



Committee on Energy



Global Energy Trends

Quentin Bchini, Head of Research department
ENERDATA – *speaker*

Marie-Line Vaiani, Chair of WFEO Committee on Energy,
Secretary General of World Energy Council France and member of UN-CEET -
moderator



World Federation of Engineering Organizations
Fédération Mondiale des Organisations d'Ingénieurs



unesco



WFEO / FMOI

WFEO : an international, non-governmental organization representing the engineering profession worldwide.

Founded in 1968 by a group of regional engineering organizations, under the auspices of the United Nations Educational, Scientific and Cultural Organizations (UNESCO), WFEO brings together national engineering organizations from 100 nations and represents more than 30 million engineers from around the world.



The international organization
for the engineering profession



Cooperates with United Nations
bodies and other international
organizations



Acts through thirteen
Committees and Working
Groups addressing key
engineering issues

World Federation of Engineering Organizations



Committee on Energy



Program

- **Task groups**
- **Sharing knowledge about best technological solutions and innovations for energy transition.**
- **Sharing best practices and effective energy policies** on how to speed up the implementation of these solutions while managing the dimension of acceptability and affordability
- **Sharing knowledge and best practices on how to guarantee the resilience of global energy systems** regarding consequences of global warming.

Task group

- **Energy Efficiency** – Dr. Ruomei Li, China
- **Solar PV** – Dr. Carsten Ahrens, Germany
- **Electrification** – Prof. Abubakar Sambo, Nigeria
- **Hydrogen** – Prof. Massimiliano Capezzali, Switzerland
- **Energy storage** – Philip Pascall, UK

Committee on Energy - Organization

Chair: Marie-Line Vaiani

Vice-Chair:

- **Africa** – Prof. Abubakar Sambo, Nigeria
- **Asia/Pacific** – Prof. Sun Hongbin, China
- **Europe/Russia** – Dr. Daniel Favrat, Switzerland
- **Latin America** – Mag. Ing. Miguel Fierro, Uruguay
- **Middle East/South Central Asia** – Mr. Pradeep Chaturvedi, India

Members:

Bahrain Society of Engineers University of Applied Sciences Jade-Hochschule Instituto de la Ingeniería de España Ghana Institution of Engineering Institution of Engineers Rwanda Order of Engineers of Angola Swiss National Committee for FEANI-WFEO Instituto de la Ingeniería de España Institution of Engineers, India Institution of Engineers, Mauritius Asociación de Ingenieros del Uruguay Macau Institute Of Engineers Union National des Ingénieurs du Maroc Engineering Council of Zimbabwe Institution of Engineers of Kenya	China Association for Science and Technology <u>Consiglio Nazionale Degli Ingegneri</u> <u>Jordan Engineers Association</u> Order of Engineers and architects of <u>Beyrouth</u> Nigerian Society of Engineers Myanmar Engineering Society Institution of Civil Engineers, UK Nigerian Society of Engineers <u>Ordem dos Engenheiros Tecnicos</u> China Association for Science and Technology Ethiopian Association of Civil Engineer Ingénieurs et Scientifiques de France China Association for Science and Technology HK Institution of Engineers
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Committee on Energy



WFEO / FMOI

WFEO Committee on Energy - 2025 Webinar Series



WORLD
ENERGY
COUNCIL



« Electricity Access Gaps and Policy Recommendations »

27 January 2025
2 to 3 PM CET

Moderator

Speaker



Marie-Line Vaiani

Chair of the Committee on
Energy, WFEO
Secretary General of the
World Energy Council France

Abubakar Sambo

Professor Emeritus,
Vice-Chair for Africa,
Chair of the Electrification
Task Group, WFEO



WORLD
ENERGY
COUNCIL



« Why is nuclear power making a comeback »

24 April 2025
1 to 2 PM CET

Moderator

Speaker



Marie-Line Vaiani

Chair of the Committee on
Energy, WFEO
Secretary General of the
World Energy Council France

Henri Paillere

Head, Planning and Economic
Studies Section
International Atomic Energy
Agency (IAEA)



WFEO-CE

Committee on Energy



WFEO / FMOI

As part of its work programme, the Committee on Energy of the World Federation of Engineering Organizations invites you to its webinar on:

« PV Module recycling as a necessity for future PV development »

Friday, 4th July 2025,
from 14:00 to 15:30 CEST

This webinar shall make clear the importance of PV module recycling as a necessity for the future of PV development. After the introduction of Marie-Line Vaiani, Chair of the Committee on Energy of WFEO, five experts from four regions of the world will give their views about the actual situation of PV module recycling.

SCHEDULE

1. **Marie-Line Vaiani**, Chair Committee on Energy - Welcome and introduction
2. **Carsten Ahrens**, Chair Solar Task Group - PV recycling worldwide, overview
3. **Jan-Philip Mai**, CEO Solar Materials - PV recycling in Germany/Europe
4. **Ismail Jefferies**, Engineer - PV recycling in South Africa
5. **Adrian Piani**, Engineer - PV recycling in Australia
6. **Yogi Goswami**, Scientist - PV recycling in USA

Open discussion at the end of the speeches for all participants.



WORLD
ENERGY
COUNCIL



« AI for Power System »

15 October 2025
10 to 11 AM CEST
4 to 5 PM Shanghai time

Moderator

Speaker



Marie-Line Vaiani

Chair of the Committee on
Energy, WFEO
Secretary General of the
World Energy Council France

Dr Yishen Wang

Department of Artificial
Intelligence
China Electric Power Research
Institute



World Federation of Engineering Organizations
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Global Energy Trends

Continued growth in energy consumption and CO₂ emissions

Quentin Bchini

14 November 2025

Since 1991, we have proven a renowned expertise in energy-climate scenario modelling services

- > **Independent energy research & consulting company since 1991**
- > Expert in analysis and **forecasting of global energy & climate issues**
- > **In-house** and globally recognised **sectoral databases** and **forecasting models**



50+
committed
Consultants
and Experts

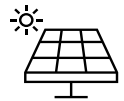
- > **Headquartered in the Grenoble (French Alps) research cluster;** a subsidiary in **Singapore**
- > **Global reach:** Clients and projects in Europe, Asia, Americas, Middle East, Africa
- > **Connected** with **leading public institutions, financial and corporate actors, academia and NGO actors**

Our services – Combining fields of expertise from research, data science to modelling



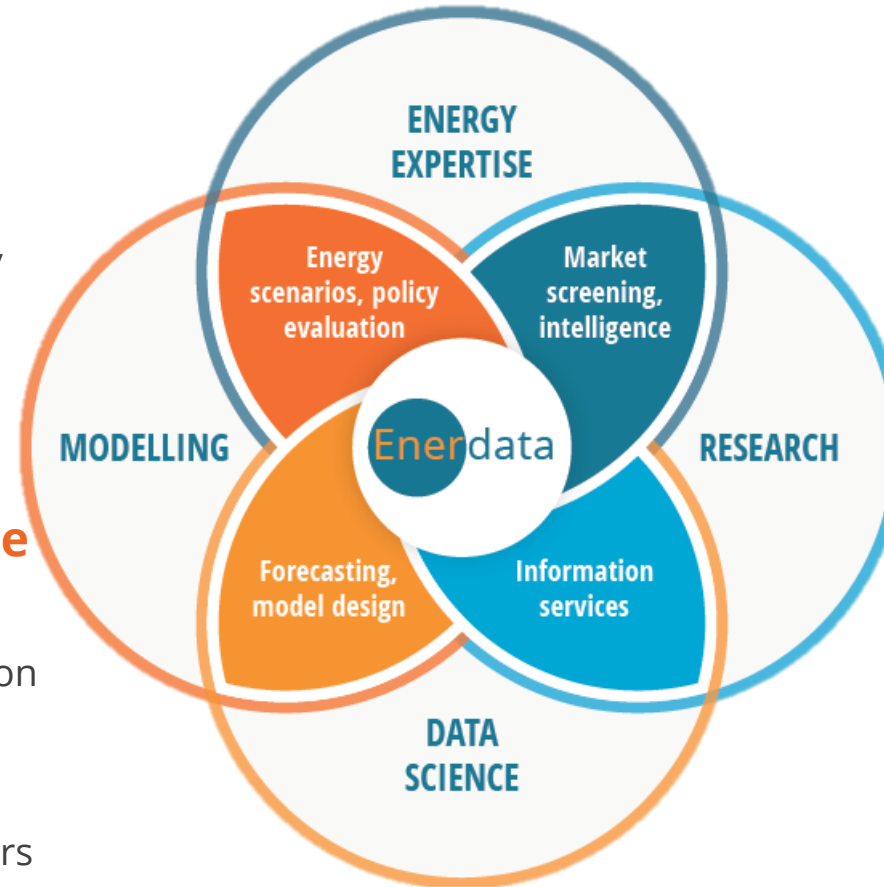
Modelling

- Creation of E-C scenarios, climate alignment trajectories
- Identification of alignment pathways by sector and by country



Expert in energy / climate

- Knowledge of market drivers
- Expertise covering all energy transition pillars: mix decarbonisation, energy efficiency, sufficiency, and flexibility (assets and markets)
- Deep coverage: all energies, all sectors and 150+ countries



Market intelligence

- Market Research
- Business intelligence
- Energy market watch
- Tracking of E-C policies worldwide



Data science

- Gathering, consolidating and analysing energy data
- Market forecasts: supply, demand and prices

A small green plant in a pot sits next to a globe on a desk. The globe shows the continents of Europe and Africa. In the background, there are various charts and documents, suggesting a professional or academic setting.

AGENDA

1

Analysis of key energy and climate figures for 2024

2

Trends by energy types

3

Comparing recent trends with decarbonization pathways

4

Recent drivers behind energy consumption and emissions in the European Union



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Key Energy & Climate Figures for G20* in 2024



