

# Florida's Energy Future

## Efficiency, Solar, Energy Storage & EVs

James Fenton, Director

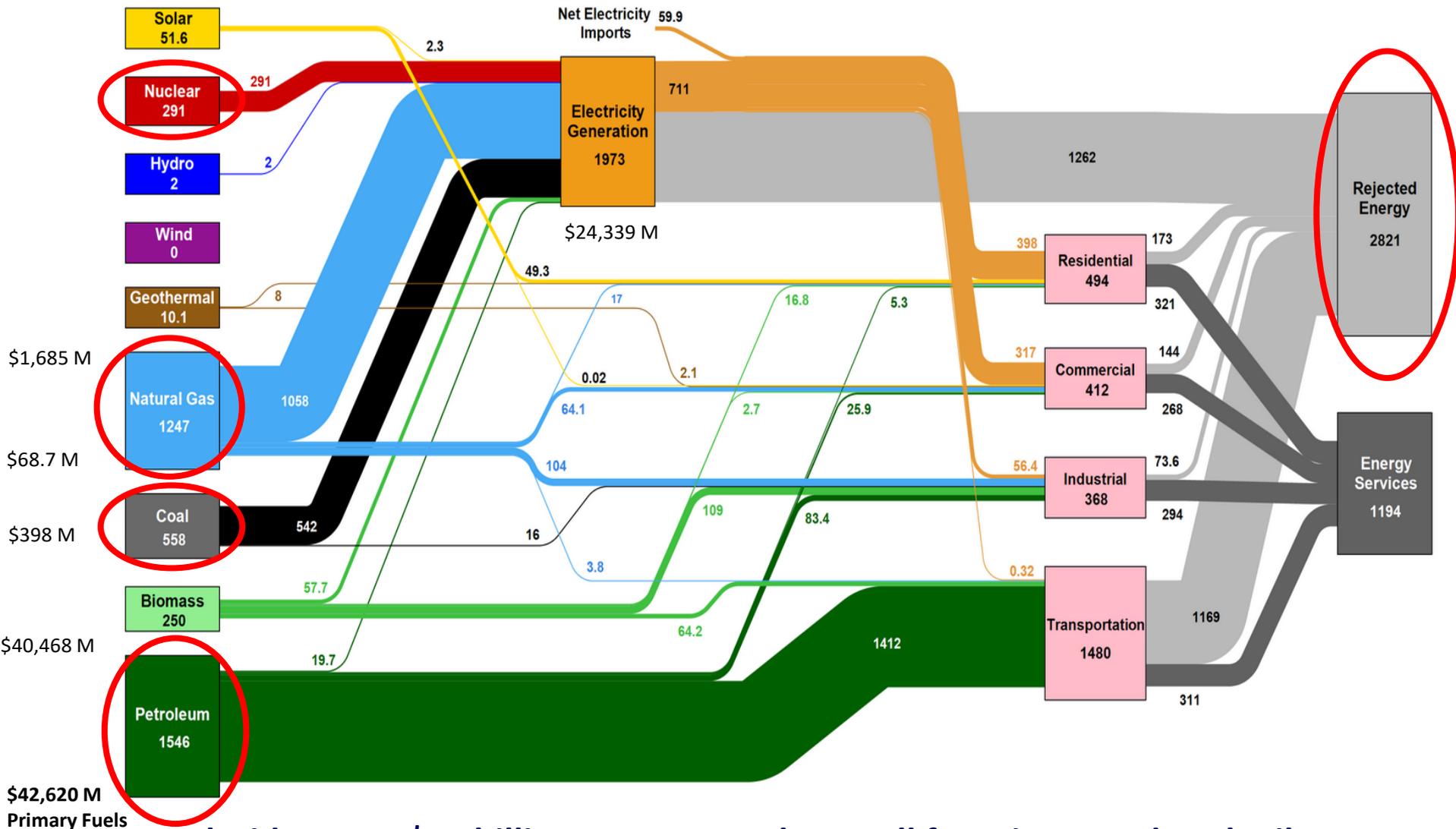


UCF

**FSEC Energy  
Research Center**

UNIVERSITY OF CENTRAL FLORIDA

# Florida Energy Consumption in 2014: ~ 4015 Trillion BTU



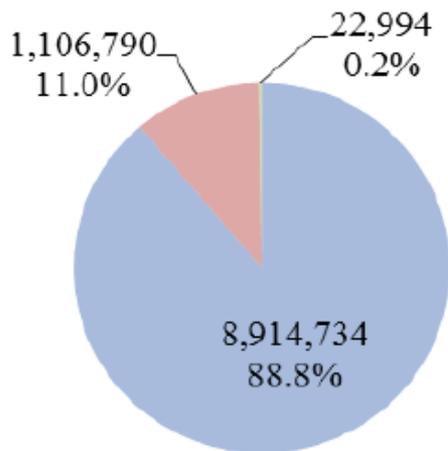
- Florida spent \$67 billion on energy, almost all from imported coal, oil, gas, and nuclear
- 70% of primary energy is wasted

\*2014 Latest Energy Flow Chart Available from LLNL <https://flowcharts.llnl.gov/commodities/energy>



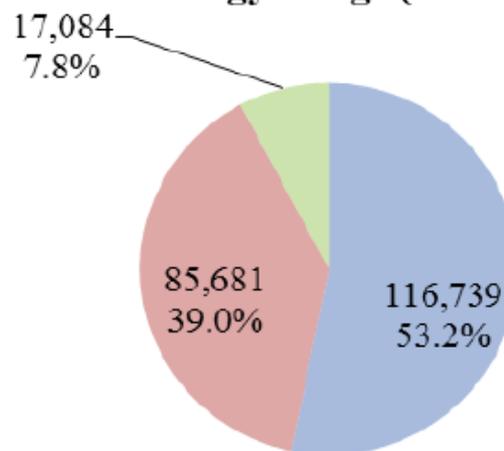
# Florida Electric Customer Composition in 2017

**Number of Customers**



- Residential
- Commercial
- Industrial

**Energy Usage (GWh)**



**>90% in Buildings**

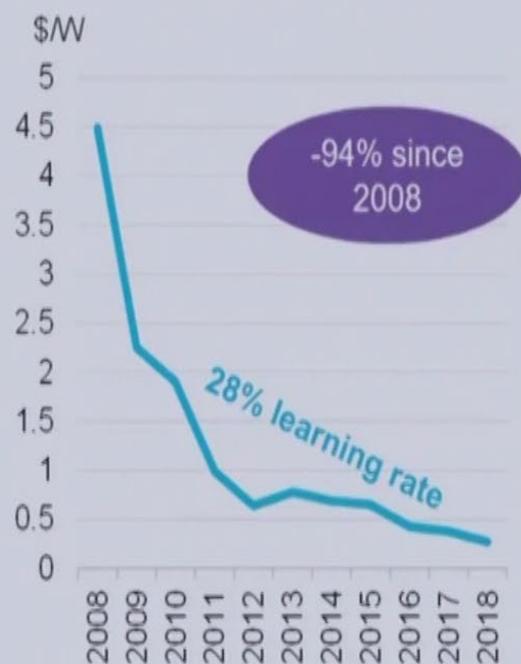
Source: FRCC 2018 Load & Resource Plan

<b>Residential</b>	<b>13,095 kWh/year</b>	<b>=9.4 kW PV</b>
<b>Commercial</b>	<b>77,414 kWh/year</b>	<b>=55 kW PV</b>
<b>Industrial</b>	<b>742,976 kWh/year</b>	<b>=531 kW PV</b>

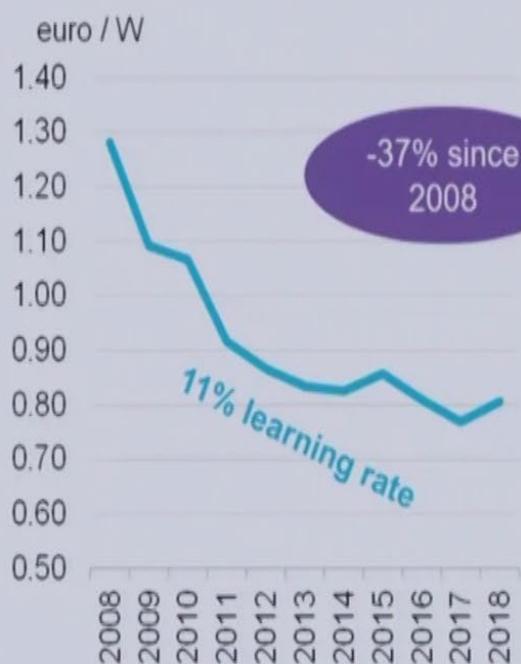
<http://www.psc.state.fl.us/Files/PDF/Utilities/Electricgas/TenYearSitePlans/2018/Review.pdf>

