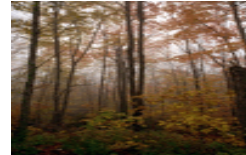


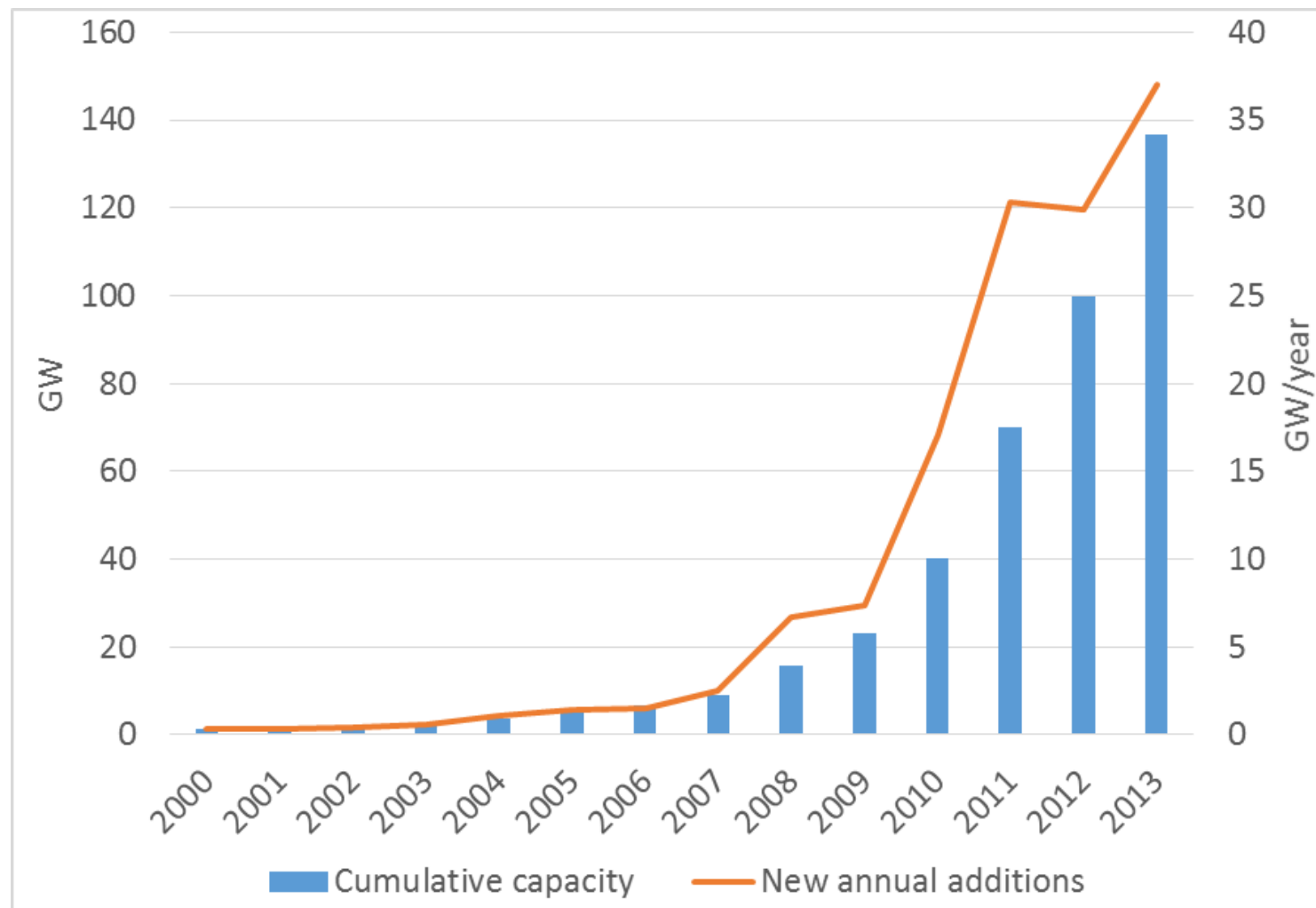
The True Costs of Solar PV: IRENA's Cost Analysis



