



UNIPOWER

Power Quality Management System

The Shift in Power Generation Changes the Landscape of PQ

A Global Outlook with a Nordic touch

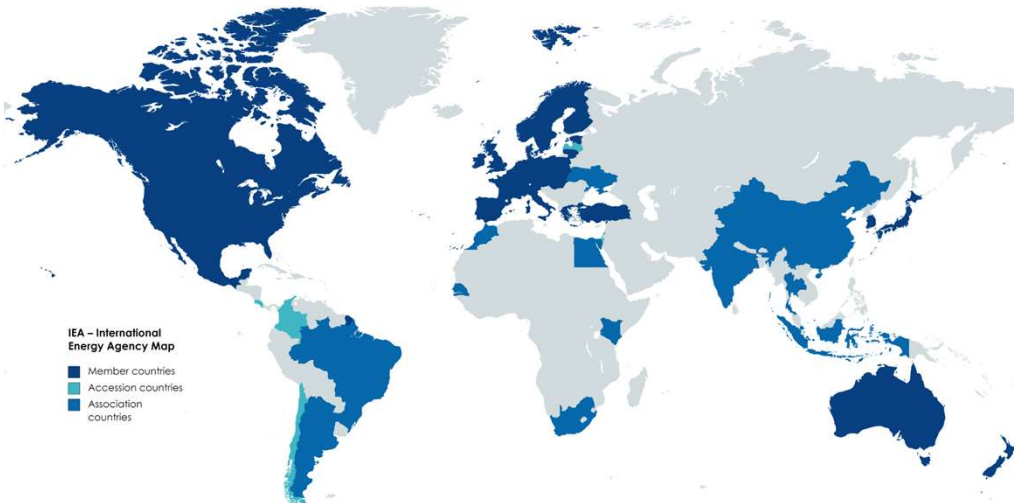
Thomas Ottosson, Managing Director

 **SDIPTeCH** Infrastructure Technology Group



IEA, International Energy Agency

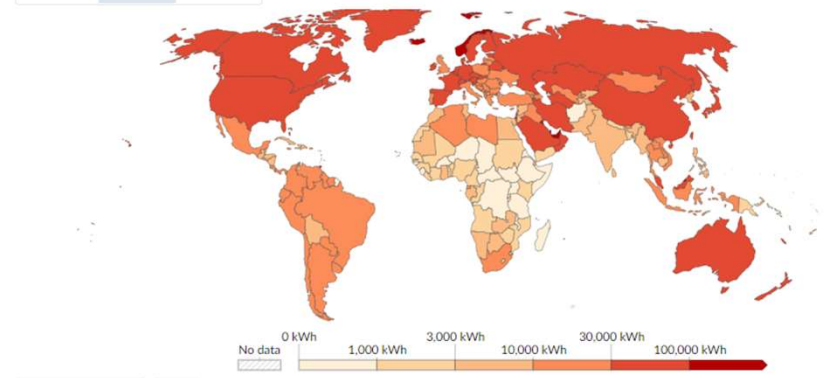
Our World in Data



Energy use per person, 2023

Measured in kilowatt-hours per person. Here, energy refers to primary energy using the substitution method.

Table Map Chart



Trends and Changes in the Grid

Increased Electricity Demand

Renewable Energy

Electric Vehicles

Energy Storage



Increased Demand

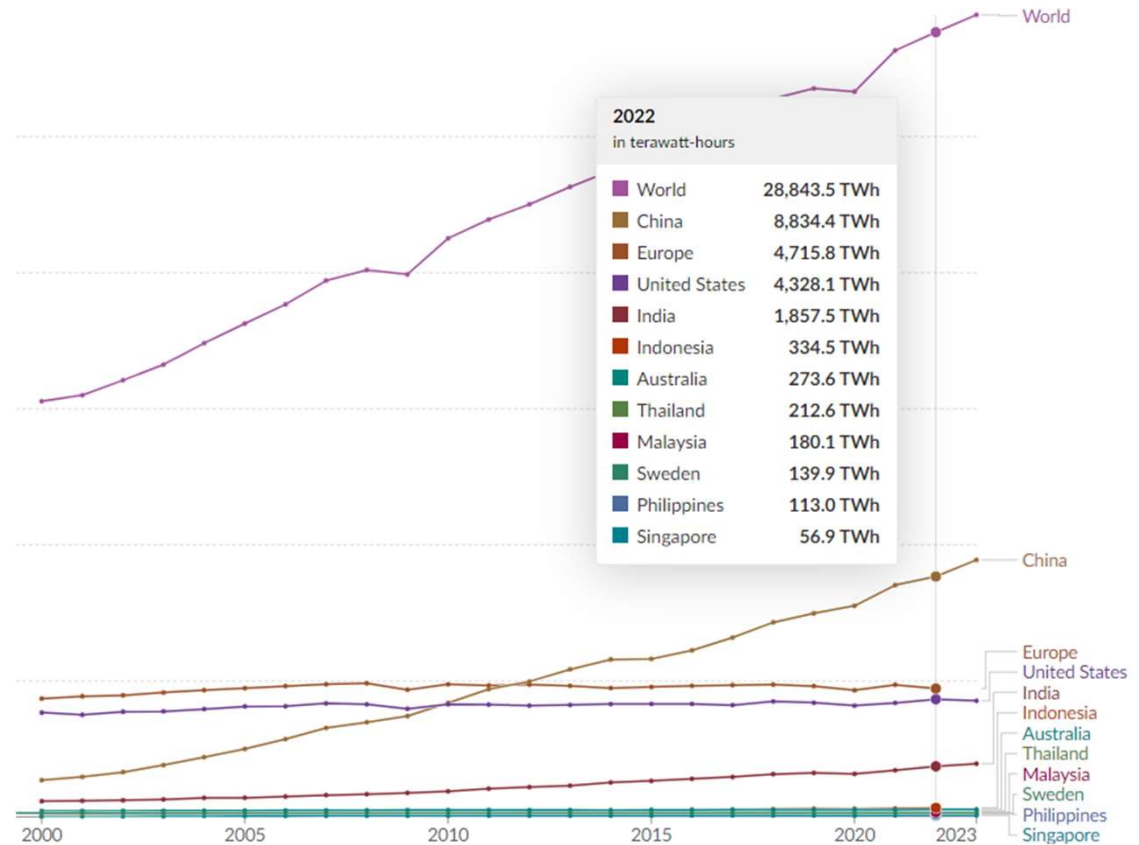
IEA estimates the grid needs to double in 15 years