# Transitions driven by technology

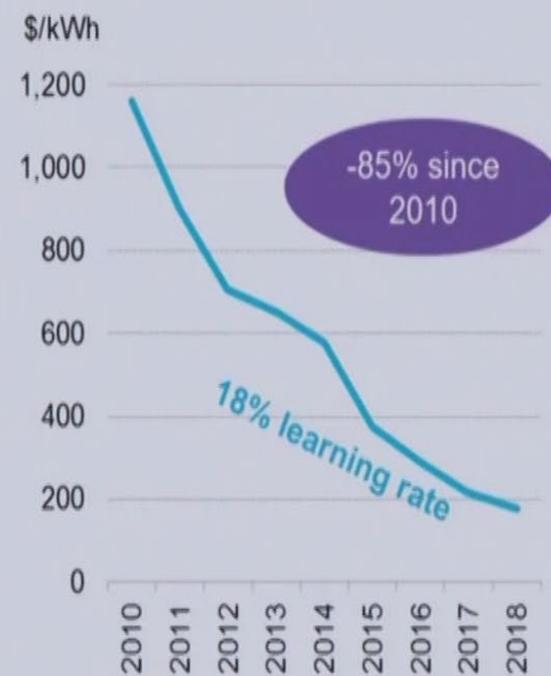
## Solar PV module prices



## Onshore wind turbine prices



## Lithium-ion battery prices

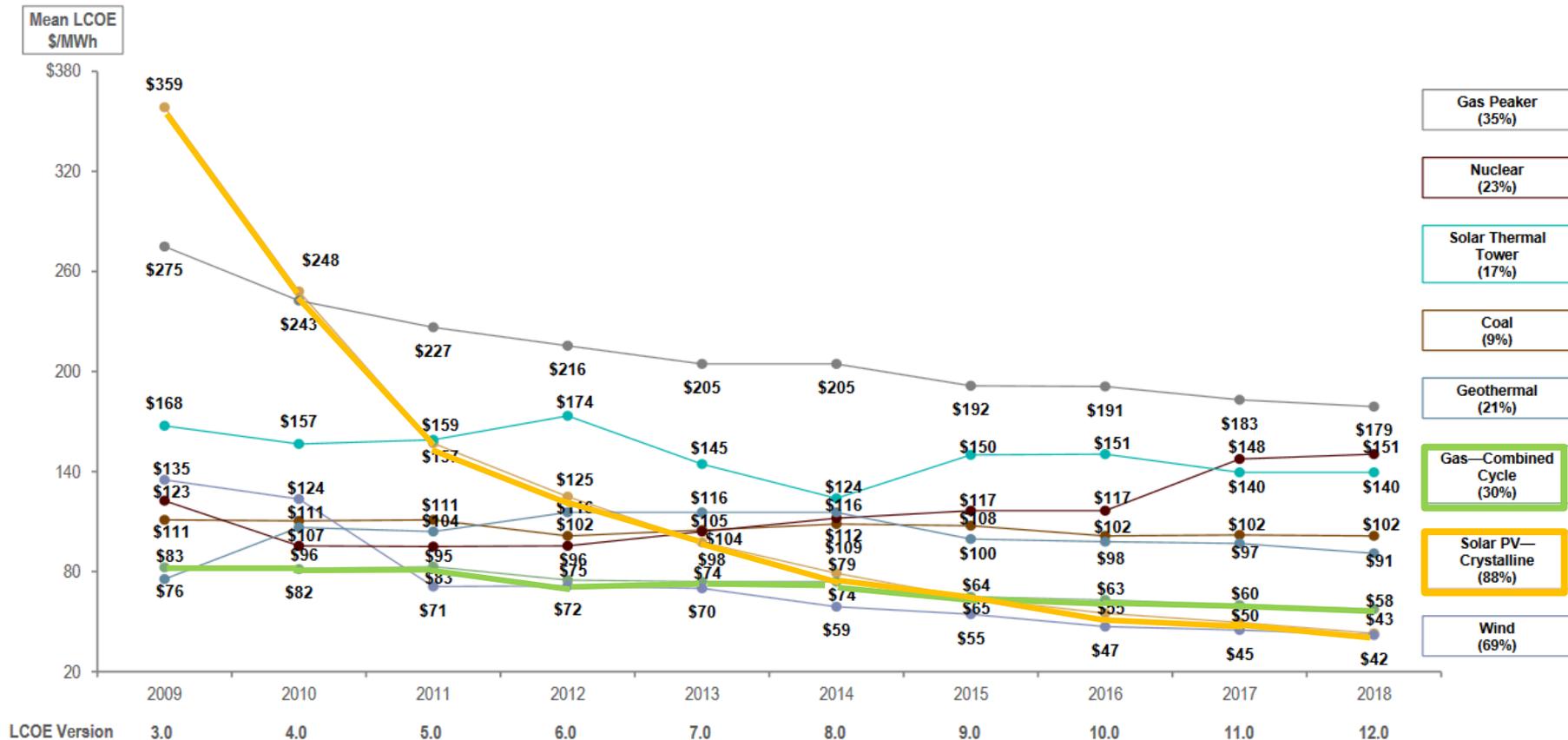


Source: BloombergNEF.

# Levelized Cost of Energy Comparison—Historical Utility-Scale Generation Comparison

Lazard's unsubsidized LCOE analysis indicates significant historical cost declines for utility-scale Alternative Energy generation technologies driven by, among other factors, decreasing supply chain costs, improving technologies and increased competition

Selected Historical Mean Unsubsidized LCOE Values<sup>(1)</sup>



Source: Lazard estimates.

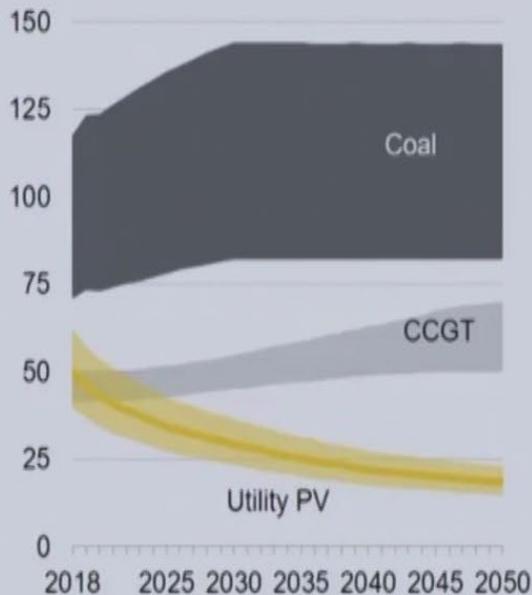
(1) Reflects the average of the high and low LCOE for each respective technology in each respective year. Percentages represent the total decrease in the average LCOE since Lazard's LCOE—Version 3.0.



# Transitions characterized by tipping points

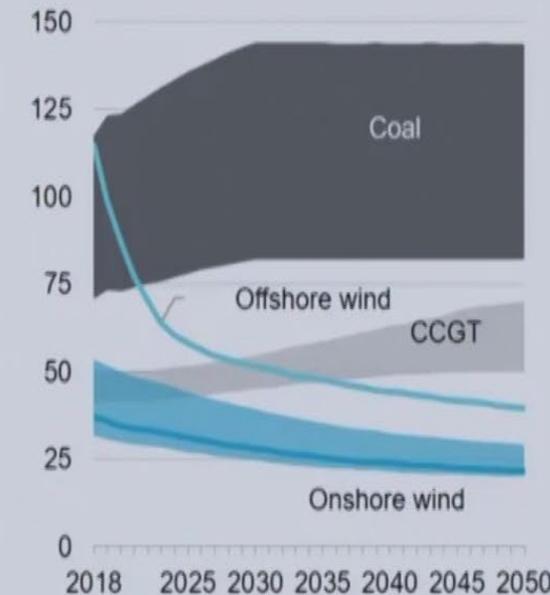
## Solar costs vs. coal & gas

\$/MWh (2017 real)



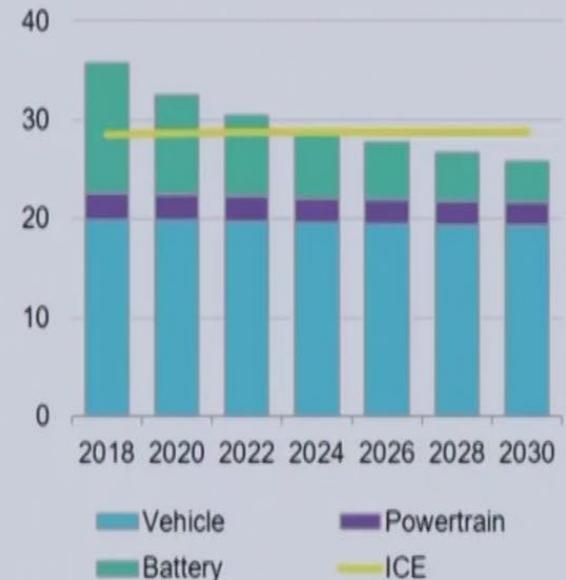
## Wind costs vs. coal & gas

\$/MWh (2017 real)



