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Clean Energy Associates (CEA)

19 January 2023

8:00 am – 9:00 am | PST, Los Angeles

11:00 am – 12:00 pm | EST, New York City

5:00 pm – 6:00 pm | CET, Berlin, Madrid



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The IRA Impact on U.S. Clean Energy Manufacturing

Welcome!

Do you have any questions? ? 

Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  



Post-IRA Domestic U.S. Solar & Battery Manufacturing

January 2023



IRA: Solar Manufacturing Production Incentives



Image credit: Solar Power World Online

Production Incentives for Solar Manufacturing (Section 13502, IRS Section 45x)

Component	Tax Credits
Solar cells	\$ 0.04/watt
Wafers	\$ 12/m ²
Polysilicon	\$ 3/kg (must be 99.999999% pure)
Backsheets	\$ 0.40/m ²
Modules	\$ 0.07/watt
Inverter	Varies
Torque tubes (trackers)	\$0.87 per kg
Structural fasteners	\$2.28 per kg

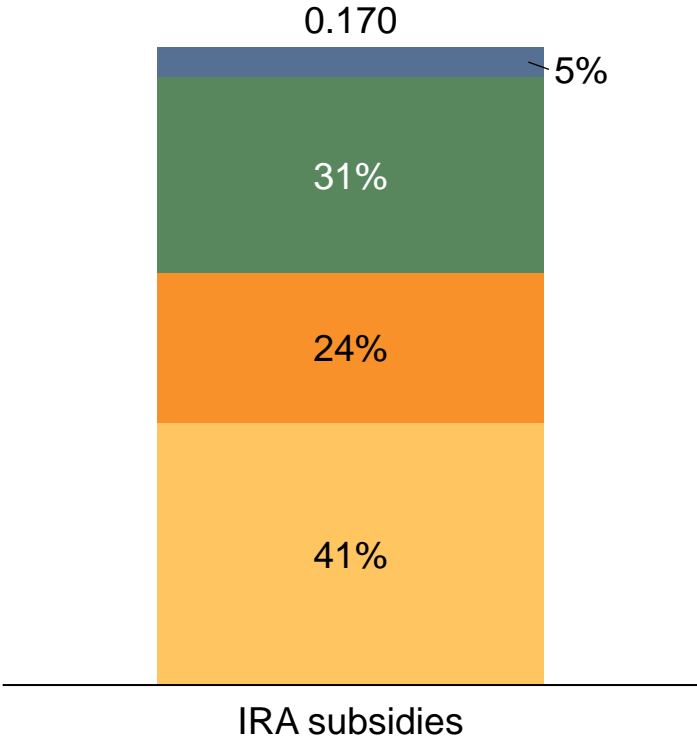
Note: Incentives phase down starting in 2030 (75%), no incentives after 2032

The new Section 45x tax credits provide incentives for many different steps along the solar and energy storage value chains

