Rooftop PV and the state of Southeast markets

Georgia Tech Cleantech Speaker Series

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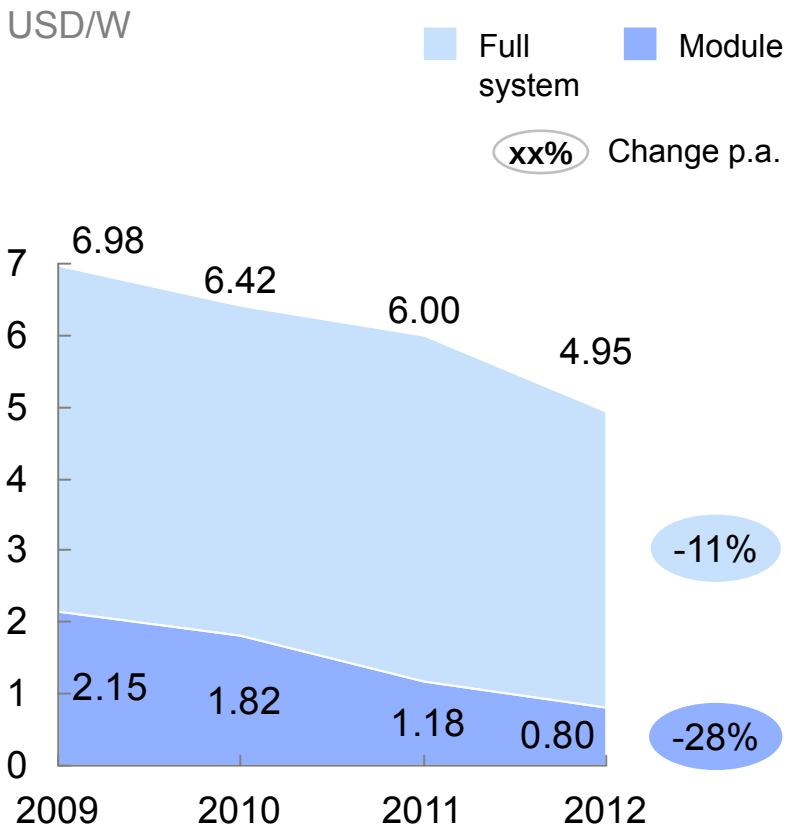
Rooftop PV and the state of Southeast markets

Rooftop Solar PV has made advances in economic viability and is rivaling "grid parity" in some regions. To date, the Southeast has seen less solar penetration then other regions but could make significant in-roads over the next five to ten years.

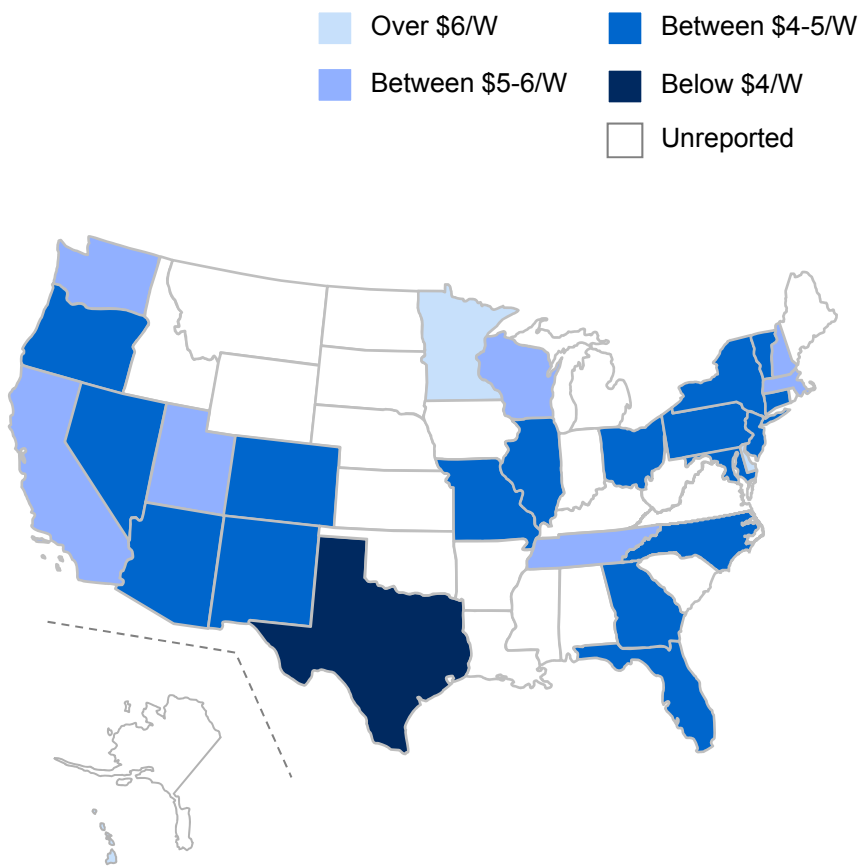
- **The full installation price of solar has dramatically declined, but will have to drop further to compete with grid electricity in most of the US, including in the Southeast.** The price of solar remains well above $3/W in most places, but needs to approach $2/W before achieving "grid parity" in most states
- **Favorable incentives and policies can accelerate the adoption of rooftop solar, though the Southeast generally has lagged other regions in such incentives and policies.** In particular, direct incentives and third party ownership accelerates solar development, as we see from examples in other states
- **As to the future of rooftop solar in the Southeast, the combination of declining solar costs, rising utility prices, and supportive incentives and policies could lead to relatively fast uptake of solar - and put pressures on the traditional utility business model.** Key policy questions driving the future adoption of rooftop solar include "how will solar power be fairly valued?" and "how will grid services be fairly priced?"