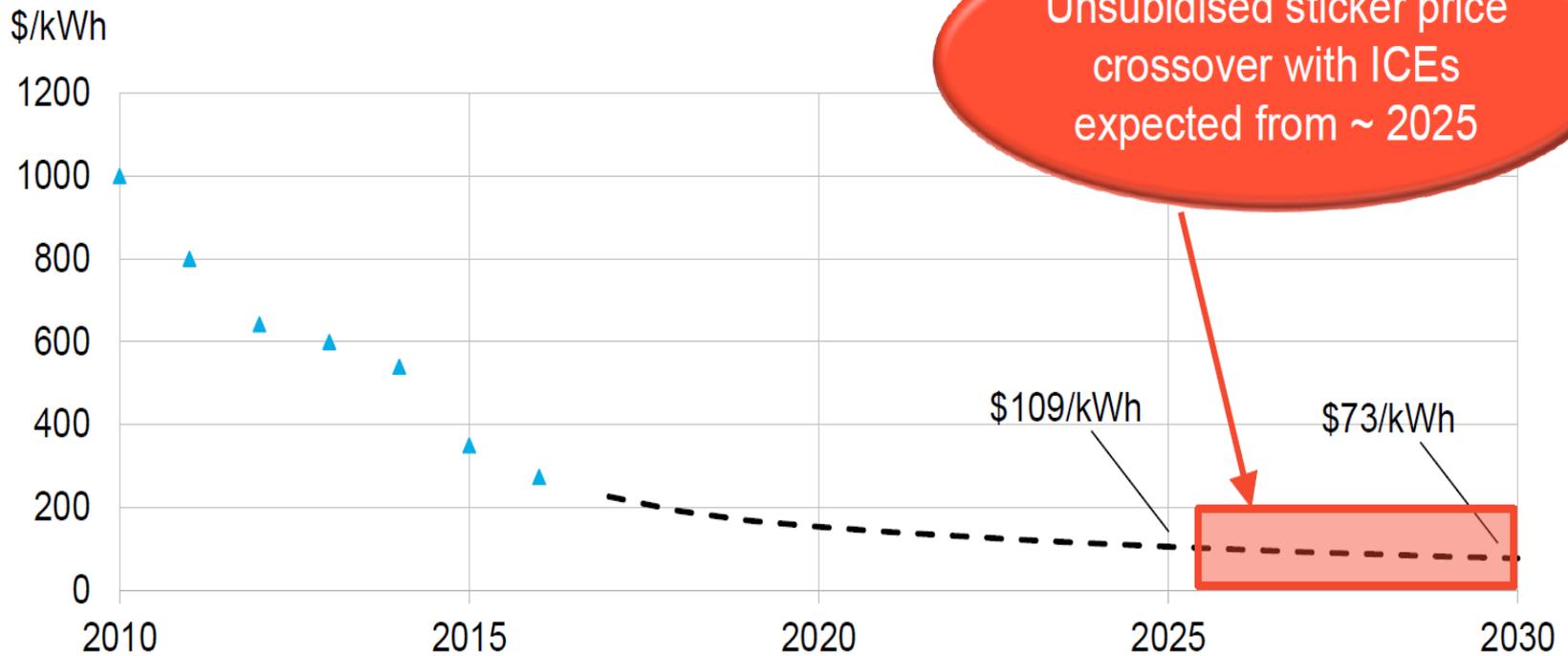
## EV purchase price vs. ICE

EV and ICE price in \$ thousand (2017 real)



Note: Levelized cost of electricity (solar, wind, gas, coal) calculations are for utility-scale assets in the U.S. and exclude incentives such as the ITC and the PTC. EV price is for a medium segment vehicle in the U.S.

# Battery pack costs to fall another 70% by 2030



Source: Bloomberg New Energy Finance

# Energy is Fungible

- Operate our Buildings with electricity from ***utility and rooftop solar and energy efficiency***
- Drive our ***cars on Florida electricity*** which is cheaper than gasoline today!
- Fossil fuel prices going up, ***solar going down for everyone!***
- Reduce greenhouse gases and NO<sub>x</sub>  
***Jobs and wealth stay in Florida***

# Vision For Florida

## Spend Little to No funds on Imported Primary Fuels

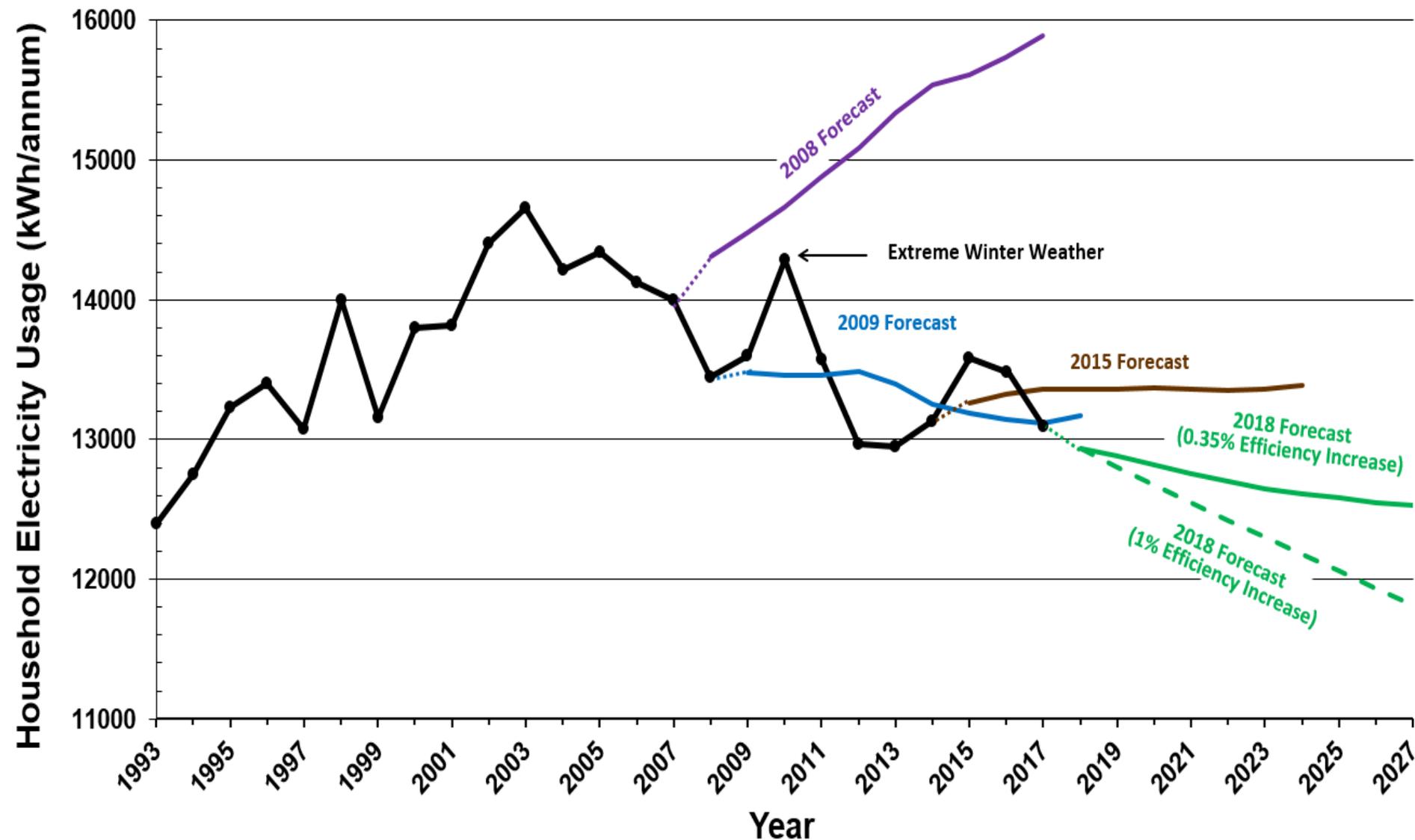
- Utility and rooftop solar, energy storage, smart-charging electric vehicles (V2G), building energy efficiency improvements and demand response all needed to achieve 100% renewables. All at a lower cost than Business-As-Usual.
- A non-optimal path will lead to longer term reliance on fossil fuel backup and oversized renewables capacity.
- Both utilities and customers (those on each side of the electric meter) must be empowered to achieve 100% renewables. Resiliency will then be achieved.

(Planes start to switch from fossil fuels to renewable hydrogen in 2045. Electric high speed trains could displace much of the fossil fuel planes and get you there quicker and cheaper!)

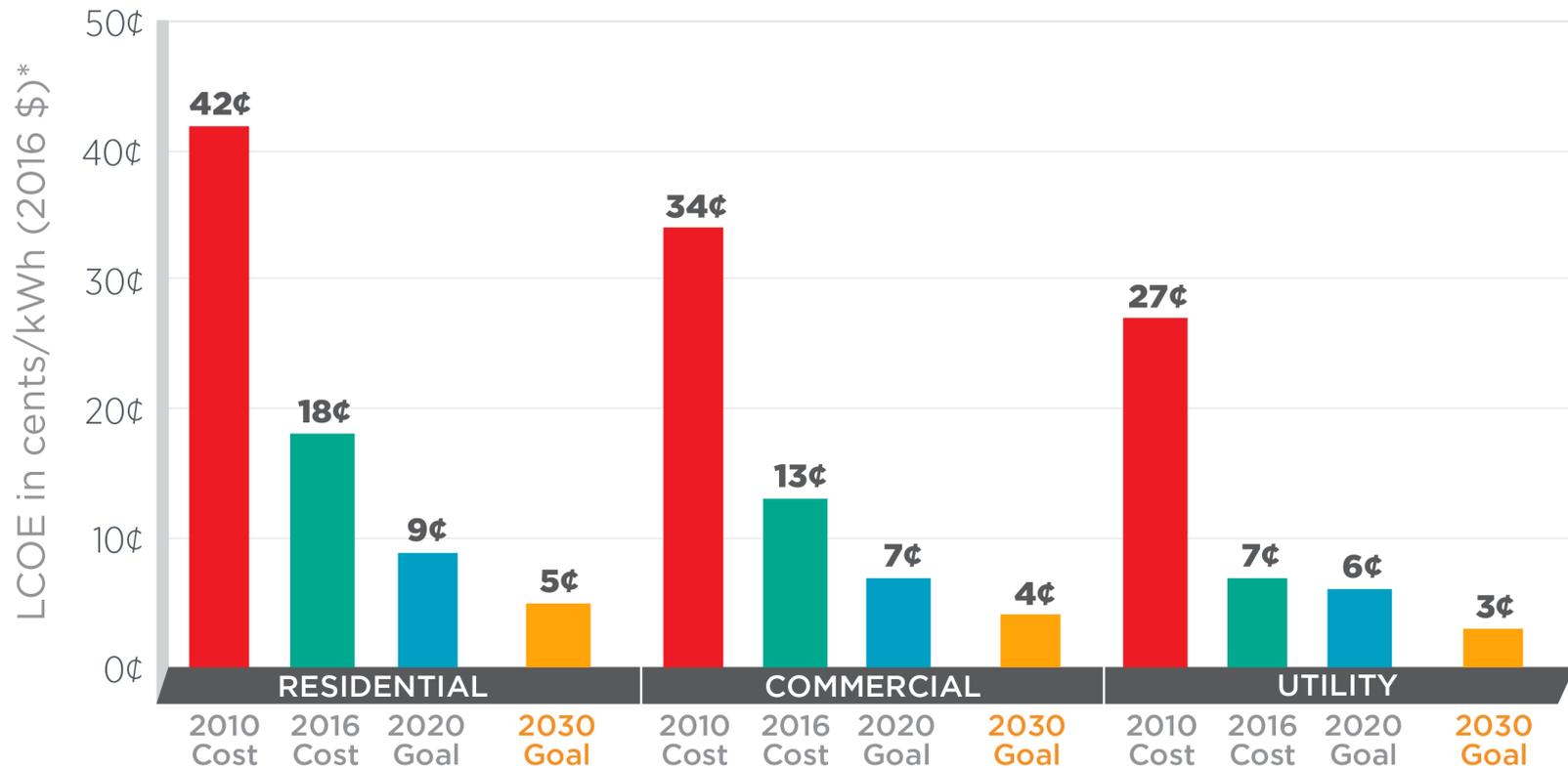


# State of Florida: Energy Consumption per Household

(In 2017 8,914,734 Residential Customers used 53.2% of the electricity = 116,739 GWh)