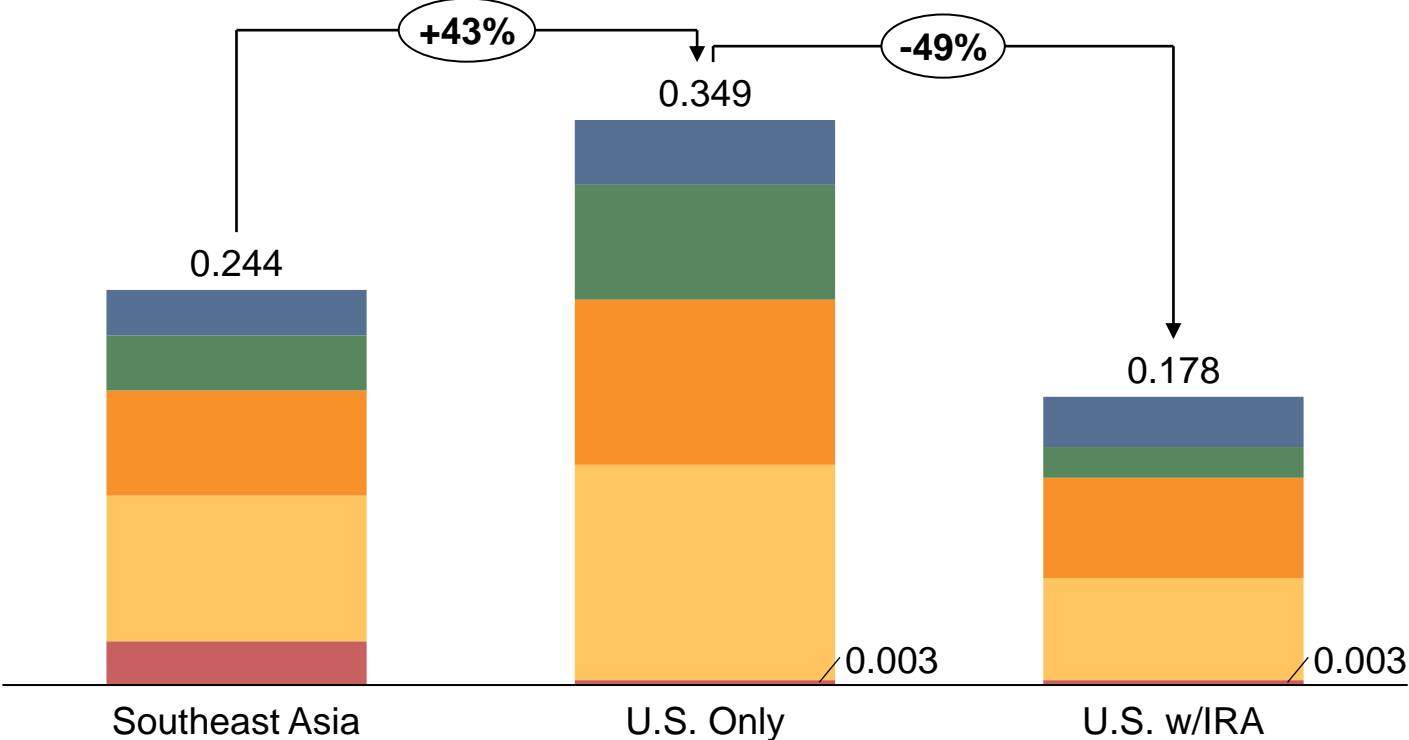
IRA Production Tax Credits Are Central to PV “On-Shoring”

IRA benefits level the playing field with imports

IRA manufacturing incentives (\$/w)



SEA v. U.S. cost stacks with and without IRA incentives (\$/w)



Polysilicon Wafer Cell Module Logistics

“Notes: Pure” markets assume all materials can be procured locally in a competitive market environment (many buyers and sellers). Costs/prices are extrapolated to a 2024 steady-state manufacturing ecosystem. Current SEA largely buys materials from China or local markets if the price is less expensive.

Timelines to Build & Ramp Factories Vary Across the PV Value Chain

The clock is ticking to get factories online and claim incentives



Time To Operation From Notice To Proceed	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Polysilicon																				
Ingots/Wafer																				
Cell																				
Module																				
Glass (CPS)																				
Aluminum																				
Silicon Metal (Wacker)																				