The Global Perspective

Since 2000:
Global electricity demand
has doubled since year
2000

15.000 TWh => 30.000 TWh

[Energy Data Explorer - Our World in Data](#)



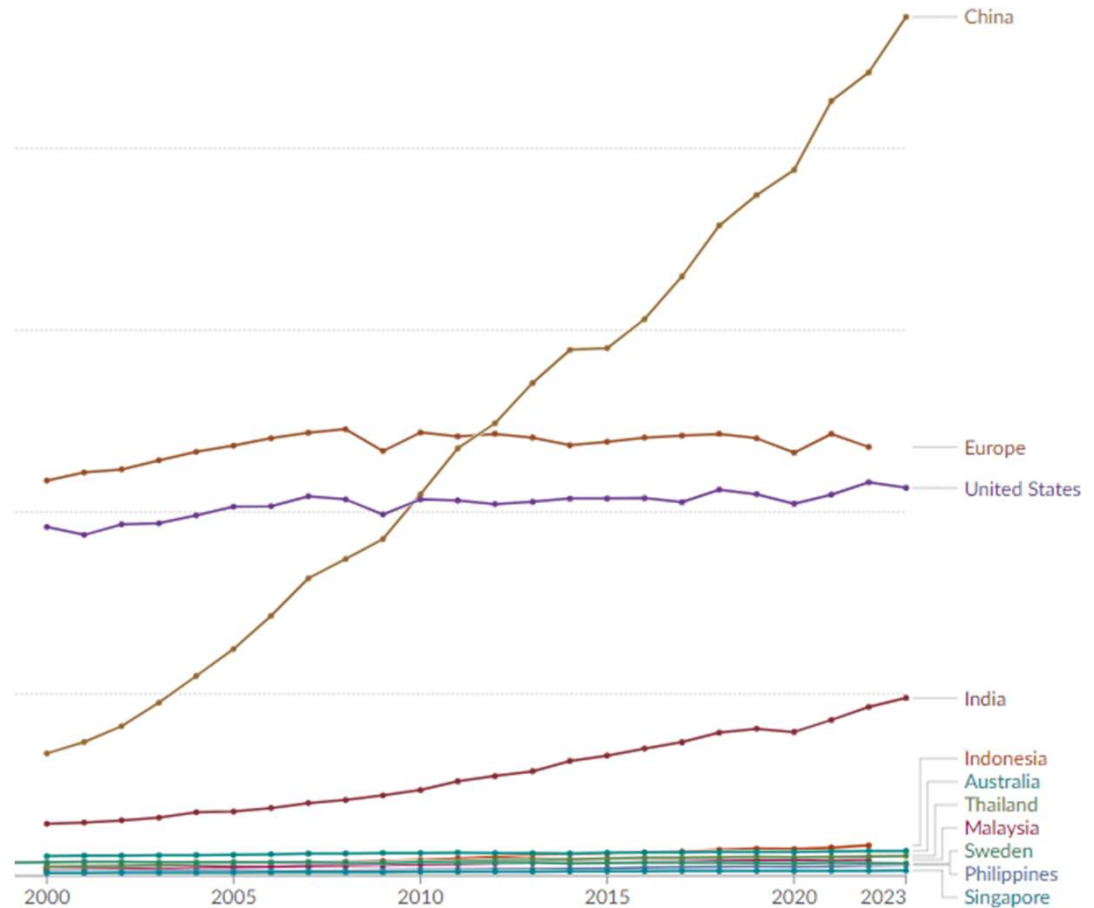
China and India

Since 2000:

