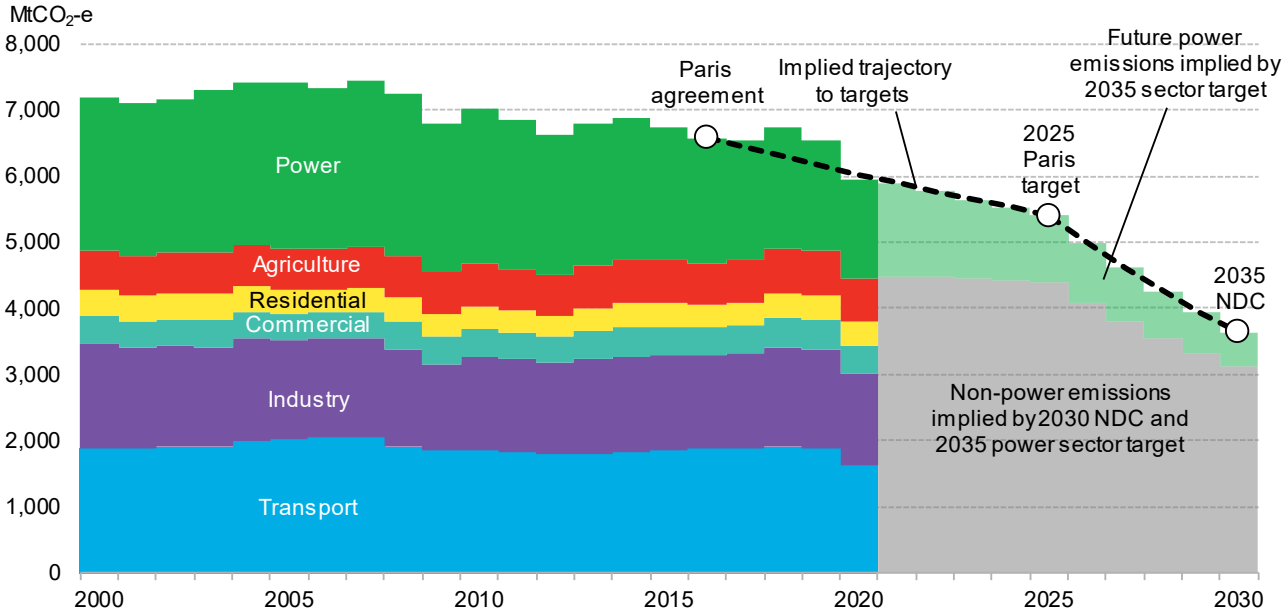
Yayoi Sekine

May 18, 2021

BloombergNEF

U.S. economy-wide emissions

Historic and future, assuming various targets are achieved



Decarbonizing power is the first and 'easiest' leg of the decarbonization journey…

…and I've been speaking about the first and 'easiest' step of that journey

Source: EIA, EPA, BloombergNEF

BloombergNEF

U.S. economy-wide emissions

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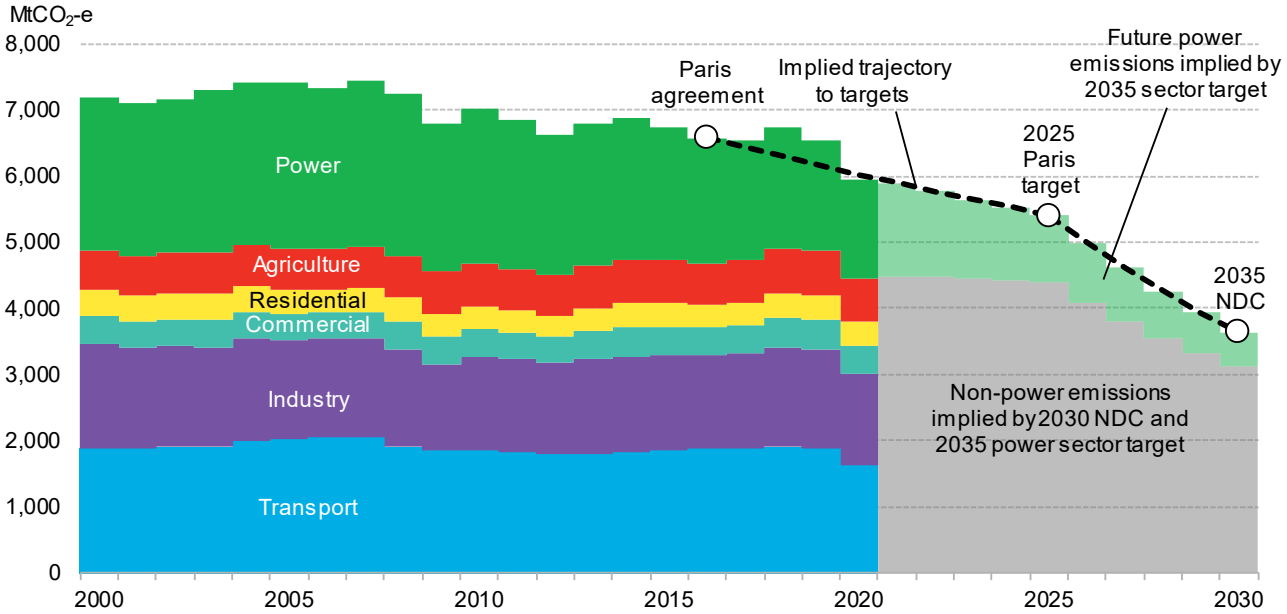

Decarbonizing power is the first and 'easiest' leg of the decarbonization journey…

…and I've been speaking about the first and 'easiest' step of that journey

…and it is not that easy!

Source: EIA, EPA, BloombergNEF

BloombergNEF

Besides wind and solar vs. gas, there's much more we need to consider

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Energy storage	Electric vehicles	Grids	Technology "X"

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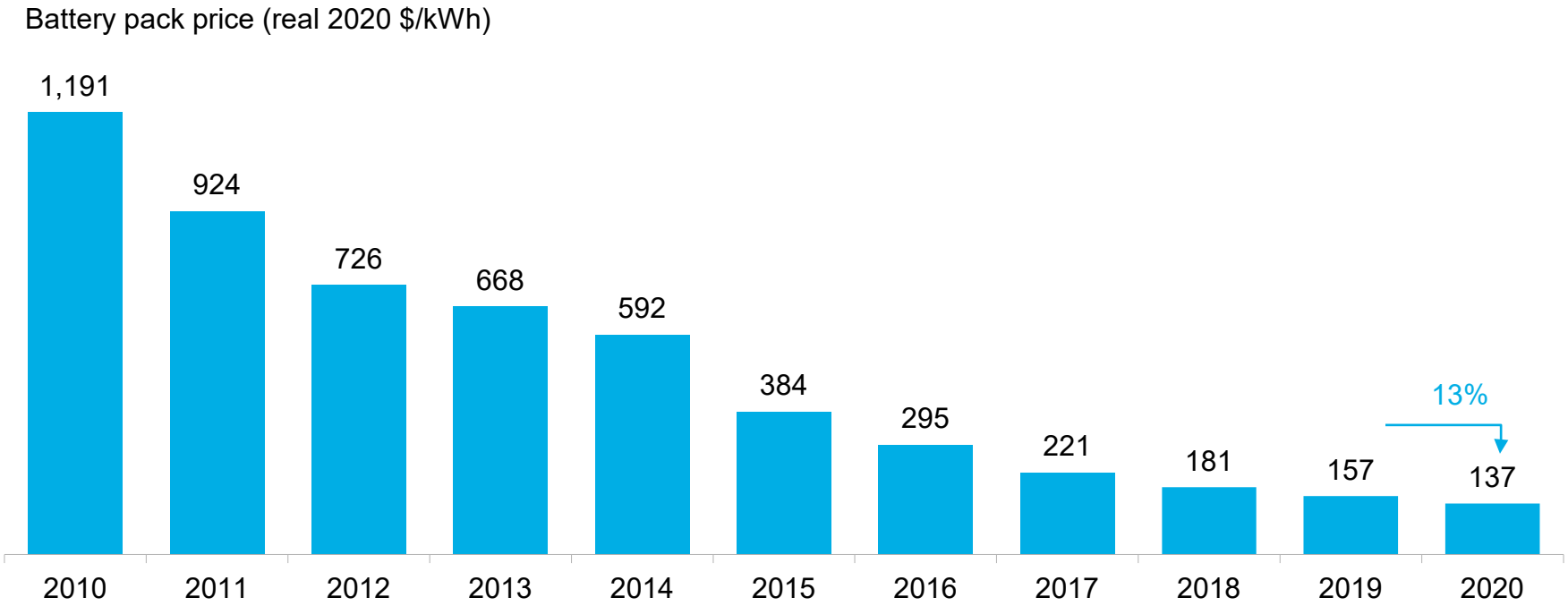
Source: Tesla

Battery costs are falling

Lithium-ion battery price survey results (volume-weighted average)



Source: BloombergNEF Note: This is based on the 2019 Battery Price Survey. The 2020 results shown here are a projection.

