

# Renewables: The True Costs

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# Renewable cost analysis at IRENA

Fills an important gap in knowledge

World-class database of costs

Cutting edge analysis, not just data

All sectors covered, not just power

Costing Alliance deepens engagement



# **THE IRENA RENEWABLE COST DATABASE**

# IRENA's database: Scope and coverage

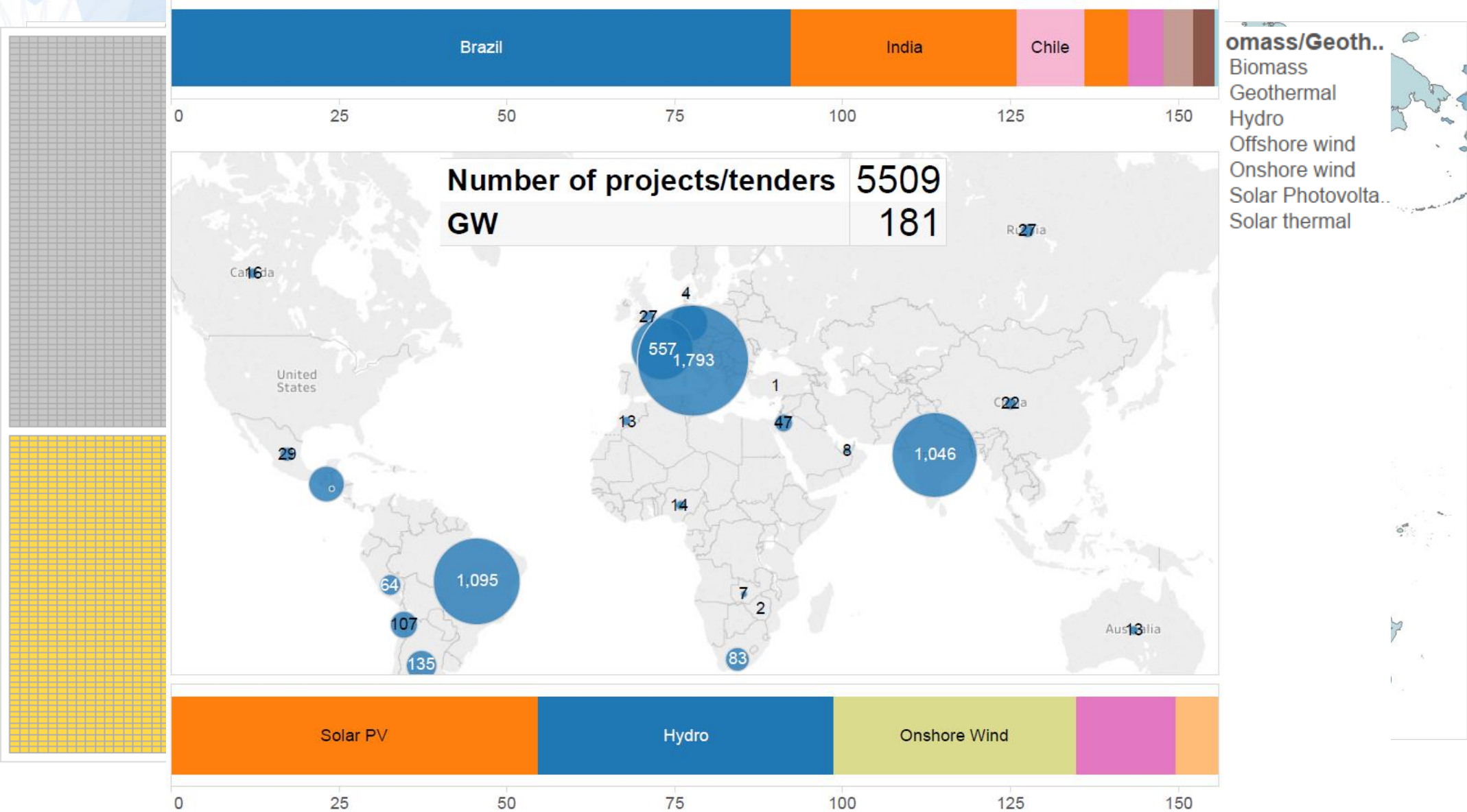
Power: 15000 utility-scale projects for LCOE,  
 $\frac{3}{4}$  million small-scale solar PV

Smaller dataset on biofuels/EVs

Stationary applications are being added

Power: database concentrated in non-OECD  
as more publicly available information

# Power generation database



# **Renewable Power Generation Costs in 2016**

# Highlights

The relentless improvement in competitiveness continues

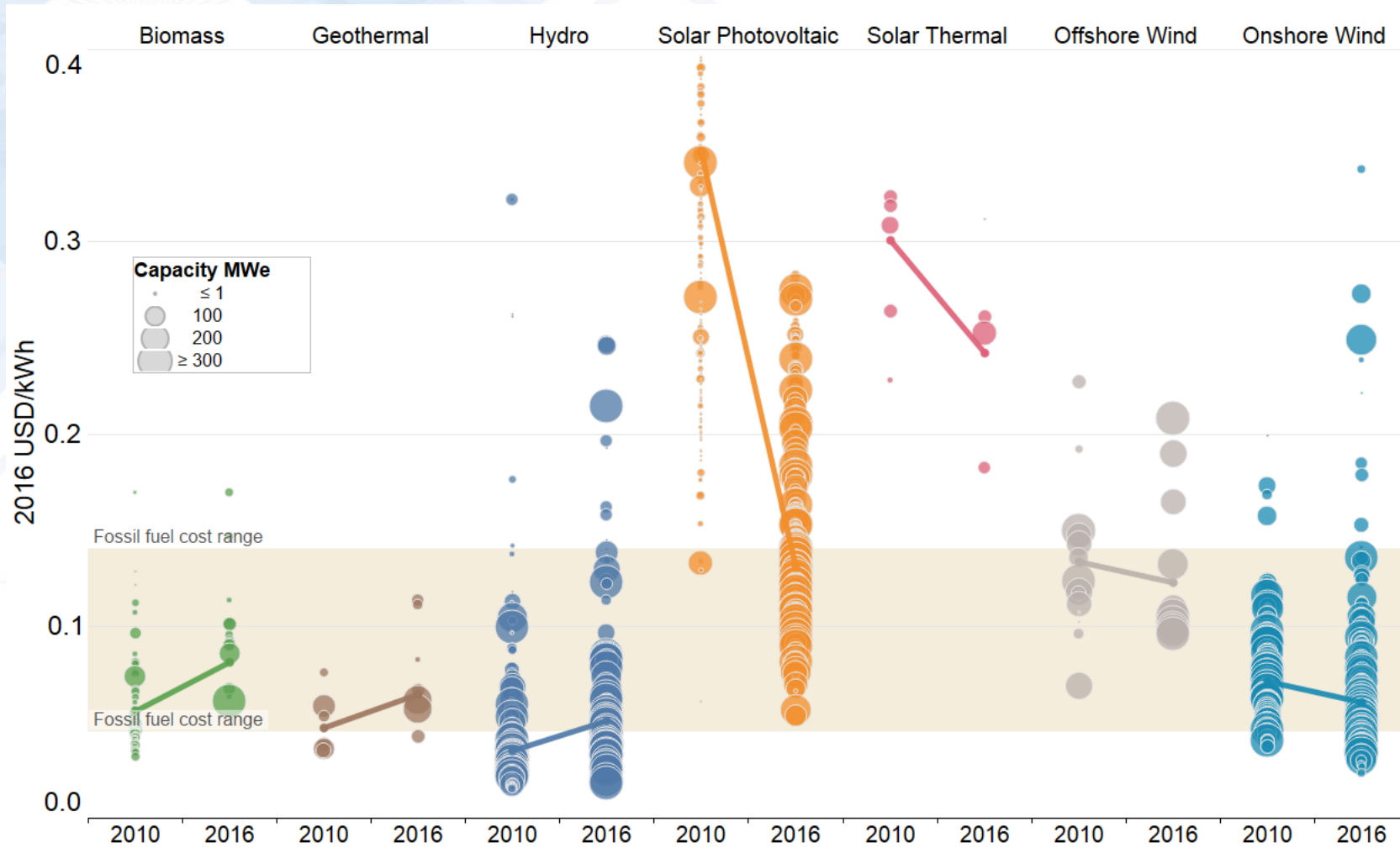
Renewables competing head-to-head with fossil fuels

Integrating variable renewables doesn't change the conclusions



Future cost reductions will be more policy driven

# Renewables: Highly competitive for new capacity



Traditional renewables highly competitive

Cost reductions for wind and solar, make them increasingly competitive

Cost rise for average hydro projects, geo & biomass data needs more work

Each circle represents one project, centre of circle is LCOE value on Y axis, diameter is size of project. Year is year commissioned.



# Wind power costs are falling....

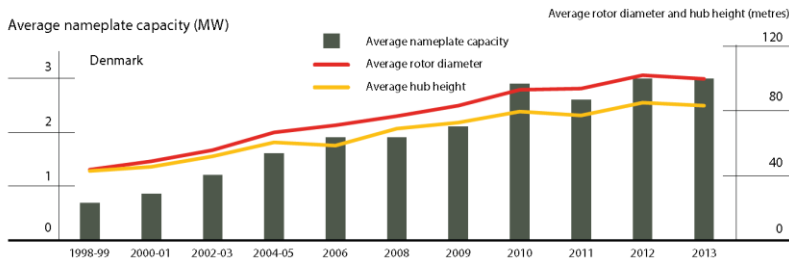
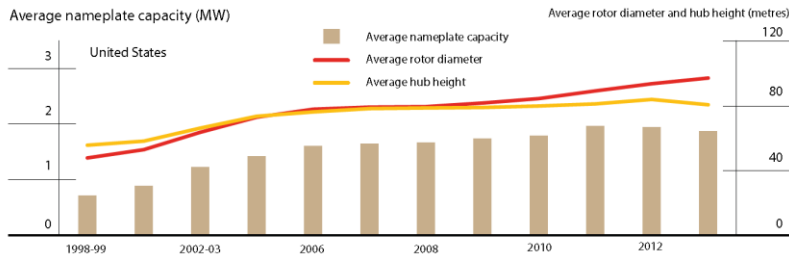
Higher capacity factors from improved technology



