

# Renewable Energy

EES 2110

Introduction to Climate Change

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Class #32: Friday, March 31 2023

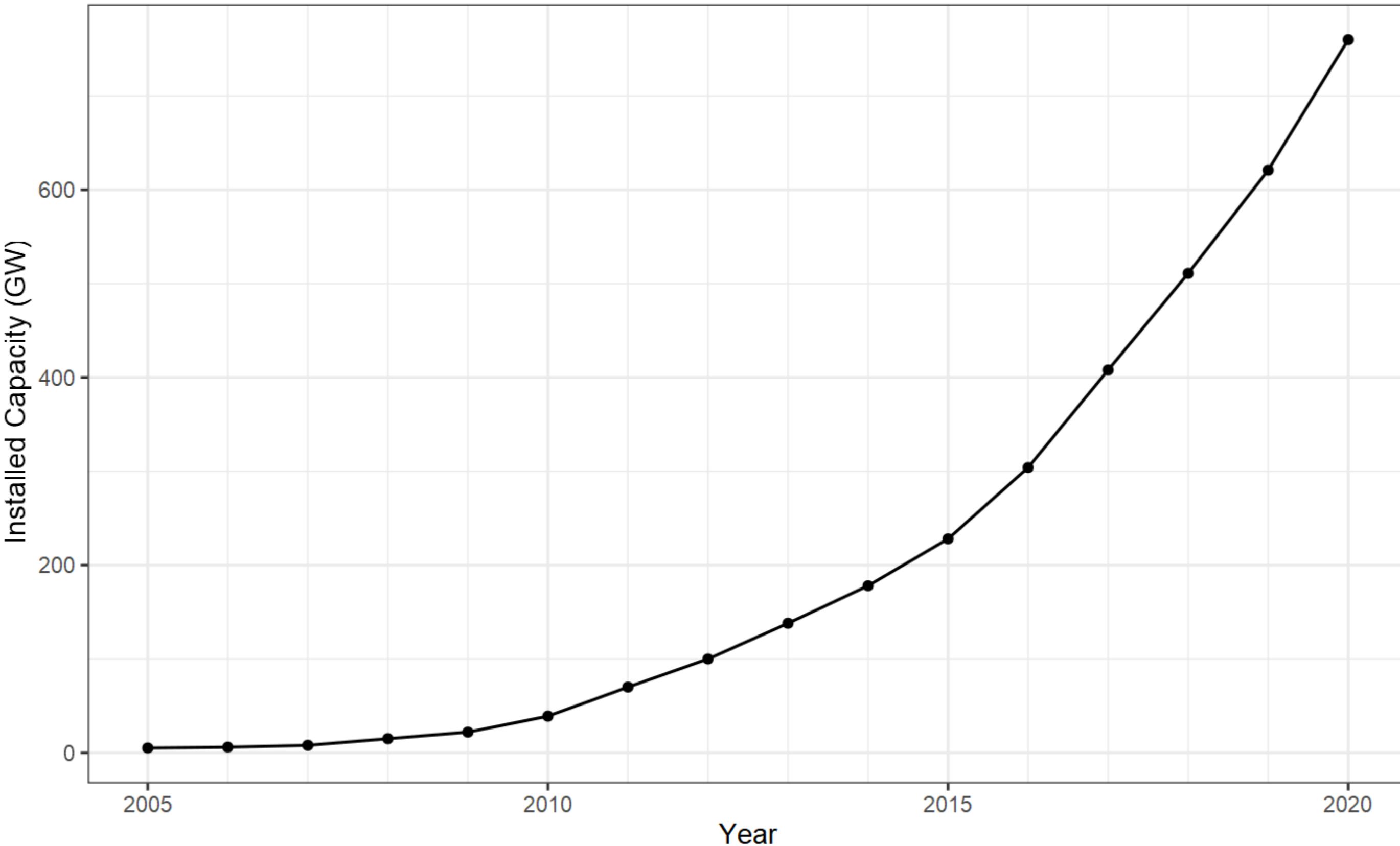
# Prospects for Clean Energy

# Solar Power

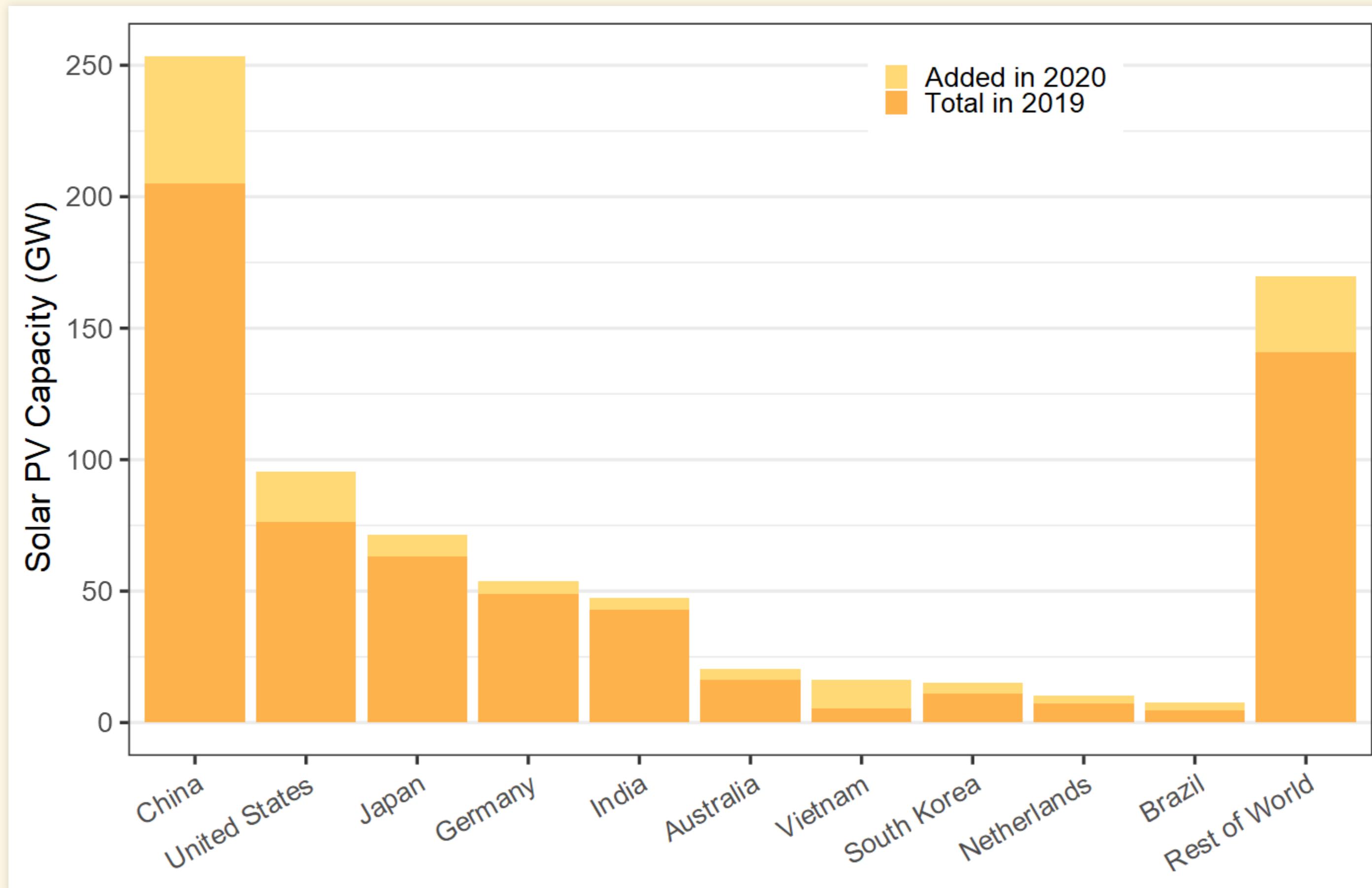


# Solar Energy over Time

Installed Solar Photovoltaic Capacity