+3.2%

Economic growth
in line with its historical
trend

At purchasing power parity

2023
+3.6%

2010-19
+3.5%

%/year



+2.1%

526 EJ

Energy consumption
grows faster than its
historical pace

2023
+2.4%

2010-19
+1.4%

%/year



+1%

32.8 GtCO₂

New growth in
CO₂ emissions**

2023
+1.9%

2010-19
+1.2%

%/year

* G20 countries represent
around 80% of global energy
consumption

** CO₂ emissions from energy
combustion (> 80% of
all CO₂ emissions) and from
industrial processes

*** CO₂ emissions from
combustion/GDP



-0.8%

Final energy intensity
Slow improvement

2023
-0.7%

2010-19
-2%

%/year



-0.7%

Carbon factor
Very low decrease ***

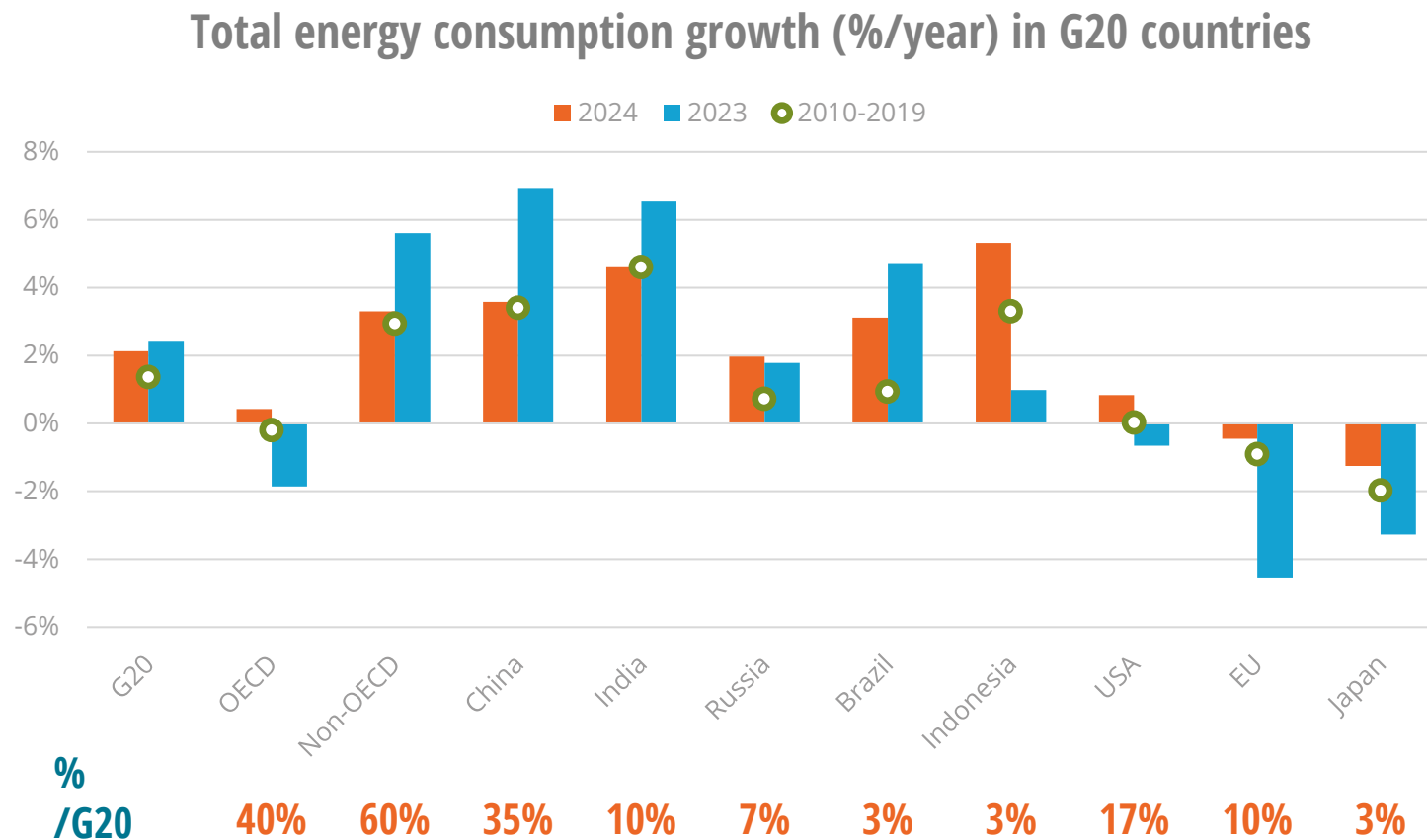
2023
-0.3%

2010-19
-0.4%

%/year

Primary energy consumption

Primary energy consumption rose by 2% in 2024, faster than in the previous decade



G20 growth (+2%), spurred by non-OECD countries (+3%)

- > China (+4%), India (+5%) and Indonesia (+6%)
- > Growth in Russia despite sanctions (+2%)
- > Non-OECD countries now account for 60% of the G20 consumption

OECD: stagnation (+0.4%) after 2 years of decline

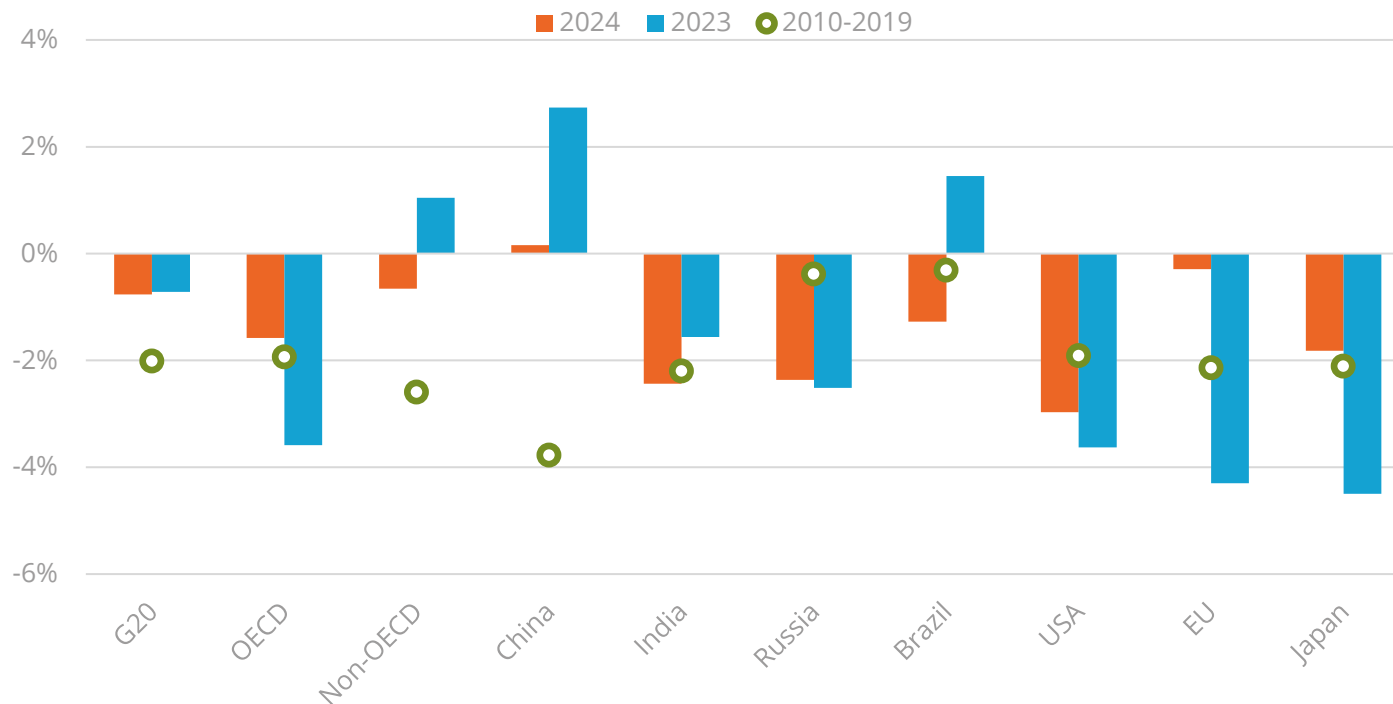
- > 1% rebound in the United States
- > Stagnation in the EU after 2 years of drop
- > Decline in Japan

Source: Enerdata

Final energy intensity*

Slow decline in 2024 (-0.8%), much lower than historical pace

Final energy intensity trends (%/year) in G20 countries



Source: Enerdata

No real decoupling between energy and GDP

- > Declining trend since 2010 (efficiency gains, tertiarisation)
- > Recent slowdown in improvement (less than 1%/year since 2022)

Different trends between developed and emerging countries

- > OECD: moderate final energy consumption (stable in the EU, drop in the US, Canada, Japan)
- > Non-OECD: stable intensity in China, with declines in India, Russia and Brazil (strong economic growth)

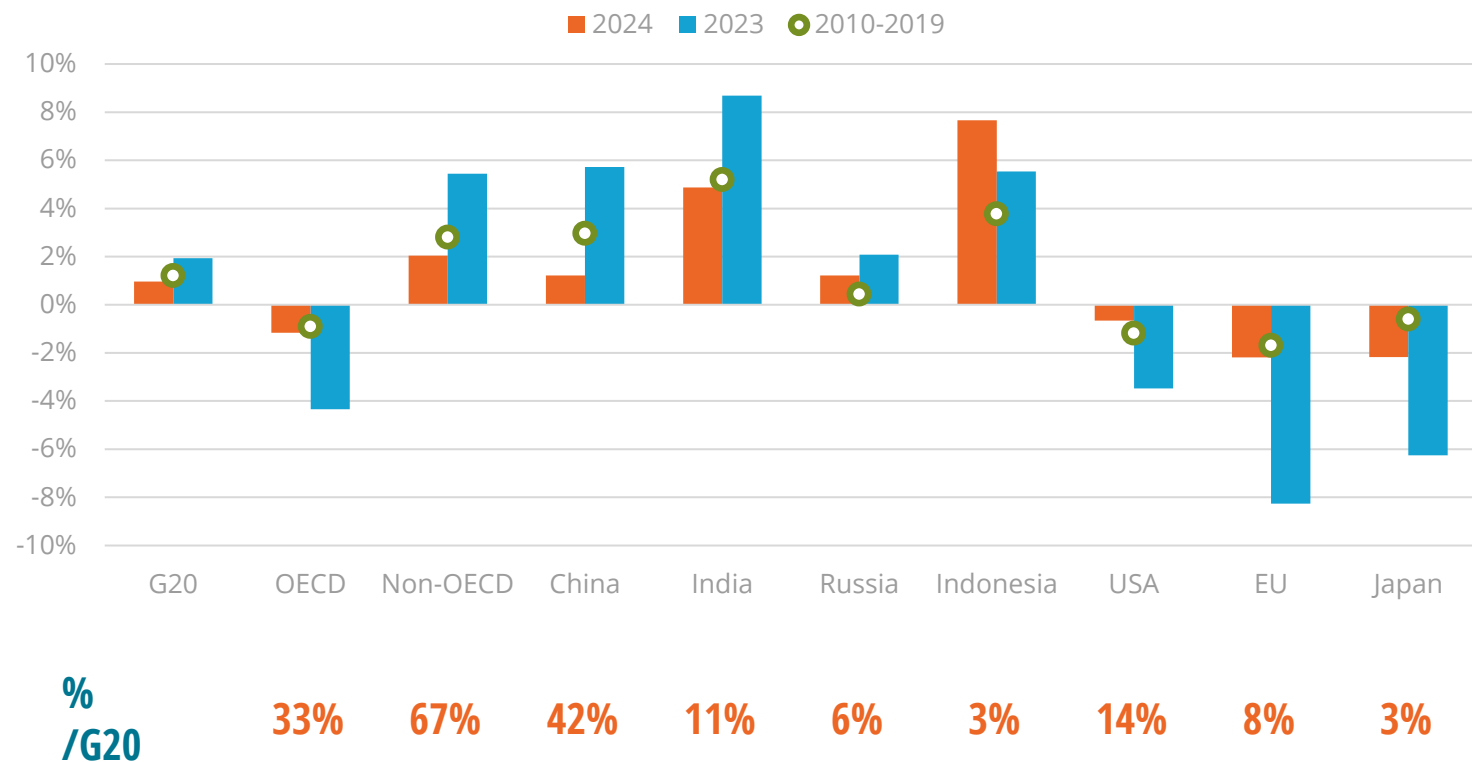
* Final energy intensity = Final energy consumption / GDP



CO₂ emissions: +1%

Slower growth in 2024, spurred by China and India (>50% of G20 emissions)

CO₂ emissions (%/year) in G20 countries



Source: Enerdata

Slower growth in emerging countries (+2%)

- > Direct impact of higher energy consumption in China, India and Indonesia, where the energy mix is still very CO₂-intensive
- > Slowdown in China and India over higher renewable power generation and lower industrial emissions in China

Limited decline in OECD countries: -1%

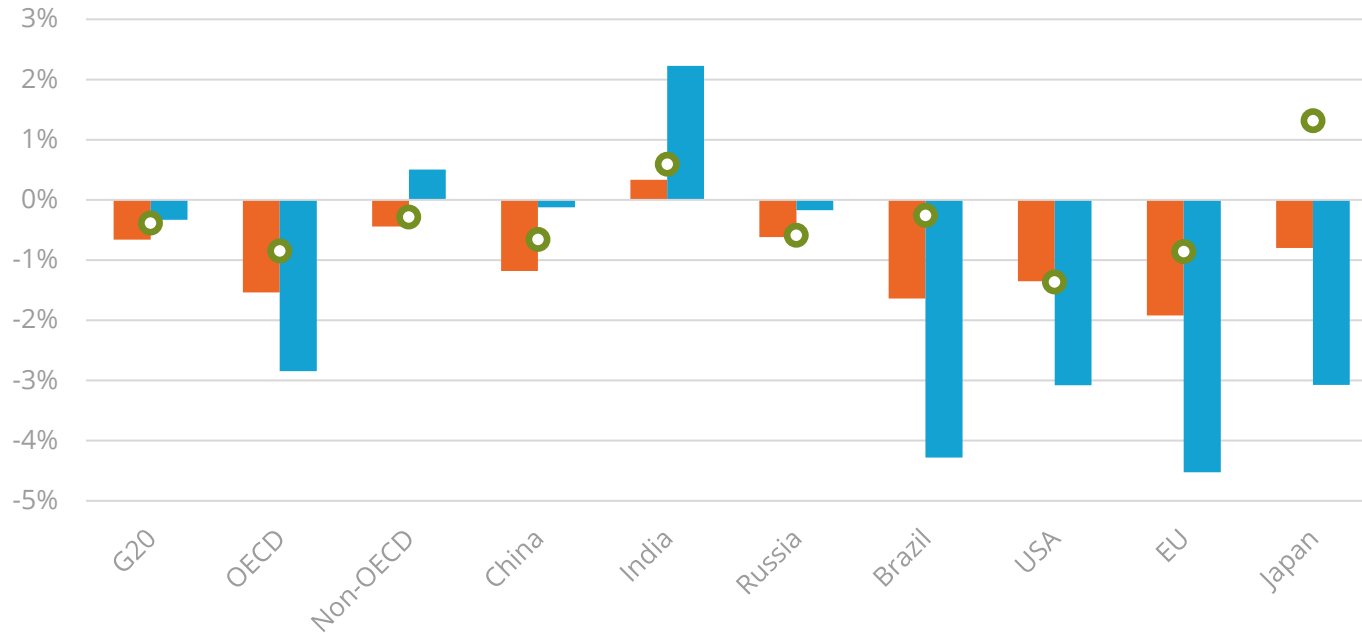
- > Impact of coal phase out and renewable generation
- > Slight decrease in the US and Europe thanks to higher renewable power generation
- > Stronger decline in Japan and South Korea