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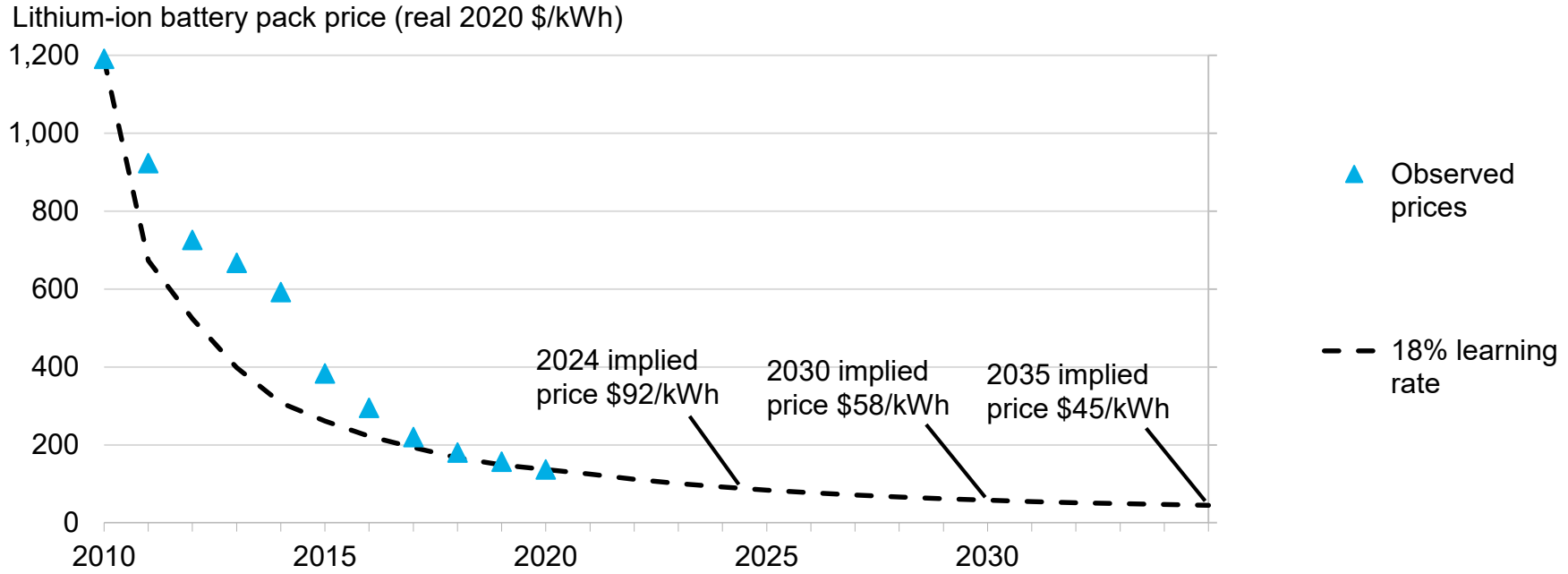
Battery costs are falling …and will continue to fall

Lithium-ion battery price outlook



Source: BloombergNEF Note: This is based on the 2019 Battery Price Survey.

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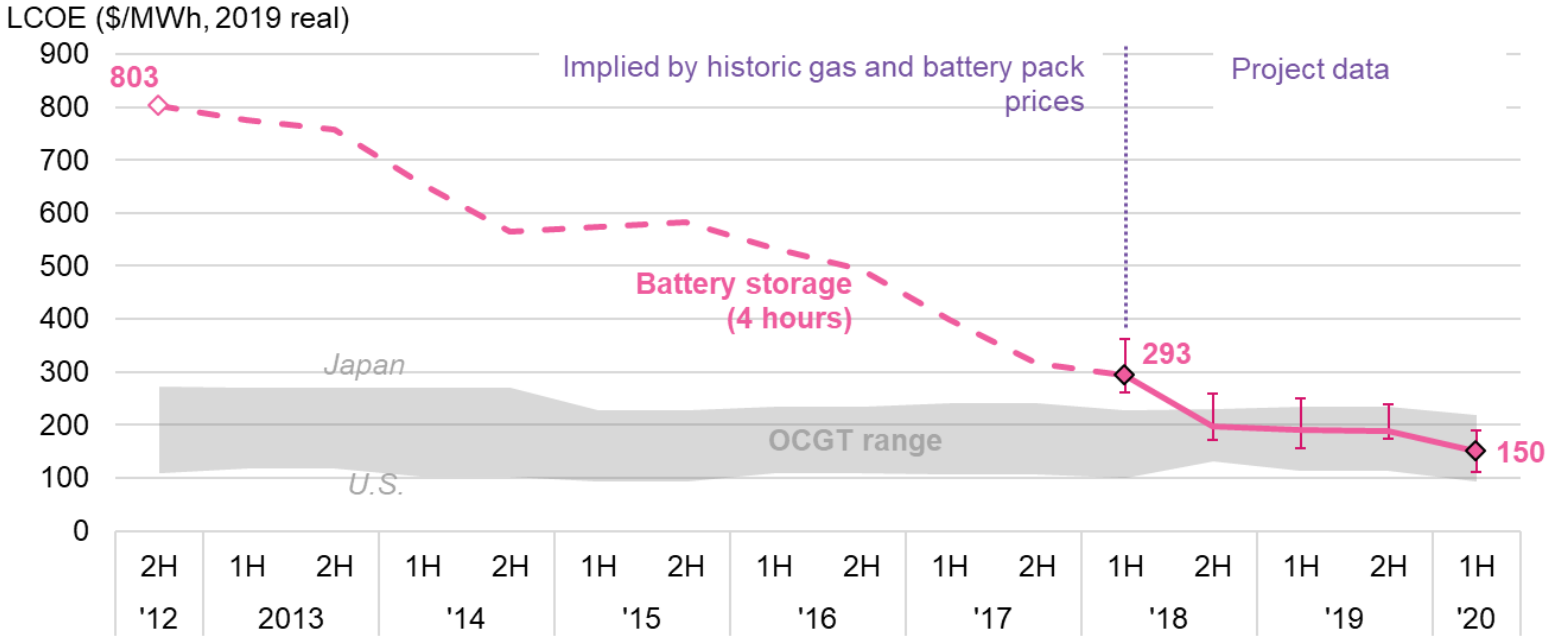
With falling costs, battery storage can compete on a LCOE basis against gas peakers

