

Global Economic Outlook

September 2024



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Cut-off date for data

13 September 2024

CF survey date

9 September 2024

GEO publication date

20 September 2024

Notes to charts

ECB, Fed, BoE and BoJ: midpoint of the range of forecasts.

The arrows in the GDP and inflation outlooks indicate the direction of revisions compared to the last GEO. If no arrow is shown, no new forecast is available. Asterisks indicate first published forecasts for given year. Historical data are taken from CF, with exception of MT and LU, for which they come from OE.

Leading indicators are taken from Bloomberg and Refinitiv Datastream.

Forecasts for EURIBOR and LIBOR rates are based on implied rates from interbank market yield curve (FRA rates are used from 4M to 15M and adjusted IRS rates for longer horizons). Forecasts for German and US government bond yields (10Y Bund and 10Y Treasury) are taken from CF.

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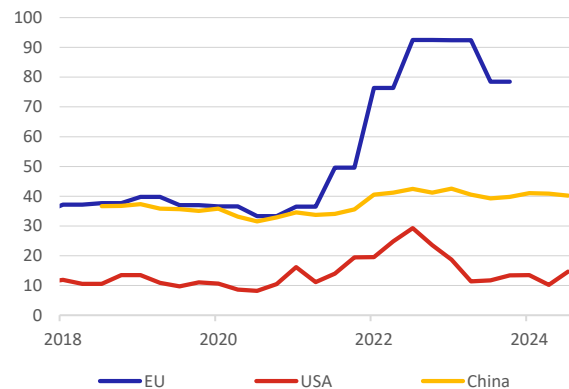
I. Introduction

Regarding the war in Ukraine, both the possibility of ending it and of breaking the taboo over the use of weapons by the Ukrainians to strike further into the Russian interior are beginning to be discussed. Russian attacks on Ukrainian towns are continuing and strong language regarding an escalation of the conflict is being bandied about. The Ukrainian army still controls some Russian territory in the Kursk region, while the Russians have made further progress in occupying more Ukrainian territory. Unfortunately, the war is not over...

September is the month of meetings of all key central banks. As expected, the ECB lowered interest rates by 25 bp and at the same time adjusted the spread between the main refinancing operations (MRO) rate and the deposit facility rate (DFR) from 50 bp to 15 bp. In September, the US Fed made its expected first interest rate cut of 50 bp, while financial markets expect further rate cuts totalling at least 50 bp by the end of the year. The Bank of England decided to keep its monetary policy unchanged at 5 % and so did the Bank of Japan that kept the rates at 0.25 %.

Competitiveness is today's key word. Since the series of crises has subsided, the extent of their future ability to assert themselves across different fields in an international environment is being discussed in a number of European states, in the EU as a whole and elsewhere around the world (e.g. the Fed's Beige Book). The [EU Competitiveness Report](#) was discussed which, among other things, quantifies the need to increase investment to maintain the competitiveness of European states with the USA and China. At the same time, higher investment put pressure on their sources of financing which, according to the Report, could be secured by the regular issuing of European bonds. This can be expected to be an explosive topic in the EU and euro area countries.

Gas price for industrial customers in various regions around the world, EUR/MWh



Source: EIA, Eurostat, CEIC, Bloomberg

Note: Data for the EU include taxes and fees and are only available for each half-year and commercial customers as a whole. Other data are averaged for the given quarter.

The chart in the September issue shows the evolution of the price of gas for the commercial sector – which has a huge impact on the competitiveness of individual economies – in various regions around the world. Before the energy crisis, even energy-intensive industry in Europe had a chance to compete with its products on the global market. The markedly higher gas price in Europe is further exacerbating the loss of price competitiveness which, together with ongoing structural changes, is hampering the resumption of economic growth in Europe.

The current issue also contains an analysis: [“Green transformation: summary of objectives and importance of critical minerals”](#). The article presents what specific goals have been agreed in this area and how successfully they are being met. The green transformation will require significant investments in new technologies and is, to some extent, conditional on the availability of “critical materials”, which are an essential part of the clean energy transition. The article points out that effective recycling and innovation in clean energy materials are key to alleviating the pressure to extract natural resources and thus to reducing environmental and geopolitical risks.

GEO barometer for selected countries

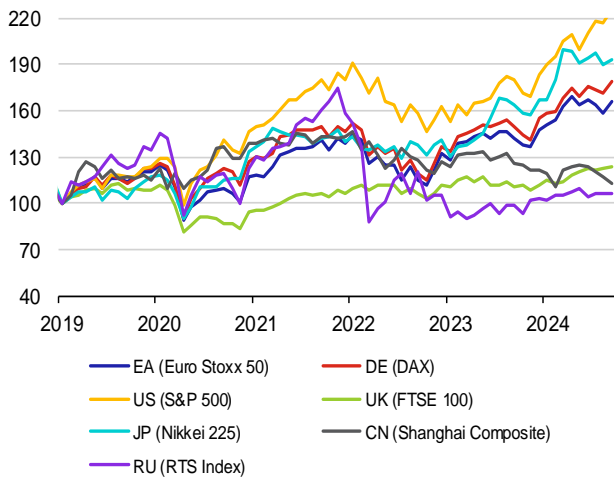
		EA	DE	US	UK	JP	CN	RU
GDP (%)	2024	0.7 ↘	0.0 ↘	2.5 →	1.0 →	0.0 →	4.8 ↘	3.4 ↘
	2025	1.3 →	0.8 ↘	1.7 →	1.2 →	1.2 →	4.4 →	1.7 →
Inflation (%)	2024	2.4 →	2.3 ↘	3.0 →	2.6 →	2.5 →	0.5 →	6.9 ↘
	2025	2.0 →	2.1 ↘	2.2 →	2.4 ↘	2.1 →	1.3 →	4.7 ↘
Unemployment (%)	2024	6.5 →	6.0 →	4.1 →	4.4 →	2.6 ↘	3.4 →	2.6 →
	2025	6.5 →	6.0 ↘	4.4 →	4.4 →	2.4 →	3.3 →	2.6 →
Exchange rate (against USD)	2024	1.11 ↘	1.11 ↘		1.30 ↘	141.3 ↘	7.19 ↘	92.5 ↘
	2025	1.13 ↘	1.13 ↘		1.32 ↘	134.7 ↘	7.07 ↘	96.1 ↘

Source: Consensus Forecasts (CF)

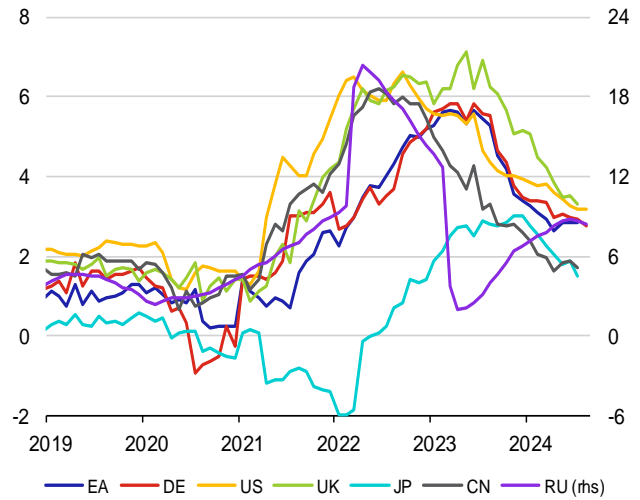
Note: The arrows indicate the direction of the revisions compared with the last GEO.

II. Macroeconomic barometer

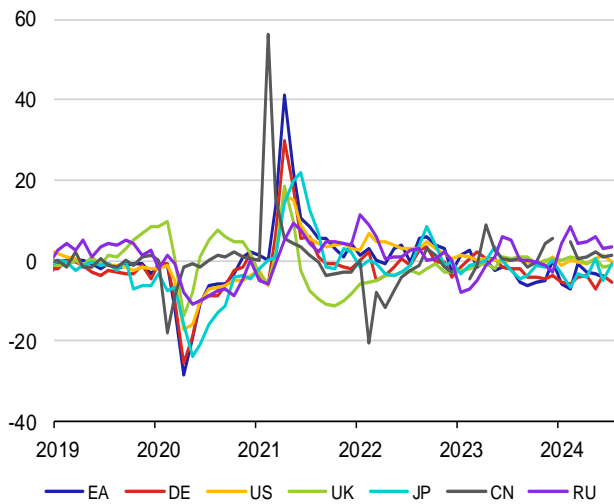
Equity markets development, index 100 = January 2019