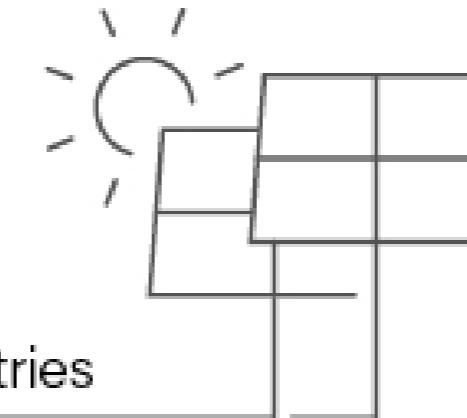
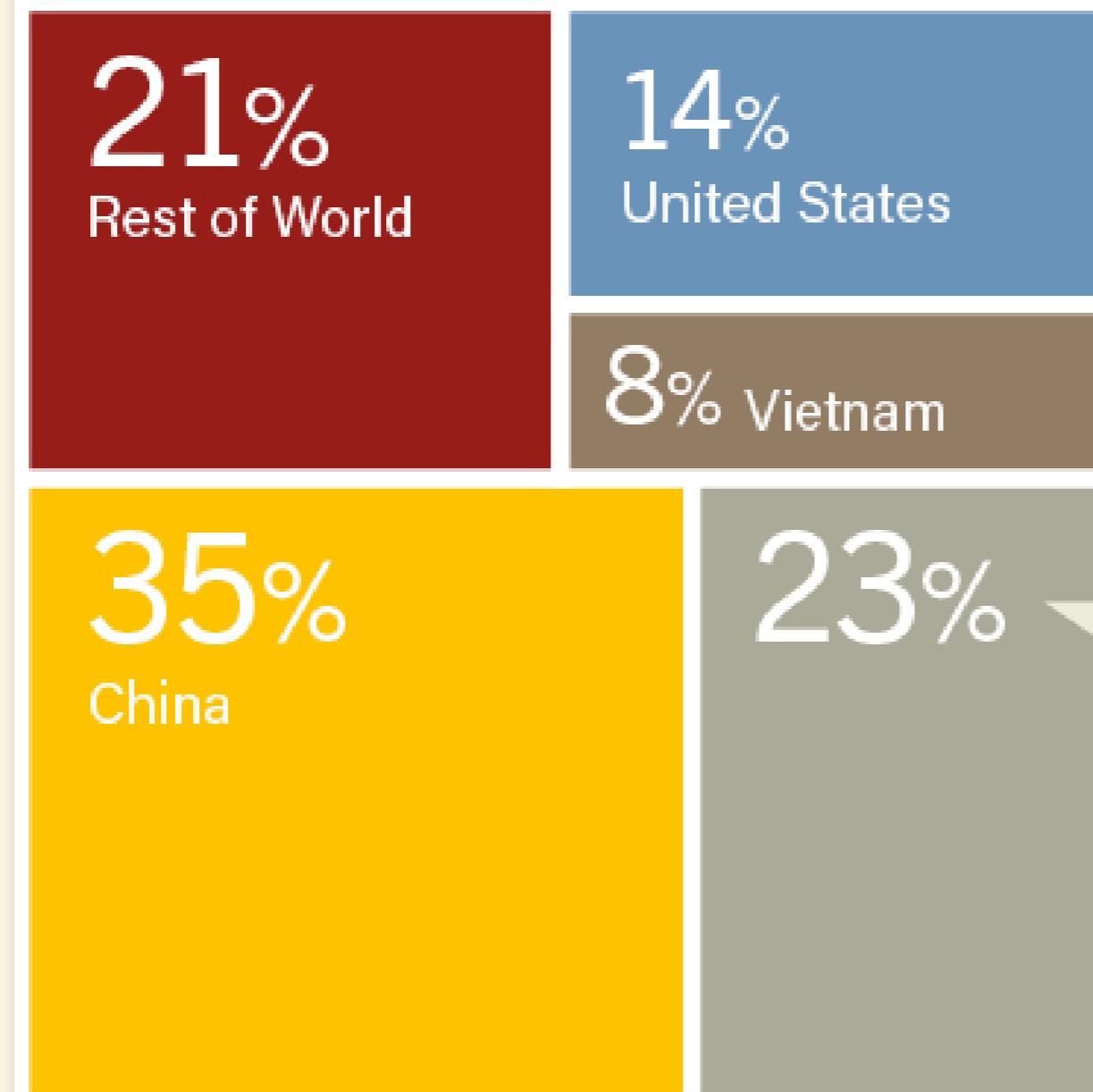
# Top-10 Nations for Solar PV



# Another View



## Solar PV Global Capacity Additions Shares of Top 10 Countries and Rest of World, 2020



Next 7 countries

Japan	6%
Germany	4%
India	3%
Australia	3%
Republic of Korea	3%
Brazil	2%
Netherlands	2%

Note: Totals may not add up due to rounding.



