International Energy Agency

Clean technology supply chains and renewable electricity in industry

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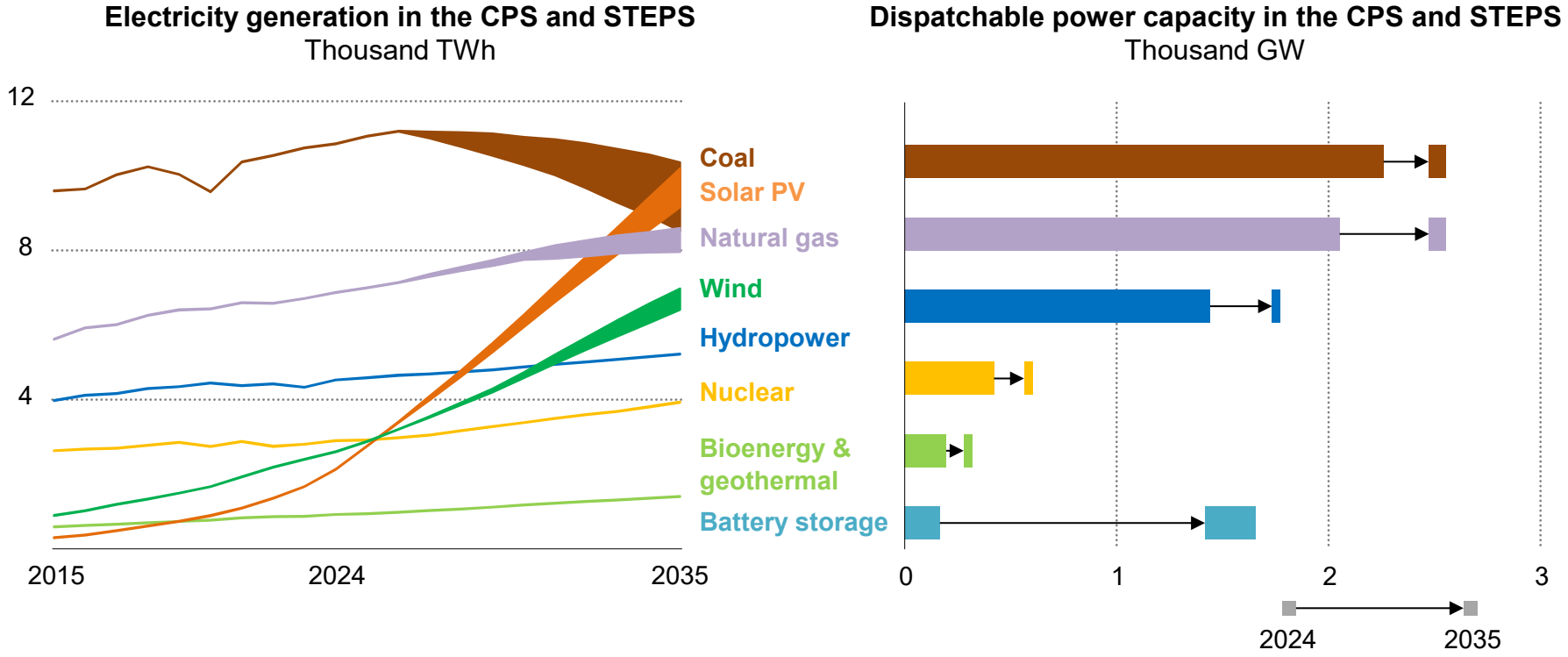
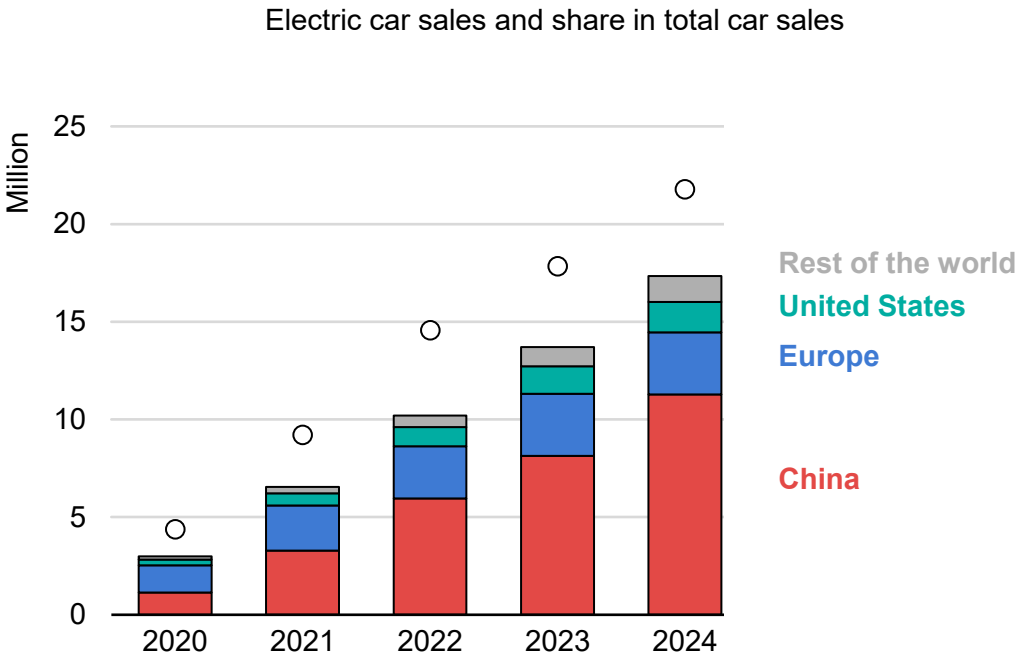
Clean technology supply chains

Changing power systems are reshaping electricity security



Renewable energy is on the rise led by solar PV and nuclear makes a comeback, natural gas continues to grow; robust electricity security strategies require dispatchable sources, more flexibility & resilience, and modernised grids

Global electric car sales continue to break records



EV sales in 2025 are set for a new record, building on global 35% year-on-year growth in Q1.
Two-thirds of battery electric cars sold in China are now cheaper than their conventional equivalent.