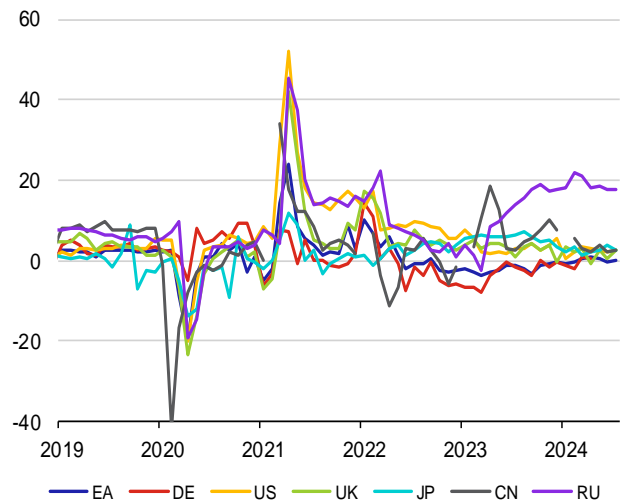
Core inflation, %



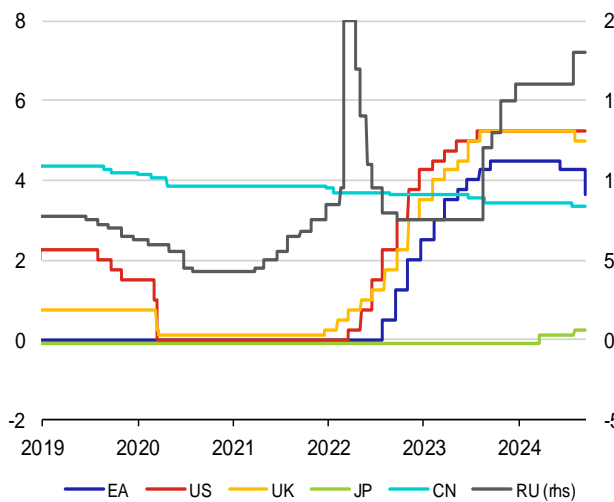
Manufacturing production, yoy %



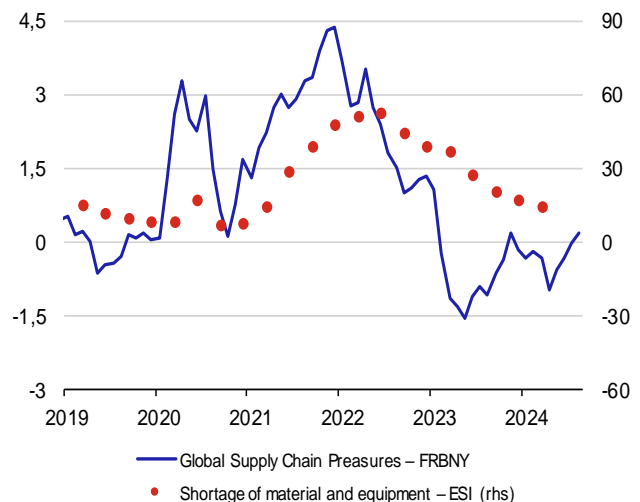
Retail sales, yoy %



Monetary policy rates, %



Supply chains development

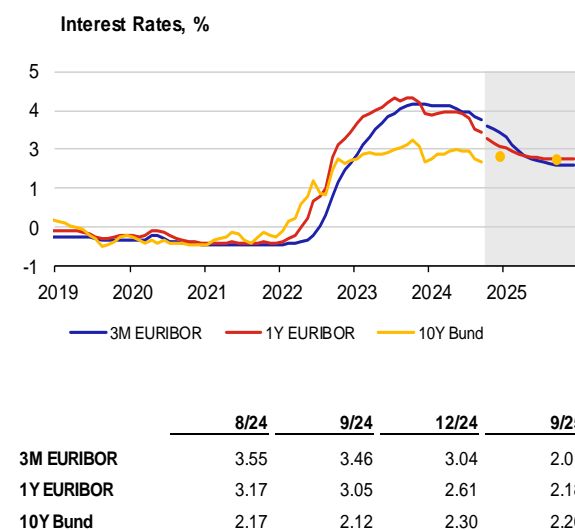
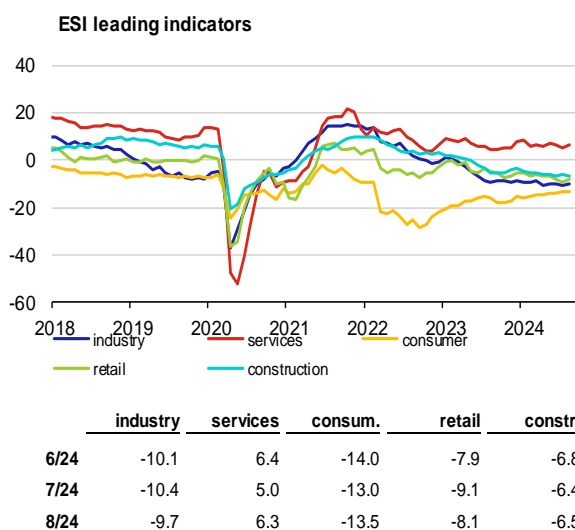
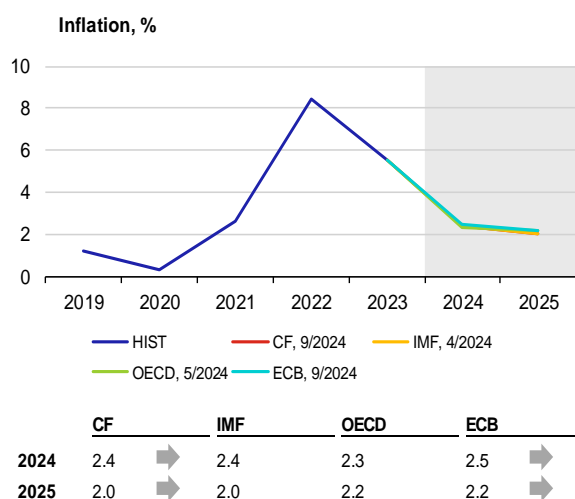
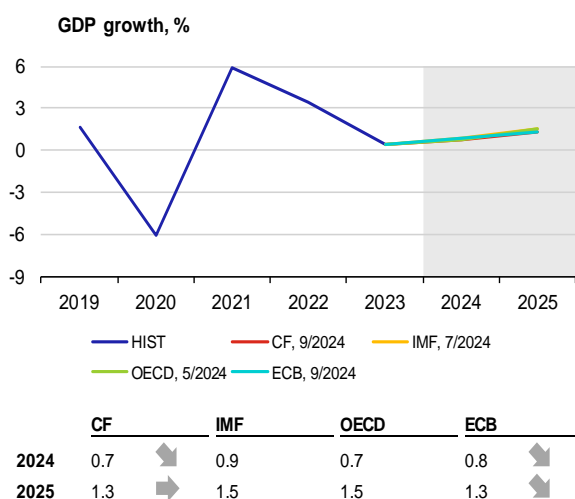


Source: Refinitiv Datastream, European Commission.

III.1 Euro area

The outlook for euro area GDP growth has been shifted lower for this year and will thus remain subdued at below 1%. After something of a recovery at the beginning of this year, driven mainly by net exports, there was a noticeable slowdown in the second quarter. The main blame was placed on a further quarter-on-quarter decline in investment. Greece, the Netherlands and Spain were the main drivers of growth, while Ireland, Latvia and Austria ended up at the imaginary tail, with Germany also doing poorly some distance behind. In a year-on-year comparison, GDP grew by only 0.6% in the second quarter (0.2% quarter on quarter) and weak growth is expected for the rest of the year. It is only expected to pick up next year. The August composite PMI improved, but mainly thanks to services. European industry in particular is currently facing difficulties, while the services sector is developing visibly better. On the one hand, consumer confidence and private consumption are having a positive effect, supported by wage growth and gradually rising real disposable income. By contrast, weak business investment and higher household savings remain obstacles to a stronger economic recovery. On the labour market, unemployment is expected to remain at historically low levels, while productivity will improve gradually.

The inflation outlook remains unchanged again, in contrast to the lowered outlook for GDP growth. Headline inflation in the euro area slowed to 2.2% in August, significantly closer to the ECB target. Despite a slight slowdown, however, core inflation remained elevated (2.8%), with slightly higher year-on-year growth in services prices (4.2%) recorded in August. Despite a temporary rise in headline inflation at the end of this year, it is expected to gradually return to 2% at the start of next year. This will also be fostered by the observed slowdown in euro area wage growth. The fulfilment of the inflation outlook led the ECB to its expected 0.25 percentage point rate cut at its September meeting. The accompanying statement shows that the ECB will continue to oscillate between supporting economic growth and seeking to bring inflation to its target. The August moderation in inflation thus provides room for a possible further easing of monetary policy, although CF still expects rates to remain stable at the October meeting.

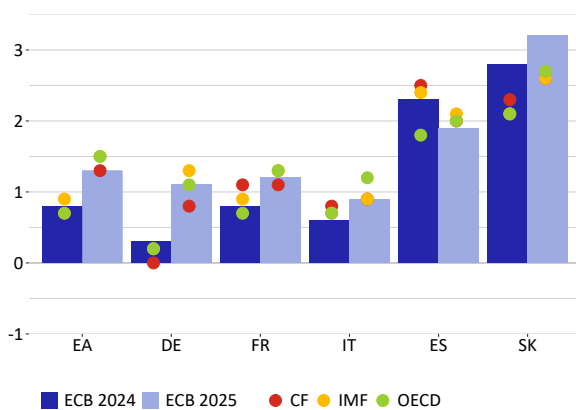


III.2 Germany

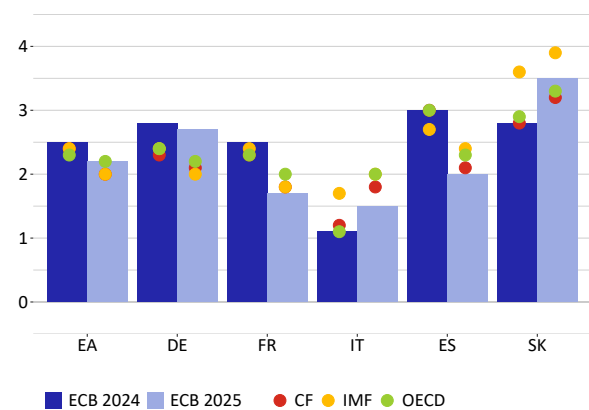
Detailed results for the second quarter confirm the worrying economic downturn. Economic performance declined slightly quarter on quarter (by 0.1%) after a slight increase in the first quarter (0.2%). This result was mainly due to declines in household consumption, investment and net exports. From a sectoral point of view, industry and construction had negative contributions. There have been attempts to meaningfully kick-start activity since the pandemic, but it has suffered several setbacks and there are now concerns about further economic developments. CF now predicts zero GDP growth this year and only 0.8% growth next year. In addition, the August developments in a number of indicators were not positive. The composite PMI recorded another and deeper contraction in private sector activity in August (48.4) due to a significant contraction in the manufacturing sector (42.4) together with a slowdown in growth in services sector (51.2). According to the Ifo and ZEW indices, the sentiment in German firms is on a downward trend. Businesses not only see their current situation as being worse, but are also more pessimistic in their expectations for the coming months. Consumer sentiment has also deteriorated significantly, affected by lower income and economic expectations. All of the above suggest that the German economy is stagnating and teetering on the brink of a crisis.

August brought a slowdown in harmonised consumer price inflation to 2%. After accelerating in July (2.6%), consumer price inflation slowed down again year on year, to a level last recorded more than three years ago (in March 2021). Falling energy prices in particular had a dampening effect on inflation, while growth in services prices is still above its long-term average and is pushing inflation upwards. Core inflation, adjusted for food and energy prices, slowed slightly to 2.8% after a period of stagnation. CF now forecasts inflation of 2.3% this year and a slowdown to 2.1% next year. The decline in industrial producer prices slowed again to 0.8% year on year in July (compared to 1.6% in June), with lower energy prices remaining the main reason, although prices of intermediate goods recorded a slight increase for the first time in a long time.

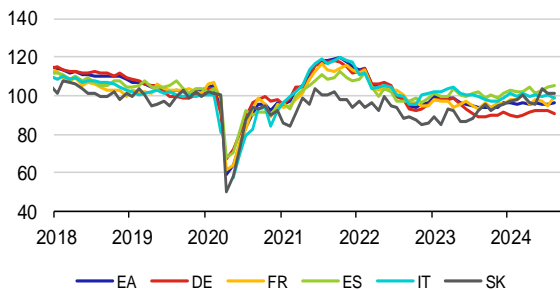
GDP growth in selected euro area countries in 2024 and 2025, %



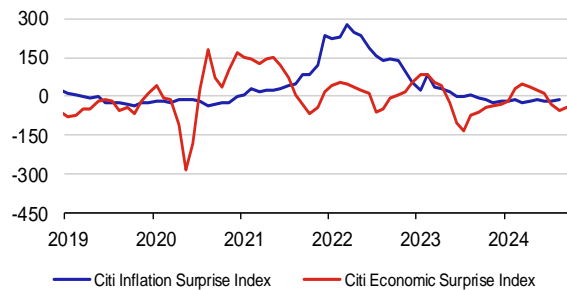
Inflation in selected euro area countries in 2024 and 2025, %



ESI leading indicators



Economic and inflation surprises in the euro area, %



	EA	DE	FR	ES	IT	SK
6/24	96.0	92.1	97.3	102.5	99.8	103.7
7/24	96.0	92.2	95.1	104.1	100.1	101.3
8/24	96.6	90.5	99.4	105.4	98.9	101.1

Inflation expectations based on 5year inflation swap and SPF

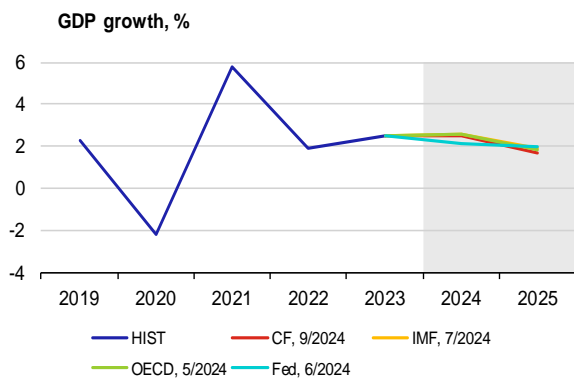
	5y5y	SPF
7/24	2.28	2.02
8/24	2.14	2.02
9/24	2.10	2.02

III.3 United States

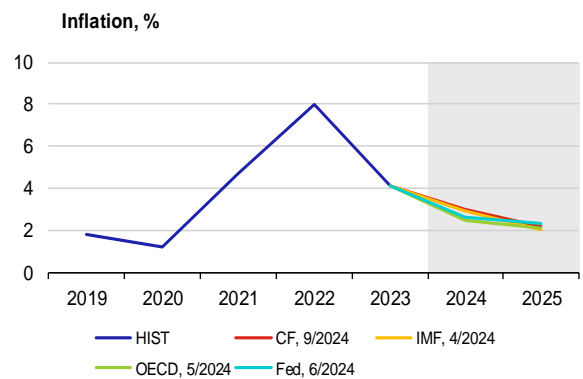
The markets expect rates to be cut by 0.25 percentage point at the September meeting, and also that the American central bank will lower rates further at each subsequent meeting. Fed Chairman Jerome Powell also said, at the annual meeting of central bankers in Jackson Hole, that the time had come to ease monetary policy. Inflation fell to 2.6% in August and core inflation to 3.2%. In month-on-month terms, consumer price growth thus reached the central bank's target. Meanwhile, the labour market is sending signals of cooling – the new jobs figures for non-agricultural sectors (142,000) fell short of expectations in August (160,000), yet unemployment fell. Sentiment indicators remain positive in services, but industry lags behind, as elsewhere in the world.