The initial price of installing solar (excluding post installation subsidies) has been rapidly declining, though wide variation exists between states

Average reported solar prices



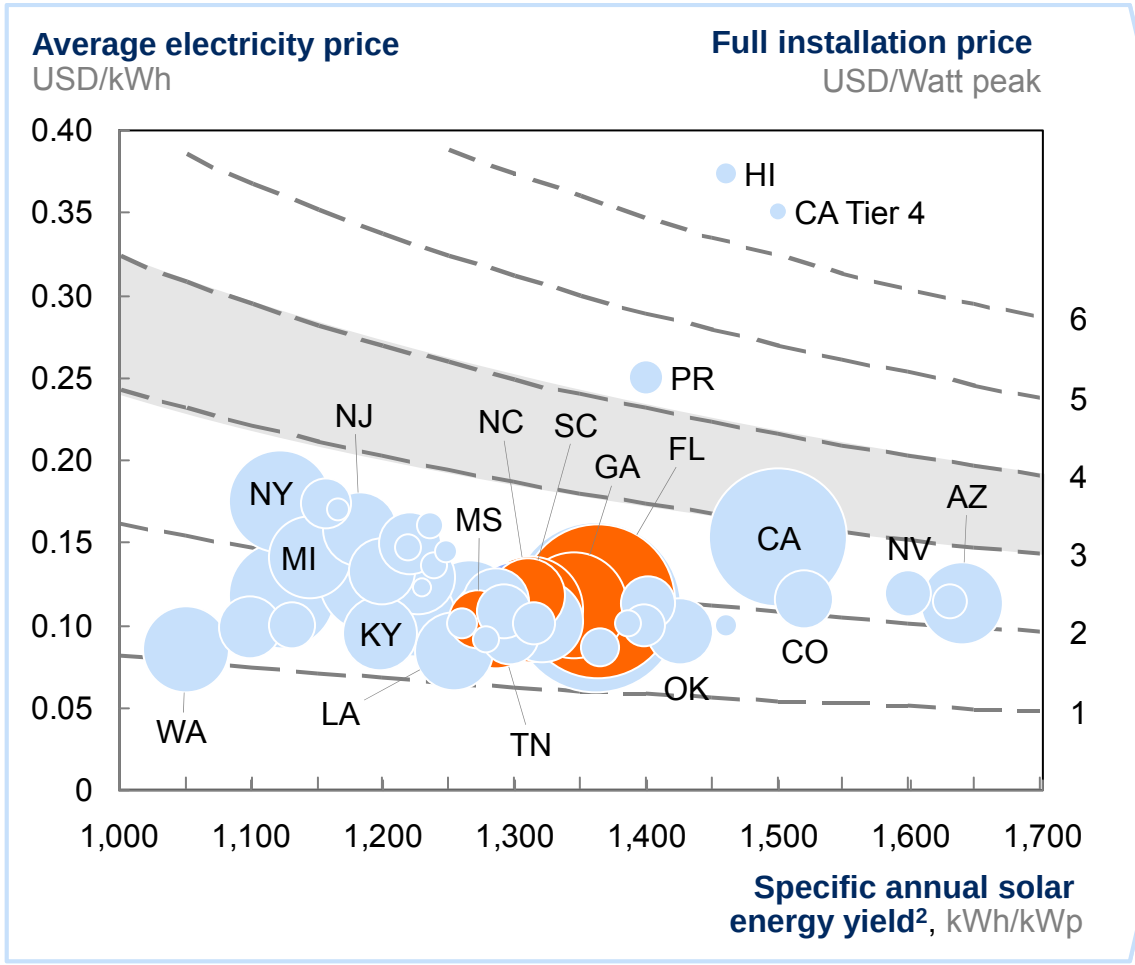
Observed residential installed prices

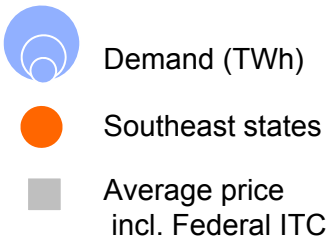


SOURCE: GTM Research

As installed prices decrease, solar reaches "grid parity" with retail electricity in a growing number of markets