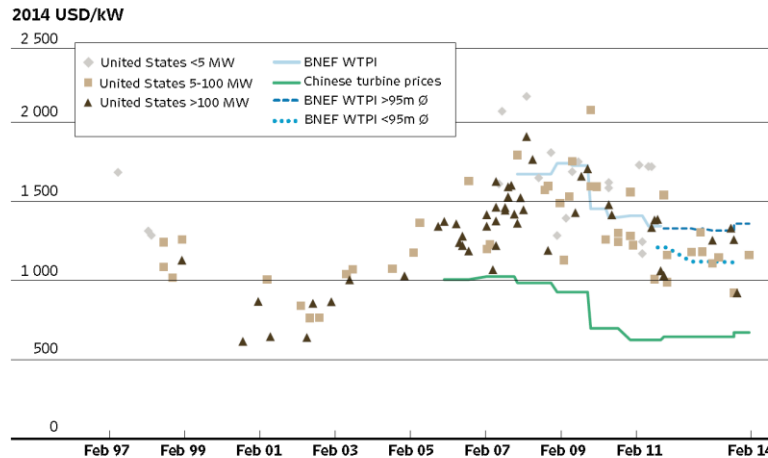
Wind turbine cost reductions



LCOEs are falling

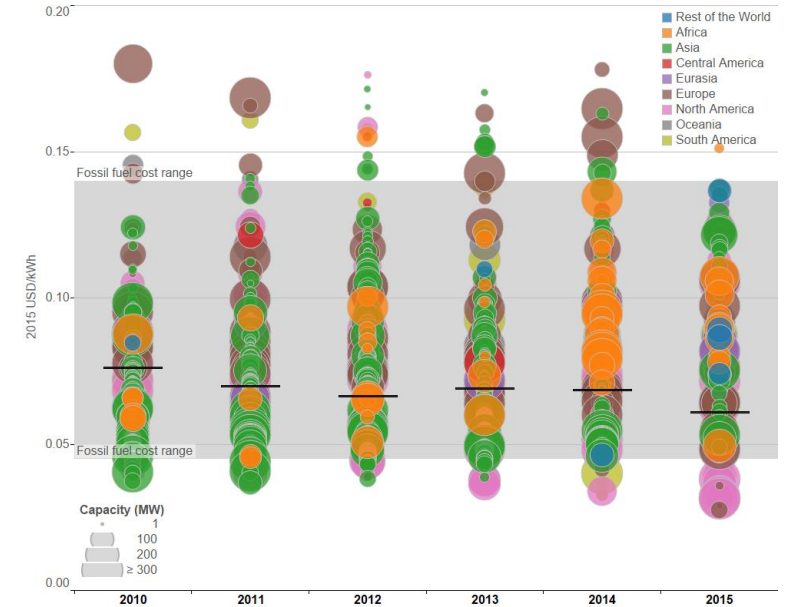


Sources: Wiser and Bollinger, 2014; Danish Energy Agency, 2014; and GlobalData, 2014

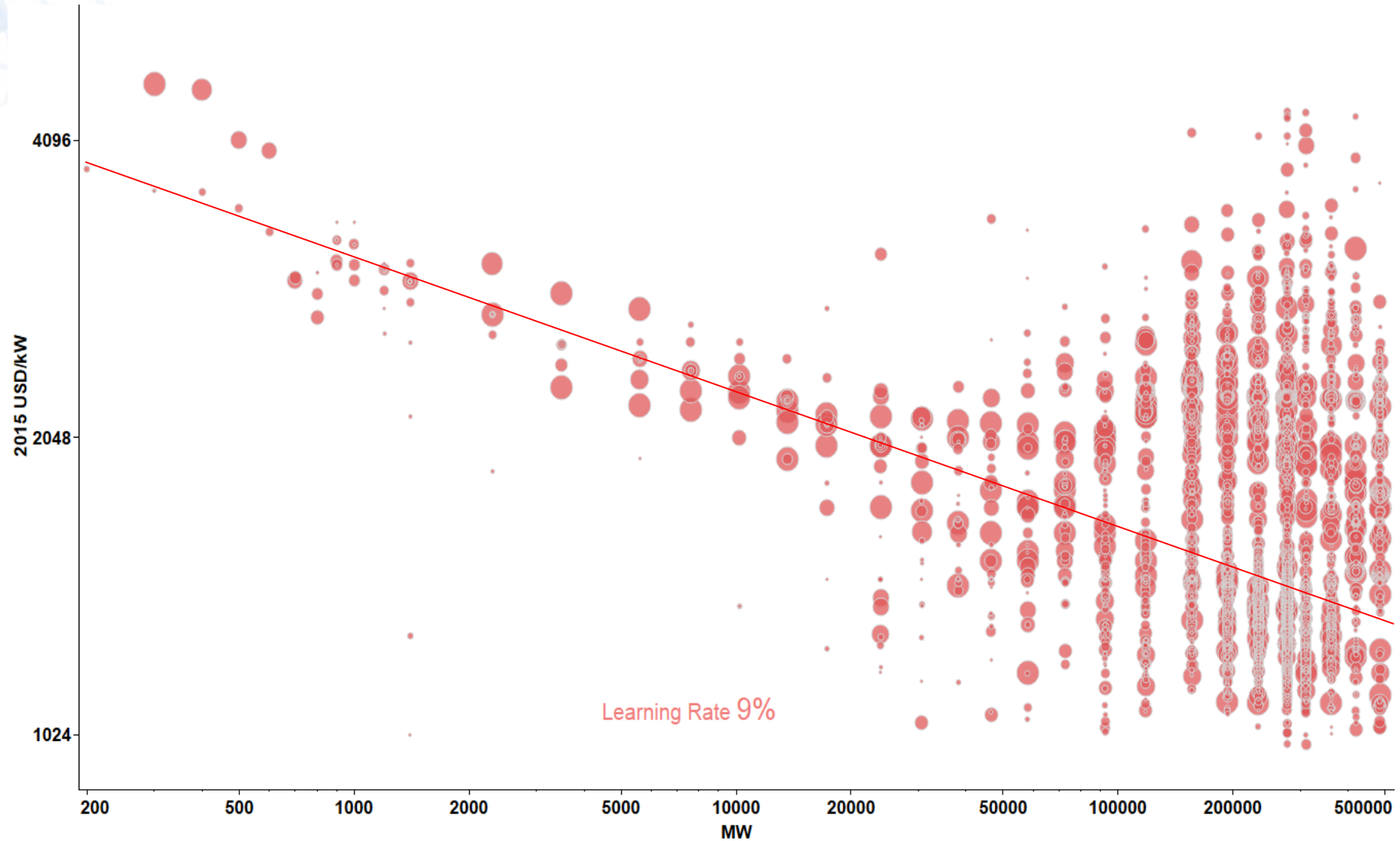


Sources: Wiser and Bollinger, 2014; CWEA, 2013; BNEF, 2014c; and Global Data, 2014.

Note: BNEF WTPI represents the half-year average for non-Asian markets, while the United States data are for the specific month of a particular turbine contract and the Chinese data are annual averages.



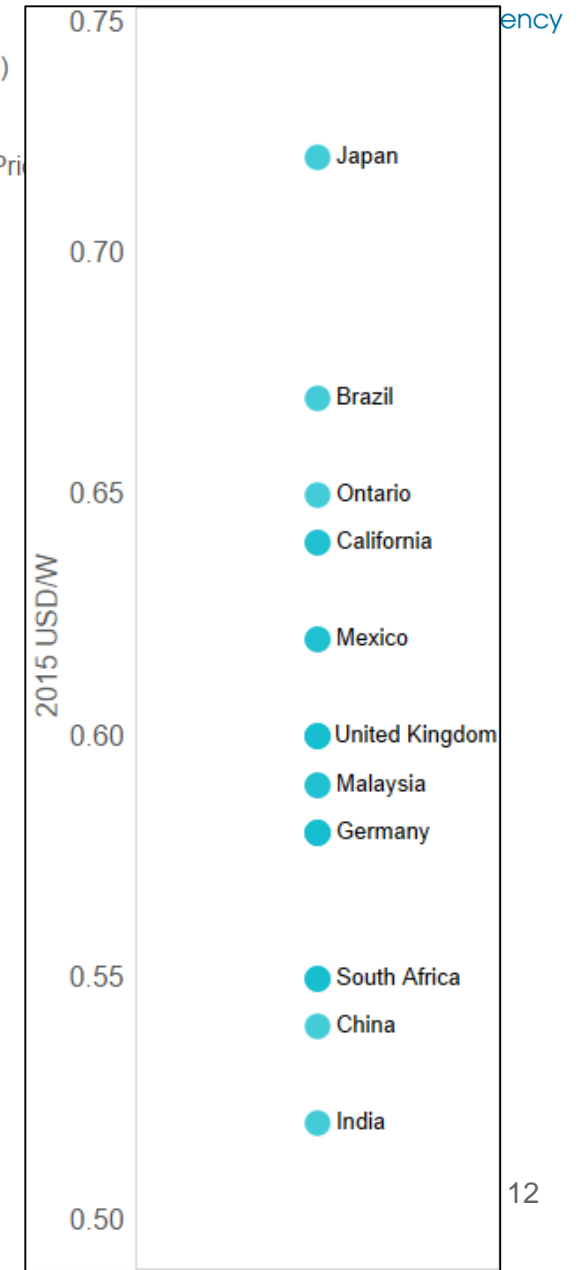
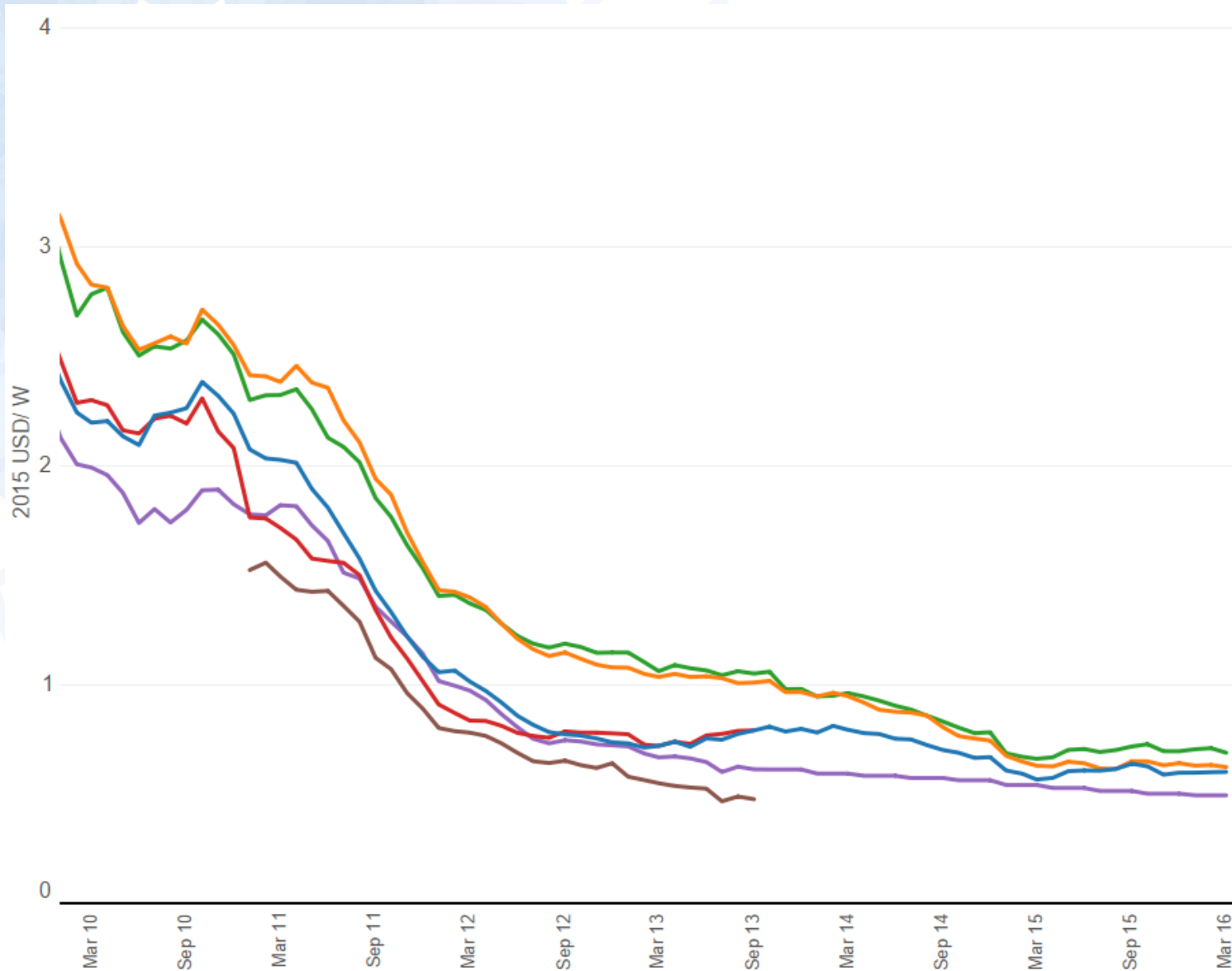
# Onshore wind learning curve: Total installed costs