GDP growth was revised higher for the second quarter (3%), mainly thanks to consumer demand. However, growth is expected to slow in the second half of the year. The outlook for GDP growth both this year and the next remains unchanged among the CF analysts, as does the inflation outlook. The same GDP growth figures are expected in Bloomberg's August survey. Although the advanced economy is doing well, the analysts say there is almost a one-third chance that the USA will go through a recession next year.

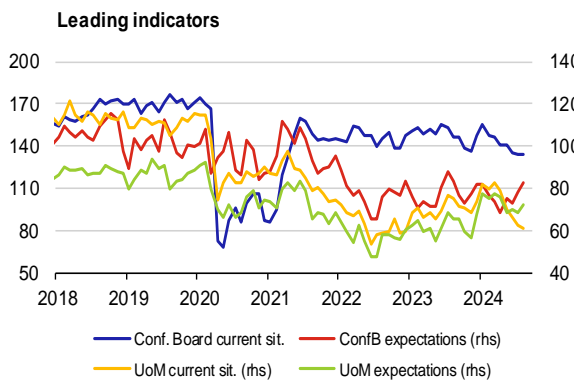
On 10 September, the candidates for the post of President of the United States – Kamala Harris and Donald Trump – met for the first time in a debate. In terms of the probability of victory, the Democratic candidate Kamala Harris came out better – her probability increased from 53% to 56% after the duel. The former prosecutor managed to put her Republican opponent on the defensive, and commentators pointed to her efforts to show that Donald Trump is no longer up to the presidency. Donald Trump raised the issue of immigrants, who are currently causing trouble especially in Springfield, Ohio, and played mainly on emotions using attacking language. The Democratic candidate was supported by former President Barack Obama and, on social networks, by the popular singer Taylor Swift.



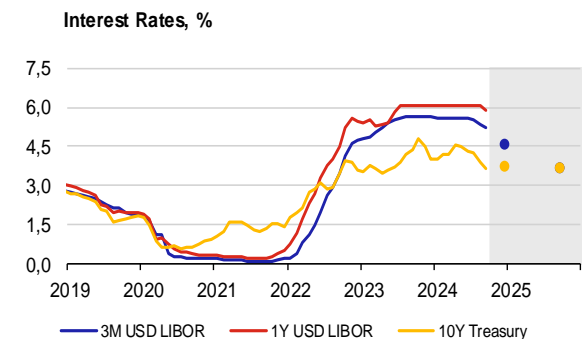
	CF	IMF	OECD	Fed
2024	2.5	2.6	2.6	2.1
2025	1.7	1.9	1.8	2.0



	CF	IMF	OECD	Fed
2024	3.0	2.9	2.5	2.6
2025	2.2	2.0	2.1	2.3



	ConfB curr.	ConfB exp.	UoM curr.	UoM exp.
6/24	135.3	72.8	65.9	69.6
7/24	133.6	78.2	62.7	68.8
8/24	134.4	82.5	61.3	72.1

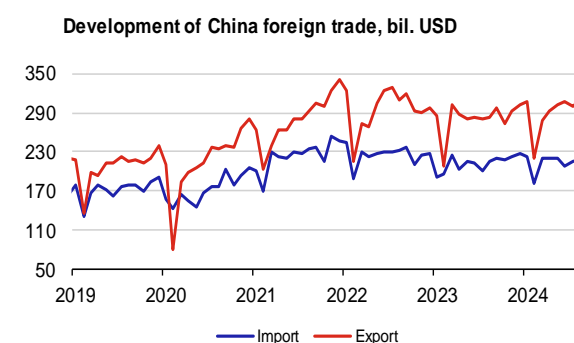
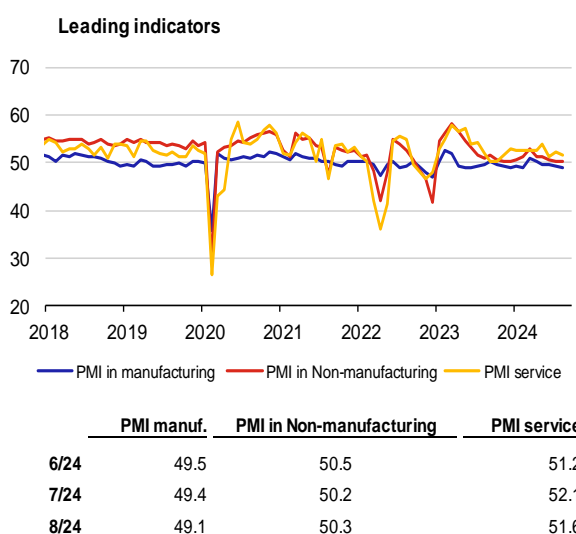
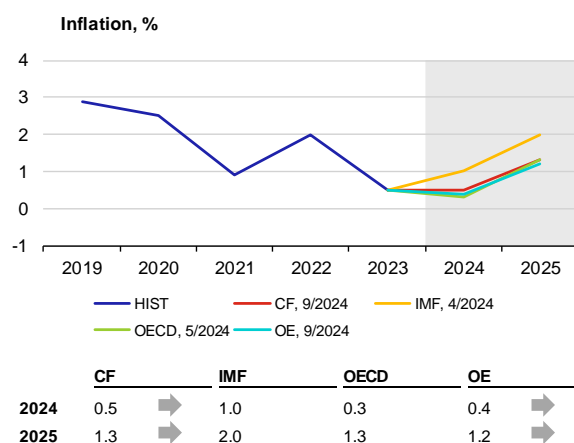
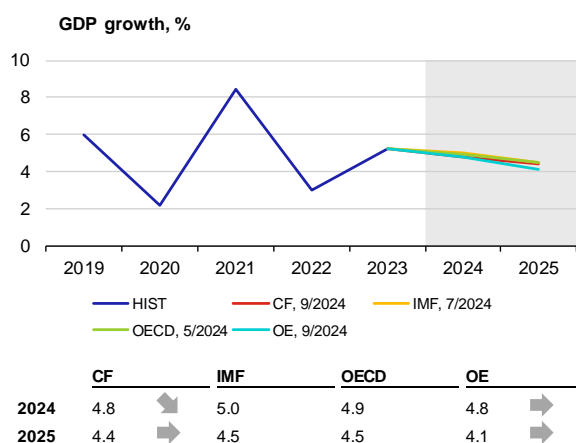


	8/24	9/24	12/24	9/25
USD LIBOR 3M	5.36	5.23	4.60	3.70
USD LIBOR 1R	6.04	6.04		
Treasury 10R	3.87	3.68	3.80	3.70

III.4 China

Leading indicators and observed data during the third quarter signal signs of weakening Chinese economic performance, mainly due to slowing growth in the industrial and services sectors. The year-on-year growth rate in retail sales decreased to 2.1% in August, while industrial production growth continued to slow, as in the previous three months, reaching 4.5% in August. Continued contraction in the manufacturing sector is indicated by the Purchasing Managers' Index (PMI) for this sector, which fell further to 49.1 in August. Despite the overall decline, a positive development was recorded in the high-tech manufacturing segment, confirming the continuing trend of industrial modernisation and growth in technology-intensive sectors. The non-manufacturing PMI remained stable with values slightly above the 50-point mark, signalling slight expansion. In services, the Caixin index showed a slight slowdown in growth in new orders, falling from 52.1 in July to 51.6 in August. Companies also faced increased labour costs, leading to a fall in employment. According to the September outlook of the CF analysts, the year-on-year growth rate of the Chinese economy will reach 4.8% this year and slow to 4.4% next year.

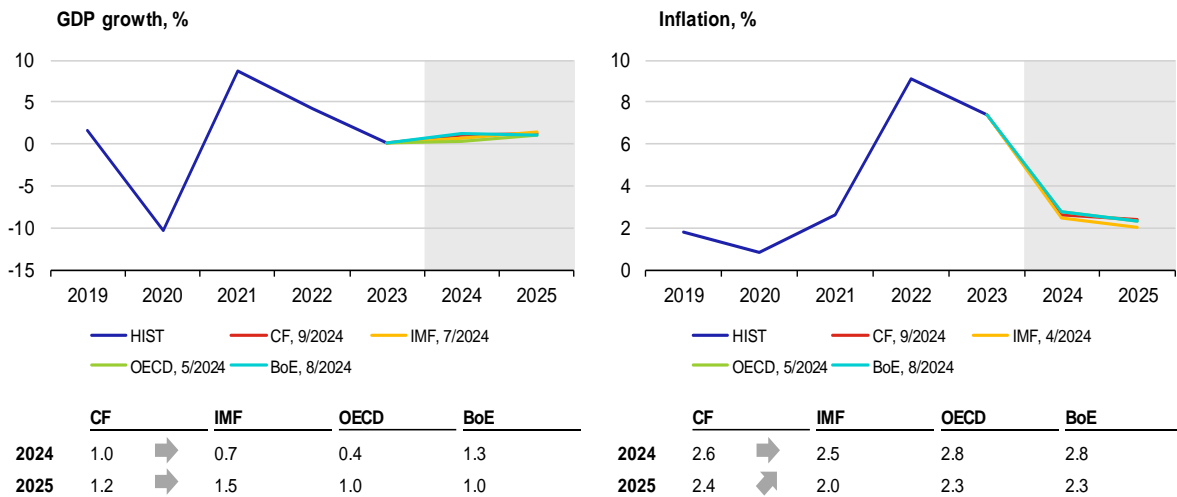
Consumer prices continued to rise modestly in August, while the decline in producer prices, which remain deflationary, deepened. Consumer prices rose by 0.6% year on year in August, a slight acceleration compared to July's 0.5% rise. This increase was mainly due to higher food prices, especially the prices of pork, fresh vegetables and fruit. On the other hand, prices in the non-food sector showed signs of weakness, falling by 0.2% year on year. This situation, where inflation remains low, provides room for further monetary policy easing by the Chinese central bank, which is likely to cut interest rates further by the end of this year. According to the September outlook of the CF analysts, consumer prices will grow by only 0.5% this year, while growth should accelerate to 1.3% next year. The sharp year-on-year decline in producer prices, from -0.8% in July to -1.8% in August, mainly reflected low domestic and foreign demand and falling prices of some commodities.