Residential example[1]



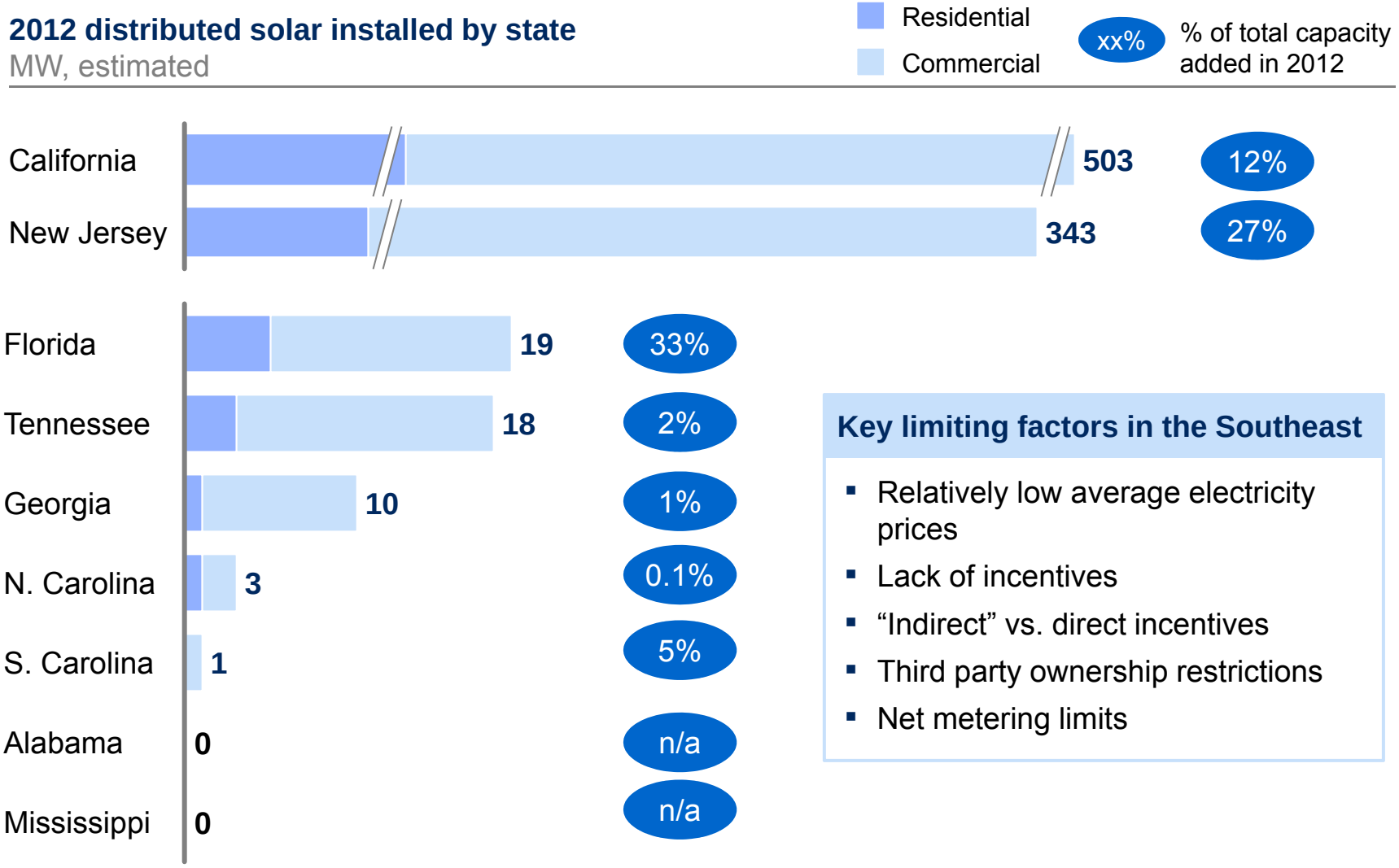


- $2/W is the ":magic number" to unlock most states
- Southeast states are around or below the $2/W threshold
- In some states, (e.g. California, and New Jersey) subsidies have improved solar economics enough to encourage adoption