Carbon factor not decreasing

G20 energy mix is still very CO₂ intensive, far from a 2°C pathway

Carbon factor trends in G20 countries

■ 2024 ■ 2023 ● 2010-2019



Decarbonisation is not substantial globally

- > The share of fossil fuels remains broadly stable despite the boom in renewables
- > The improvement in carbon factor is very slow (-0.5% in 2024) and far from the 3%/year decrease required to meet global targets

Carbon factor is barely decreasing in emerging countries

- > The (very small) decrease in non-OECD countries is mostly driven by China
- > The decrease has also slowed down in OECD countries

* CO₂ emissions from fuel combustion / primary energy consumption

Source: Enerdata

2024 trends: Key takeaways

Historical economic growth but energy demand rises faster than historical trends again.

- 2024 confirms the return to historical economic trends, which began in 2022 (around 3%/year).
- Energy consumption, on the other hand, continues to rise faster than historical trends – and therefore away from a gradual “decoupling” trajectory.
- The rate of reduction in energy intensity is still far from compatible with a 2°C trajectory
- This trend is strongly differentiated between countries, depending on their own GDP growth, the structure of the economy and the evolution of the energy mix.

New increase in CO₂ emissions, though at a slower rate than over 2021-2023

- Despite a strong increase in wind and solar power generation, the share of renewables in the energy and electricity mix has only marginally increased.
- The rate of reduction of the carbon factor is still very insufficient to achieve a temperature rise objective of <2°C, and CO₂ emissions have therefore continued to grow in 2024



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Trends by energy types

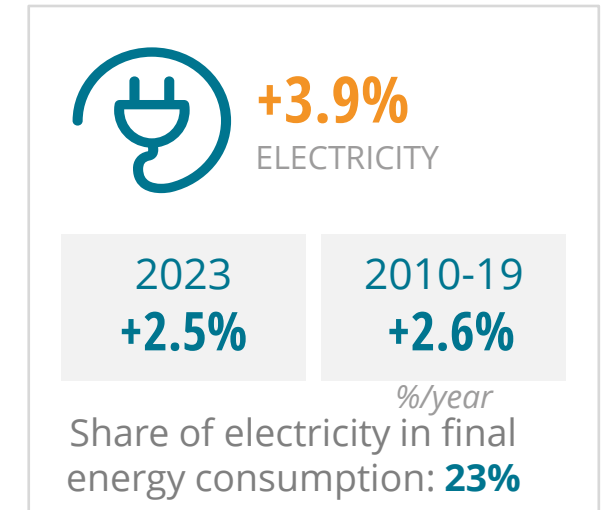
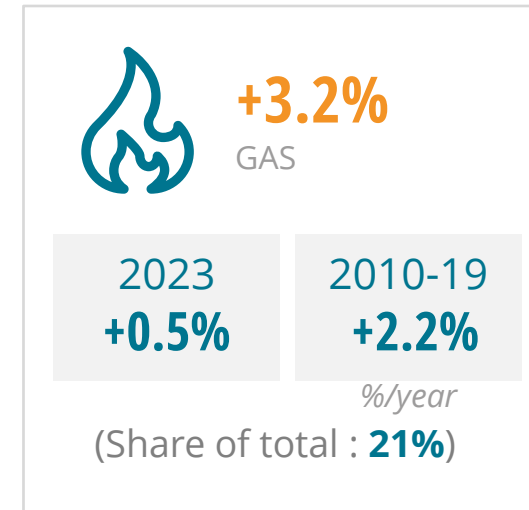
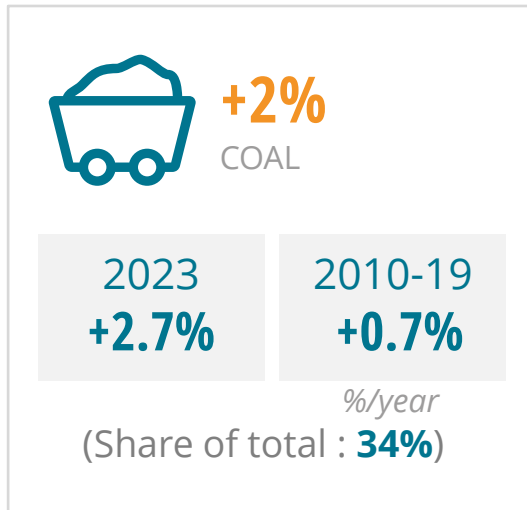
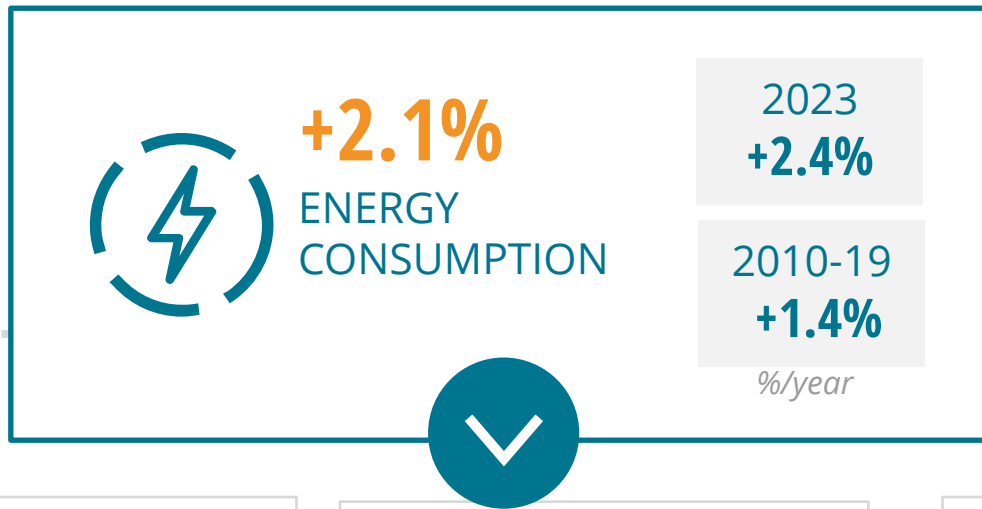
3

Comparing recent trends with decarbonization pathways

4

Recent drivers behind energy consumption and emissions in the European Union

G20 Energy Trends 2024



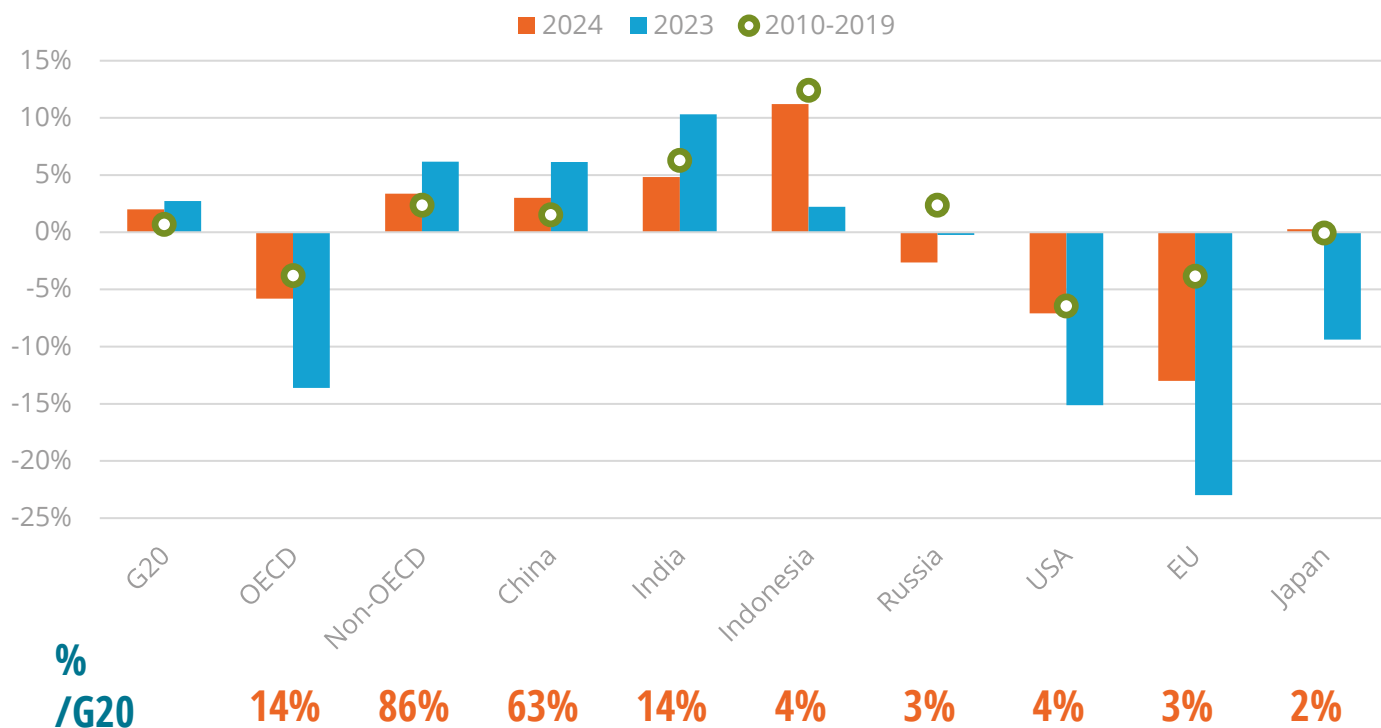
Source: Enerdata



Coal

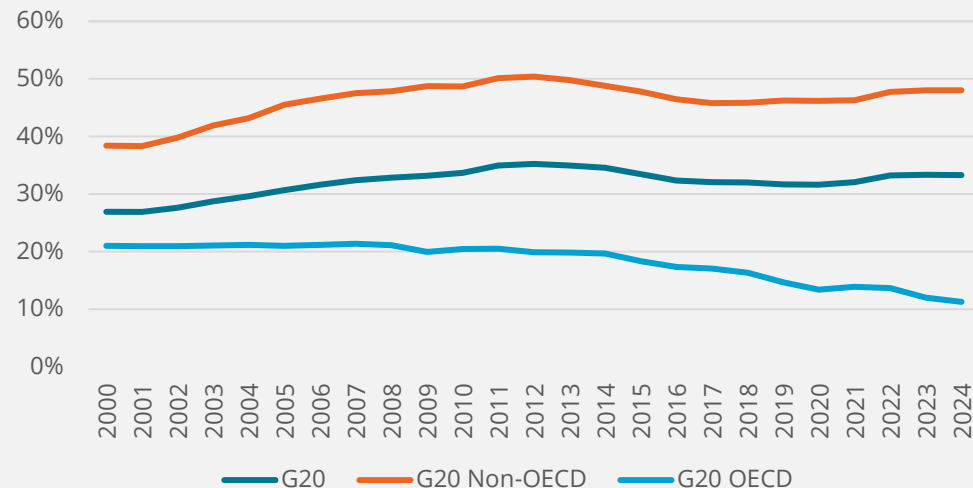
Consumption continues rising: **+2%**, pulled by China, India and Indonesia

Trends in coal consumption in G20 countries (%/year)



Source: Enerdata

Share of coal in primary consumption



Source: Enerdata

Continued growth in 2024...