Source: Bloomberg

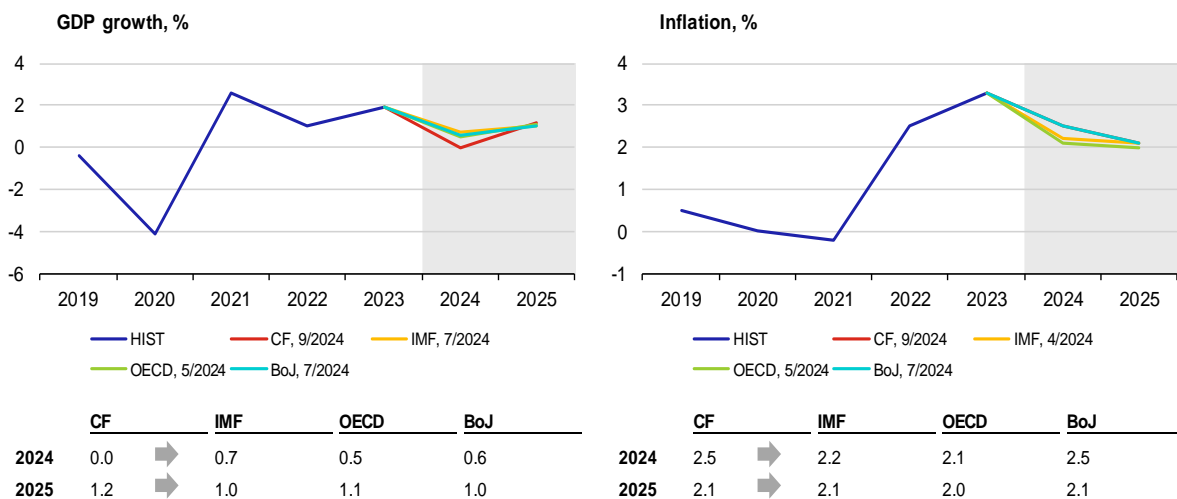
III.5 United Kingdom

The British economy unexpectedly stagnated in July for the second consecutive month. The disappointing zero month-on-month growth overshadowed the previously published optimistic results for Q2 (0.6%). The economy was hampered by a contraction in construction and manufacturing in July, with only weak growth of 0.1% in the key services sector. The fact that GDP did not grow in June underscores the challenge for the newly elected Labour government preparing its first autumn budget. Most economists expect economic activity to slow in the second half of 2024, **while** according to the BoE, GDP will grow by only 0.2% in Q4. CF maintained its forecast of 1% economic growth in 2024 and 1.2% growth in 2025. The composite PMI remains positive, reflecting the tenth expansion in private sector activity in August (53.8), whether this was due to a rise in the services sector or in the manufacturing sector. Inflation rose from the BoE's 2% target to 2.2% in July and should average around 2.5% over the next two years, according to the new CF forecast.



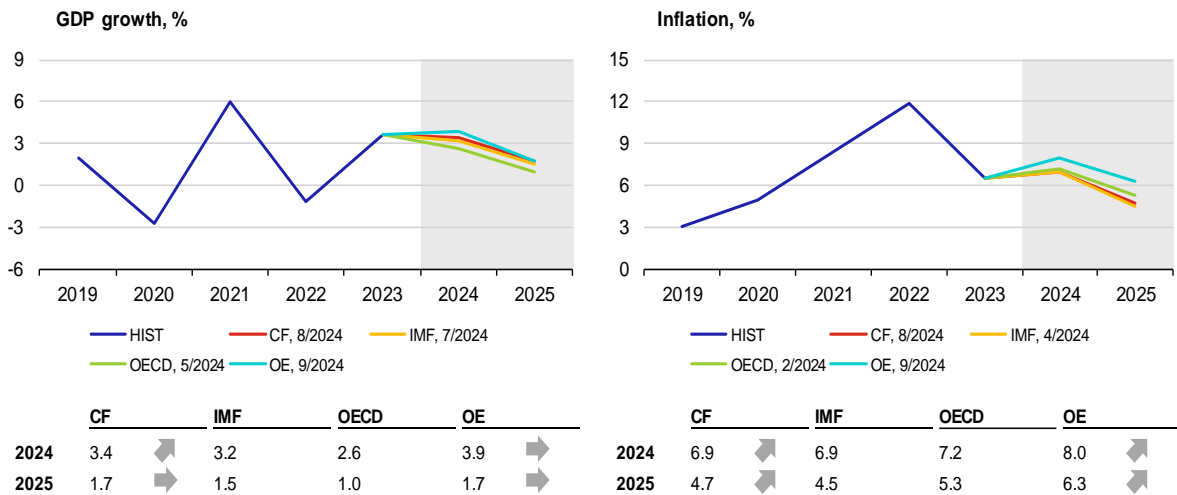
III.6 Japan

Japanese GDP was revised downwards by 0.2 percentage point to 2.9% in annualised terms in Q2. However, this revision does not change the overall picture of sustainable growth, driven by domestic demand. Private capital spending has increased, probably thanks to an increase in car production and in the demand for semiconductors. Inflation continues to cause concerns, especially as core consumer prices in Tokyo rose by 2.4% in August, exceeding expectations. The unemployment rate rose to 2.7%, while the job-to-applicant ratio rose to 1.24. Factory production returned to growth, expanding 2.8% month on month in July, but it was expected to be 3.5%. Retail sales growth slowed to 2.6% year on year in July and barely beat inflation. For the first time in eight months, the PPI slowed due to falling energy costs, easing some cost pressures for businesses. Meanwhile, the yen strengthened against the dollar, helped by expectations of a narrowing of the interest rate differential between Japan and the USA. The next rate hike is expected in October at the earliest.



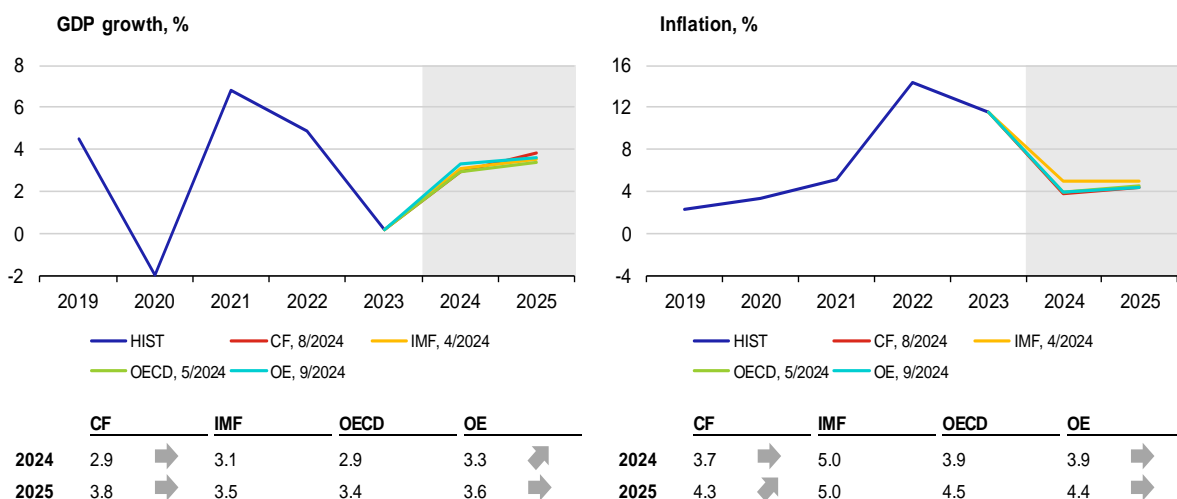
III.7 Russia

Inflation rose to 9.1% in August, its highest level since February 2023 and slightly above the analysts' expectations of 9%. However, monthly price growth slowed from 1.1% in July to 0.2%. Russia's foreign trade surplus fell from USD 11.6 billion in June to USD 8.7 billion in July coupled with a concurrent decline in exports and increase in imports. Russian oil exports continued their downward trend in August, with average weekly oil export volumes falling by 360,000 barrels per day. Although production at refineries, which have faced constant attacks by Ukrainian drones in recent months, rose to its highest level since July 2023, Russian diesel exports fell to a 10-month low in August, partly due to an outage at a Belarusian refinery. To help grow revenue, Russia plans to expand supplies through a gas pipeline to Mongolia as part of the Power of Siberia 2 project. On the other hand, President Vladimir Putin has said that he is considering restricting the export of some commodities such as uranium, titanium and nickel.



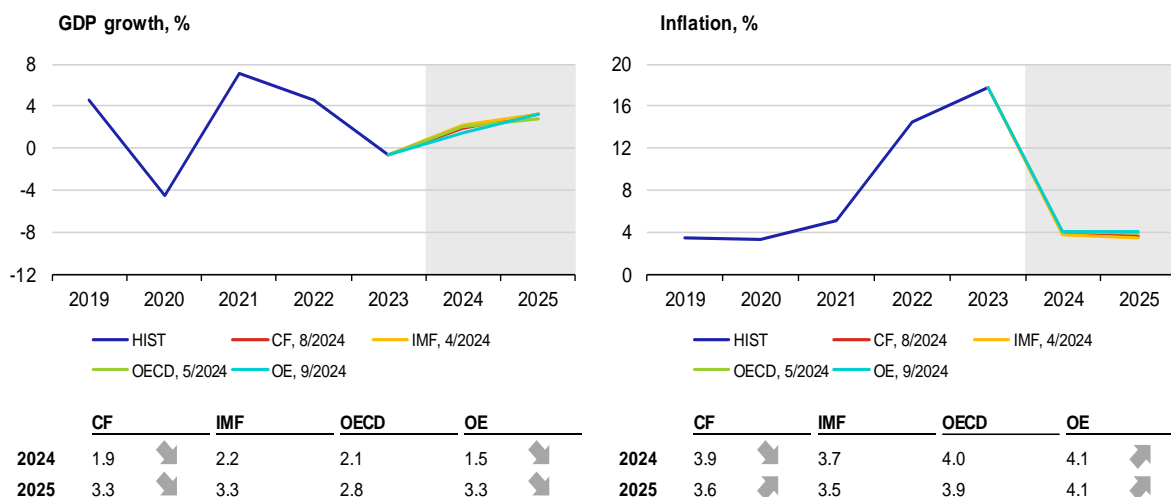
III.8 Poland

Annual inflation rose by 0.1 percentage point compared to July, reaching 4.3% in August. The main inflation pressures came mainly from the housing and energy (+9% year on year), food and non-alcoholic beverages (+4.1% year on year) and leisure activities (+4.1% year on year) segments. The National Bank of Poland again left interest rates at 5.75% at its September meeting. Governor Adam Glapiński has softened his rhetoric on interest rate cuts, admitting a possible rate cut as early as mid-2025. Poland's new draft budget for 2025 foresees the third consecutive year with a government deficit of more than 5% of GDP. The budget counts on economic growth of 3.9% and inflation at 5%, and includes increased spending on health and pensions, as well as defence spending of 4.7% of GDP in response to the conflict in Ukraine. Prime Minister Donald Tusk refuses to cut spending ahead of the presidential election, despite pressure to comply with EU fiscal rules. Following the publication of the draft budget, the zloty weakened and yields on Polish government bonds rose.



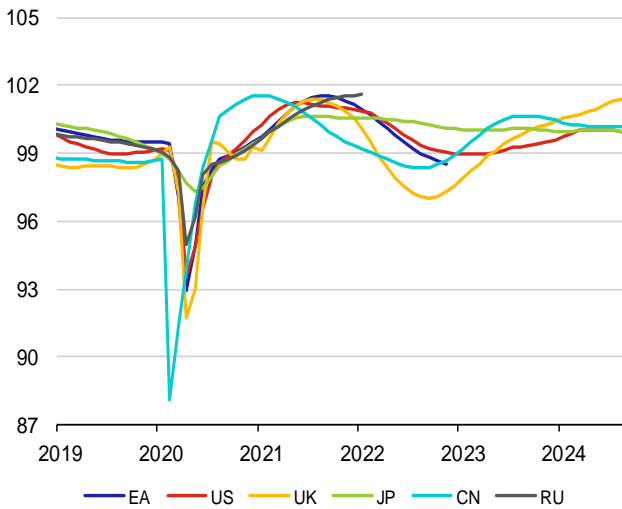
III.9 Hungary

The MNB Bank Board decided unanimously to temporarily suspend interest rate reductions. Revised GDP data confirm year-on-year growth of 1.5% in Q2. The performance of the construction and [real estate property](#) markets contributed to the year-on-year growth, while the key industrial sector continued to dampen economic growth. Consumer confidence has been stagnating for several months despite strong wage growth. However, the MNB expects a gradual decline in precautionary savings in the coming months and household consumption to become key for economic growth in the remaining half of the year. After several months of persistent inflationary pressures, the annual inflation rate fell to 3.4% in August (4.1% in July), beating market expectations (3.6%). Slower price growth was recorded mainly by food and alcoholic beverages. Despite this, the MNB maintained its cautious stance and left its key interest rate unchanged at 6.75%.