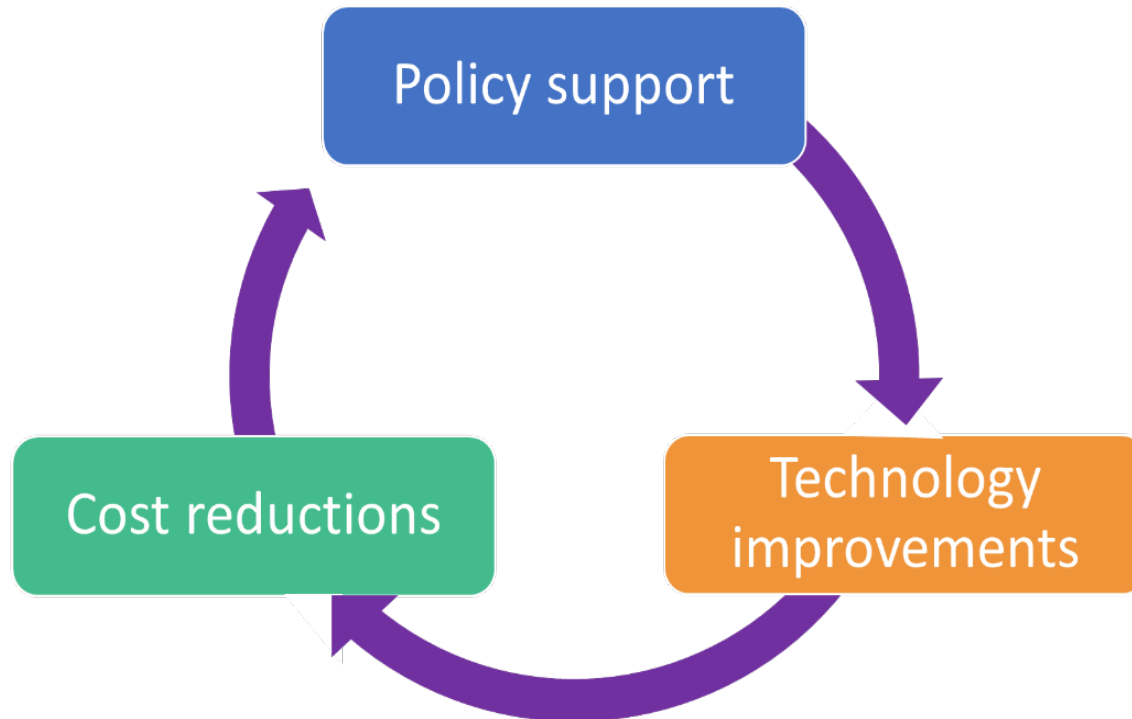
Michael Taylor
mtaylor@irena.org

EU PVSEC Amsterdam, 25 September 2014

A dynamic market



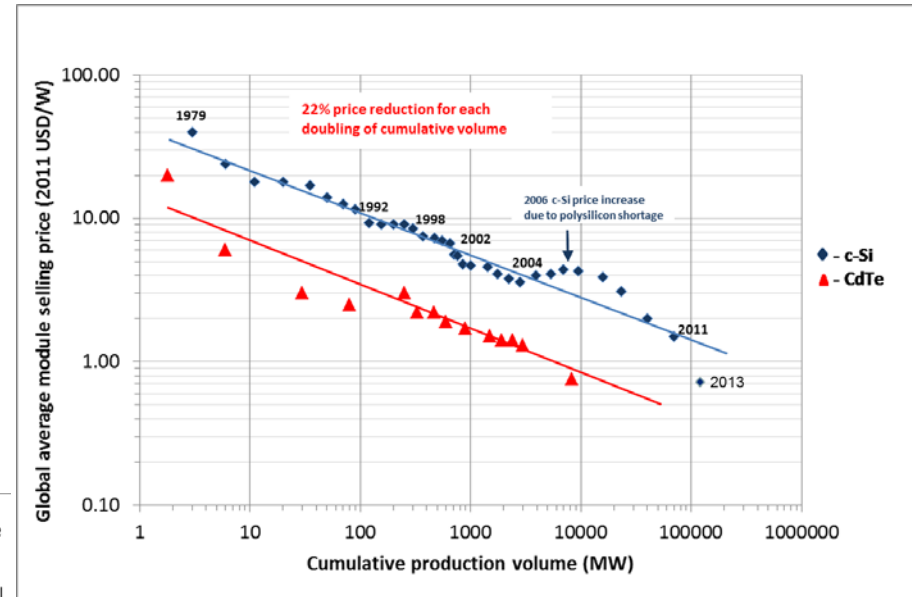
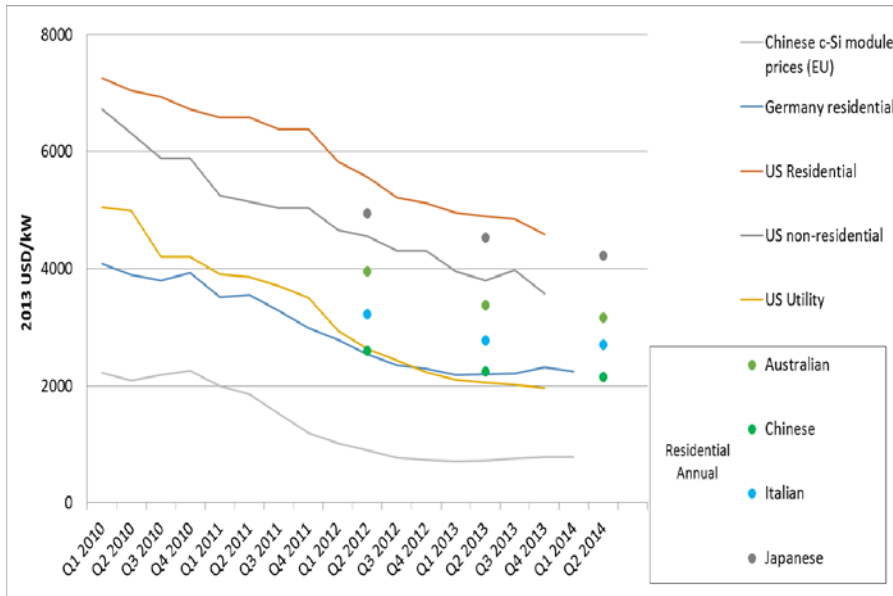
The energy sector is being transformed....