China and India are the biggest contributors to the growth

China: 1.350 => 9.450 TWh

India: 570 => 1.960 TWh



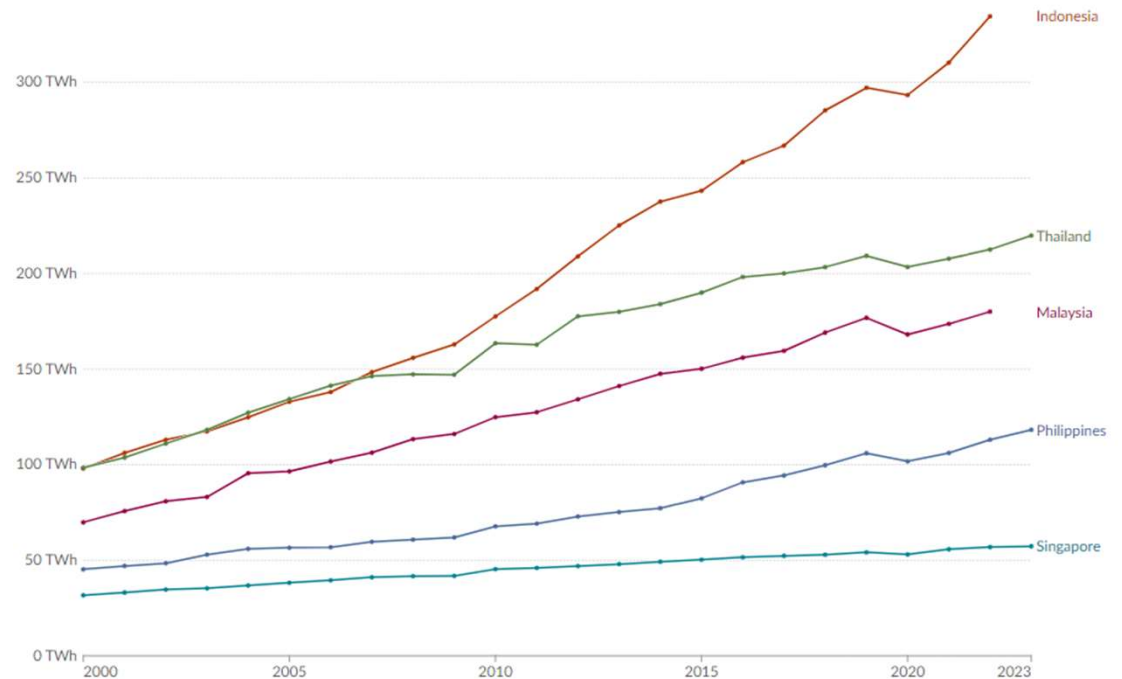
Doubling the consumption in some Asian countries

Since 2000:

31 => 57 TWh in Singapore

2x the consumption in the Philippines, Thailand, Malaysia

3x the consumption in Indonesia

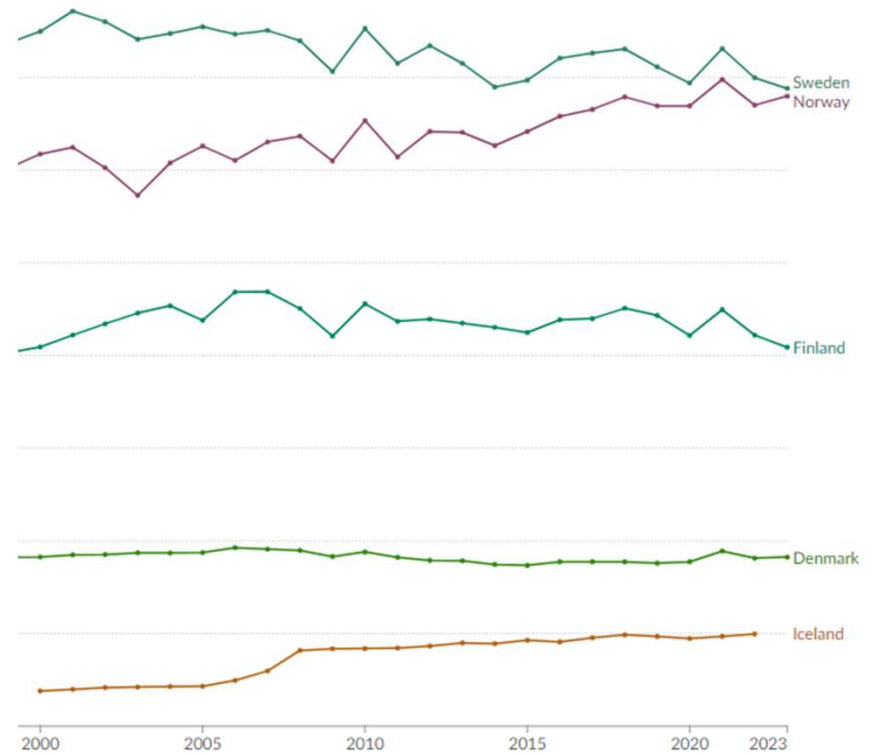


Slow growth in the Nordics

Since 2000:

Zero or negative electricity consumption growth in the Nordics.

But this will soon change, e.g. Sweden plans to go from 140 to 330 TWh in 20 years to meet the climate goals



Double the global grid in 15 years!


Slow industry? ..I don't think so

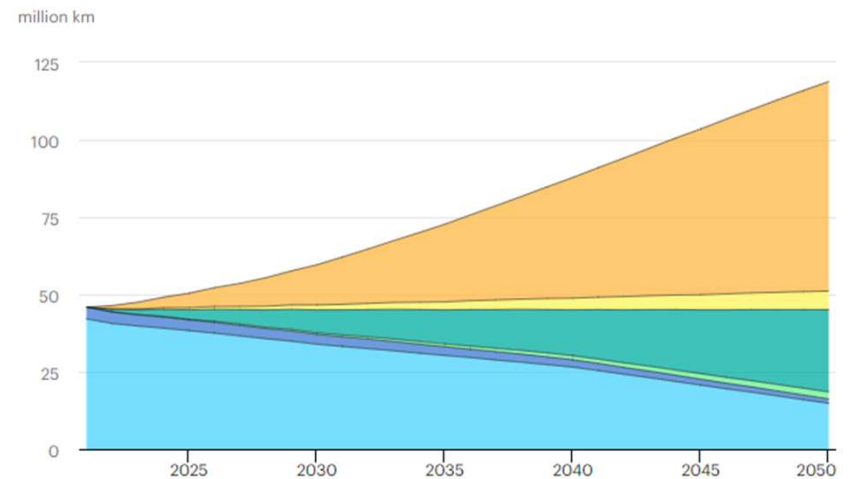
For the next 15 years, we must build 80 million kilometres of grids equivalent to 608 km/h

...Reaching national goals also means adding or refurbishing a total of over 80 million kilometres of grids by 2040, the equivalent of the entire existing global grid...