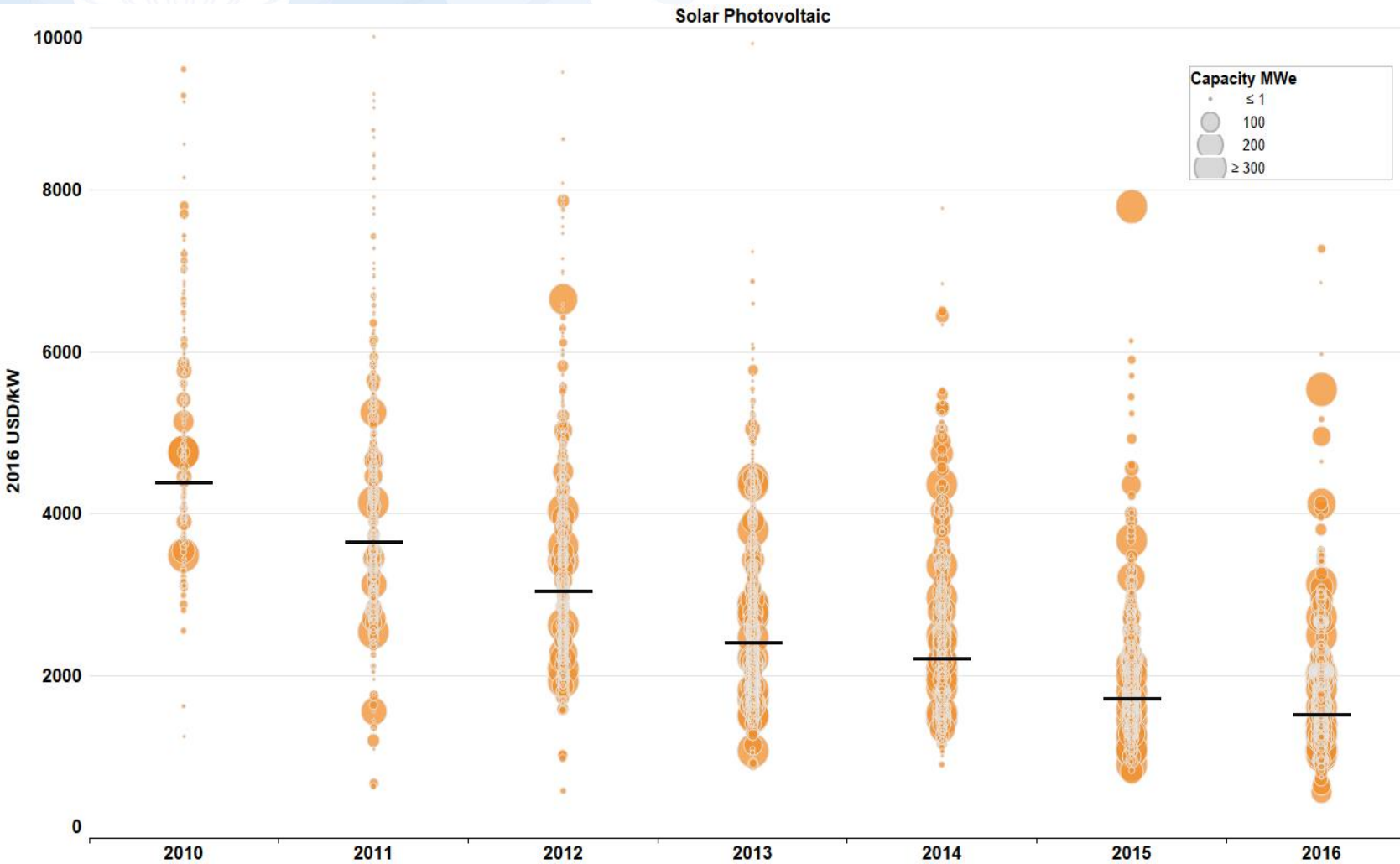
# Onshore wind learning curve: Levelised cost of electricity