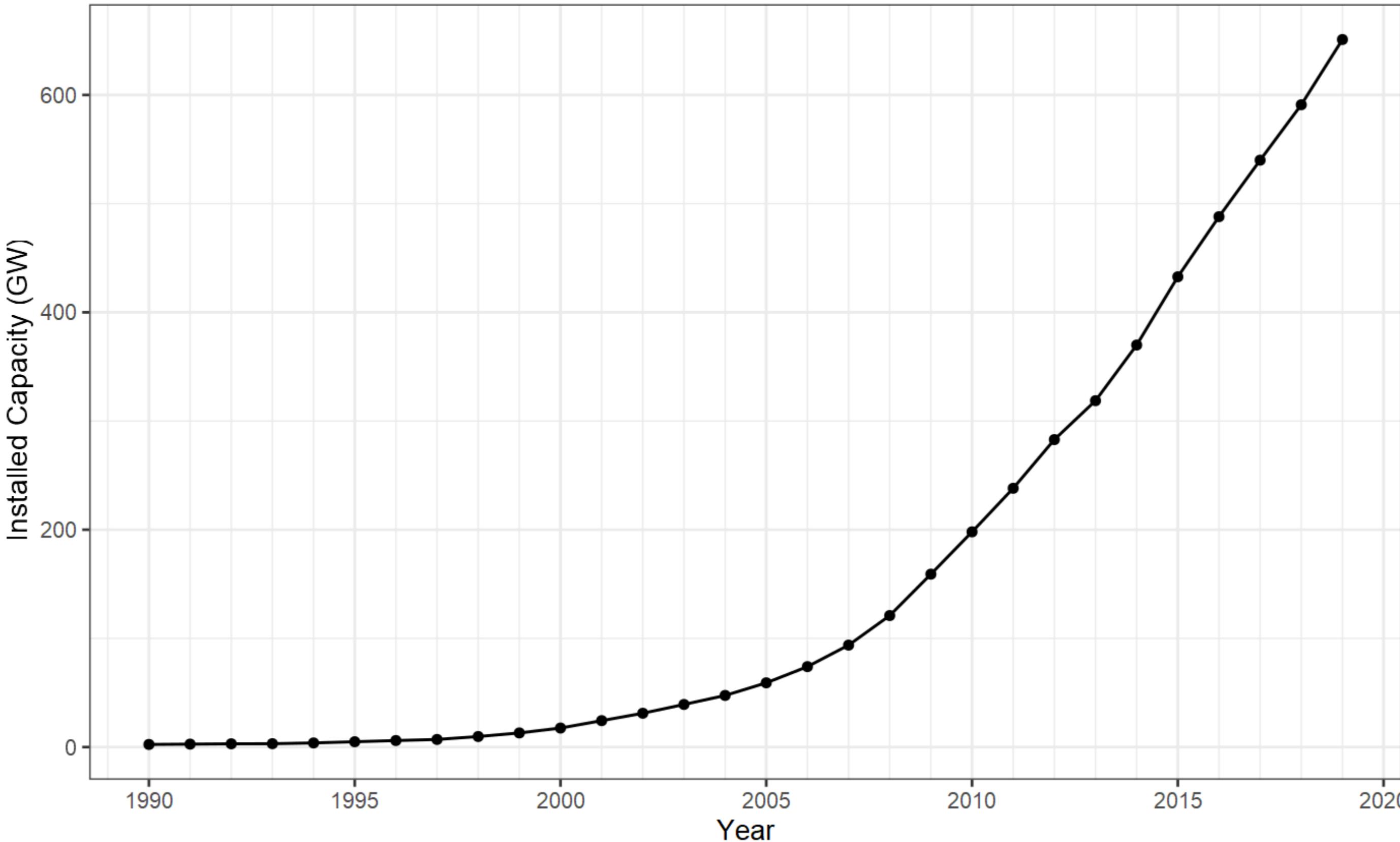
RENEWABLES 2021 GLOBAL STATUS REPORT

# Wind Power

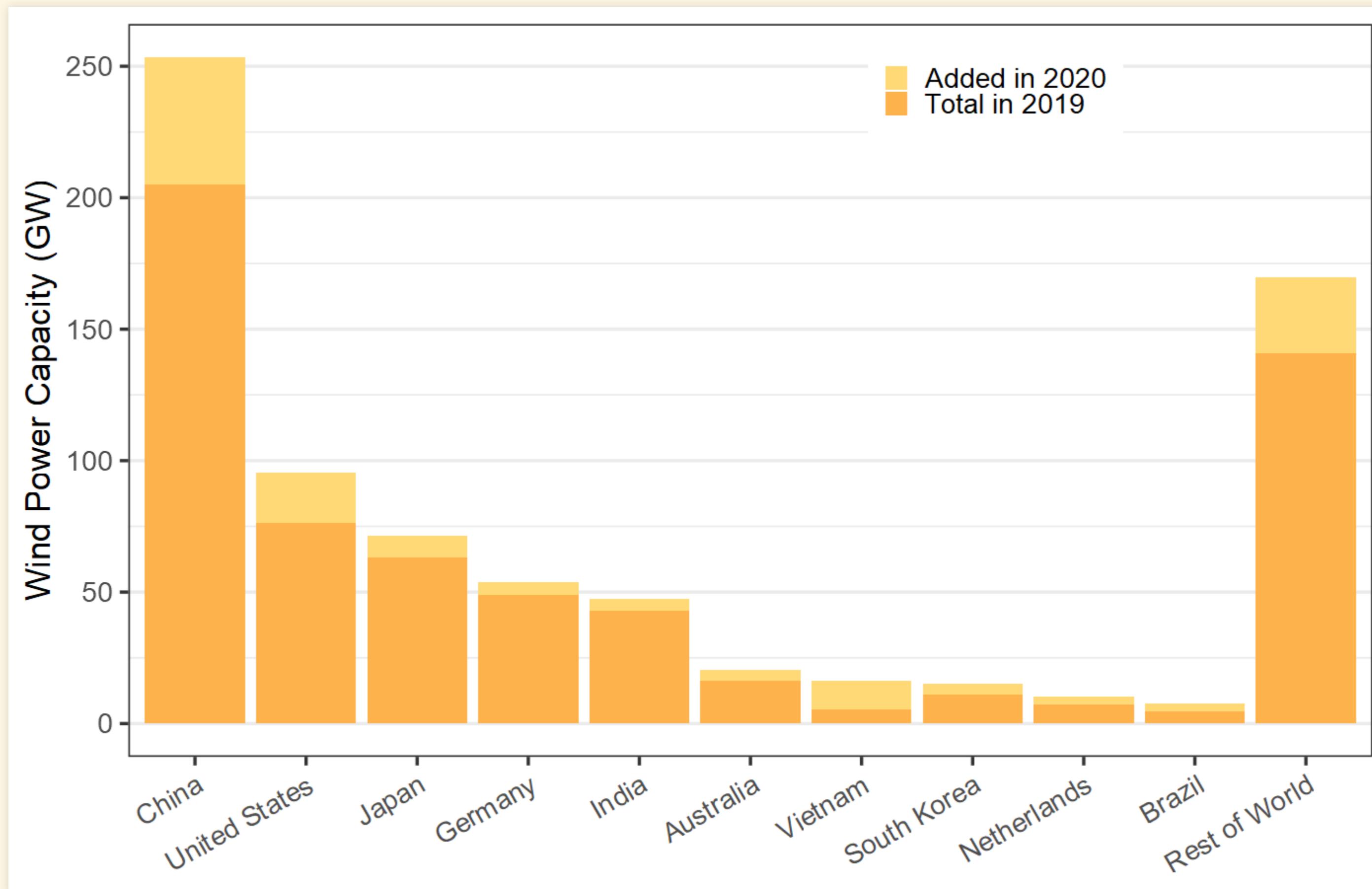


# Wind Energy over Time

Installed Wind Capacity



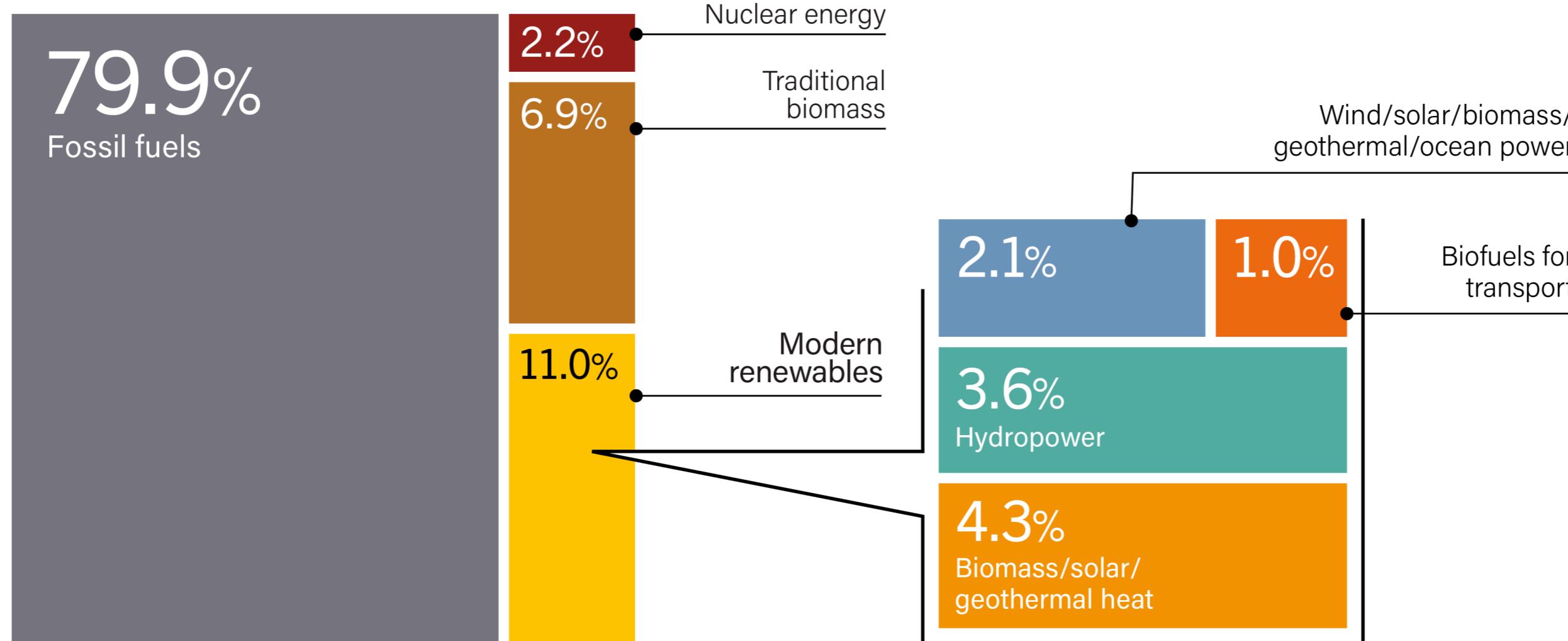
# Top-10 Nations for Wind



# Challenges

# Current World Mix of Energy