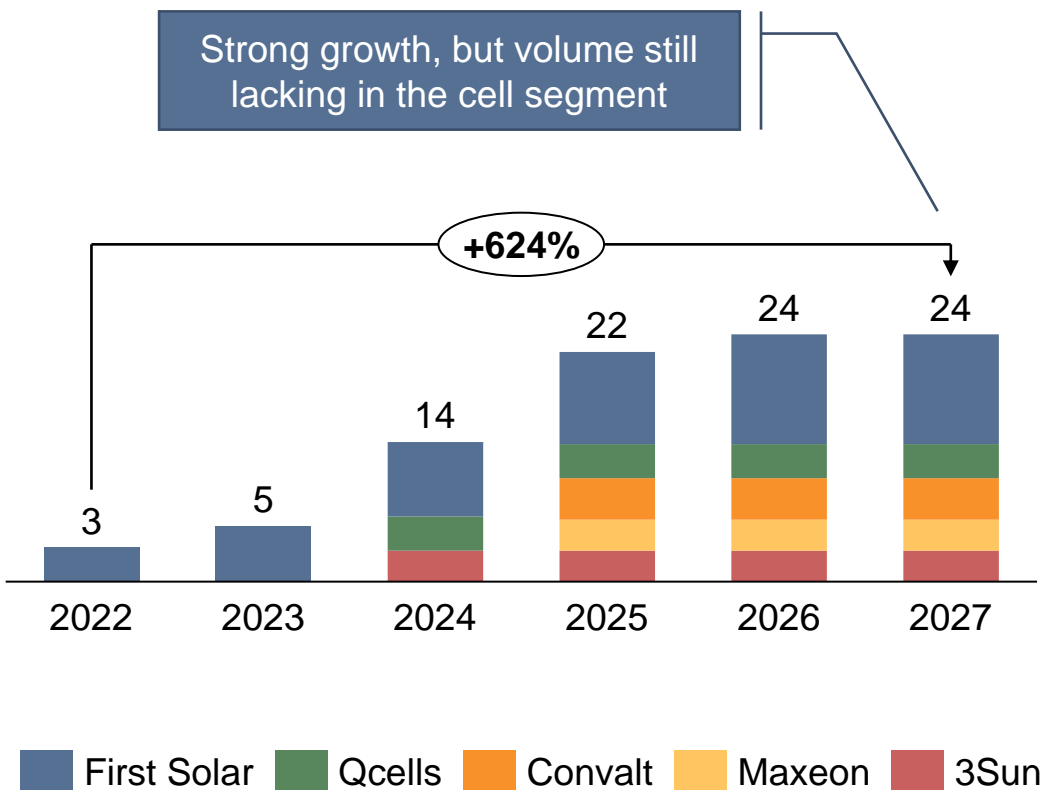
- While module factories can go from start of construction to fully ramped in ~18 months, ingot and wafer factories takes 3 ½ years and greenfield polysilicon plants 4 ½ years
- This leaves limited time to claim the Section 45x incentives before they begin phasing down in 2030.

Notes | All stages reflect 'run-rate' production timelines for full-scale production facilities (polysilicon: ~10 GW, wafers: ~7-10 GW, cells: ~5-7 GW, modules: ~3-5 GW);
Factories assume greenfield investments, brownfield plants and expansions may take less time.

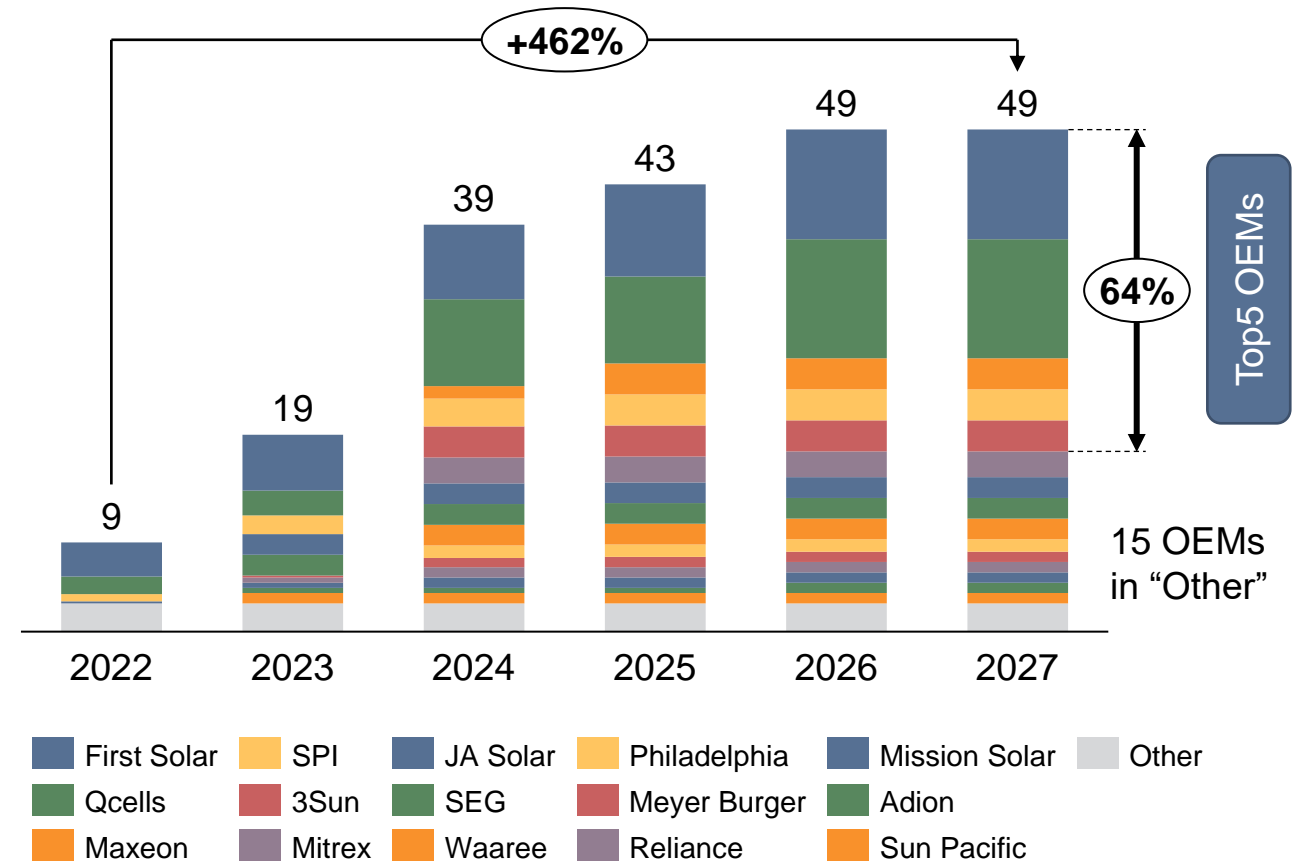
Mismatch between Cell & Module Announced Capacities

