

The Solar Boom:

Here Today? or Coming Tomorrow?

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10 June 2015

Four key themes

1

Deployment is rising, but not fast enough

2

Four key drivers of future growth

3

African opportunities

4

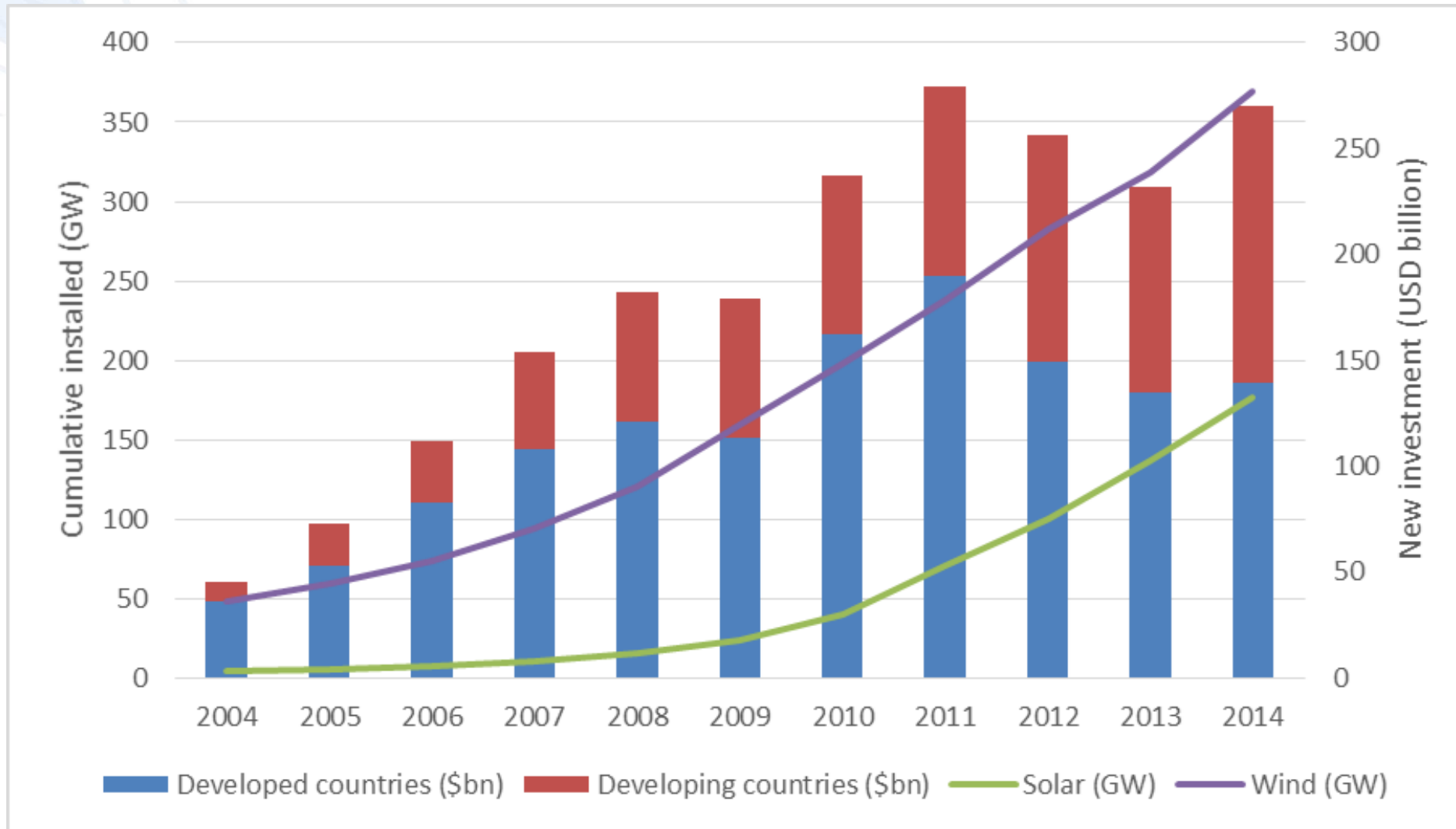
Challenges and upcoming work



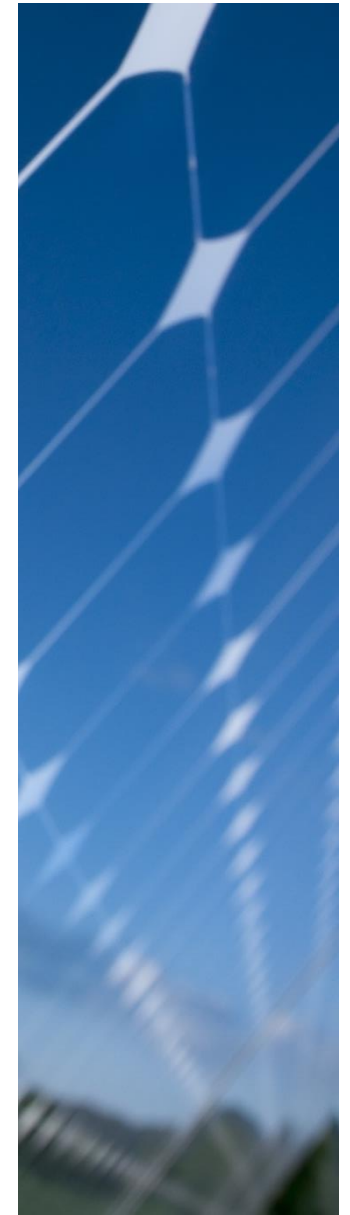
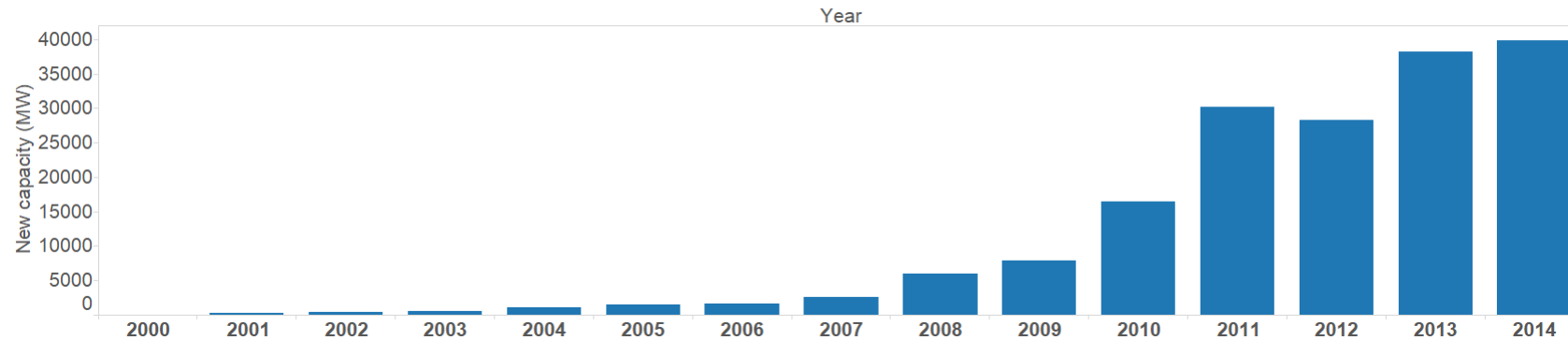
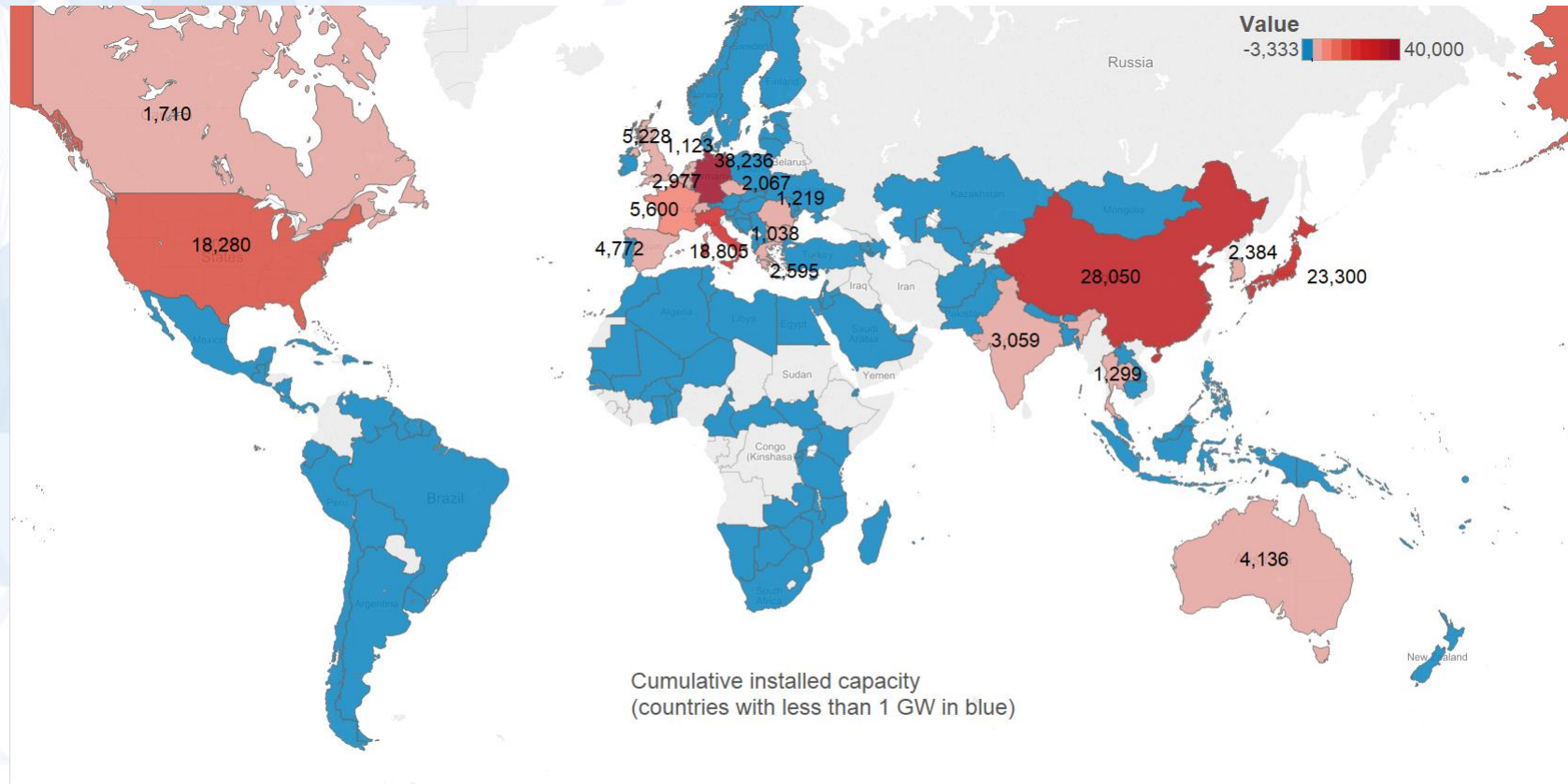
1