# Solar PV module prices in 2015/16



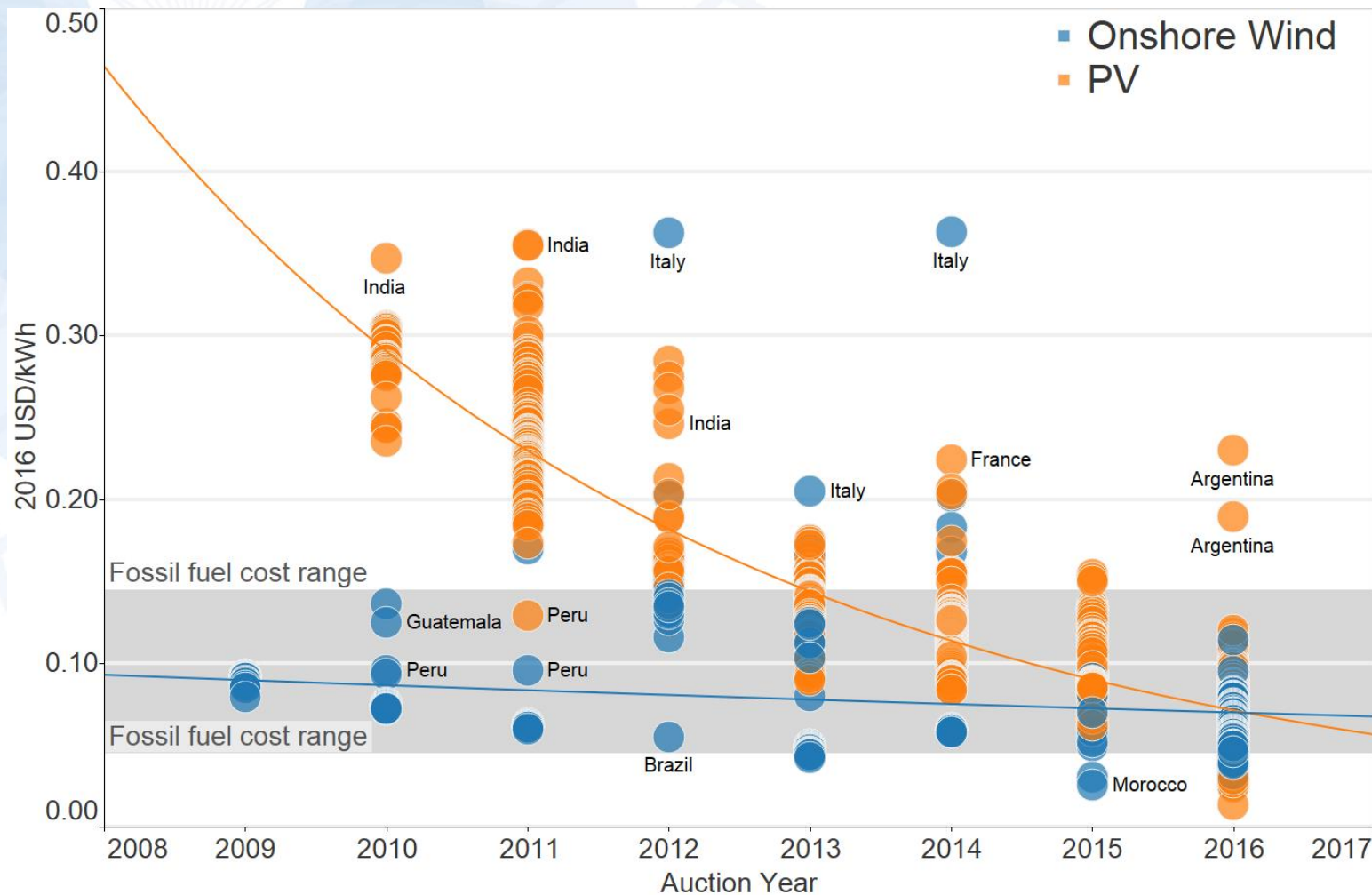
# Solar PV utility-scale projects



Technology improvements  
and  
cost reductions

=  
Falling LCOEs

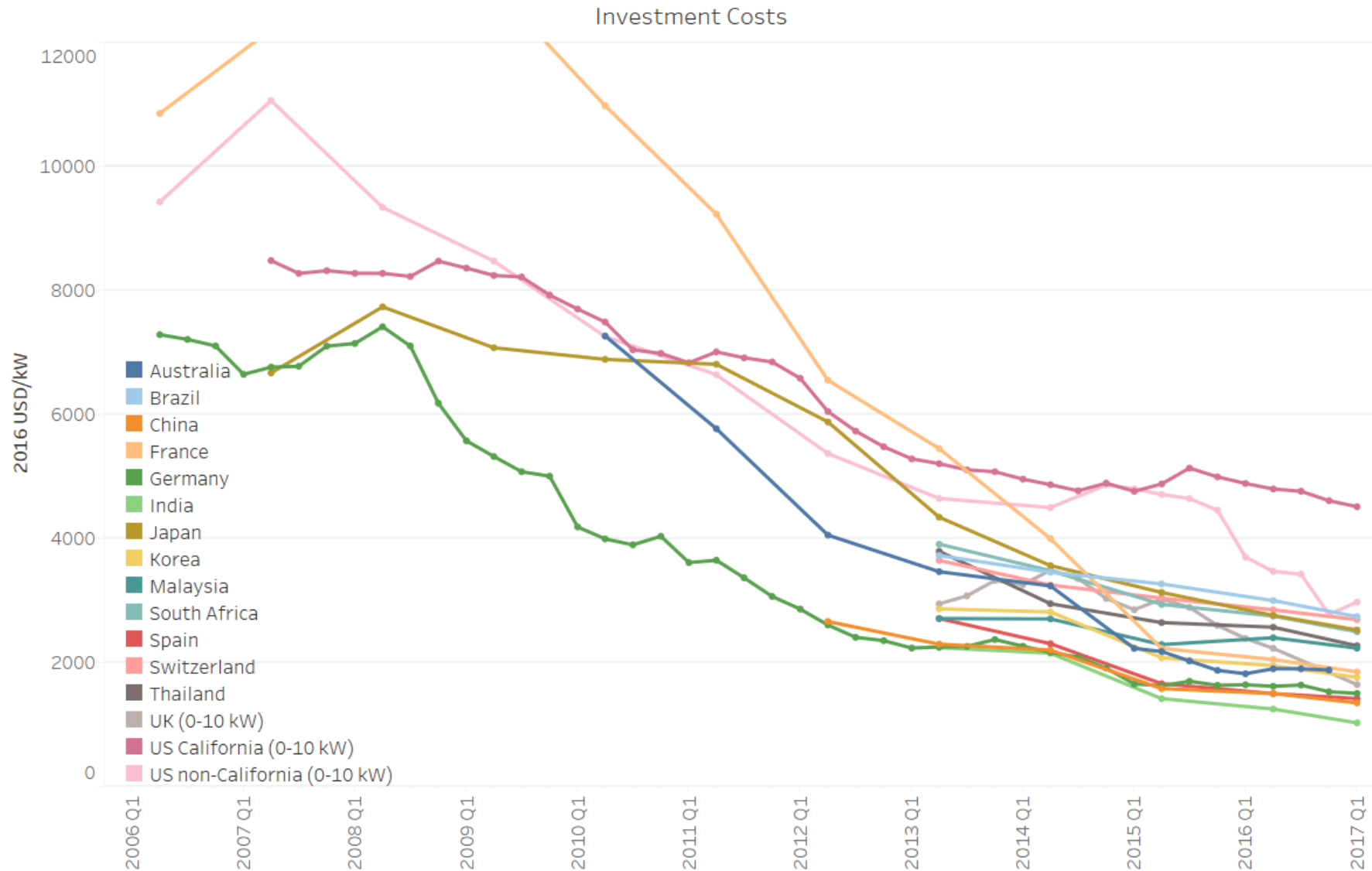
# Tender and PPA results



Dramatic convergence of solar PV and onshore wind to same LCOE range

But some of these projects are “boundary” projects, difficult to replicate for solar PV

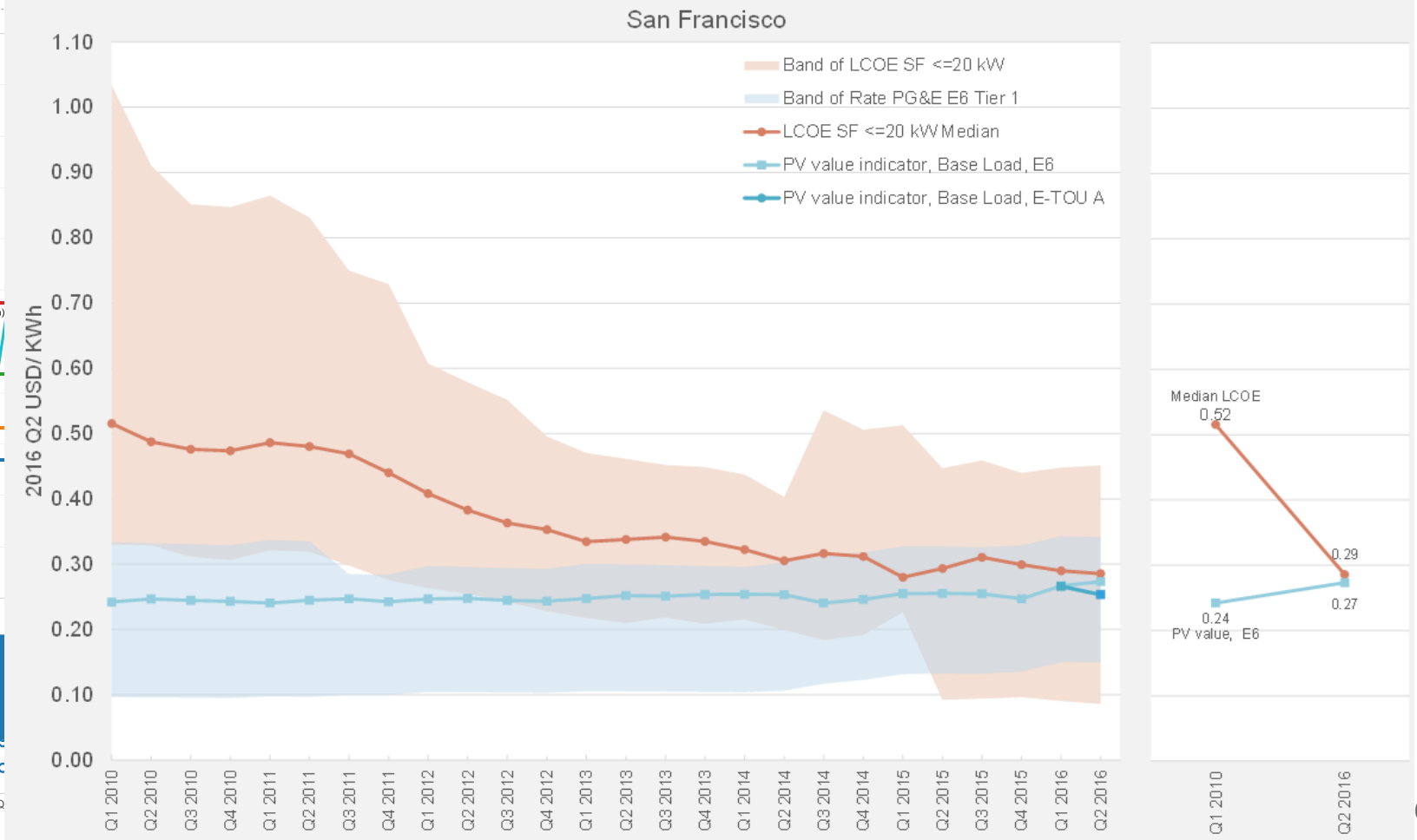
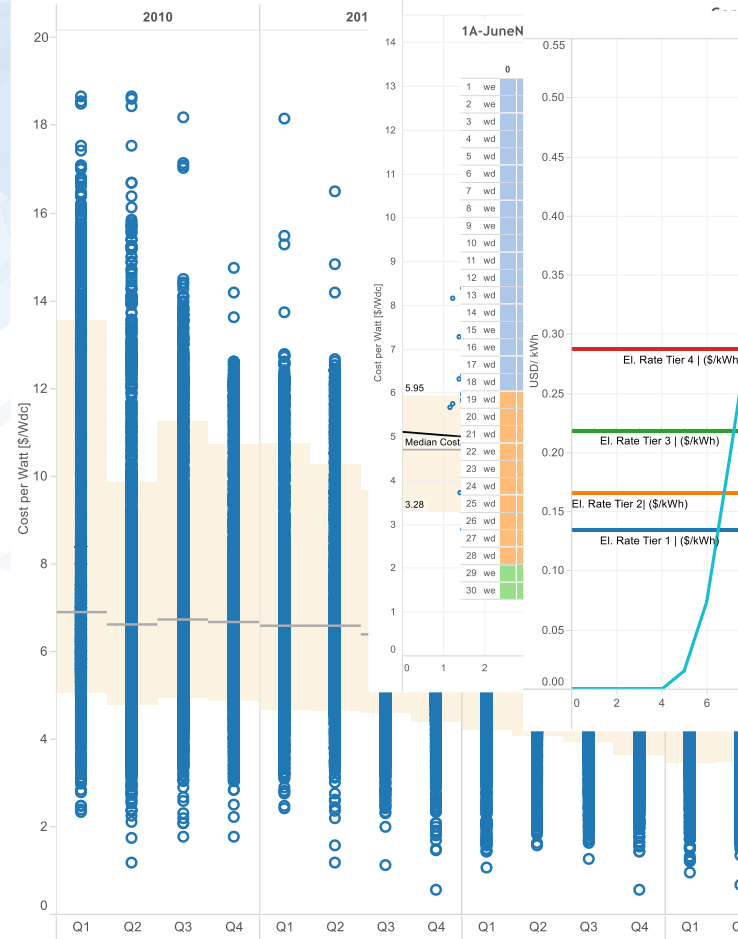
# Residential solar PV: Cost differentials persist



# IRENAs PV Parity Indicators (Pre view)

## Real Projections Data Electricity Rates Analysis PV Parity Analysis

Evolution of Costs per Quarter (Prelim) Costs in 2014 vs System Size (Preliminary Results)