U.S. module makers will remain dependent on imported cells

U.S. cell manufacturing capacity outlook (GW)



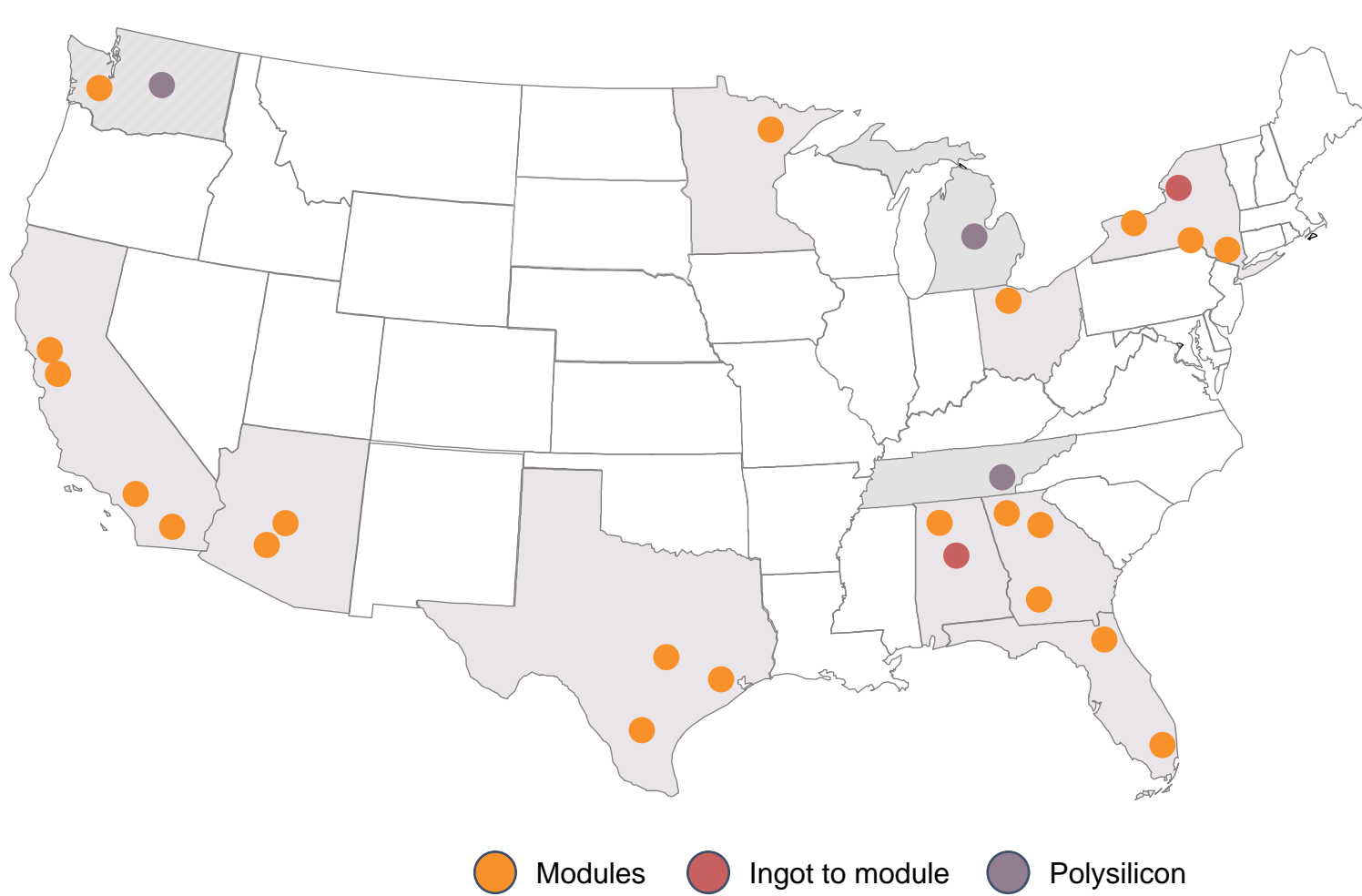
U.S. module manufacturing capacity outlook (GW)