<https://www.iea.org/reports/electricity-grids-and-secure-energy-transitions/executive-summary>

Grid length development in emerging market and developing economies in the Announced Pledges Scenario, 2021-2050

Open 



IEA. Licence: CC BY 4.0

Existing Dx Existing Tx Replaced Tx Replaced Dx Additional Tx
Additional Dx

Rapid growth will change our industry!

Efficient supply chains are very important

Conclusions – from a PQ perspective

We need **Faster Deployments**

We need **More Automation**

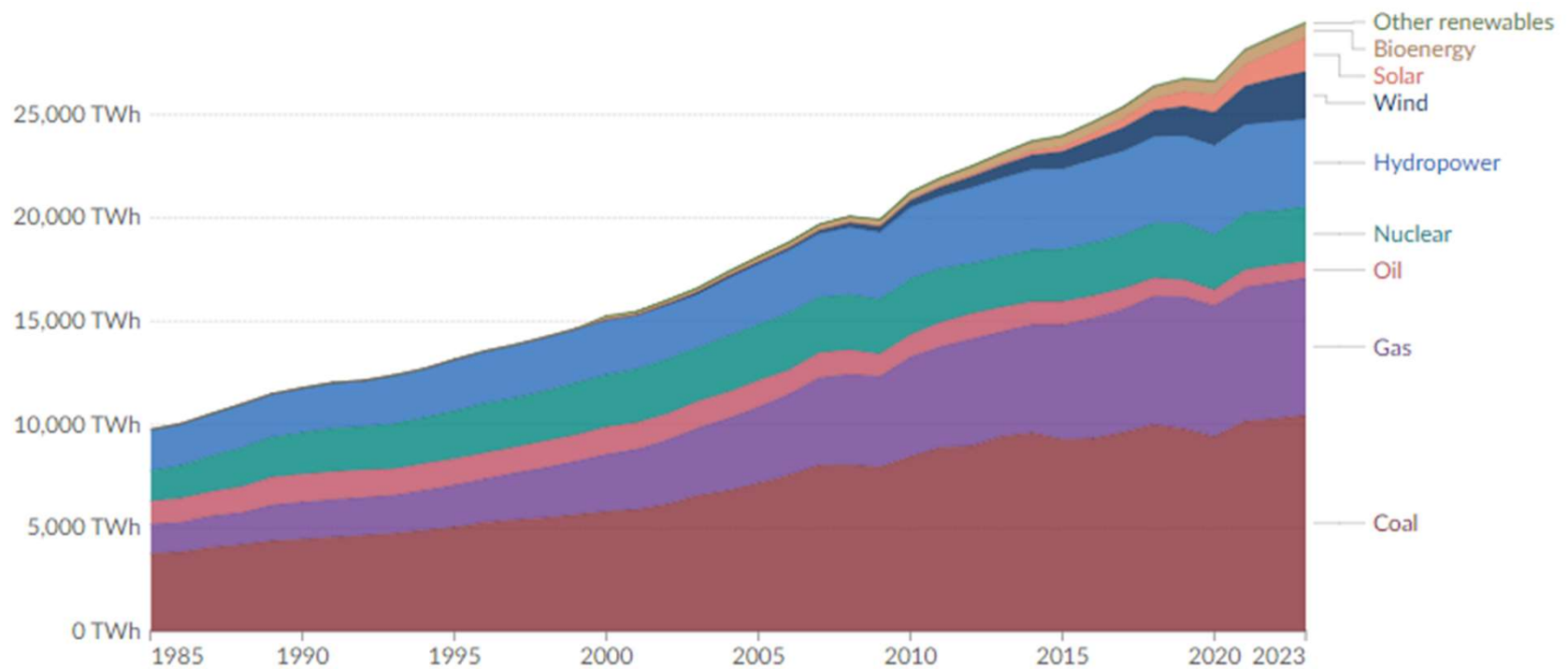
We need **Cost Efficient Solutions**

We need Efficient Management of **Cyber Security**

Wind and Solar

Renewables

Global electricity production



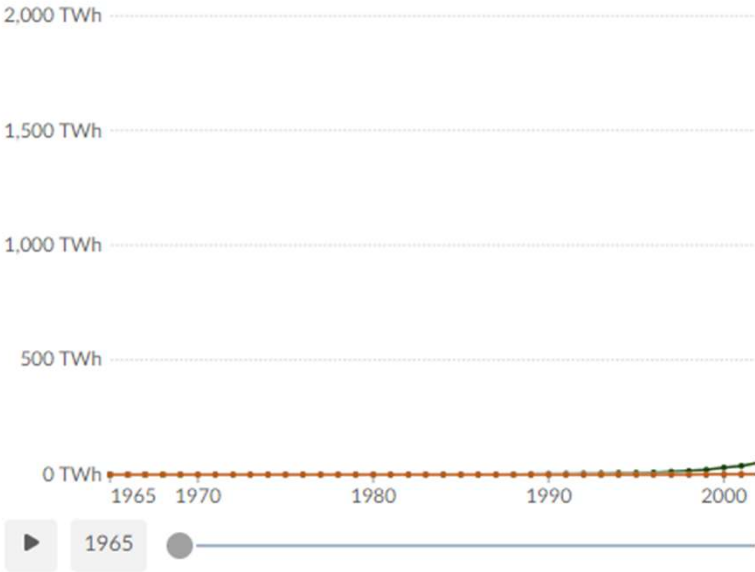
Wind

Wind power generation between 1965 and 2000

Wind power generation

Annual electricity generation from wind is measured in terawatt-hours (TWh) per offshore wind sources.