Investment in clean technology manufacturing is booming

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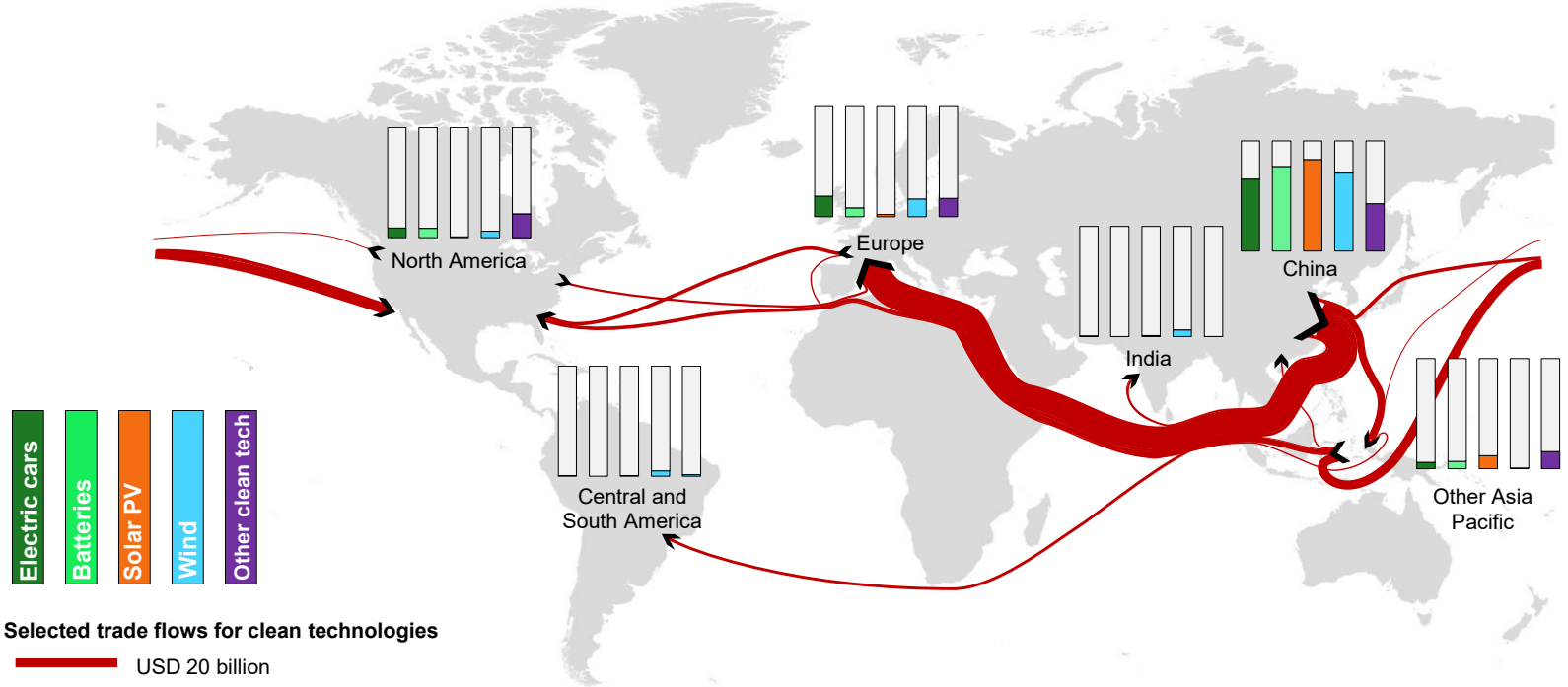
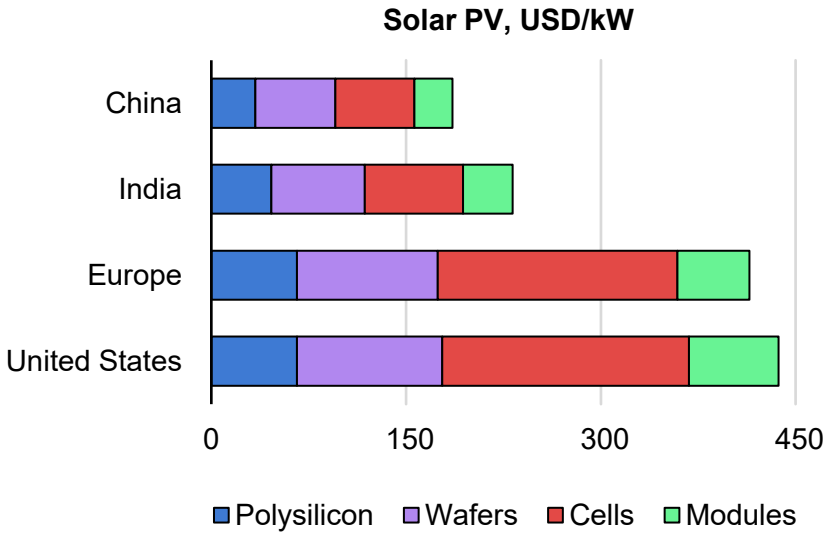
Share of global clean technology manufacturing output by technology, 2023

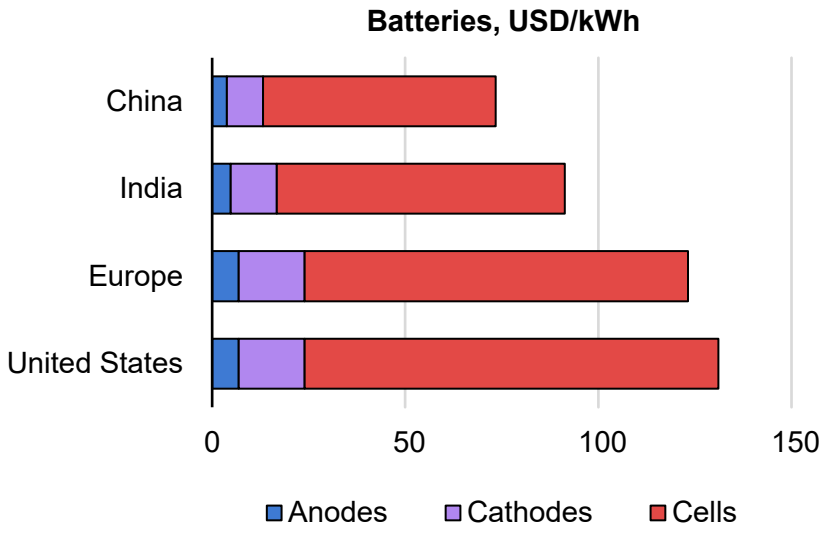


The manufacturing of clean technologies is highly concentrated geographically, with China accounting for around 70% of the global manufacturing output value for the six key clean technologies.