Solar PV Markets 2000 to 2014

Global Investment in Renewable Energy

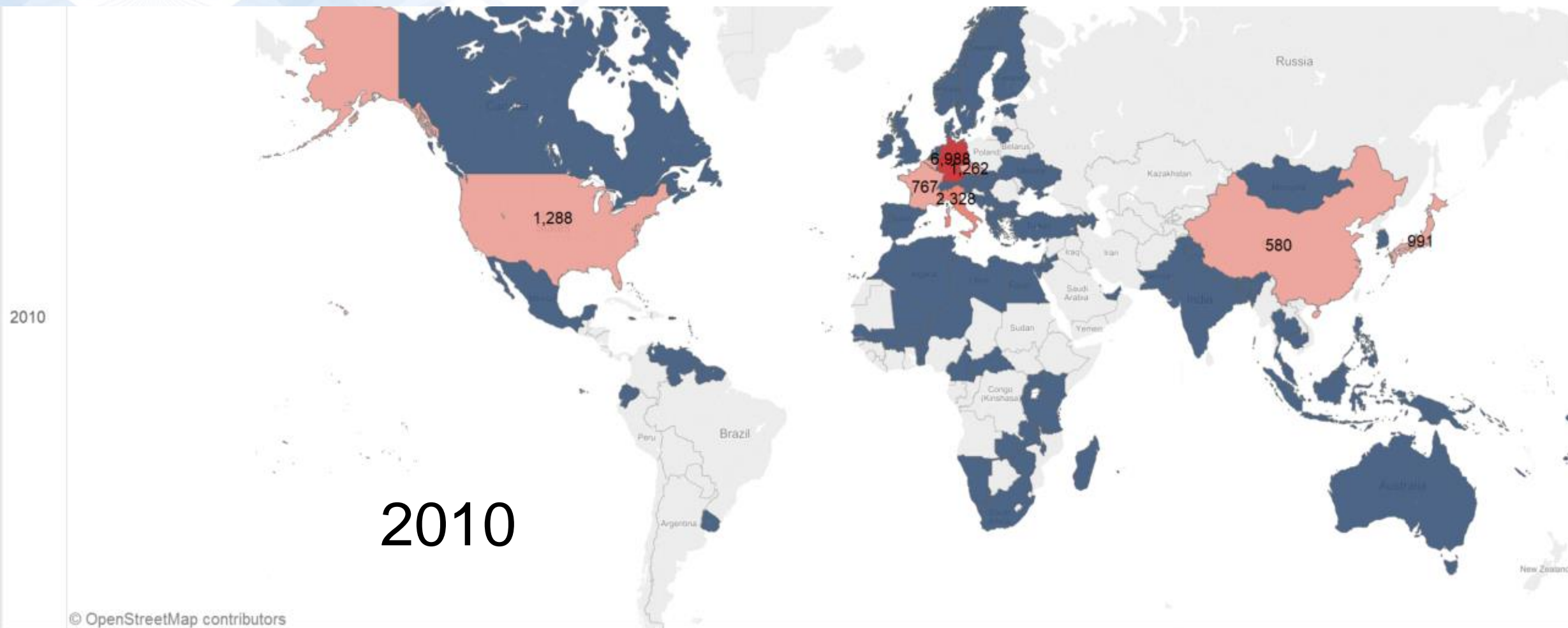


Solar PV deployment



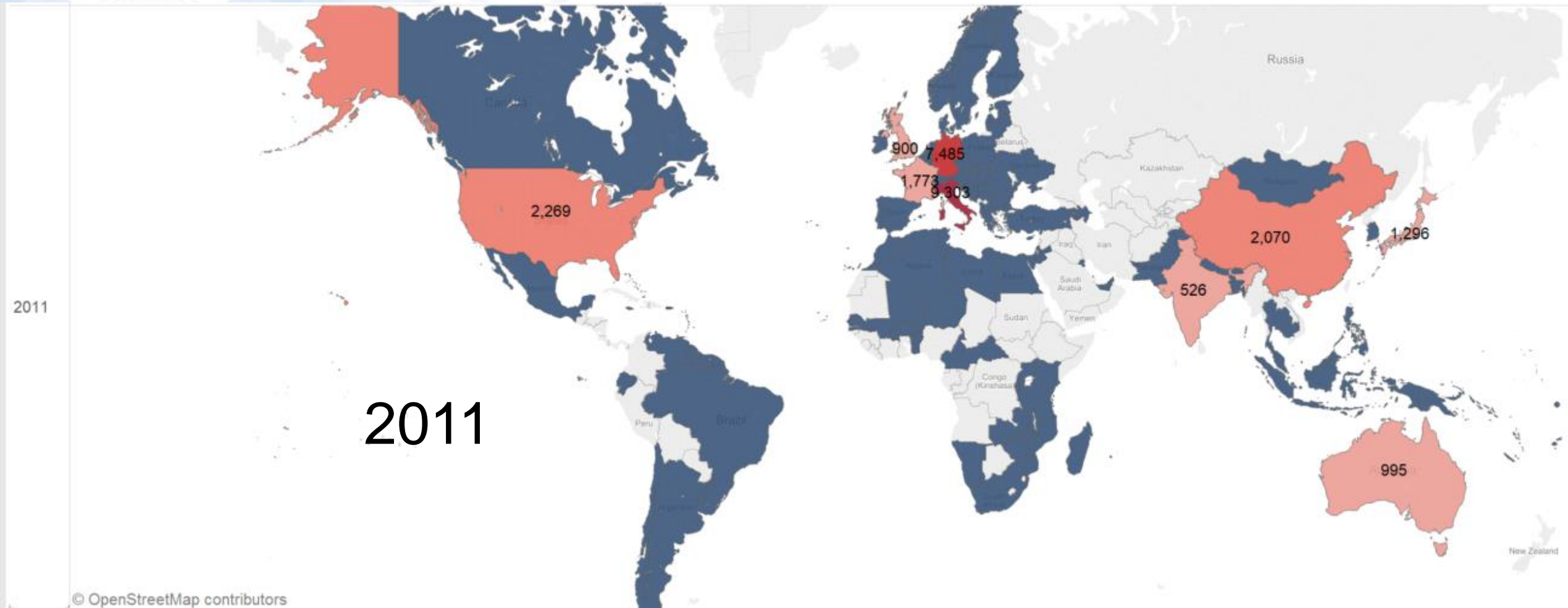
The shift to the East and West

New annual capacity additions



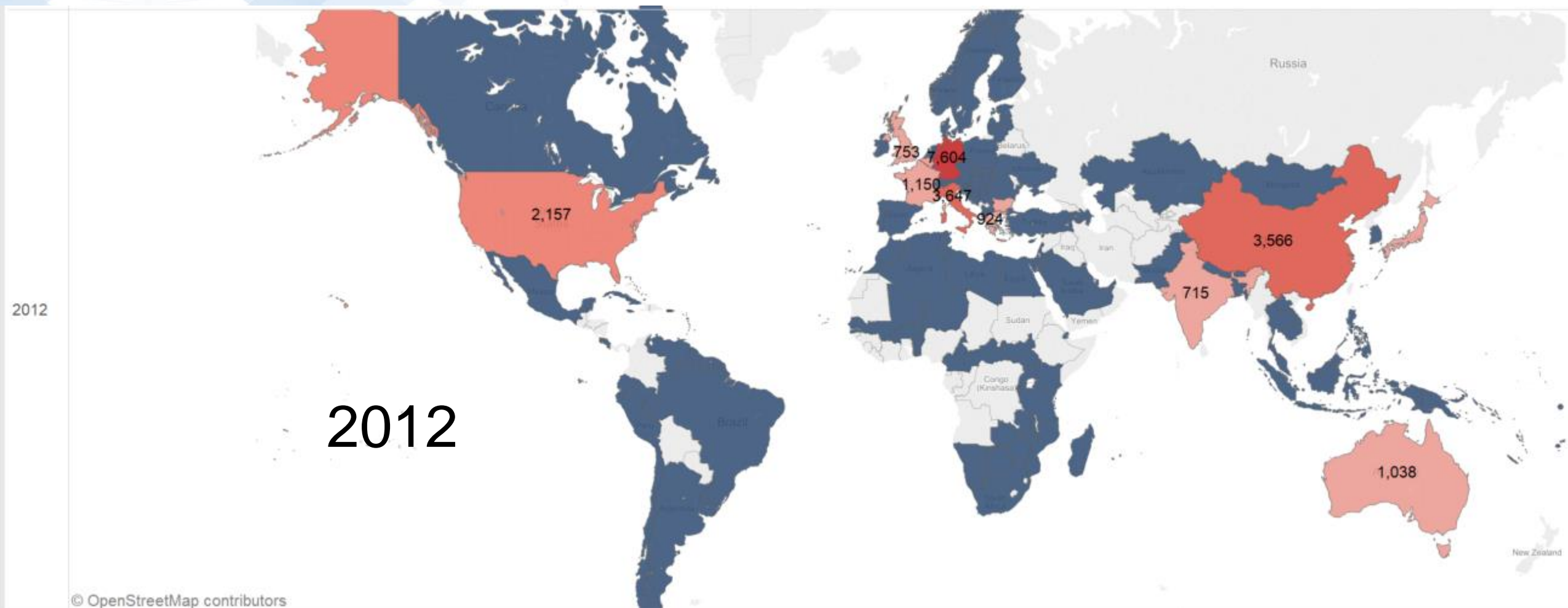
The shift to the East and West

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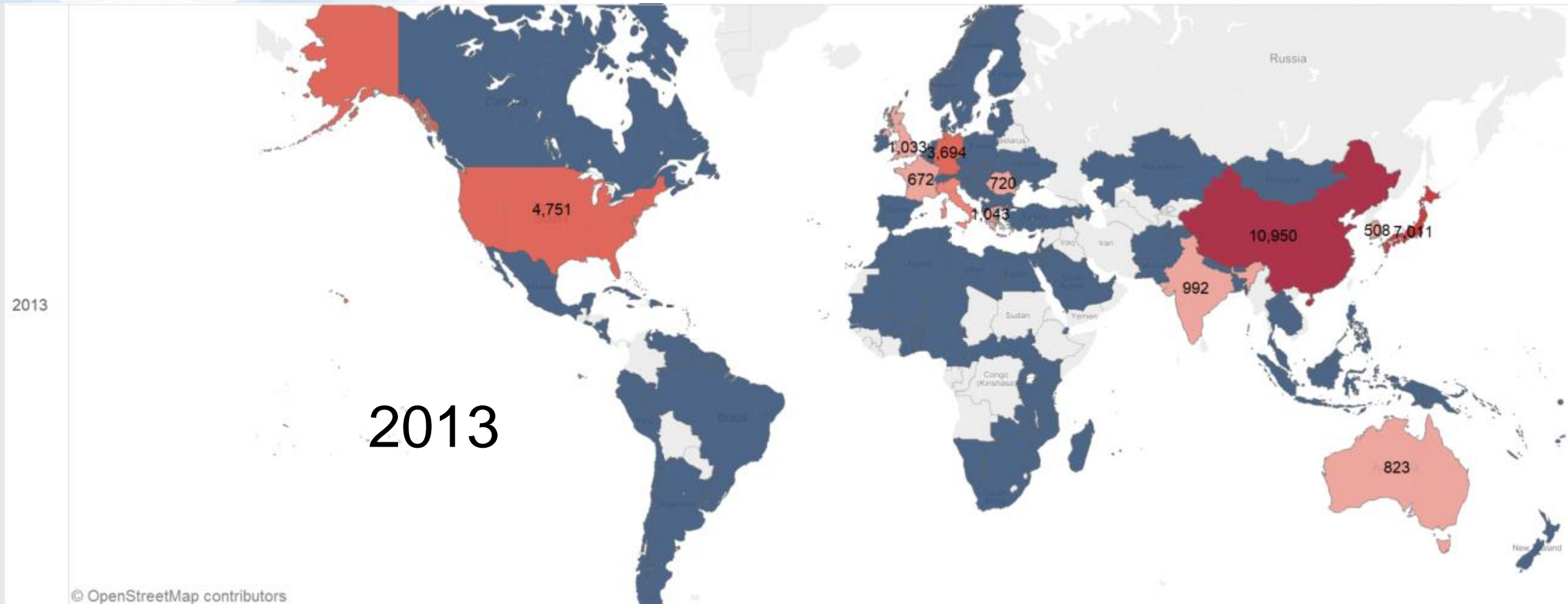
The shift to the East and West