Estimated Renewable Share of Total Final Energy Consumption, 2018



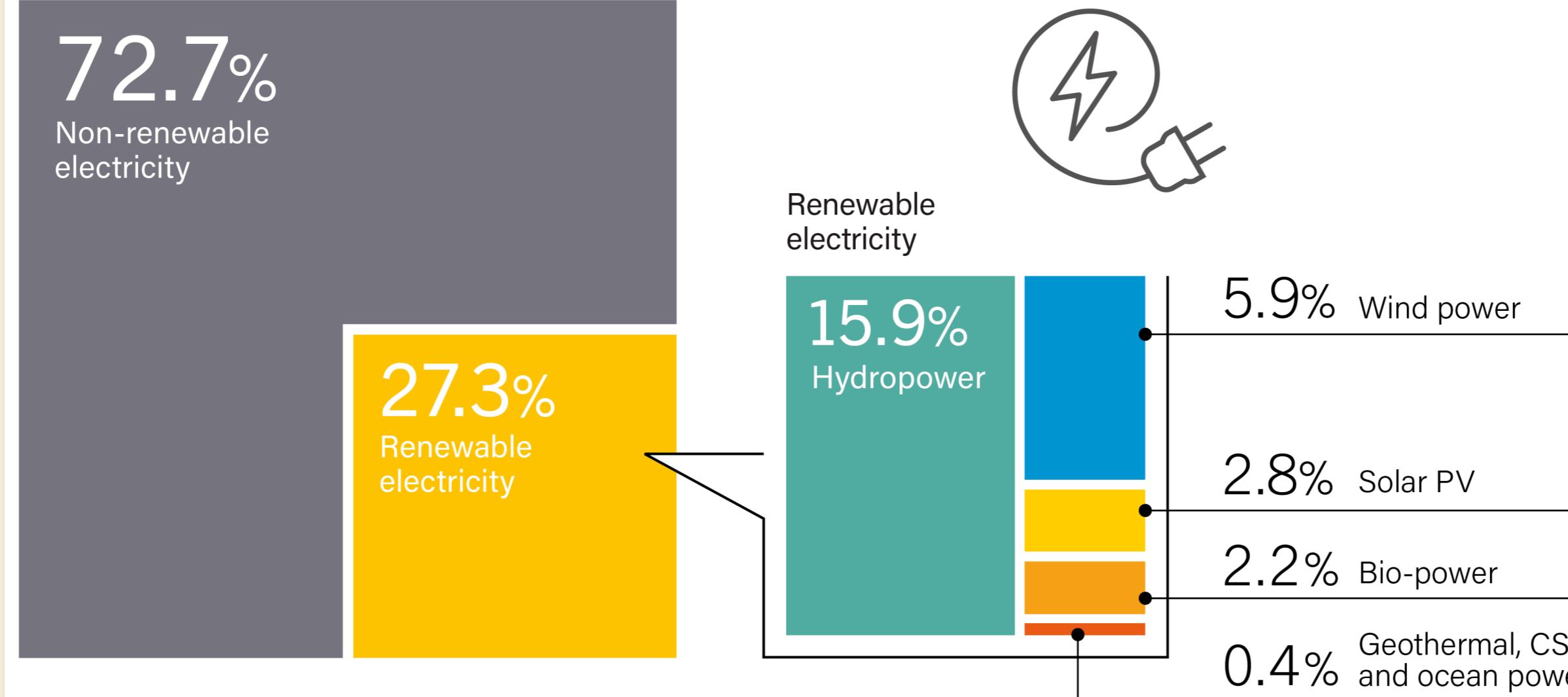
Note: Data should not be compared with previous years because of revisions due to improved or adjusted data or methodology. Totals may not add up due to rounding.

Source: Based on IEA data.