There is significant regional variation in capital costs…

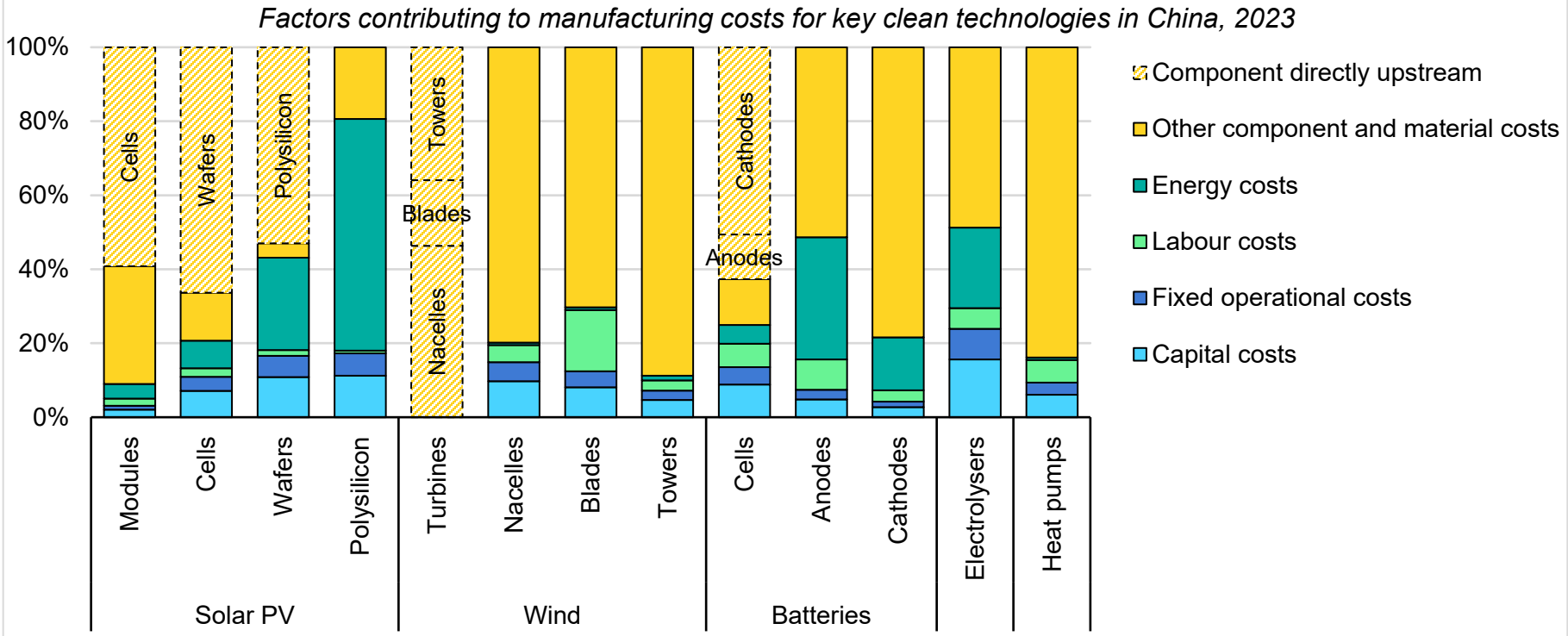
Clean technology manufacturing facility capital costs, 2023





An analysis of cost data for 750 projects shows significant variation in average capital costs by region – a recent announcement for a large integrated solar PV facility suggests even lower costs (USD 140/kW) are possible in China