New annual capacity additions



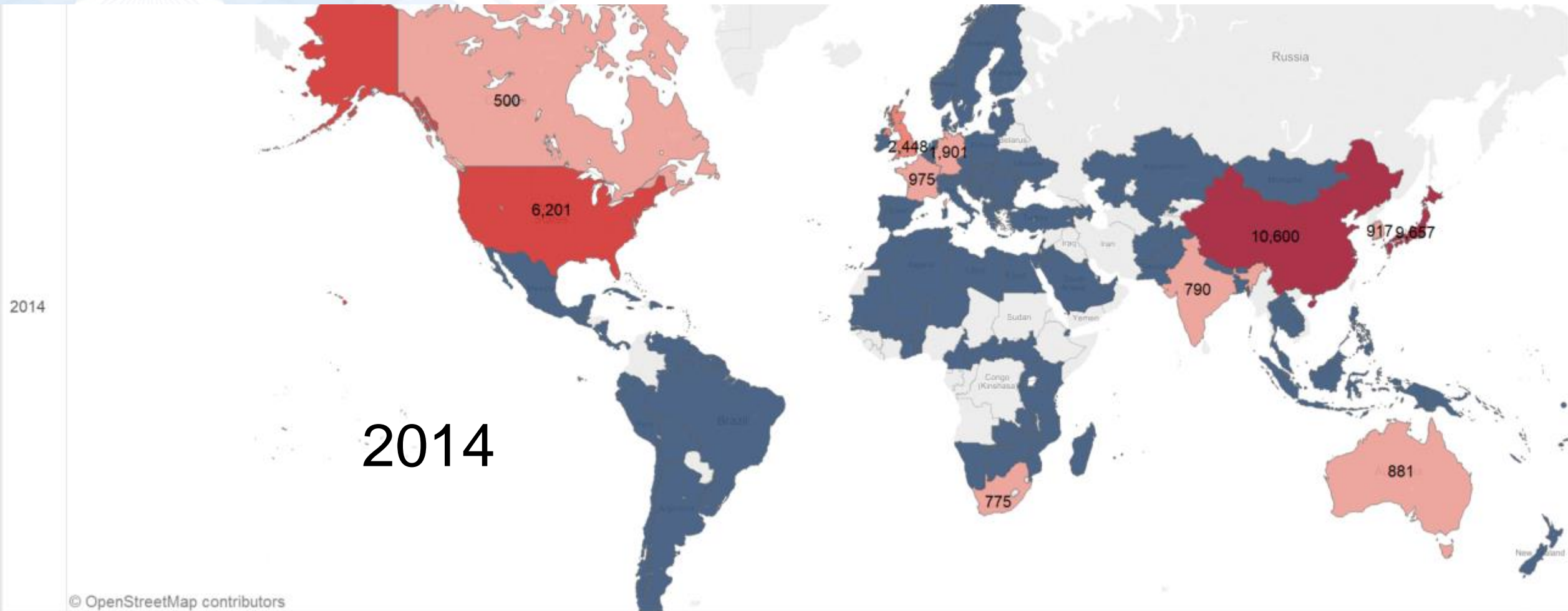
The shift to the East and West

New annual capacity additions



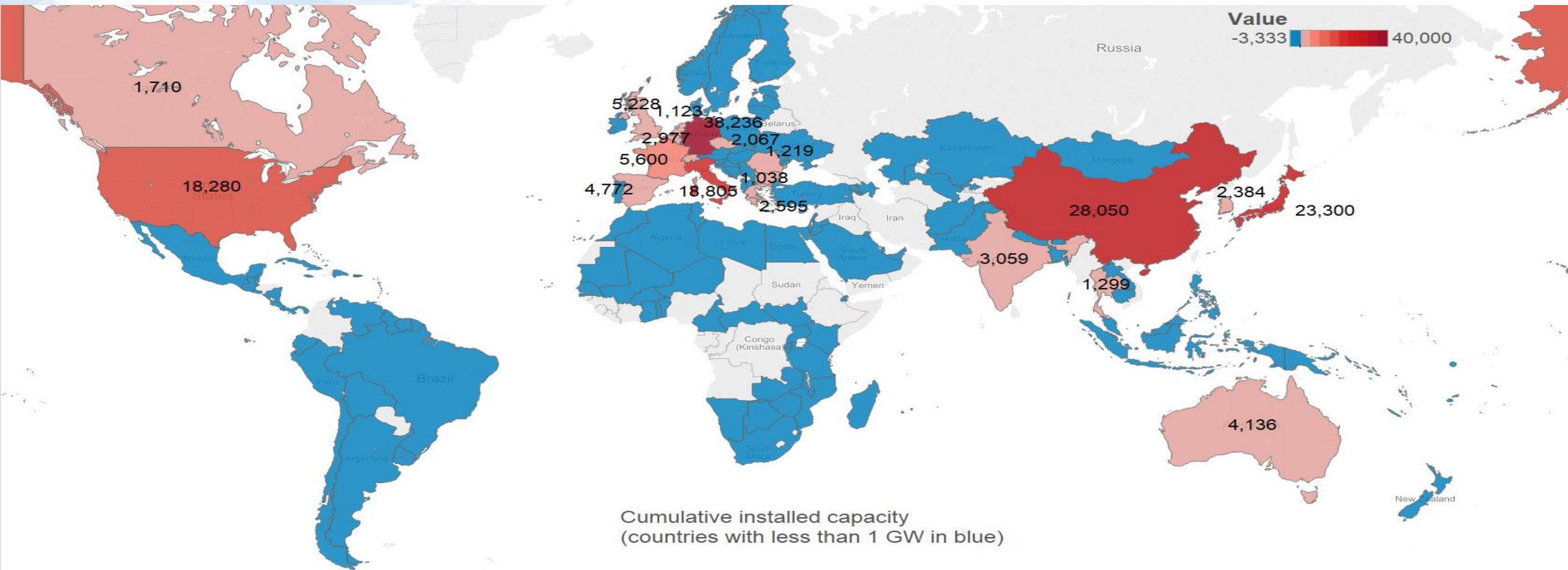
The shift to the East and West

New annual capacity additions



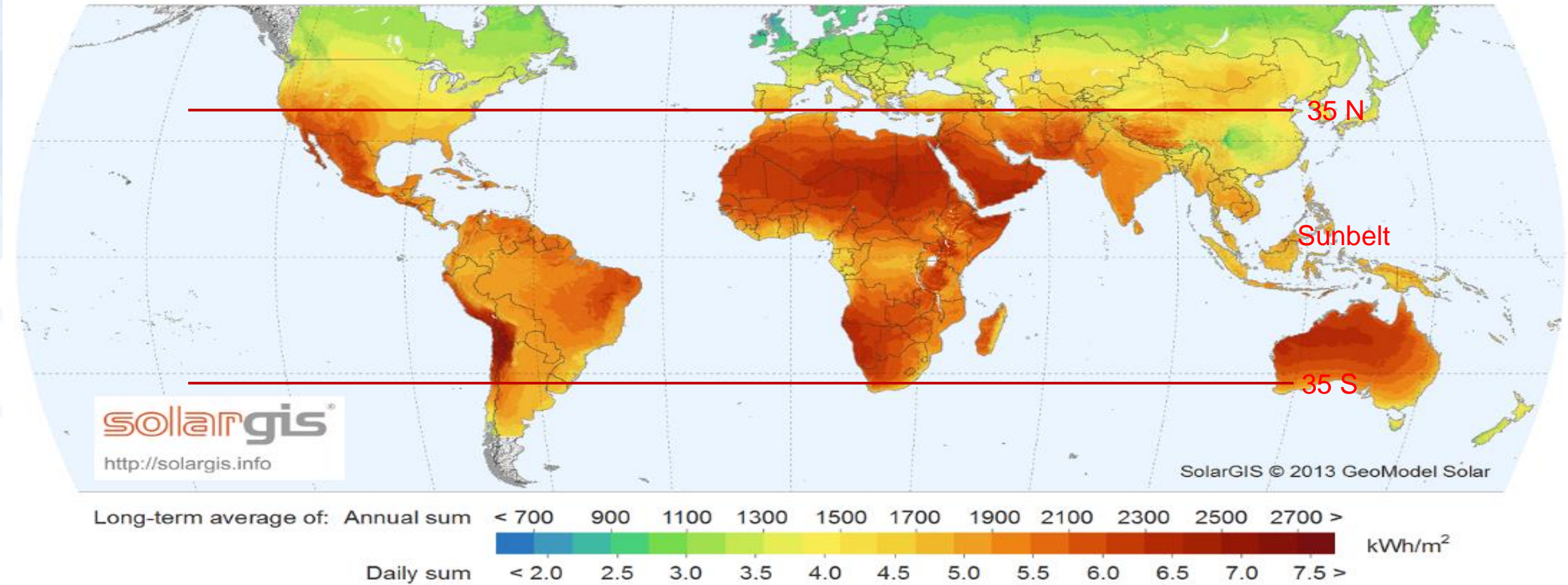
Mismatches and opportunities

Deployment



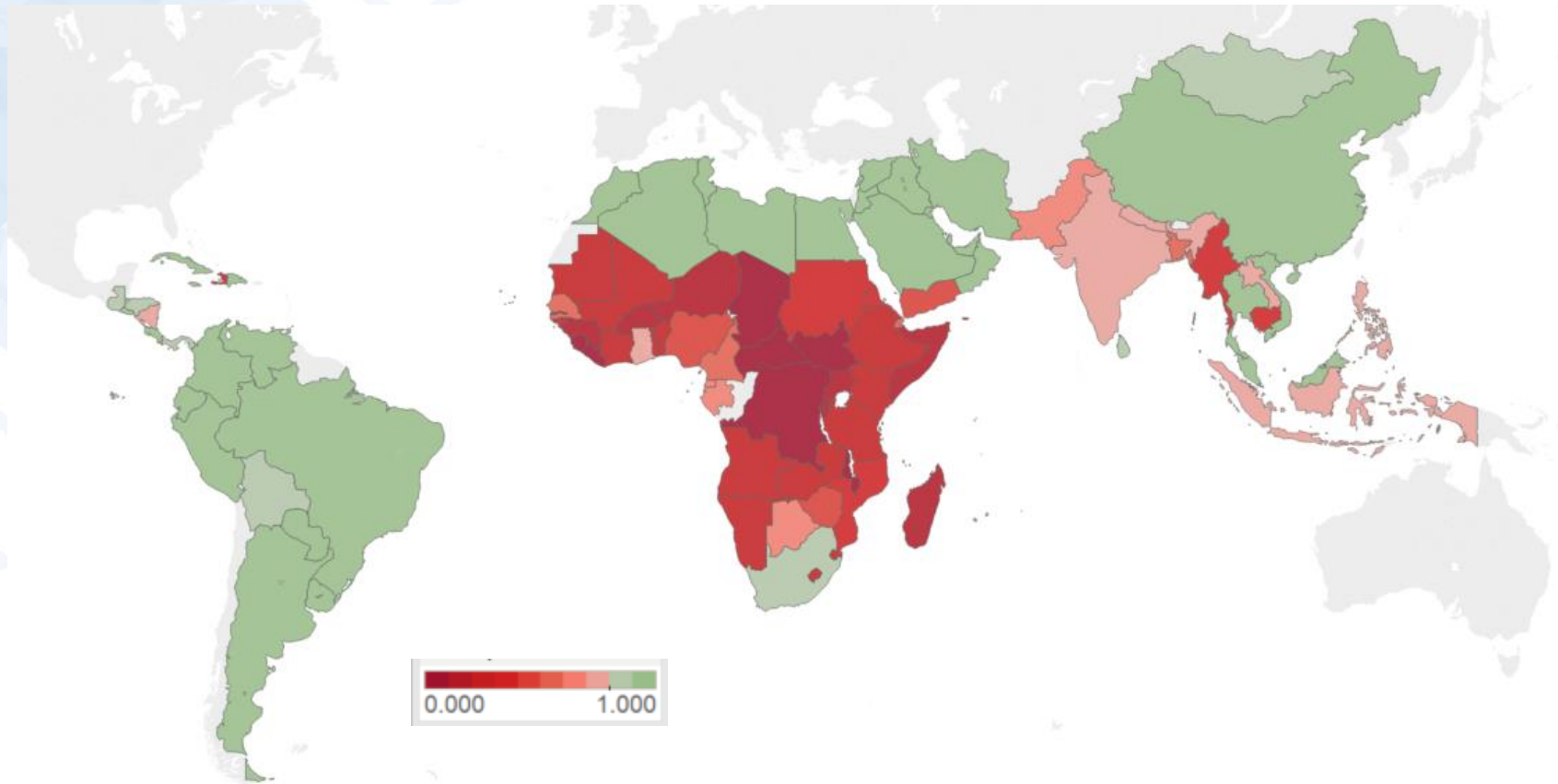
Mismatches and opportunities

has missed the best resources



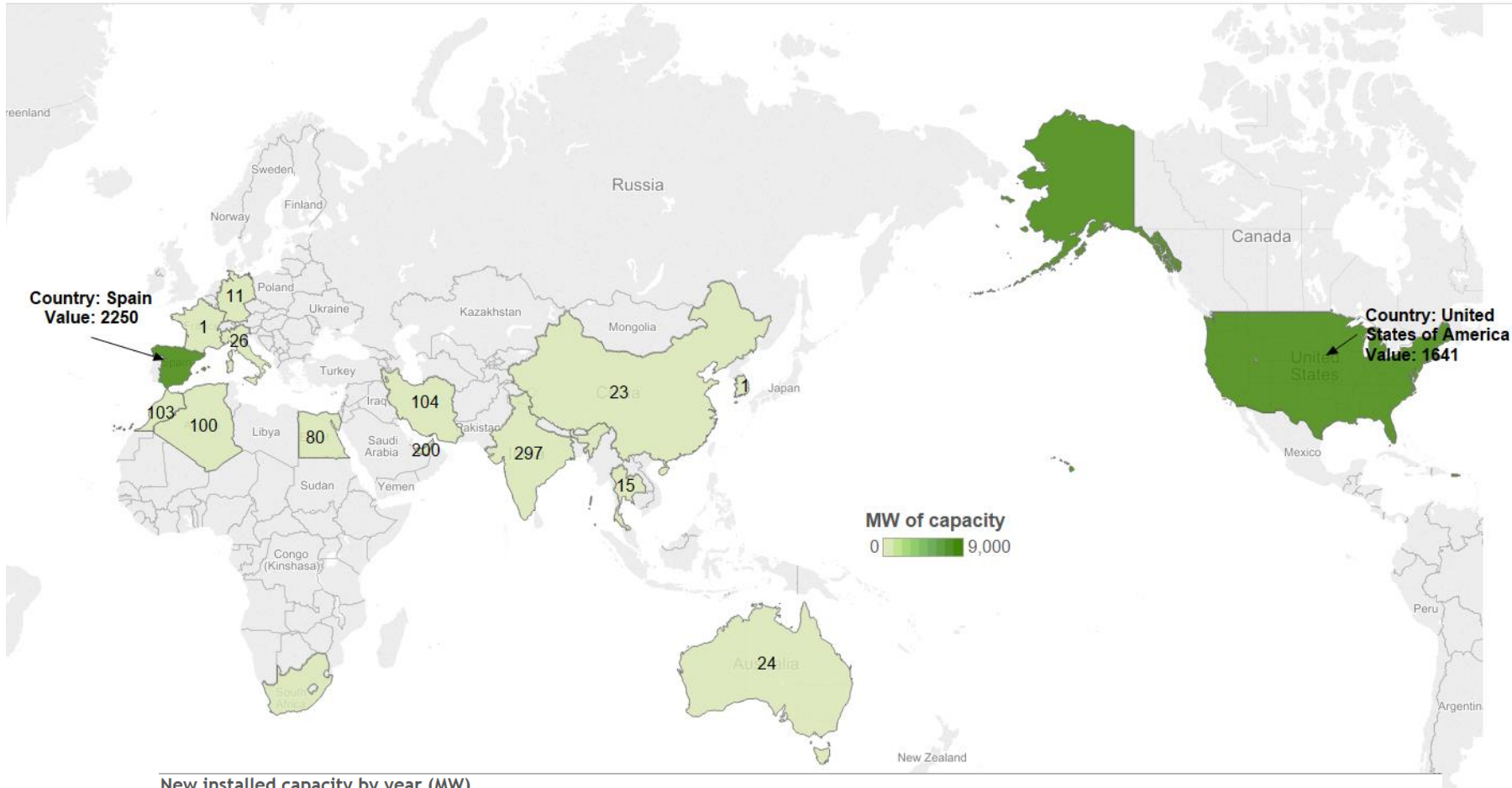
Mismatches and opportunities

And those without access to electricity

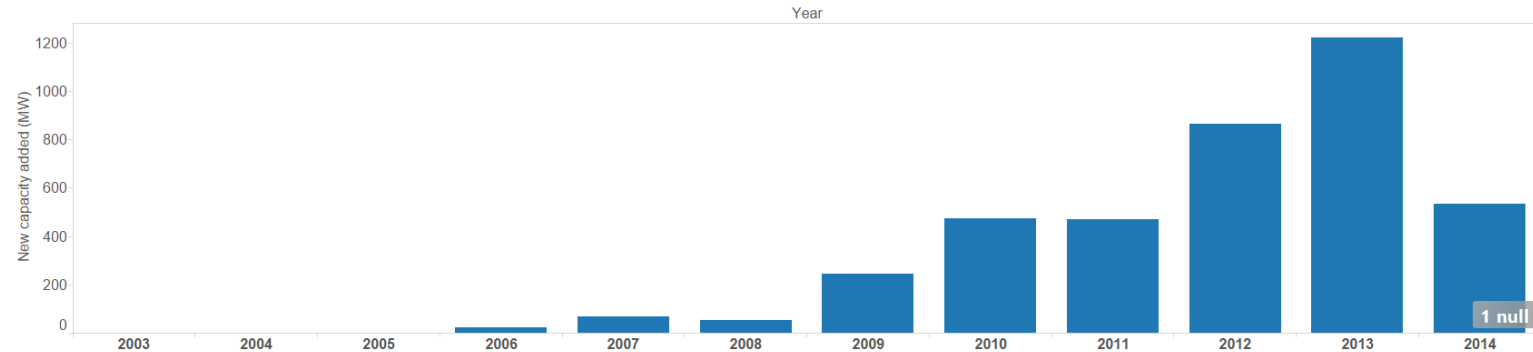


Concentrating solar power

Culative installed CSP capacity in 2014 (MW)



New installed capacity by year (MW)



2

Opportunities and New Markets

Four drivers for the future

Electricity access

To address environmental concerns
(local & global)

Deployment in developing/resource
rich countries

Increasingly driven by economics

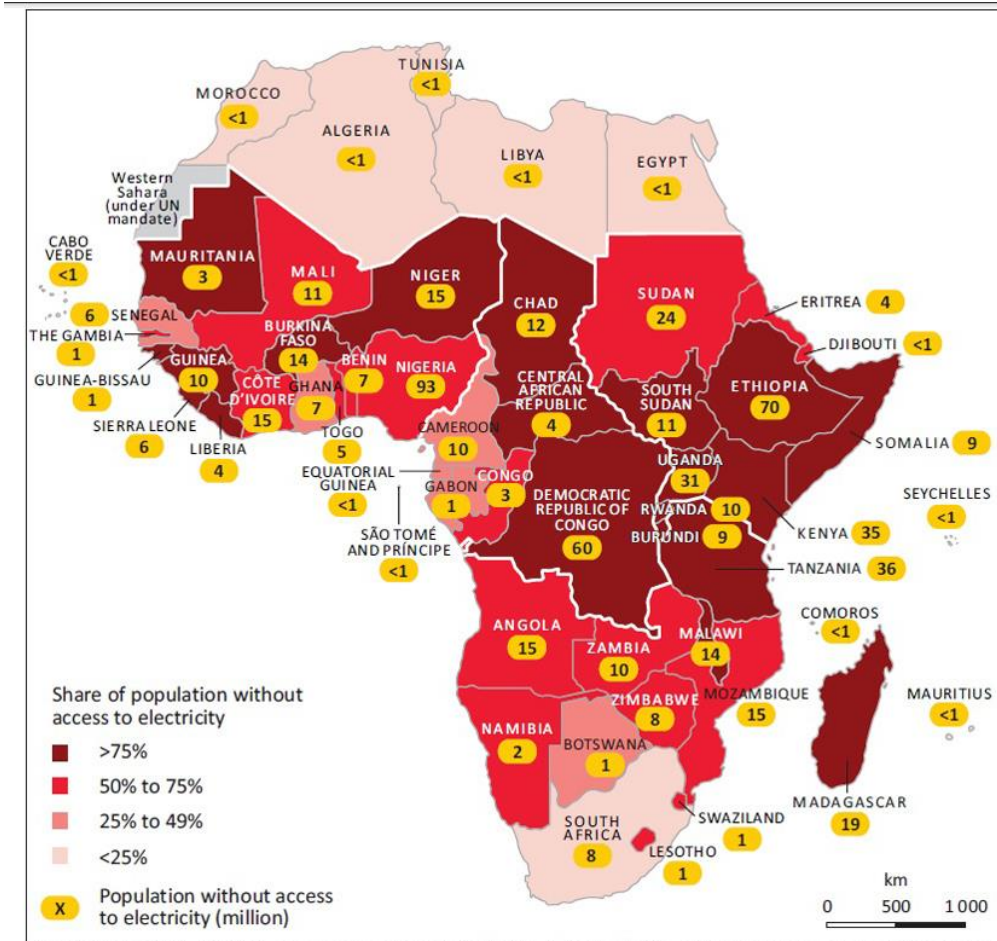
Electricity access

Solar PV resources high where access low

620 million people without access in Sub-Saharan Africa

Solar home systems: rapid, cheap access

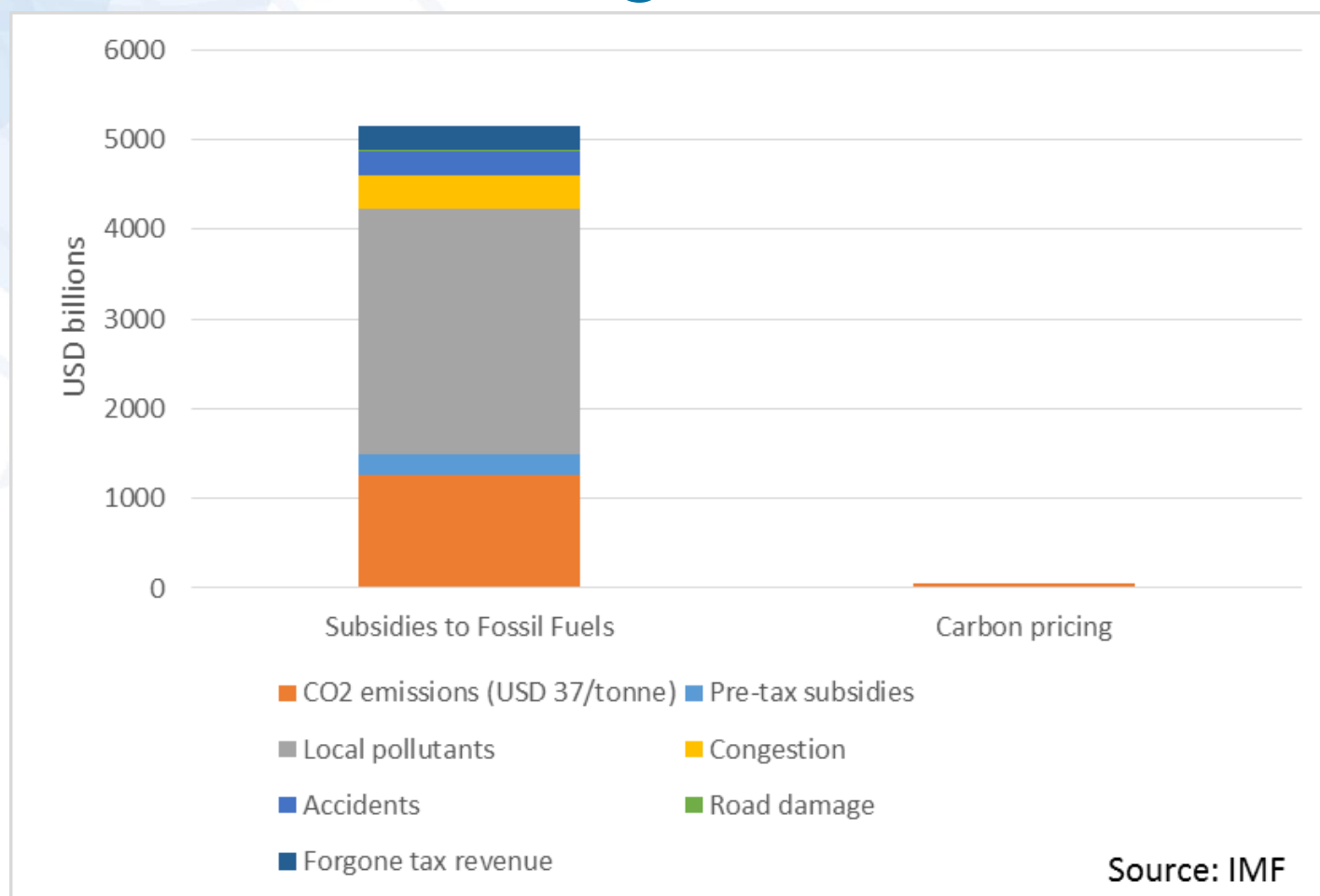
Low-cost economic opportunity



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Environmental concerns

Local and global environmental costs from fossil fuels are significant



Environmental concerns

Solar PV can address these costs and bring large benefits

↓ **\$200bn**



Global health-related costs can be reduced up to \$200 billion annually

↑ **900,000 jobs**



Doubling the global share of renewable energy would create a net gain of 900,000 jobs in the energy sector in 2030

↓ **15%**



Demand for oil and natural gas can be reduced by around 15%, creating more energy security for fossil-fuel importing countries

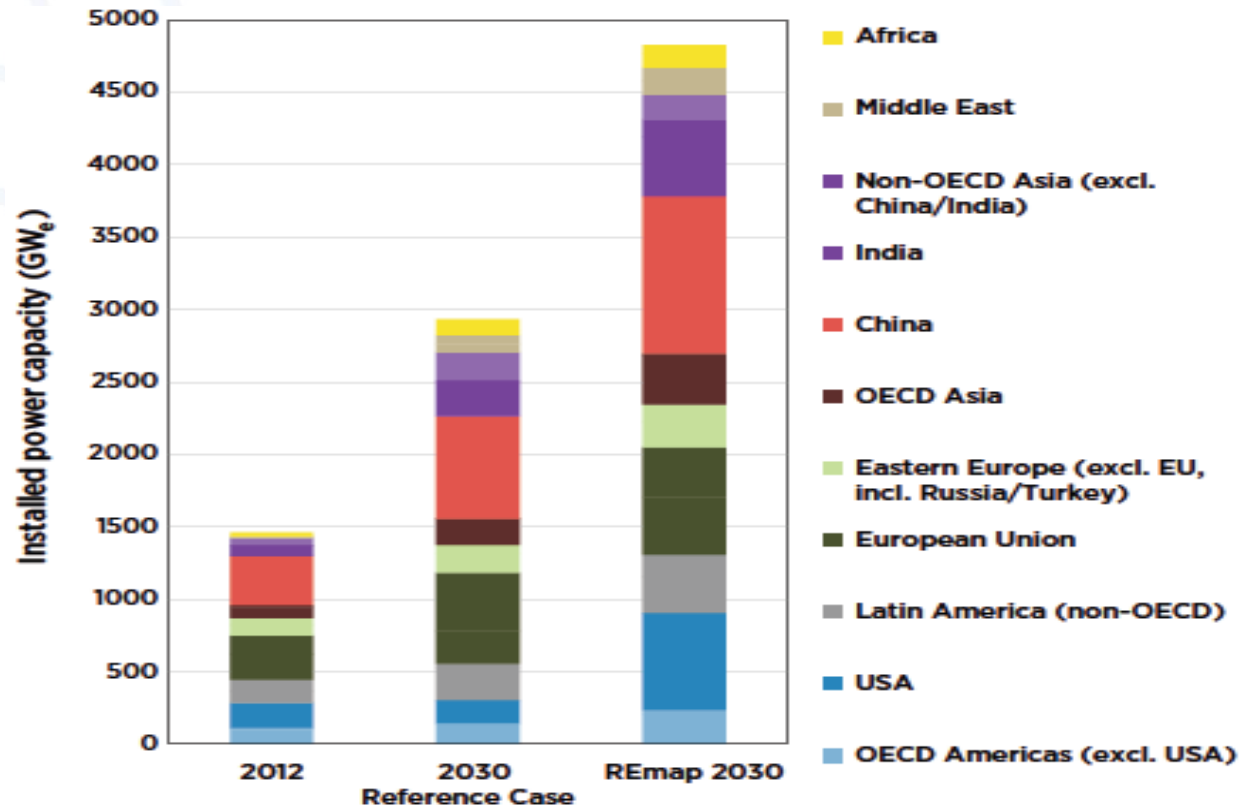
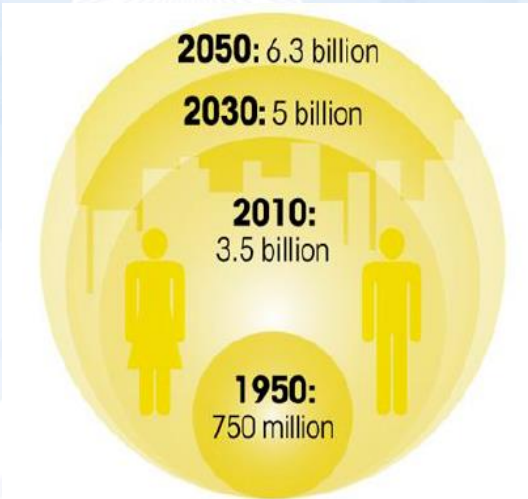
↓ **26%**



Demand for coal can decline by 26% resulting in reduced carbon emissions and cleaner air