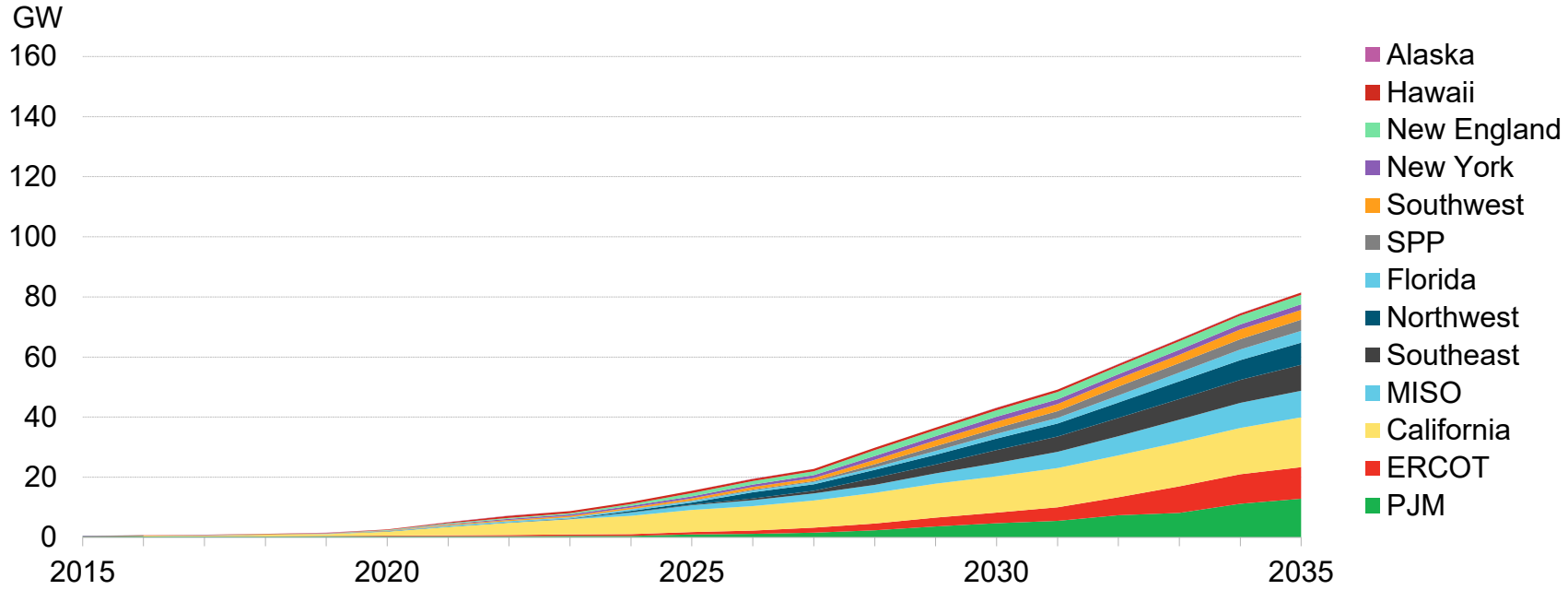
Global levelized cost of electricity (LCOE)



Source: BloombergNEF. Note: The storage benchmark is a country weighed-average using the latest annual capacity additions. It assumes a daily cycle and includes charging costs at 60% of the wholesale base power price. OCGT: open-cycle gas turbine. The lower (higher) bound of the OCGT range reflects the U.S. (Japan).

In batteries alone, 80GW of storage capacity could be on-line by 2035

The U.S. cumulative market size by region based on power capacity



Source: BloombergNEF

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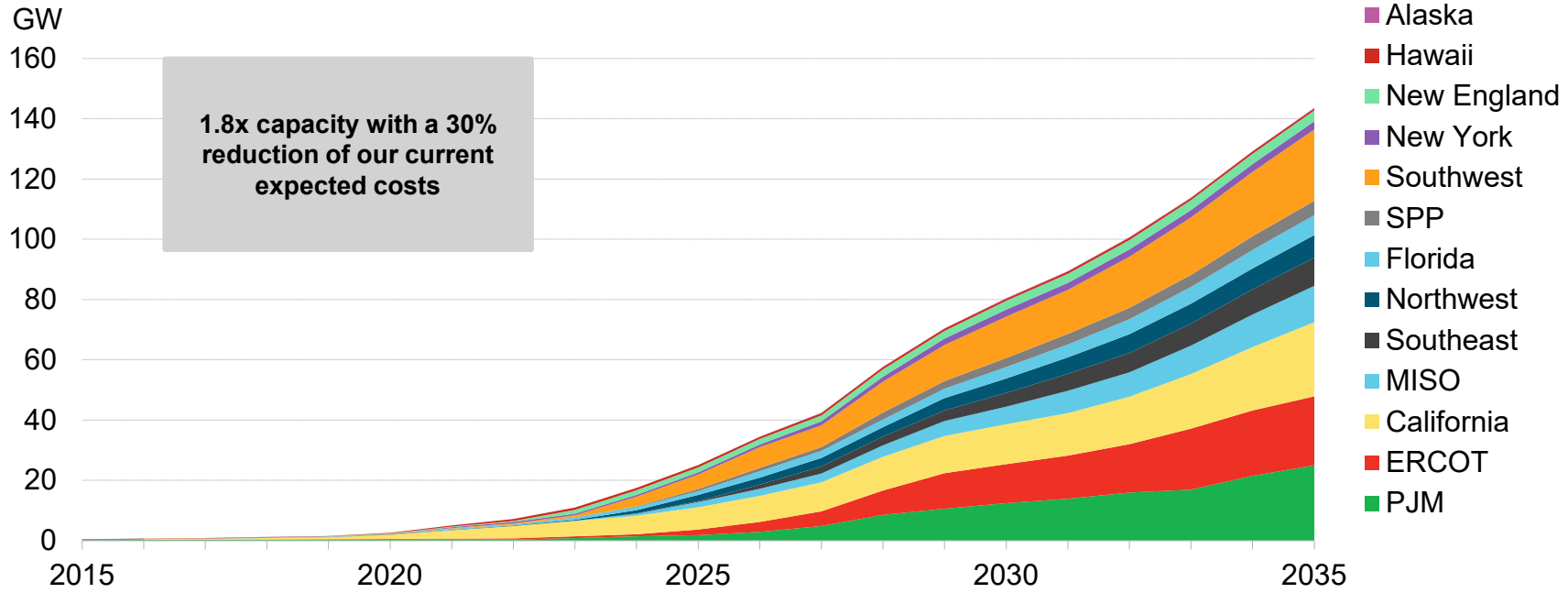
In batteries alone, ~~80GW~~ 143GW of storage capacity could be on-line by 2035

The U.S. cumulative market size by region based on power capacity



Source: BloombergNEF

BloombergNEF

There’s a fairly known pathway for storage

Energy storage	Electric vehicles	Grids	Technology “X”

Known?

Source: Tesla

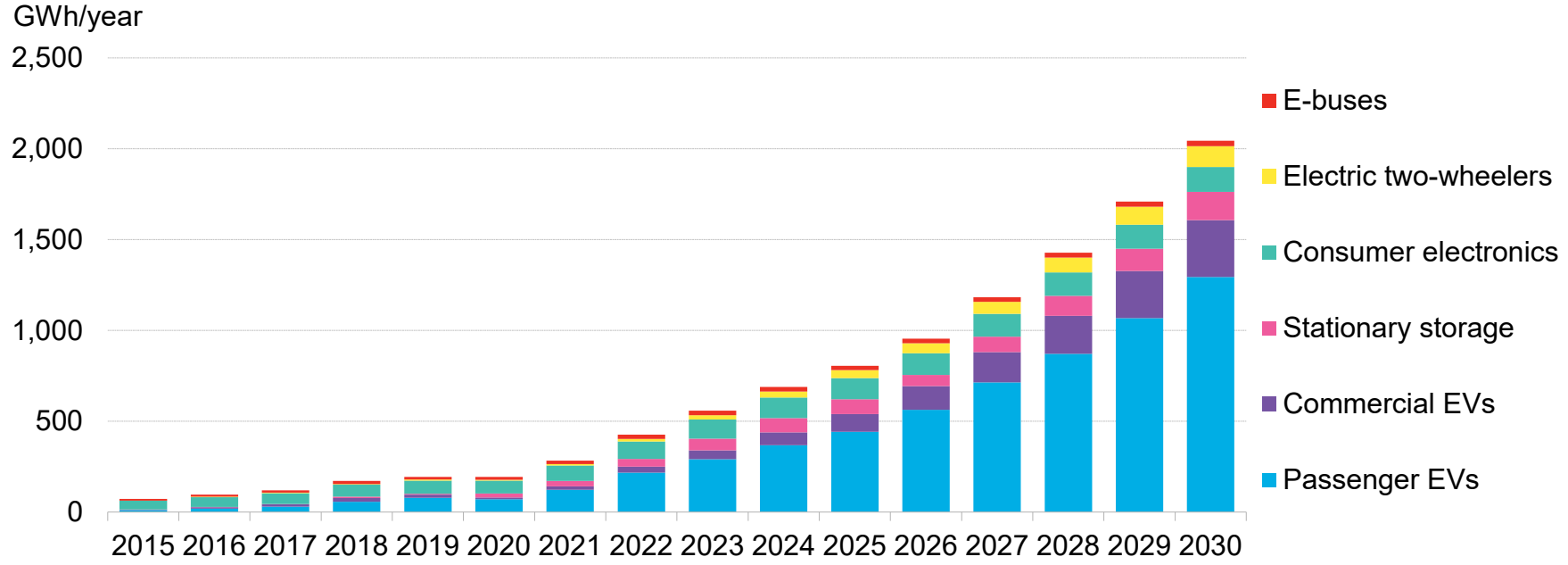
What about electric vehicles?