- > New increase in Asian coal producers such as China (+3%), India (+5%) and Indonesia (+12%), despite rising renewable power generation in China and India

Continuous decrease in OECD countries over coal phase out policies

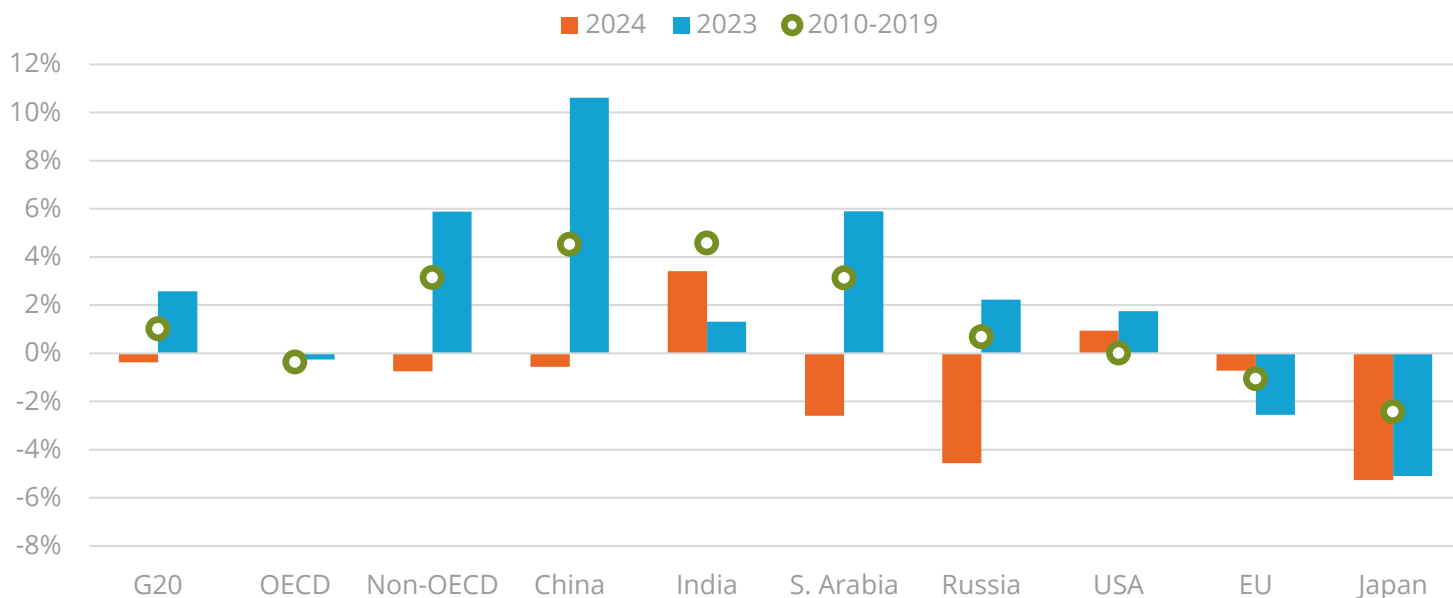
- > Demand falls in the US (-7%), the EU (-13%), Canada, Korea and the UK



Oil

Small decline in oil consumption in 2024

Trends in oil consumption in G20 countries (%/year)

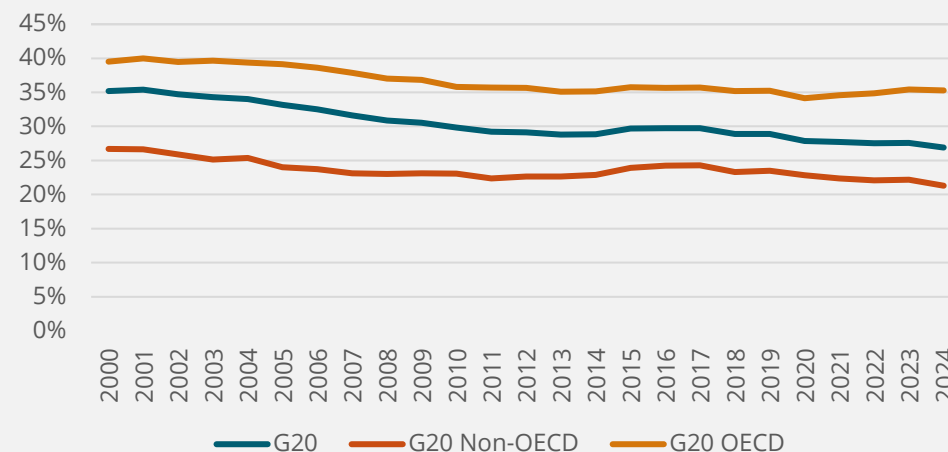


% /G20

53% 47% 23% 8% 5% 5% 23% 13% 4%

Source: Enerdata

Share of oil in primary consumption



G20: stable after post-COVID rebound

Source: Enerdata

- > Lower but volatile world oil prices (still 28% higher than in 2019)
- > Consumption back to pre-COVID levels

Decline in major non-OECD countries

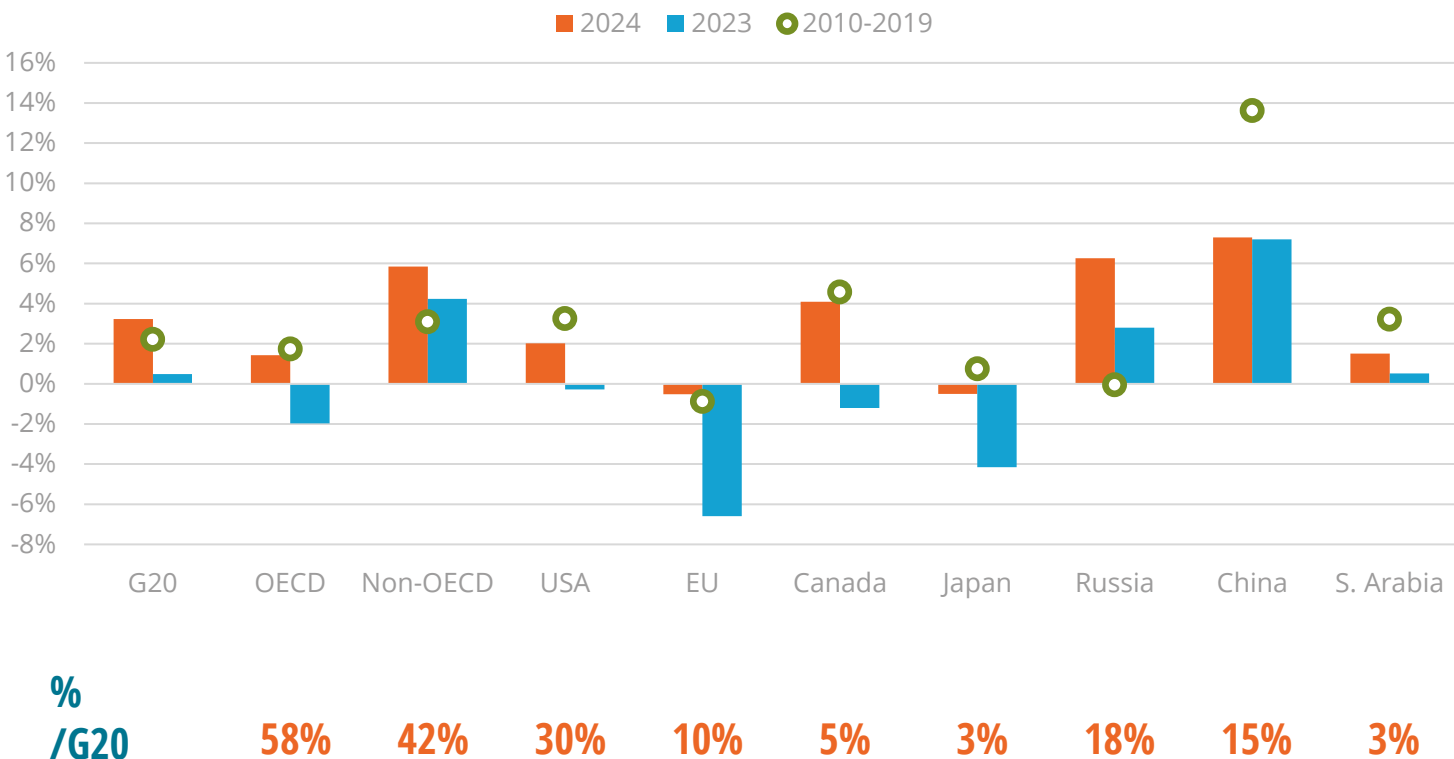
- > 1% drop in China (EVs) after a big rebound in 2023, 8% fall in Brazil (biofuels), decline in South Africa and Russia
- > Confirmed downward trend in the EU and Japan



Gas

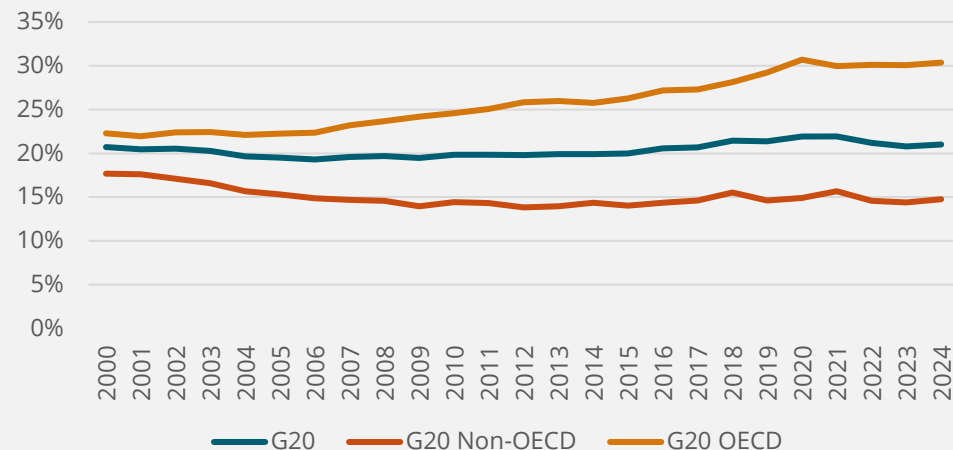
Rebound in gas consumption in 2024, with lower (but still high) gas prices

Trends in gas consumption in G20 countries (%/year)



Source: Enerdata

Share of natural gas in primary consumption



Source: Enerdata

Strong increase in emerging economies

- > Strong growth China and India (+7% each), Russia (+6%), which together account for 34% of G20's gas demand
- > Higher demand in Indonesia, Saudi Arabia and Brazil