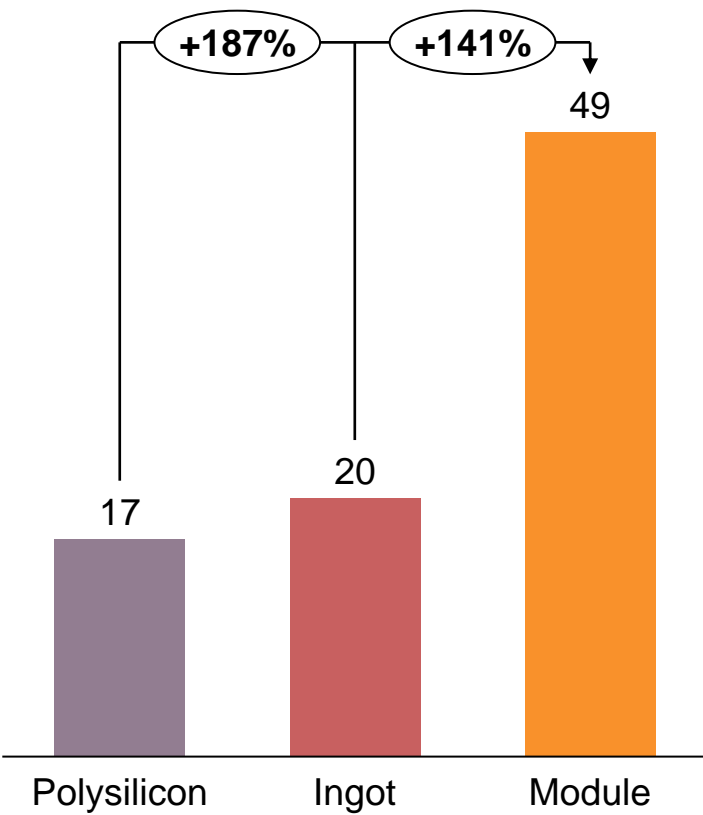
Note: Data aggregated by CEA based on company announcements and disclosures. Data does not account for utilization, ramp times, or other potential production delays. Timelines are based on supplier statements or industry best practices if no timeline data was reported.

Plans for Upstream Materials Lags Module Announcements

Ingot/wafer manufacturing has added risk of relatively inexperienced suppliers



U.S. manufacturing capacity outlook by component, YE 2027



Note: Data aggregated by CEA based on company announcements/disclosures

BESS: \$35/kwh Cell Credit to do more to Spur Manufacturing than the Electrode Active Material Credit

Production Incentives for battery Manufacturing (Section 13502, IRS Section 45x)

Component	Tax Credits
Electrode active materials	10% of active materials
Battery cells	\$35/kWh
Battery modules	\$10/kWh
Critical minerals	10% of cost of production