Deployment in developing countries

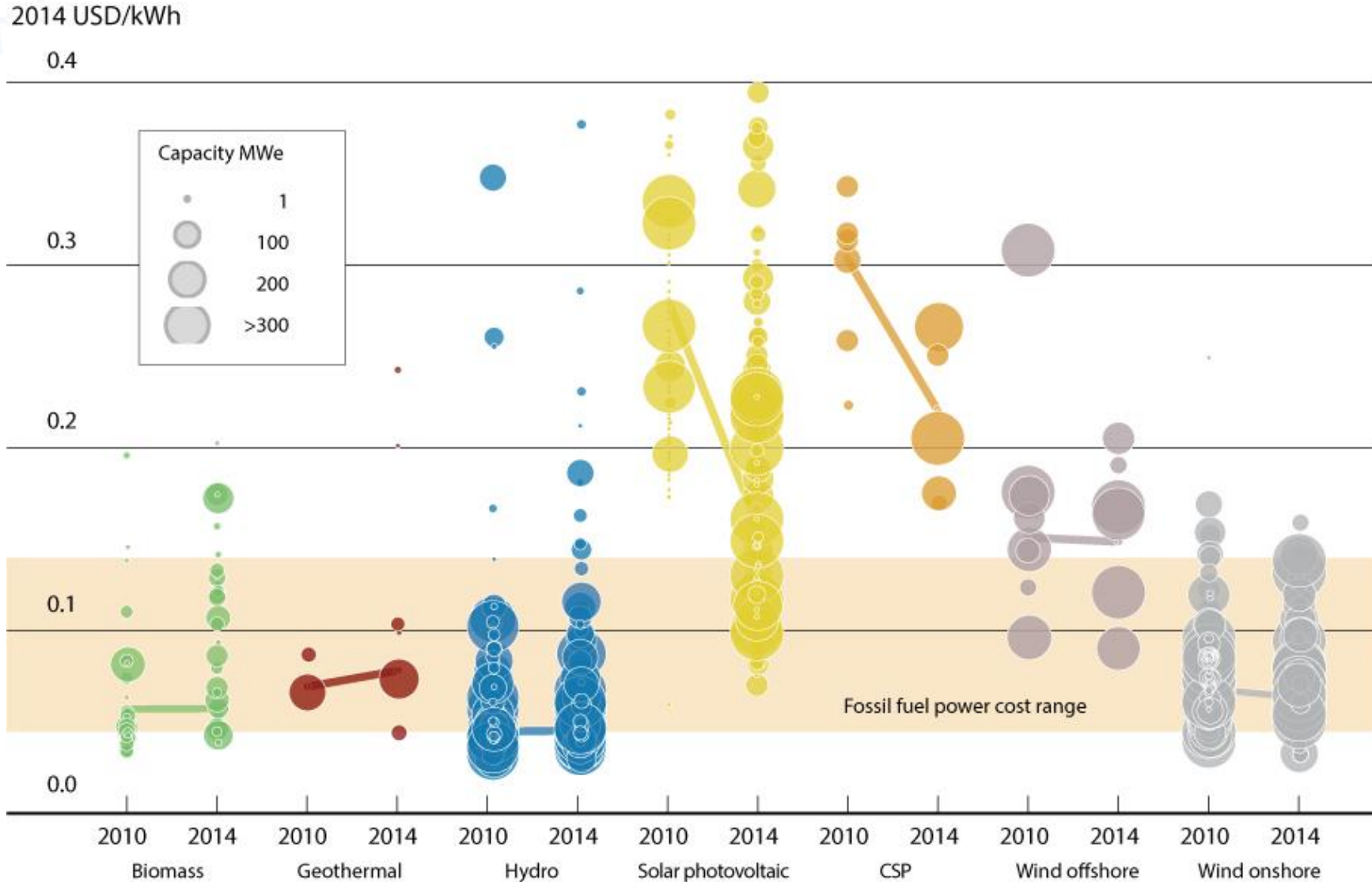
The urban middle class is growing



Increases in power demand by 2030 under current patterns

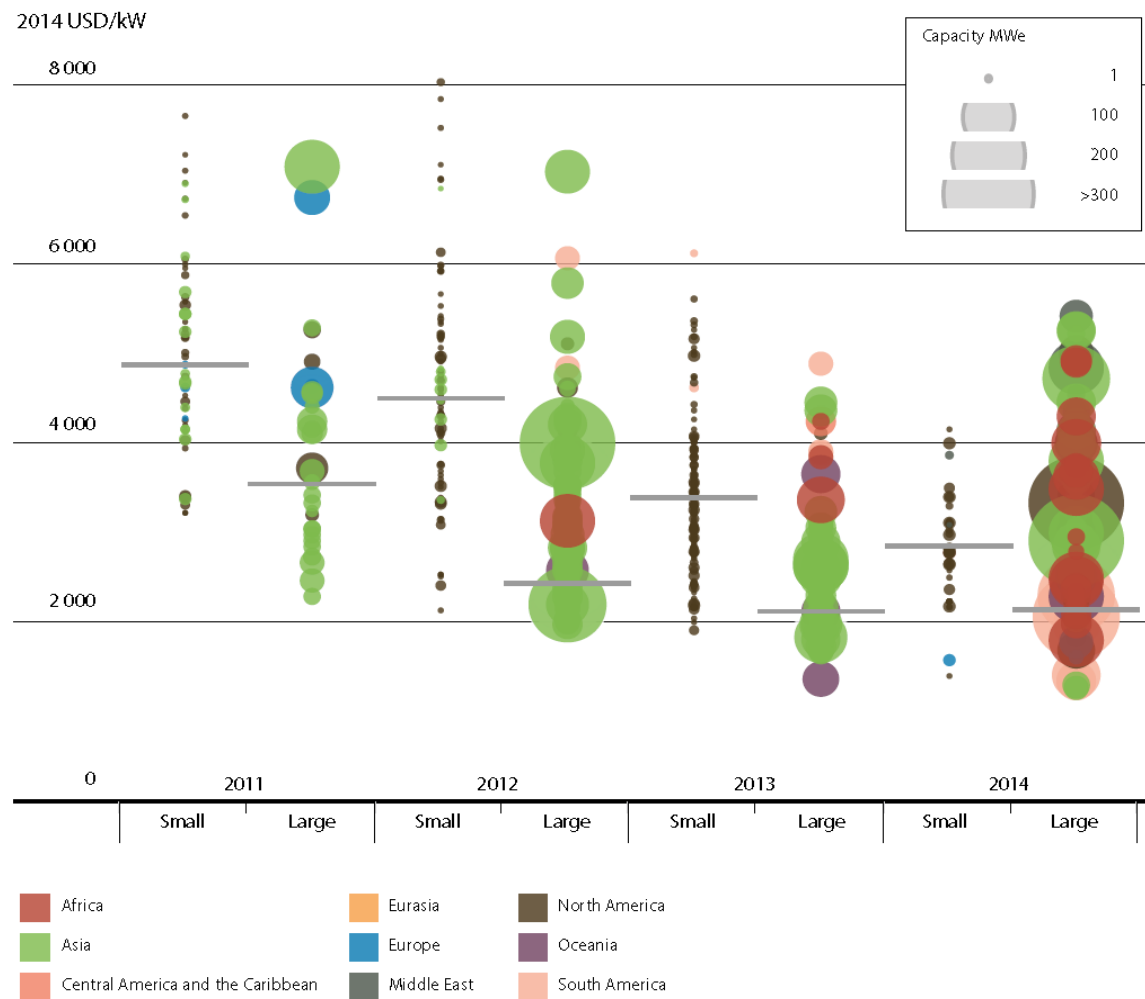
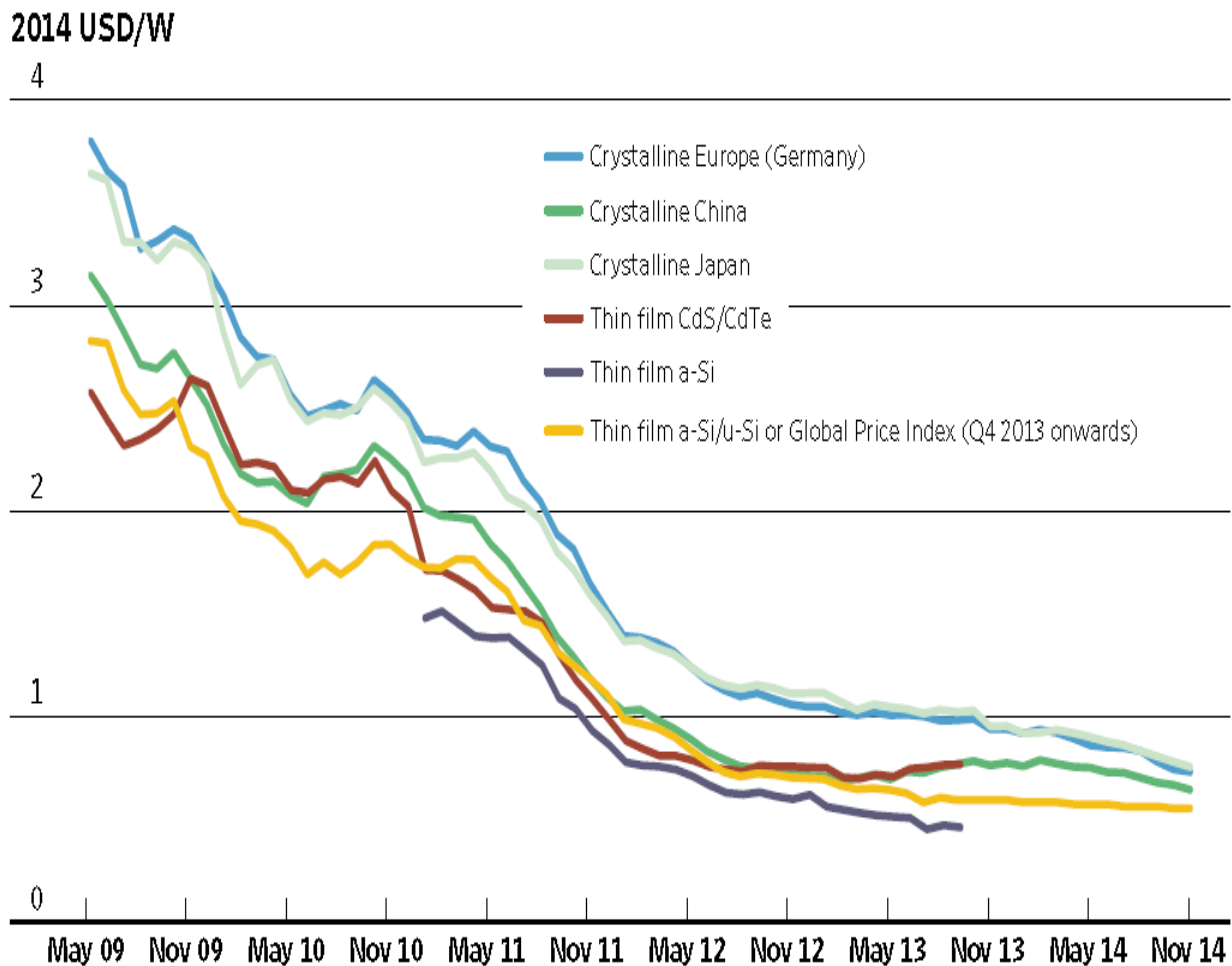


Renewables competitiveness continues to improve



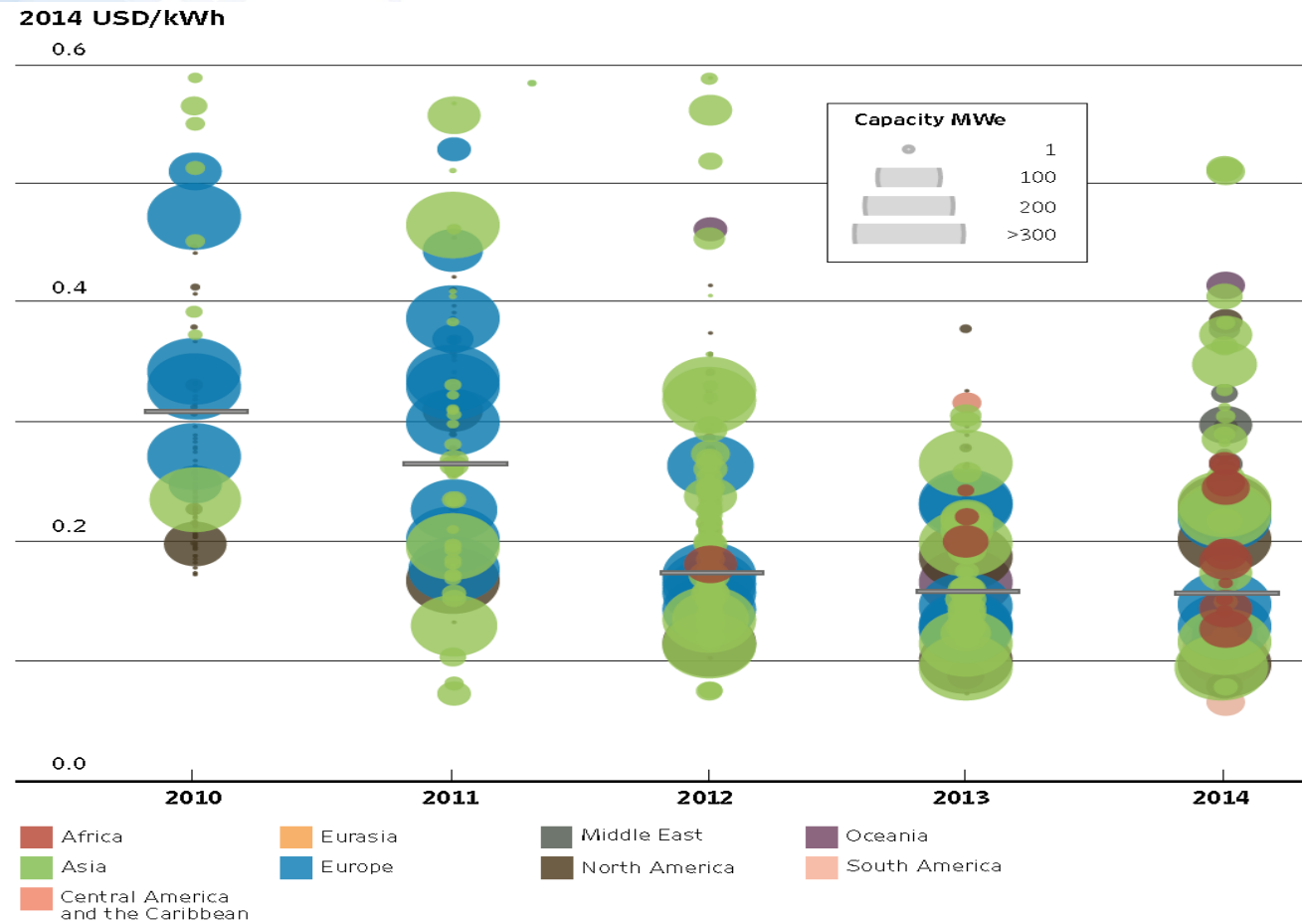
Solar PV modules and utility-scale projects