 REN21 RENEWABLES 2020 GLOBAL STATUS REPORT

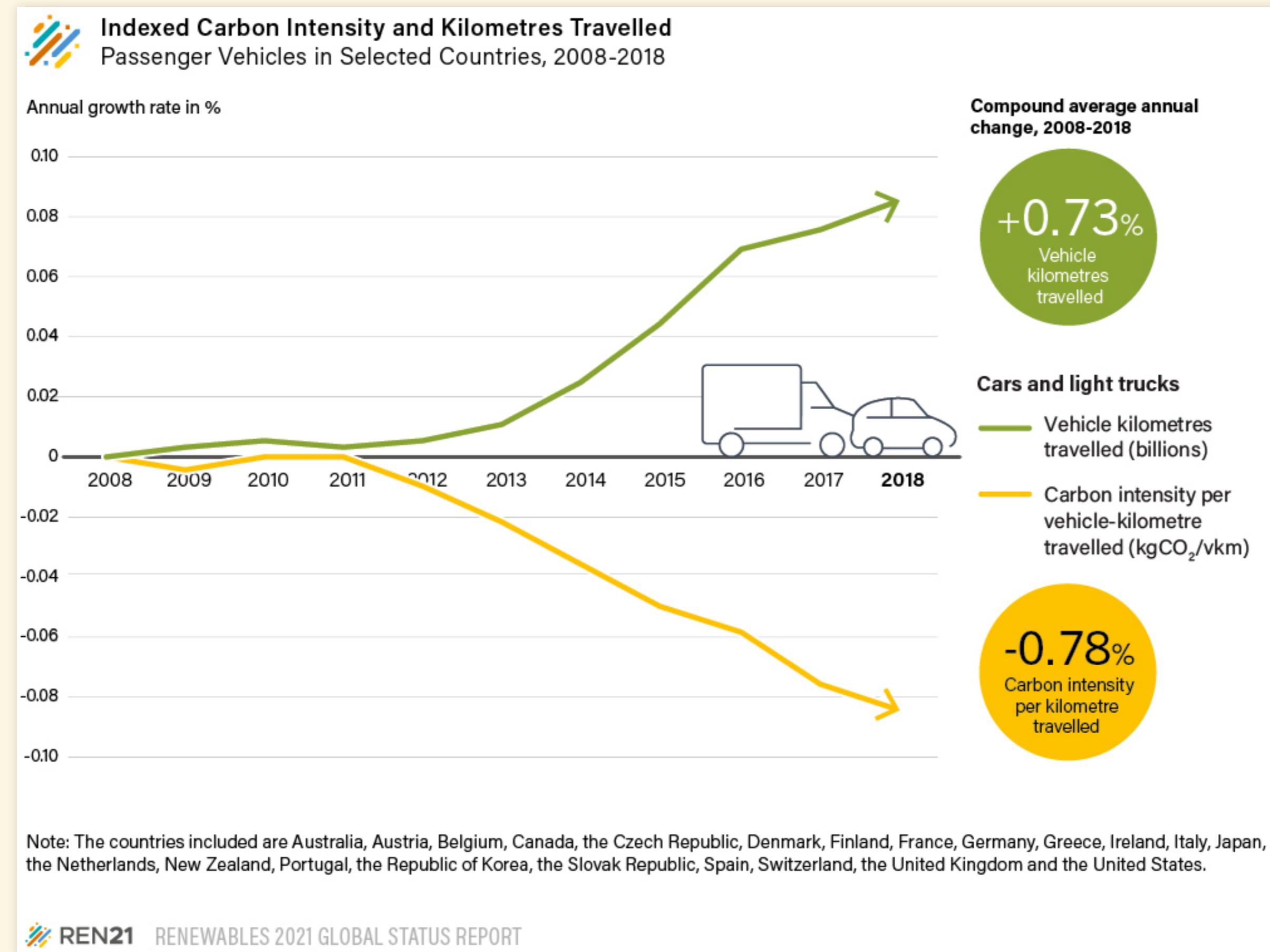
# World Electricity Generation

Estimated Renewable Energy Share of Global Electricity Production, End-2019

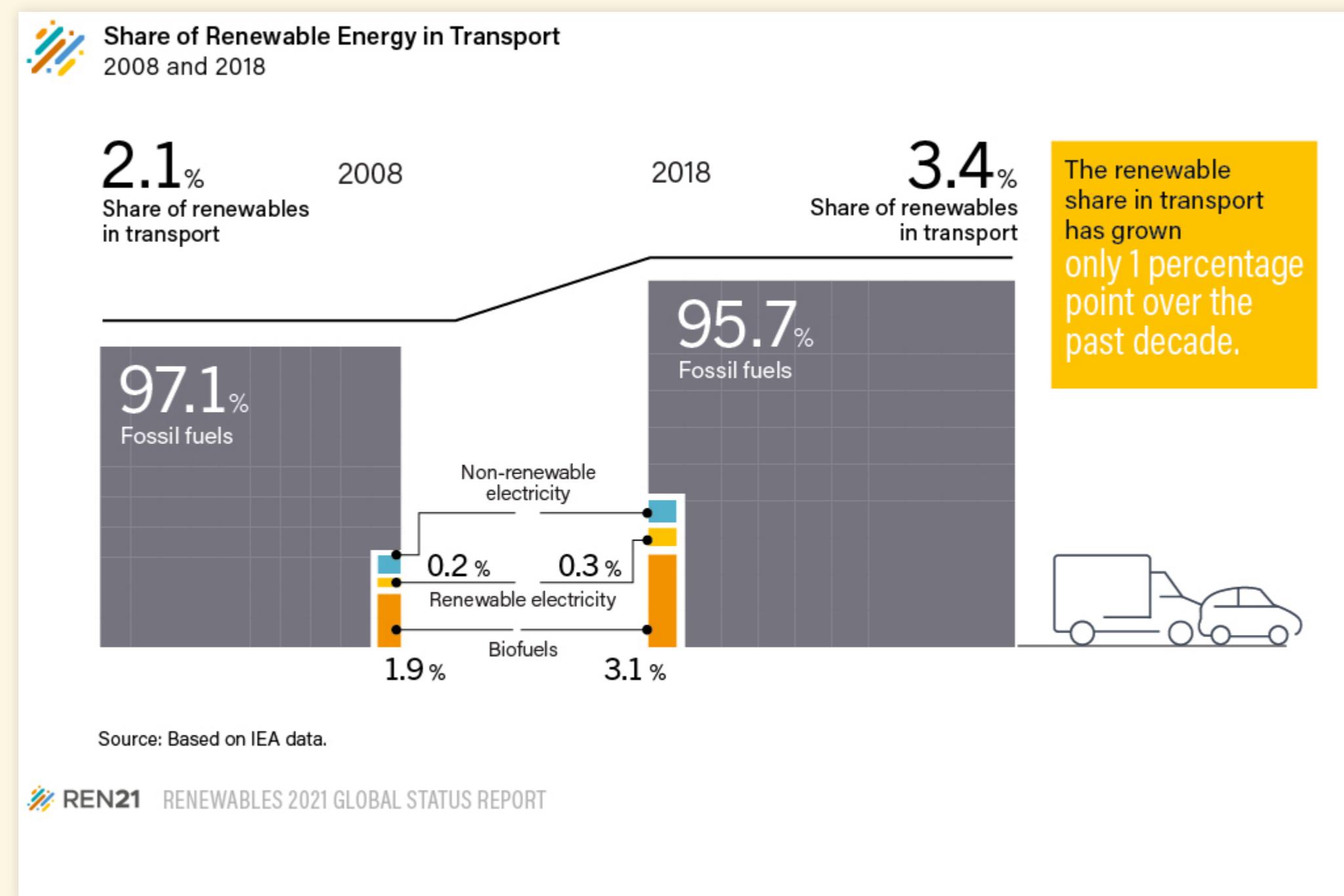


Note: Data should not be compared with previous versions of this figure due to revisions in data and methodology.