[Table](#) | [Map](#) | [Chart](#)

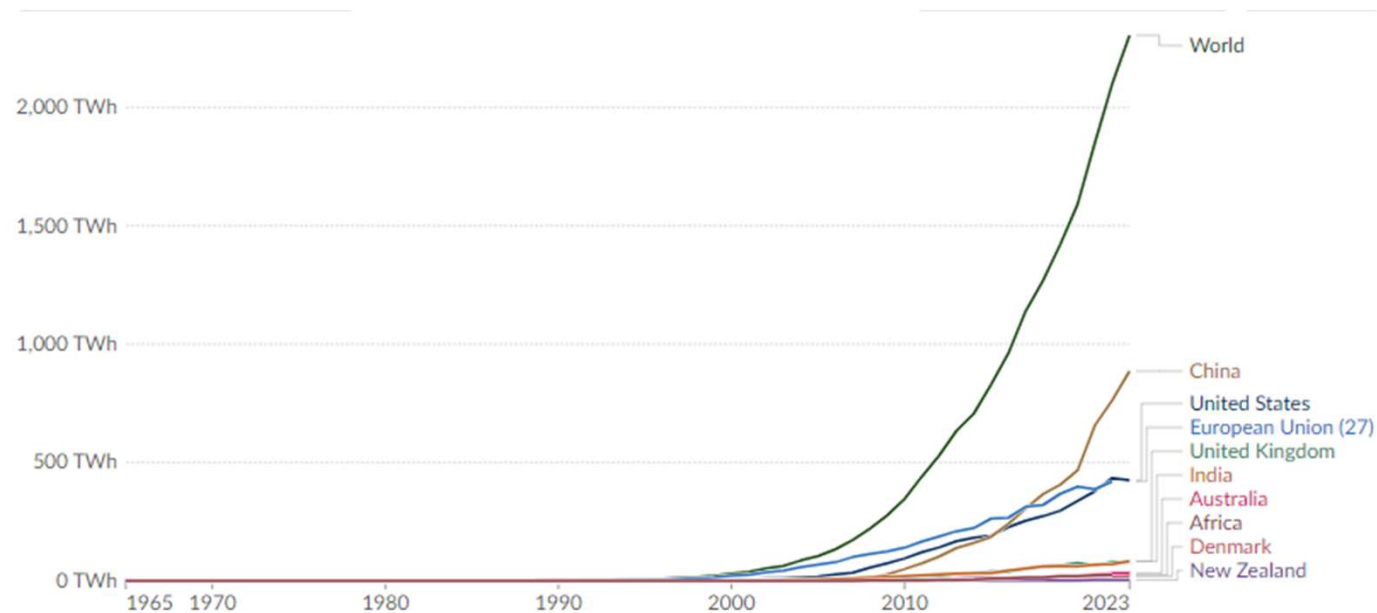


Wind

Wind power generation between 1965 and 2023

0 => 2300 TWh

4x Germany's yearly consumption



Solar

Solar power generation between 1965 and 2010

Solar power generation

Electricity generation from solar, measured in terawatt-hours (TWh) per year.