Technology improvements and cost reductions

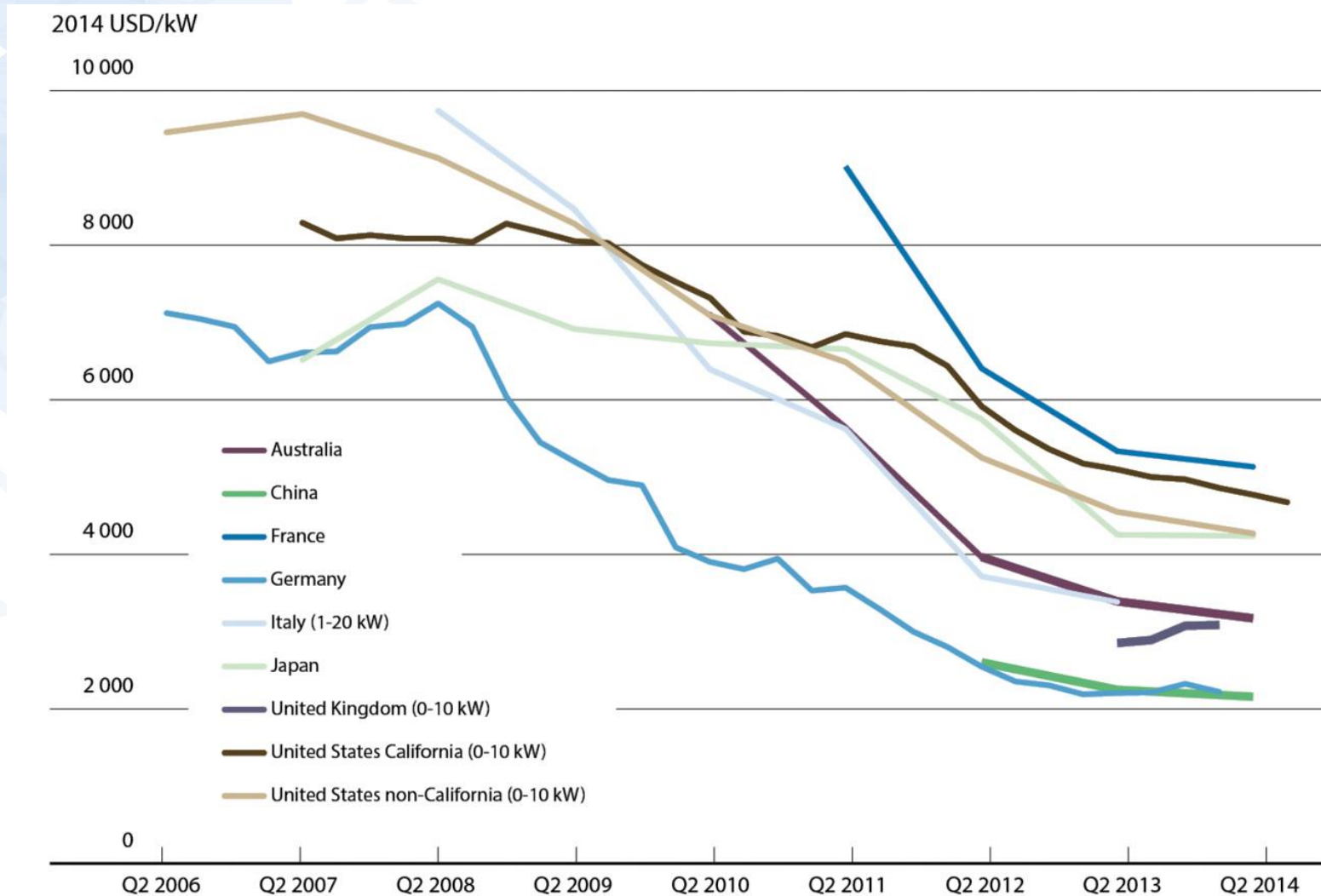


Solar PV modules and utility-scale projects

Falling LCOEs



Residential Solar PV: Cost Declines Slowing

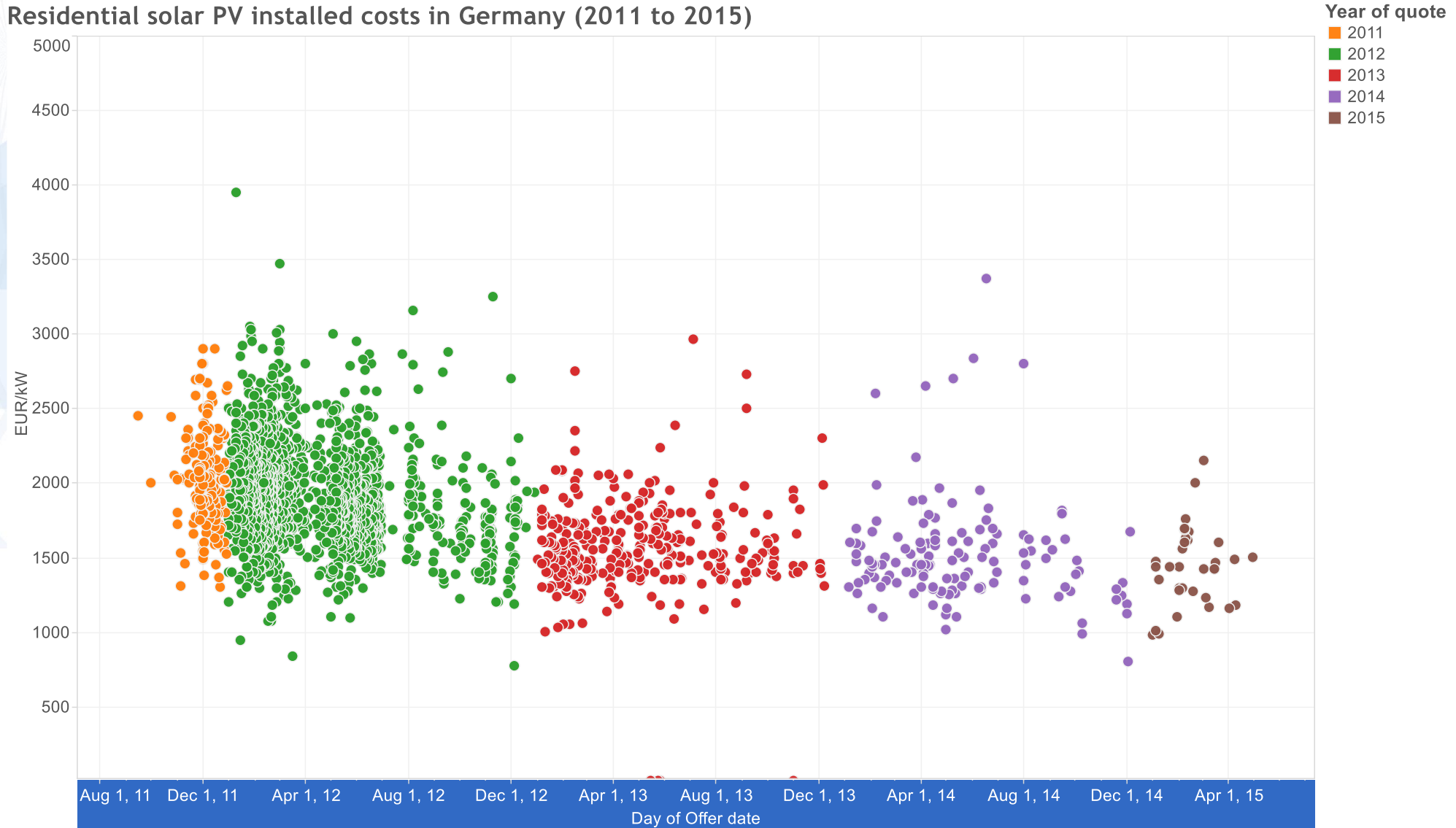


Source: IRENA Renewable Cost Database; CPUC, 2014; GSE, 2014; IEA PVPS, 2014; and Photon Consulting, 2014.

Note: Annual data for Australia, China, and Italy; quarterly data for the remaining countries.

Residential Solar PV: Cost Declines Slowing

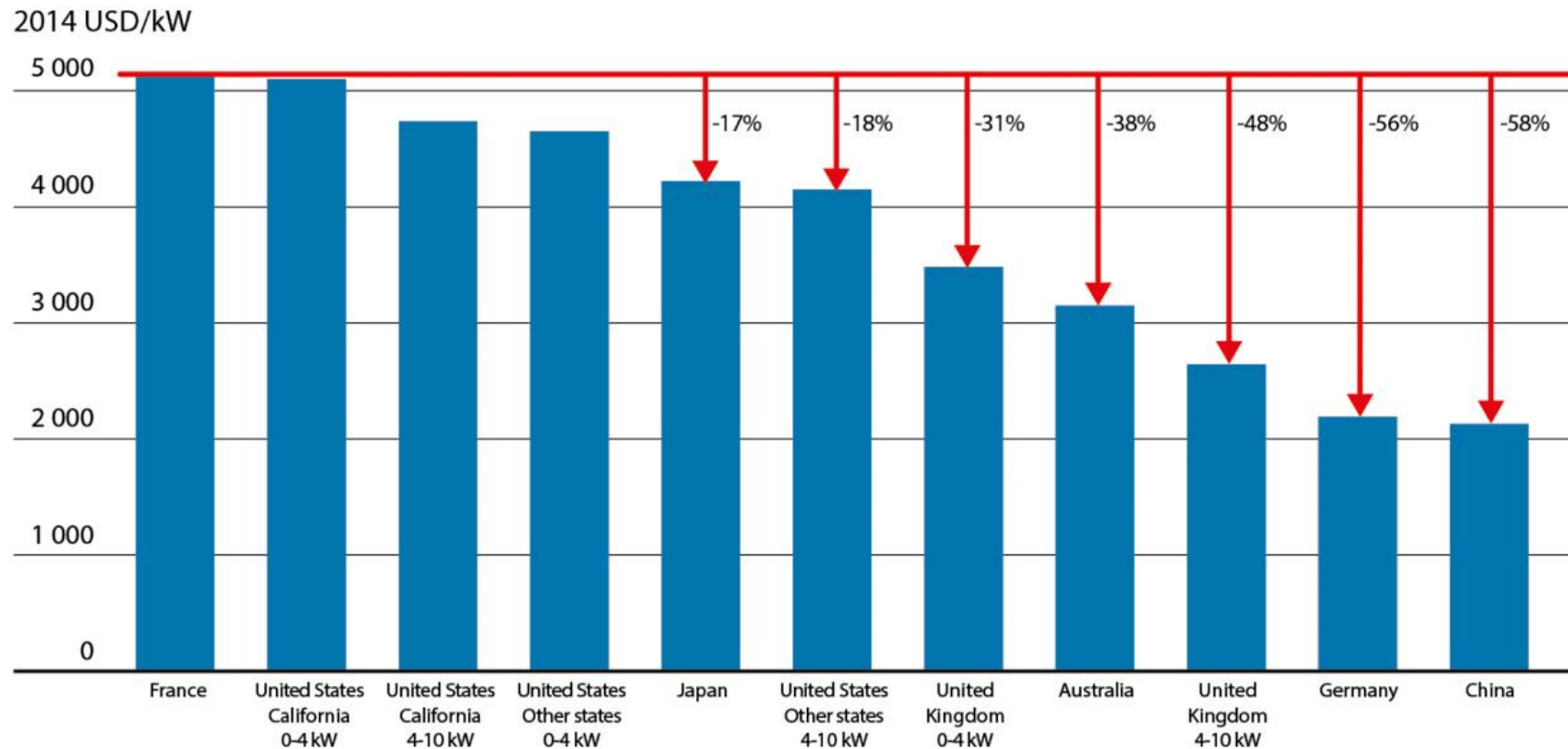
Residential solar PV installed costs in Germany (2011 to 2015)



Residential Solar PV: Cost Declines Slowing

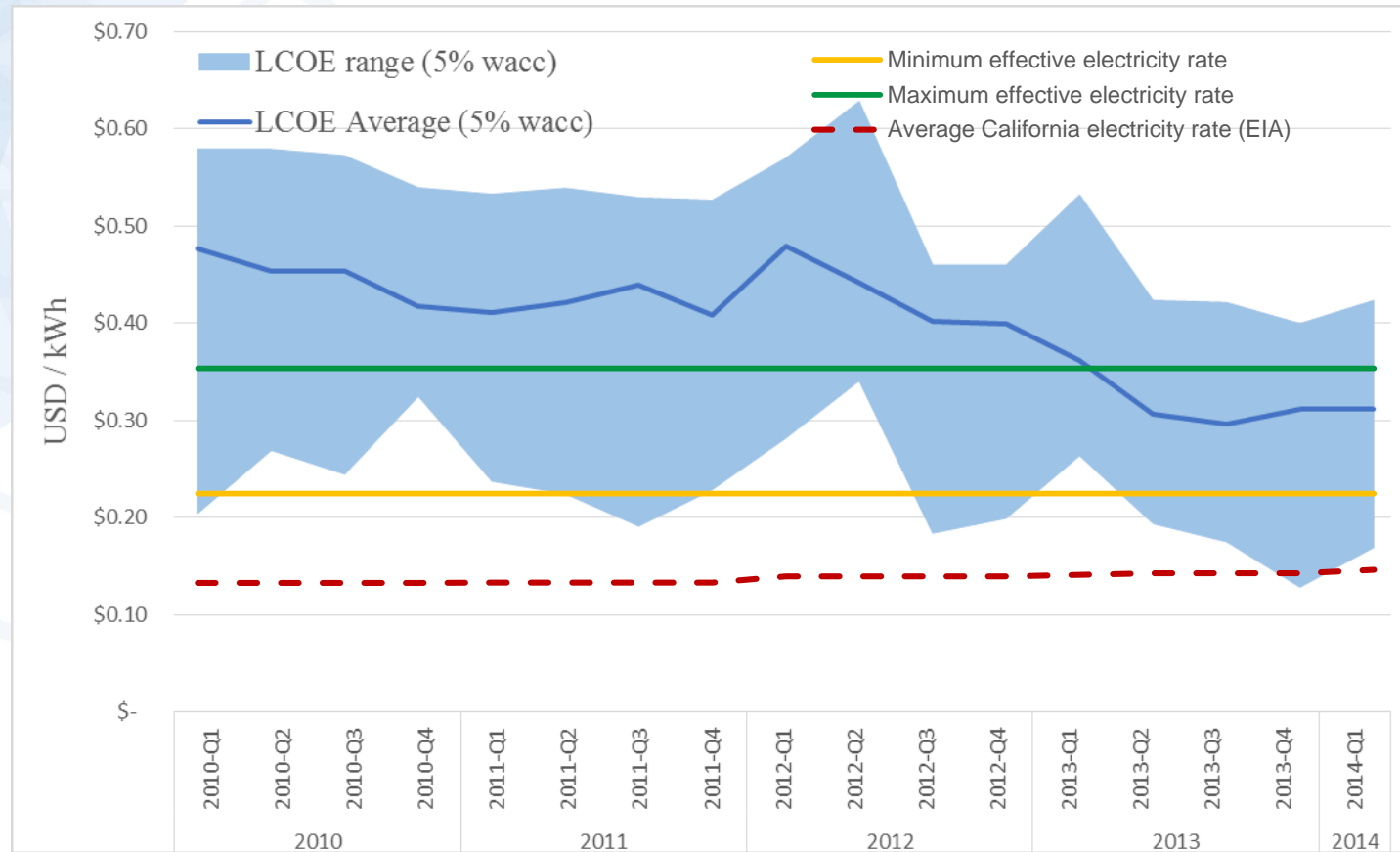
RENEWABLE POWER GENERATION COSTS IN 2014

FIGURE 5.11: ESTIMATED AVERAGE TOTAL INSTALLED PV SYSTEM COSTS IN THE RESIDENTIAL SECTOR BY COUNTRY, 2014



Source: IRENA Renewable Cost Database; DECC, 2014; GSE, 2014; IEA PVPS, 2014; and Photon Consulting, 2014.

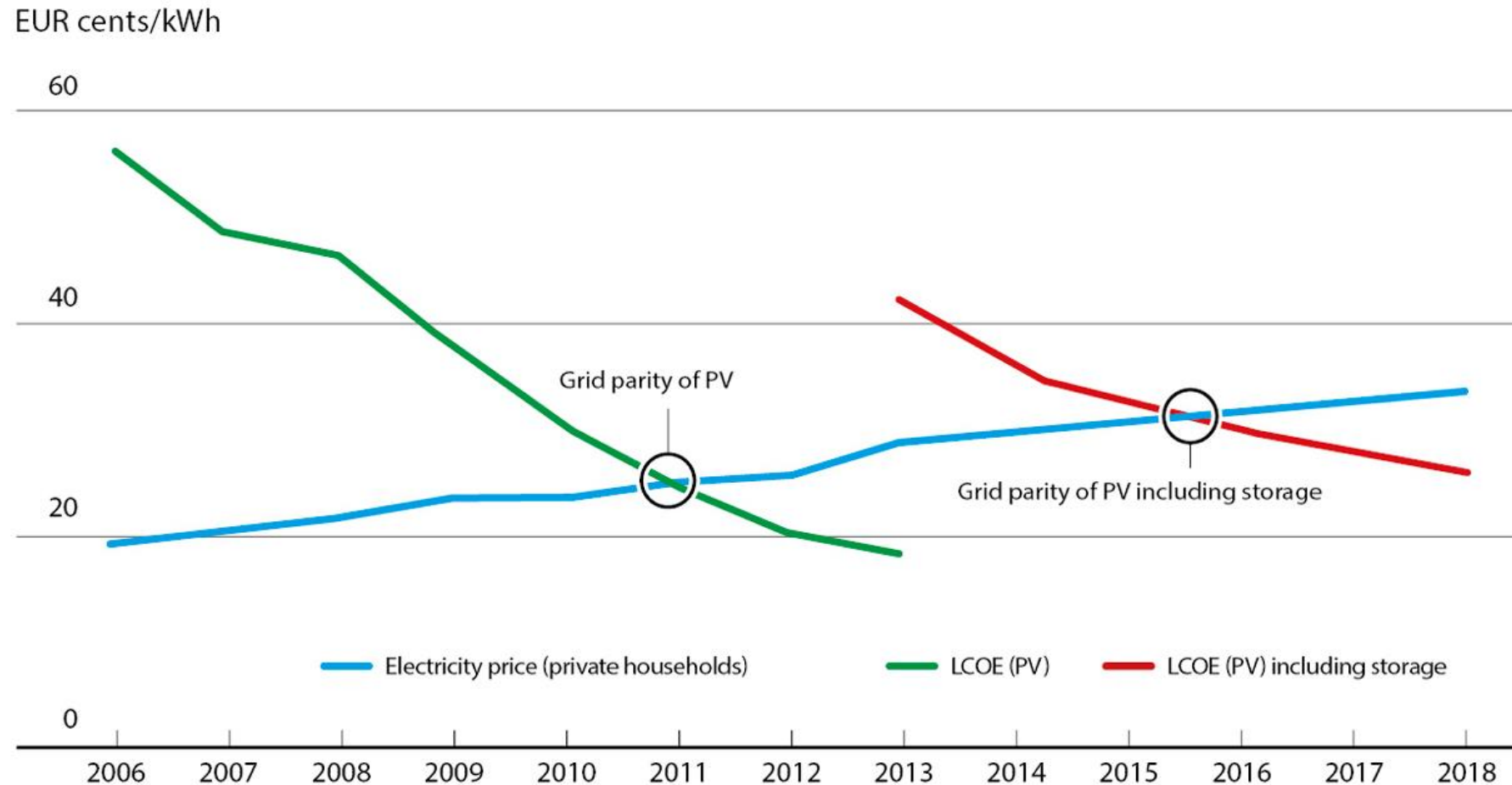
Residential PV parity the new norm



San Francisco

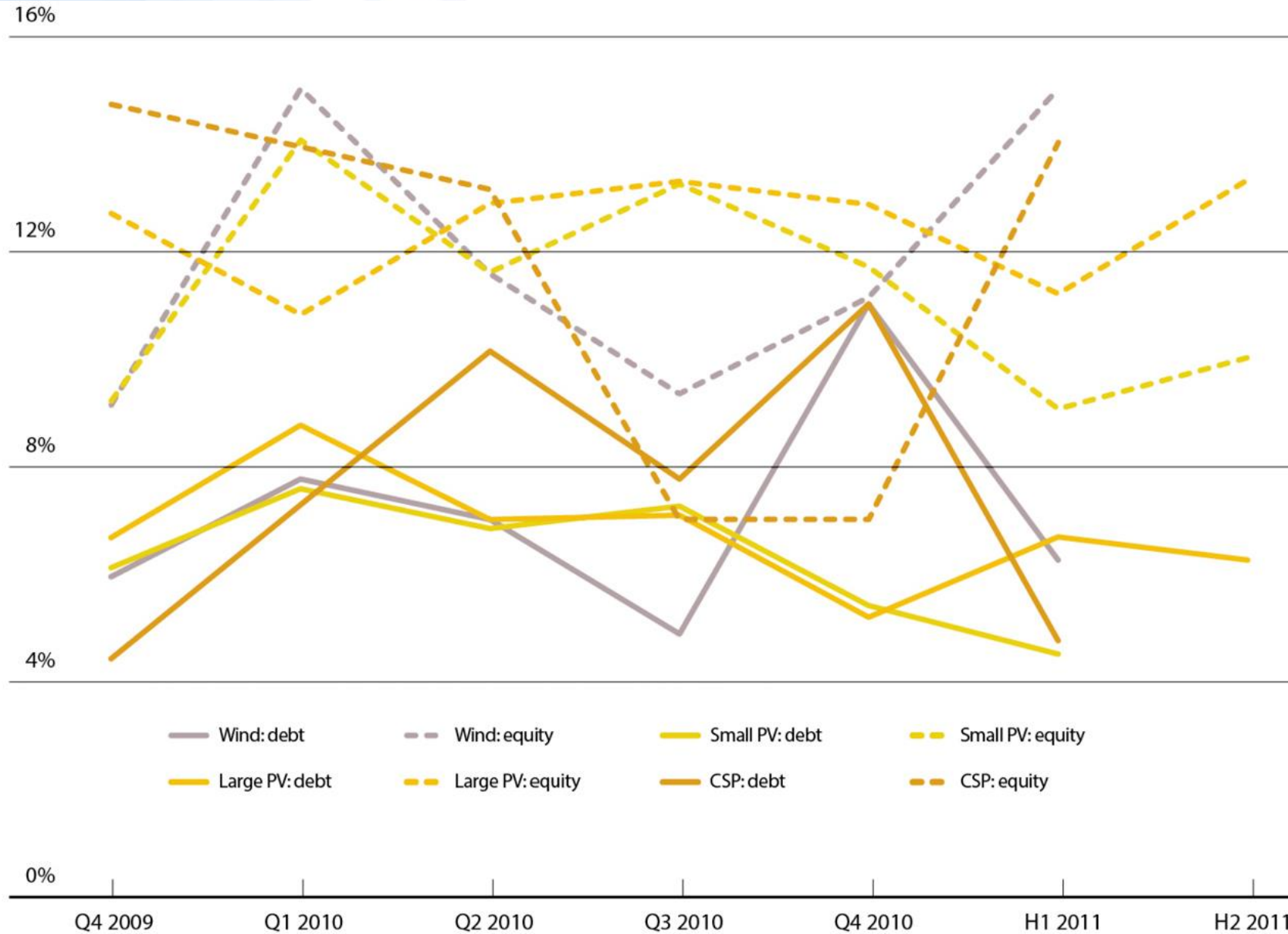
Without FITS or net metering: Residential PV challenges and storage