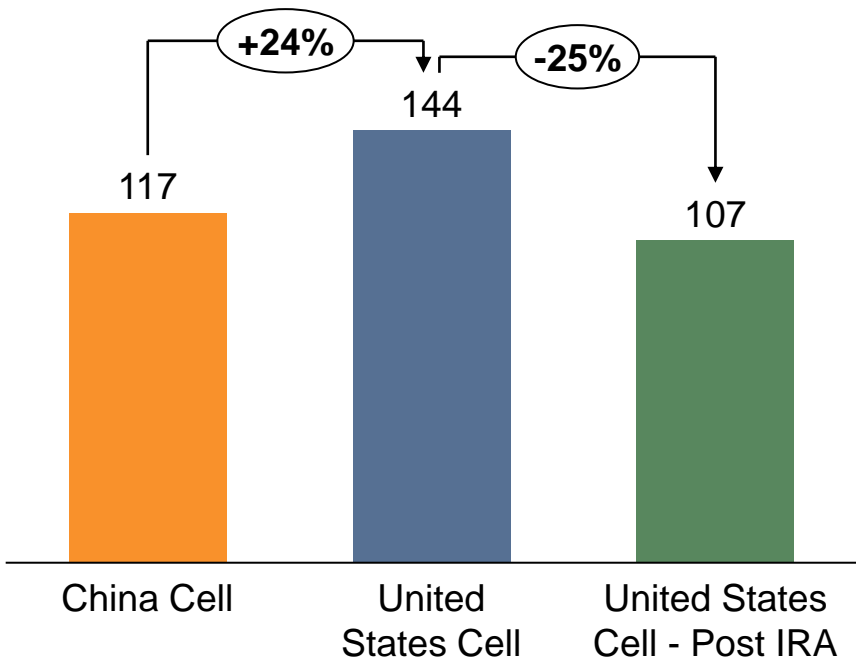
Domestic manufacturers can also claim a 6%/30% Advanced Energy Project Credit for building or refurbishing solar or energy storage factories, including recycling facilities (IRA Section 13501, USC Section 48c)

- To qualify for tax credits to offset 30% of investment costs, it is necessary to meet labor requirements (prevailing wage and apprenticeship utilization). Otherwise, the credit is 6%.
- The Section 48c credit is limited to \$10 billion and will be allocated by the Secretary of Energy.
- Manufacturers cannot claim both the Section 45x credits and the Section 48c Advanced Energy Project Credit; they must choose one or the other.

Similar to PV, IRA Incentives are Critical for Battery “On-Shoring”