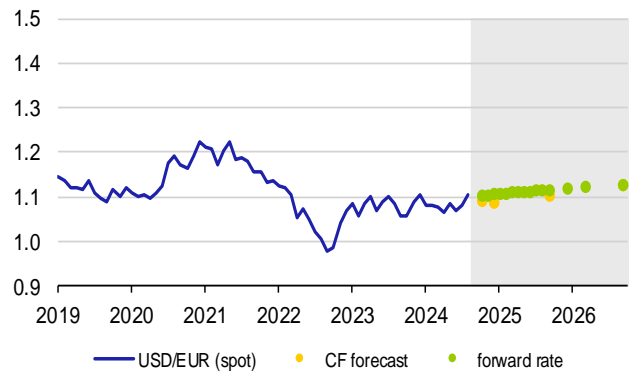


IV. Leading indicators and exchange rate outlooks

OECD Composite Leading Indicator

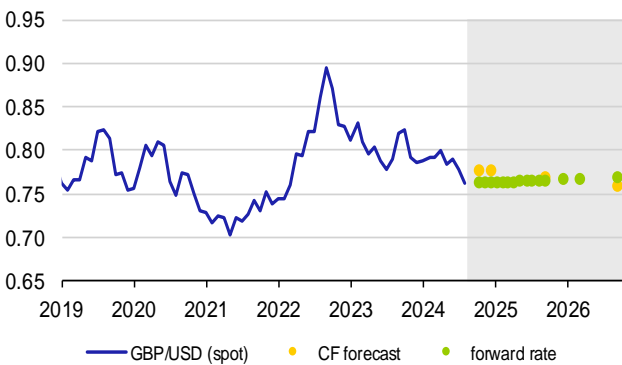


The US dollar (USD/EUR)



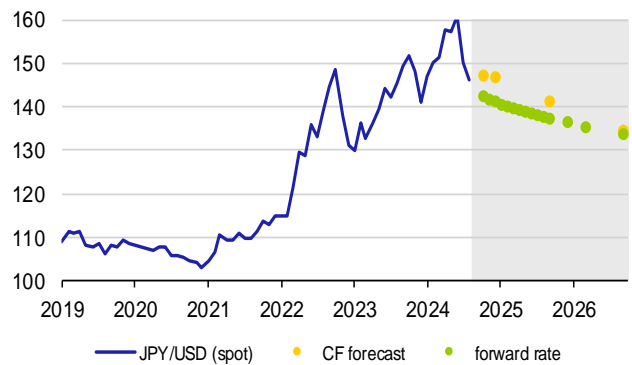
	9/9/24	10/24	12/24	9/25	9/26
spot rate	1.104				
CF forecast		1.092	1.091	1.107	1.127
forward rate		1.105	1.108	1.118	1.131

The British pound (GBP/USD)



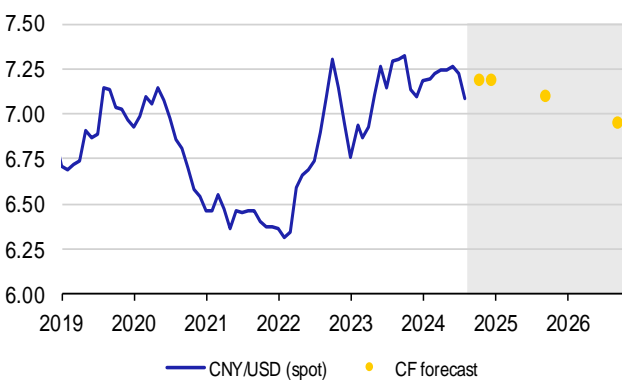
	9/9/24	10/24	12/24	9/25	9/26
spot rate	0.765				
CF forecast		0.778	0.779	0.771	0.760
forward rate		0.765	0.765	0.767	0.770

The Japanese yen (JPY/USD)



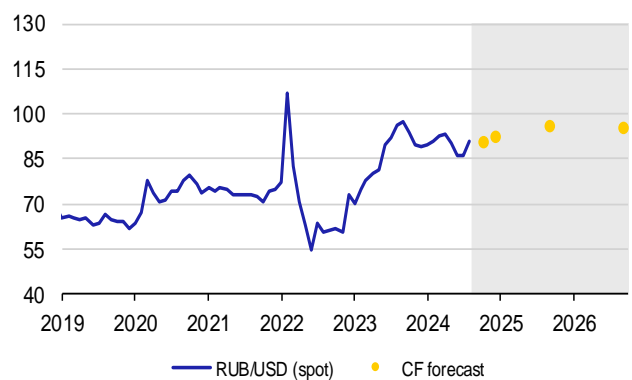
	9/9/24	10/24	12/24	9/25	9/26
spot rate	142.8				
CF forecast		147.4	147.0	141.3	134.7
forward rate		142.6	141.4	137.6	133.7

The Chinese renminbi (CNY/USD)



	9/9/24	10/24	12/24	9/25	9/26
spot rate	7.117				
CF forecast		7.189	7.190	7.104	6.959

The Russian rouble (RUB/USD)

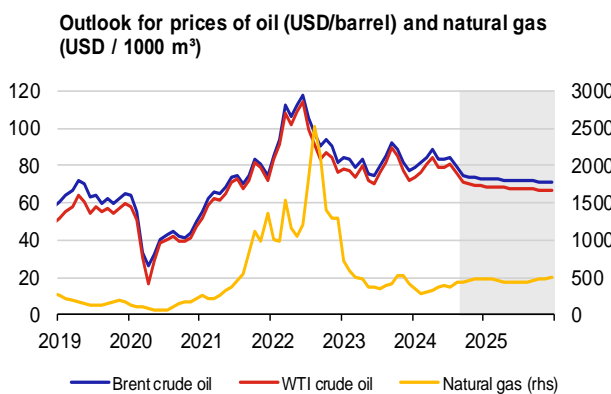


	9/9/24	10/24	12/24	9/25	9/26
spot rate	90.50				
CF forecast		91.15	92.47	96.26	95.56

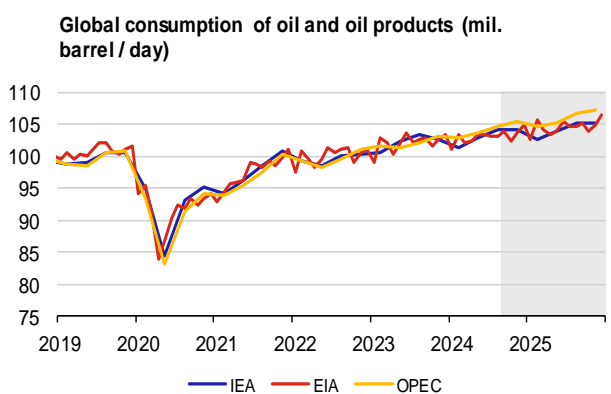
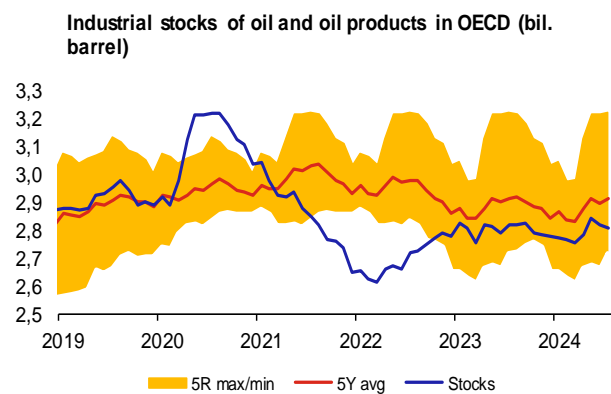
Note: Exchange rates as of last day of month. Forward rate does not represent outlook; it is based on covered interest parity, i.e. currency of country with higher interest rate is depreciating. Forward rate represents current (as of cut-off date) possibility of hedging future exchange rate.

V.1 Oil

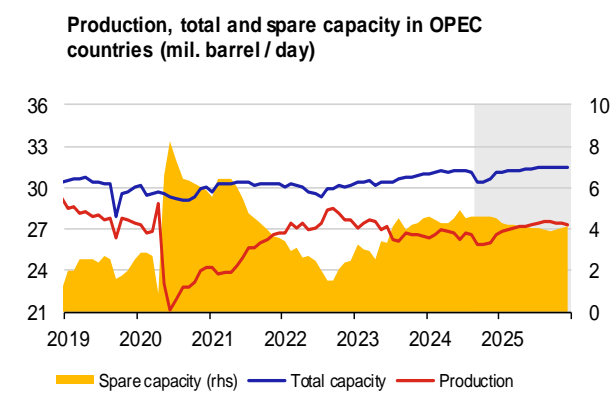
The price of Brent crude oil fluctuated strongly in the range of USD 76 to USD 82 per barrel during August, but fell sharply to below USD 70 per barrel in the first ten days of September. While the situation remains tense in the physical market, the price is being pushed down by negative sentiment in financial markets, where investors are heavily reducing their net long positions due to concerns about weakening demand for oil, especially in China. Negative data from the US labour market also contributed to the fall in prices in early September. A decision by OPEC+ to delay the start of production increases (scheduled for October) by two months did not translate into oil price growth, nor did cuts in oil production and exports from Libya. Only a reduction in oil production in the Gulf of Mexico due to the approaching Hurricane Francine stopped the decline and returned the Brent price above USD 70 per barrel. The analysts now significantly differ in their views on the global oil demand outlook. The most optimistic forecast is from the OPEC which, despite a gradual downward reassessment, expects oil demand to grow by an average of 2 million barrels per day (mb/d) in 2024 and by a still strong 1.7 mb/d in 2025. This should allow OPEC+ to gradually start raising production by the planned 0.18 mb/d each month. Even the US EIA now sees a deficit in oil supply in the physical market, which should last until mid-2025. Global oil demand growth is expected to average 0.9 mb/d in 2024 and 1.7 mb/d in 2025. The IEA is the most pessimistic, estimating demand growth for 2024 and 2025 at just 0.9 mb/d and 0.95 mb/d, respectively, while production growth should rise from 0.66 mb/d in 2024 to 2.1 mb/d in 2025 (with OPEC+ only contributing a small part of the planned production increase in this scenario). The market outlook for the Brent crude oil price from the first half of September has shifted further downwards and implies values of USD 71.3 and USD 70.1 per barrel at the end of 2025 and 2026 respectively. By contrast, the EIA expects the price of Brent crude oil to gradually rise to USD 85 per barrel in April and to stay at this level for almost the whole of 2025. The September CF expects the oil price to be stable at just below USD 80 per barrel.



	Brent	WTI	Natural gas
2024	79.82	75.65	390.27
2025	72.01	67.73	458.64



	IEA	EIA	OPEC
2024	103.20	103.09	104.23
2025	104.22	104.61	106.00



	Production	Total capacity	Spare capacity
2024	26.44	30.97	4.53
2025	27.27	31.35	4.08

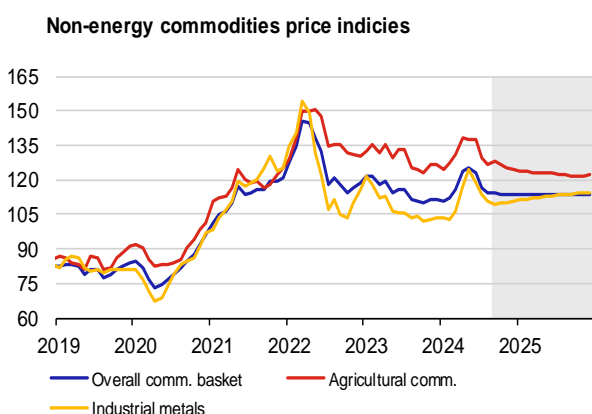
Source: Bloomberg, IEA, EIA, OPEC, CNB calculation
 Note: Oil price at ICE, average natural gas price in Europe – World Bank data. Future oil and gas prices (grey area) are derived from futures. Industrial oil stocks in OECD countries – IEA estimate. Production and extraction capacity of OPEC – EIA estimate.

