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Wide scale deployment of renewable energy – Technical and Economic Implications for Utilities

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Outline

- What is going on in the renewable energy space?
- Disruptive nature of renewable energy & inevitability of change for utilities
- Implications of Wide scale PV deployment for utilities
  - Technical
  - Economic
- Final remarks

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What is going in the renewable energy space

- Cost of renewables dropping rapidly. Already attained grid parity in grid connected wind and solar PV
- Efficiency of solar PV has also been improving
- Exciting developments in storage technology leading to more robust lower priced products
- Uptake of solar PV is accelerating including domestic & commercial rooftop as well as grid connected systems ➔ uptake in Africa was slow initially but is now ramping up due to rapid deployment and minimal environmental impact

The era of energy autonomy is no longer far fetched

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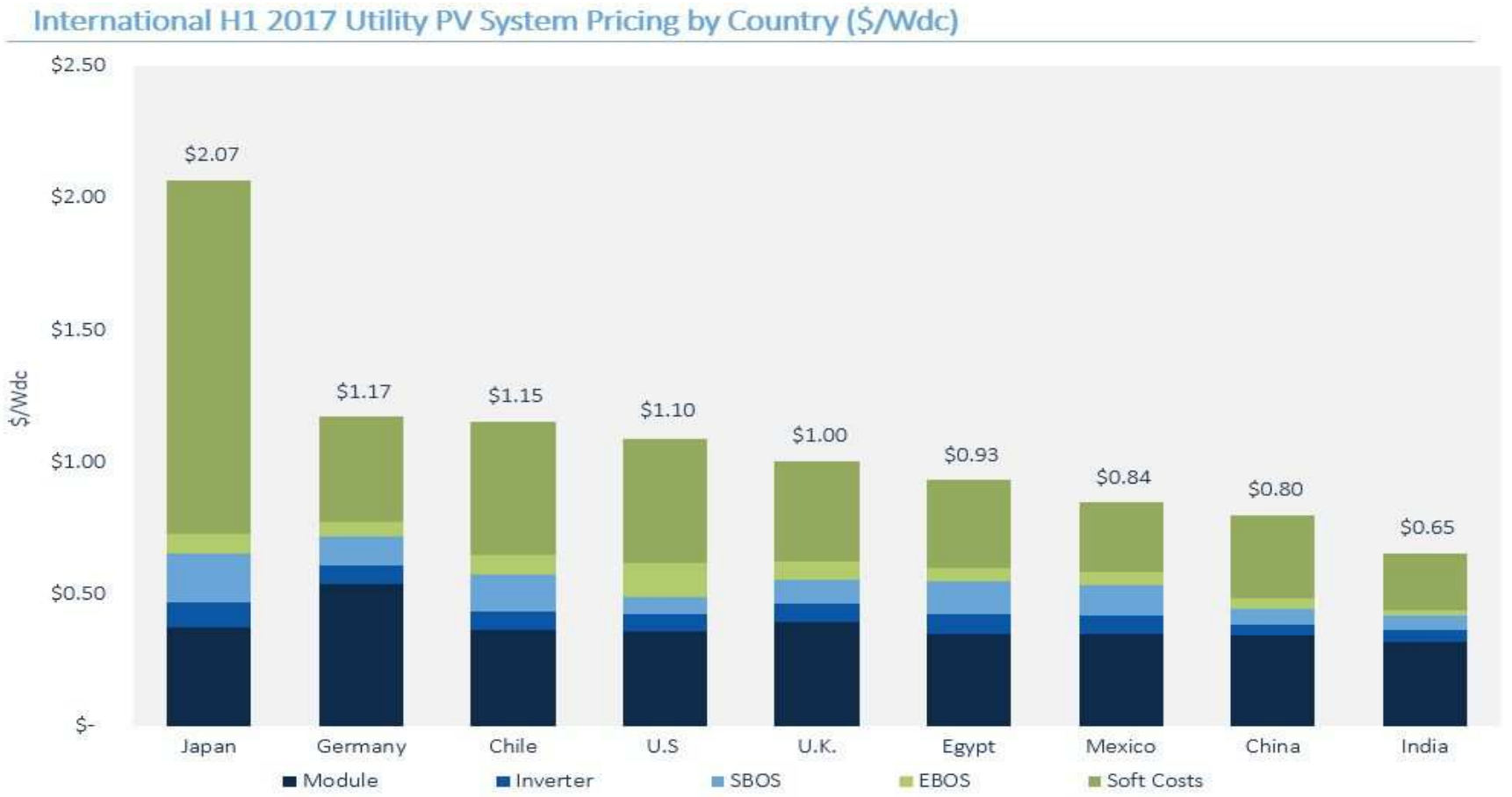
Trend of solar prices in different parts of the world in 2017