A virtuous cycle is unlocking the economic, social and environmental benefits of renewables

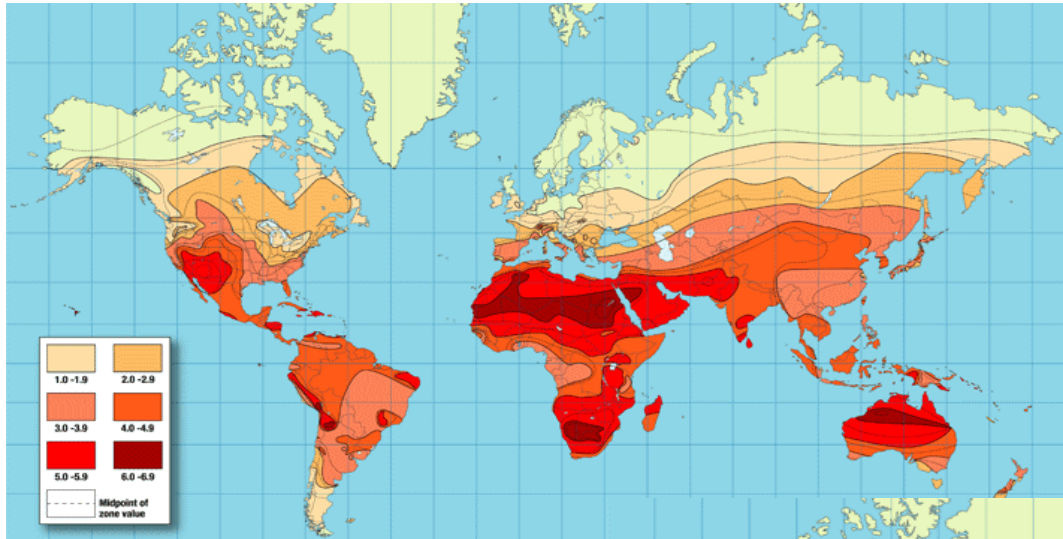
Recent cost trends

Rapidly declining solar PV module prices.....



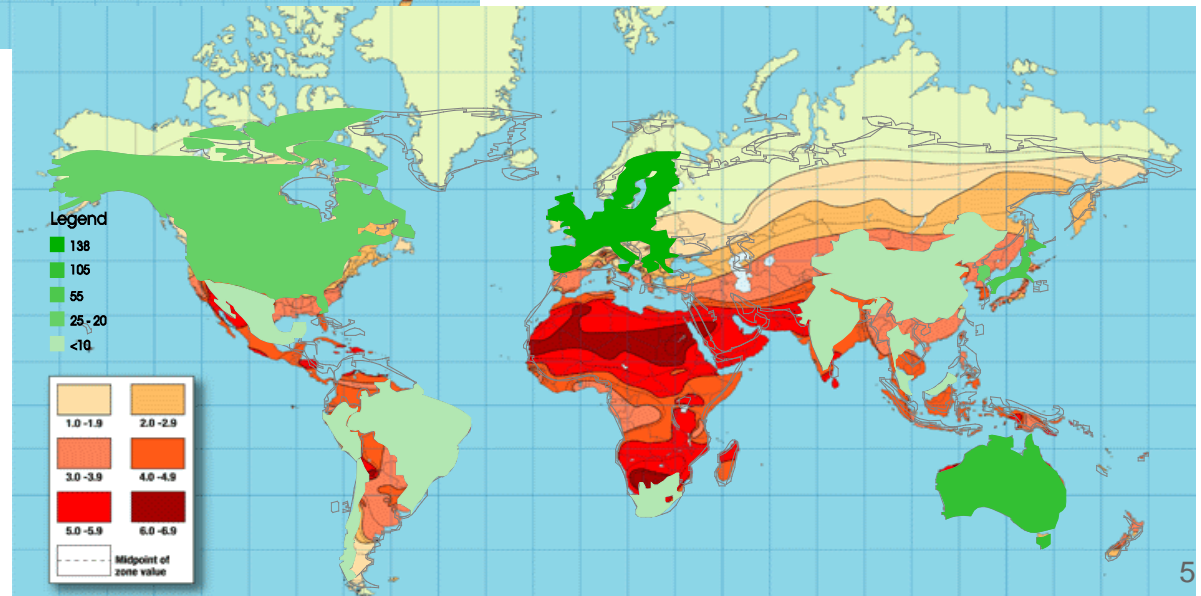
.....and installed costs

Solar resources, deployment...



Missed opportunities:

Deployment typically is not where the best resources exist!