FIGURE 5.17: GRID PARITY OF PV-STORAGE IN GERMANY



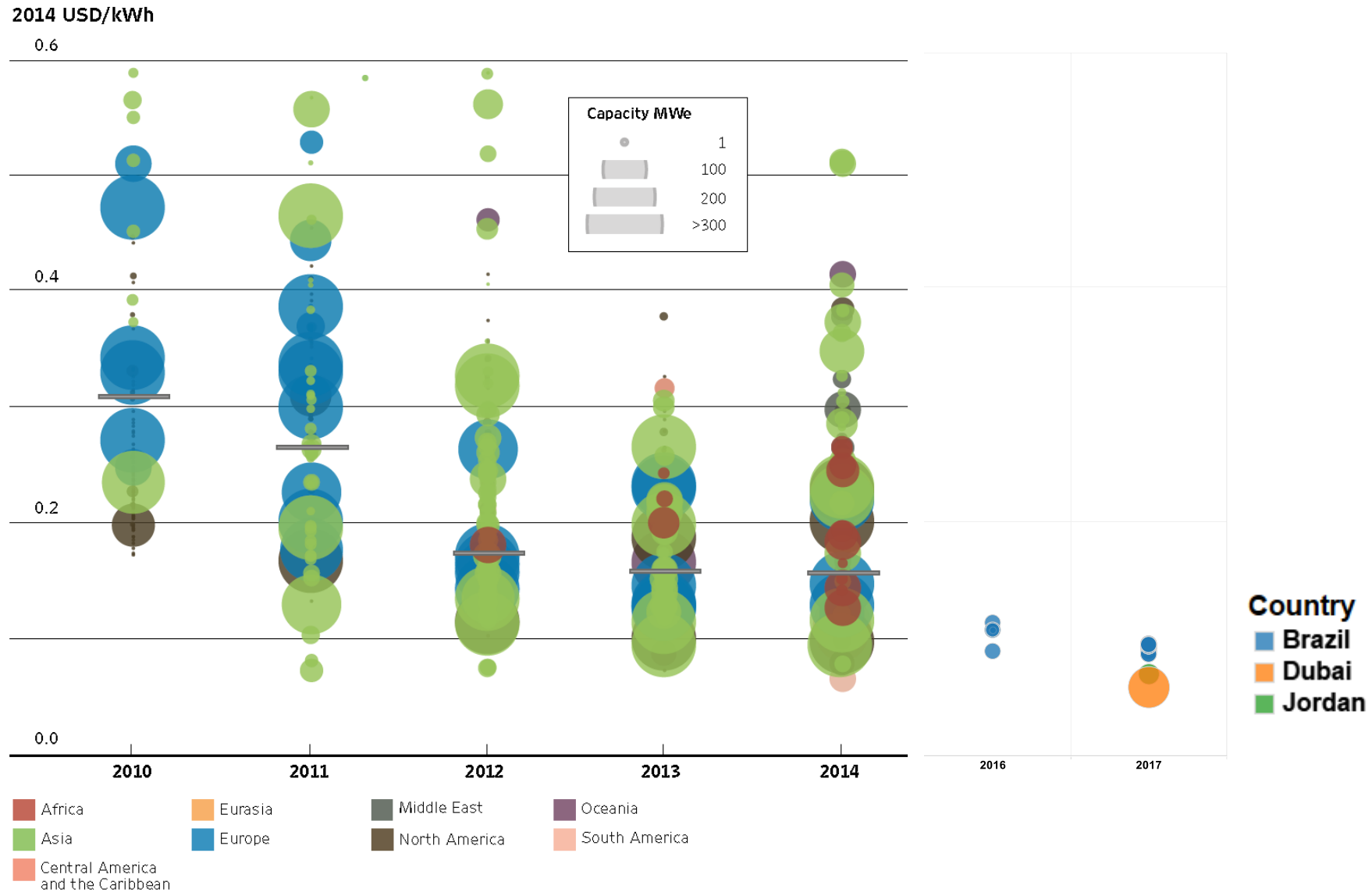
Source: EuPD Research/ BDEW 2013.

The elephant in the room: The cost of finance



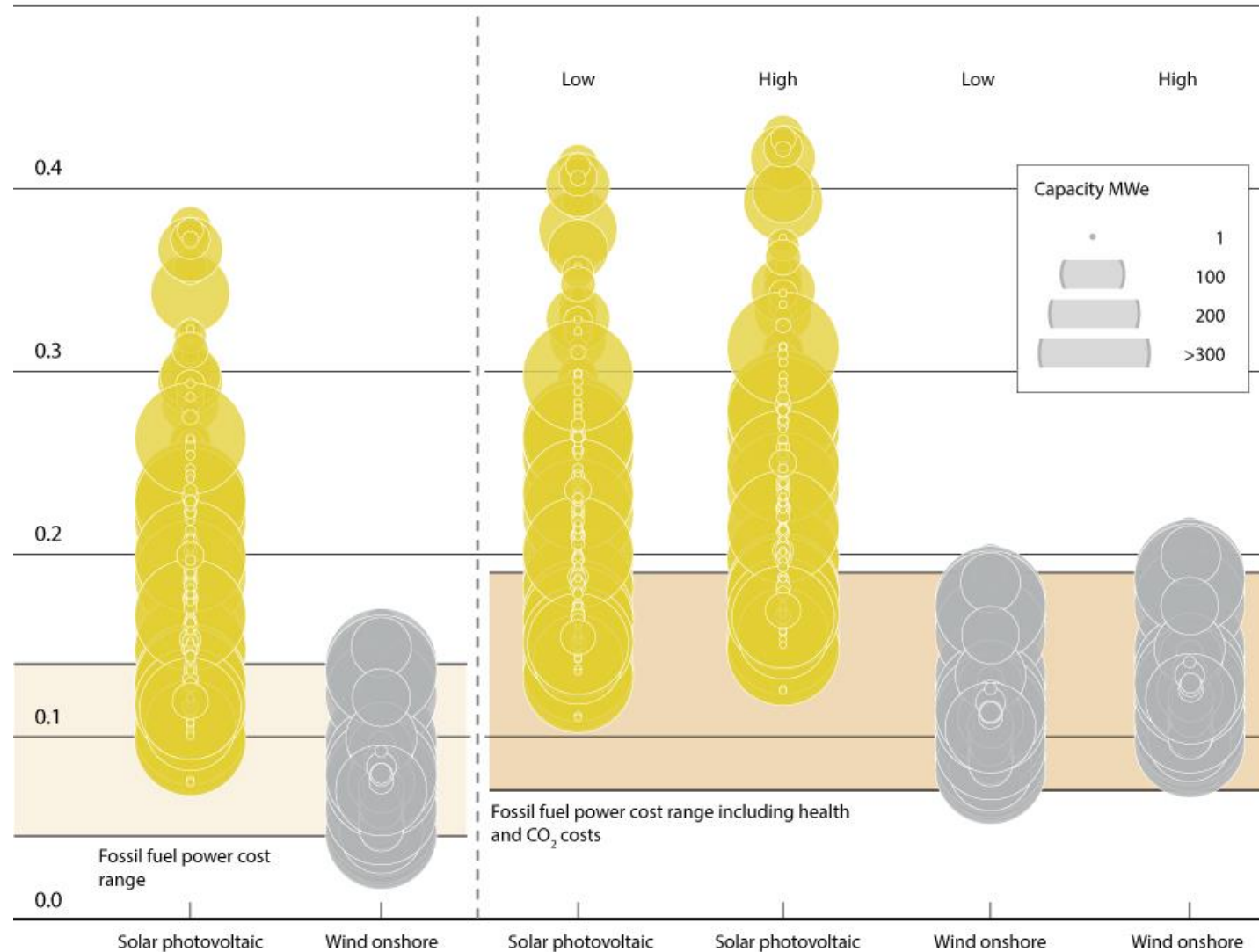
Source: Renewable Energy Finance Tracking Initiative

A look into the future

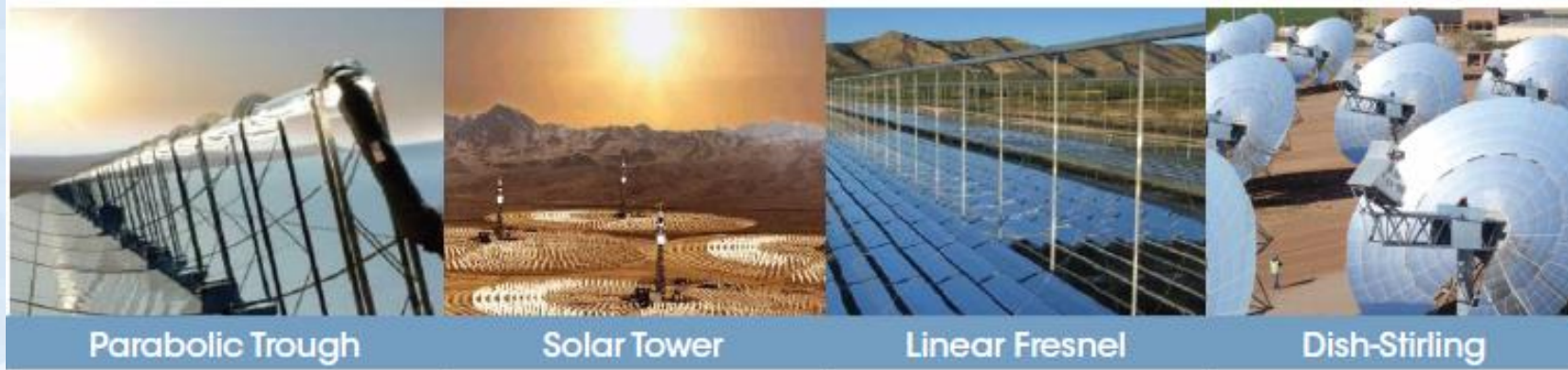


Integrating high levels of variable renewables is competitive

2014 USD/kWh
0.5



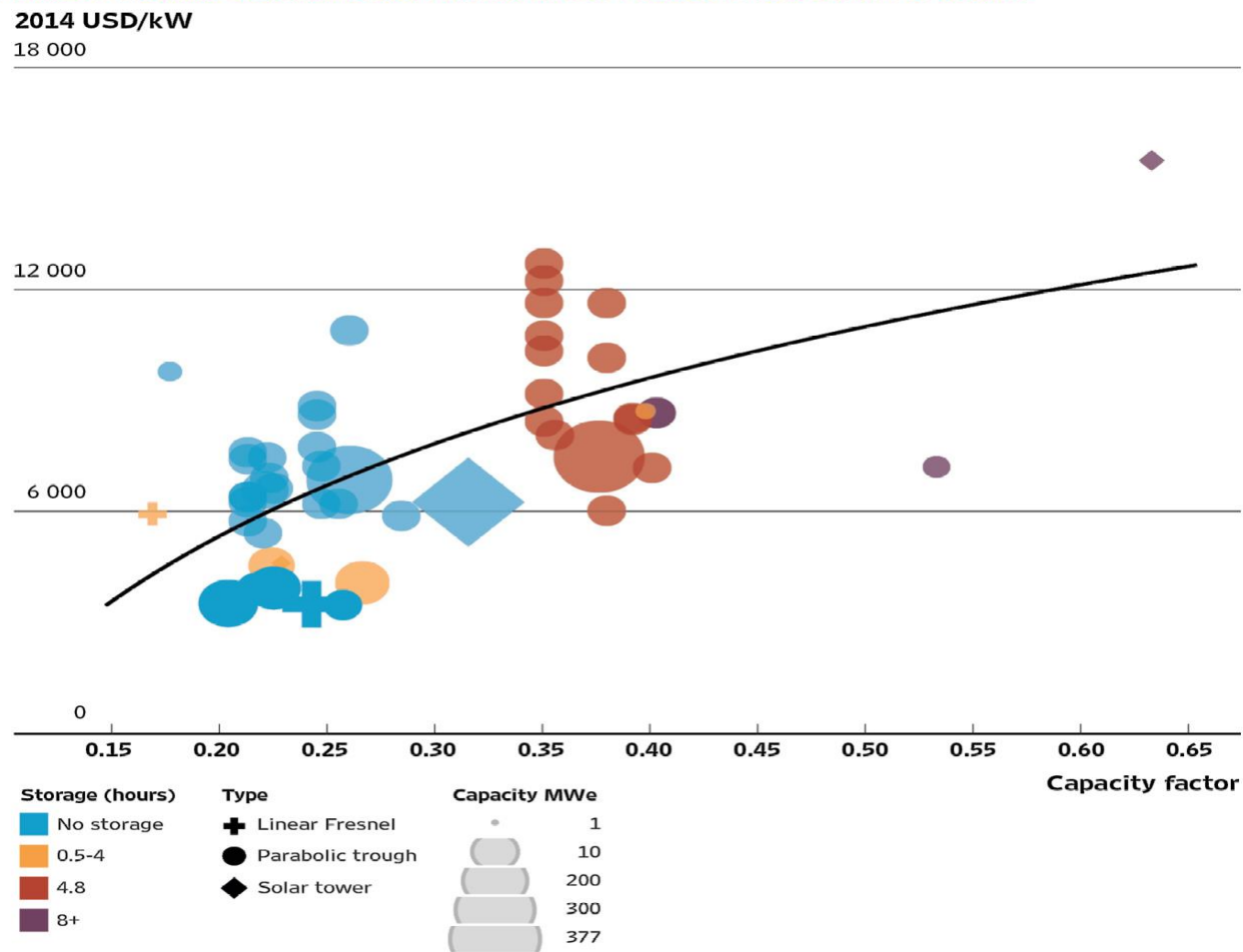
CSP: a set of technologies



- Deployment is in its infancy (~5 GW)
- Cost reduction potential is good
- Solar towers have greater cost reduction potential with higher operating temperatures and lower cost thermal energy storage
- Cheap thermal energy storage allows dispatchable power -> more valuable generation (particularly in high RE scenarios)

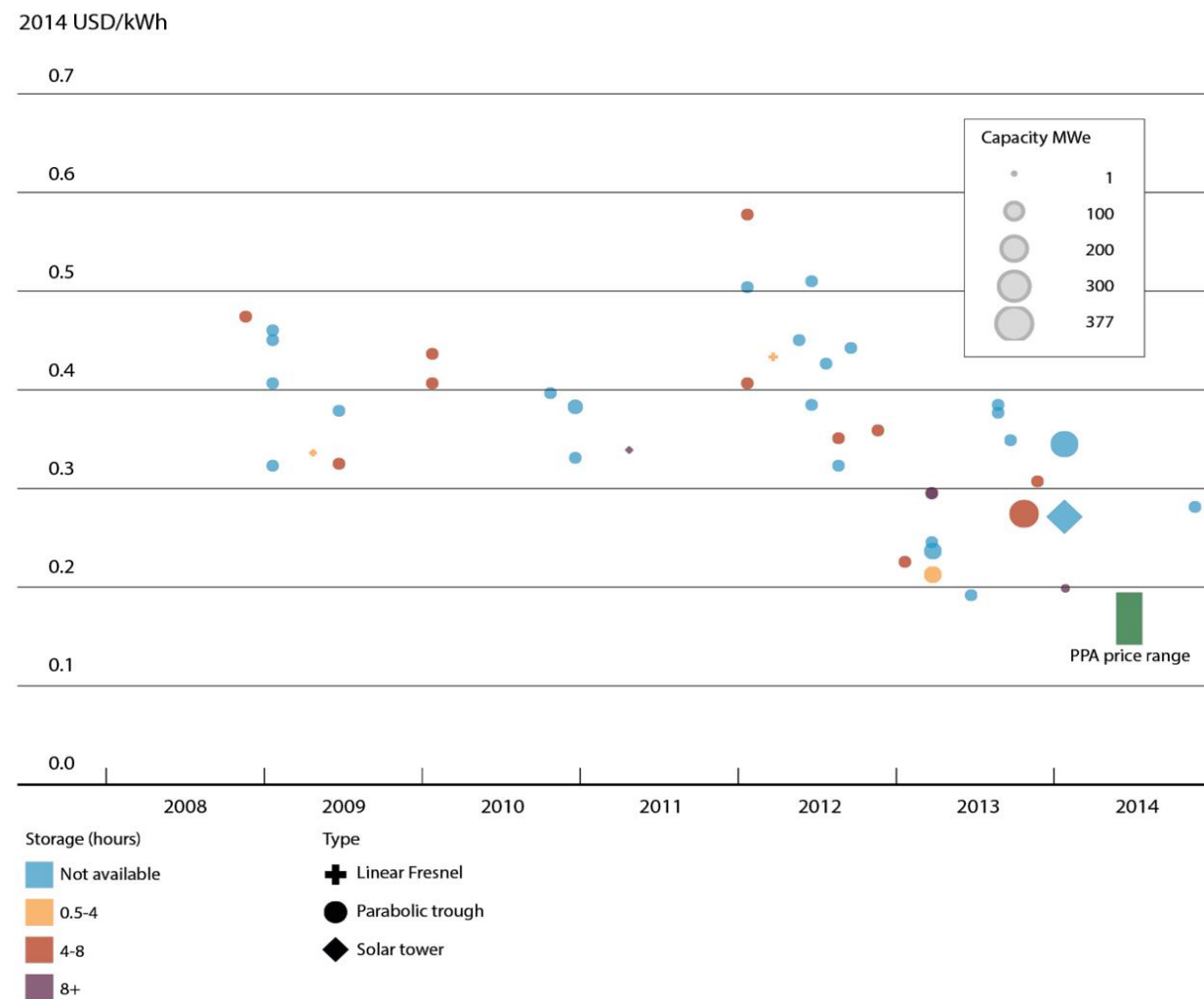
RENEWABLE POWER GENERATION COSTS IN 2014 