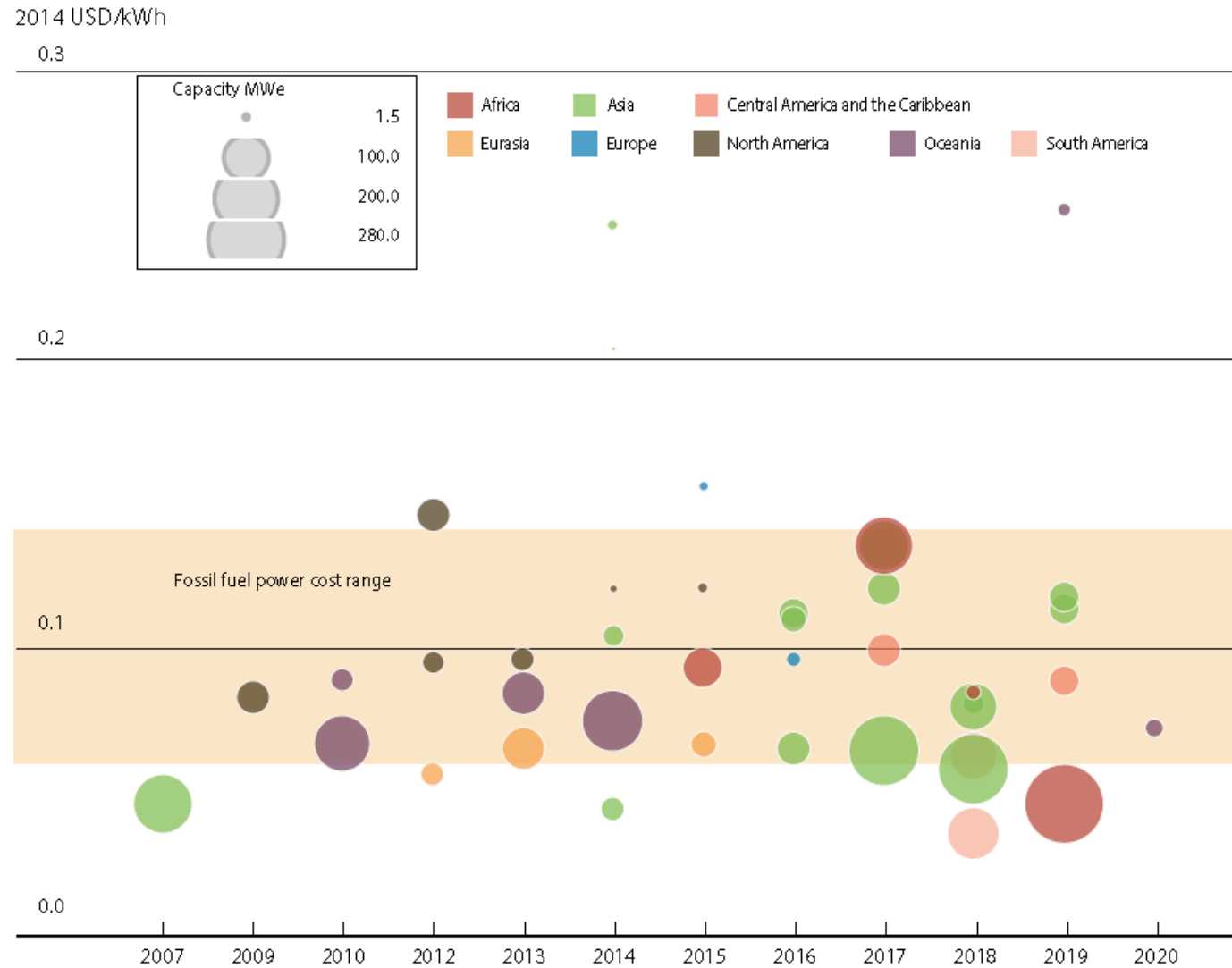


# Don't forget about biomass, geothermal and hydro

Hydropower

Biomass

Geothermal



Source: IRENA Renewable Cost Database and Global Data, 2014



# The Power to Change



**Cost Reduction Potentials  
for Solar and Wind**



# Costs will continue to fall for solar and wind power technologies to 2025



Large cost differentials

Continued technology innovation

Growing scale of markets

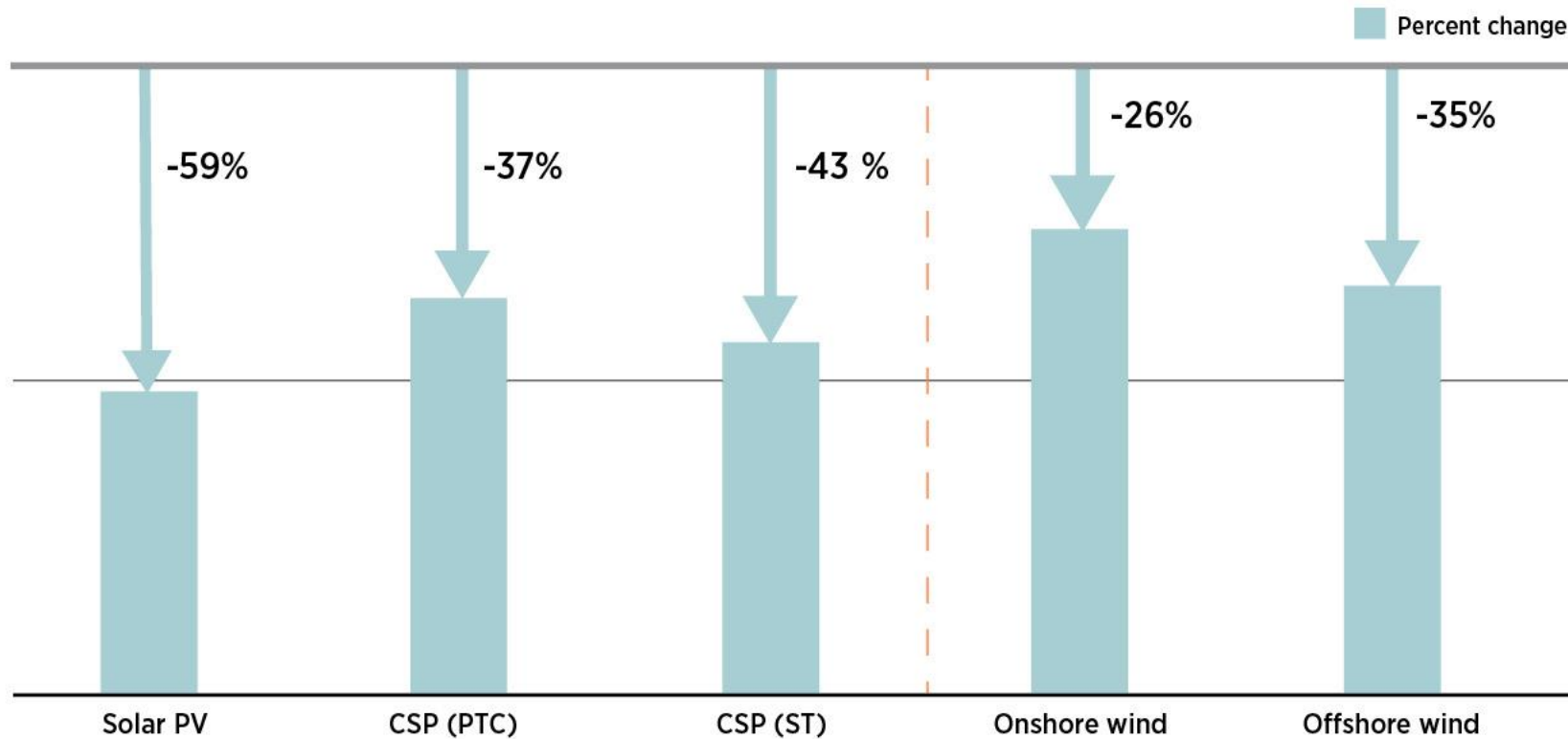
Policy framework critical to unlocking largest savings  
Cost reduction drivers are changing

# Cost reduction potential overview



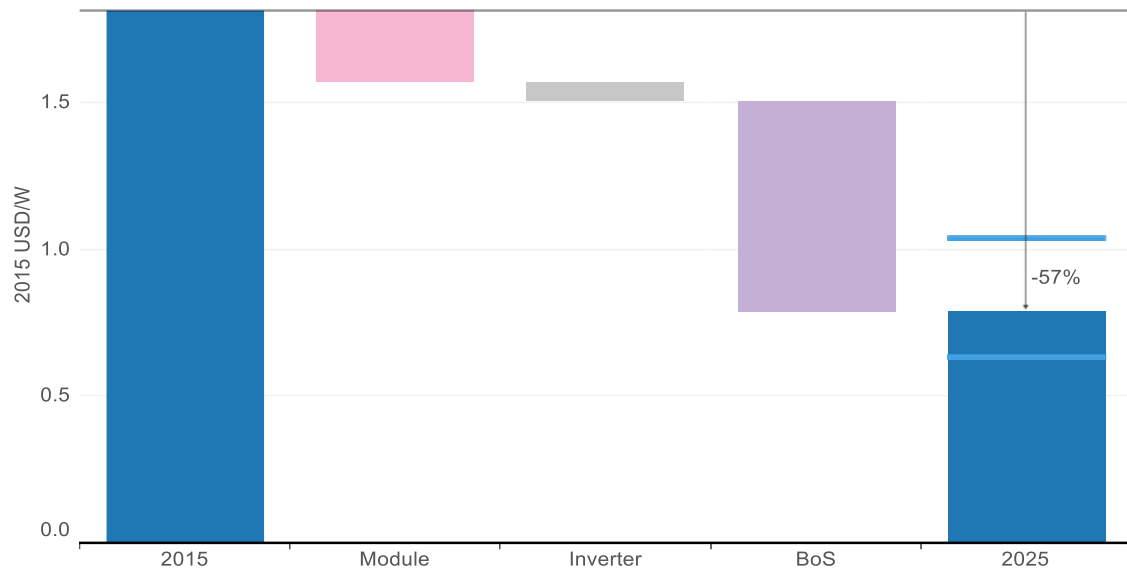
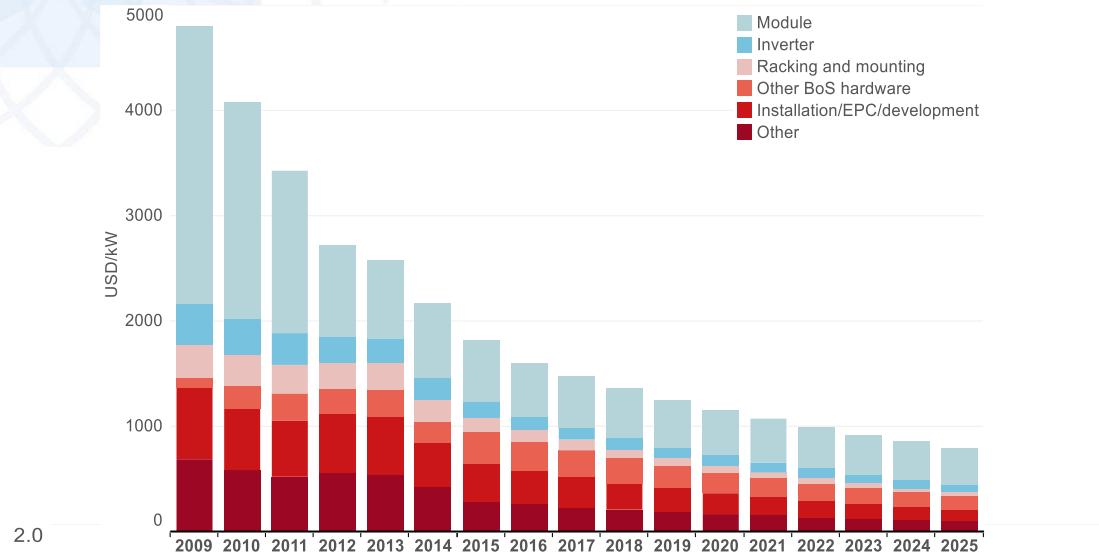
## THE POWER TO CHANGE: SOLAR AND WIND COST REDUCTION POTENTIAL TO 2025