Energy storage	Electric vehicles	Grids	Technology “X”
			
Known?			

Source: Tesla, Lockheed Martin, R&D World

Electric vehicle demand driving majority of demand for batteries

Annual lithium-ion battery demand by application



Source: BloombergNEF

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Passenger EV could hit price parity in the mid-2020s

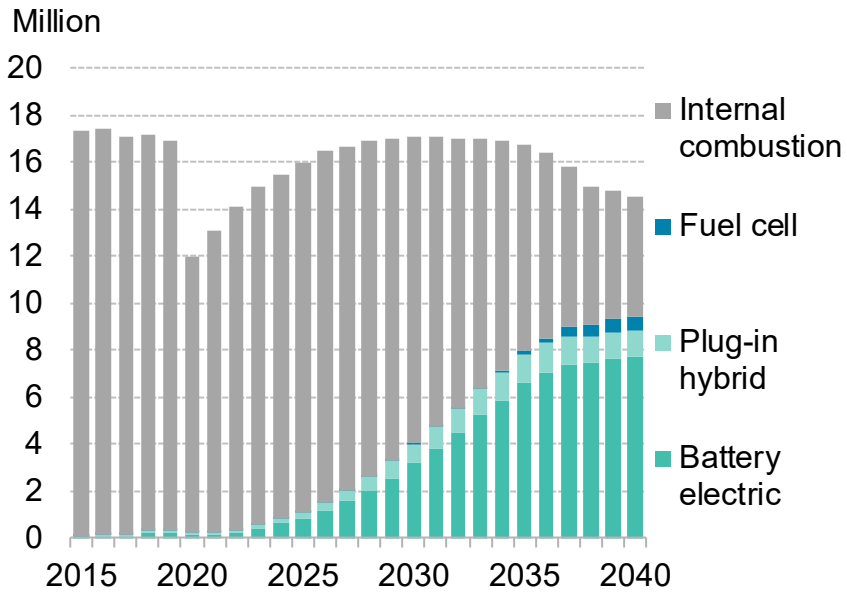
Upfront price parity year

Segment	U.S.	EU	China
Small	2024	2027	2026
Medium	2024	2023	2022
Large	2023	2022	2030
SUV	2023	2024	2033*

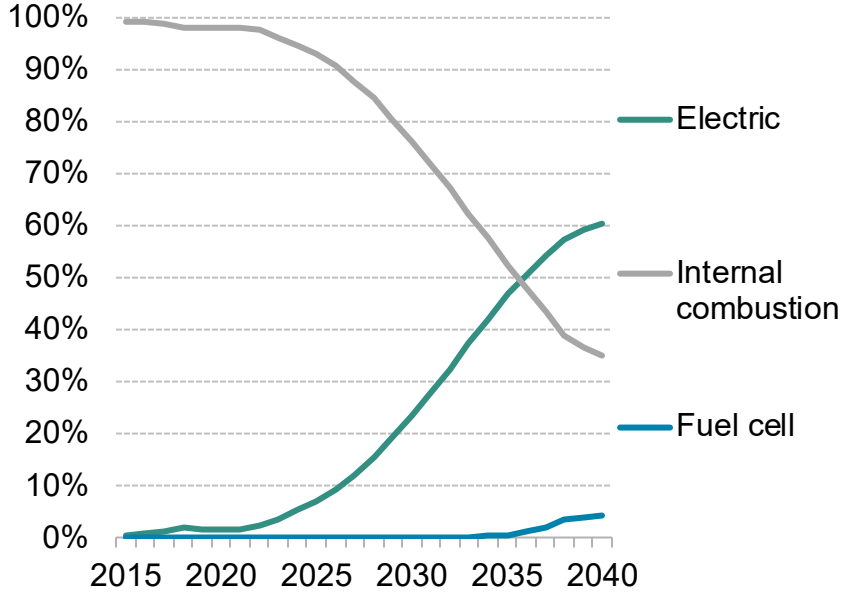
Source: BloombergNEF's "When Will EVs Be Cheaper Than Conventional Vehicles?". Note: We assumed the same real world driving range for EVs globally: small = 200 miles; medium = 250 miles; large and SUVs = 300 miles. (*) In China many smaller cars are classified as SUVs, thereby reducing the segment-average price.

The U.S. passenger EV sales are growing

U.S. annual passenger vehicle sales by drivetrain



U.S. share of annual passenger vehicle sales by drivetrain



Source: BloombergNEF. Note: Electric contains battery electric and plug-in hybrid.

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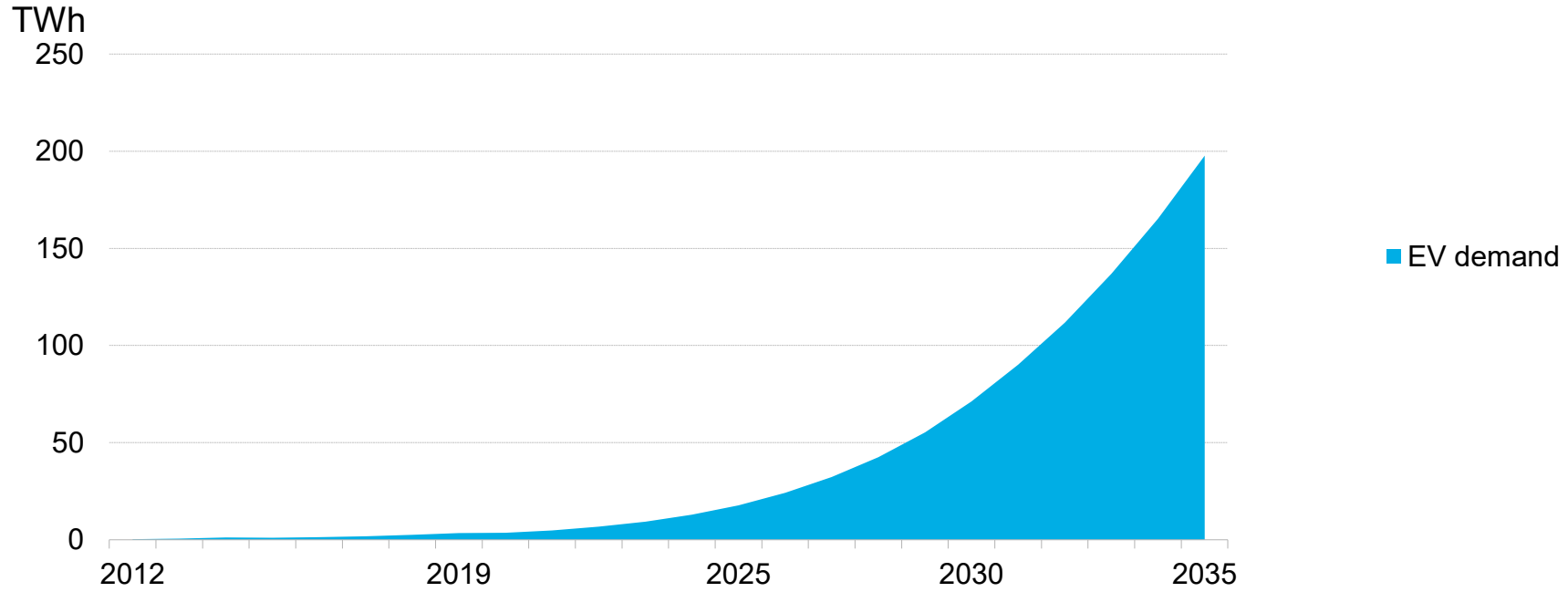
Electric vehicle uptake would increase power demand

