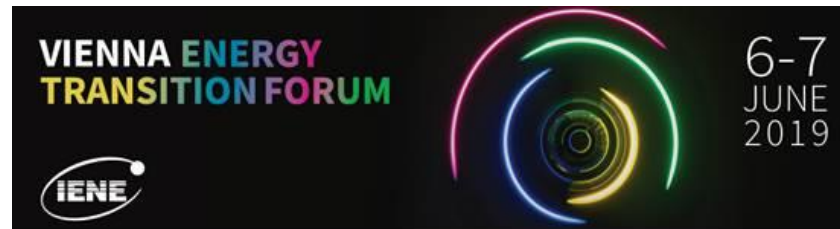


The New Era for Energy Efficiency and Further RES Deployment



Photovoltaics – Trends and Perspectives

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Chair Austrian Technologyplatform Photovoltaics

Vice chair of the Photovoltaic Programme of the International Energy Agency (IEA-PVPS)



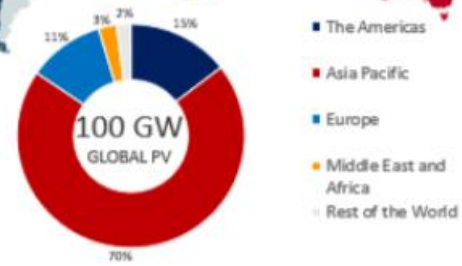
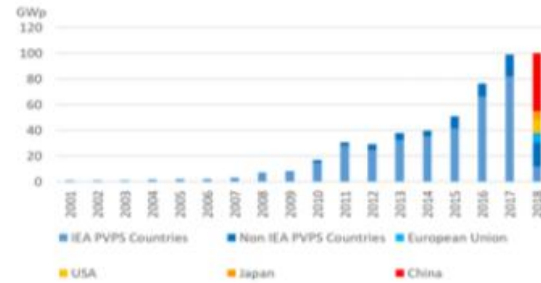
10 Minutes...

- PV History ... it began 60 years ago...
- World market... 2,5 % of global electricity... soon 20...40,50,60 %???
- PV is already now the cheapest form of electricity
- PV needs to partner with flexibility options
- PV will enter the
 - Building-, Agriculture- and Mobility Sector
- The role of PV in the energy transition process