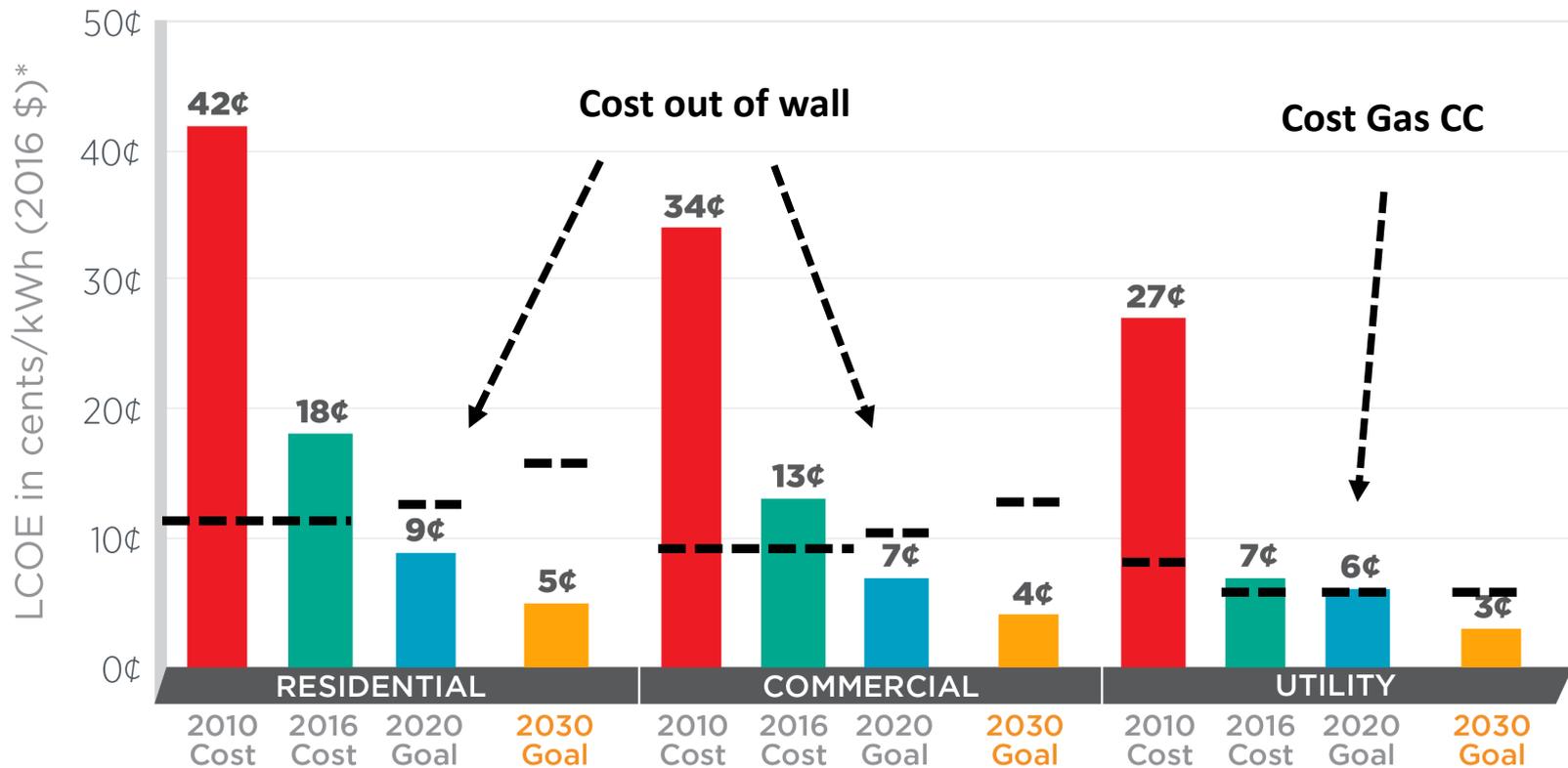


# SunShot Progress and Goals



\*Levelized cost of electricity (LCOE) progress and targets are calculated based on average U.S. climate and without the ITC or state/local incentives. Utility-scale PV uses one-axis tracking.

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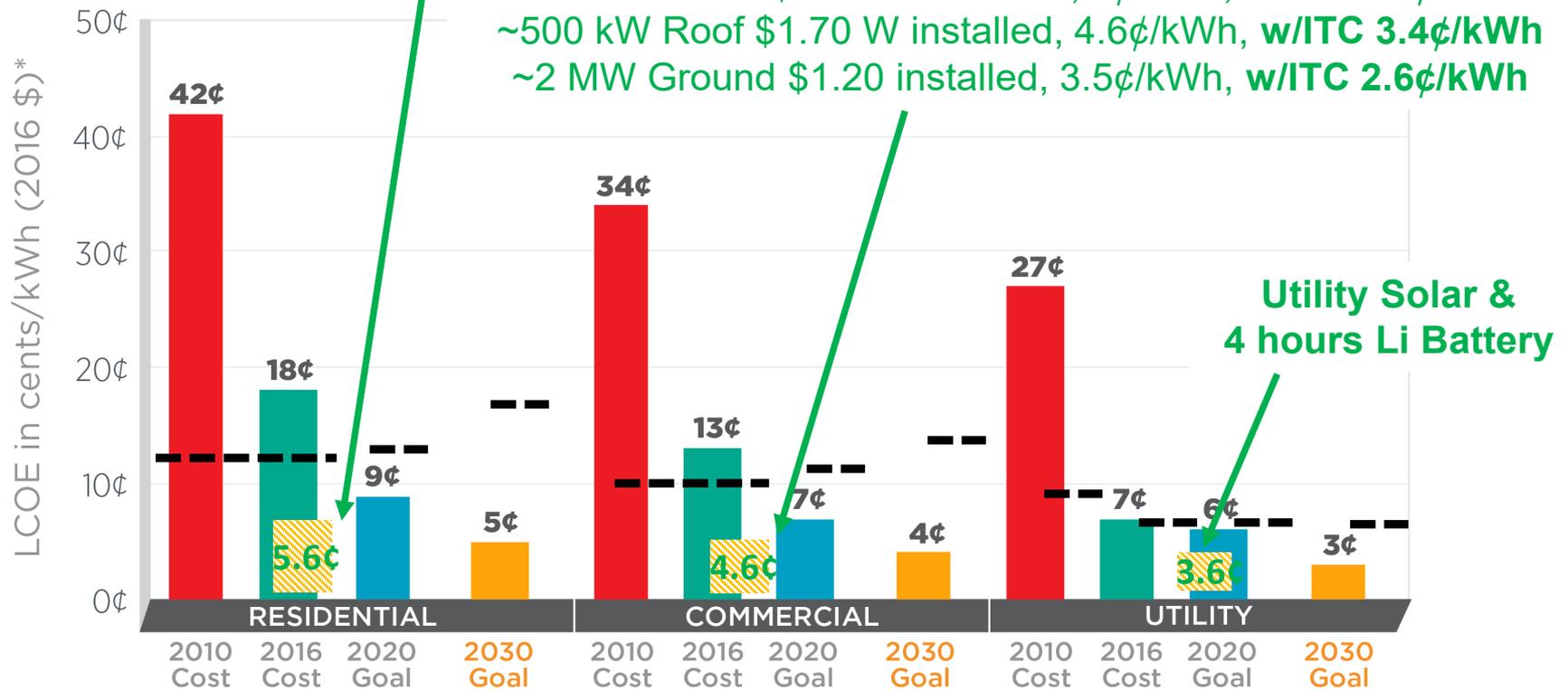
# SunShot Progress and Goals