# Transportation

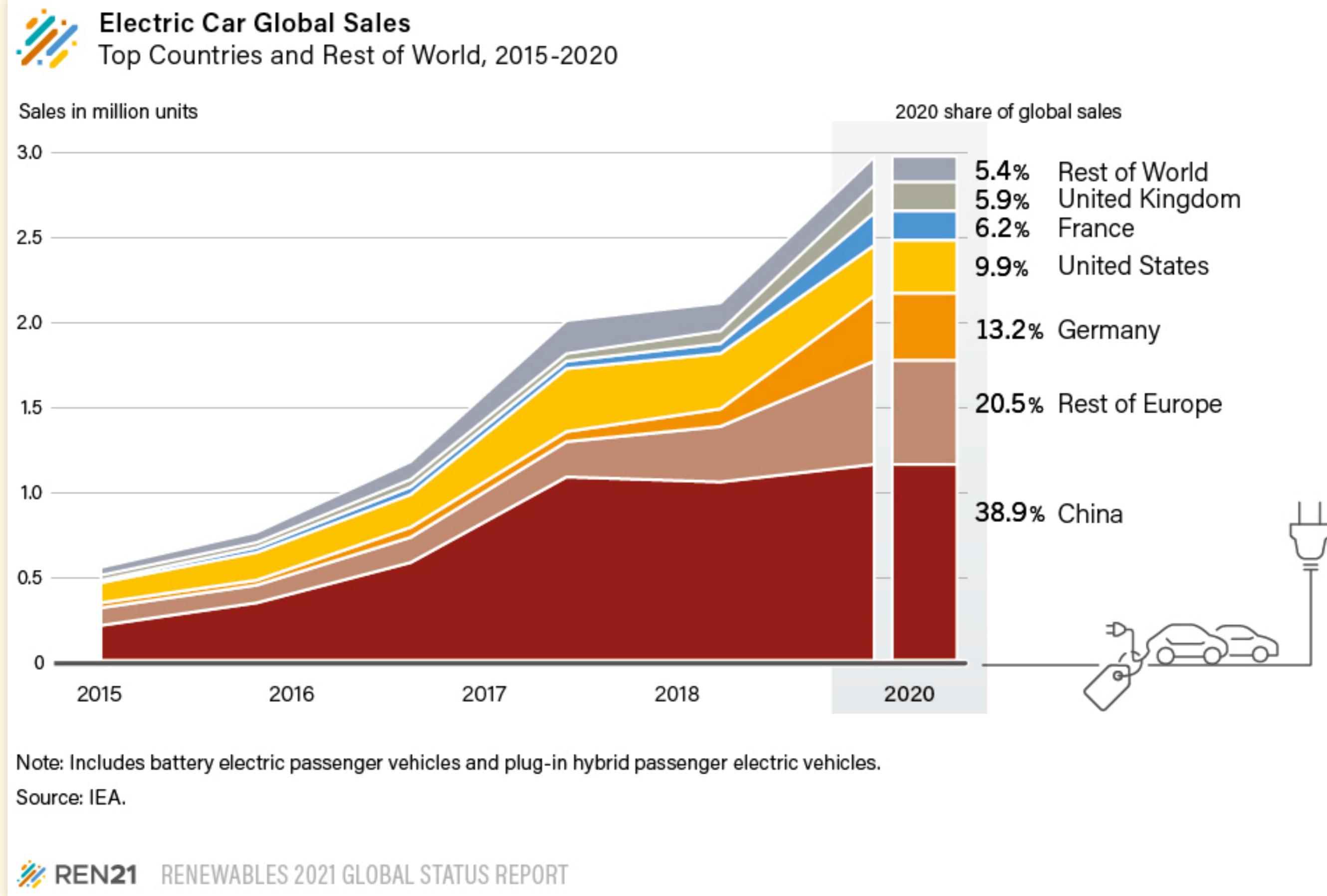


# Transportation



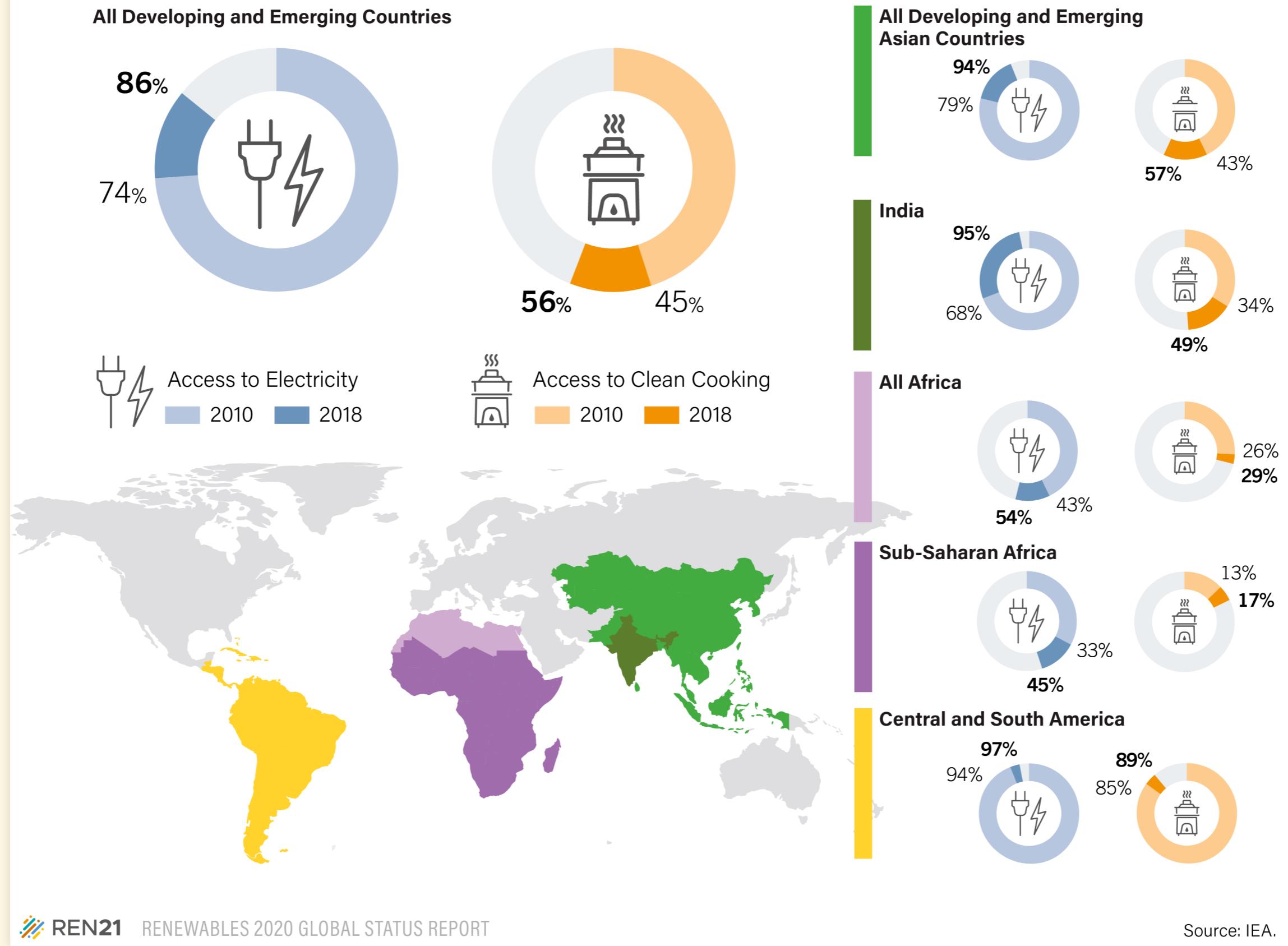
Renewable Energy Parity Network for the 21st Century, *Global Status Report 2021*, <http://www.ren21.net/status-of-renewables/global-status-report/>

# Transportation



# Energy Poverty

Access to Electricity and Clean Cooking by Region, 2010 and 2018



# Prospects for Future Renewable Energy

# Solar PV

The price of solar modules declined by 99.6% since 1976

Our World  
in Data

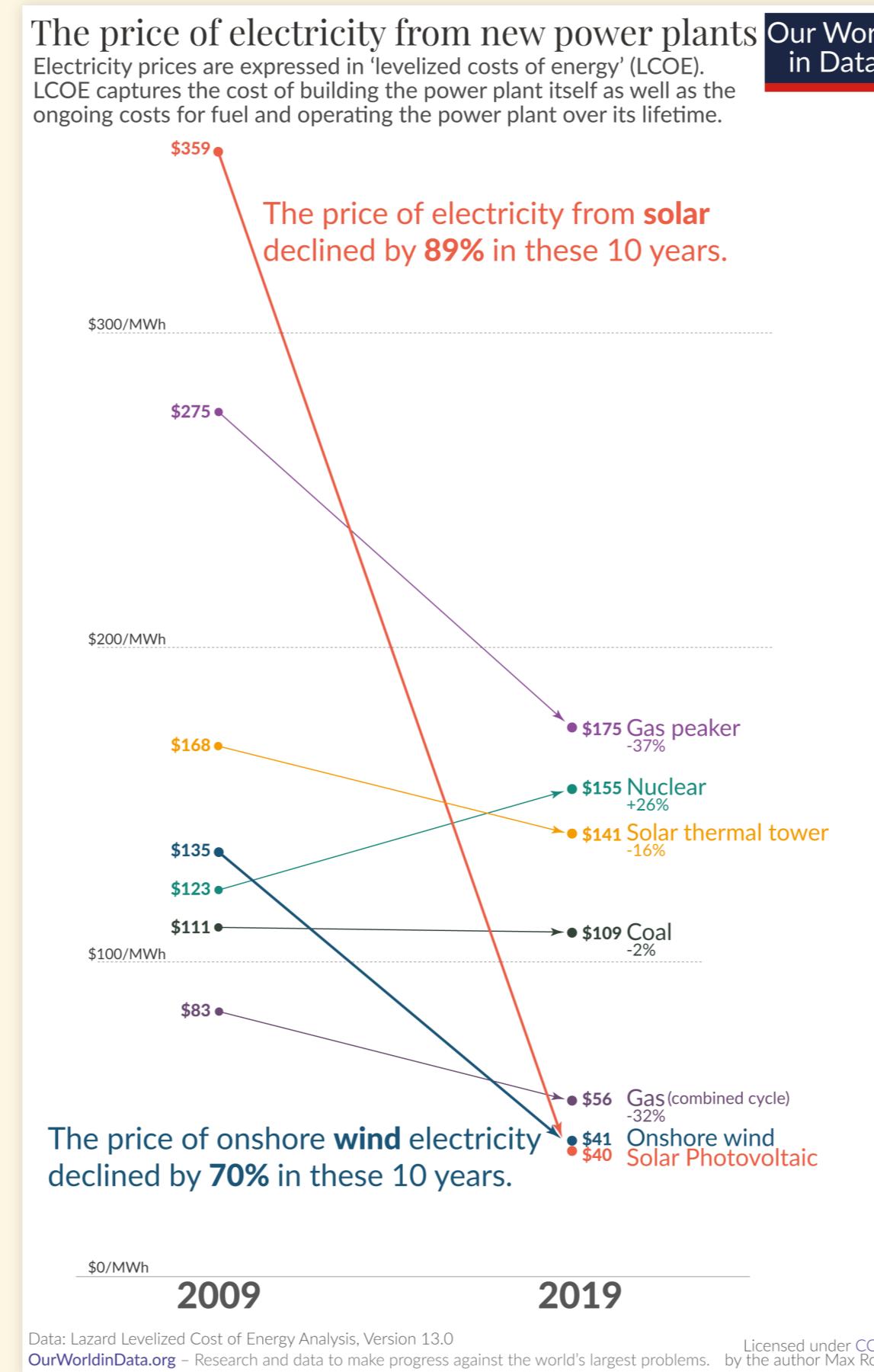
Price per Watt of solar photovoltaics (PV) modules (logarithmic axis)  
The prices are adjusted for inflation and presented in 2019 US-\$.