POTENTIAL GLOBAL REDUCTIONS IN SOLAR AND WIND POWER LCOEs,  
2015-2025



PTC: Parabolic trough collector  
ST: Solar tower

# Solar PV: Installed system costs to 2025

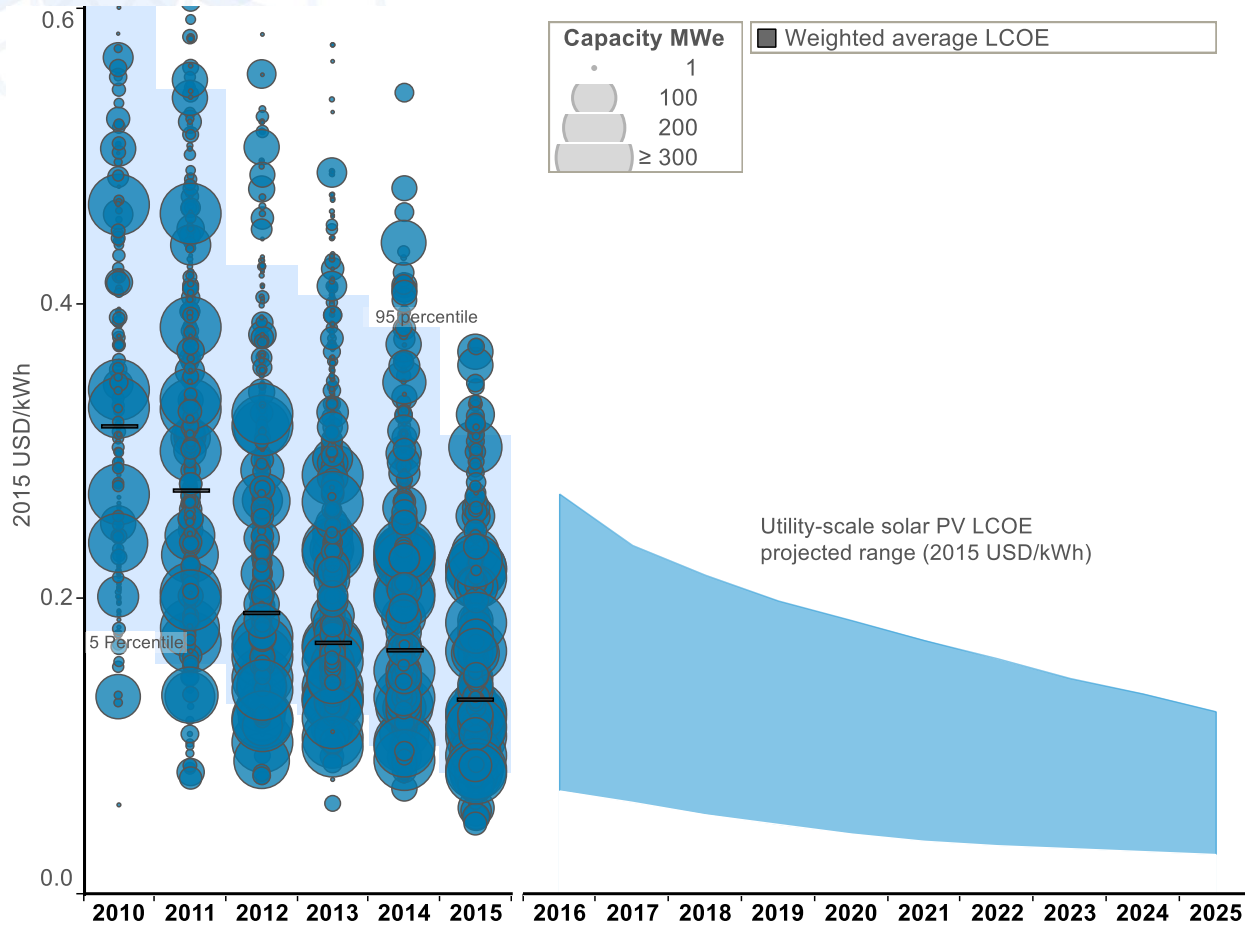


Large average cost reduction potential

BoS dominates potential

Will require action by policy makers

# Solar PV LCOE to 2025



Highly dependent on BoS convergence scenario

# IRENA Renewable COSTING ALLIANCE



## Member countries:

- Steering group for costing analysis focus
- One workshop a year
- Must nominate institution to deliver data
- Quarterly newsletter

## Alliance Members:

- Provide data, confidentially
- One workshop a year
- Ability to query the database in detail
- Quarterly newsletter