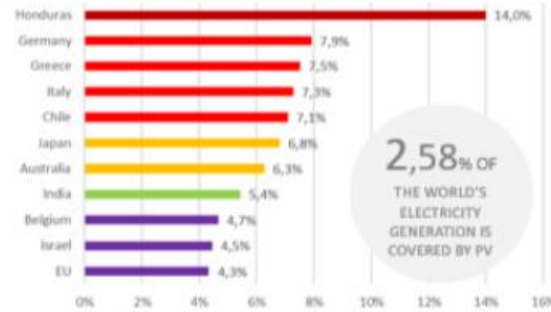
TOP PV MARKETS 2018



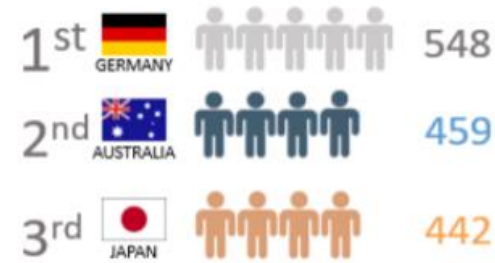
EVOLUTION OF ANNUAL PV INSTALLATIONS



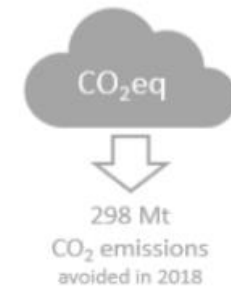
COUNTRIES WITH HIGHEST PV PENETRATION



SOLAR PV PER CAPITA 2018 Watt/capita



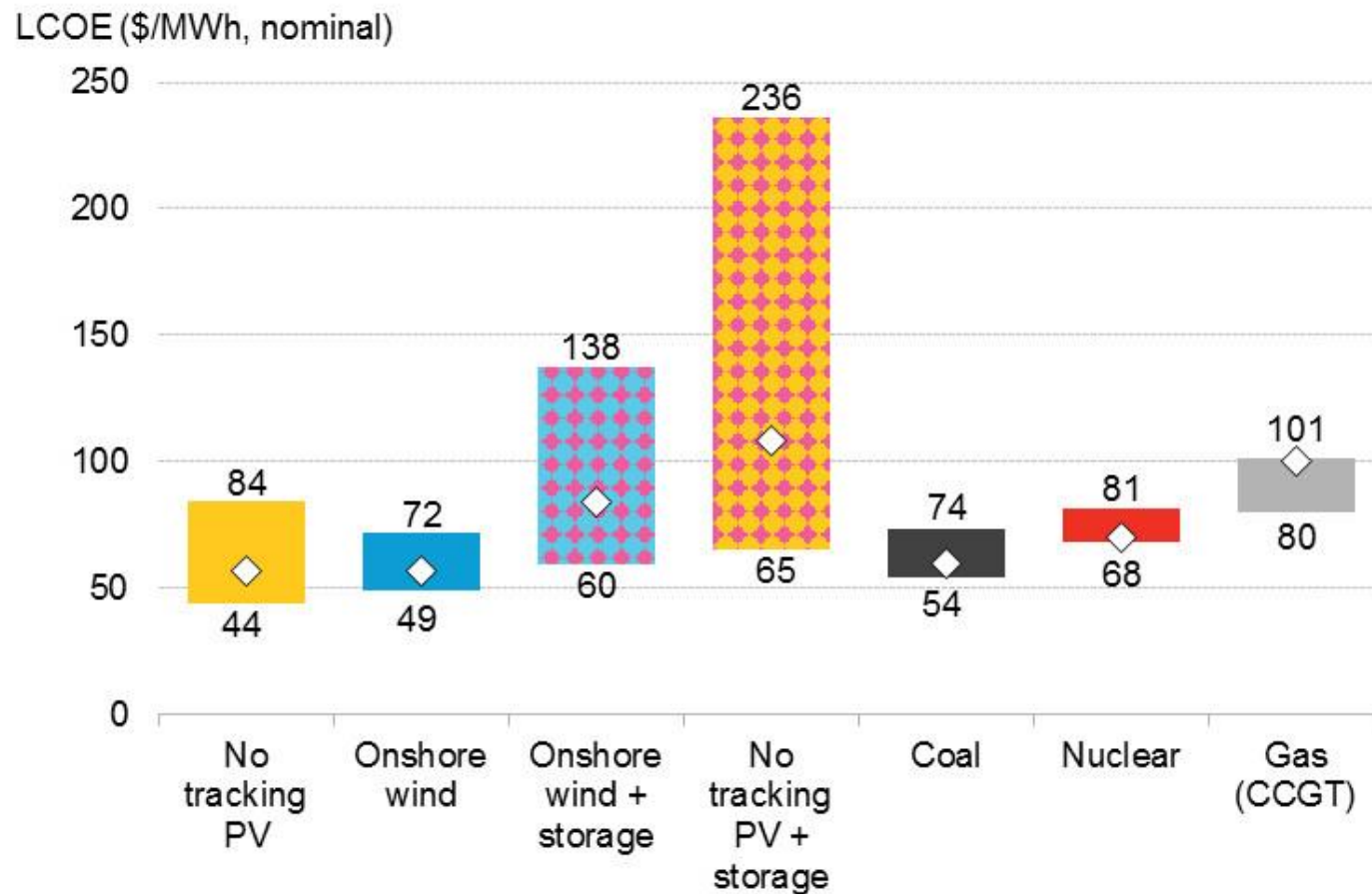
-  100 GW were installed all over the world by the end of 2018
-  China is the world's #1 PV market
-  32 countries had at least 1 GW of cumulative PV capacity at the end of 2018
-  10 countries installed at least 1 GW each in 2018