Source: GTM Research's PV System Pricing H1 2017 (https://www.greentechmedia.com/research/report/pv-system-pricing-h1-2017#gs.sfNf1w4)

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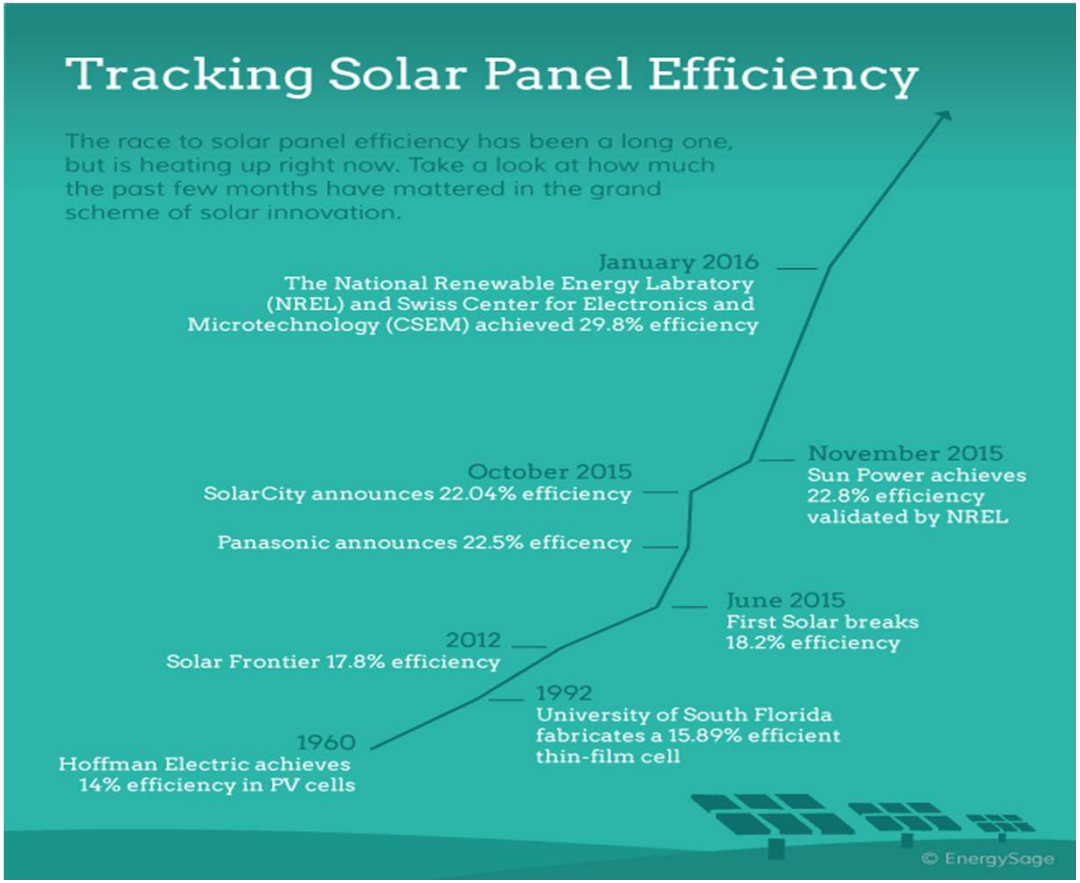
Panel efficiency improvements



Source: https://news.energysage.com/solar-panel-efficiency-cost-over-time/

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Disruptive nature of renewable energy & inevitability of change for utilities

- Solar PV can be classified as a disruptive technology as it is challenging the traditional assumptions of technical & commercial operation of utilities ➔ driven by environmental and sustainability imperatives including climate resilience
- Utilities worldwide have been generally slow to accept connection of renewables due to the changes that large scale deployment imply for them ➔ this is changing supported by appropriate regulatory regimes
- Utilities are no longer in control of the change that is coming ➔ Hence they must adapt or risk commercial failure

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PV Implications for utilities – Technical…1

- Change of power flow in distributions systems from unidirectional to multidirectional with attendant implications for **protection** and system **operating** procedures to ensure safety of personnel and equipment
- Impact on **fault levels** and need for switchgear upgrades
- **Voltage rise** → investment in voltage control
- **Harmonics** due to convertor connected systems