## TODAYS Florida Solar Co-ops <15 kW

\$2.00 W installed, 5.6¢/kWh

## Florida Commercial Solar

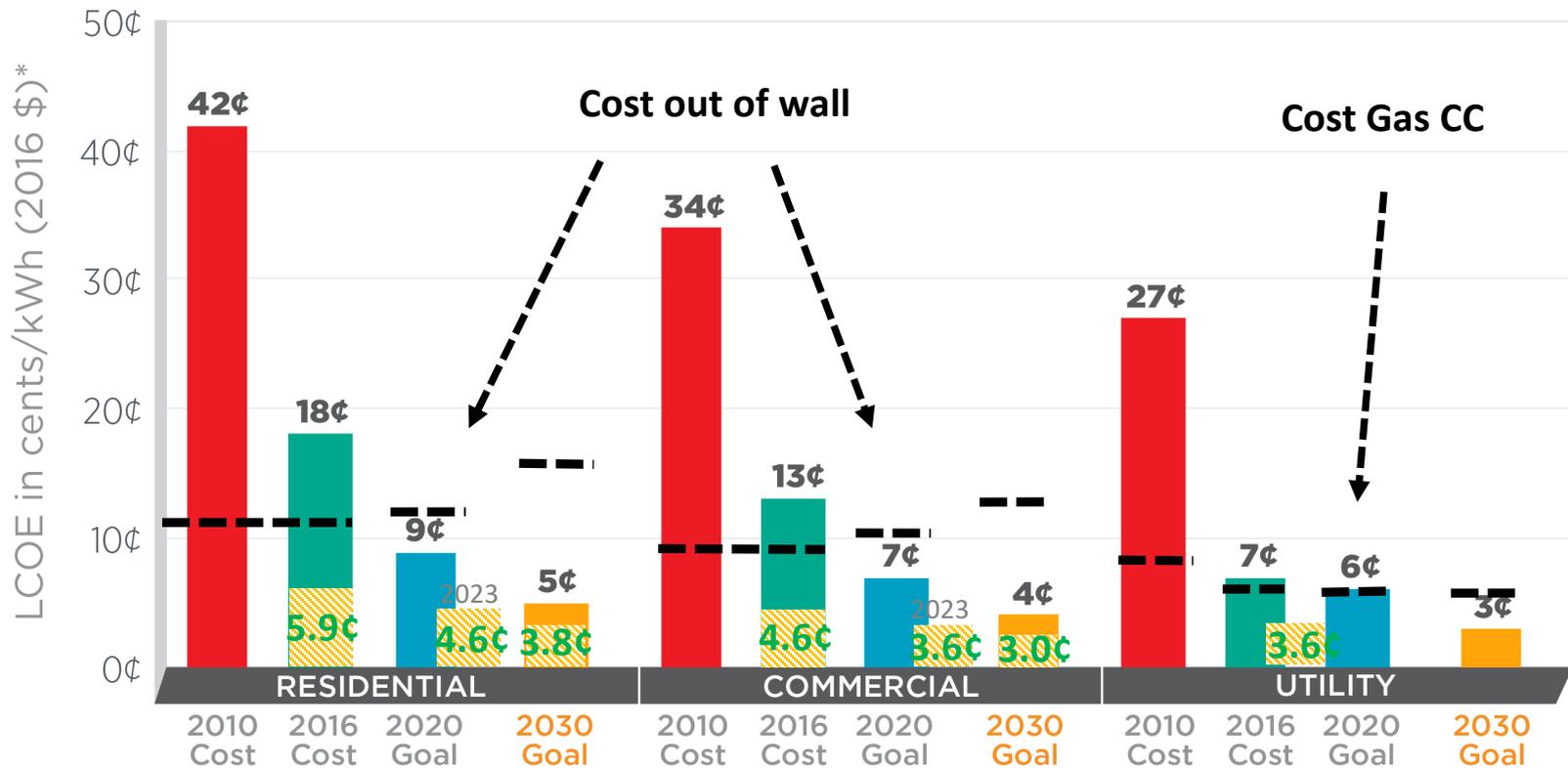
~100 kW Roof \$1.90 W installed, 5¢/kWh, w/ITC 3.7¢/kWh  
 ~500 kW Roof \$1.70 W installed, 4.6¢/kWh, w/ITC 3.4¢/kWh  
 ~2 MW Ground \$1.20 installed, 3.5¢/kWh, w/ITC 2.6¢/kWh



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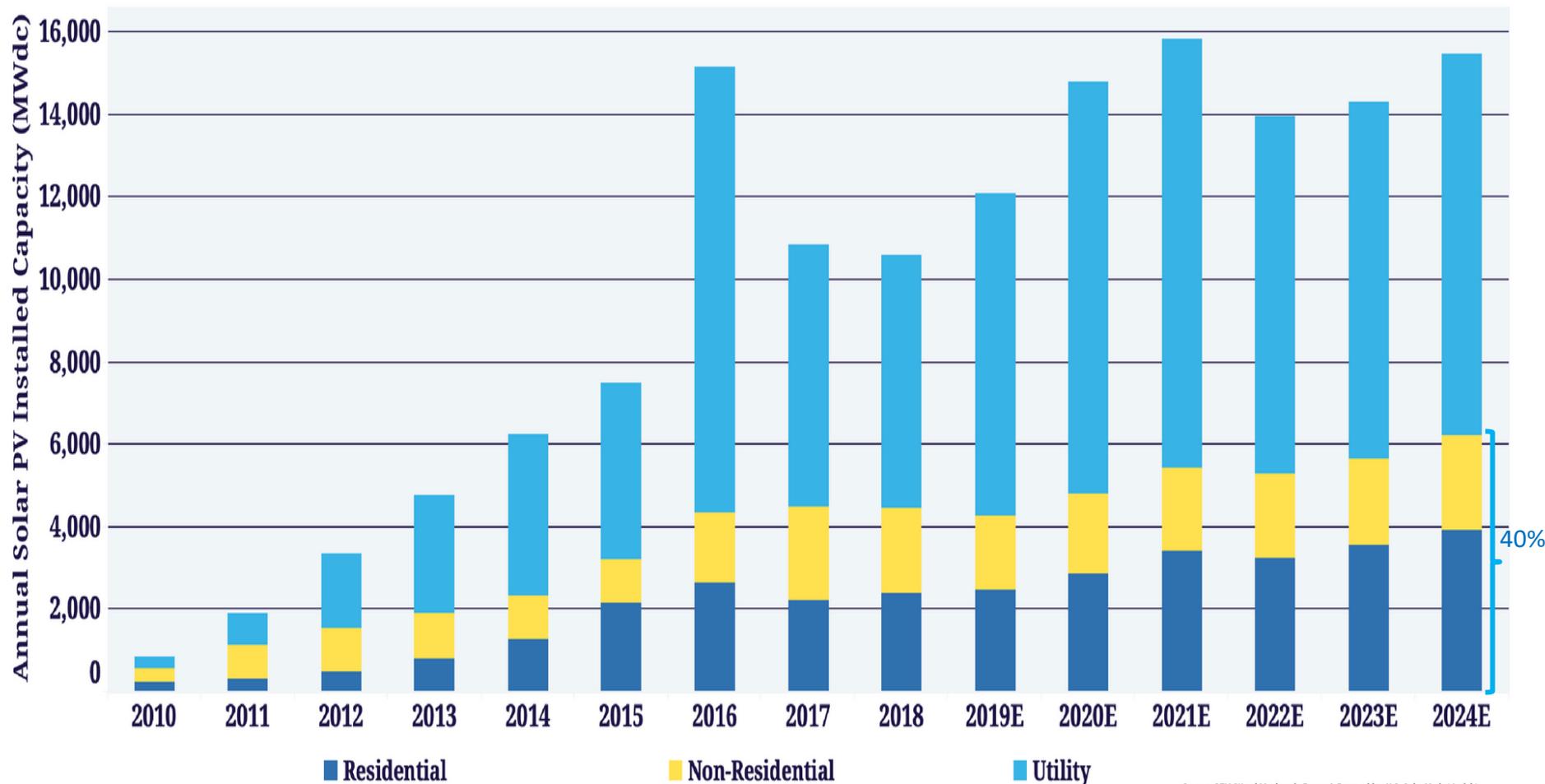


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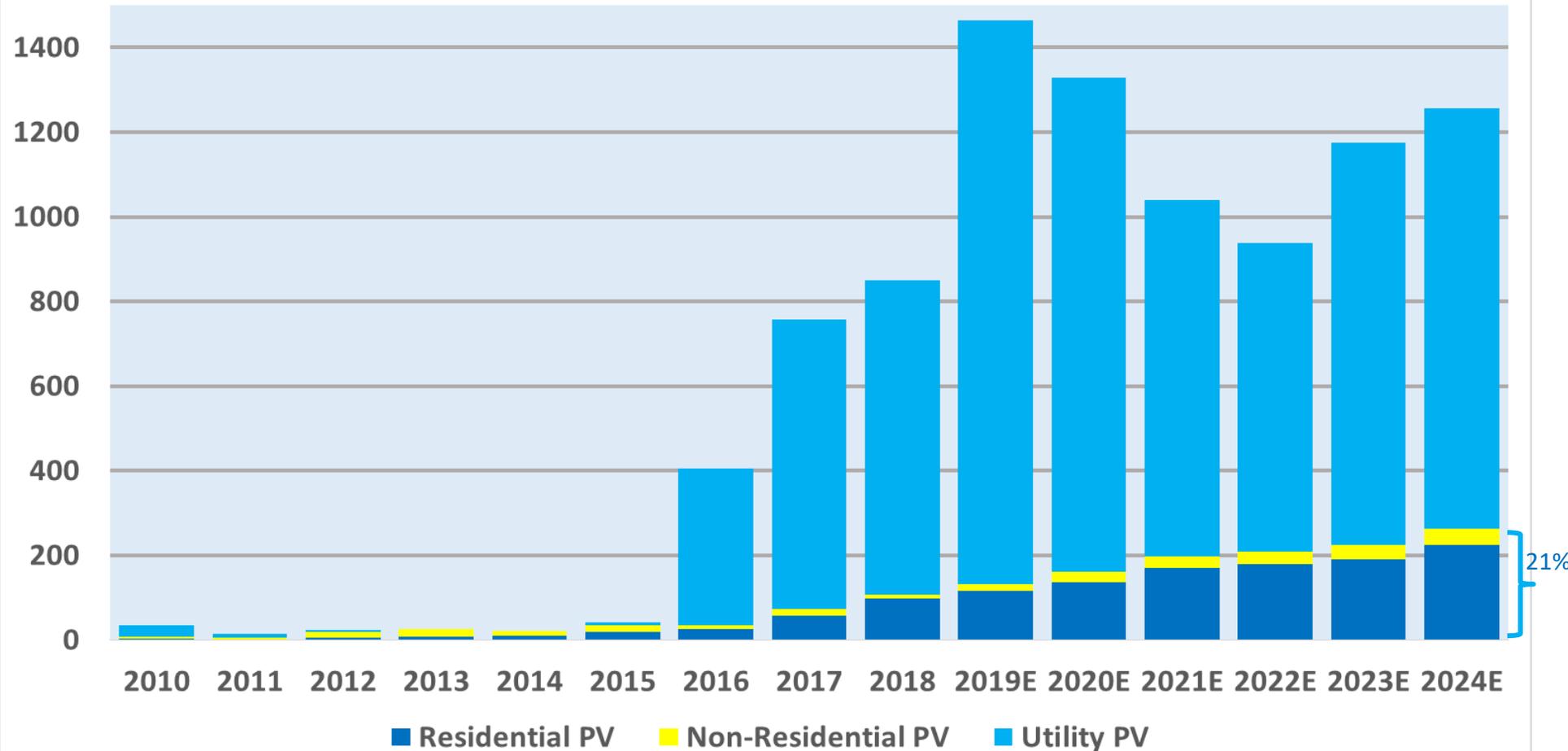
## U.S. Solar PV Deployment Forecast