U.S. EV electricity demand



Source: BloombergNEF

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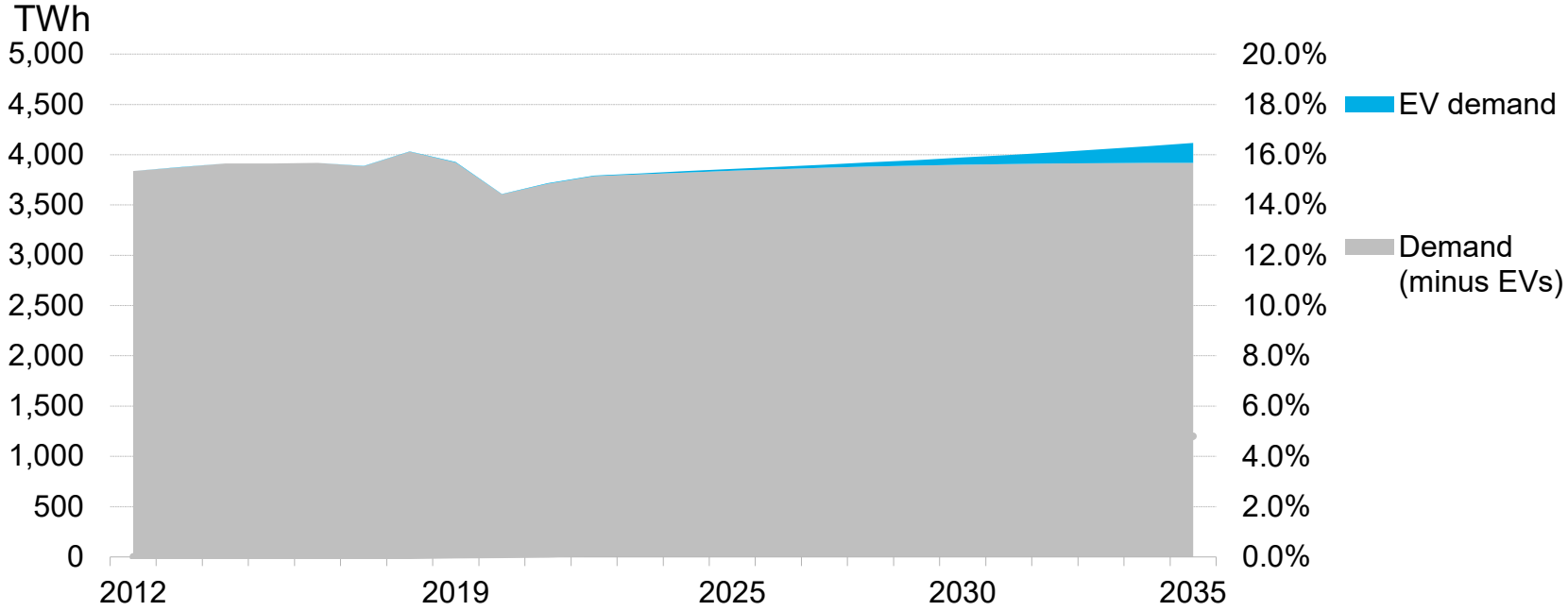
…Although not by a lot by 2035

U.S. electricity demand



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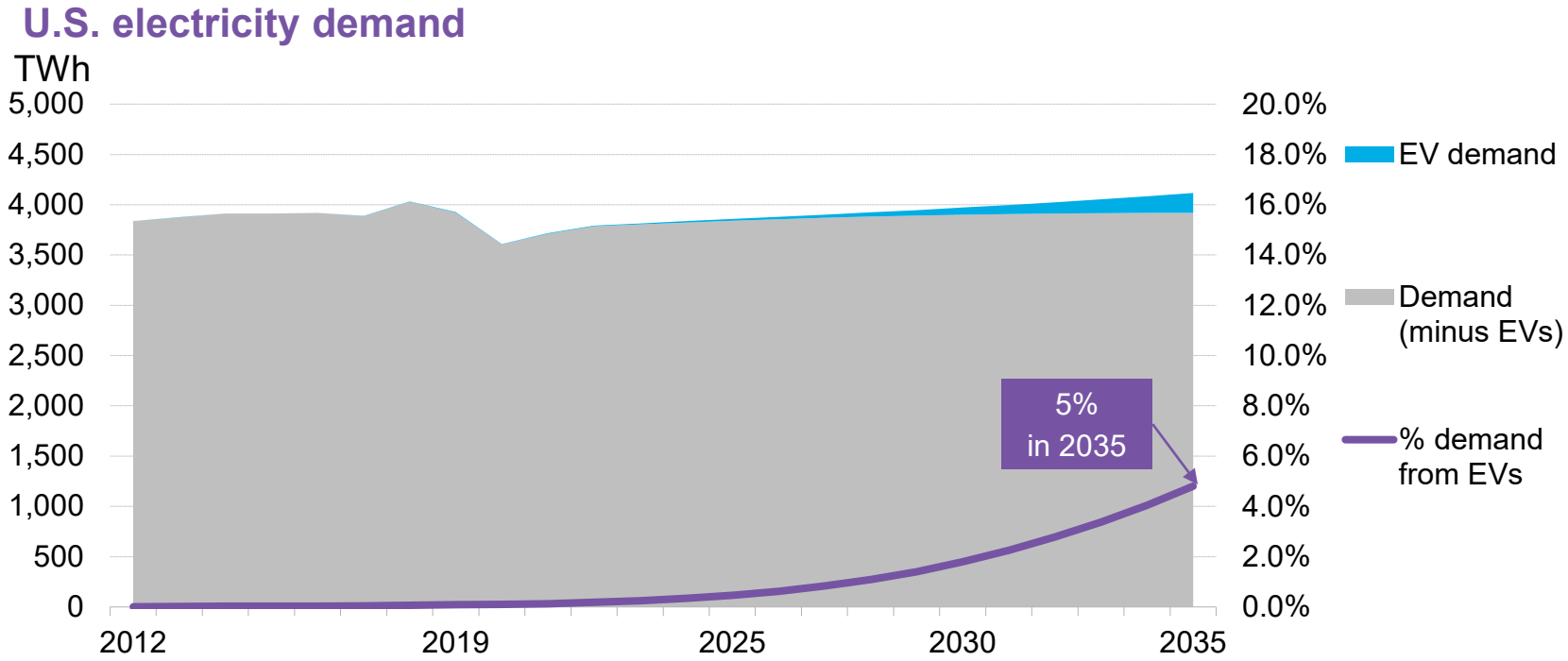

Source: BloombergNEF

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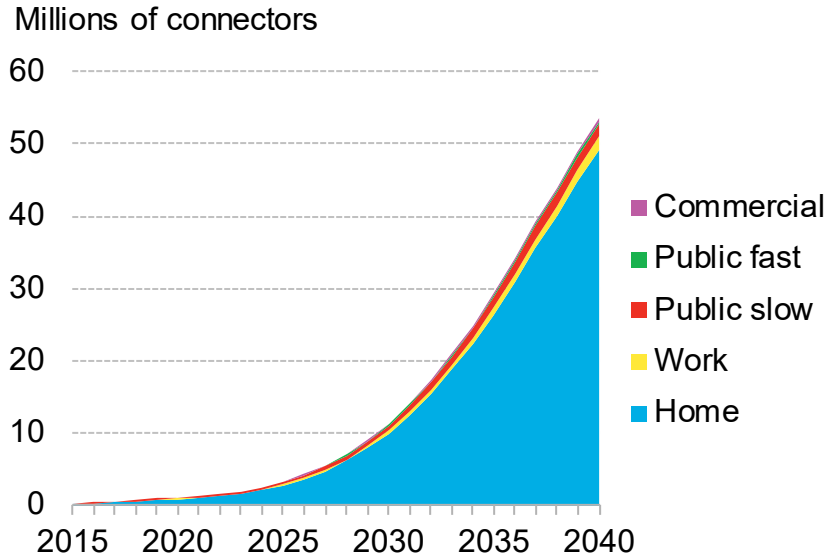
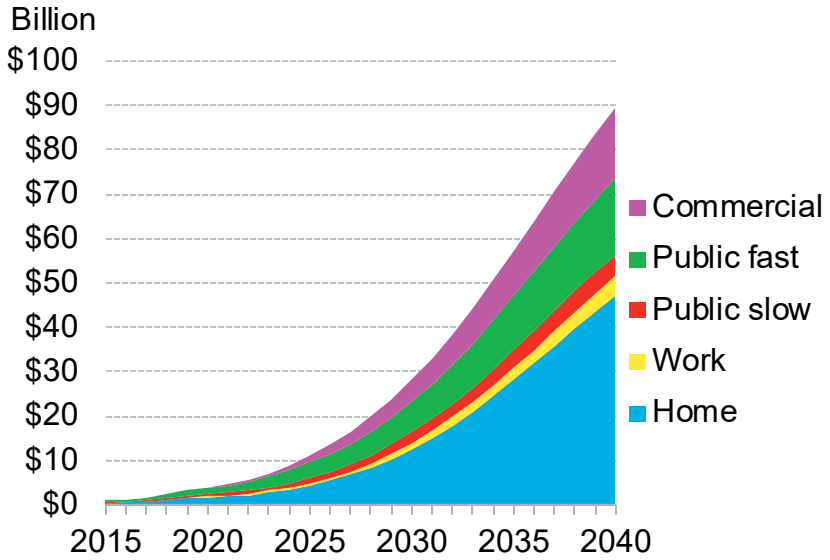
But major investments in charging infrastructure will be needed

Cumulative U.S. charging infrastructure demand forecast, by location



Cumulative U.S. charging infrastructure investment, by location



Source: BloombergNEF. Note: Analysis is using the latest forecast numbers for passenger vehicles and van – home charging. For more details, see our "Charging Infrastructure Forecast Model" (web). For details on our base case forecast, see our "Long-Term Electric Vehicle Outlook 2020" (web | terminal).