…but other factors influence total manufacturing cost

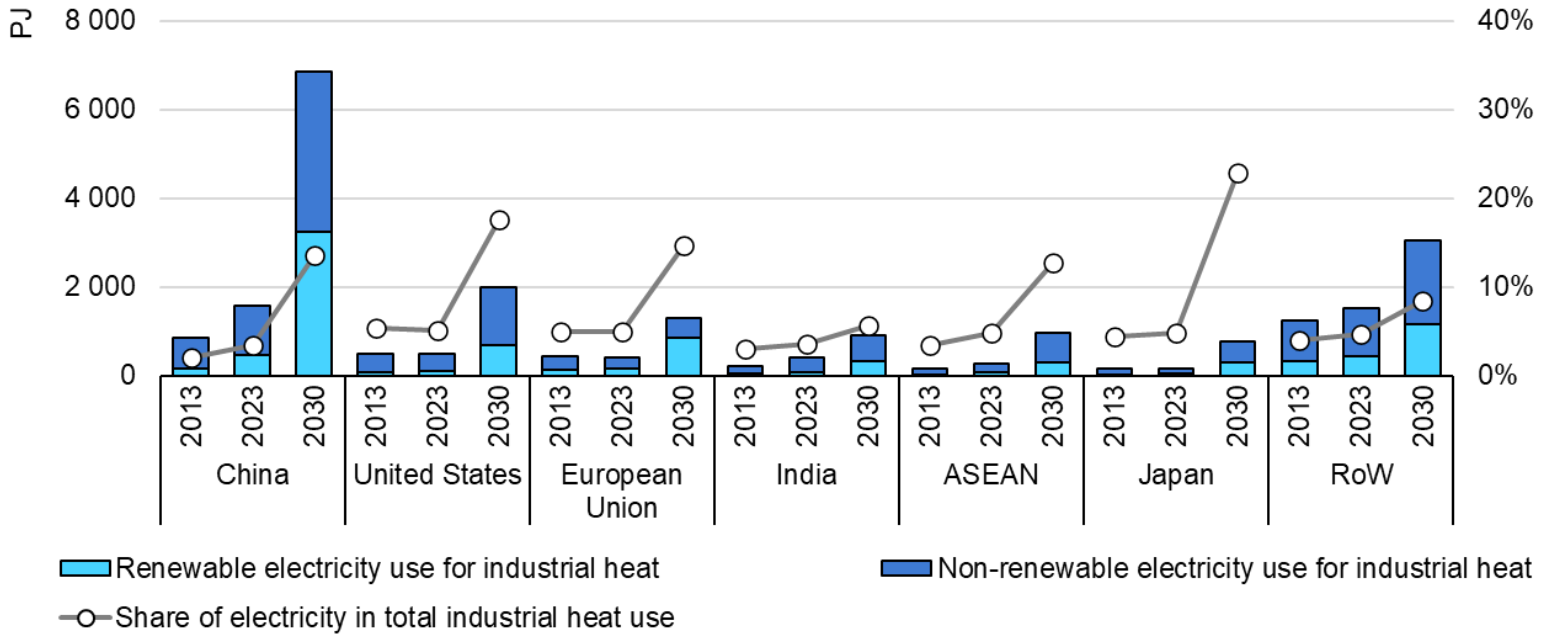


Capital costs contribute significantly to the regional variation in clean technology manufacturing cost, but account for only modest proportions of the total – materials and energy account for much larger shares

Renewable electricity in industry

Industrial heat is slowly electrifying, with renewables leading the way

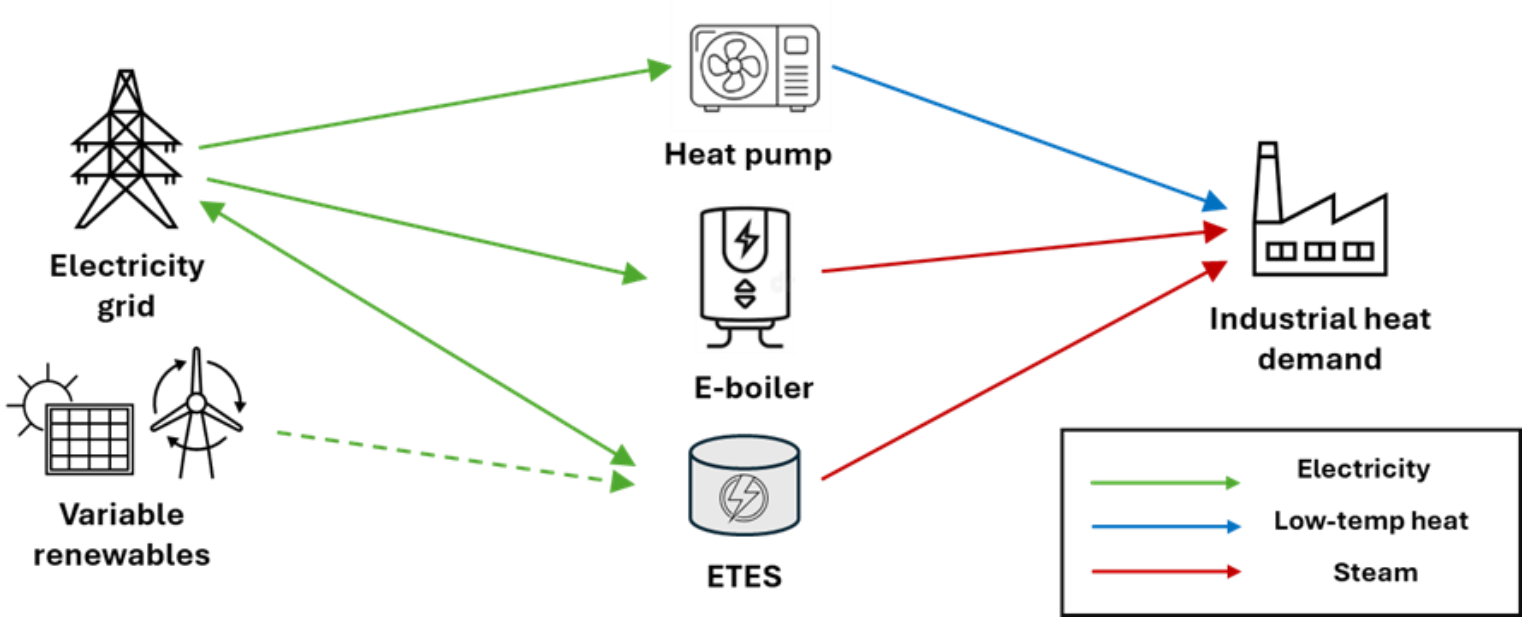
Non-renewable and renewable electricity use for industrial heat and share of electricity in total industrial heat use in major economies, 2013&2023



Shift in electrification of industrial heat is global but uneven. Renewable electricity use for industrial heat has been growing faster than total electricity use and is set to grow even faster with 8x growth in Japan, 6x in China, 5x in the US and 4x in the EU, India and ASEAN.