2% rebound in OECD countries

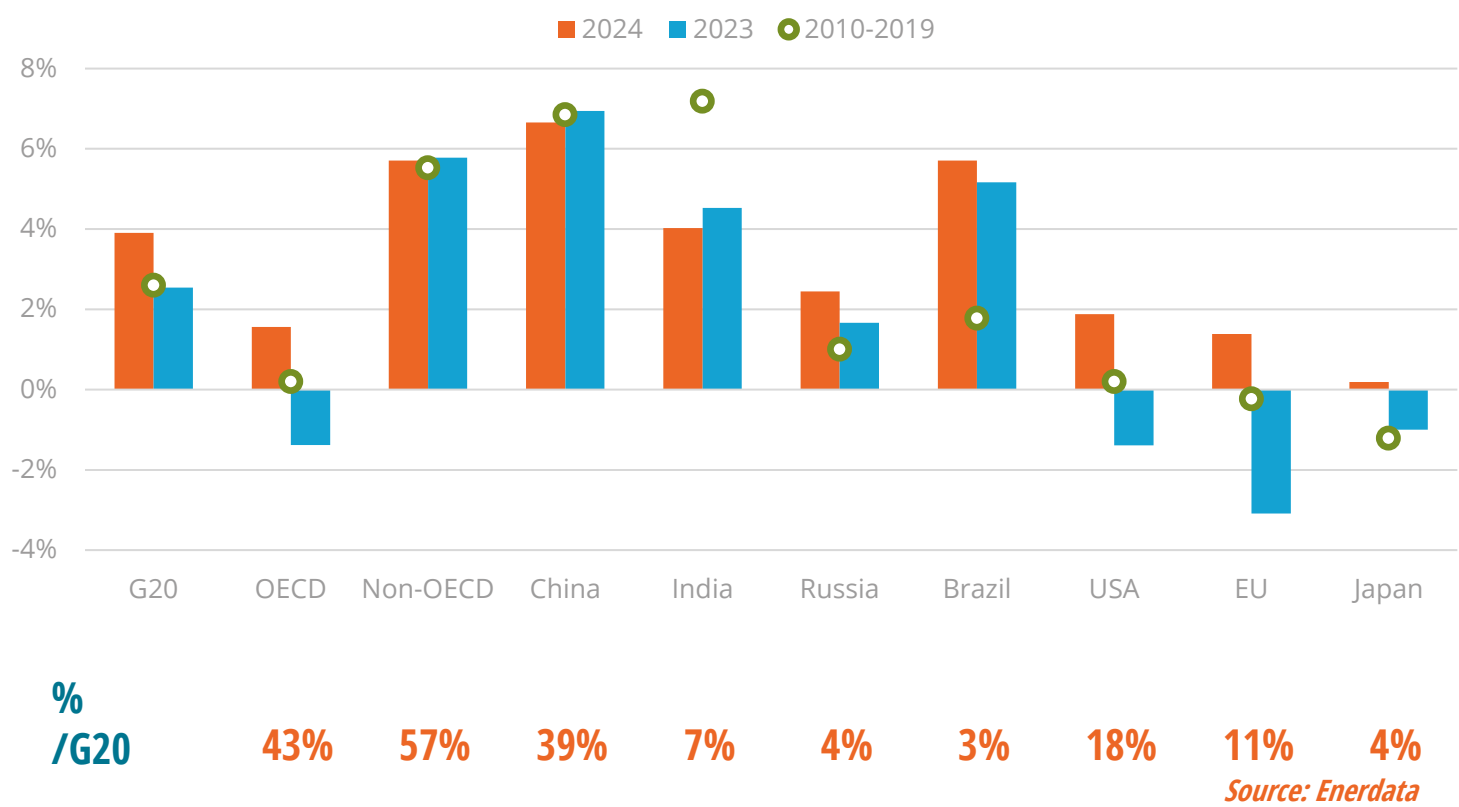
- > Growth in the United States, Canada, South Korea and Germany
- > Signs of recovery after the gas crisis in the EU



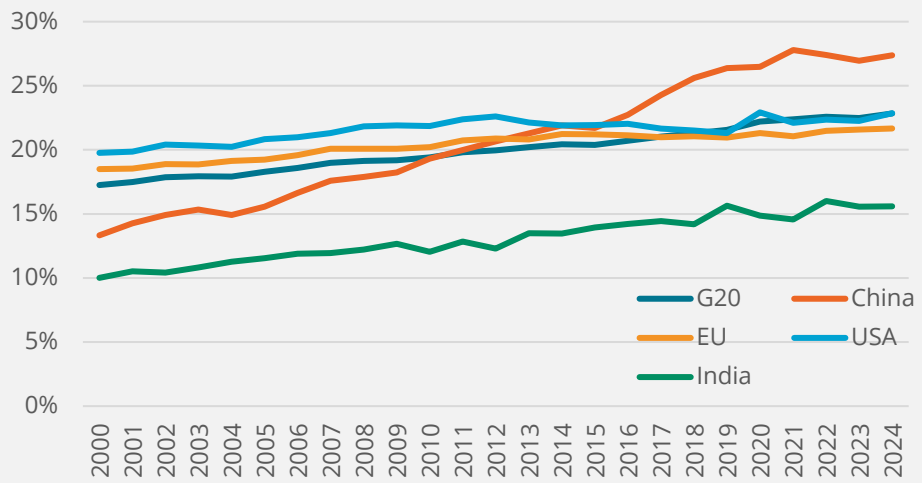
Electricity

Electricity consumption accelerates (+4% in 2024), but only a marginal gain in market share

Trends in electric consumption in G20 countries (%/year)



Share of electricity in final energy consumption



Source: Enerdata

The share of electricity is increasing in the G20, albeit at a slow pace

- > Driven by new uses (data centres, cooling)...
- > And moderate electrification of existing uses (industry, Evs)

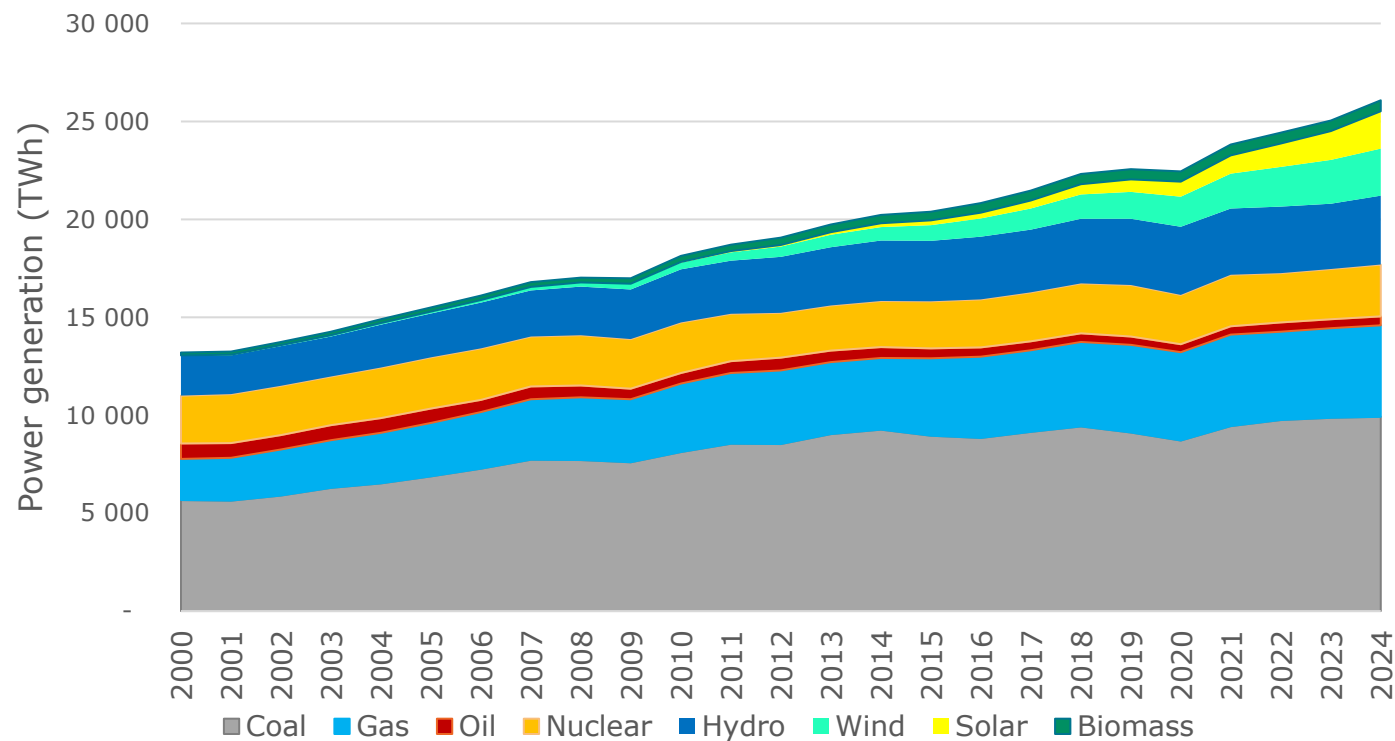
Continued growth in non-OECD

- > Strong growth in China (+7%), Indonesia (+6%), Brazil (+5%) and India (+4%)
- > Rebound in the US (+2%), in the EU (+1%) and South Korea

Power Mix

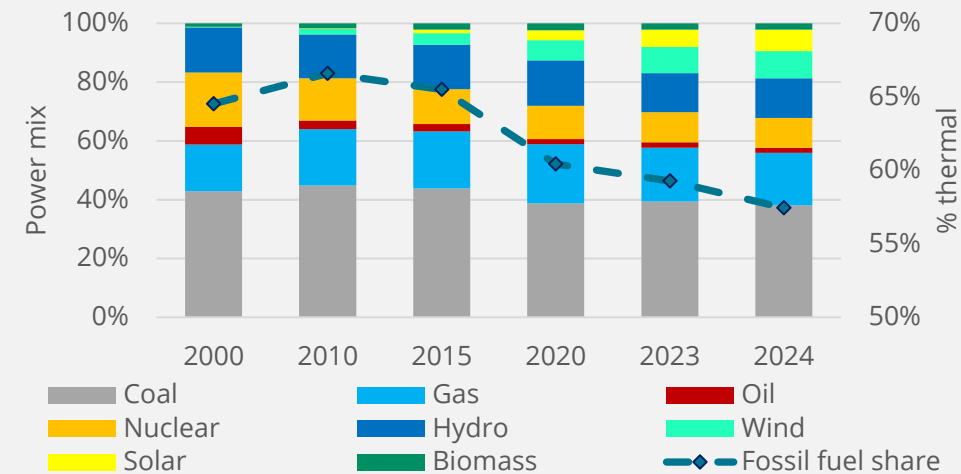
New growth in thermal power generation, though slower than wind and solar power generation

Evolution of power generation by source - G20



Source: Enerdata

G20 Power Mix



Source: Enerdata

Fossil fuels below the 60% threshold

- > Thermal power generation continued to increase in 2024 (+1%)
- > Slow trend of switching towards natural gas globally

Steady growth in renewable power generation in 2023, reaching 30% of the power mix

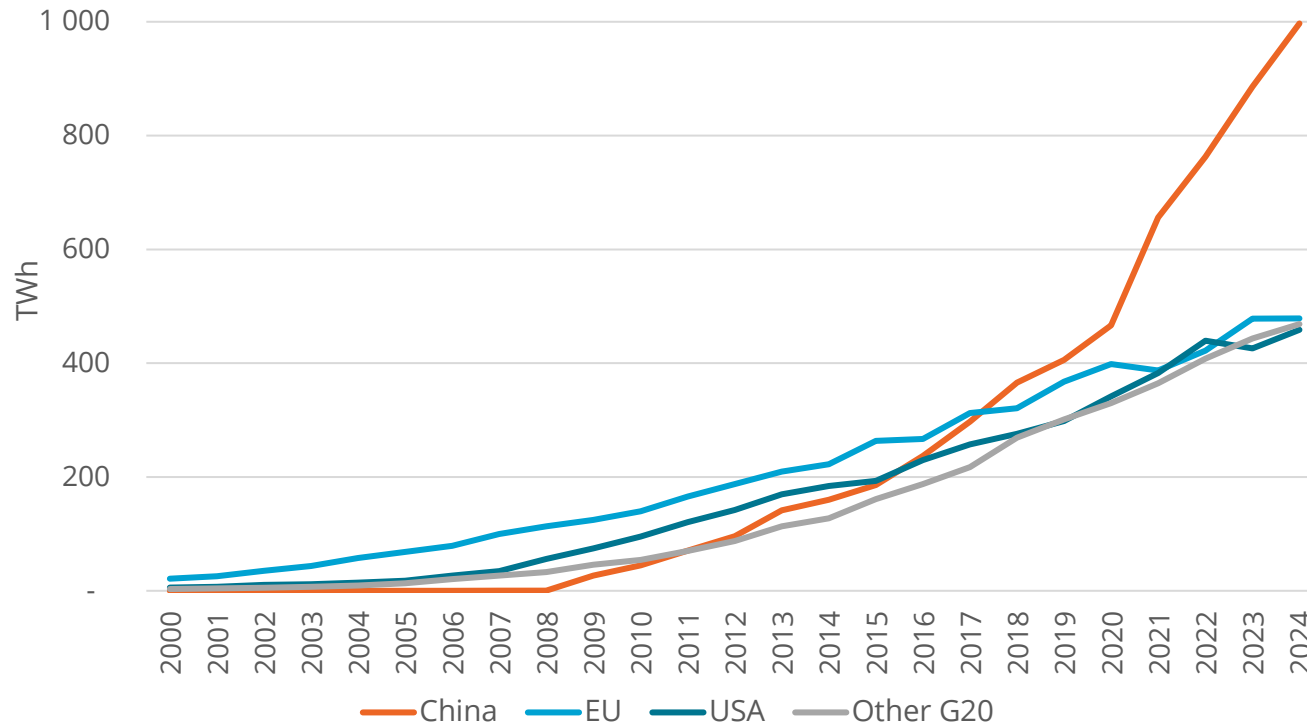
- > Strong growth in solar and wind power generation in 2024 (+29% and +8%), close to the 2023 growth
- > Wind now accounts for 9% of the power mix (2% in 2010) and solar for 7% (0% in 2010)