Electric vehicles are likely to happen, but ‘positive’ grid contribution is uncertain

Energy storage	Electric vehicles	Grids	Technology “X”
			
Known?	Known?		

Source: Tesla, Lockheed Martin, Electrive, R&D World

Grids are central to the transition, and under-appreciated

Energy storage	Electric vehicles	Grids	Technology “X”
			
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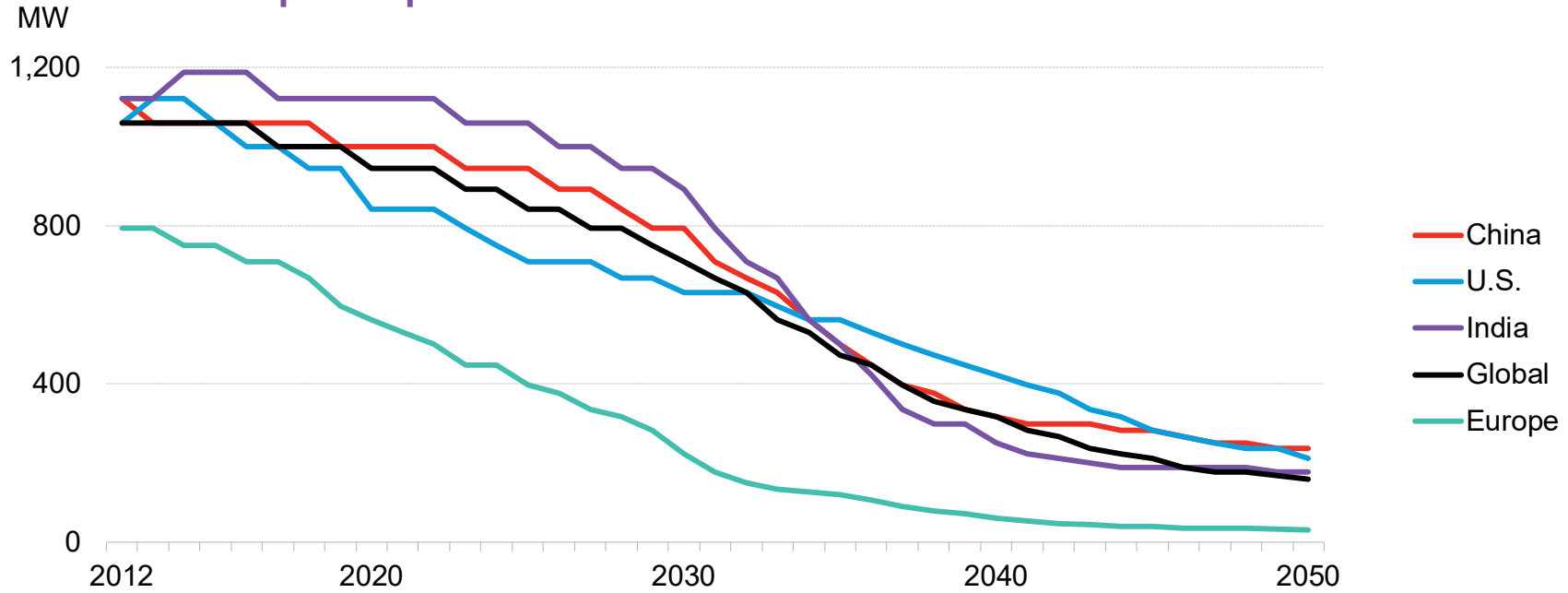
Power plants are becoming smaller, more and more of them will be added

Size of median power plant



Source: BloombergNEF

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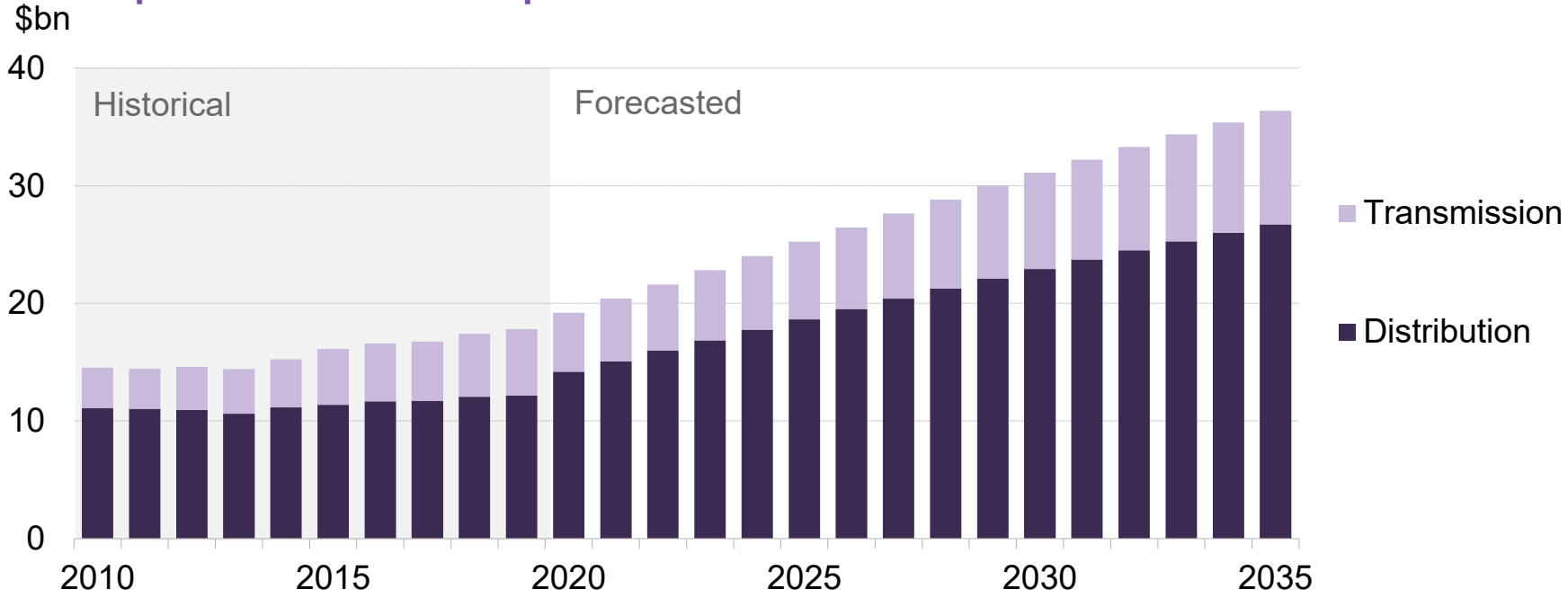
Grid investment needs to ramp up significantly