1 Size of bubbles represent total residential TWh at stake
2 Amount generated by a south-facing 1 kWp module in 1 year (a function of solar intensity)

SOURCE: Ventyx Energy Velocity; EIA; PV Watts; Utility publications; McKinsey Global Solar Initiative

Distributed solar development in the Southeast has been limited thus far



Key limiting factors in the Southeast

- Relatively low average electricity prices
- Lack of incentives
- "Indirect" vs. direct incentives
- Third party ownership restrictions
- Net metering limits

SOURCE: GTM Research, McKinsey analysis

Market incentives and regulations are key contributors to market adoption; the Southeast is less aggressive than other regions

Available
Available for some
Not available

More direct → Less direct

Rebate	FiT/PBI[1]	State ITC	Other tax	3rd party ownership	NEM aggregate and system limits
■	■	□	■	✓	▪ 5% aggregate demand ▪ 1 MW
□	■	□	■	✓	▪ None enforced ▪ Equal to site consumption
□	□	▨	■	✗	▪ 0.2% utility peak load ▪ 10kW res; 100kW non-res
□	■	□	■	✗	▪ No aggregate limit ▪ 2 MW system
□	□	■	□	✗	▪ No aggregate limit ▪ 1 MW system
▨	□	■	■	?	▪ 0.2% utility peak load ▪ 20kW res; 100 kW non-res
□	□	■	□	?	▪ None specified
□	□	□	□	?	▪ None specified

1 Feed-in tariff or Production-based incentives

SOURCE: Database of State Incentives for Renewables and Efficiency (DSIRE)

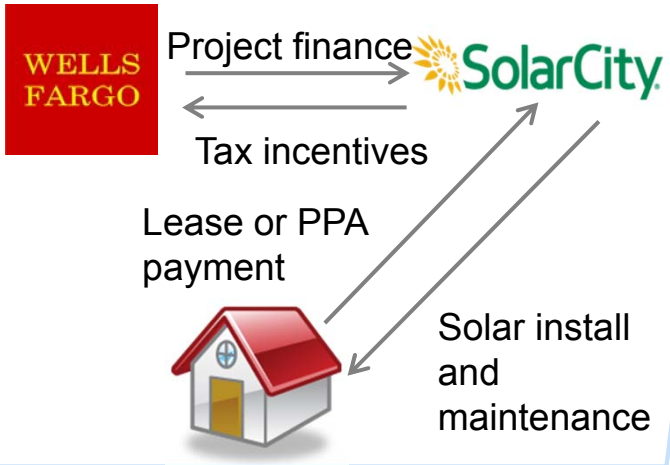
Third party ownership have been an important driver of growth for solar in other states

xx 2011-12 installed MW

What is third party ownership?

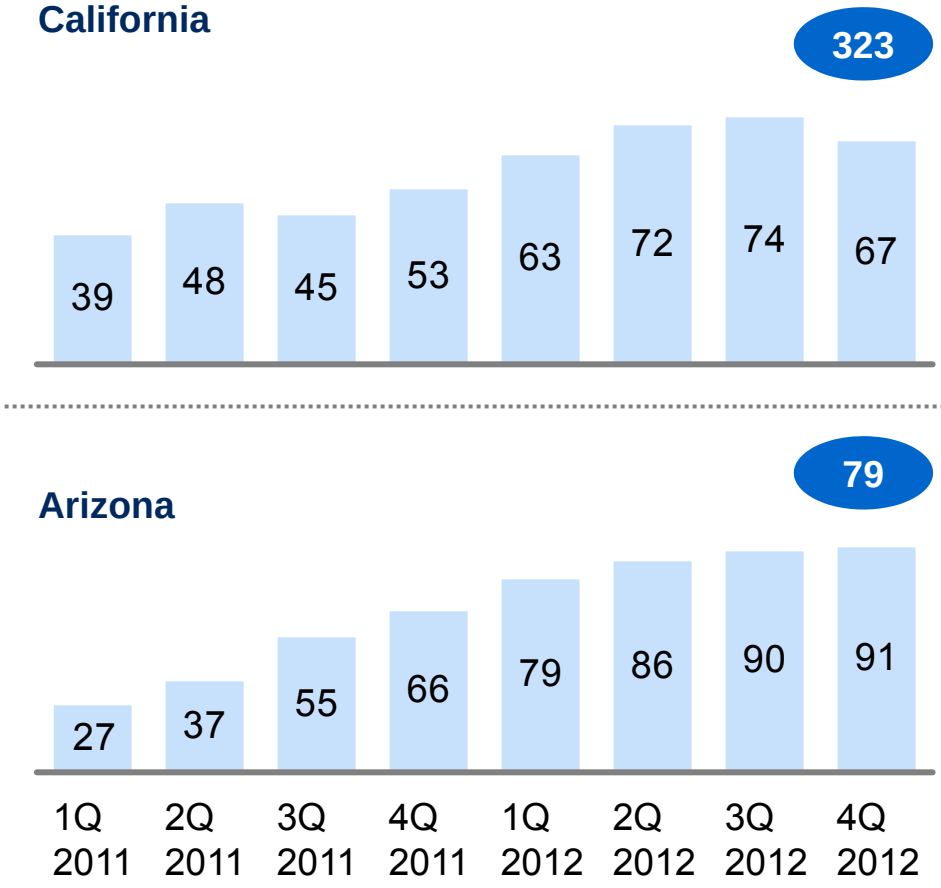
Developers retain ownership of customer-sited rooftop systems; sell electricity to site customers in the form of a PPA or flat lease