Wind

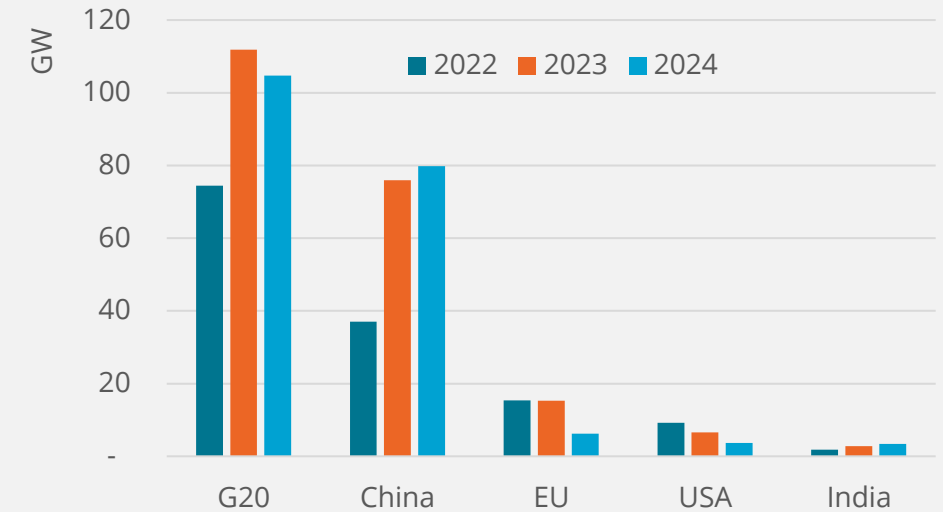
China accounted for $\frac{3}{4}$ of wind capacity additions and most of the increase in wind production in 2024

Wind power generation in the main G20 countries (TWh)



Source: Enerdata

Wind power: new capacity additions (GW)



Source: Enerdata

Steady wind installations (+105 GW, +11%)

- > Slow down after 112 GW added in 2023
- > New record in China with +80 GW, i.e. 76% of G20 wind additions
- > Slowdown in installations in the EU and the US but steady additions in India

+8% wind power generation in 2024

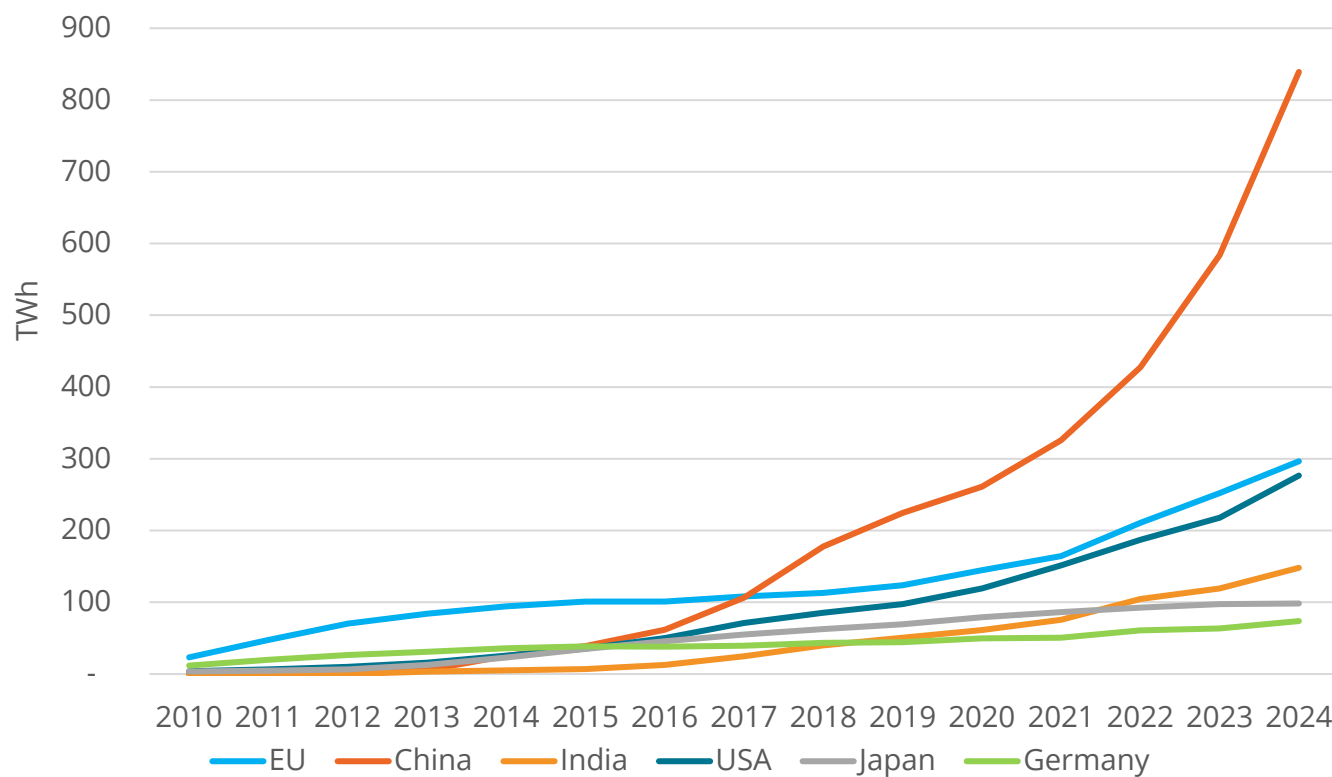
- > Double-digit growth in China, Brazil, Canada and Japan
- > Strong growth in the US (+8%) but stable in the EU
- > China accounts for 41% of G20 wind generation (around 20% each for the EU, the US and the rest of the G20)



Solar

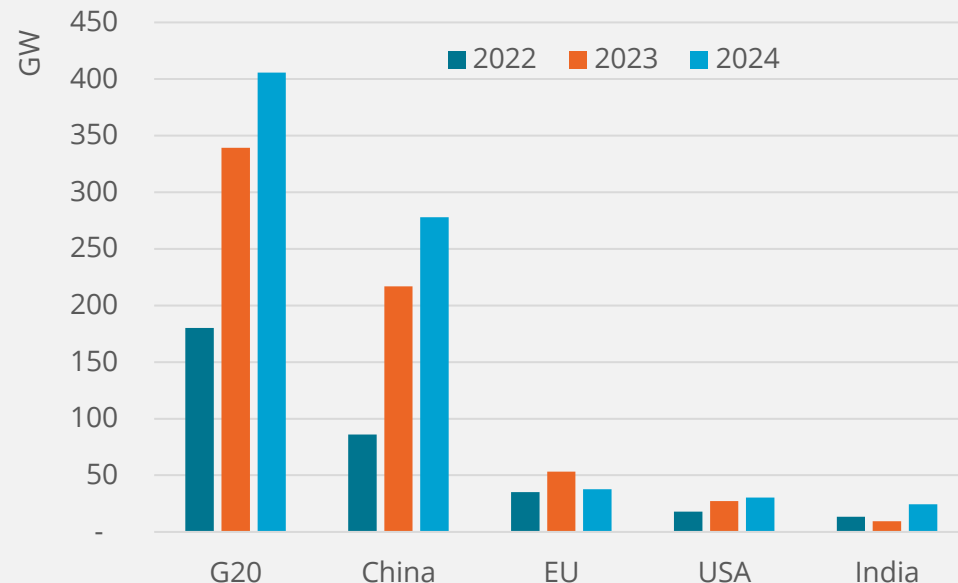
China has doubled its installed solar capacity in two years and accounts for half of the G20 solar capacity

Solar power generation in the main G20 countries (TWh)



Source: Enerdata

Solar power: new capacity additions (GW)



Source: Enerdata

New surge in installations (+406 GW)

- > New acceleration in China (+278 GW, 69% of G20's additions in 2024), the USA (+30 GW) and India (+25 GW)
- > Slowdown in the EU (+38 GW after 53 GW in 2023)

+29% in solar power generation in 2024

- > Strong growth for the main producers: China (+44%), the USA, the EU (especially in Germany), India, and Brazil
- > Overall, China accounts for 44% of the G20's solar power generation (as much as the EU, the US, India and Japan together)



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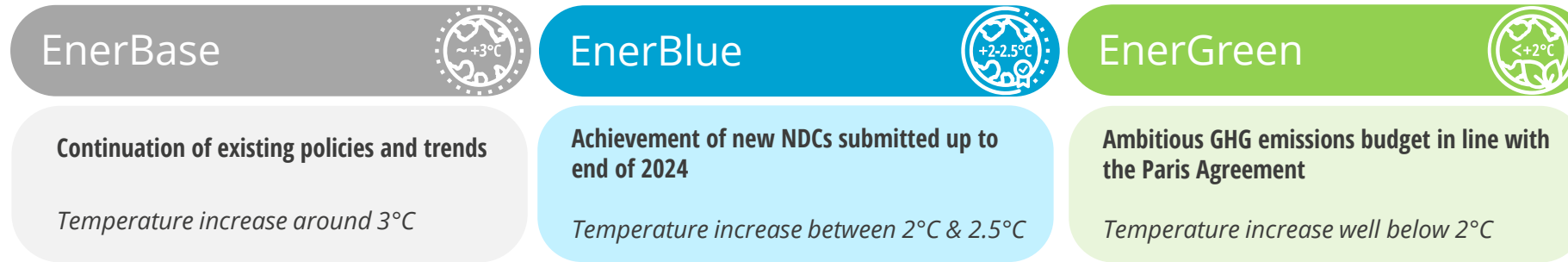
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Recent drivers behind energy consumption and emissions in the European Union

EnerFuture Scenarios

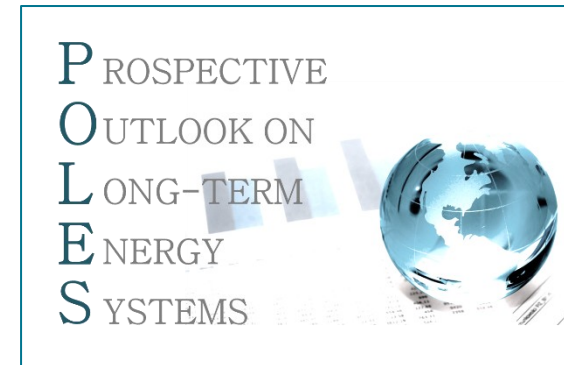
Three energy-climate scenarios to explore possible futures of global energy systems

Enerdata has prepared **three contrasted energy-climate scenarios** up to 2050 to explore **possible pathways for the global energy sector**