U.S. expenditure on asset replacements



Source: BloombergNEF

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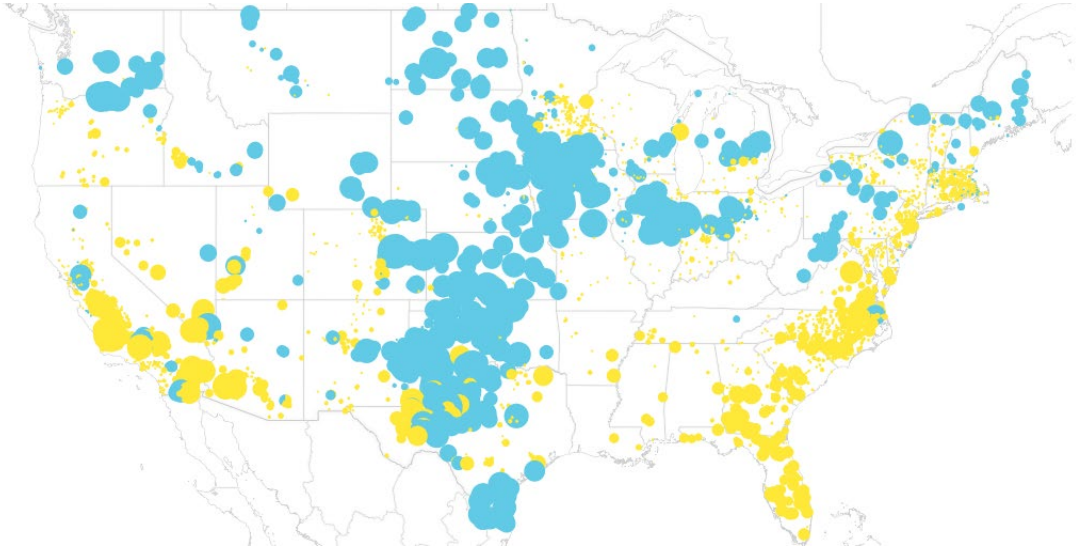
High quality renewable resources are often remote

U.S. renewable resources and demand



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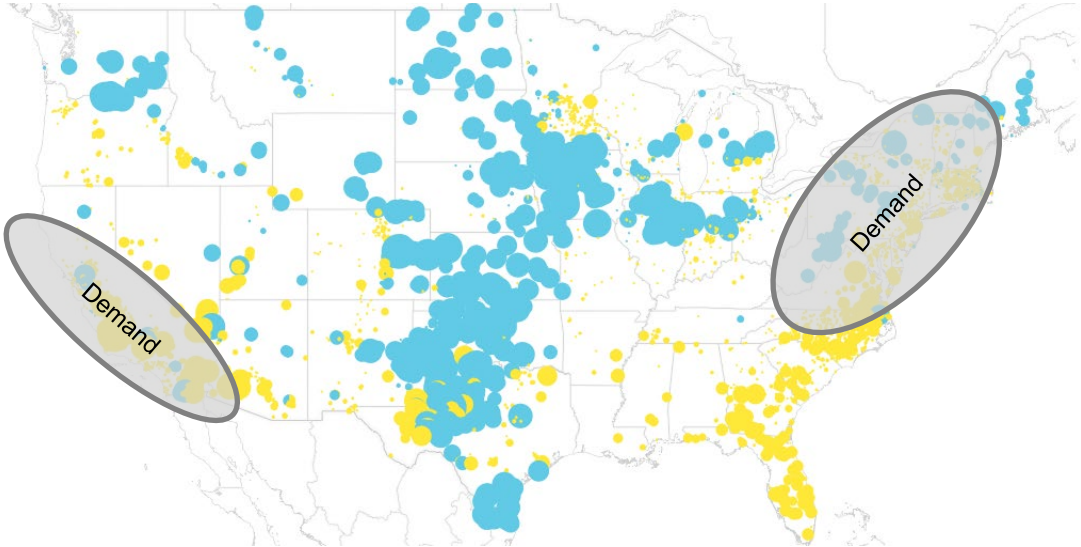

Source: BloombergNEF

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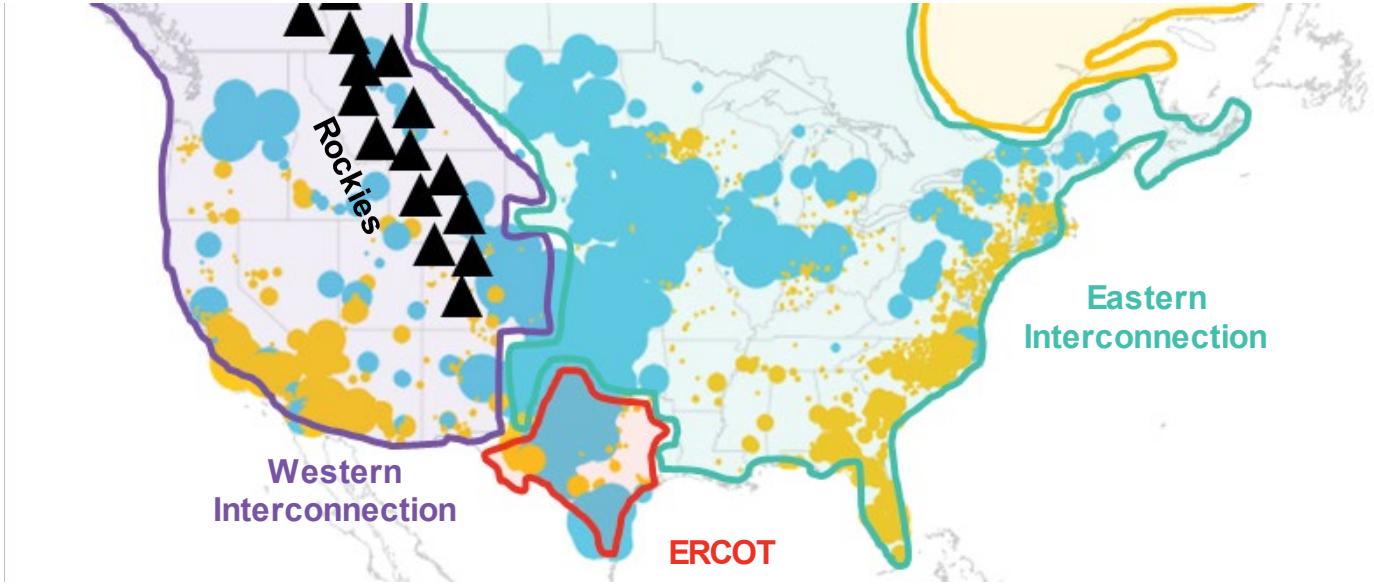
High quality renewable resources are often remote

U.S. Interconnection regions and wind and solar generation



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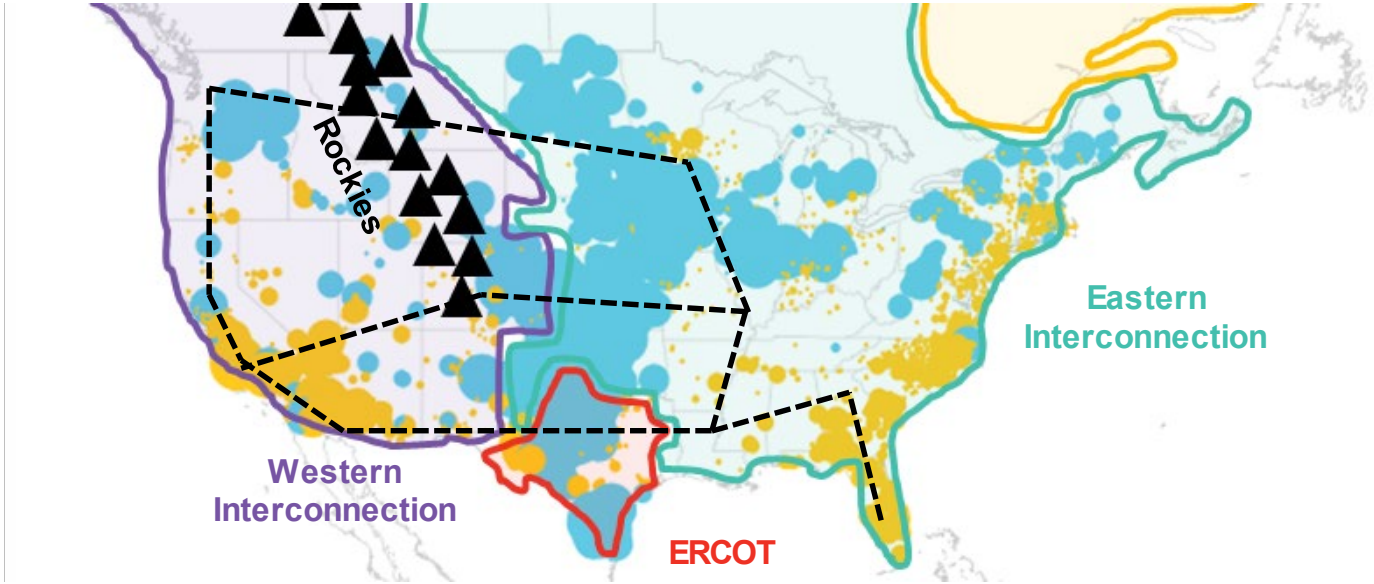
High quality renewable resources are often remote

Studied U.S. macrogrid



Source: BloombergNEF, NREL

More investment in grids is necessary with more ambitious clean power goals

Energy storage	Electric vehicles	Grids	Technology “X”
			
Known?	Known?	Known?	