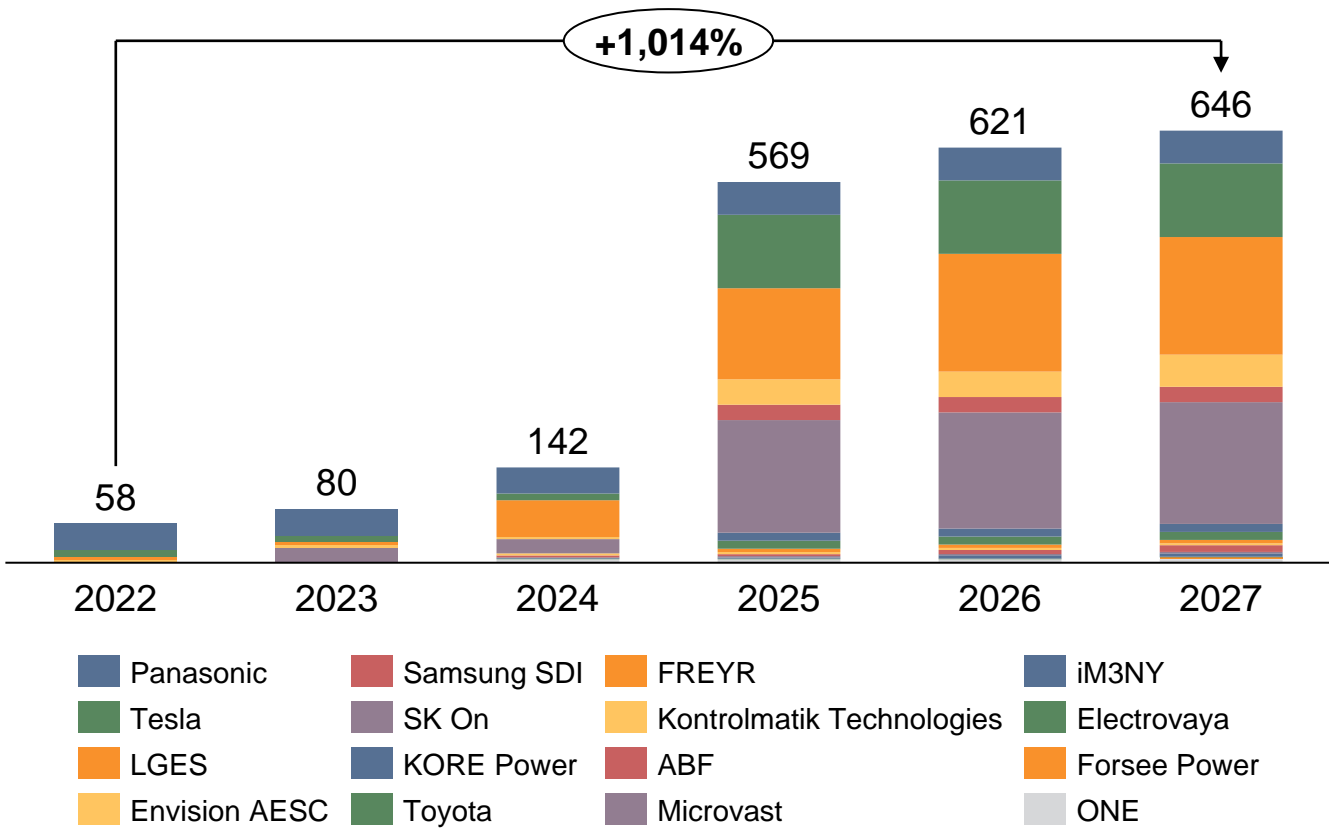
Massive battery cell capacity expansion is boosted by IRA

China v. U.S. cost stacks with and without IRA incentives (\$/kwh)



Note: Data is based on a data model created by E-source and refined by CEA. Post-IRA represents a manufacturing scenario available after the United States Inflation Reduction Act (IRA) passage using the \$35/kWh cell manufacturing credit and the incentives available for new factory set-up (Advanced Energy Credit) and the 10% electrode materials credit.

U.S. battery cell manufacturing capacity outlook (GW)



Note: Data aggregated by CEA based on public announcements and Benchmark Mineral Intelligence Megafactory Assessment Report December 2022.

Factory Complexity vs. Speed to Market

As you move up the domestic supply chain for PV, factories get to be more complex, ROI is longer, and fewer capable players currently exist.

PV Module Factory

- Annual Capacity: 500 MW
- Cost: \$150M
- Construction & ramping time: 12-18 months
- Site Size: 20 acres
- Building Size: 500,000 sq. ft.
- Headcount: 280



PV Cell Factory

- Annual Capacity: 500 MW
- Cost: \$300M
- Construction & ramping time: 18-24 mos.
- Site Size: 40 acres
- Building Size: 1,000,000 sq. ft.
- Headcount: 450



PV Ingot/Wafer Factory

- Annual Capacity: 500 MW
- Cost: \$700M
- Construction & ramping time: 36-42 mos.
- Site Size: 40 acres
- Building Size: 1,000,000 sq. ft.
- Headcount: 250



- Figures are approximate and based off a common, minimum, North American crystalline factory size.
- Headcount is highly dependent on factory automation level used.



Thank you!

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Q&A



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Fossil fuels already peaked, growth in renewables exponential

by Ryan Kennedy



Most-read
online!

Ørsted to commence construction on 471 MW Texas solar project

by Ryan Kennedy



Coming up next...

Wednesday, 25 January 2023

9:00 am – 10:00 am PST, Los Angeles

12:00 pm – 1:00 pm EST, New York City

Tuesday 31 January 2023

10:00 am – 11:00 am CET, Berlin, Paris, Madrid

1:00 pm – 2:00 pm Dubai

Many more to come!

**Hindsight to
foresight:
Applying lessons
from solar to
battery storage**

**Kicking off the
heterojunction
era**

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Anne Fischer
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