Bloomberg: Photovoltaic is cheapest form of Electricity in all leading Economies (Exeption:Japan)

PV Tenders for large Systems:

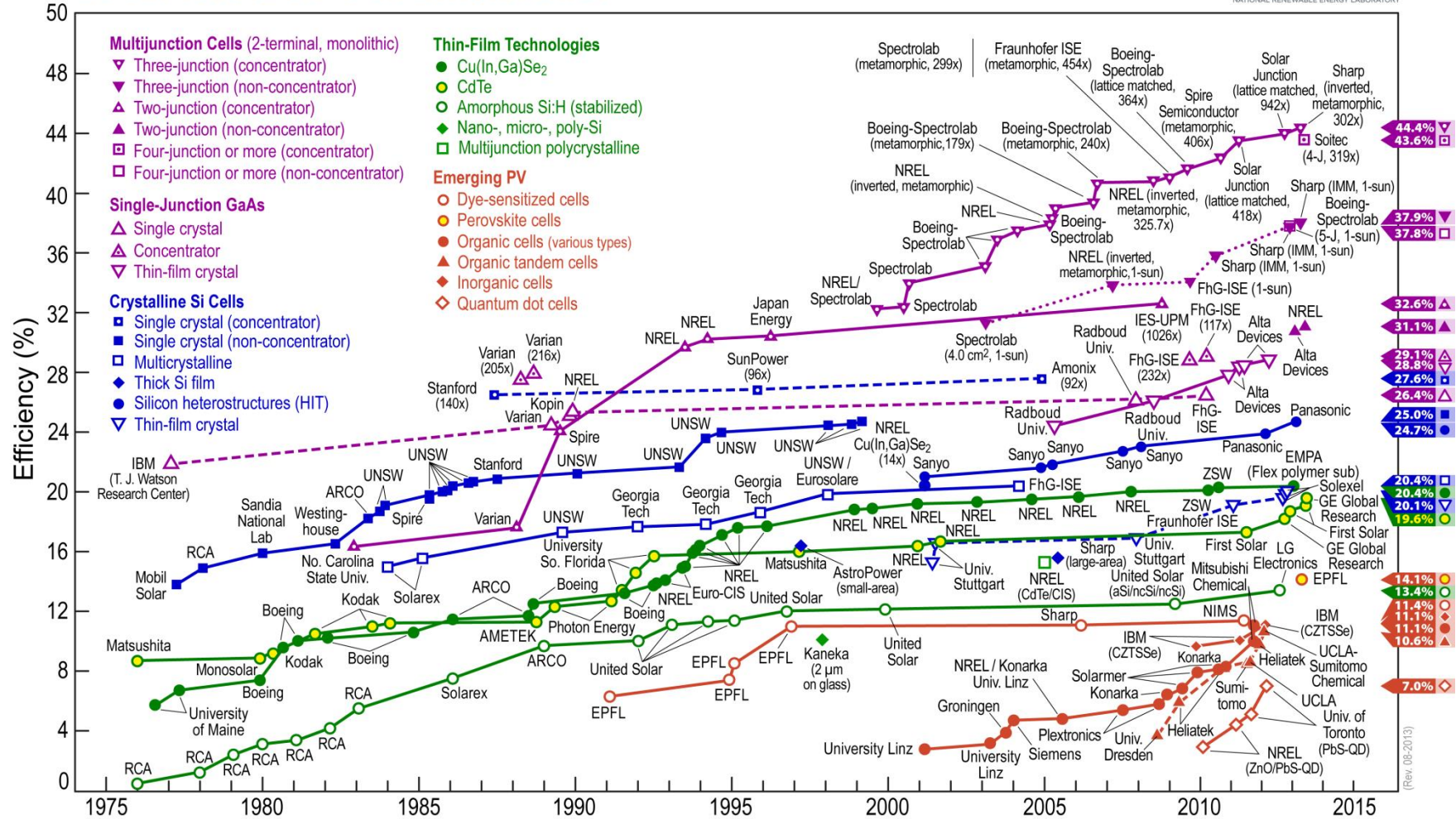
- 4,33 €Cent /kWh in Germany (2018)
- 2,175 US Cent in USA (Idaho)