Introducing renewables to industrial energy mix through heat electrification

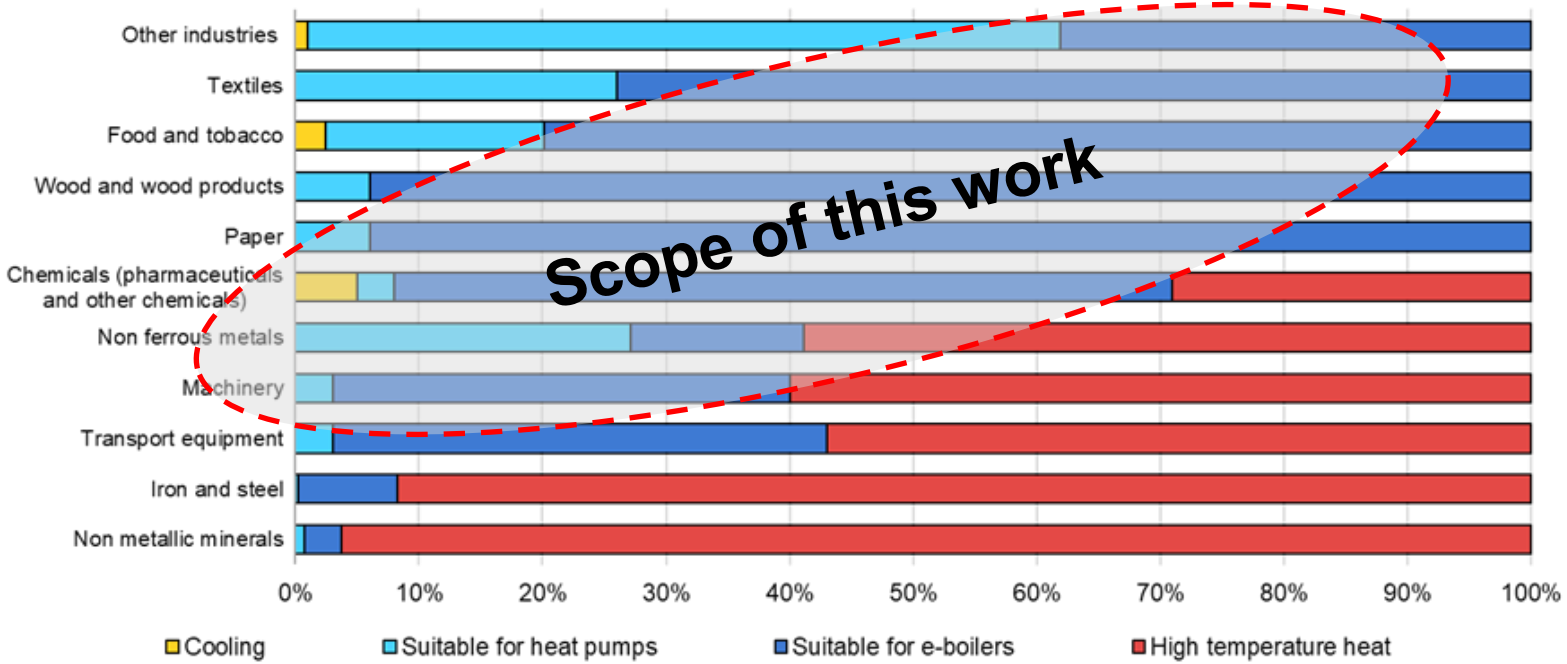
Electrification pathways for industrial heat covered in the IEA report



Integration with thermal storage enables either to use captive variable renewables as industrial energy source, or to avoid the highest cost hours of the day in the electricity market.

Industrial energy use is mostly in the form of heat

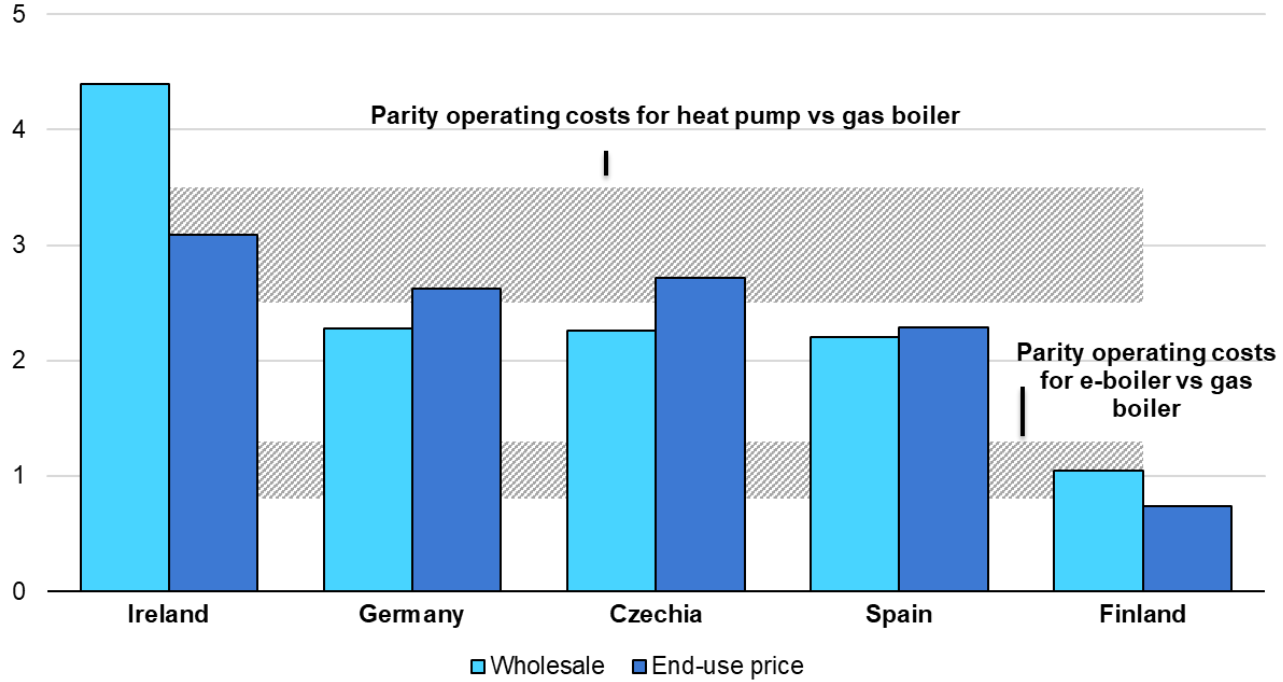
Distribution of heat use to different temperature levels in the industry sector (2023)



Low-temperature heat and steam can be electrified via industrial-scale heat pumps and electric boilers that are mature and commercially available.