Source: SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight;

# Florida PV Installation Forecast

MWs

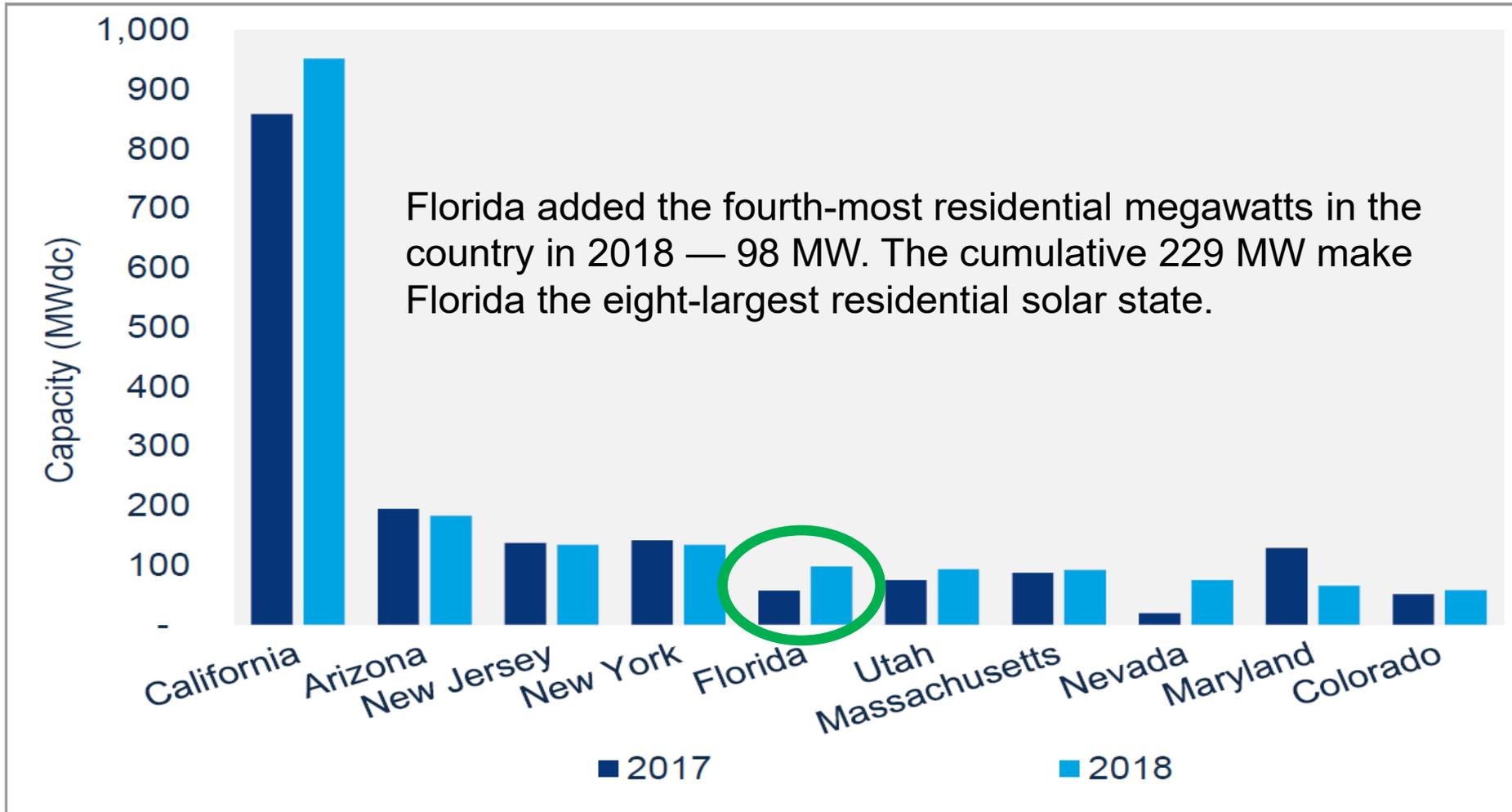


The CAGR from 2018 to 2024 is **15% for residential installations, 29% for non-residential installations** and 5% per year for utility installations. In 2035, customer owned installations in MWs will be equal to those installed by Utilities (50% of total solar deployment, ~1,400 MW each annually).



# Residential Solar

Figure 2.2 Top 10 state markets, 2017 vs. 2018



Source: Wood Mackenzie Power & Renewables



# PV Installer Fastest Growing Job

## United States

- PV installer fastest growing occupation\* 2016 to 2026 (105%)
- 2017 Median Pay of \$39,490

## Florida

- 10,528 State Solar Jobs, 1<sup>st</sup> New Solar Jobs (1,769), 20.6% Growth Rate
- 7,445 Installation Jobs, 2<sup>nd</sup> in Nation
  - 6,539 Residential jobs
  - 817 Non-Residential jobs
  - 89 Utility-scale jobs
- 991 Manufacturing Jobs, 9<sup>th</sup> in Nation
- Future Florida Job growth is on the Roof and Manufacturing floor

\*Bureau of Labor Statistics, US Department of Labor

<https://solarstates.org/#state/florida/counties/solar-jobs/2018>

# Solar Efficiency Energy Storage & EV Job Growth is Just Starting

## TOP 10 STATES FOR CLEAN ENERGY JOBS

RANK	STATE	TOTAL*	SOLAR	WIND	ENERGY EFFICIENCY	CLEAN VEHICLES
1	California	512,934	126,507	5,785	318,542	22,389
2	Texas	233,447	11,433	25,386	162,816	17,800
3	Florida	158,652	10,528	4,461	118,412	9,360
4	New York	156,059	11,603	3,491	123,292	8,624
5	Michigan	126,081	5,419	4,783	85,061	25,304
6	Illinois	123,247	5,341	8,706	89,469	10,417
7	Massachusetts	116,491	16,527	1,983	86,473	3,184
8	Ohio	112,486	8,108	1,080	81,676	16,646
9	North Carolina	110,913	8,912	908	86,559	7,280
10	Virginia	95,158	4,241	1,628	78,670	5,436



<https://www.e2.org/reports/clean-jobs-america-2019/>

\* Total includes renewable energy, energy efficiency, clean vehicles, battery storage, advanced biofuels, low-impact hydro and other sectors.

## CLEAN ENERGY GROWTH IN PERSPECTIVE

# 110,000

Clean energy jobs grew 3.6 percent in 2018, adding jobs in nearly every state and combining to add over 110,000 net new clean energy jobs nationally.

# 12

Number of states that have or are considering policies that get 100 percent of their electricity from clean energy sources.

# 3X

Clean energy jobs outnumbered fossil fuel jobs nearly 3 to 1 in 2018.