Table | Map | Chart

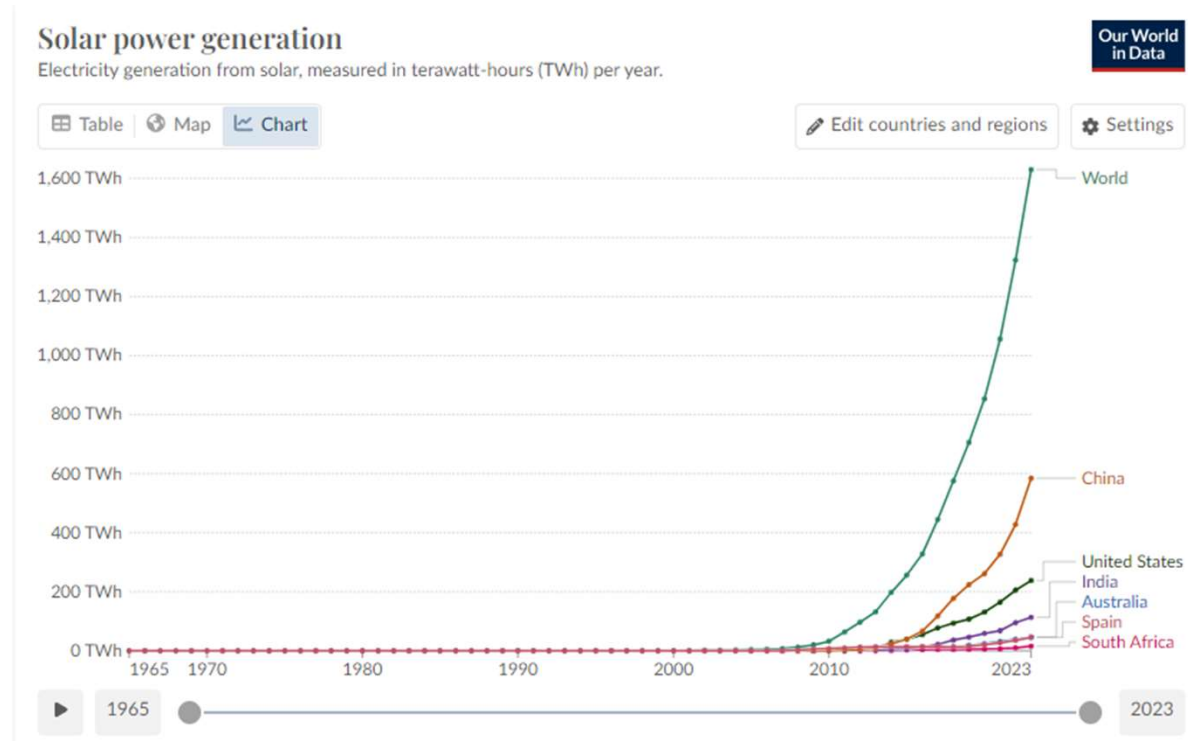


Solar

Solar power generation
between 1965 and 2023

0 => 1600 TWh

12x Sweden's yearly
consumption



Renewables in the future

1500 GW are waiting to be connected

1500 GW is four times the electrical output of all the nuclear reactors in the world

Renewables vs. non-renewables

...At least 3 000 gigawatts (GW) of renewable power projects, of which 1 500 GW are in advanced stages, are waiting in grid connection queues – equivalent to five times the amount of solar PV and wind capacity added in 2022...

<https://www.iea.org/reports/electricity-grids-and-secure-energy-transitions/executive-summary>

...As of December 2023, there are 413 operable power reactors in the world, with a combined electrical capacity of 371.5 GW. Additionally, there are 61 reactors under construction and 110 reactors planned, with a combined capacity of 68 GW and 110 GW, respectively, while 321 more reactors are proposed...

https://en.wikipedia.org/wiki/List_of_commercial_nuclear_reactors

Renewables will change our industry!

Distributed energy sources will change the topology and complexity of the grids

Conclusions – from a PQ perspective

We need to pay attention to **Network Stability**

We need Capabilities and features to detect **Potential Problems**

We need **Real-Time** measurements and actions

We need **Predictions** of short-term PQ parameters

Batteries and EVs

Grid Scale Batteries, Cars, Trucks, Buses and Ferries

EV and Charging

40 Million cars needs power from the grid.

22 Million in China

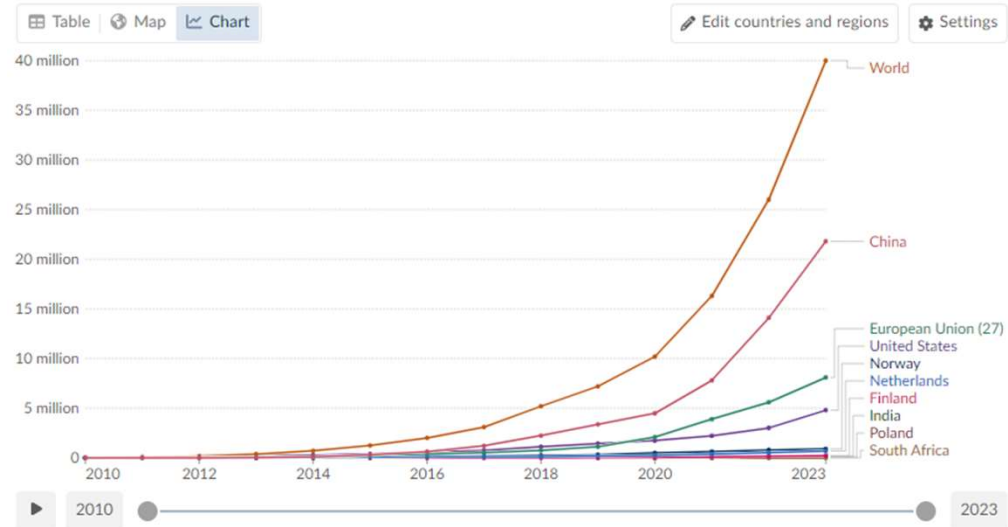
1 Million in Norway

150.000 in India

Electric car stocks, 2010 to 2023

Car stocks represent the number of cars that are in use. It is the balance of cumulative sales over time and the number of cars that have been retired or taken off the road. Electric cars include fully battery-electric vehicles and plug-in hybrids.