## Observers:

- Quarterly newsletter
- Mailing list for new publications/analysis

**Your  
organization?**



# Upcoming cost analysis: Firm

Quarterly PV parity indicators

Global wind learning curve

Heat pumps for stationary applications

RE Power Generation Costs in 2016

Battery markets & costs to 2030

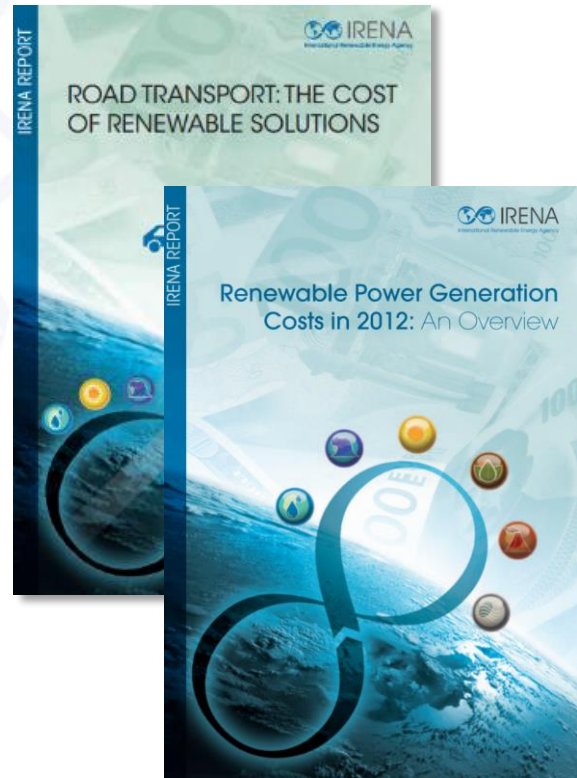
RE financing costs

Solar PV & Wind power in extreme climates

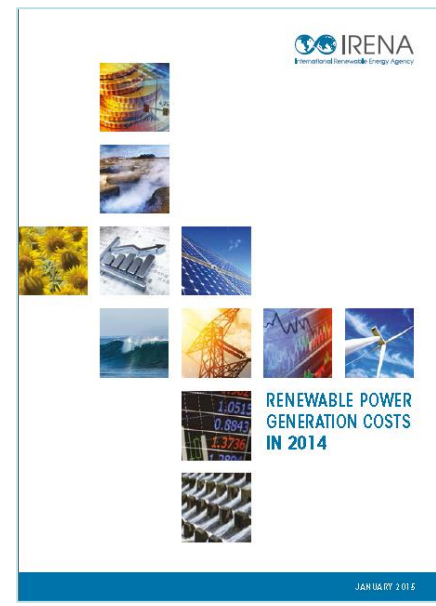
# IRENA Costing Analysis Products



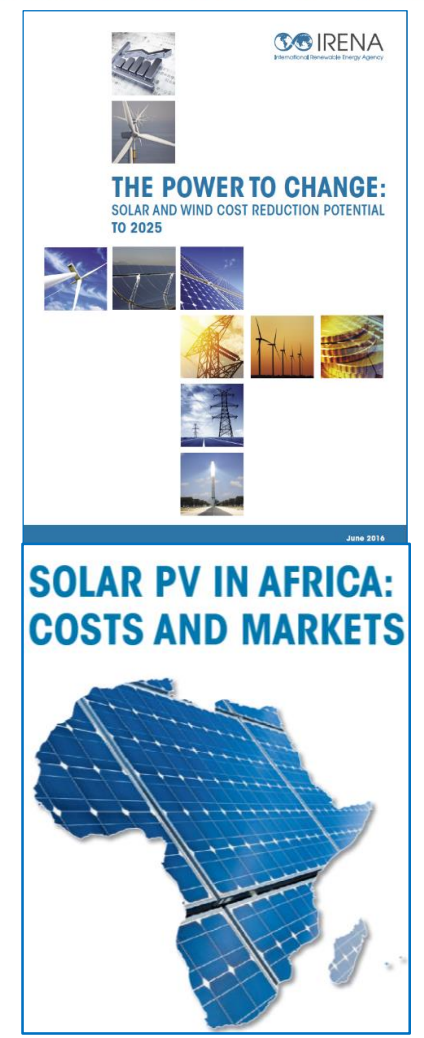
**2012**



**2013**



**2015**



**2016**

# Renewables are increasingly competitive

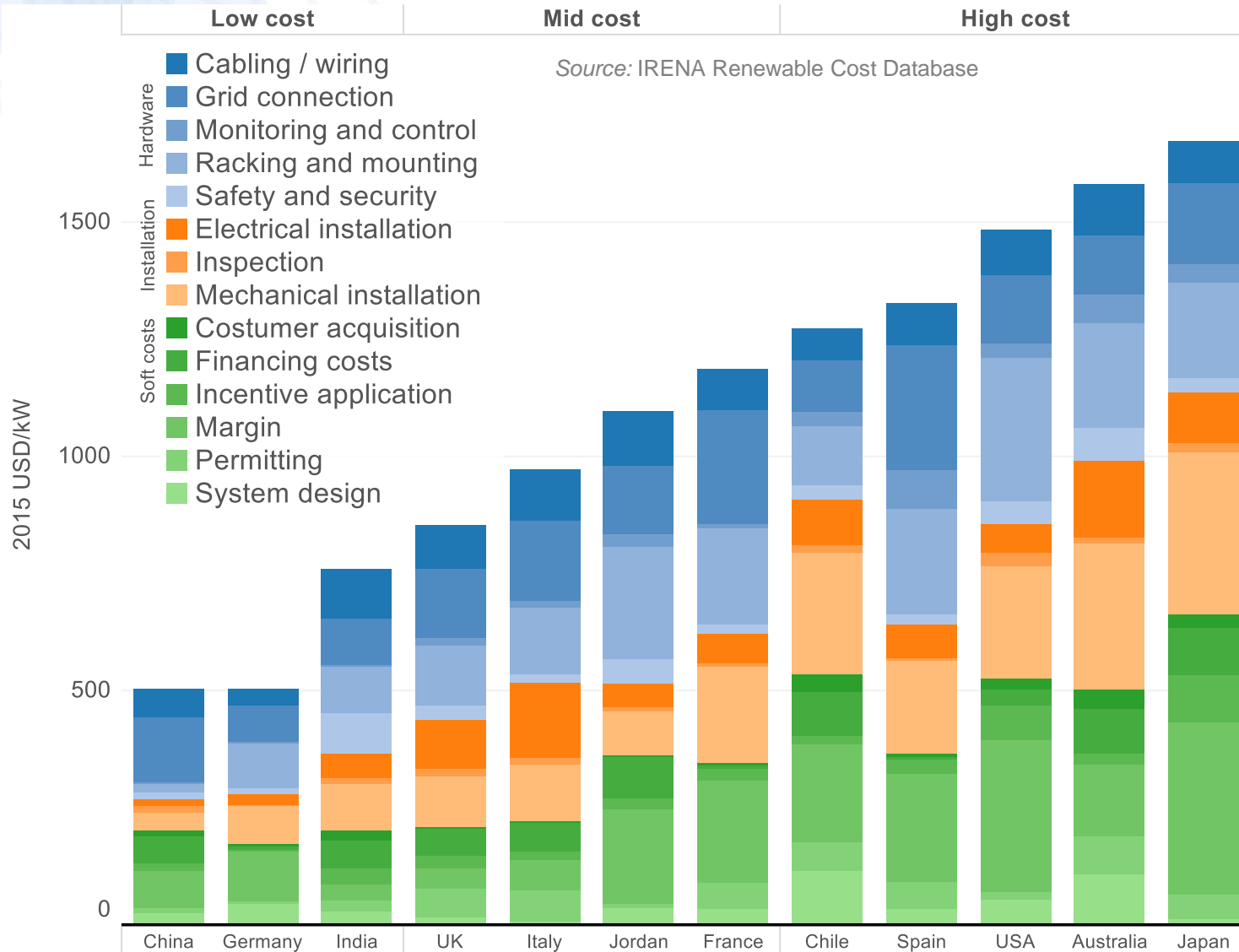


**The winners are customers, the  
environment and our future**

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# Solar PV: BoS costs

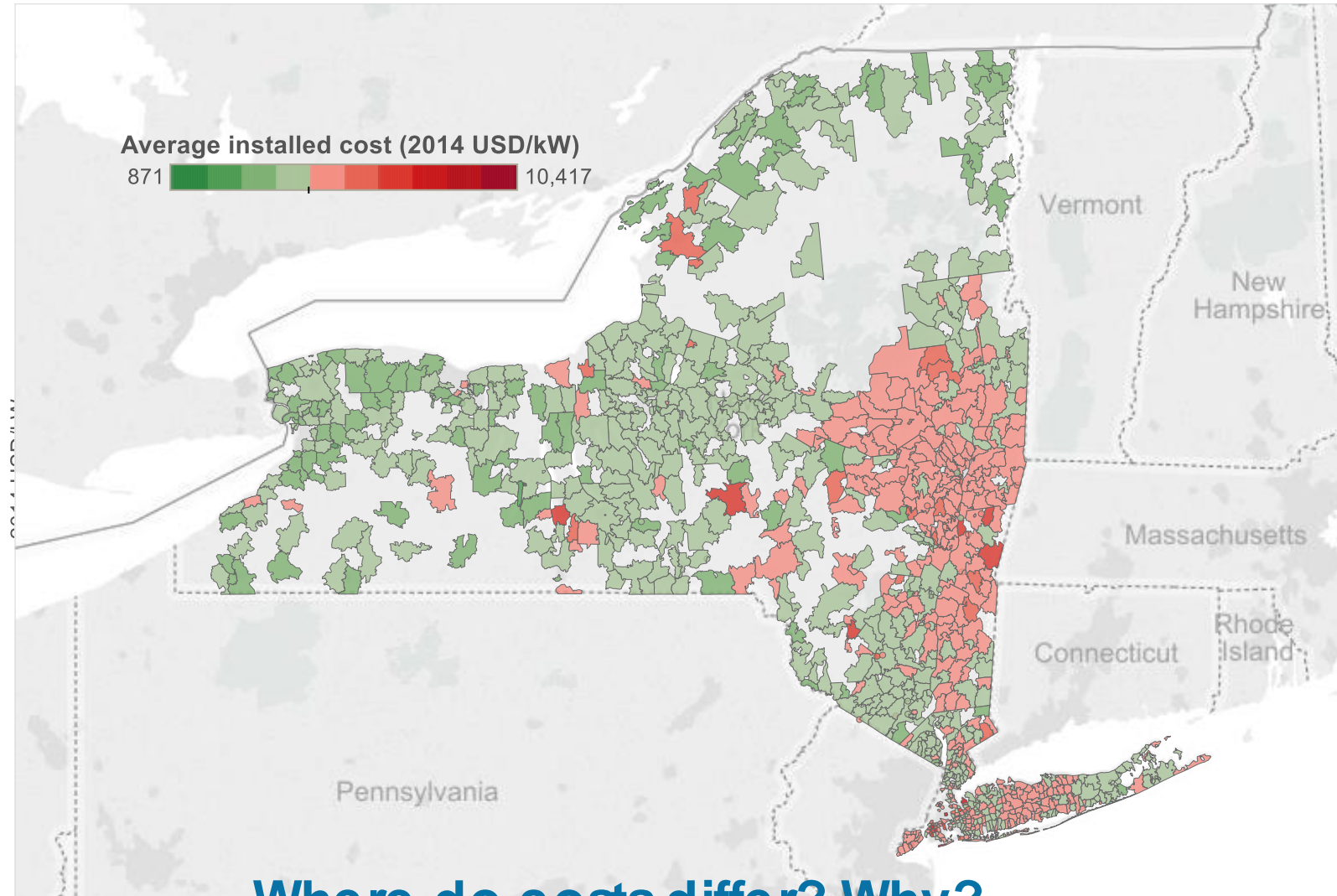
Detailed breakdown of solar PV BoS costs by country, 2015



The range of BoS costs between costs groups is very large, but BoS costs also present the greatest opportunities for reduction potential

# Identify policy questions that need to be asked.....

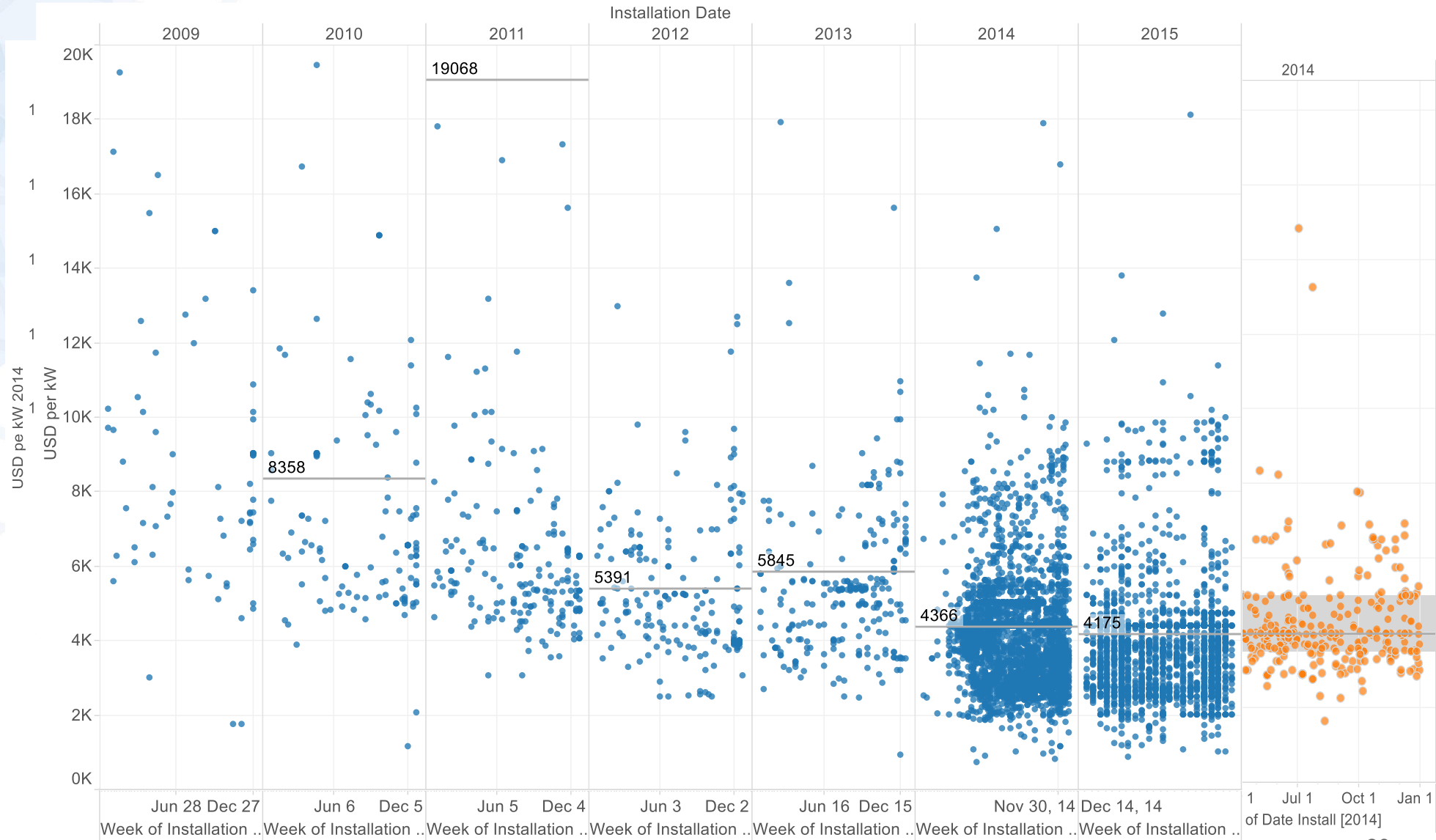
Average residential PV system cost (relative to 2014 median)