Source: Tesla, Lockheed Martin, Electrive, R&D World

Technology “X”: Technologies that may be needed for the next-stage decarbonization

Source: BloombergNEF. Note: Green = Strength, Yellow = Neutral, Red = Weakness.

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It is firm?				
It the U.S. currently a leader in this field?				
How mature is it?				

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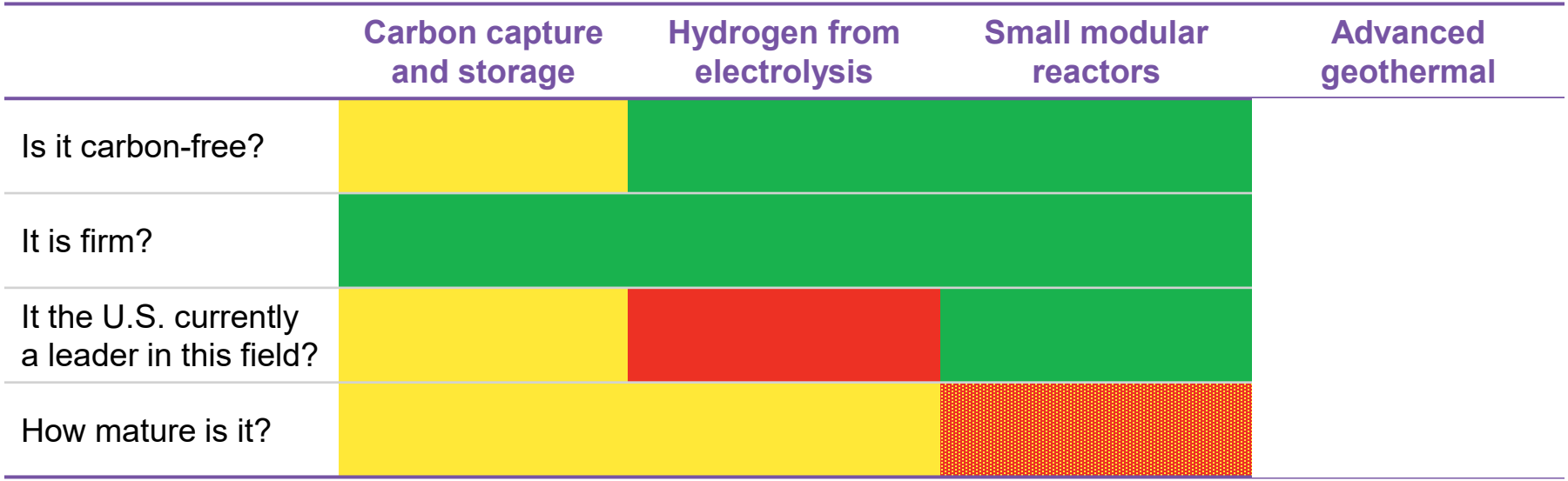

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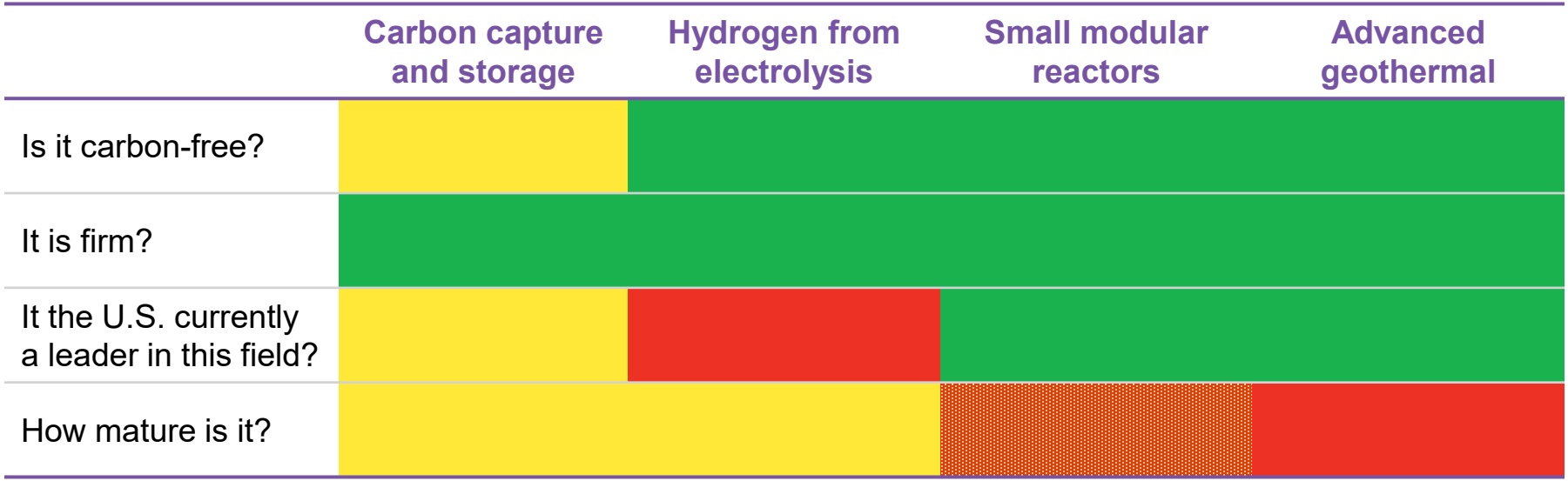

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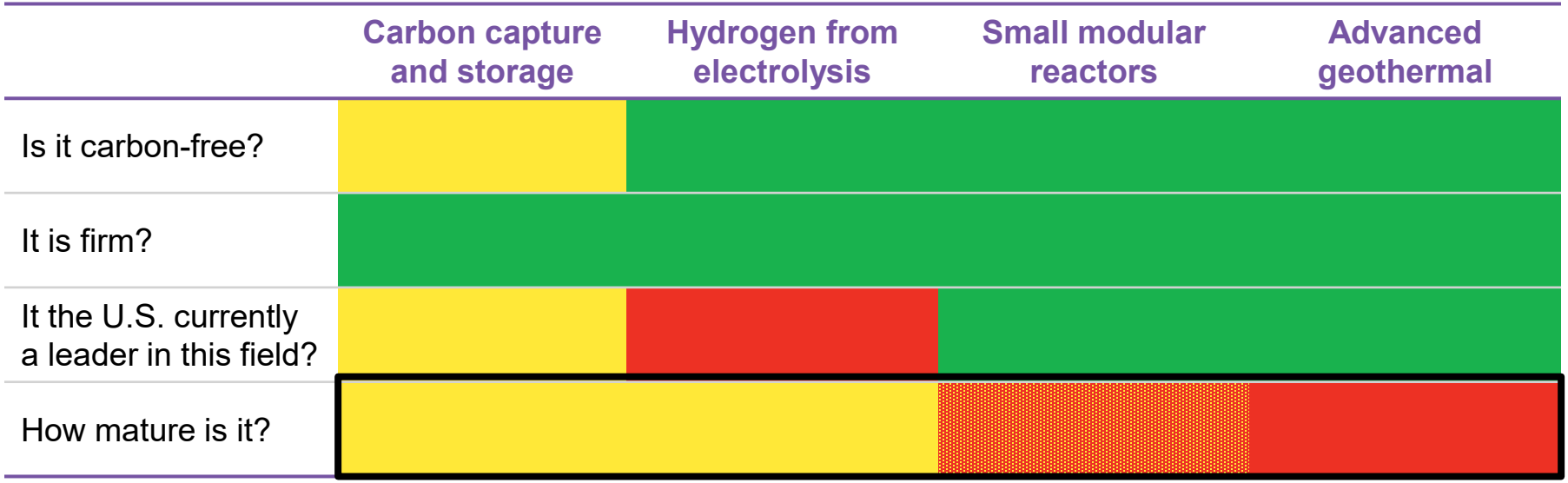

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There are more knowns than unknowns, but we'll need to the unknowns!

Energy storage	Electric vehicles	Grids	Technology "X"
			
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Source: Tesla, Lockheed Martin, Electrive, R&D World

Thank you!

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We help commodity trading, corporate strategy, finance and policy professionals navigate change and generate opportunities.

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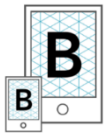

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