V.2 Other commodities

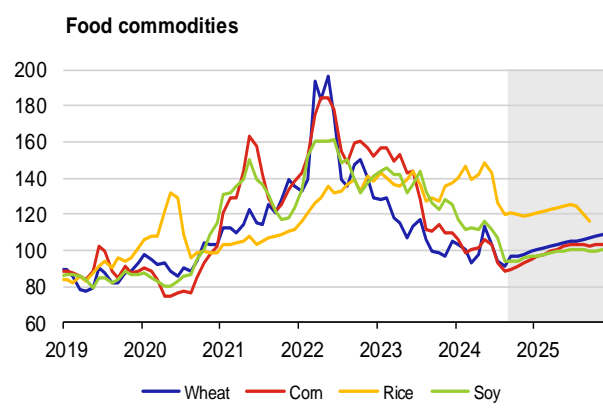
The price of natural gas in Europe rose strongly at the turn of July and August. Since then, it has shown a slightly downward trend thanks to seasonally high reserves and stable supplies from Russia via Ukraine. However, this decline is only gradual due to forecasts of colder weather in Europe, maintenance in Norwegian fields, threats to LNG exports from the Gulf of Mexico due to the hurricane, and restrictions on Australian LNG exports due to security checks. In response to the high price of gas, the price of coal – a close substitute for gas – has also risen strongly in the European market. The price of coal was also pushed higher by increased imports to China and higher demand in the rest of Asia due to the high temperatures there, resulting in higher electricity consumption to run air conditioners.

The average monthly index of industrial metals prices fell for the third month in a row in August, but almost stopped in the first half of September. The prices of virtually all its components continued to fall in the first ten days of August due to the unsatisfactory situation of global manufacturing. However, they then rose in the rest of the month due to growing expectations that the Fed would soon start to cut rates. This led to a decline in risk aversion on commodity markets. Yet prices across the index started falling again in September. Iron ore prices continued to fall steadily in this period, although the decline in steel prices, which have been highly volatile since mid-August, halted. The output of China’s steel industry continues to fall according to leading indicators, but inventories of finished steel products have reached an eight-month low. Moreover, further steps by the Chinese government to support construction and real estate are expected.

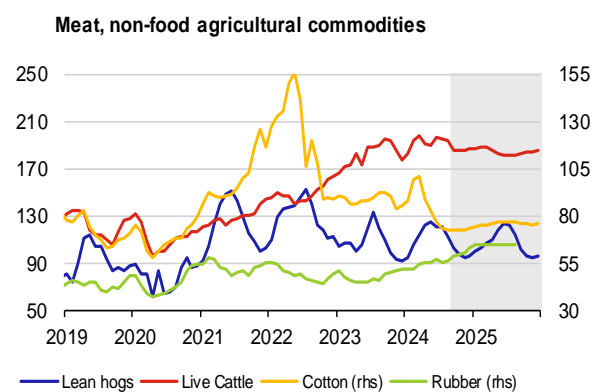
The food commodity price index fell for the second consecutive month in August, but then rose slightly in the first half of September. The prices of wheat, corn, soybeans and sugar developed in a similar manner. Concerns about worsened weather in the USA contributed to the price growth at the beginning of September, while low stocks in Ukraine and a weak harvest in Russia contributed to the price growth in early September. The price of coffee is near its multi-year high and, despite a slight decline, so is the price of beef.



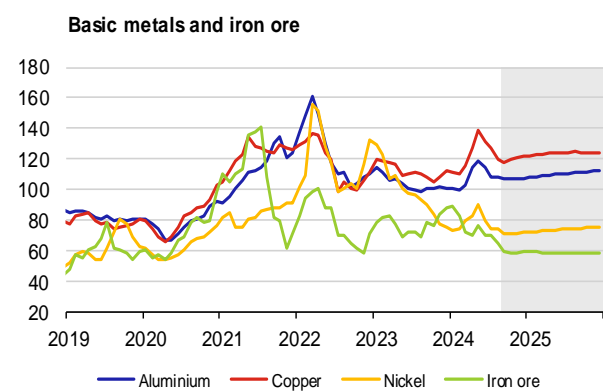
	Overall	Agricultural	Industrial
2024	116.5	129.7	111.5
2025	113.6	122.6	113.1



	Wheat	Corn	Rice	Soy
2024	98.9	97.2	132.0	105.1
2025	105.1	101.6	122.2	99.6



	Lean hogs	Live Cattle	Cotton	Rubber
2024	108.8	190.1	81.2	56.4
2025	107.1	184.5	75.7	64.8



	Aluminium	Copper	Nickel	Iron ore
2024	108.2	121.9	76.7	69.7
2025	110.6	124.0	74.4	59.1

Source: Bloomberg, CNB calculations.

Note: Structure of non-energy commodity price indices corresponds to composition of The Economist commodity indices. Prices of individual commodities are expressed as indices 2010 = 100.

Green transformation: summary of objectives and importance of critical minerals¹

In the last two decades, the global community has started to intensively deal with issues related to environmental protection and mitigation of the effects of climate change. The 2015 Paris Agreement set a target of limiting global warming to significantly below 2 °C, with an aspiration not to exceed 1.5 °C above the pre-industrial average. This target requires a transformation of energy systems, industry and the whole global economy towards low-carbon and sustainable models. The transition to renewable and low-emission energy sources comes with a number of opportunities and challenges. On the one hand, there is potential for other sources of economic growth, job creation and improved quality of life through a healthier environment. On the other hand, this transformation requires significant investment in new technologies and infrastructure, as well as changes in current production and consumption patterns. The article presents the specific targets agreed at the last UN COP28 (Conference of the Parties) meeting in Dubai in 2023 and how they are being met. We then familiarise ourselves with the critical materials that are an essential part of the transition to clean energy. Their regional accumulation and processing increase the risk of their use in geopolitical disputes and endangers the timely transition to a green economy. This vulnerability can be reduced by investments in recycling, which is, however, technologically insufficient and not completely ready for the large number of products that will be disposed of in future decades.

How are we faring?

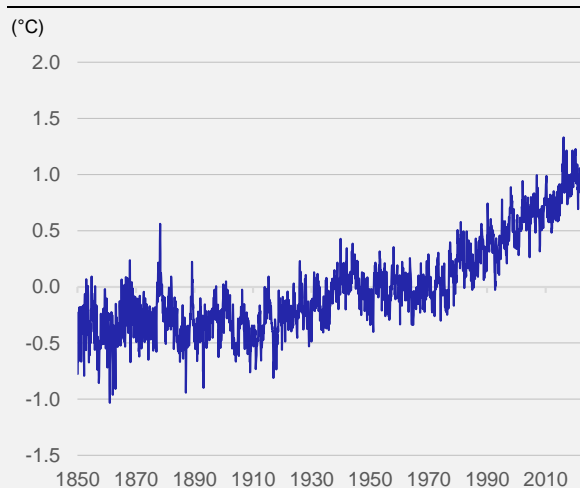
Greening economies is closely connected to the objective of limiting global warming and better protecting the environment from the impacts of human activity. The 2015 Paris Agreement translated these efforts into specific objectives. One of them is a reduction in greenhouse gas emissions² and maintaining a measured average global temperature of up to 1.5 °C above the pre-industrial average (1850–1900)³. But why 1.5 °C? Scientists estimate⁴ that in the case of an increase of 2 °C:

- Extremely hot days in the mid-latitudes (regions outside the poles and tropics) would be 4 °C warmer on average compared to 3 °C warmer in the case of an overall increase of 1.5 °C.
- The sea level would rise by 0.1 m compared to a temperature rise of 1.5 °C, which would expose up to 10 million people to more frequent flooding.
- 99% of coral reefs would disappear, whereas 70–90% would disappear at 1.5 °C.

Global warming is clearly getting worse (Chart 1). In 2023, the highest temperature recorded until now is 1.45 ± 0.12 °C above the pre-industrial average. In addition to stopping temperature rises, transitioning to carbon neutrality has other benefits. It represents a great opportunity to transform economies, increase environmental sustainability and improve social welfare. From an economic viewpoint, the transition promises the creation of millions of jobs throughout the world (but more in developed and emerging countries than in developing countries), in particular in renewable energy sectors such as solar and wind power, which are labour-intensive (Fragkos and Paroussos, 2018). By reducing dependence on fossil fuel imports, countries can strengthen their energy security and reduce their vulnerability to geopolitical tensions and interruptions of supply. Investments in renewable energy sources and energy efficiency not only stimulate economic growth through the development of infrastructure and technological innovation, but also reduce long-term energy costs, because renewable source technologies bring cheaper energy than fossil fuels.

On the level of the whole of society, transitioning to cleaner energy sources brings significant health benefits, as it reduces the incidence of diseases related to pollution such as asthma, lung cancer and heart disease. This improvement in public health not only improves the quality of life, but also reduces

Chart 1 – Deviation from Average Pre-industrial Temperature



Source: <https://berkeleyearth.org>

¹ By Milan Frydrych. The opinions expressed in this article are his own and do not necessarily reflect the official position of the Czech National Bank.

² More here: <https://www.europarl.europa.eu/topics/en/article/20230316STO77629/climate-change-the-greenhouse-gases-causing-global-warming>.

³ 1.5 °C as the average for the last 20 years, not the figure for a year.

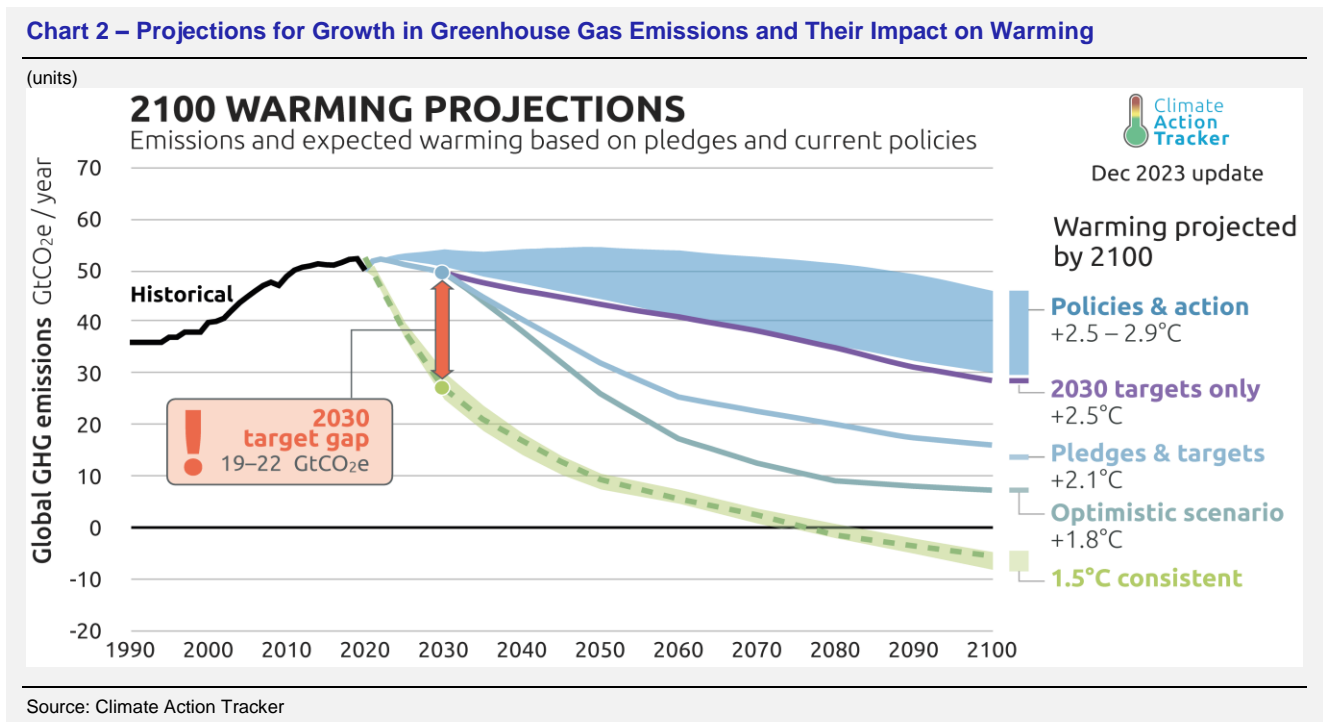
⁴ <https://www.bbc.com/news/science-environment-35073297>, in more detail here: <https://climate.nasa.gov/news/2865/a-degree-of-concern-why-global-temperatures-matter/>

spending on public healthcare. Renewable energy can bring electricity to remote and insufficiently-served areas, promoting energy independence and enabling all communities to use modern energy services. This approach is essential for improving the standard of living and supporting economic growth in such regions. In addition, decentralised renewable energy systems, such as rooftop solar systems, can increase communities' resilience to climate impacts by providing reliable energy and reducing dependence on centralised energy grids.