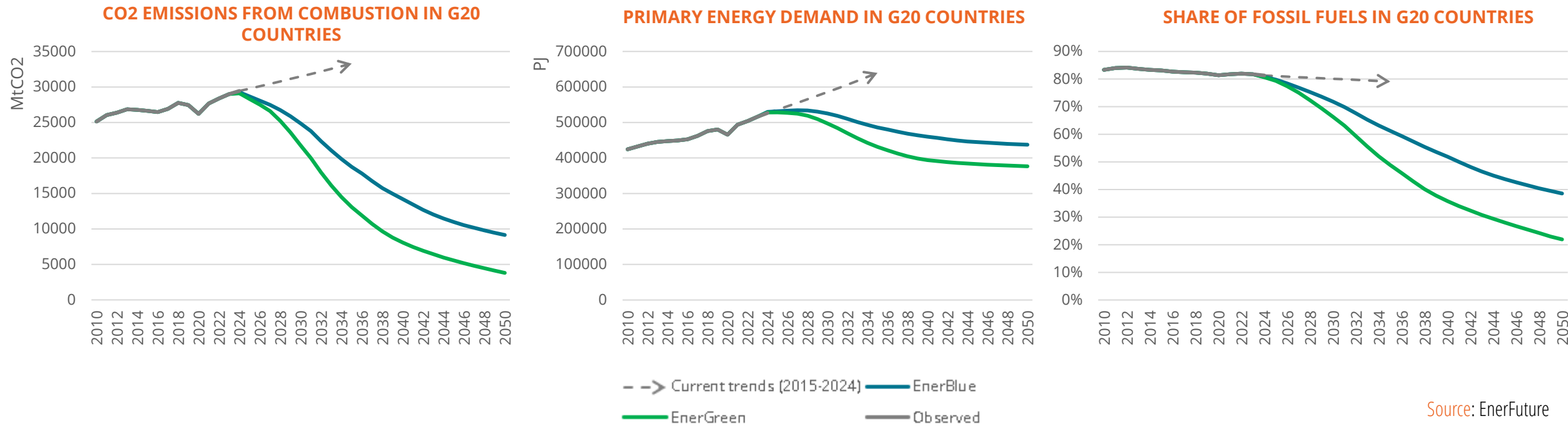
EnerFuture is relying on the recognised **POLES-Enerdata model**, an energy-economy-environment model of the global energy system, covering 66 countries and regions, with dedicating modelling of the individual end-use sectors, energy supply, prices and GHG emissions

Note: The POLES model has been initially developed by IEPE (Institute for Economics and Energy Policy), now GAEL lab (Grenoble Applied Economics Lab)



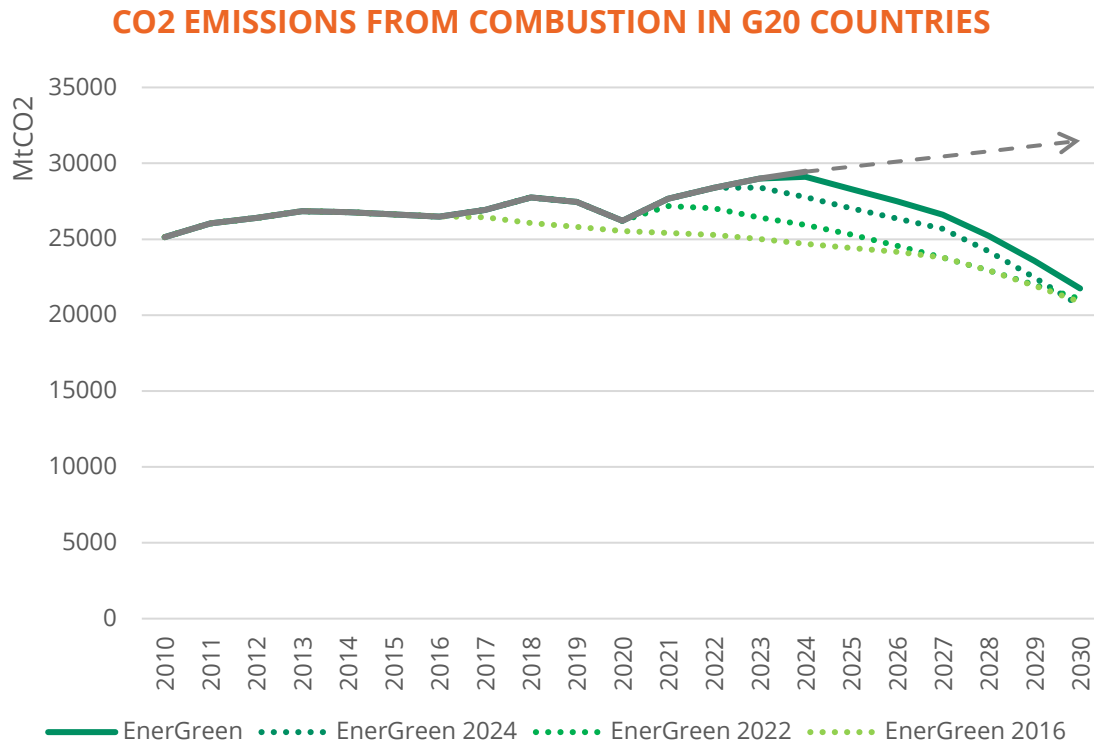
Global key indicators of EnerFuture scenarios

A major shift required to meet climate pledges and targets



Emissions still on the rise since the Paris Agreement

The path to “below 2°C” becomes increasingly unrealistic



Source: EnerFuture, Global Energy & CO₂ Data

The shift needed for a pathway aligned with the objective of the Paris Agreement keeps being pushed back

That pathway is getting more and more unrealistic, with emissions requiring a **5%/year drop on average between now and 2030**

Cumulated emissions have also been adding up with **more than 18 GtCO₂ that could have been prevented** by implementing policies consistent with these long-term ambitions

Main energy transition indicators for G20 countries

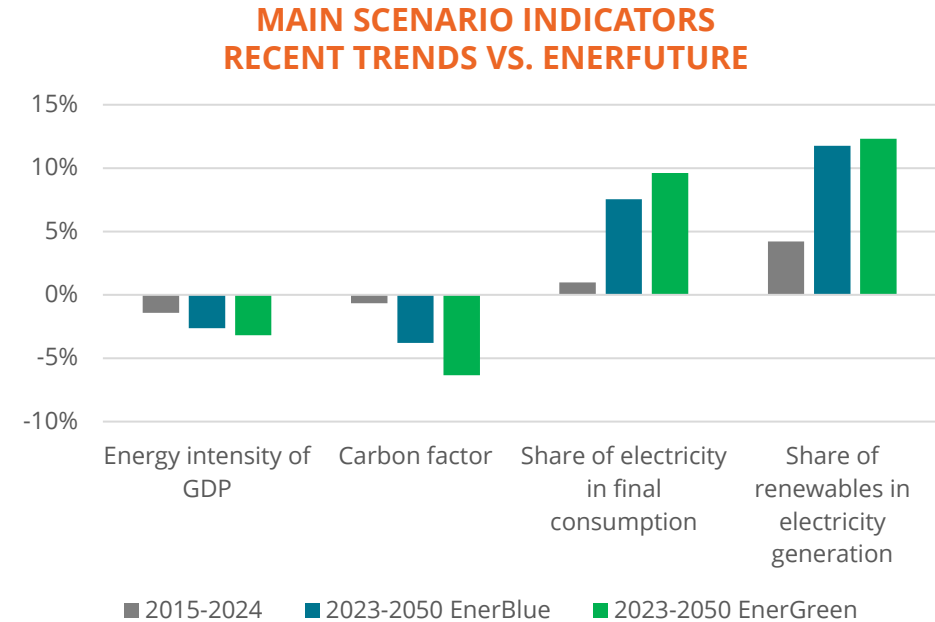
Current trends need to be significantly accelerated

Marginal progress in terms of decoupling:

- of energy consumption and economic activity on the one hand;
- and CO₂ emissions and energy consumption on the other.

Electrification of end-uses is not happening, despite being considered as a key component of deep-decarbonization pathways

While the **expansion of renewables has been noticeable**, it still **needs to be picked up** massively



Source: EnerFuture, Global Energy & CO₂ Data

Key takeaways

- Energy consumption is growing at a faster rate than before the energy crisis
- We are not yet seeing a significant decoupling between GDP and energy consumption on the one hand, and between energy consumption and CO₂ emissions on the other
- Each year passing takes us further away from a pathway compatible with the objectives of the Paris Agreement
- Dynamics vary across G20 regions: energy consumption and CO₂ emissions increase in emerging countries while relatively stagnant in developed economies, but this is mostly driven to economic and demographic factors.
- Renewables continue their expansion but at an insufficient rate, while electrification of end-uses is very limited
- Consumption of fossil fuels continues to grow in volume

A small green plant in a pot sits next to a globe on a desk. The globe shows the Americas. In the background, there are charts and documents. The word 'AGENDA' is written in large yellow letters.

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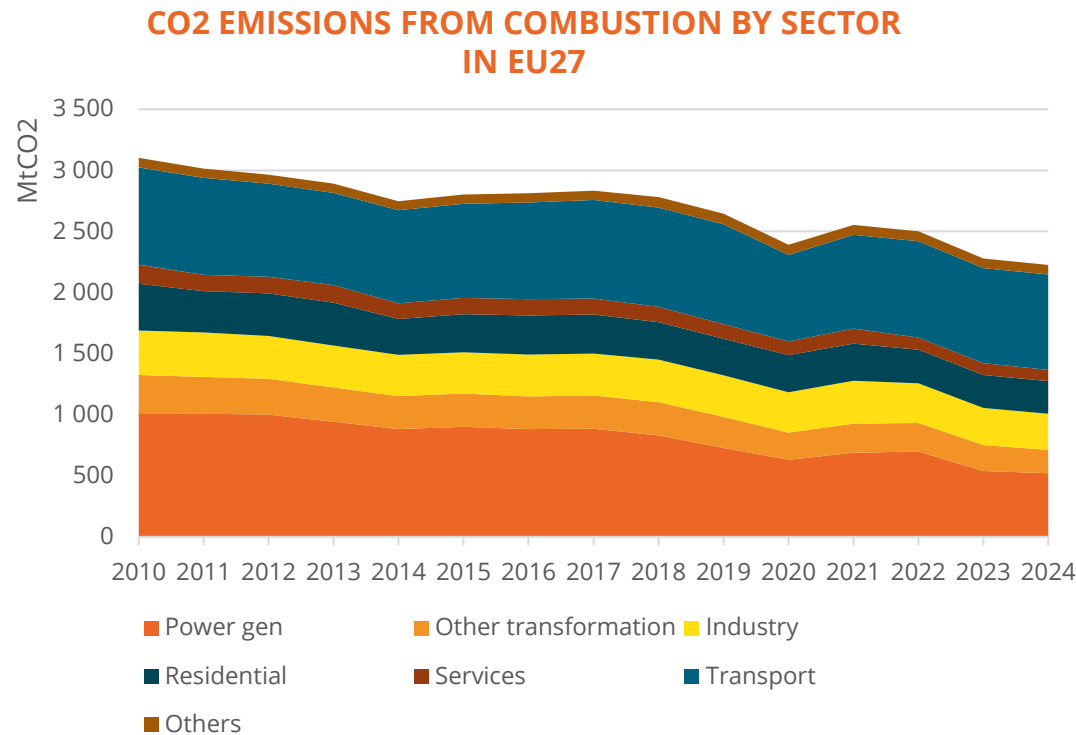
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Recent drivers behind energy consumption and emissions in the European Union

CO₂ emissions are going down in the EU27

What are the sectoral trends and drivers behind that ?