The electricity to gas price ratio shapes the feasibility of industrial heat electrification

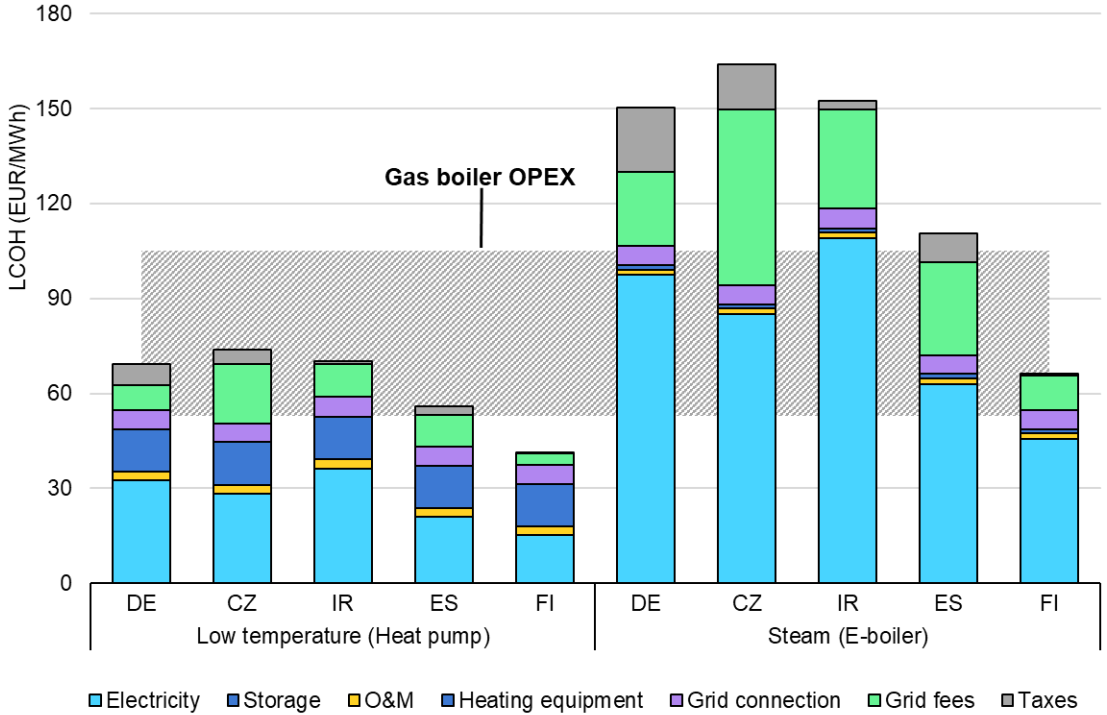
Electricity to natural gas price ratios for industrial users in selected EU member states in 2024



Electricity to gas price ratio of about 1 is required for steam and high-temperature heat. For low-temperature heat, ratios above 1 are still feasible as heat pumps are much more efficient than gas boilers.

Heat pumps are becoming attractive in EU for industrial purposes

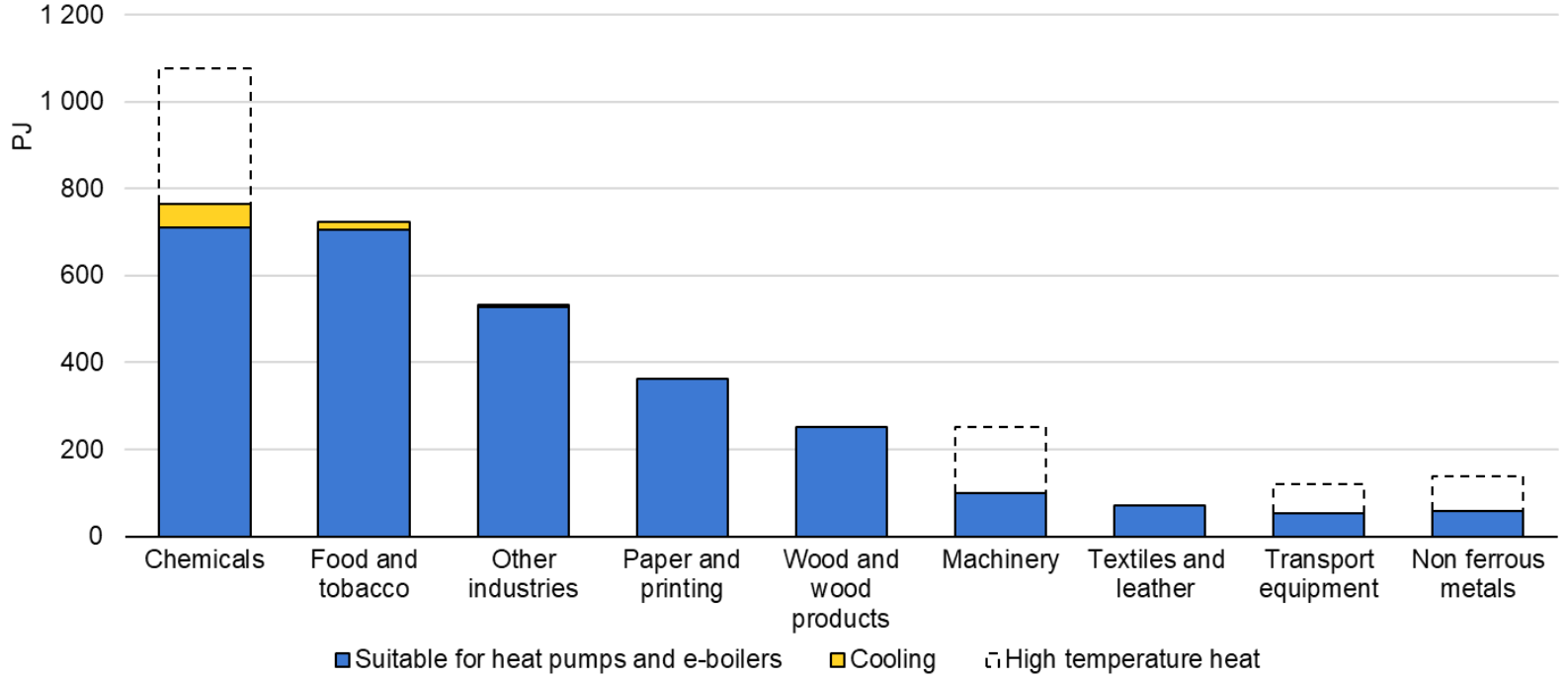
Levelised cost of heat (LCOH) from electricity and natural gas under various assumptions in the selected EU countries, 2024



Despite lower investment costs, steam generation struggles to compete due to lower efficiency compared to industrial heat pumps.