- Customers can "go solar" without an upfront investment
- Developers and their investors to fully utilize corporate tax credits + other incentives
- Does not require solar company to classify as a utility



Percent of installed capacity that is 3rd party owned

Residential



SOURCE: GTM Research, McKinsey analysis

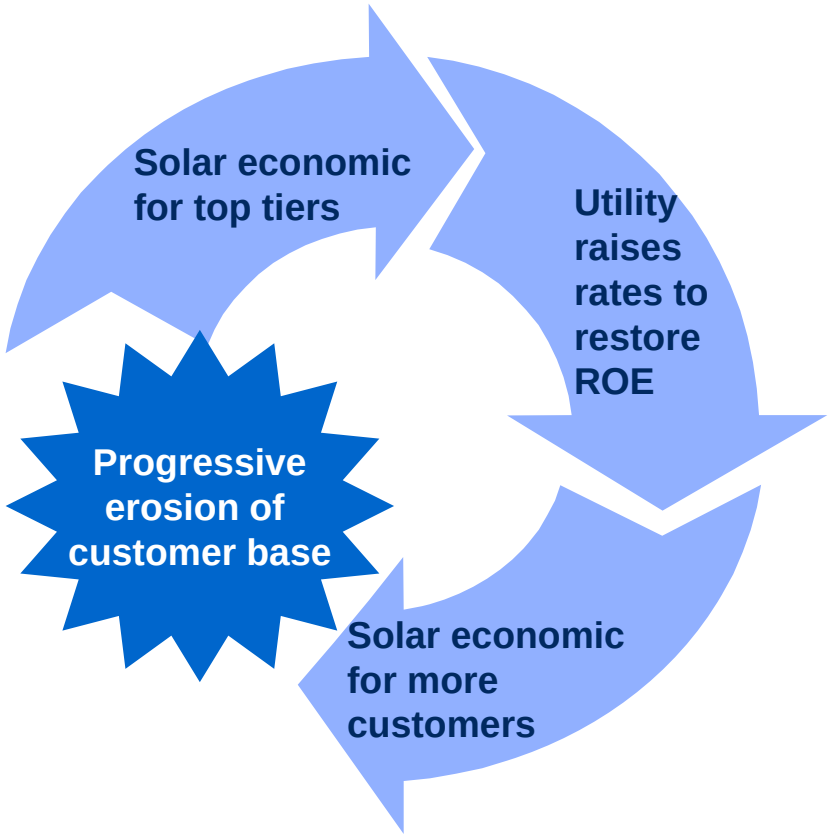
States typically raise NEM limits as thresholds are approached, but subsequent solar adoption can put pressure on the utility business model

System and jurisdictional NEM limits

- State law has traditionally set:
  - **System limit**: size of individual interconnected DG eligible for net metering
  - **Aggregate limits**: How much total capacity can be grid interconnected for net metering in a utility territory
- States have tended to adjust net metering limits upward when capacity nears the ceiling

States	Old aggregate limit[1]	New aggregate limit[1]
HI	5% utility peak demand	15% per distribution circuit
CA	2.5% utility aggregate peak	5% utility peak demand
MA	1% utility peak demand	3% of utility peak demand