Beyond narrow markets Accelerating PV deployment

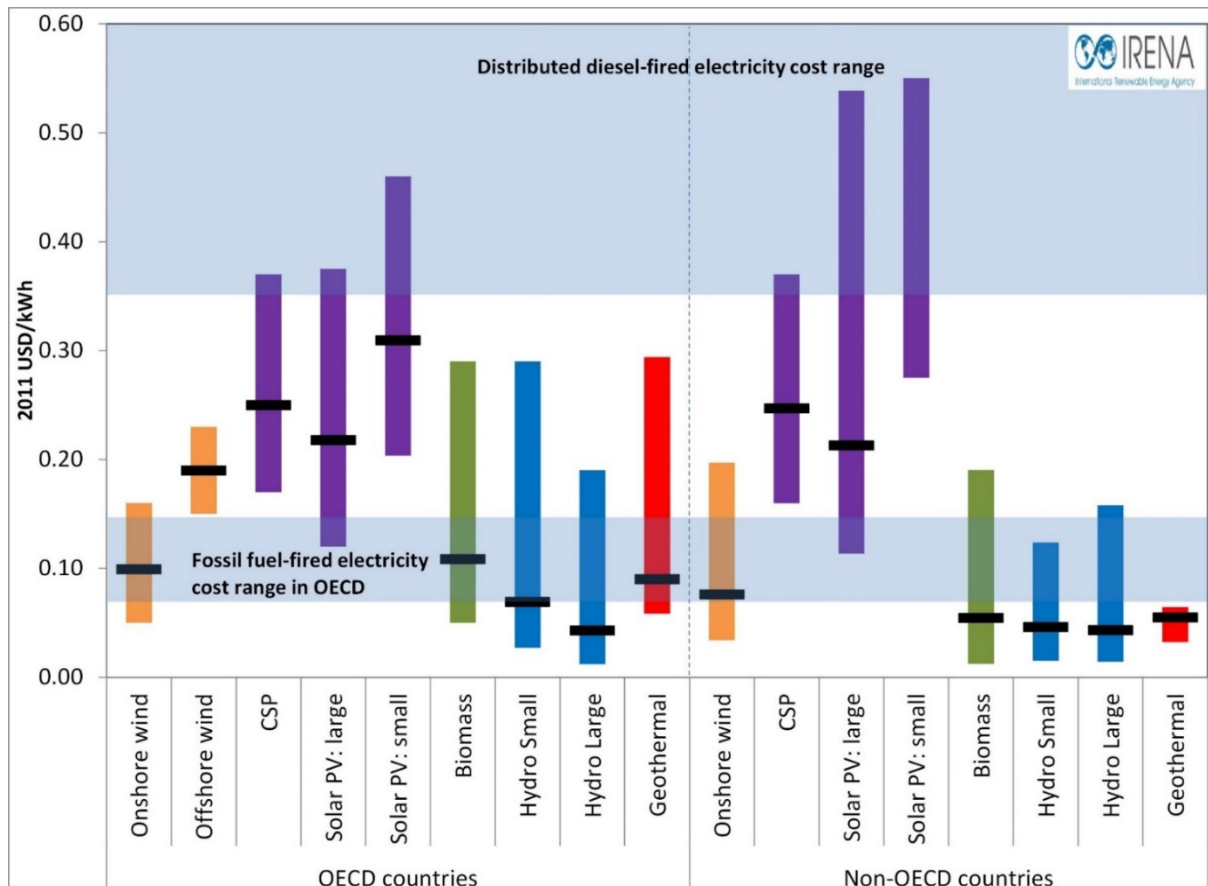
The absence of up-to-date cost data is a barrier...

...in response, IRENA is ramping up its work



Renewables are increasingly competitive!

IRENA's analysis of 9000 utility-scale projects and 200k small-scale solar PV allows us to make conclusions like this:



Solar PV costs: Current work

1. IRENA Renewable Costing Alliance

- Works at technical level
- Pool, confidentially, data
- Low overheads
- Entirely voluntary, no fees

2. Accelerating cost reductions in new markets in Africa

3. IRENA's Solar PV Parity Indicators

Solar PV costs: Current work... continued

1. IRENA Renewable Costing Alliance
2. **Accelerating cost reductions in new markets in Africa**
 - Joint project with GIZ/BMZ
 - Focus on collecting up-to-date data on current costs for utility-scale, mini-grids and SHS
 - What do “competitive” costs look like in Africa?
 - What are the barriers to achieving these levels in new markets in Africa?
 - How do we get there? What facilitating policies are needed?
3. IRENA’s Solar PV Parity Indicators

Accelerating cost reductions in new markets in Africa

Why Africa?

- 599 million people without access to electricity (IEA)
- Deployment is tiny relative to potential and excellent resources exist
- Off-grid sector is growing rapidly, but what are the costs, why so few systems so far?

Table 4: Global status of off-grid solar home systems markets

| | Year | Solar Home Systems |
|---------------------|--------------|--------------------|
| Bangladesh | 2013 (Dec) | About 2 600 000 |
| India | 2012 (March) | 861 654 |
| China | 2008 | > 400 000 |
| Kenya | 2010 | 320 000 |
| Indonesia | 2010 | 264 000 |
| Nepal | 2012 | 229 000 |
| South Africa | Est. | 150 000 |
| Sri Lanka | 2011 | 132 000 |
| Morocco | Est. | 128 000 |
| Zimbabwe | Est. | 113 000 |
| Mexico | Est. | 80 000 |
| Tanzania | Est. | 65 000 |
| Total | | 5.1 million |

Source: IRENA, 2013

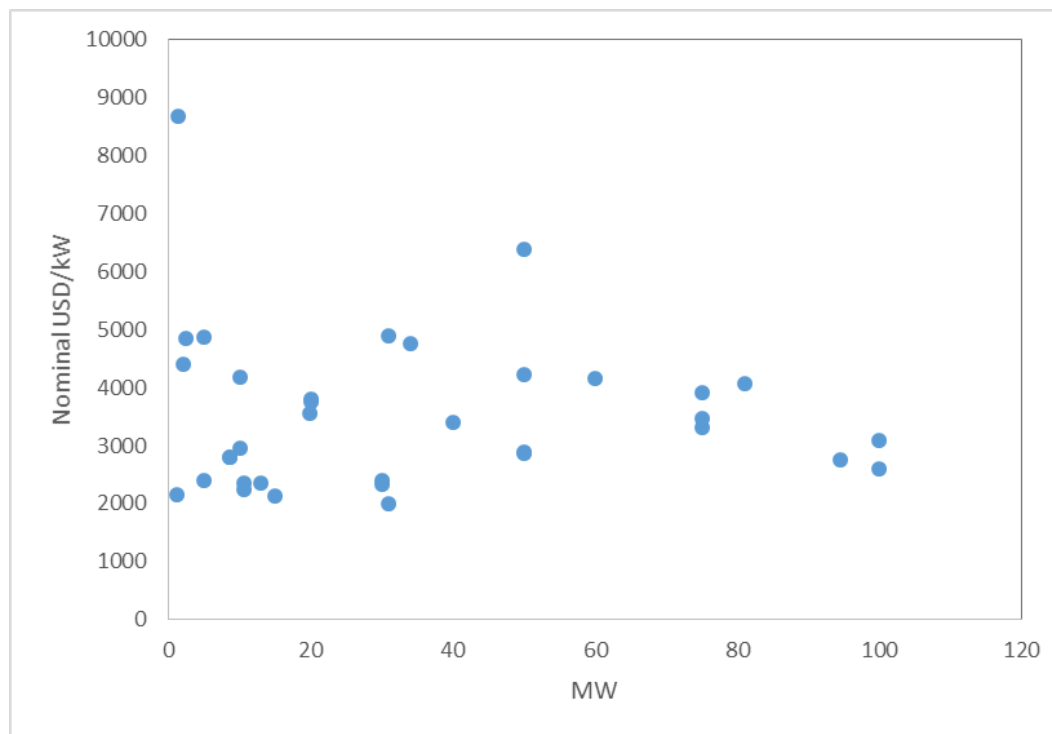
[NB: The information is Indicative, data gaps prevent reliable analysis of the number of SHS deployed globally]