The Potential



Best Research-Cell Efficiencies



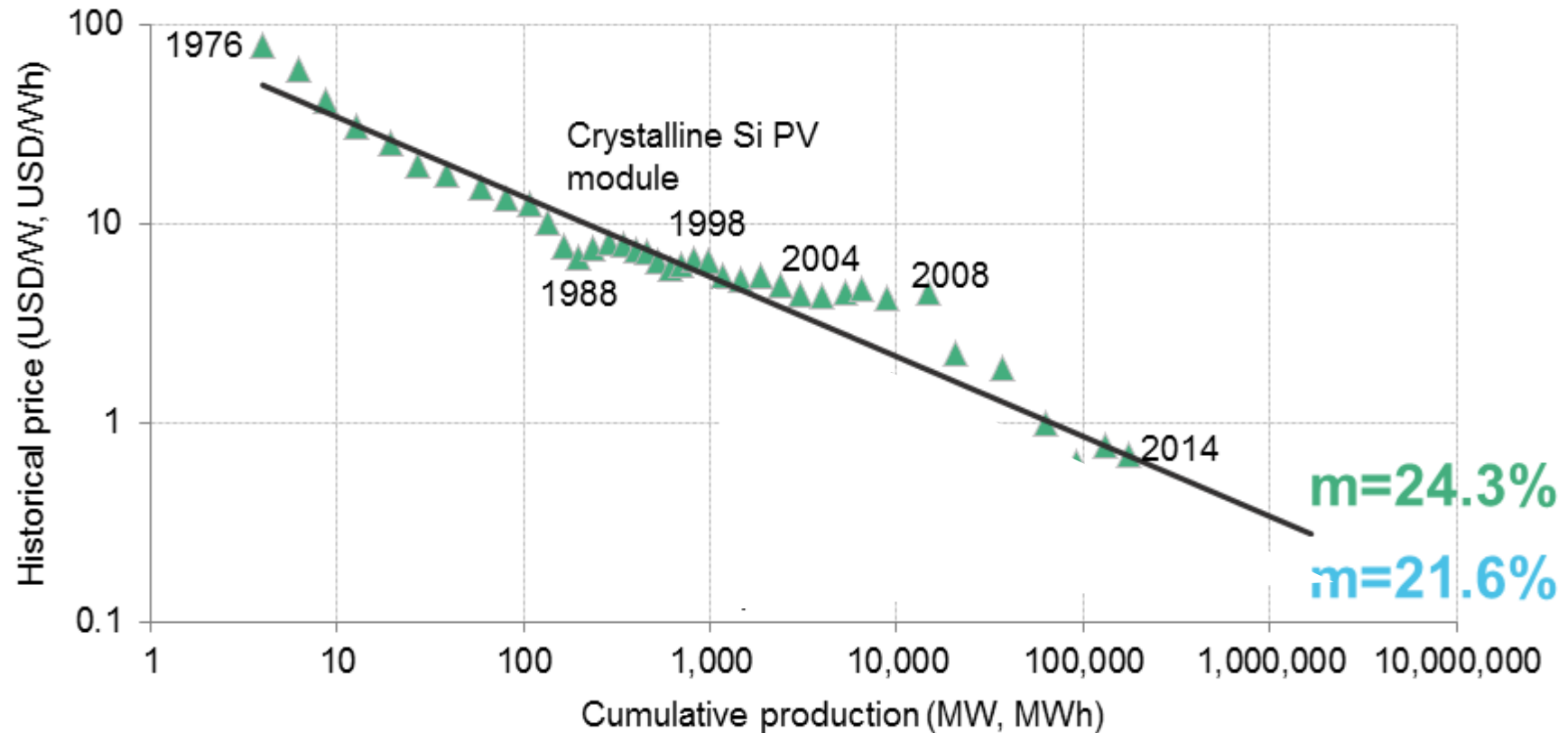
Cell-Efficiencies are - slowly – growing

Hetero-Junction – cells: - Mass production of cells with ~30% efficiency in preparation (Perovskite on Silicon)

PV + Storage

LITHIUM-ION EV BATTERY EXPERIENCE CURVE COMPARED WITH SOLAR PV EXPERIENCE CURVE

Bloomberg
NEW ENERGY FINANCE



Note: Prices are in real (2014) USD.