NEM compensation can create a vicious cycle for utilities



1 Sometimes varies by utility or implementing sector; value listed is the one that is most prevalent in the state

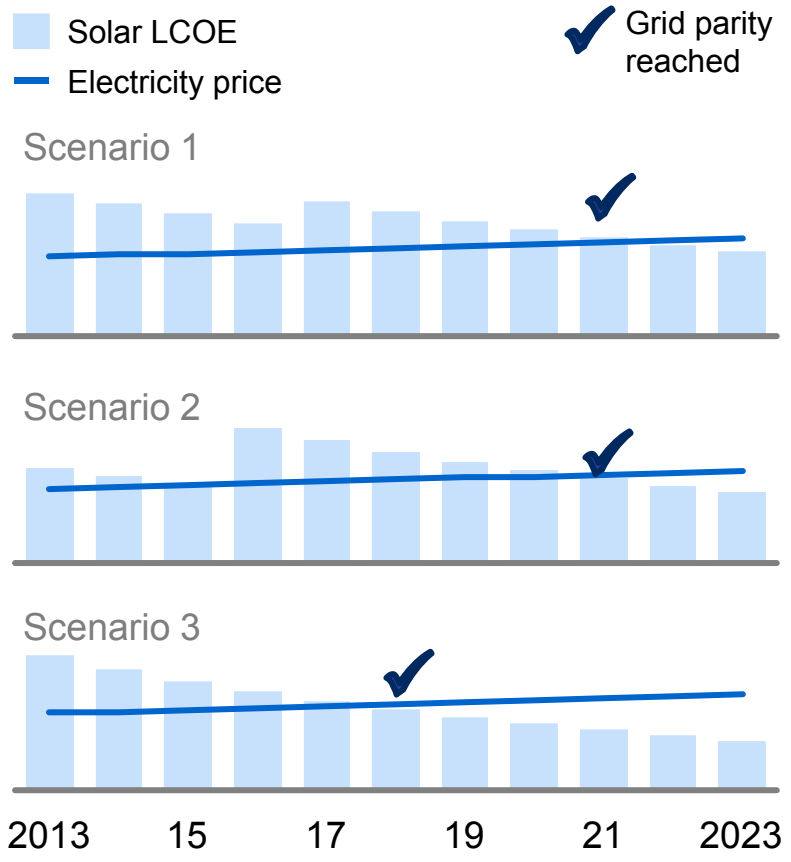
SOURCE: DSIRE, Energy Velocity, McKinsey analysis

Utilities are modeling alternative scenarios around solar reaches grid parity and the rate of adoption, to assess load loss