| | Without access to electricity | | Traditional use of biomass for cooking* | |
|-----------------------------|-------------------------------|---------------------|---|---------------------|
| | Population | Share of population | Population | Share of population |
| Developing countries | 1 257 | 23% | 2 642 | 49% |
| Africa | 600 | 57% | 696 | 67% |
| Sub-Saharan Africa | 599 | 68% | 695 | 79% |
| Nigeria | 84 | 52% | 122 | 75% |
| South Africa | 8 | 15% | 6 | 13% |
| North Africa | 1 | 1% | 1 | 1% |
| Developing Asia | 615 | 17% | 1 869 | 51% |
| India** | 306 | 25% | 818 | 66% |
| Pakistan | 55 | 31% | 112 | 63% |
| Indonesia | 66 | 27% | 103 | 42% |
| China | 3 | 0% | 446 | 33% |
| Latin America | 24 | 5% | 68 | 15% |
| Brazil | 1 | 1% | 12 | 6% |
| Middle East | 19 | 9% | 9 | 4% |
| World*** | 1 258 | 18% | 2 642 | 38% |

Accelerating cost reductions in new markets in Africa

Utility scale solar PV projects in Africa

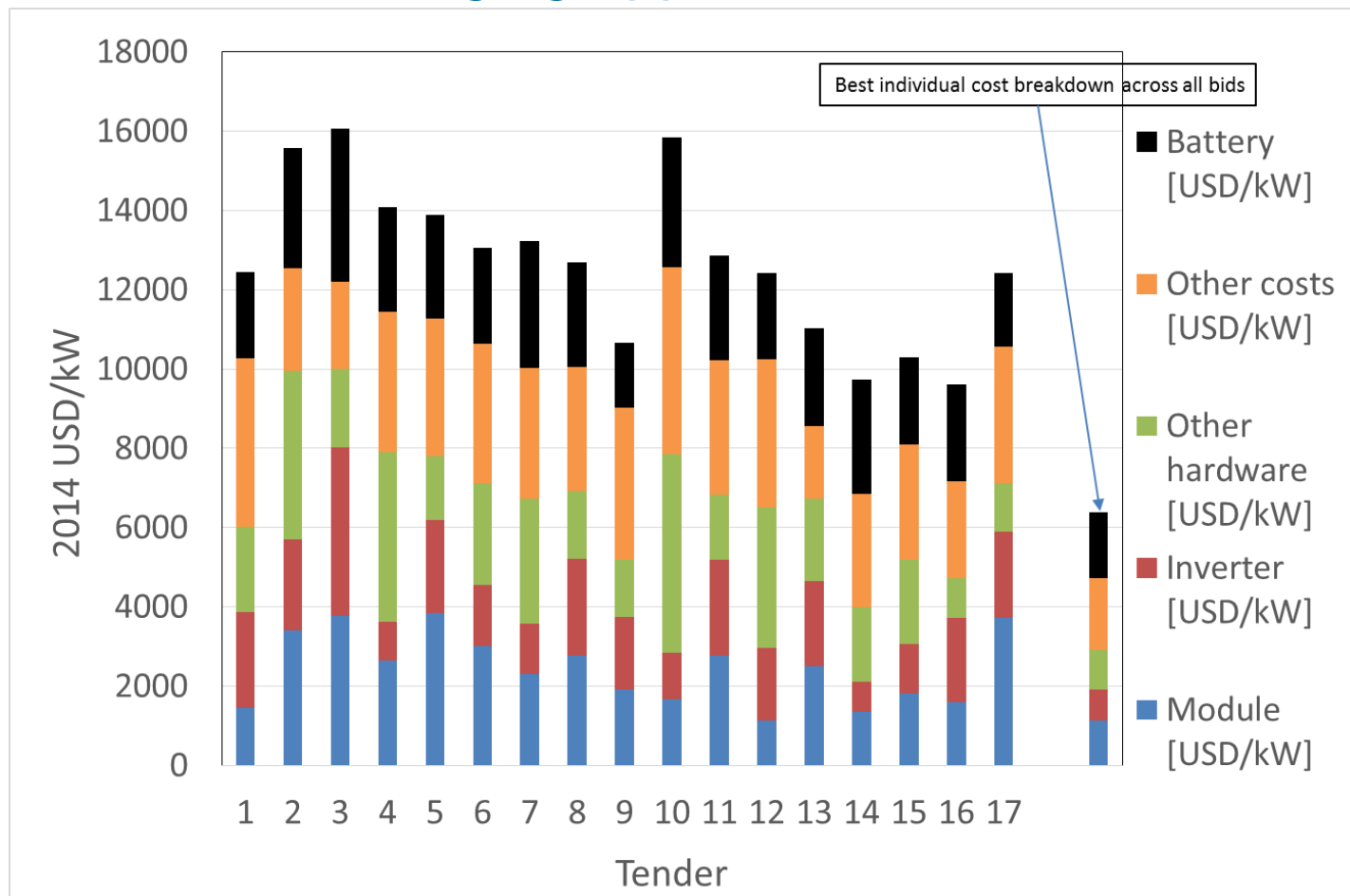
- Operating or under construction in 8 African countries
- A further 6.5 GW either permitting or financed
- Some projects with competitive cost structures