FIGURE 6.1 : INSTALLED COSTS AND CAPACITY FACTORS OF CSP PROJECTS BY THEIR QUANTITY OF STORAGE

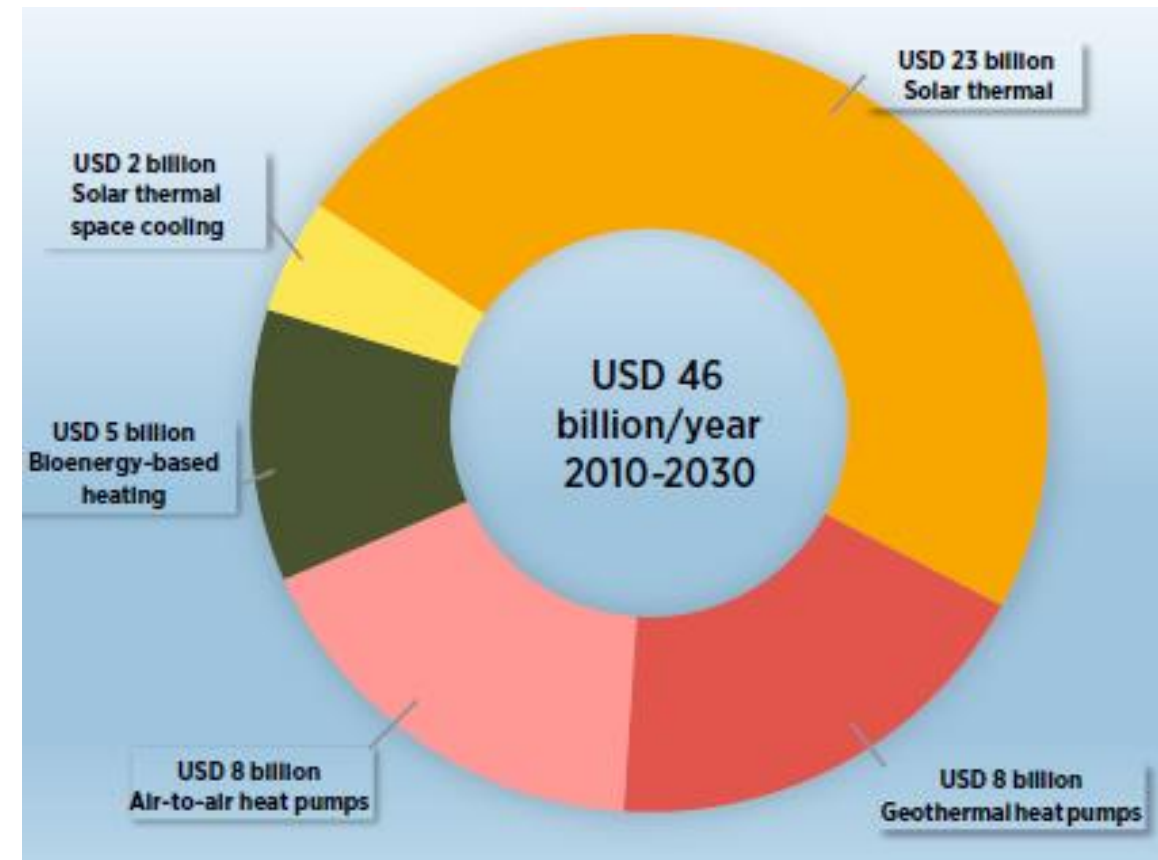
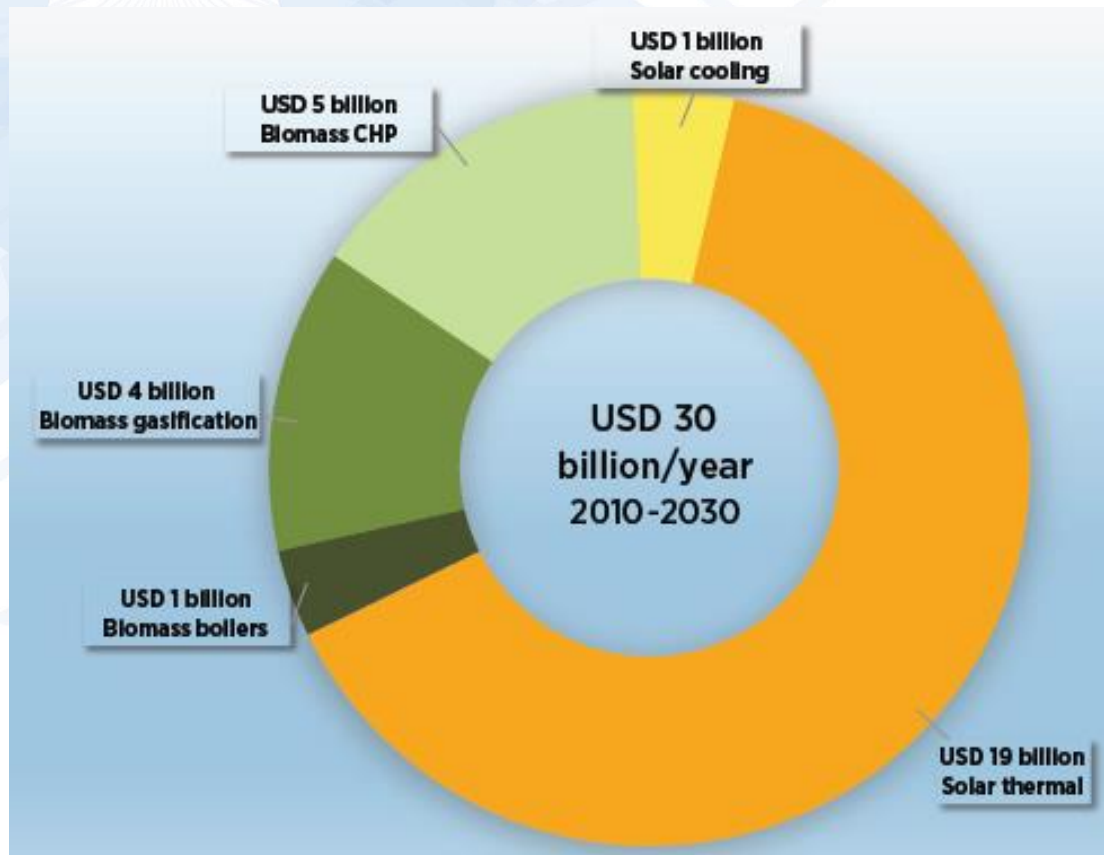


Sources: IRENA Renewable Cost Database; BNEF, 2014e; GlobalData, 2014; and NREL/SolarPACES, 2014.

FIGURE 6.8: THE LEVELISED COST OF ELECTRICITY FOR CSP PROJECTS, 2008 TO 2014



Solar thermal in industry and buildings



3

From potential to deployment:

**Solar PV in Africa
Cost Reduction Potentials**

Project background

- Joint project with **GIZ / BMZ and funding**
- No clear view of costs, what is a competitive cost structure for Africa?
- How do we accelerate costs to efficient levels in new markets, addressing soft costs

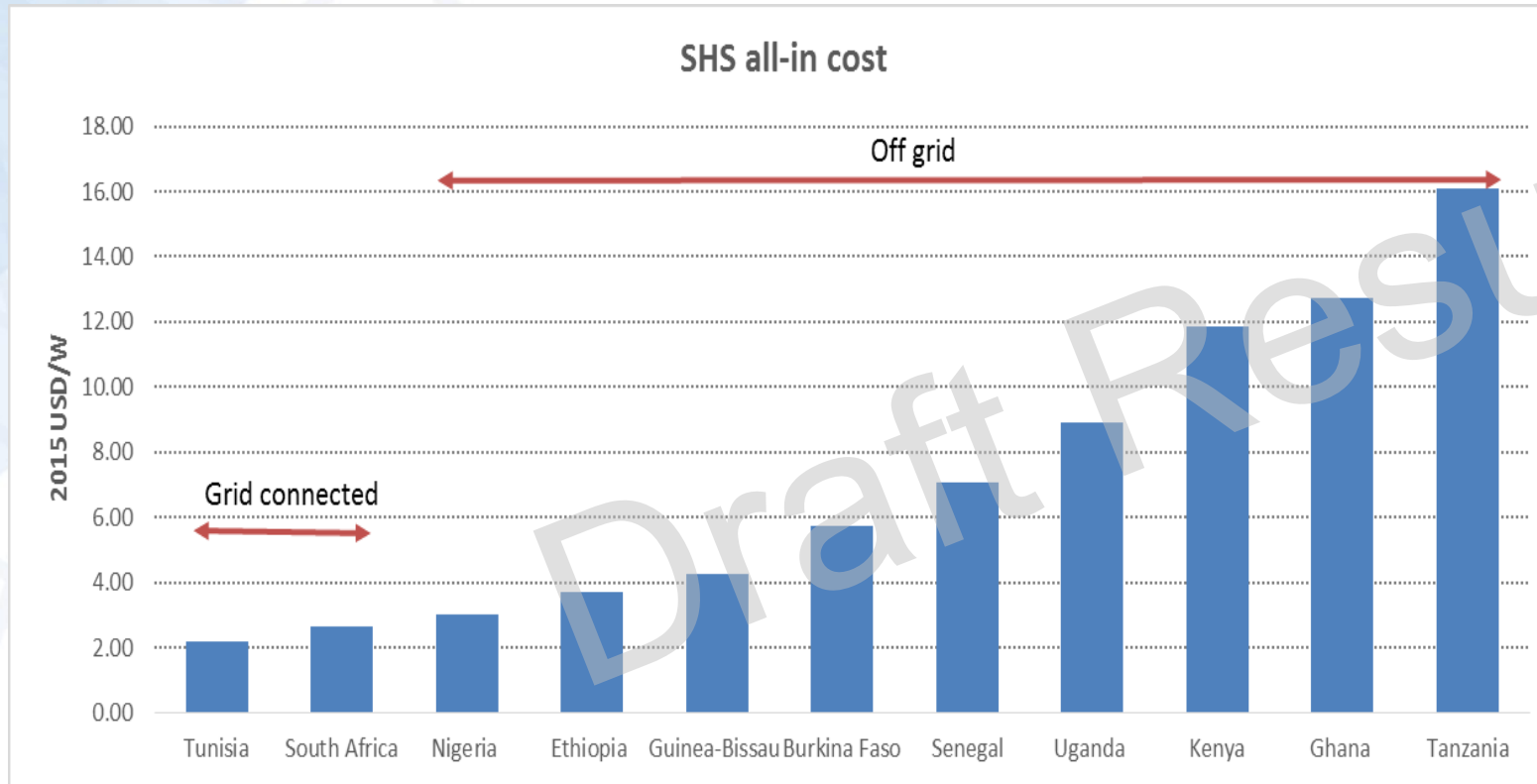
To achieve:

- Leapfrogging the development pathway of OECD countries by using RE with mature technology
- Meeting electricity access and socio-economic goals

Highlights

- Data collection is very challenging
- Utility-scale projects cost structure can be competitive
- Market scale and costs for small-scale and solar home systems (SHS) still highly uncertain, but:
 - **Some markets relatively competitive, narrow ranges**
 - **Very small SHS cost structures challenging**
 - **Procurement processes for small-scale systems and mini-grids can suffer from high transaction costs**
- Significant cost reductions appear possible for hardware and soft costs
- Regional deep dives necessary for greater clarity

SHS/Small institutional system all-in cost



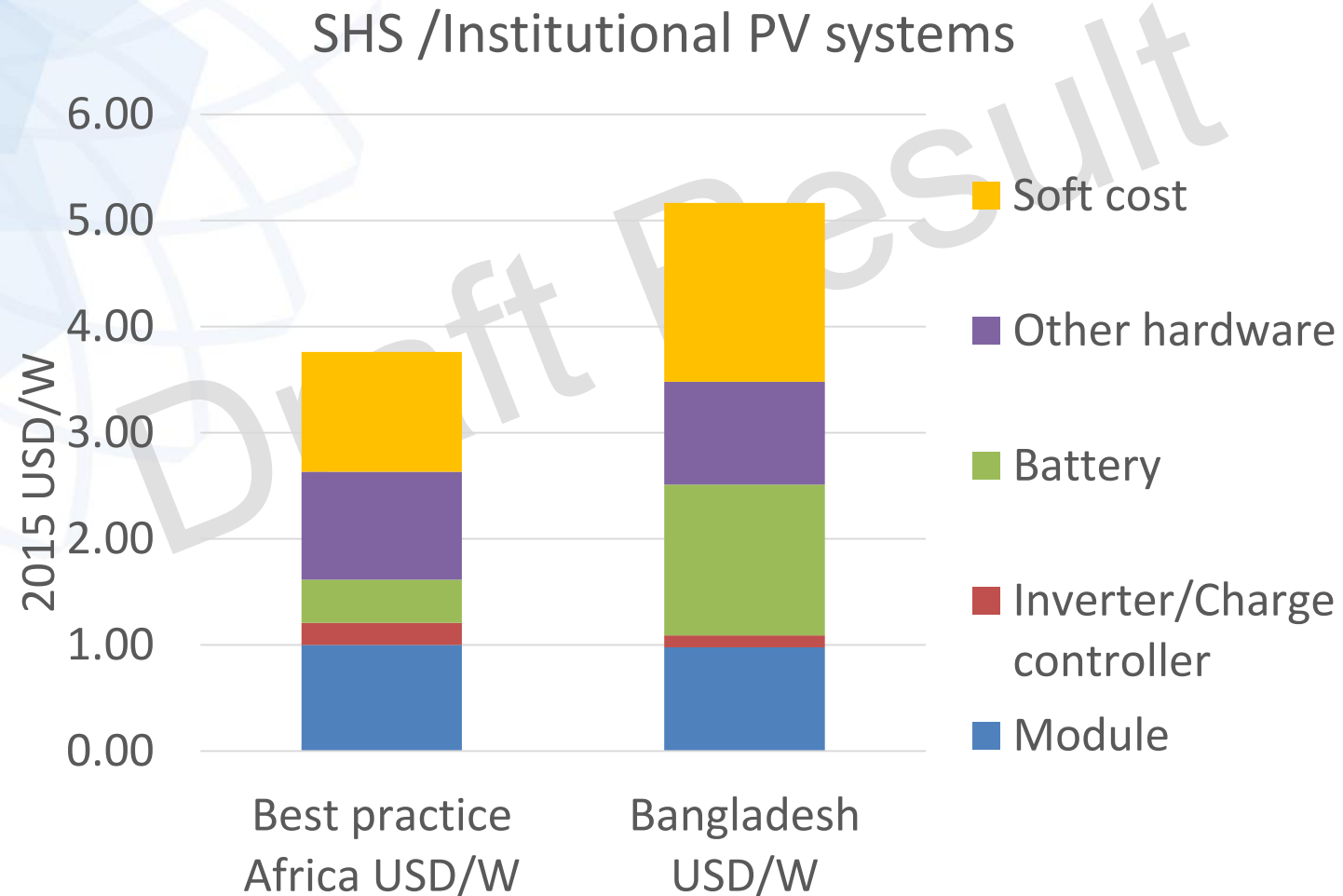
Kenya: VAT 16 % included for parts of data from the beginning of 2014