From the technology viewpoint, this transition is the driving force behind innovation and enables countries to take a leading position on the global market in clean energy technologies. This leading position attracts additional investments, supports research and development and there is a spillover of innovation into different sectors. Introducing modern and efficient technologies, such as smart grids, energy storage and advanced renewable energy systems, optimises energy use, reduces losses and increases the overall efficiency and reliability of energy systems.

The topic of greening economies is broad and includes a number of areas such as the decarbonising of industry, the circular economy and water management. In this article, we will primarily focus on the critical (crucial) minerals for production for the transition to carbon neutrality and related recycling.

According to *Climate Analytics and the NewClimate Institute*, which created the *Climate Action Tracker (CAT)*, countries' current policies are far from consistent with the objective of the Paris Agreement (**Chart 2**). In the case of the optimistic scenario, which includes all binding and notified objectives, we will reach 1.8 °C (0.3 °C above the target) in the long term. If we project the current state of implementation of policies, emissions would remain stable for several decades and then start to decline slightly at a temperature of +2.5 to +2.9 °C. Current efforts are therefore insufficient. The *UN International Panel for Climate Change (IPCC UN)* is of a similar opinion⁵. In the next year, participating countries have to submit revised non-binding national plans ("nationally determined contributions") for 2030 and new objectives for 2035.

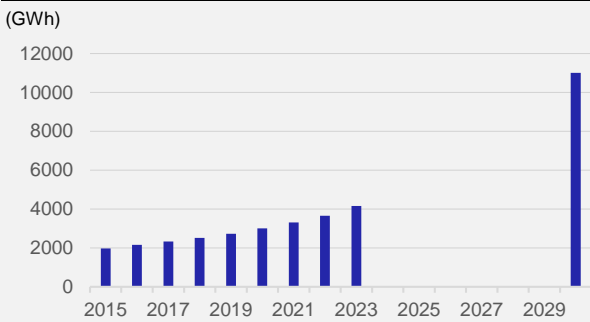


At COP28 in Dubai, a number of targets were agreed to achieve reductions in greenhouse gas emissions. Some specific targets related to energy are monitored and assessed by the International Energy Agency (IEA) in cooperation with other institutions. The following box 1 offers a brief overview of these.

The world is falling behind the Paris Agreement targets and governments are preparing for COP29 in Baku, where they will present revised nationally determined contributions (NDCs) to reduce emissions after 4 years. It is evident that all regions have to markedly increase their efforts and prepare more ambitious targets across a number of sectors in order to achieve the emissions targets.

⁵ https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf

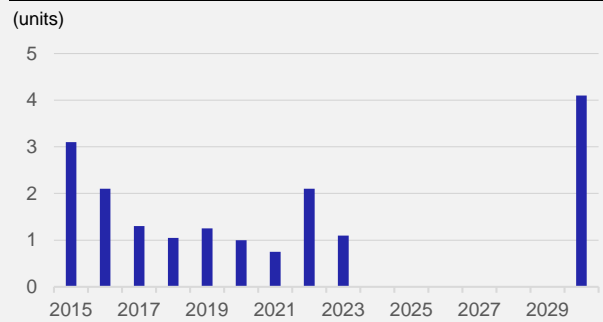
Chart 3 – Global Production of Electricity from Renewable Sources



Source: <https://www.iea.org>

Electricity production saw marked growth in 2023 thanks to photovoltaics and wind energy. China, together with Europe and the USA, are investing the most in this segment.

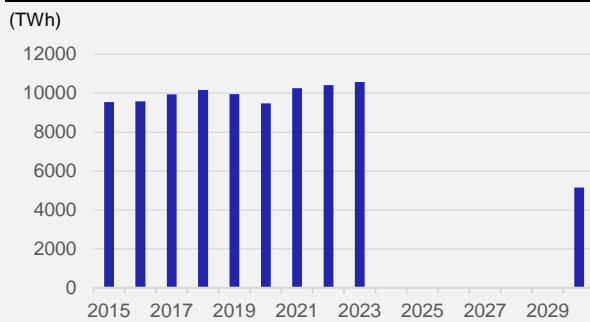
Chart 4 – Growth in Energy Efficiency



Source: <https://www.iea.org>
 Note: Measured as primary energy demand, or rather reductions in it.

In order to achieve zero emissions of greenhouse gases, it is necessary to improve energy efficiency to 4% a year.

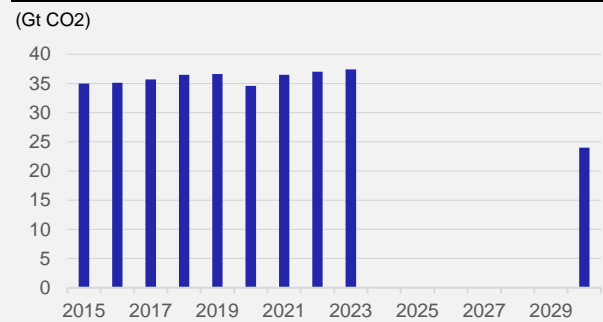
Chart 5 – Global Production of Electricity from Coal



Source: <https://www.iea.org>

Electricity produced from coal is the largest individual source of CO₂ emissions. In line with current measures, it is expected that demand for coal will reach a peak before the end of this decade and will then gradually decline, which is not consistent with the COP28 target.

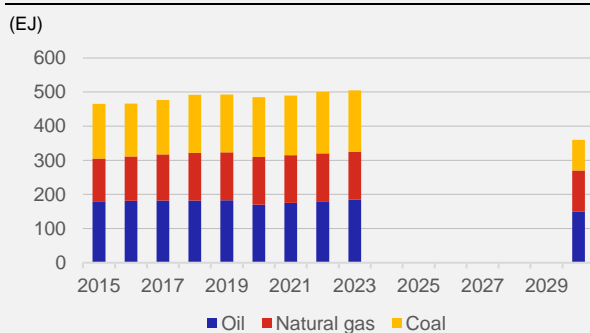
Chart 6 – Global Emissions from the Energy Sector



Source: <https://www.iea.org>

Another target from COP28 is a marked reduction in energy sector emissions by 2030 and zero emissions by 2050. These emissions, however, still rose to record levels in 2023, in particular because of the lower contribution of hydropower due to drought.

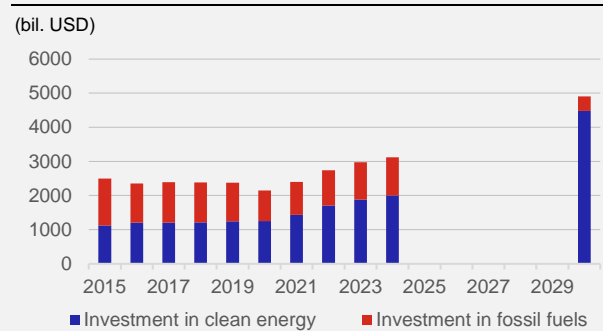
Chart 7 – Global Demand for Fossil Fuels



Source: <https://www.iea.org>

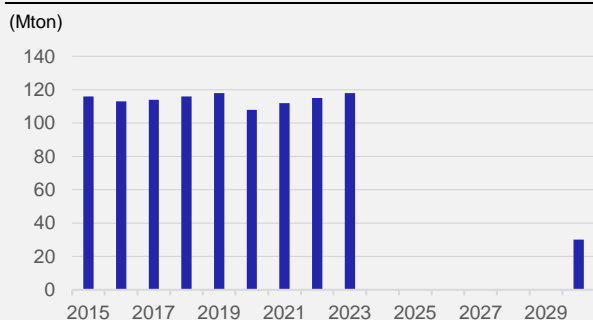
On the path to zero emissions by 2050, demand for fossil fuels must fall by more than a quarter from the 2023 level by the end of the decade. This is another target that is not being achieved.

Chart 8 – Global Investments in Clean Energy and Fossil Fuel

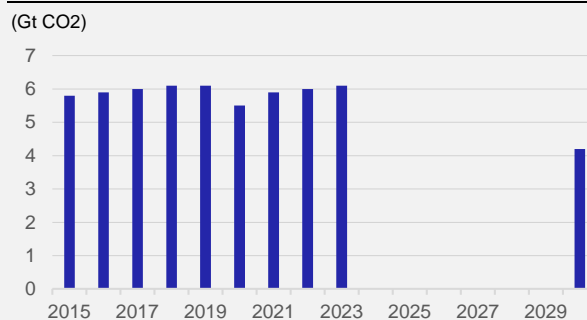


Source: <https://www.iea.org>

At the current time, investments in clean energy in developing and emerging economies outside China are insufficient. Even in the case of zero emissions there is still a need for certain investments in the current oil and natural gas infrastructure.

Chart 9 – Global Emissions of Methane from Fossil FuelsSource: <https://www.iea.org>

In addition to carbon dioxide emissions, one of the goals is to reduce methane emissions from fossil fuels. Such emissions are responsible for approximately 30% of the increase in global temperatures since the industrial revolution.

Chart 10 – Global Emissions from Road TransportSource: <https://www.iea.org>

Note:

Rapid reductions in emissions from road transport, including infrastructure development, are another objective from COP28. If growth in the number of electric vehicles continues at the same rate, this would be more than sufficient to achieve the desired emissions reductions.

Critical (Crucial) Minerals

Definitions of critical minerals differ by region, geopolitical and economic factors.⁶ But we are interested in the raw materials needed to produce products for the transition to a green economy. They are products such as batteries, wind turbines and electrolyzers.

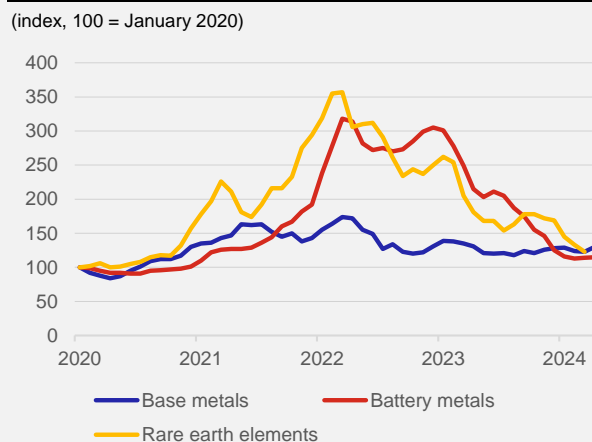
According to the IEA, demand for critical minerals rose significantly in 2023, driven by the accelerating transition to clean energy technology. Demand for lithium rose by 30%, whereas demand for nickel, cobalt, graphite and rare earths increased by between 8% and 15%. Electric vehicles strengthened their position as the largest consumer of lithium and markedly increased demand for nickel, cobalt and graphite. Despite the strong demand, marked increases in deliveries and sufficient stocks led to a fall in mineral prices (Chart 11). New sources of deliveries, in particular from Africa, Indonesia and China, have exceeded the growth in demand over the last two years. This, together with surplus stocks in sectors such as batteries and cathodes, as well as a correction to the sharp price increases in 2021–2022 led to pressure for a fall in prices. Sales of electric vehicles totalled almost 14 million in 2023, which represents a year-on-year increase by 35%. Continuing growth in sales of electric vehicles on the main markets is expected, although adoption in developing economies will rise. In the scenario for achieving zero emissions by 2050, the share of sales of electric vehicles rises from the current 18% to 65% in 2030, which means that demand for batteries will increase seven-fold to 6 TWh in 2030.