Our World in Data



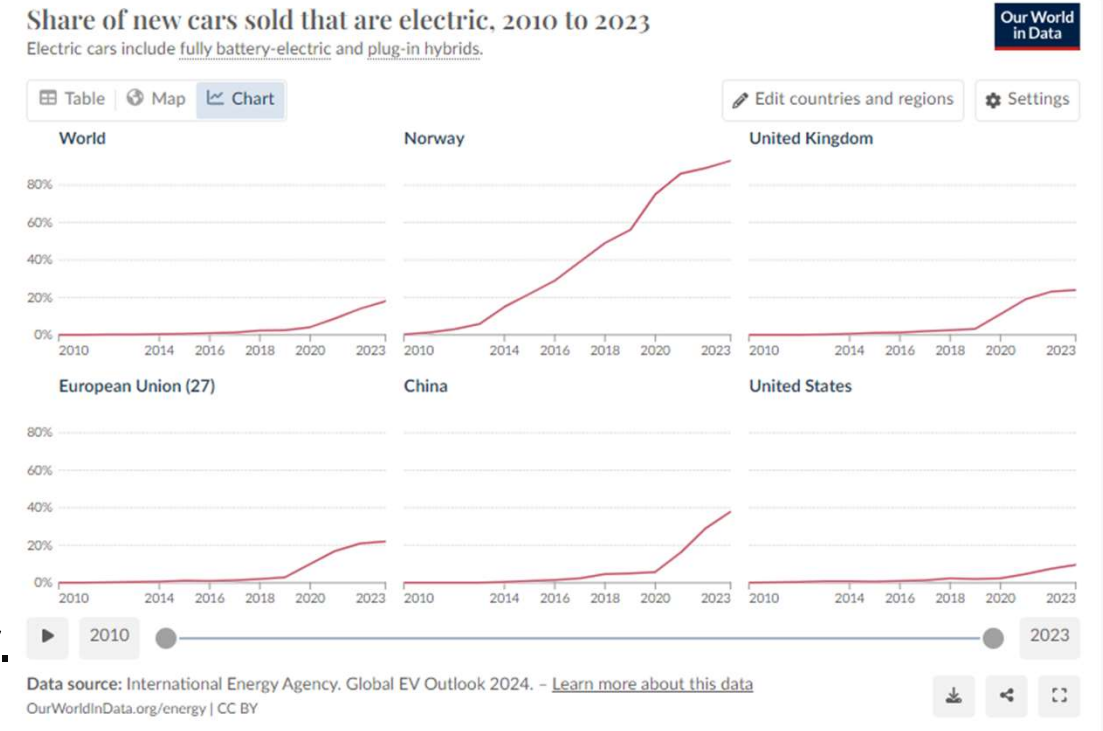
Data source: International Energy Agency, Global EV Outlook 2024. Learn more about this data.

EV and Charging

40M cars is just 3% of all existing cars

But 20% of all sold cars are electric.

Everything else equal, the nr. of electric cars will reach 240M in a few years.

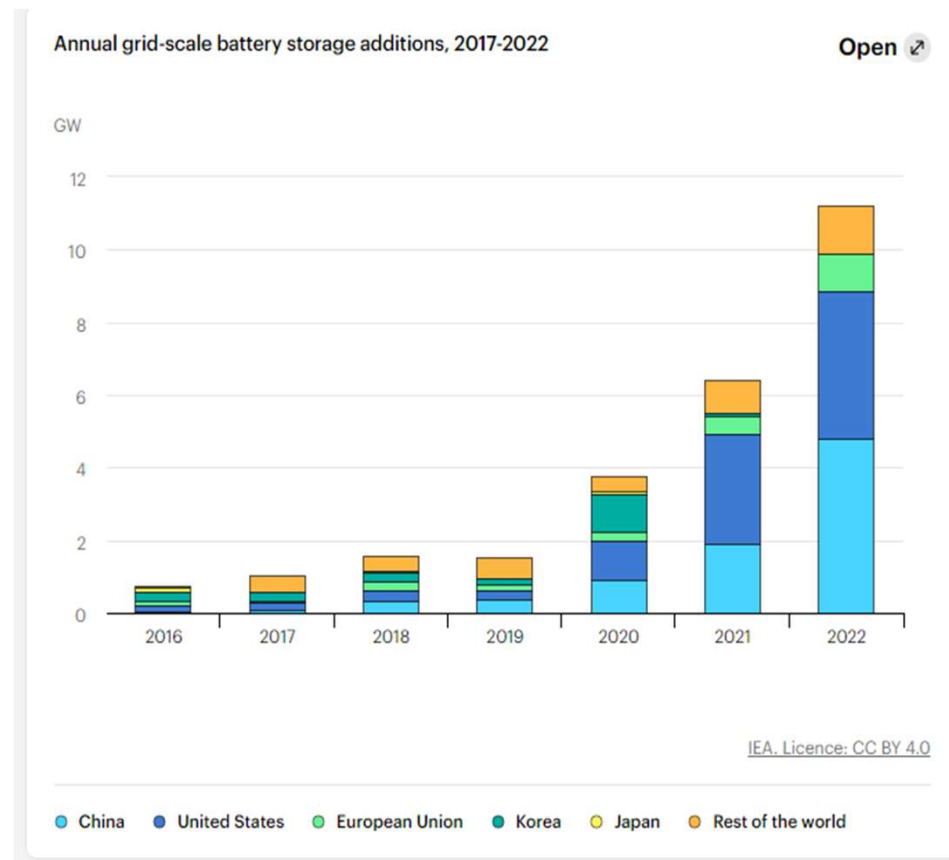


Energy storage

Grid scale battery storage needs 35-fold expansion in 8 years in the Net Zero Scenario