Tanzania: Installation accessories and labor charges include VAT

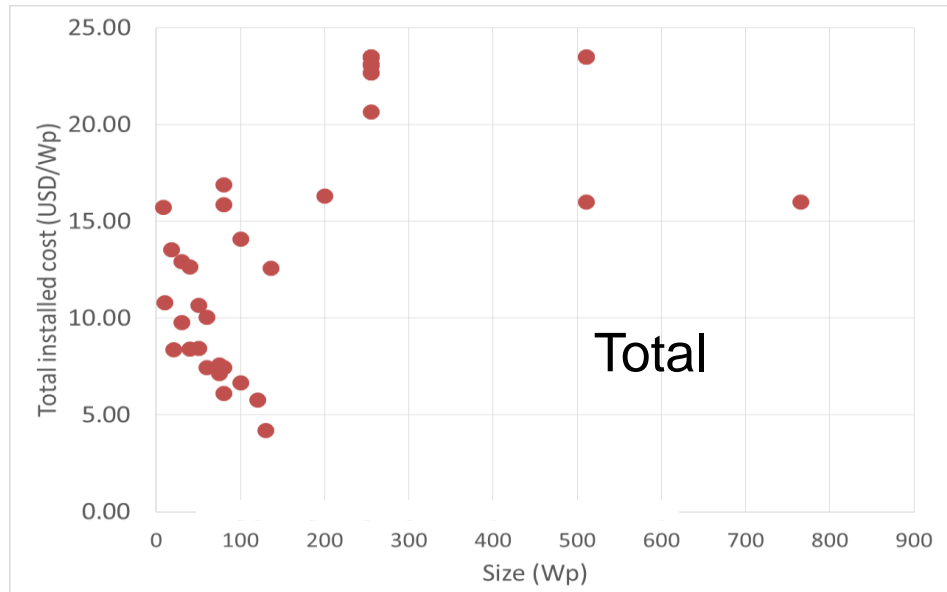
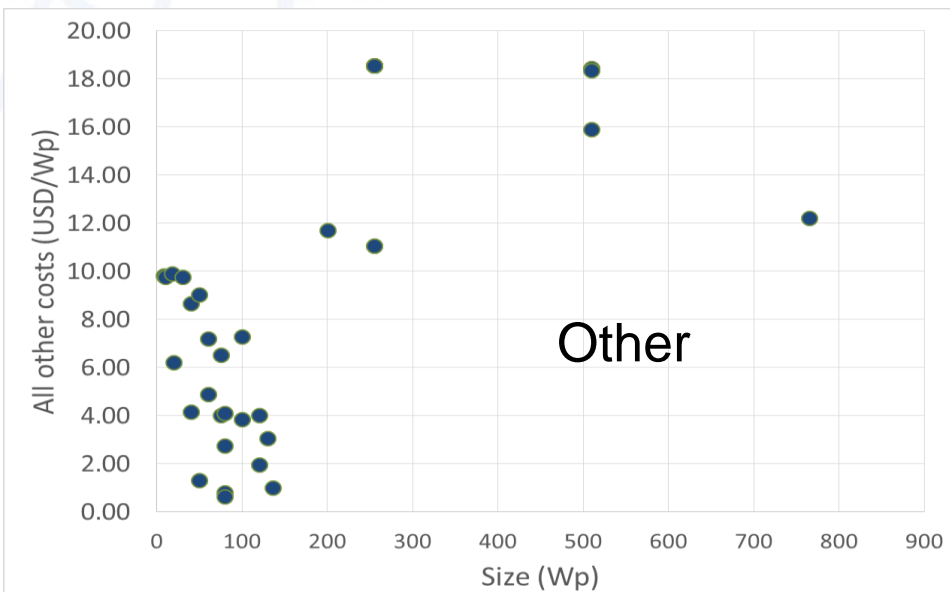
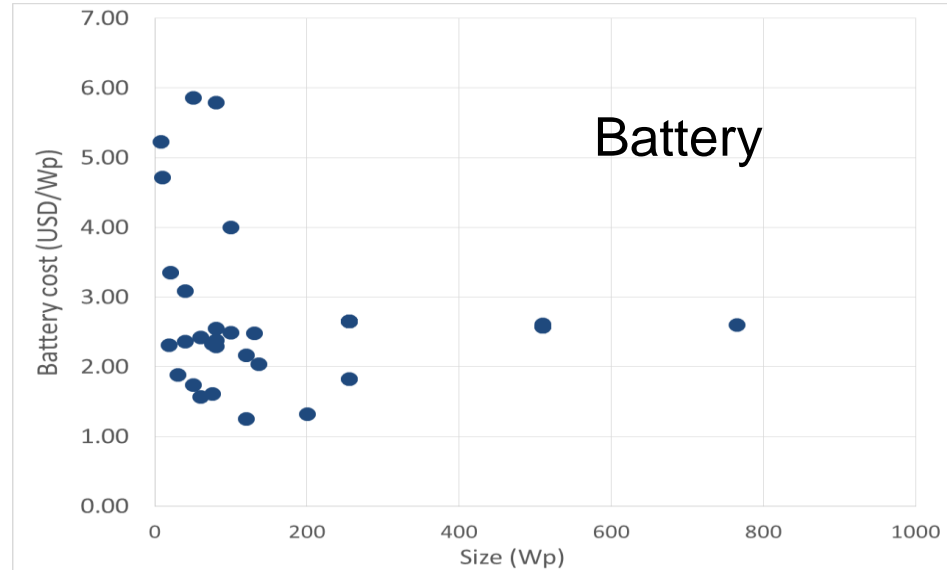
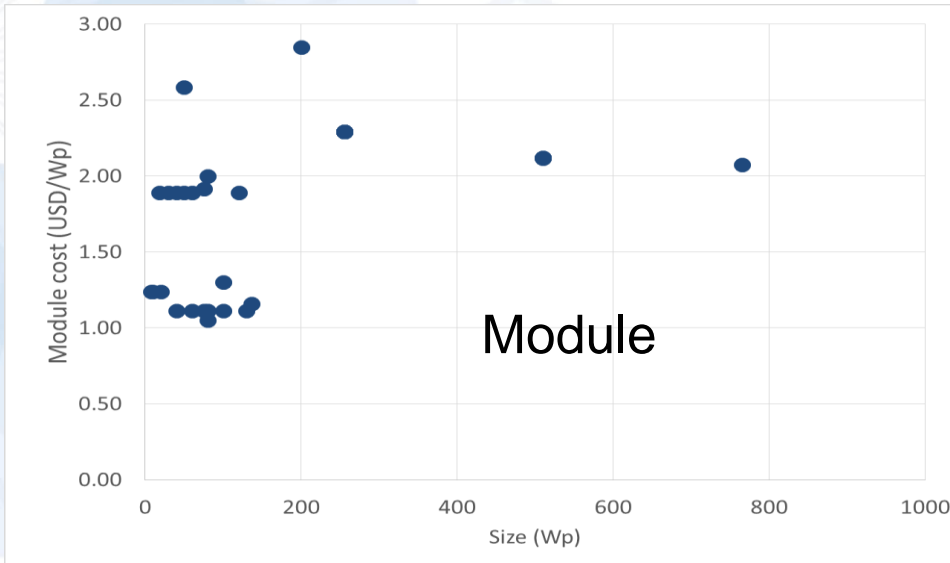
Ghana: Only solar panel has no import duty

Nigeria: equipment and machinery for the power sector to enjoy zero duty.

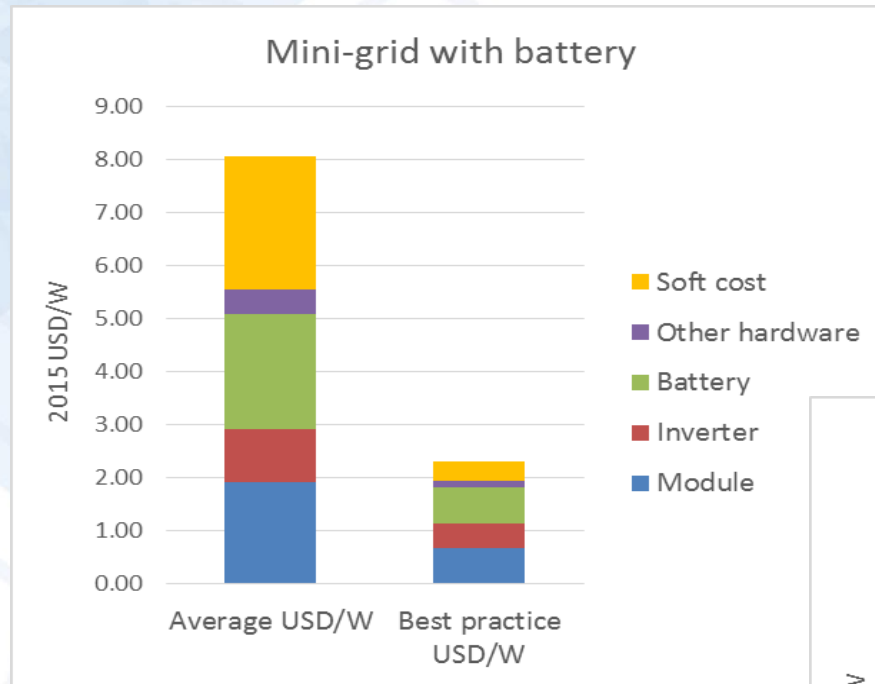
Off-grid PV system cost breakdown differences



Less than 1kW SHS cost distribution

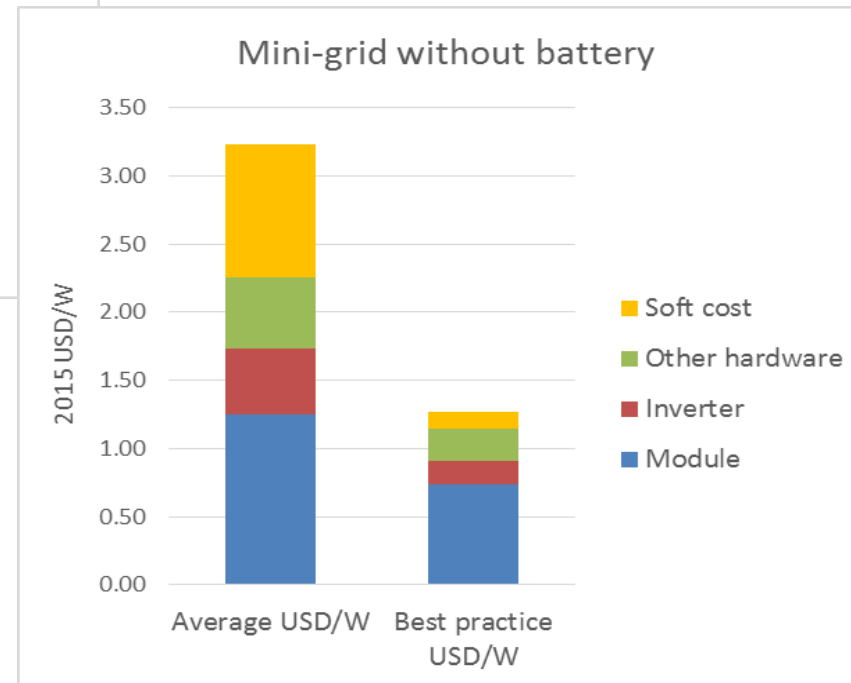


Mini grid costs in Africa



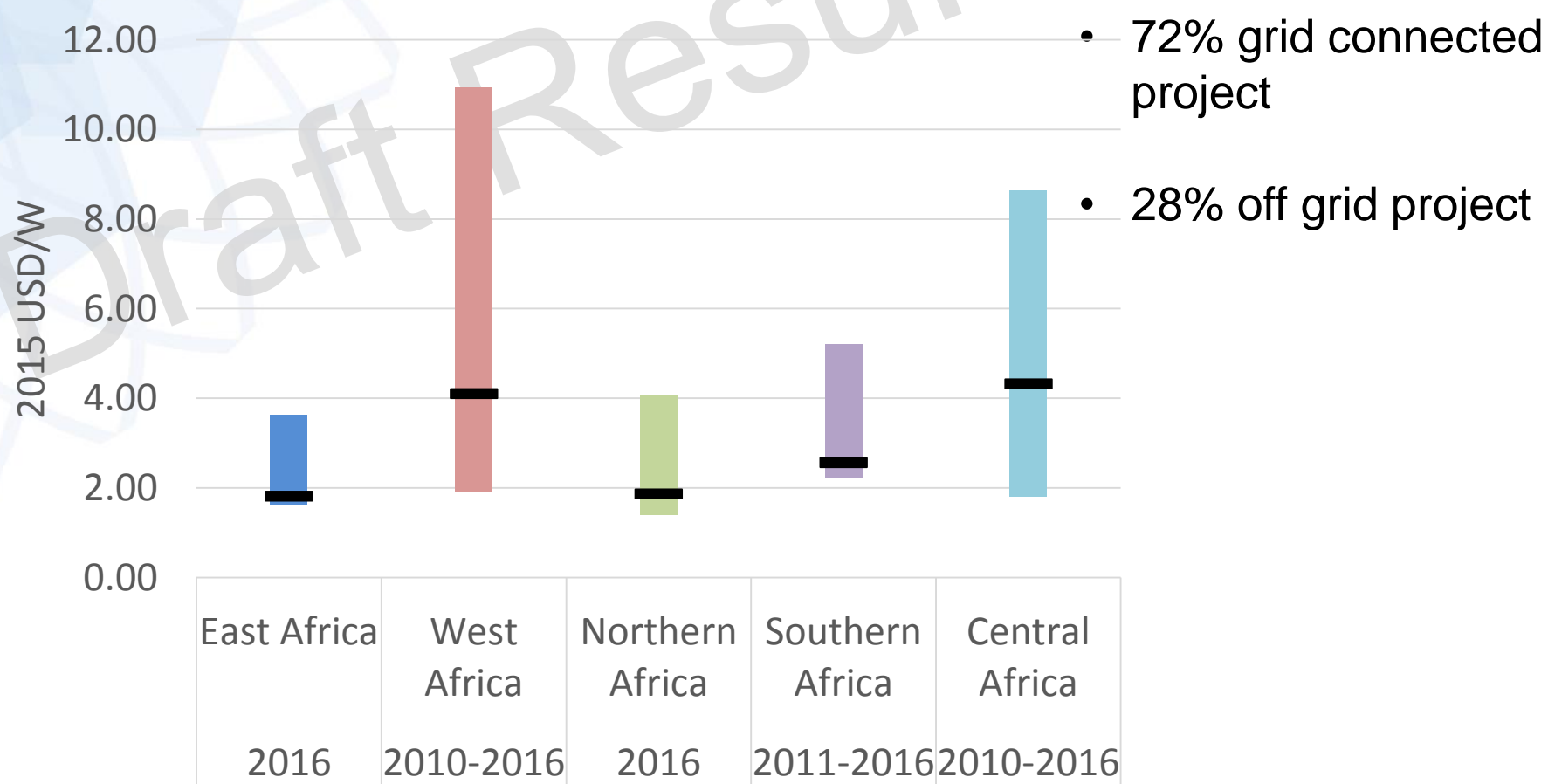
All cost components have large potential to cut the cost down

Especially, **Soft cost**



Utility scale

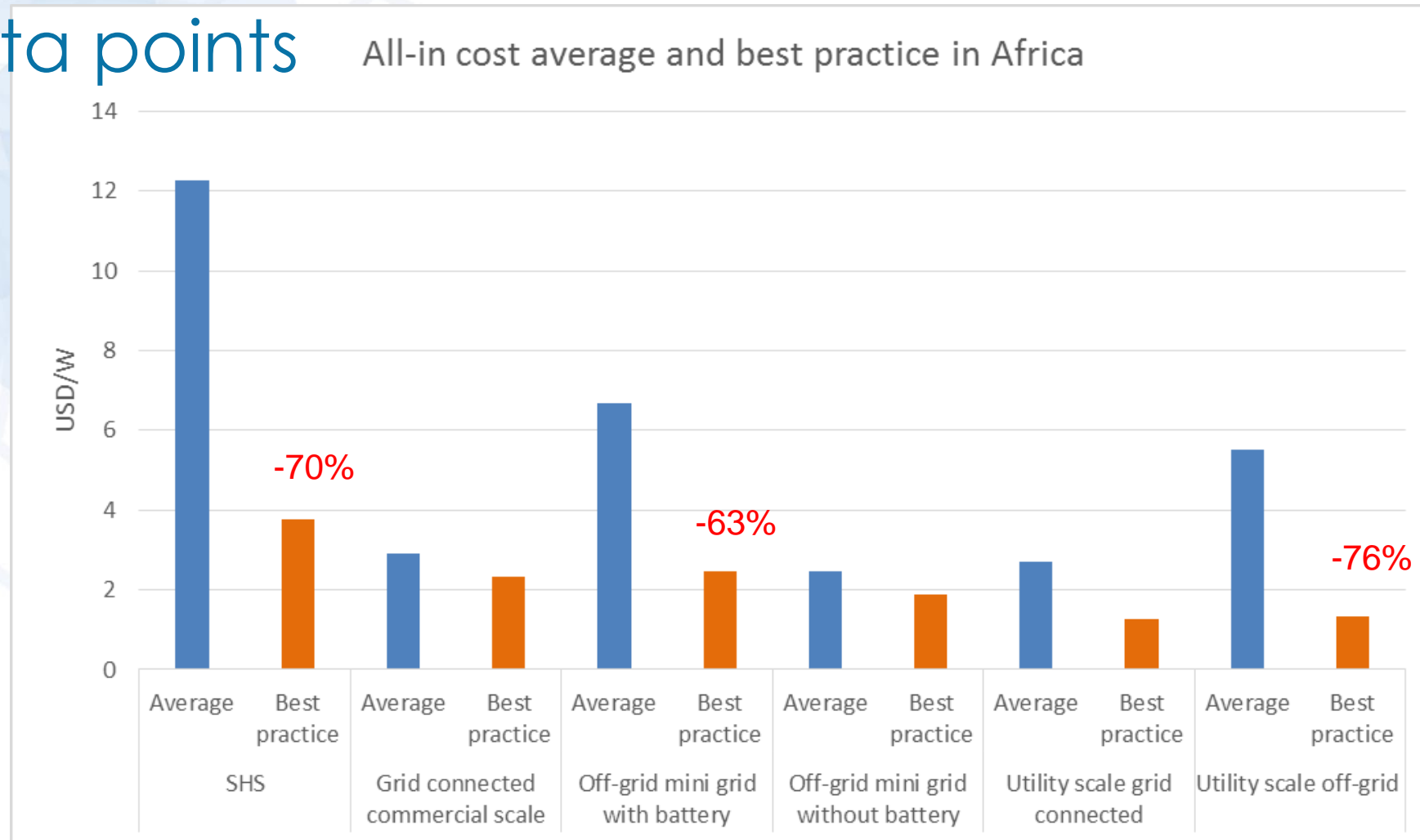
Typical ranges and averages for the total installed costs of utility scale PV projects



Cost reduction potential

370 data points

All-in cost average and best practice in Africa



Recommendations and next steps

- Market size and structures not clear except at utility-scale
 - ➔ role for IRENA in data collection and statistics
- Cost breakdown difficult to obtain due to confidentiality and small-scale of the market by country
 - ➔ Continuing work to gain confidence of industry and show value-added
- Clear opportunity for regional co-operation on deployment to increase scale and drive down costs
 - ➔ IRENA would like to work with regional groups to identify challenges and opportunities and pathway to higher deployment and lower costs

4

Upcoming Work and Closing Thoughts

Upcoming work of IRENA costing

PV parity indicators

Solar PV and CSP cost reduction potentials

Stationary applications

PPA and auction database

RE and energy security

Solar PV: Big, small and in between

Grid parity increasingly the norm
FITs falling → role of storage

Utility-scale, massive potential

Challenges to utility business model:
New business models → embrace solar

Wholesale markets and
network models need to adapt

Solar PV: Cost reductions

Large variation in installed costs
→ policy opportunity

Need to increasingly focus on
soft costs and finance

What are efficient costs in new mkts?
→ How to drive these down rapidly?

What about hardware costs? Where is tipping point?



IRENA's Cost Analysis



Bringing Our Future Forward

Thank you!
mtaylor@irena.org