Source: Enerdata, Eurostat

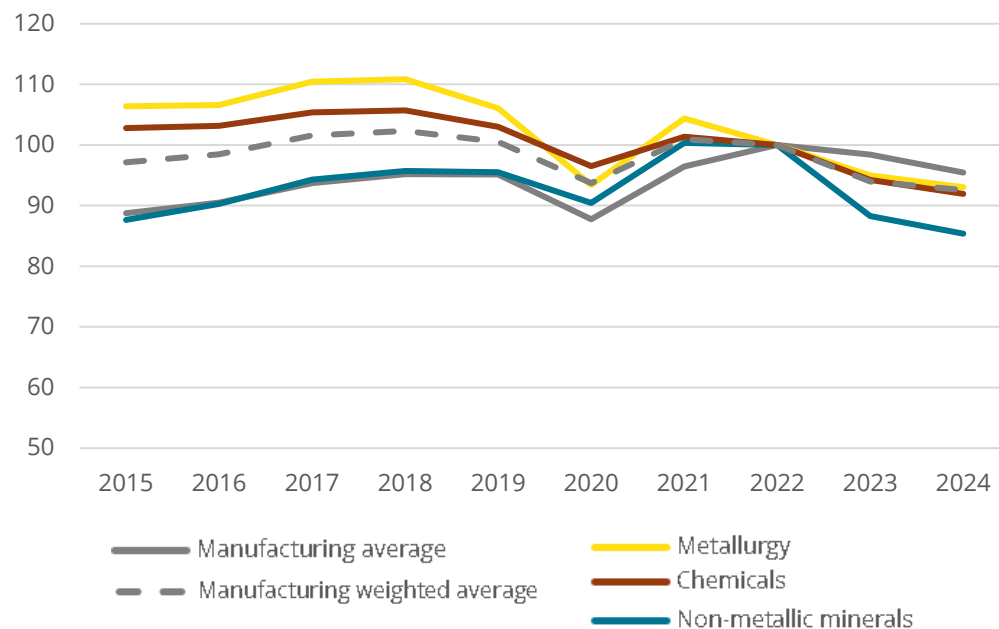
Since 2015, **emissions are down by 2%/year**, driven more by the **power sector (-6%/year)** than final consumption (-1%/year)

This is in a context of **low economic and demographic growth** => marginal progress has been made in terms of energy intensity and carbon factor

Energy-intensive industrial activity is down

The energy crisis has led to a significant loss in competitiveness

ACTIVITY INDICES OF MANUFACTURING INDUSTRY
IN EU27



Source: Eurostat, Enerdata

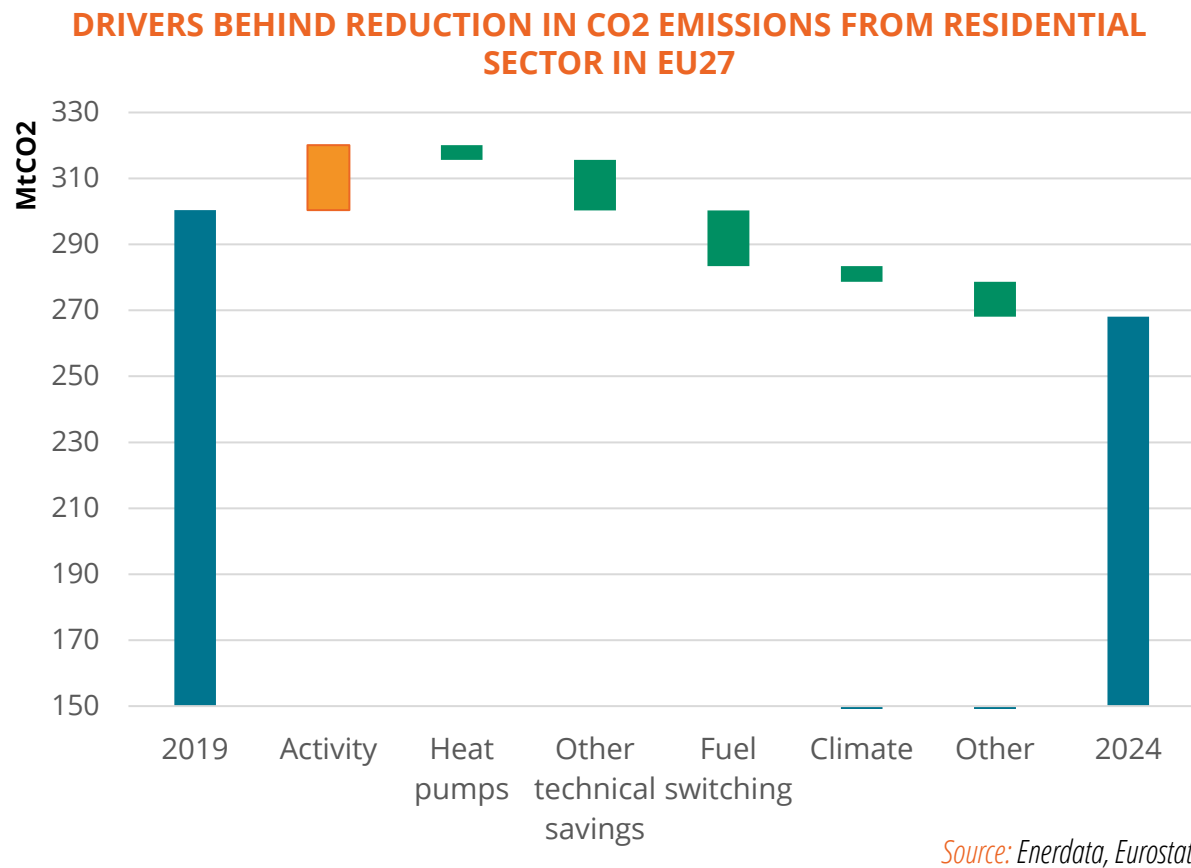
Industrial activity has declined in the EU by 5% since 2022, this is particularly the case of energy-intensive industries (-7% when accounting for energy consumption of different branches)

Activity explains most of the reduction in energy consumption and CO₂ emissions in the sector

Electricity consumption has decreased overall since 2015 and electricity has only gained marginal weight in total energy consumption

Decline in CO2 emissions from households

Equipment renewal and behaviours barely compensated for activity



Direct emissions from households are down 11% since 2019

The raise in activity (demography, dwelling surfaces, household equipment, etc.) is compensated by:

- Energy efficiency
- Fuel switching
- Milder temperatures
- Behaviours (as a reaction to high prices)

Electricity only gained 1.5 percentage points since 2019

Heat pumps have been emerging but account for **only around 8%** of residential space heating, while sales have been declining in 2024

Stabilization of emissions in transport post-COVID

EVs are not playing a significant role but traffic is starting to decline

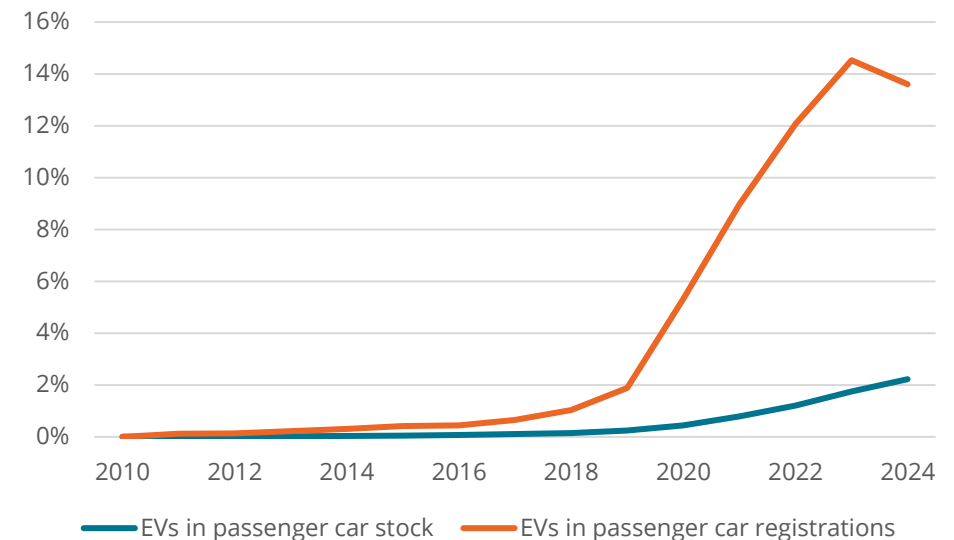
CO₂ emissions from transport are relatively stable since 2022, 4% lower than in 2019

- **Passenger traffic has not recovered its pre-COVID level**, goods traffic is relatively stable
- The **share of oil products is not decreasing** (92%, stable since 2010)
- **No modal shifts**, road transport accounts for 90% of passenger transport (stable since 2010) and 80% of goods transport (moderate increase)

A **minor role for electricity**

- Electric vehicles only account for 2% of private cars stock, with new registrations going down in 2024
- Electricity represents only 2% of total energy consumption from transport (still mainly in rail transport)

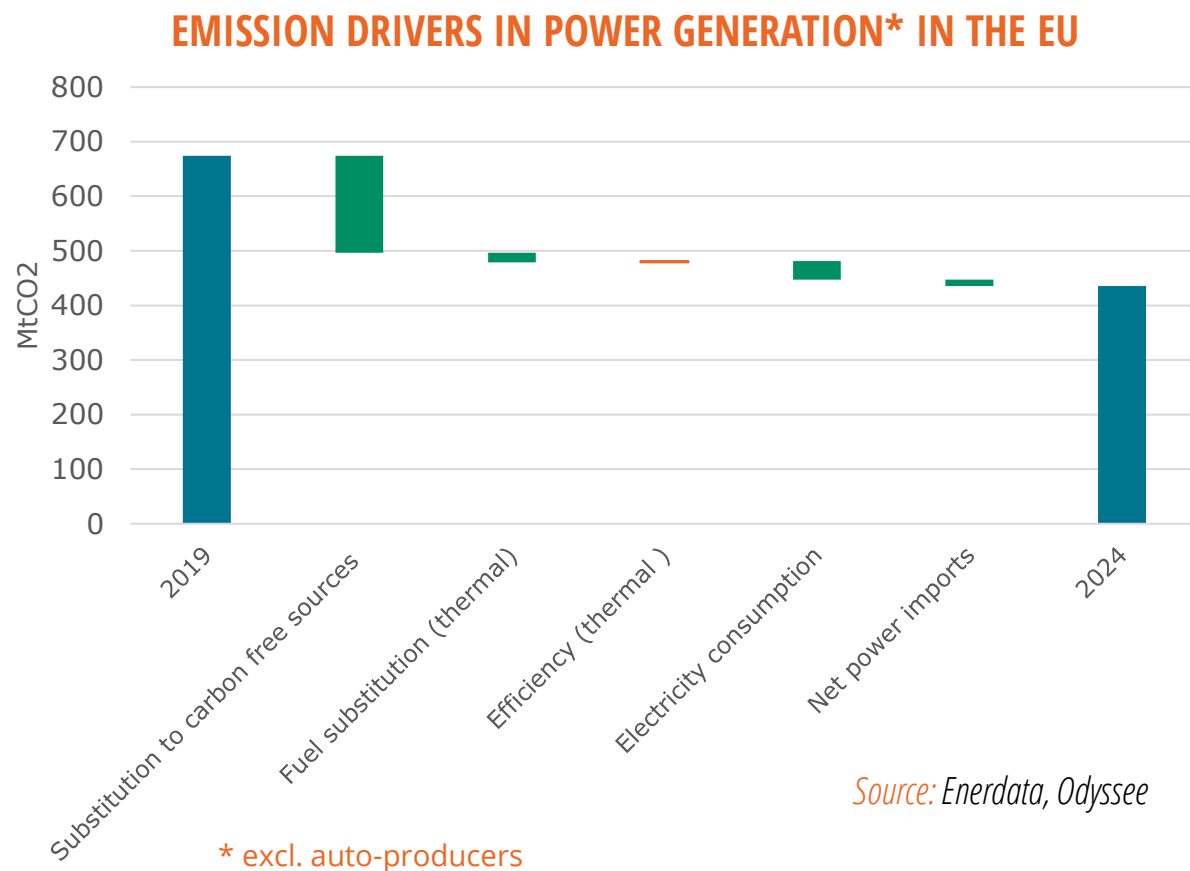
SHARE OF ELECTRIC VEHICLES IN EU



Source: Enerdata, Eurostat, ACEA

The EU power sector is on the right path

Noticeable decarbonization, but a limited impact overall



Source: Enerdata, Odyssee

Almost **50% of renewables**, mainly to the detriment of fossil fuels

The **carbon factor dropped by 40%** between 2015 and 2024

However, electricity consumption itself is driving down emissions... **The impact of decarbonizing power generation is limited in the absence of end-use electrification**

Key takeaways

- The **recent decrease in emissions in the EU** is due in large part **to the economic and demographic context**
 - European industry has been struggling since 2022
 - Contrary to emerging economies: increasing population and access to energy are not driving energy consumption
- Low-emission and energy efficient technologies are emerging but not at a high-enough pace
 - **Decarbonization of power generation has been significant...**
 - ... but in the **absence of substantial electrification** of end-uses, impact is limited
 - EVs and heat pumps are still very niche applications, and start to show signs of slowing down
- (Small) positive changes in behaviours to build upon ?
 - Energy sufficiency in households, though mostly as a response to high energy prices
 - Passenger traffic has not fully recovered its pre-COVID levels

Questions & Answers

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Thank you for your attention

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