# 10

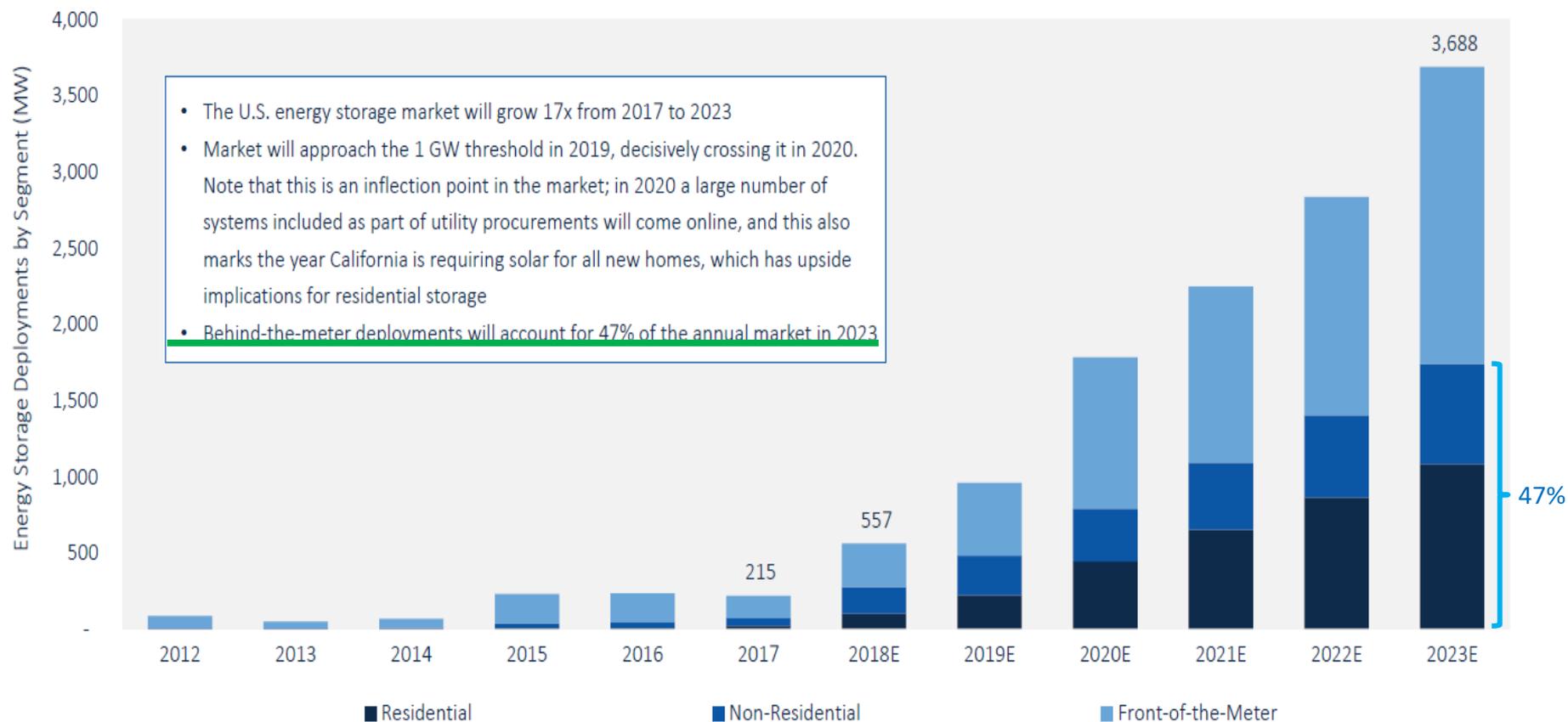
The number of states that generate more than 20 percent of their electricity from wind and solar—Kansas, Iowa, Oklahoma, North Dakota, South Dakota, Vermont, California, Maine, Colorado, and Minnesota.<sup>3</sup>

# 156 GW

Combined capacity of installed solar and wind surpassed 150GW in 2018. Wind energy is the largest source of renewable generating capacity. A new solar project is installed in America every two minutes.<sup>4,5</sup>

# U.S. Energy Storage Annual Deployments Will Reach 3.7 GW by 2023

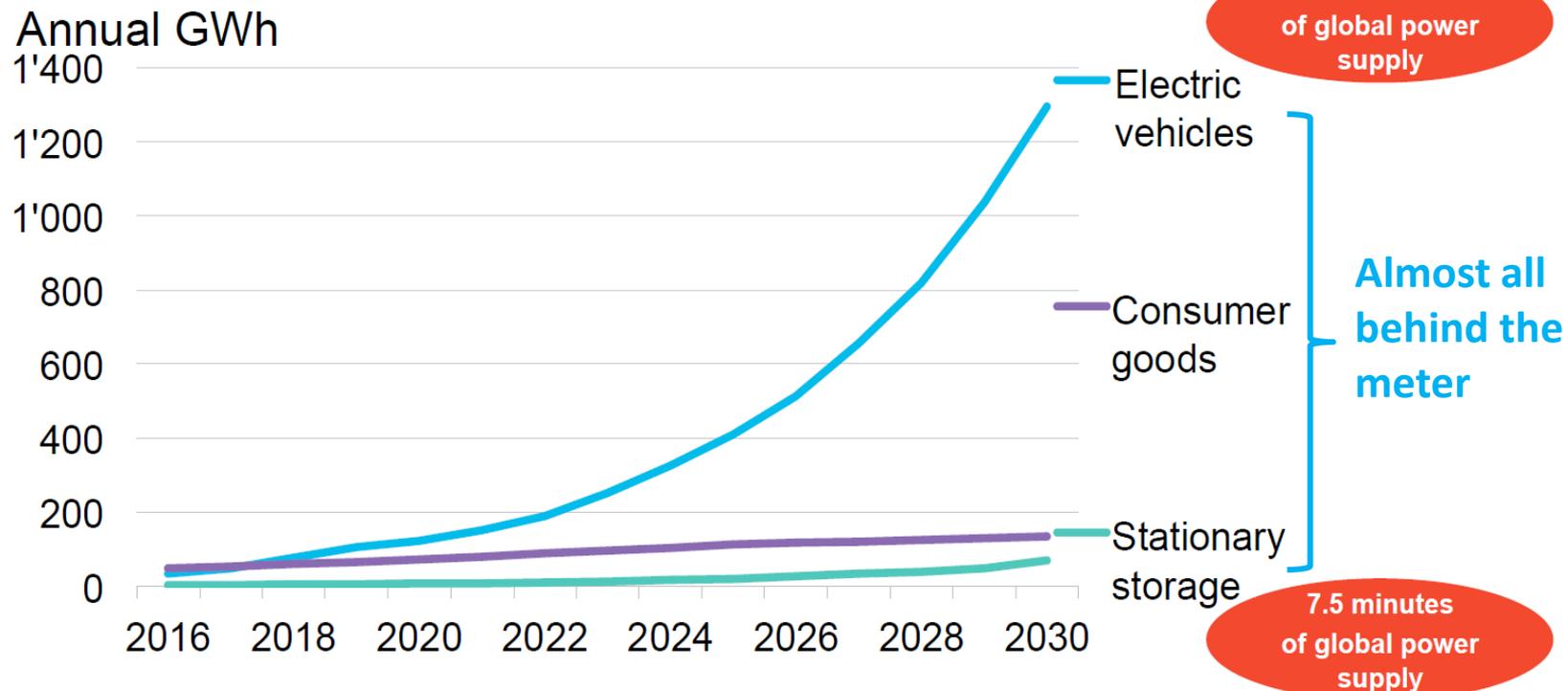
U.S. Annual Energy Storage Deployment Forecast, 2012-2023E (MW)