Source: IRENA Renewable Cost Database and Global Data, 2014

Accelerating cost reductions in new markets in Africa

Off-grid PV costs in Africa are still high.....
But there are encouraging opportunities for cost reduction



Accelerating cost reductions in new markets in Africa

For example, off-grid solar home systems in Uganda show large variation in offers and costs



| Size (kW) | Battery | Cost (USD/kW) |
|-----------|-------------------|---------------|
| 0.3 | 2 x 12V/ 100 Ah | 1731 |
| 1 | 2 x 12 V / 150 Ah | 2692 |
| 1.5 | 2 x 12 V / 230 Ah | 3269 |
| 3 | 8 x 6 V / 220 Ah | 6154 |

Accelerating cost reductions in new markets in Africa

Timeline

- Data collection till December 2014
- Analysis and cost reduction identification till Jan 2015
- Drafting of results and handbook Feb-Apr 2015
- Publication June 2015
- Can you help us make the analysis better?

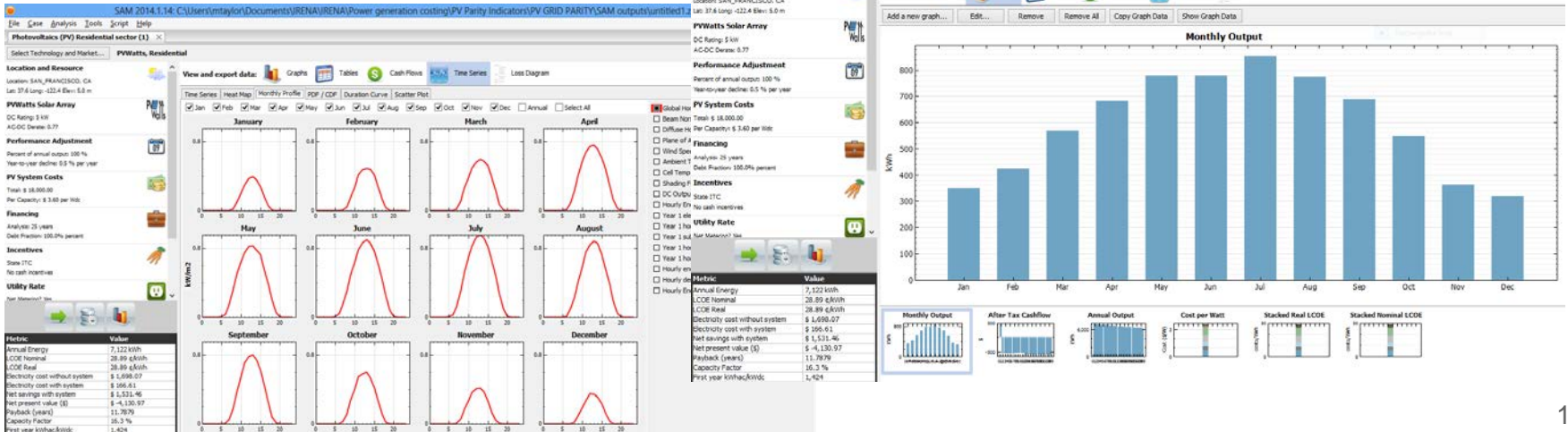
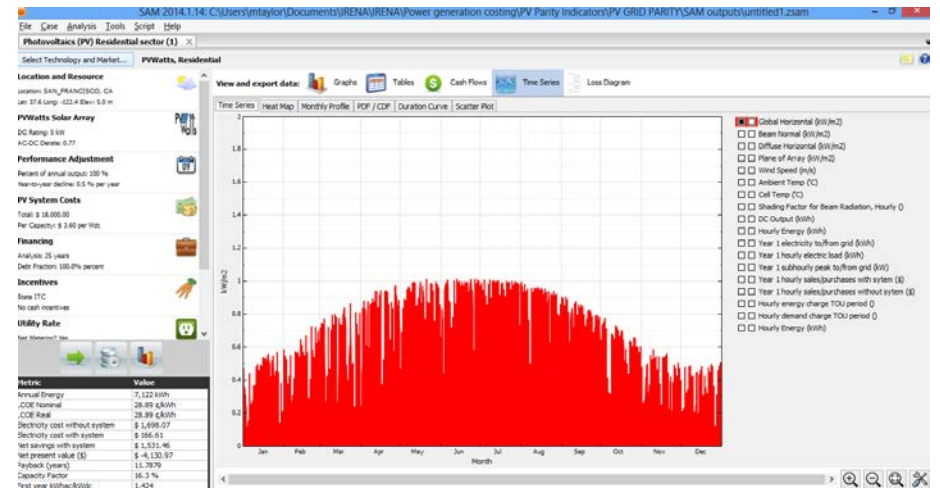
Solar PV costs: Current work... continued

1. IRENA Renewable Costing Alliance
2. Accelerating cost reductions in new markets in Africa
3. **IRENA's Solar PV Parity Indicators**
 - Tracks quarterly competitiveness
 - Indicators, not actual costs
 - Target audience are policy makers and thought leaders
 - Start with North America
 - Can lead to more detailed analysis
 - Supports other IRENA activities