Electrification can cut industrial use of fossil fuel for heat in the EU by 56%

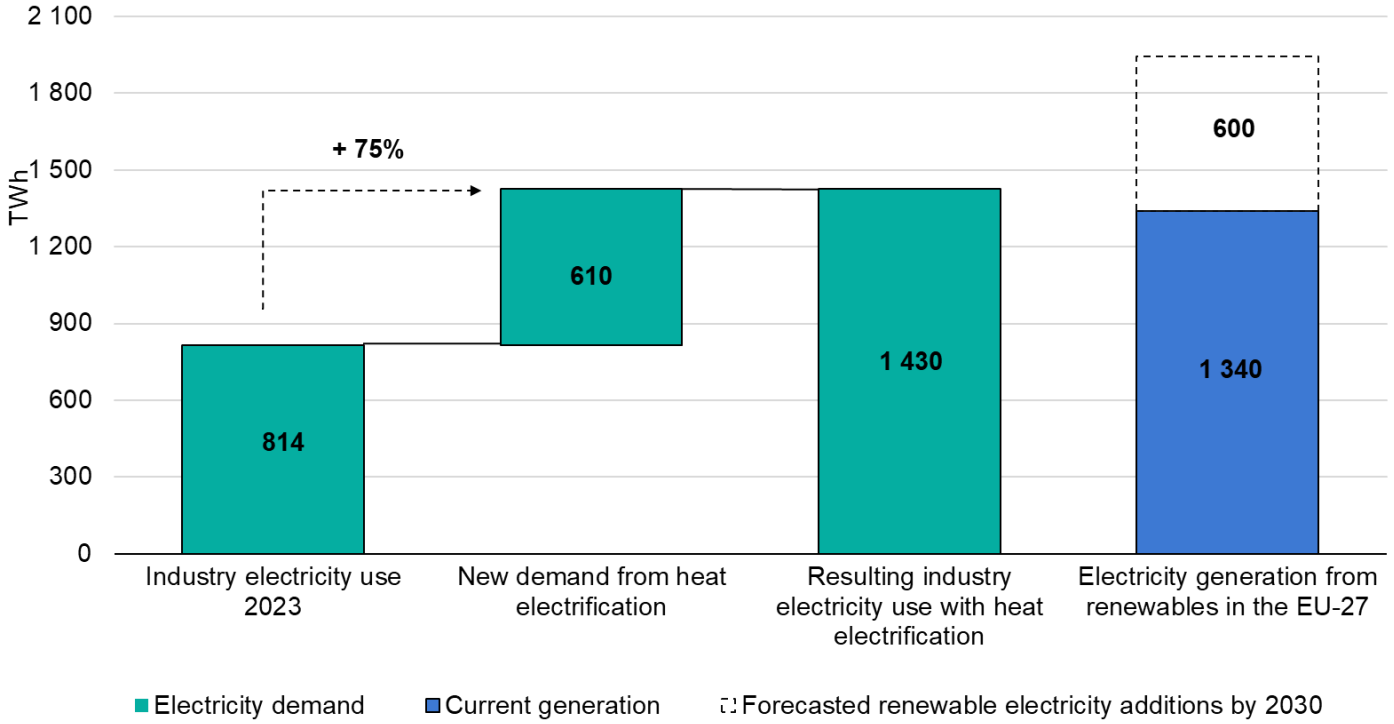
Technical potential for heat electrification in European industry sectors with commercially available technologies (2023)



Heat electrification would reduce direct natural gas use for industrial heat by 35 bcm, equal to 70% of the remaining imports from Russia.

Heat electrification would create 610 TWh of new electricity demand

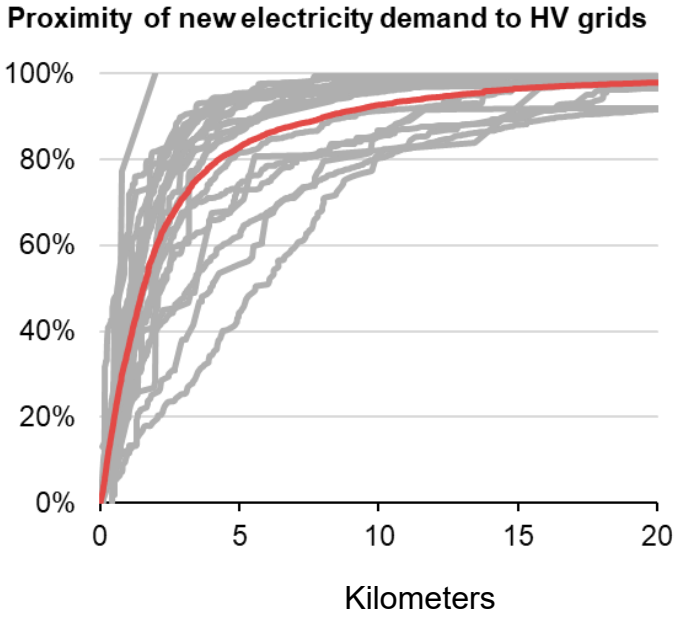
Impact on EU-27 electricity demand if the technical potential for electrifying steam and low-temperature heat were realised.