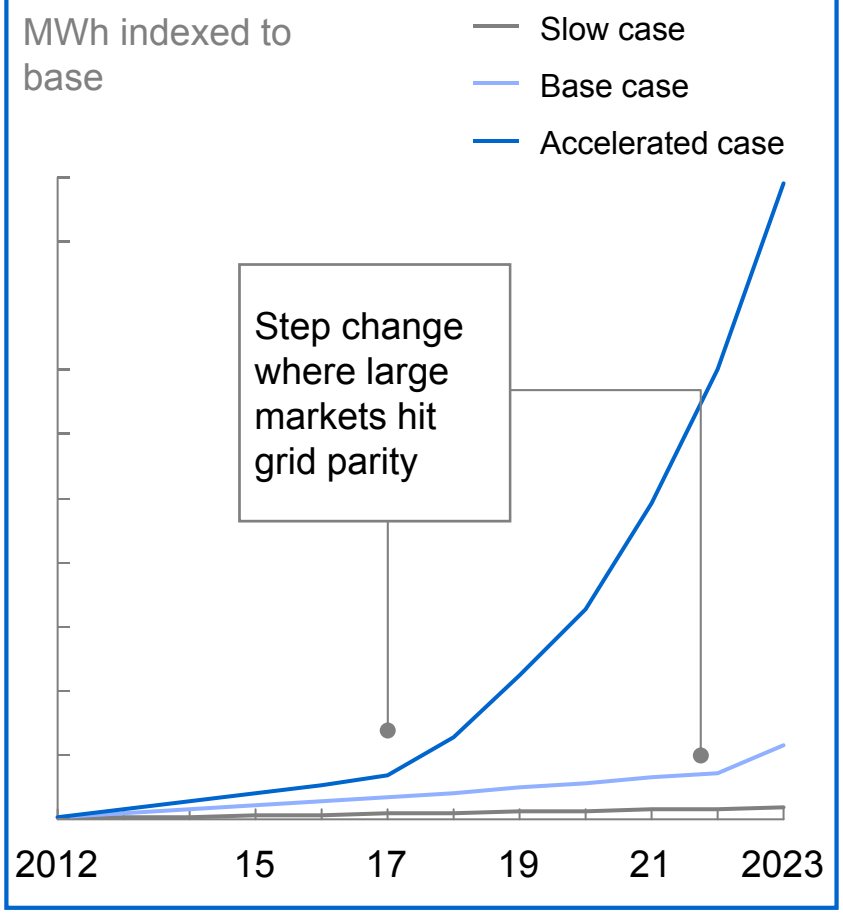
ILLUSTRATIVE

Solar vs. retail electricity cost by market

¢/kWh, LCOE vs. average retail electricity price

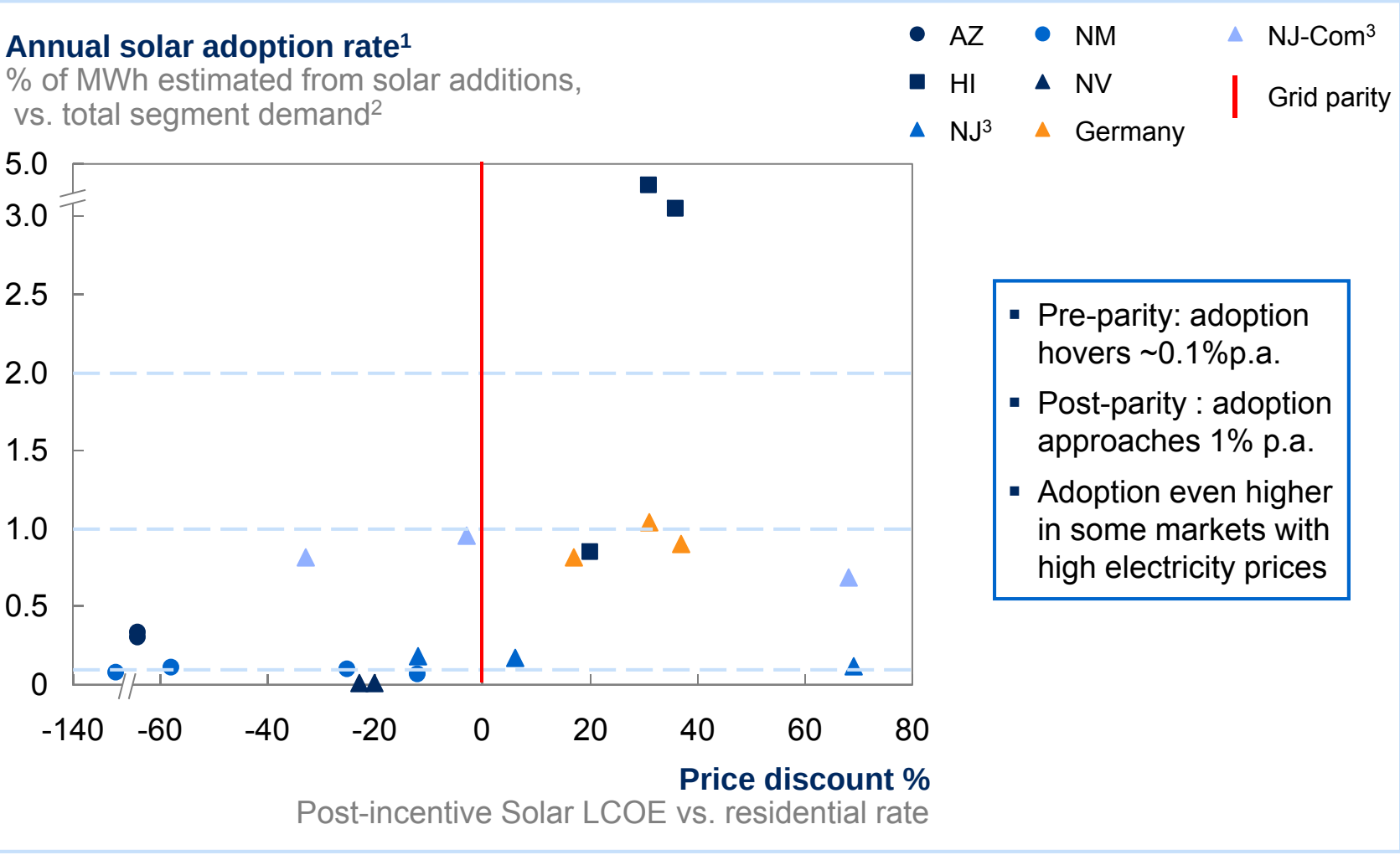


Projected demand reduction



SOURCE: McKinsey analysis

While the data sets are still somewhat limited, an emerging pattern of adoption rates can be seen pre- and post-parity relative to grid prices



1 2013 Normalized for full year based on 1Q data 2 Based on residential data, except where noted 3 REC market makes it difficult to quantify LCOE