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PV Implications for utilities – Technical…2

- **Losses** could rise depending on level of penetration
- **Low inertia** due to convertor connected plants and implications for system **transient stability** and **frequency control**
- System operation - **The duck curve**

Review of transmission and distribution grid codes required

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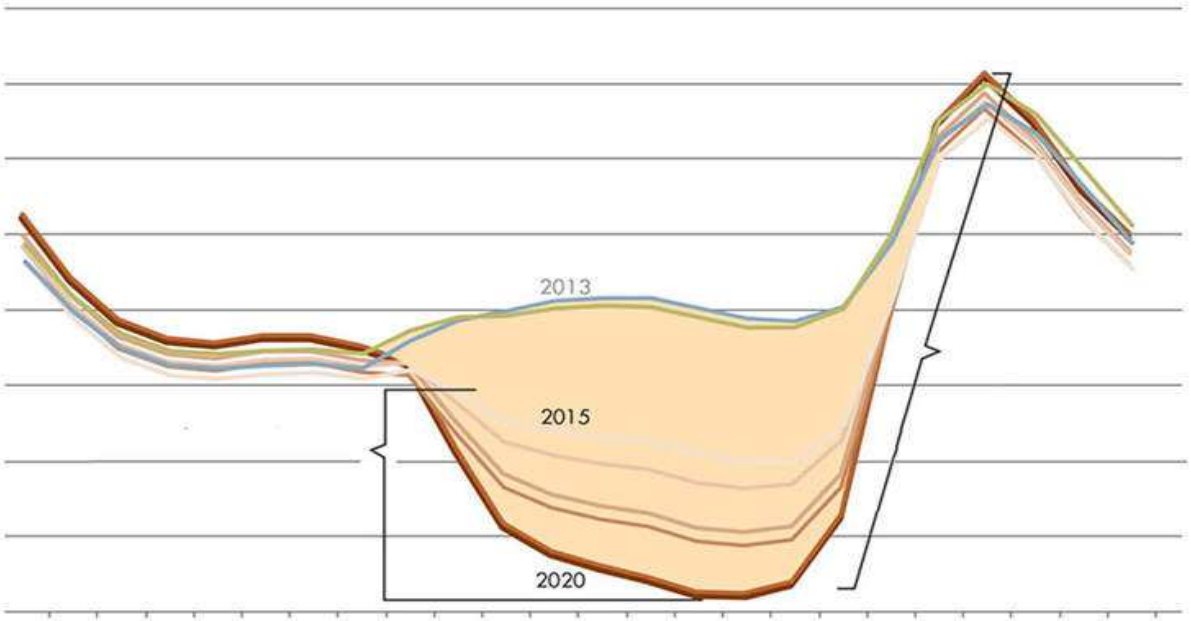
PV Implications for utilities – Technical…3



The duck curve

"Without any form of energy storage, after times of high solar generation generating companies must rapidly increase power output around the time of sunset to compensate for the loss of solar generation, a major concern for grid operators where there is rapid growth of photovoltaics"

Source: https://www.greenbiz.com/article/californias-grid-geeks-flattening-duck-curve

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PV Implications for utilities-Economic/Commercial

- **Reduced sales revenue** due to deployment of domestic and industrial rooftop solar as well as plants developed by IPPs ➔ could threaten viability of the utility
- Need for **investment in primary** assets such as switchgear and reinforcement
- **Metering** systems – net metering or dual metering
- **Pricing** – export and import tariff? Economic efficiency in pricing ➔ cost reflectivity
- **Ancillary services** provided by utility to support rooftop solar systems may not yet be fully understood ➔ need to develop a commercial framework to remunerate utilities for backup power and stabilising role?

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Final remarks → Utilities must embrace the change and position themselves for success

- There is no question that change is coming to utilities as deployment of solar PV and other renewables accelerates
- Utilities must embrace the change and position themselves to ride the wave and thrive
- New and innovative approaches to the concept of a utility in this brave new world must be developed
- Many utilities still lack capacity to address the myriad of issues brought about by renewable energy integration→ Capacity building is urgently required

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The irreversible momentum of clean energy – Barak Obama - *Science* 09 Jan 2017

The renewable energy revolution is already under way, and there's nothing you can do to stop it

http://science.sciencemag.org/content/early/2017/01/06/science.aam6284.full

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Thank you for your attention

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