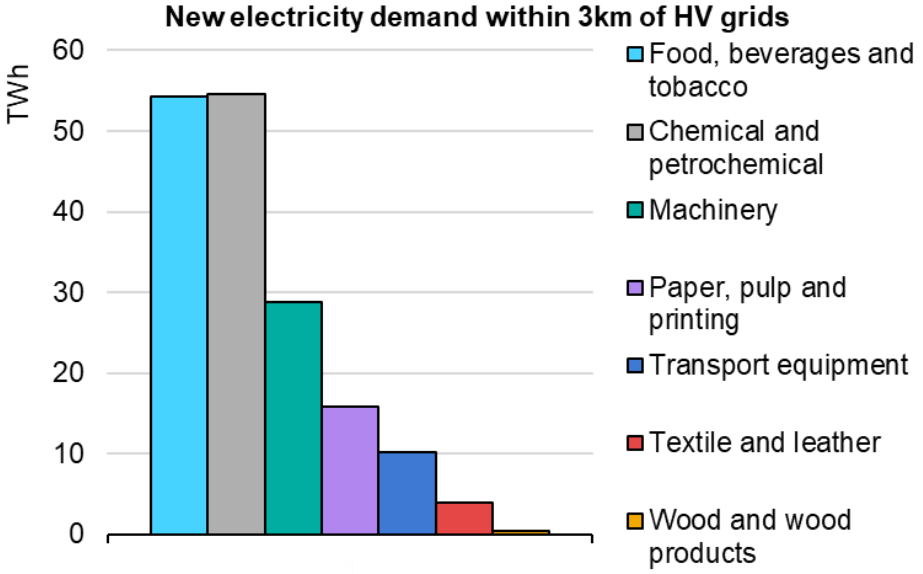


This is also close to the projected growth (602 TWh) of EU's renewable generation in 2025-2030.

70% of industrial NG use for heat is located within 3 km from a HV grid

Proximity of new electricity demand to HV grids (left) and new industrial electricity demand within 3 km of HV grids (right)

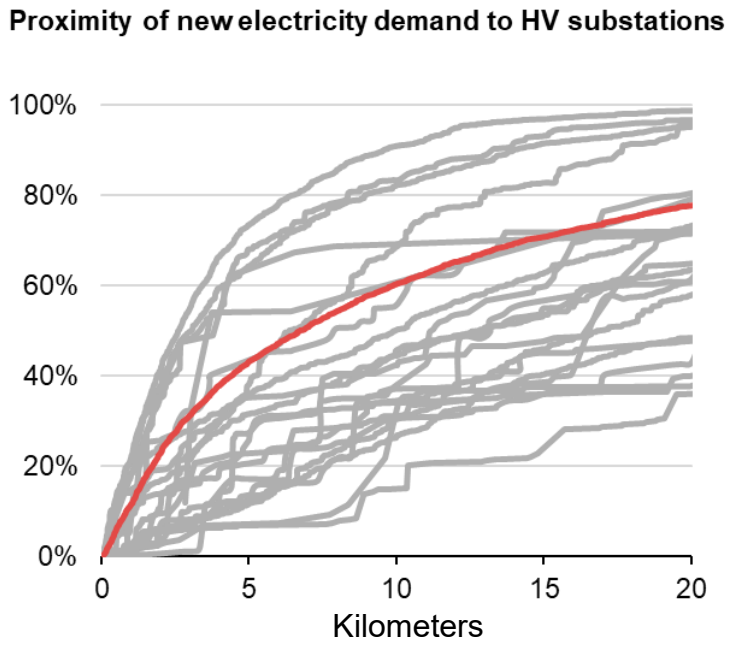


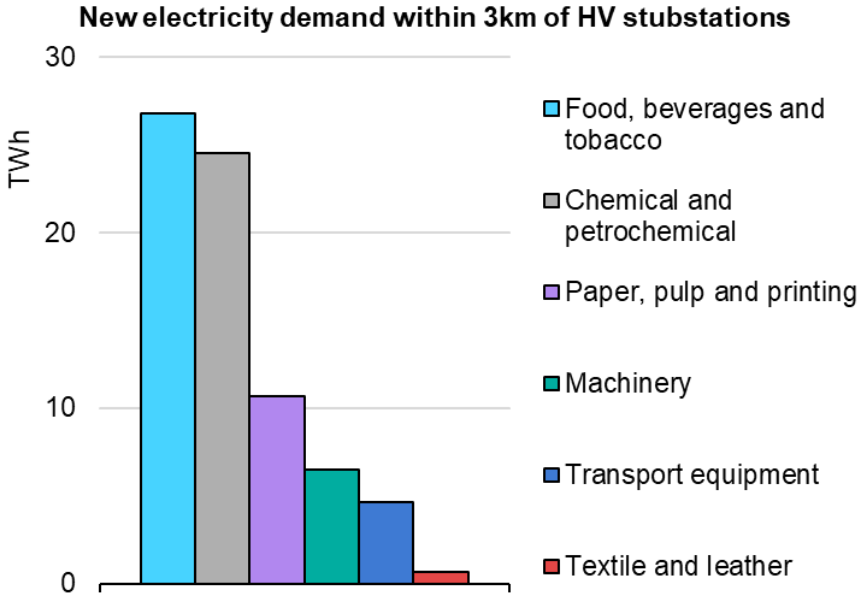


Around 70% percent of the industrial facilities currently using natural gas for heat supply are sufficiently large to depend on a HV grid connection for their electrification.

Only 30% of NG use for heat is within 3 km to existing HV substation

Proximity of new electricity demand to HV substations (left) and new industrial electricity demand within 3 km of HV substations (right)





Around 160 TWh of new electricity demand (today supplied from NG) is within 3 km from existing substation.

The IEA recommends 6 priority actions

Electrifying low temperature heat and steam helps **increase the share of renewables** in the industrial energy mix. Priorities include:

1. **Elevate industrial heat electrification into the policy agenda and integrate it into industrial roadmaps and targets**

2. **Anticipate industrial electrification in grid planning** and prioritise connection requests with demand side flexibility

3. **Reform electricity taxes and levies for industrial users** and provide lower **network tariffs** for flexible demand

4. **Enable business models and provide targeted support for capital and operational costs** for the accelerated roll-out of heat electrification technologies

5. **Prepare skills and capacity for industrial electrification**

6. **Promote international collaboration on technical standard frameworks**

Thank you!