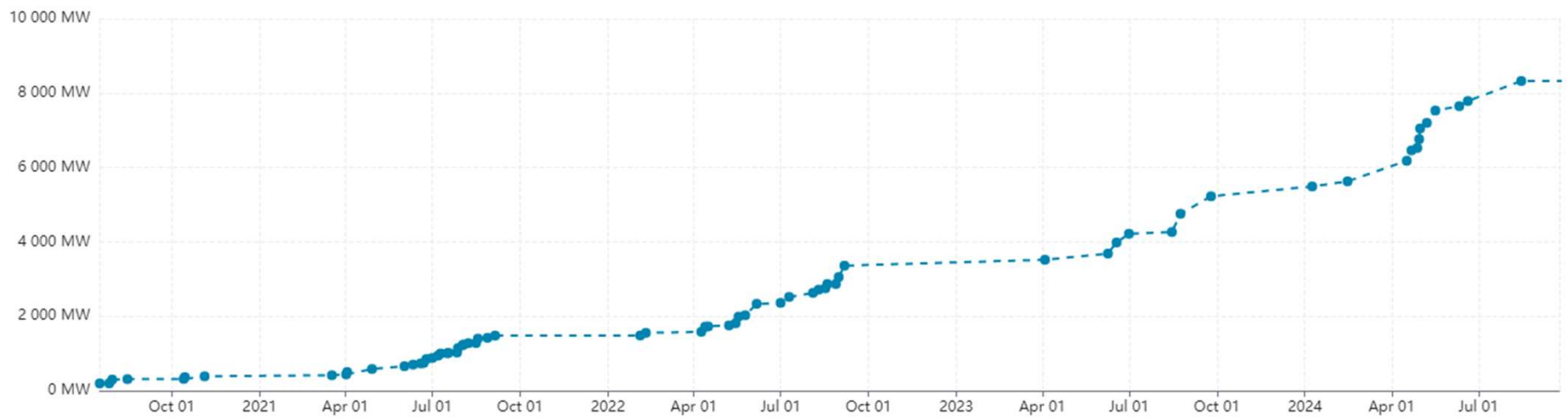
...Grid-scale battery storage in particular needs to grow significantly. In the Net Zero Scenario, installed grid-scale battery storage capacity expands 35-fold between 2022 and 2030 to nearly 970 GW. Around 170 GW of capacity is added in 2030 alone, up from 11 GW in 2022. To get on track with the Net Zero Scenario, annual additions must pick up significantly, to an average of close to 120 GW per year over the 2023-2030 period...

<https://www.iea.org/energy-system/electricity/grid-scale-storage>



Maximum Battery Discharging Record in California

Maximum Battery Discharging Record - CAISO



Top 10 Days

Rank	Time	Maximum Battery Discharging MW	
1	14 augusti 2024 kl. 19:35 GMT-7	8 322	View Day →



The price of batteries has declined by 97% in the last three decades

To transition towards low-carbon energy systems, we need low-cost energy storage. Battery costs have been falling quickly.

EVs and batteries will change our industry!

The consumption and production patterns will change

Conclusions – from a PQ perspective

We need **High Quality** measurements at many more locations

We need a **System Approach** to PQ-measurement

We need to help new customers in **New Segments**

**Together we will be a part of
the solution**

Good for our business, good for our children ...and a lot of fun!

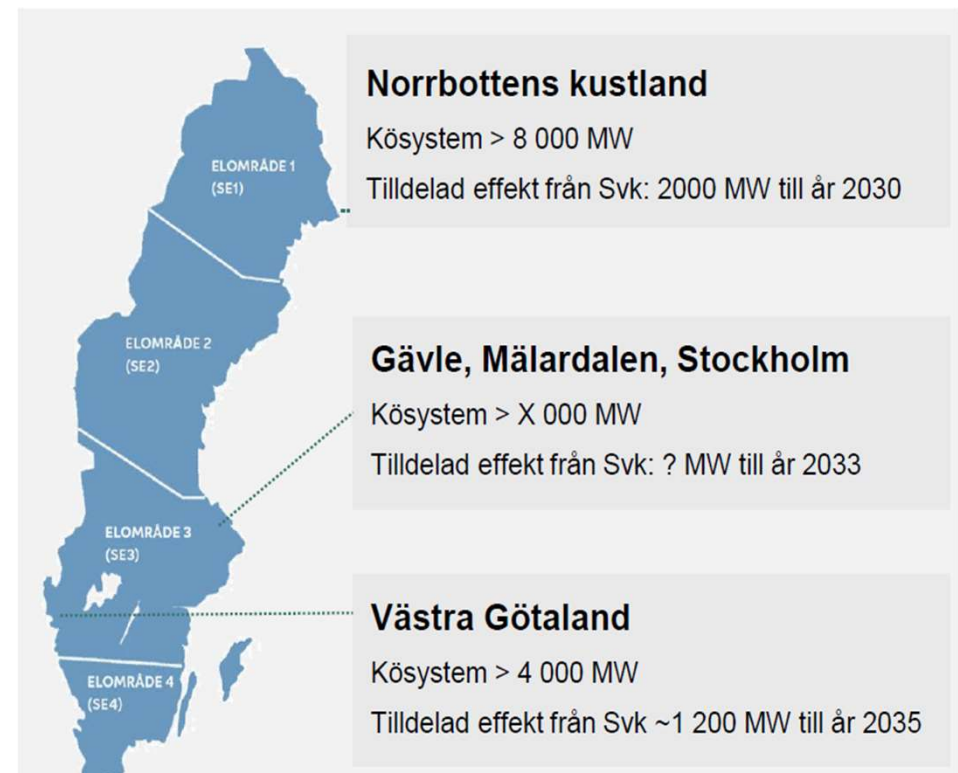
The Nordics

Sweden will go from 140 to 330 TWh in 20 years with an estimated investment in grid infrastructure of 100 B Euro until 2045

Finland started a new nuclear reactor in April last year

Norway are investing heavily in more power from existing hydro plants.

➤ Good news for the PQ industry!



<https://www.vattenfalleldistribution.se/om-oss/>