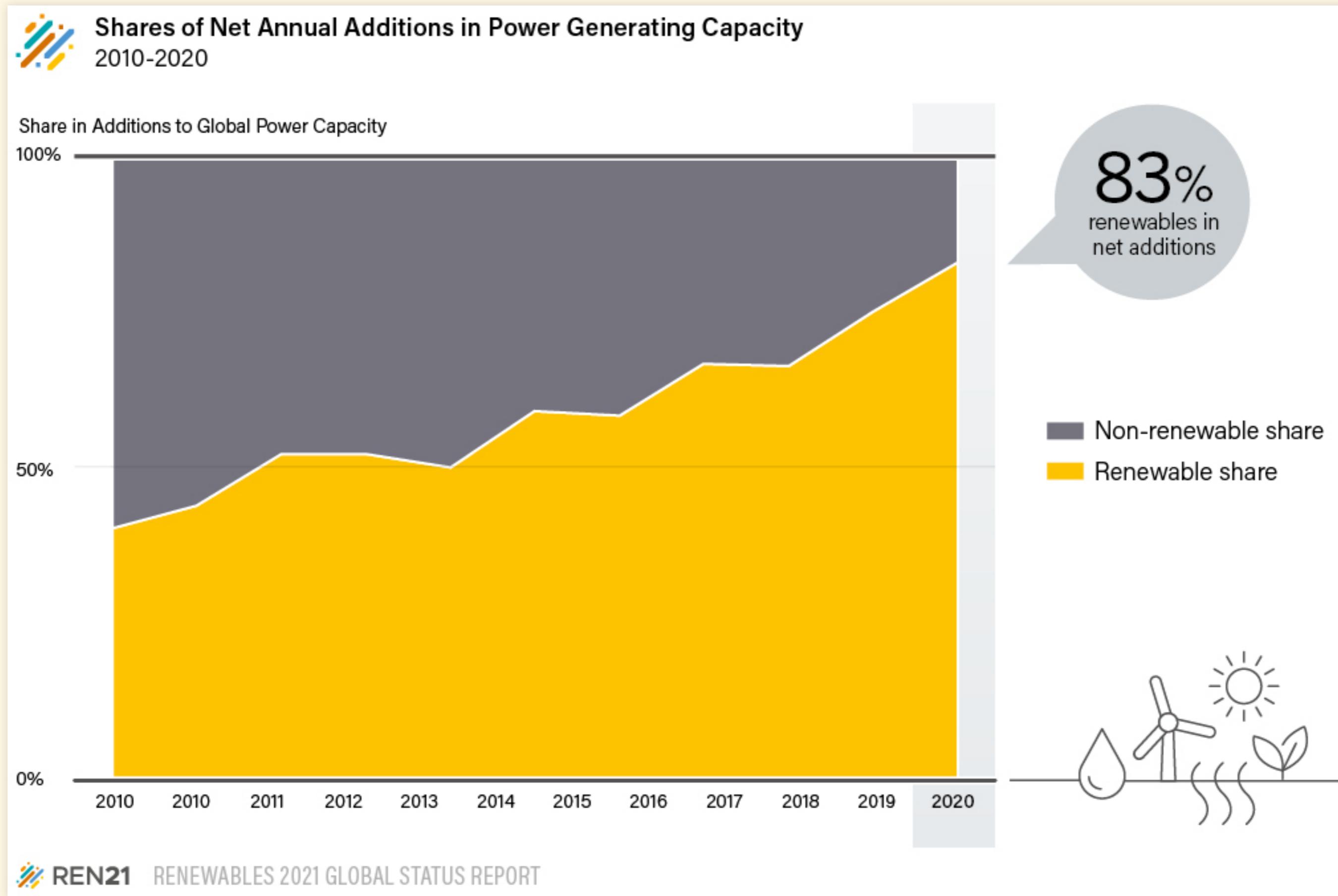
Data: Lafond et al. (2017) and IRENA Database; the reported learning rate is an average over several studies reported by de La Tour et al (2013) in Energy. The rate has remained very similar since then.  
OurWorldInData.org – Research and data to make progress against the world's largest problems.

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# Cost of Renewable Energy vs. Fossil Fuels