SOURCE: GTM Research, Ventyx Energy Velocity, McKinsey analysis

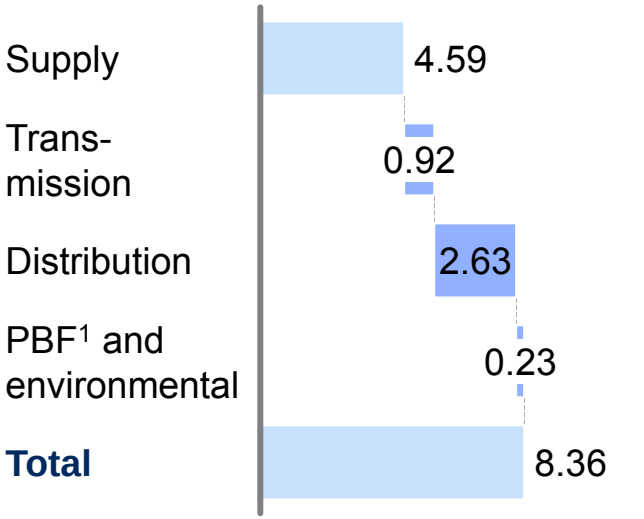
Fundamental policy question: Is “grid parity” the right comparison point?

Is “grid parity” the right metric?

- Currently we determine “grid parity” as the average sales price
- Electric charges are broken up into multiple components

Example volumetric electric charge

USD Cents/kWh



+ Customer connection charge

+ Tax

What is the fair value of rooftop solar power?

Potential factors

- Avoided generation?
- Avoided distribution & transmission charges?
- Time of day adders?
- Environmental benefits?

What is the fair value of utility grid services?

Potential factors

- Distribution system maintenance?
- Capacity charges?
- Standby charges?
- Public benefit charges?

1 Public benefit fund

SOURCE: Commonwealth Edison, NRRI, McKinsey analysis

Some utilities and jurisdictions are developing innovative policy frameworks for solar

Value of solar tariffs (VOST) are calculated annually, based on a combination of factors:

- Marginal cost of displaced energy
- Avoided capital cost of building new centralized generation
- T&D line loss savings and upgrade expenses
- Environmental benefits

Solar customers are essentially dual metered

+ Billed for all electricity consumed on-site on a regular residential rate
- Credited for solar electricity generated on-site according to the VOST calculation

VOST intends to be an improved compensation method over net metering

- Rate algorithm attempts to account for both benefits and costs to utility system due to DG solar
- Helps utility preserve traditional revenue model
- Removes disincentives for energy efficiency

A few jurisdictions are employing or developing VOST already

AUSTIN ENERGY

CPS ENERGY

THE GREAT SEAL OF THE STATE OF MINNESOTA · L'ETOILE DU NORD · 1858

SOURCE: Austin Energy, press search, McKinsey analysis

APPENDIX

Future demand destruction in Georgia?

Solar advocates battle Georgia Power for more favorable regulations

- Feb 2012: Senate Bill 401 proposed changes to allow third party PPAs in the state and remove DG interconnection limits
- Nov 2012: Georgia Solar Utilities petitioned the PSC to operate as a utility and sell directly to customers

Georgia Power then launches voluntary DG solar program

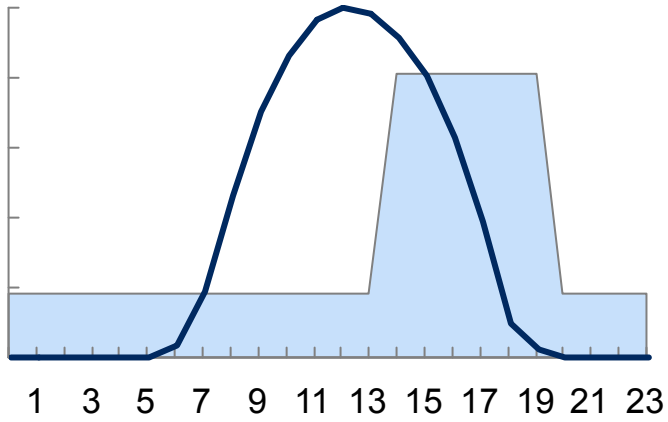
- Small and medium sized customers can sell output from <100 kW systems; paid $0.13/kWh over 25 years

And later proposes changes to rates, including charges to solar customers

- Standby charge of ~$22/month proposed; customers on time of use rates or selling output to Georgia Power exempt

Although TOU is preferred by the utility, it also helps solar customers shave demand during peak price periods

Illustrative hourly solar output vs. TOU rate blocks



- 4 kW system could earn ~$0.10/kWh on average with TOU pricing
- Highest price tier for generic rates is ~$0.9 cents/kWh; with solar, customers may drop to lower tiers
- Flat standby charge would likely encourage switching to TOU

A combination of **solar's favorable generation profile vs preferred rate structures,** as well as recent **regulatory pressure**, puts Georgia Power at risk for future solar demand destruction

SOURCE: Georgia Power, NREL, press search, McKinsey analysis