IRENA Solar PV Parity Indicators

Methodology

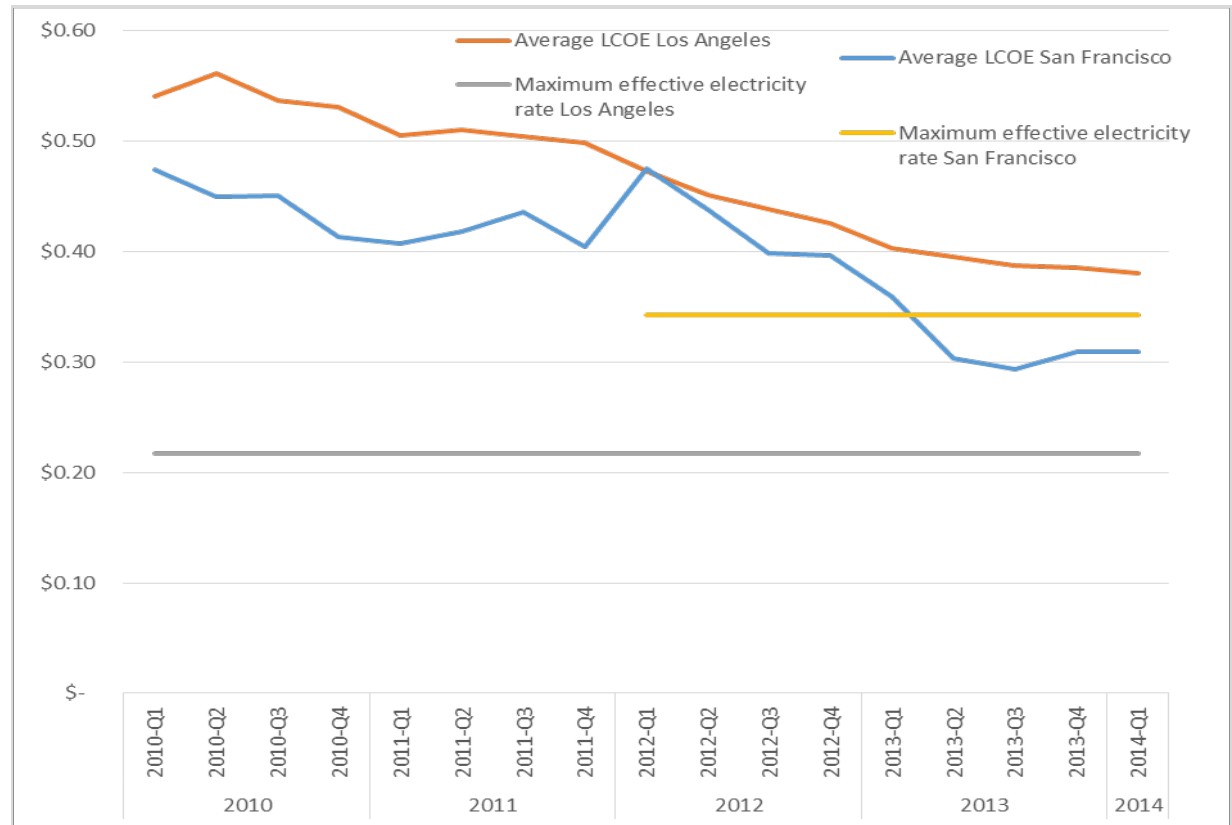
- Simple metrics
- LCOE vs Effective Electricity Rate/Value
- Leads to detailed assumptions & analysis



IRENA SOLAR PV PARITY INDICATORS

Residential PV Parity:

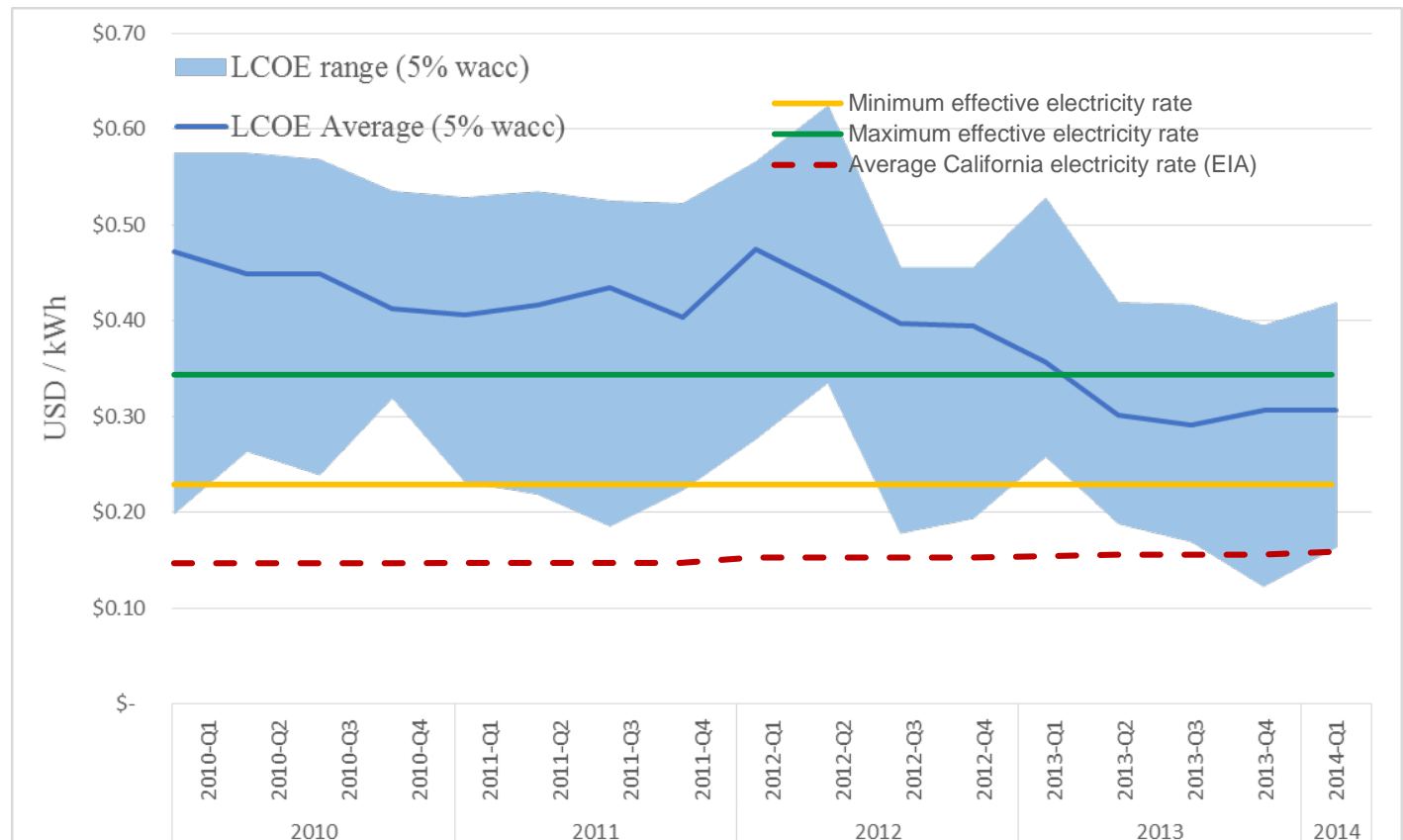
- Recent module price reductions make solar PV increasingly competitive