Source: Bloomberg New Energy Finance, Maycock, Battery University, MIT



**Zürich,
Hofwiesenstrasse**

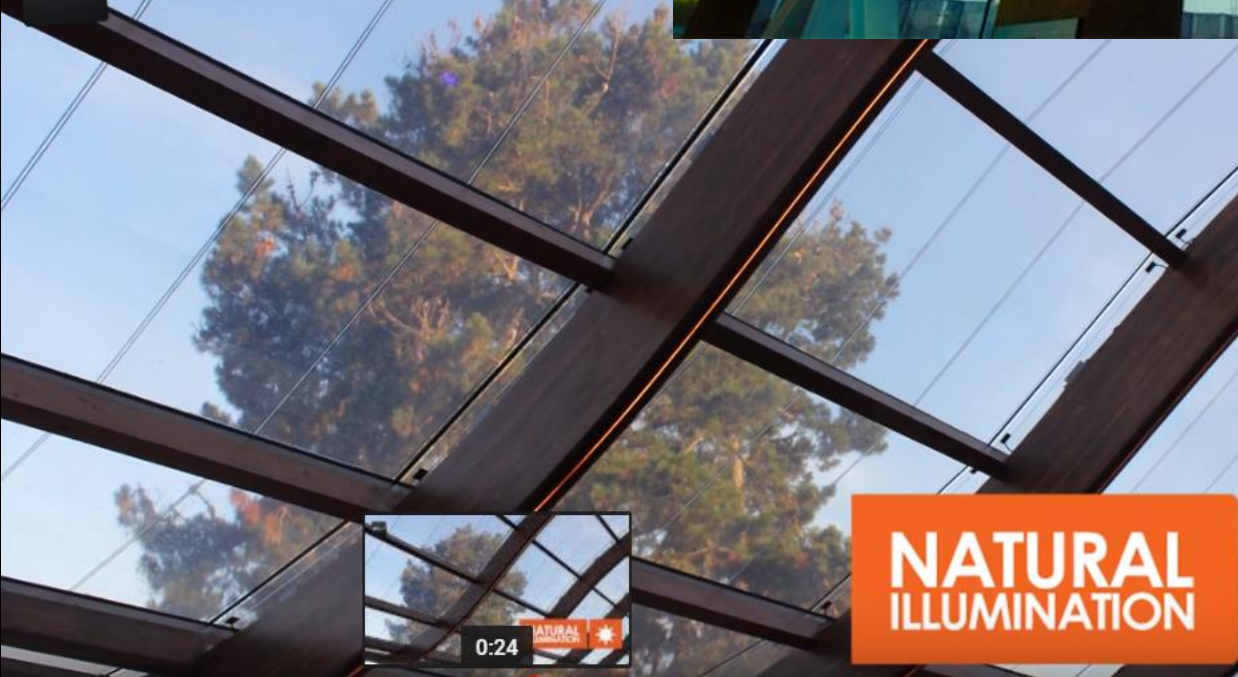
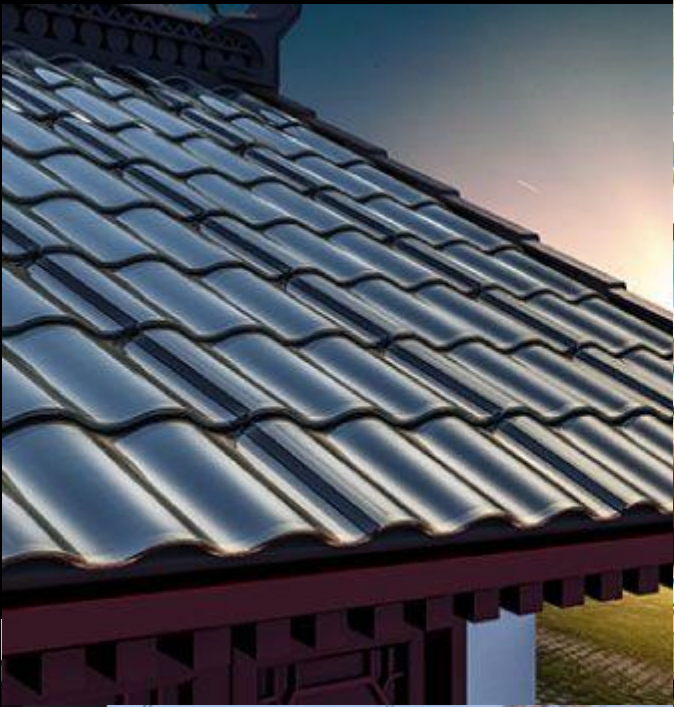
**Energetic
Refurbishment:**
107...13 kWh/m²a