**Where do costs differ? Why?**

# COMMERCIAL SOLAR PV COSTS

Arizona  
New York State



# SOLAR PV IN AFRICA: COSTS AND MARKETS



## NEW OPPORTUNITIES UNLOCKED

# Solar PV Costs in Africa

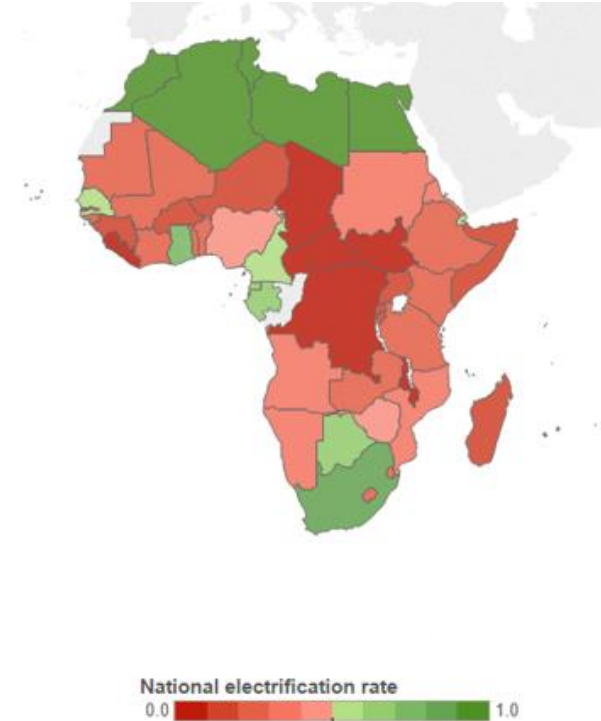
Africa has a need for power:  
Solar resources make PV an excellent fit

But cost structure is different from other regions

Data collection challenging, but encouraging results

- Some markets relatively competitive
- Very small SHS cost structures are challenging
- Regional deep-dives necessary for greater clarity

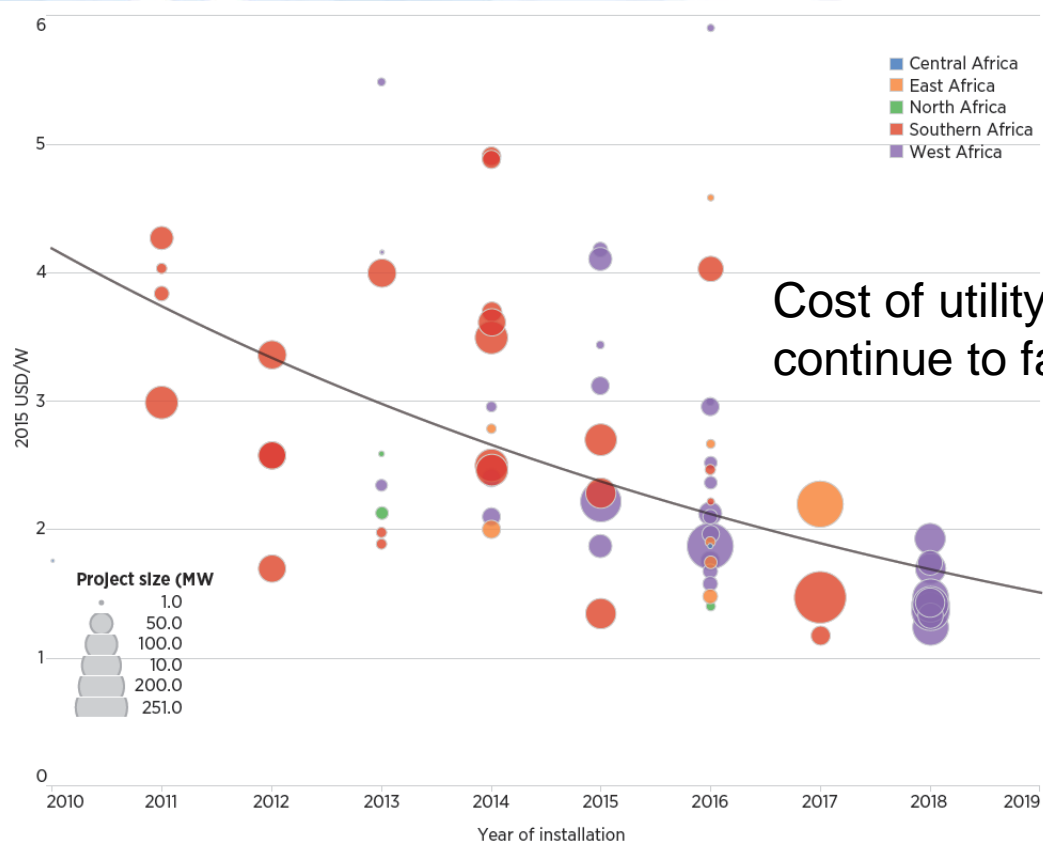
~600 million lack access



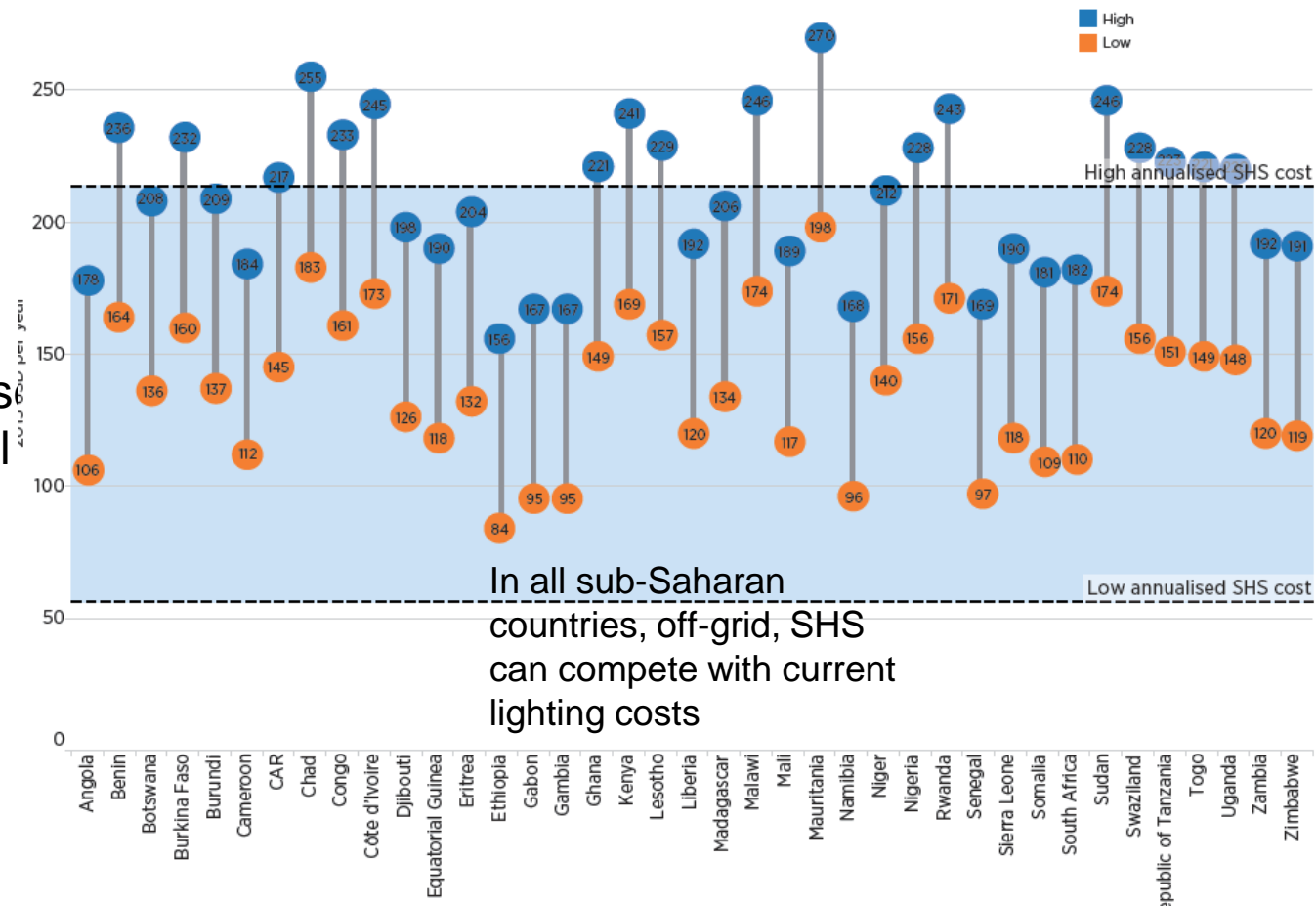


# Solar PV costs in Africa: Utility-scale and SHS

Operating and proposed utility scale solar PV project installed costs in Africa, 2010-2018 (IRENA)



Annual off-grid household expenditure on lighting and mobile phone charging compared to SHS (<1kW) annualized costs, by country (IRENA)



Source: IRENA Renewable Cost Database, 2016