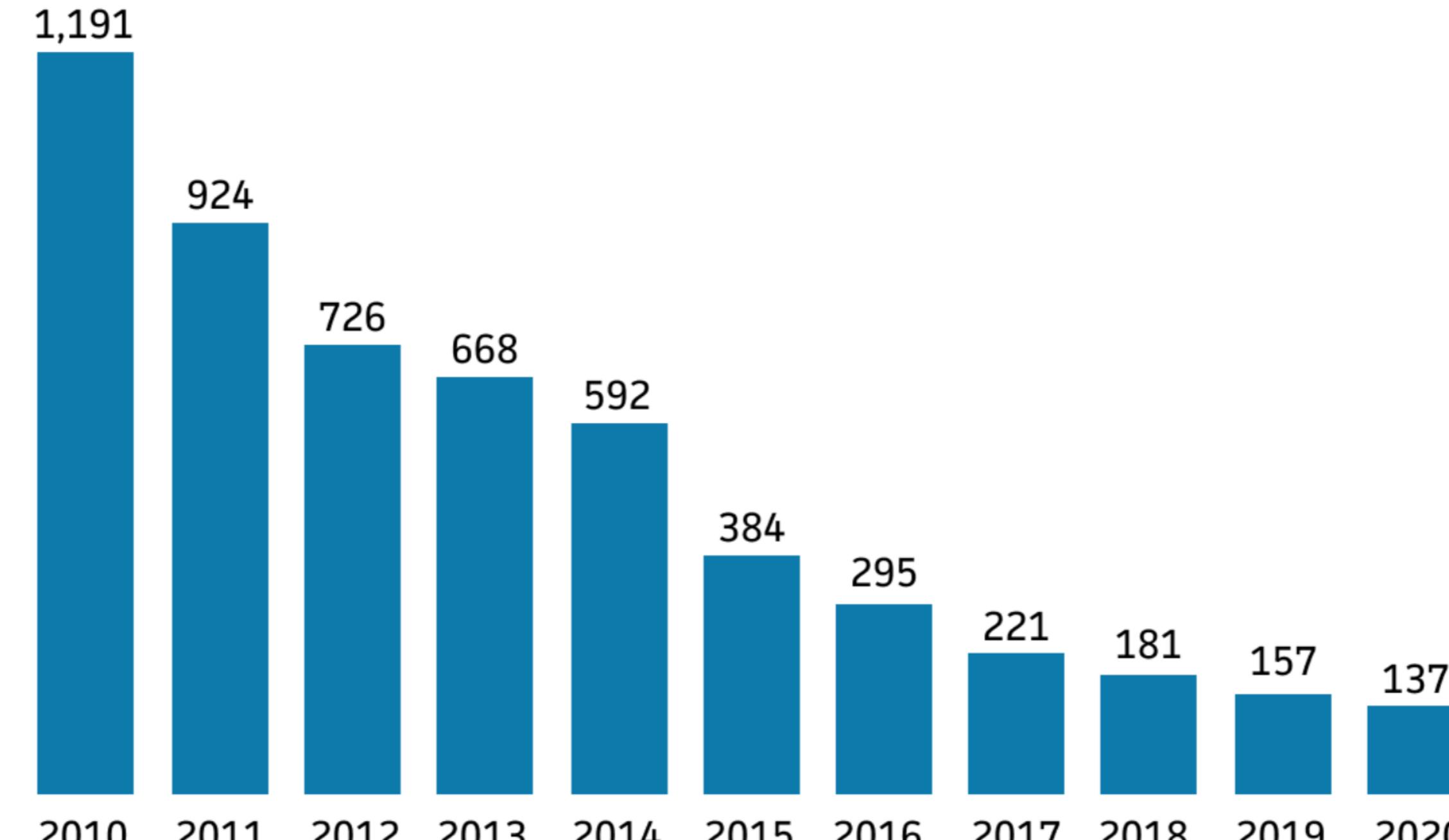


# Renewables Are the Fastest-Growing Source of Electricity



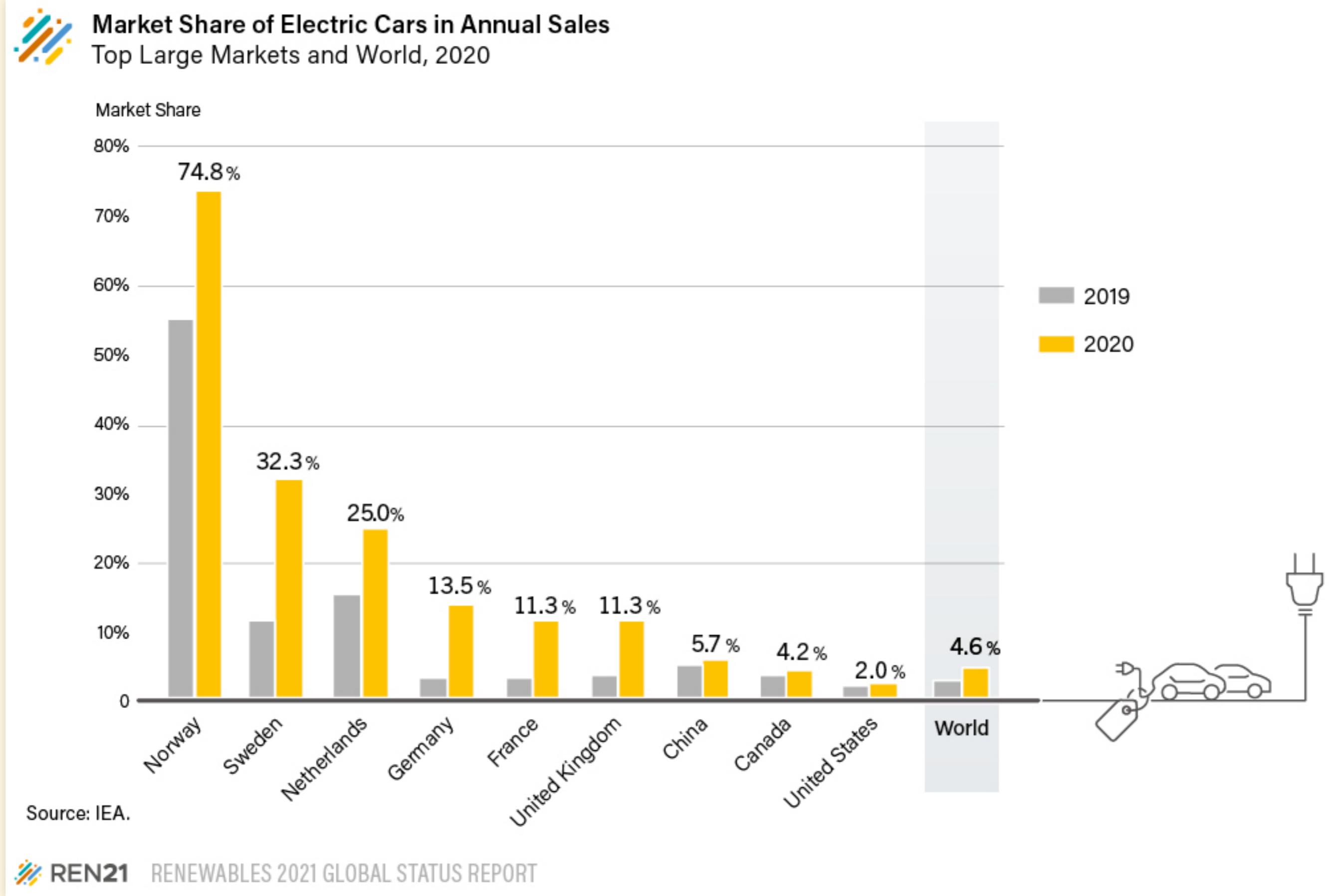
# Battery Storage

Volume-weighted average of lithium-ion battery price from all sectors (in USD)



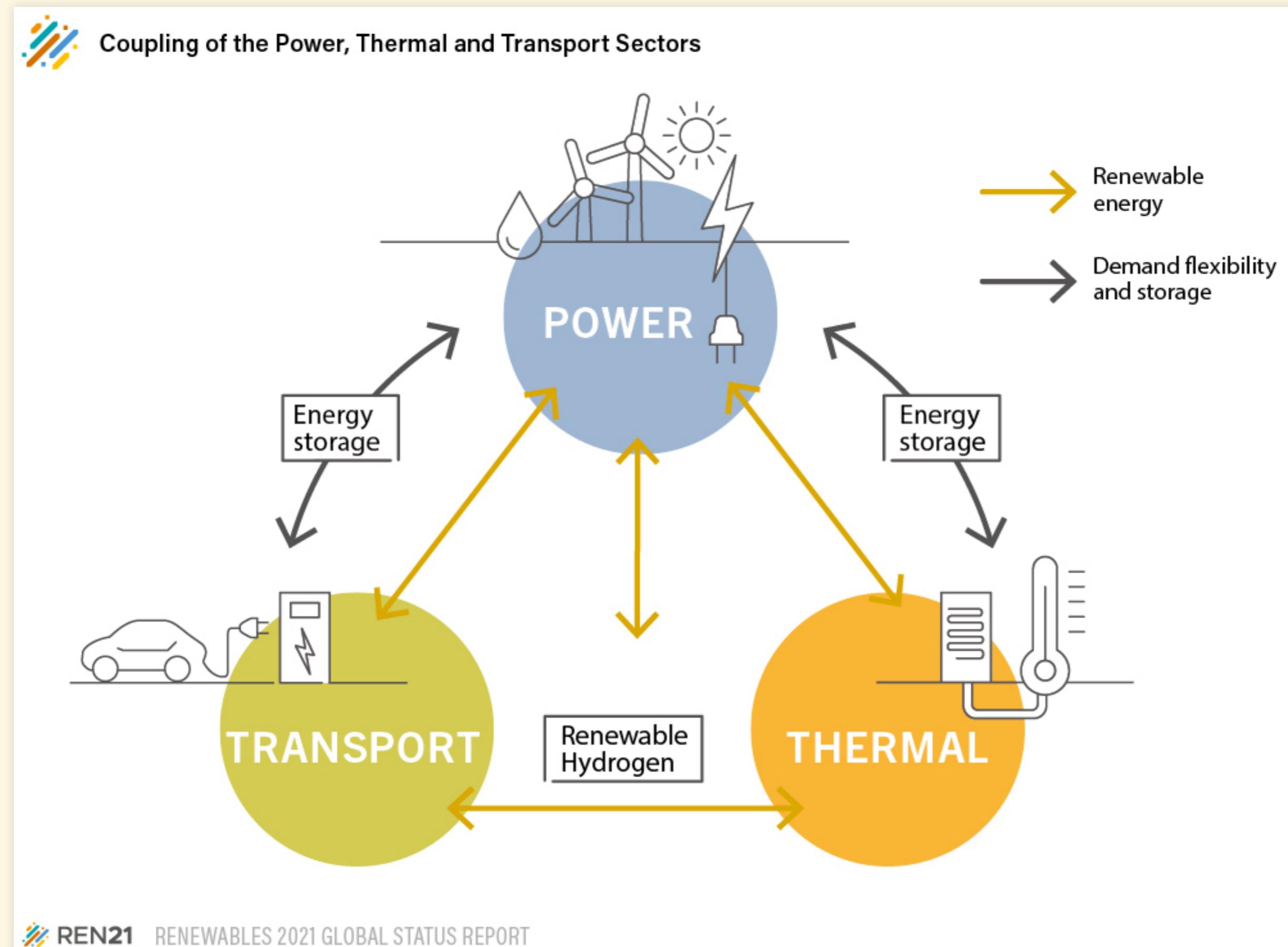
Source: Bloomberg

# Electric Cars



# Other Considerations

# Holistic View of Energy



# Prospects for Future Renewable Energy

# Cost of Renewable Power

- Cost of solar energy is 90% less than in 2009
- Cost of wind energy is 70% less than in 2009
- Cost of wind and solar is now one third the cost of coal power
- Cost of battery storage is down 87% since 2010.
- Most car companies say the future of cars is electric
- Politics and government regulations are **preventing** the rapid expansion of renewable electricity
- Many tech companies like Amazon, Facebook, Google, Microsoft, and Apple want to install more renewable electricity
- Vanderbilt is building 70 million Watts of solar power to supply 100% of campus electricity.