Source: GTM Research

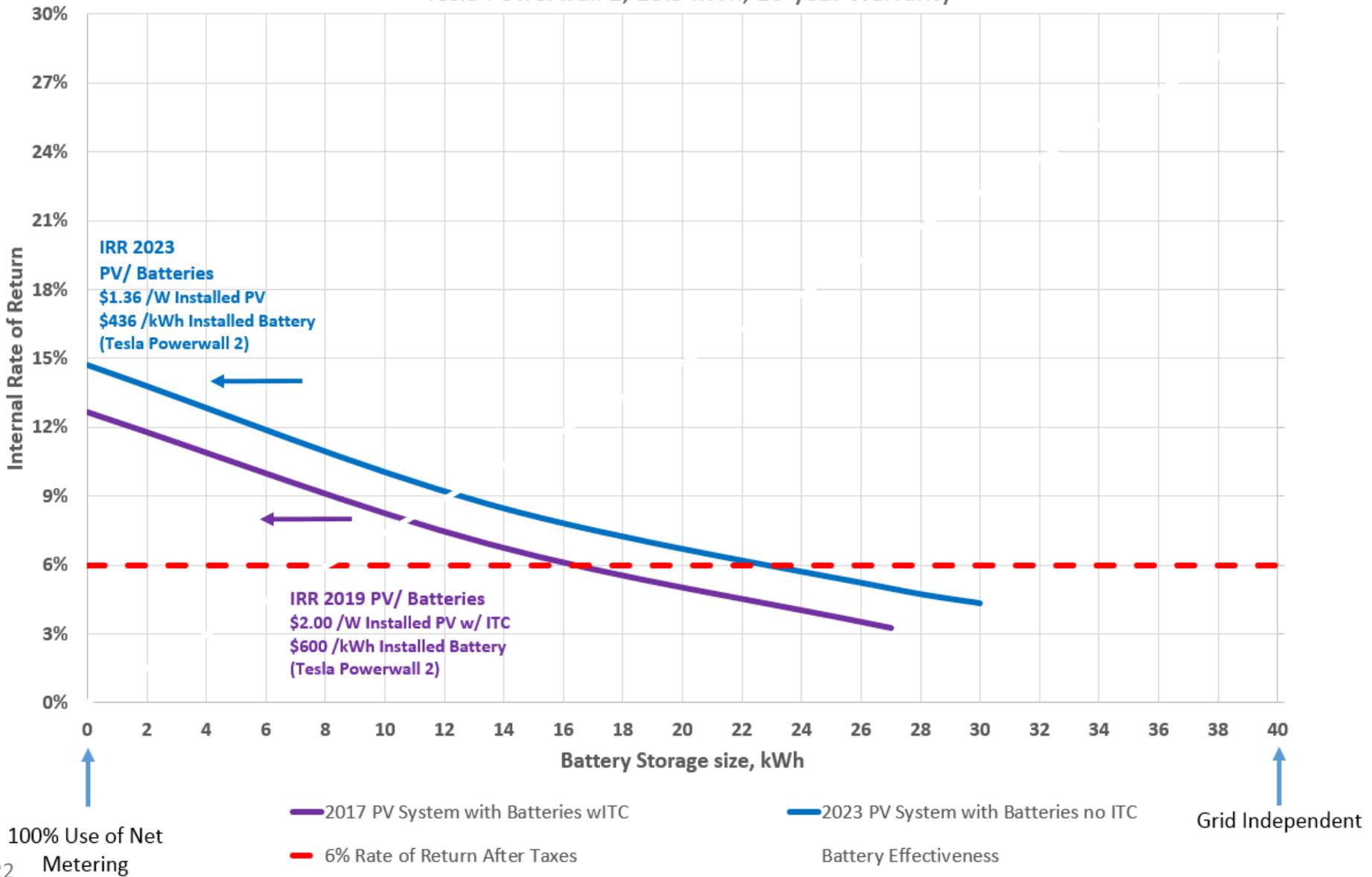
# V2G – Where the Batteries Are

## Global lithium-ion demand by market segment



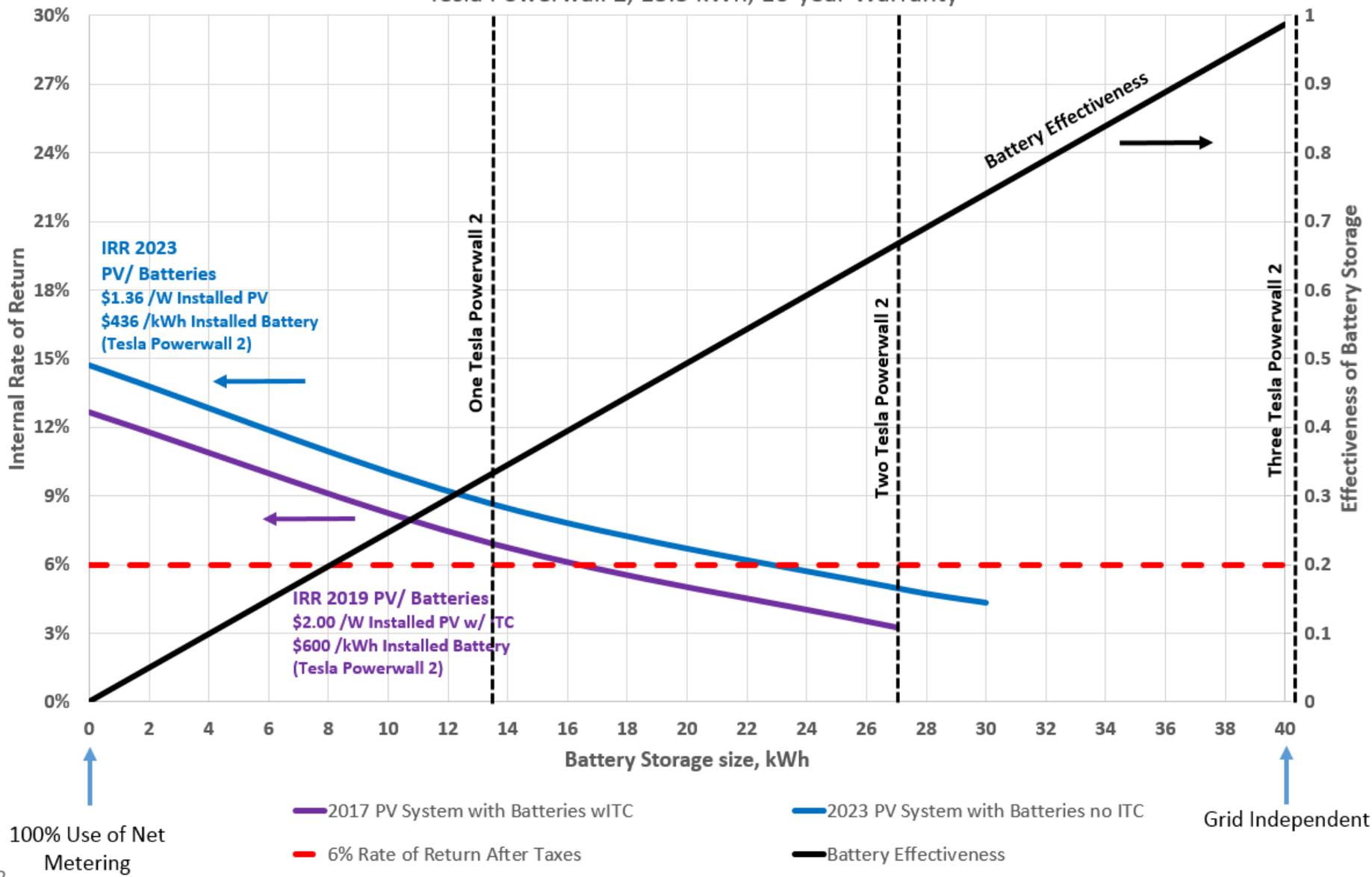
Source: Bloomberg New Energy Finance. Note: Assumes 100% of stationary is lithium-ion.

**Internal Rate of Return for Average Florida Net Zero Energy Residence**  
 9.35 kW PV provides the 13,090 kWh/yr Consumption (36 kWh Daily Load)  
 Tesla Powerwall 2, 13.5 kWh, 10-year Warranty

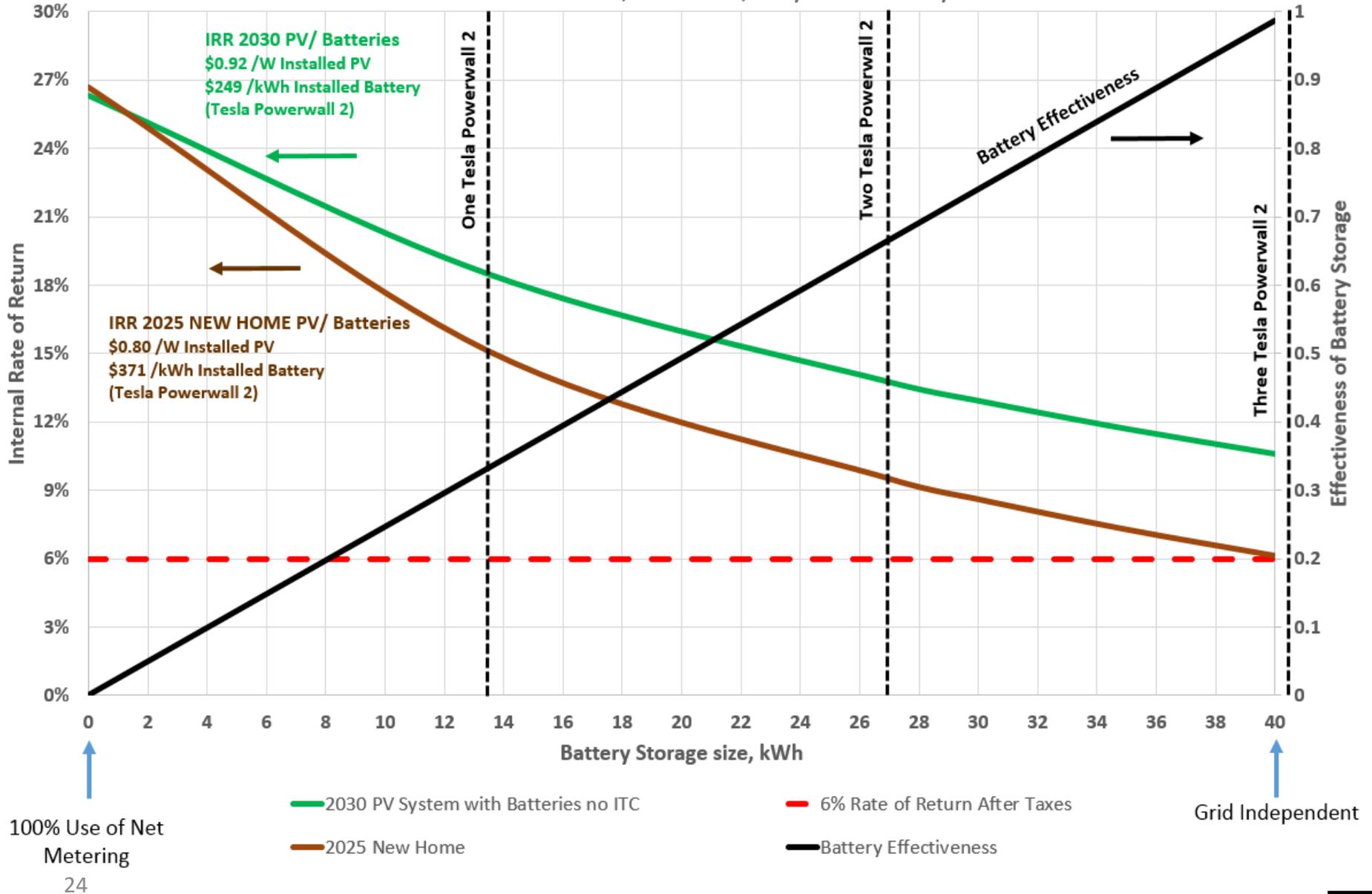


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# Florida Today

- New Net-Zero Energy Homes are more cost-effective than code homes
- Older homes can be retrofitted cost-effectively to net-zero-ready
- Rooftop PV today is less than half the cost out of the wall (**4.7¢ per kWh versus 11.7¢ per kWh from the utility**) with a 12.7% internal rate of return.
- An EV in your garage uses this rooftop solar at the equivalent of \$0.32 per gal.

# Florida 2025 to 2030

- By 2025 U.S. customer owned PV installations and energy storage both in MWs will be equal to those installed by Utilities (50% of total deployment). Florida will reach 50% customer owned by 2035 under BAU.
- In 2030 a Florida retrofit home with 9.25 kW PV and 40 kWh Li battery will have a 10.6% internal rate of return.  
***A net-zero resilient home!***
- The unsubsidized EV sticker price crossover with Internal Combustion Engine (ICE) vehicles expected shortly after 2025.
- By 2030 EVs will have 24 times the GWh of storage as stationary storage



# Florida 2025 to 2030

- Employees will charge their EVs using peak solar at work and then drive home, plug-in and use the EV battery to handle the evening residential demand.
- Utilities will be more concerned about managing electricity then making electricity as every “electron” will need to have a “bit” with it.

***In partnership, owners of PV, EVs and storage WIN!  
Jobs and Wealth Stay in Florida***

“The gazelle does not have to outrun the cheetah  
It has to outrun the slowest gazelle”



Utility Solar,  
Bldg. EE inside,  
Rooftop Solar,  
Storage ...

Coal

Oil  
Sands

Oil

Natural  
Gas

Adapted from Bloomberg New Energy Finance presentation in London of October 2015

# Questions?