**190 kWp
Photovoltaic**

**Energy-
Autarcy: 98%**

PV Modules:
PVP Wies,
Steiermark,
Austria

Architect:
Karl Viridén



Sources:

- Hanergy (oben)
- Onyx Solar (links)

Agro PV





**We are Lightyear,
we are on a mission.**

Developing the electric car that charges itself.



Solar Highway

China, Jinan

1,08 km, 6.000m²

Total Cost 6,5 Mio USD

Qilu Transportation, 2018

Floating PV



Image: Trina Solar

Photovoltaics and the role in the energy transition...

- PV has the potential to take over a main role in the - growing – Electricity/Energy sector
 - (30...60% electricity globally?)
- PV is ready to take over, no near bottlenecks in materials
 - (silicon, glass, copper, silver,...)

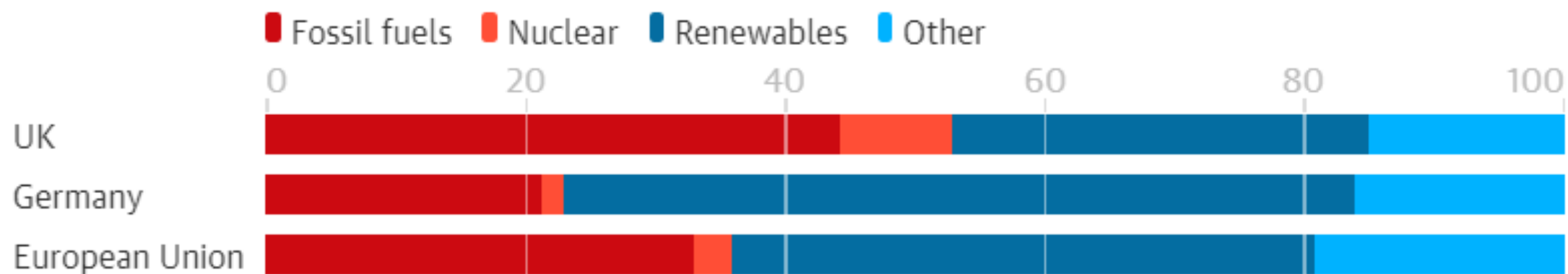
However:

- PV needs a flexible energy system environment
 - Storage, Power2X, demand side management, direct coupling (e.g. with cooling),...
- PV still faces a lot of non technical barriers
 - Regulation, Taxes, Codes, ...
 - Change in the energy support schemes: Fossiles are still more subsidised than Renewables
- Awareness and Education on PV needs to be increased



UK's tops fossil fuel subsidies in the EU

Percentage of 2016 energy subsidies



Guardian Graphic | Source: European Commission, Trinomics