IRENA SOLAR PV PARITY INDICATORS

Residential PV Parity: San Francisco

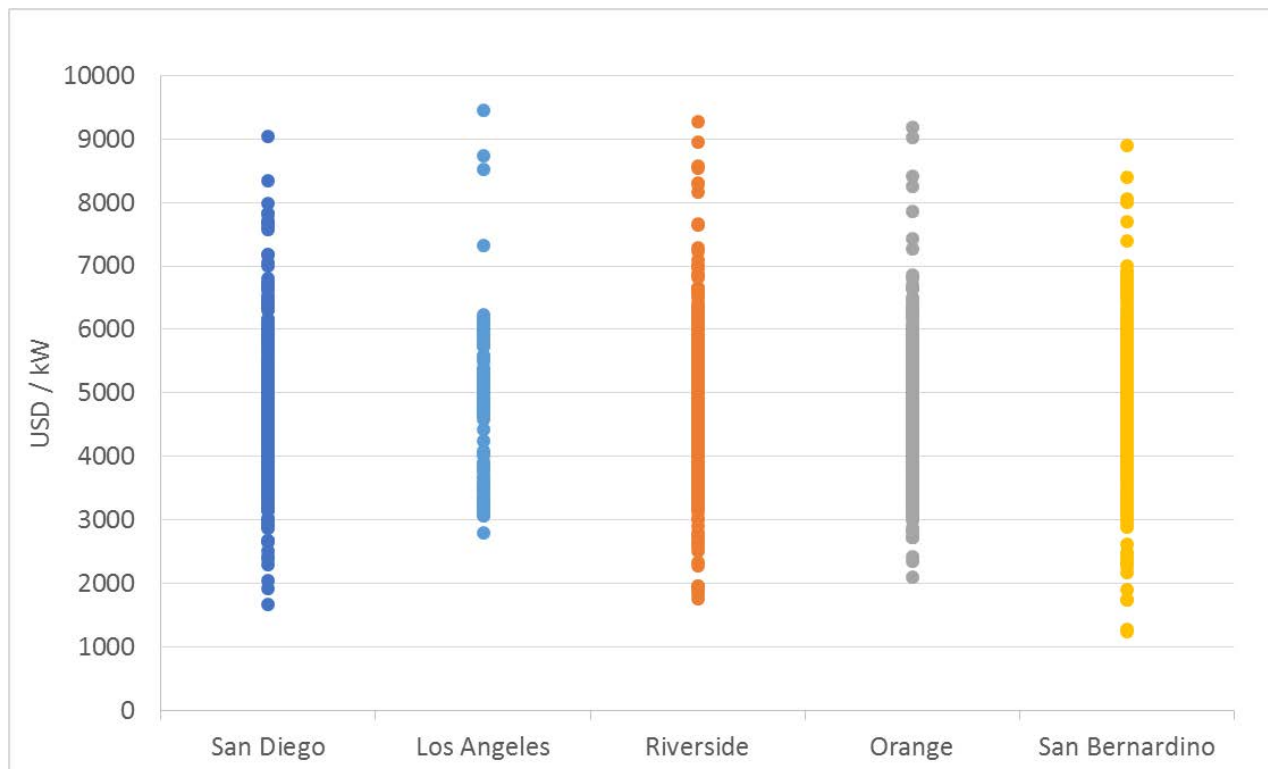
➤ Nuanced results depending on rate and system cost



IRENA SOLAR PV PARITY INDICATORS

Installed cost variation by city

- Consistently wide variation in installed costs



IRENA Solar PV Parity Indicators

IRENA's PV cost analysis

- Transparent data
- Simple methodology
- Timely and policy relevant information



IRENA's PV Cost Analysis



Bringing Our Future Forward