According to the IEA stated policies scenario (STEPS),⁷ it is expected that demand for minerals for clean energy technology will double by 2030. The announced pledges scenario (APS)⁸ forecasts even higher demand, which will almost treble by 2030. Lithium can expect the fastest growth in demand because of growing needs for batteries for electric vehicles, whereas copper, which is key for an electrified energy system, is seeing the greatest increases in production volume. According to the NZE scenario (“Net Zero Emissions”), demand for graphite will almost quadruple by 2040, whereas the demand for nickel, cobalt and rare earths will double.

⁶ One of the possible definitions is: A critical mineral is defined as a mineral or non-fuel mineral material that is essential to a country's economic and national security and whose supply chain is vulnerable to disruption. Critical minerals are also characterised as performing an essential function in the production of a product the absence of which would have material consequences for economic or national security.

⁷ A scenario that takes into account all implemented policies, including those that are in the approval/implementation process.

⁸ A scenario that takes into account all implemented policies, commitments and promised future implementation. APS – STEPS = implementation gap.

Chart 11 – Trends in Prices of Critical Materials

Source: Global Critical Minerals Outlook 2024, IEA

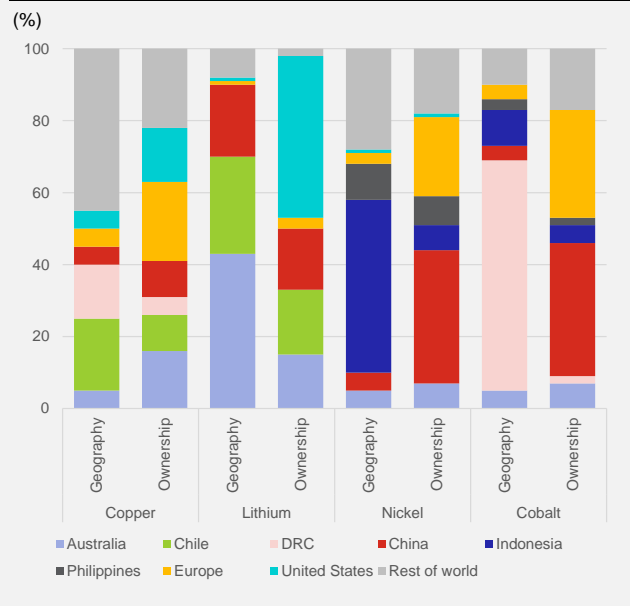
Some countries from various regions will benefit from expansion of the market in critical materials. Latin America should obtain by 2030 the highest market value for unextracted production, approximately USD 120 bn. Indonesia, driven by its nickel production, is expected to double its market value, while Africa will see a 65% increase. By 2030, it is expected that China will concentrate almost 50% of the market value from refining. Concentration in the mining sector looks different when examined from the viewpoint of asset ownership (Chart 12), with US and European companies playing a major role in supplying copper and lithium, whereas Chinese companies play a larger role in nickel and cobalt production, although these minerals are mined elsewhere (for example, in Indonesia for nickel and in the Democratic Republic of Congo for cobalt). Despite the smaller growth in 2023 in comparison with 2022, investment in the mining of critical minerals rose by 10%. China, in particular, is active in this segment.

Despite the increase in mining capacities, according to IEA estimates there is a very large gap between expected supplies and demand for copper and lithium, where expected supplies from announced projects cover only 70% of the demand for copper and 50% of the demand for lithium. Supplies of nickel and cobalt better reflect the needs of demand, provided expected projects are completed on time. Nevertheless, graphite and rare earths face the risks of a concentration of supply, where more than 90% of the graphite for batteries and 77% of refined rare earths will come from China by 2030. Similarly, 70%–75% of the increase in production of refined lithium, nickel, cobalt and rare earths by 2030 will come from today's largest 3 producers. The 5 largest mining companies control 61% of lithium mining and 56% of cobalt mining. Limited progress in the diversification of supply and the high concentration of production in a few countries are risks for the energy transformation.

The current falls in prices, although they are beneficial for the deployment of clean energy, are preventing investments in critical minerals and their diversification. A comprehensive risk assessment by the IEA reveals the potential vulnerability of each mineral when supporting the aims of the energy transformation (Chart 13)⁹. Lithium and graphite have the highest risk score, where the risk for supplies and volume are especially high for lithium and copper, and the geopolitical risk is significant for graphite, cobalt, rare earths and nickel. High environmental risks are also a cause for concern, in particular in regions relying on coal for refining. The search for critical materials could bring about geopolitical competition in areas with significant deposits, such as the Arctic or greater depths of the ocean. Even if stocks are more than adequate, caution is needed given the environmental impacts and regulatory challenges of exploiting underground and deep-sea resources. Any suspension of deliveries of critical materials has different implications to those in the case of fossil fuels. After being built, renewable sources work for decades, even if the supply of inputs is suspended. There is no interruption of energy security, as is the case for fossil fuels. The negative impact is only the slowdown in the energy transition process.

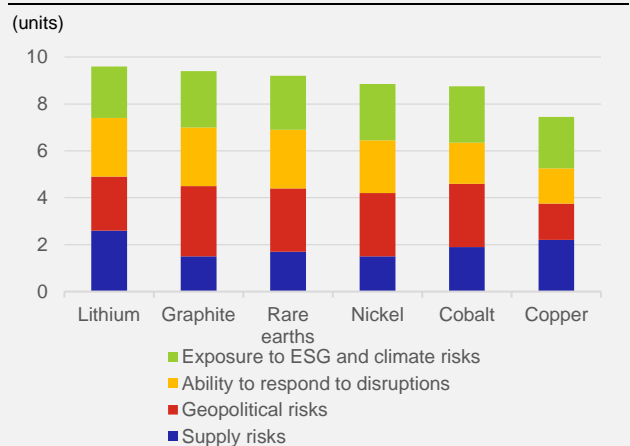
Dealing with the challenges of supply concentration and investments in critical minerals requires targeted political intervention. Increasing the transparency of the market through effective mechanisms for determining prices and financial tools to ensure risks can support investments. An increase in the availability of reliable data about consumption, supplies and trading is also essential. In addition to this, politicians that support recycling, innovation in alternative chemistry and the correct sizing of batteries for electric vehicles can help mitigate future pressure on supply and support sustainable development in supply chains.

Chart 12 – Ownership and Geographic Structure of Extraction



Source: Global Critical Minerals Outlook 2024, IEA

Chart 13 – Evaluation of Critical Materials Risks – IEA



Source: Global Critical Minerals Outlook 2024, IEA

⁹ The Balance of payments report 2023, pp. 23-29, deals with the Czech Republic's economic vulnerability.

Recycling

Recycling may not eliminate the need for additional primary supplies, but it offers significant potential as a secondary source of critical minerals, in particular because large volumes of batteries and other end-of-life products will be available in the coming years.

The recycling of materials used in green technologies represents a marked challenge with regard to the complexity of the relevant products. Batteries for electric vehicles, solar panels and wind turbines are often made up of a complicated mixtures of metals, plastics and composite materials. For example, lithium-ion batteries in electric vehicles contain not only lithium, but also cobalt, nickel, manganese and graphite, which are built in to complicated structures. Similarly, solar panels contain silicon wafers, silver and aluminium, often covered with protective layers and glass. Wind turbine blades are produced from durable composite materials that are designed to withstand harsh weather conditions. The complicated combination of these materials makes it hard to separate and recover the individual elements during the recycling process, which frequently requires advanced and specialised techniques.

The current state of the recycling infrastructure is not fully equipped to handle the high demands on such materials. Because traditional recycling equipment is optimised for simpler materials such as paper, glass and standard metals, it cannot cope with the more sophisticated materials found in green technologies. Many recycling plants lack the tools for the effective disassembly of complicated products or for processing specific materials. This limitation leads to a subsequent lower degree of use of critical/valuable materials and they are often left unprocessed or recycled into products with a lower value. In addition, the capacity of the current recycling infrastructure is often not sufficient to deal with the growing volume of materials coming into being as a consequence of the transition to environmentally-friendly technologies. From the economic viewpoint, material recycling faces several challenges. The main problem is the cost-effectiveness of recycling, because the processes necessary to separate and obtain valuable materials from complicated products are often expensive and energy-intensive. In addition, the demand for recycled materials on the market can be volatile, as fluctuations in prices of primary materials sometimes make recycling less financially attractive. Logistical problems also play an important role; collecting and transporting used products to recycling facilities can be costly and complicated, especially for large or dangerous items such as batteries for electric vehicles or wind turbine blades.

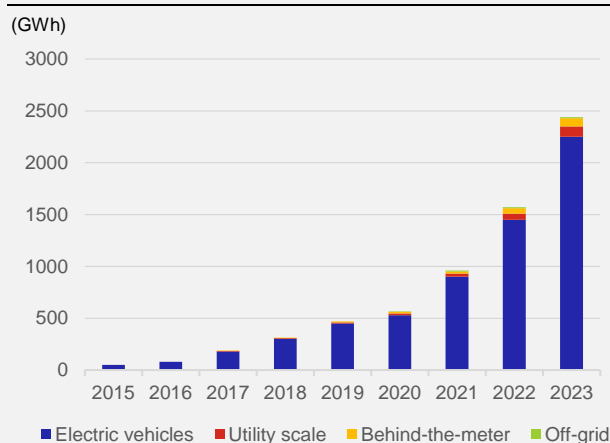
The recycling and correct sizing of batteries for electric vehicles could significantly reduce future demand for minerals. For example, according to the IEA (IEA, 2024b), by 2024 recycling could reduce the primary need for copper and cobalt by 30% and for lithium and nickel by 10% by 2040. Without an increase in the recycling and recovery rate, the capital requirements for mining would have to be a third higher. Innovations, in particular in battery composition chemistry, continue to change demand, which adds uncertainty to long-term projections.

Battery and EV Recycling

The aim of recycling lithium-ion batteries that are mainly used in electric vehicles (Chart 14), is to recover valuable metals, such as lithium, nickel, cobalt, copper and aluminium. The situation with batteries for electric vehicles is complicated by the fact that three types of batteries are often used: NCA (nickel-cobalt-aluminium), NMC (nickel-manganese cobalt) and LFP (lithium ferrophosphate). There are concerns that as soon as sufficient raw materials from end-of-life electric vehicles are available for recycling, industry may have a greater financial motivation to recycle NCA and NMC batteries than LFP batteries due to the higher value of the materials. The recycling of LFP batteries focuses primarily on lithium, which is the most valuable element in the absence of nickel and cobalt. However, pyrometallurgical processes are not suitable for obtaining lithium and hydrometallurgical processes must be modified to increase the recycling efficiency from LFP batteries. The European Union's Batteries Regulation tries to prevent this and orders a 70% recycling rate for lithium-ion batteries by 2030, including batteries with less-valuable chemicals such as LFP.

It is expected that the volume of discarded lithium-ion batteries available for recycling will increase significantly by 2030 (IEA, 2024c), as the first generation of batteries for electric vehicles reaches the end of its life. According to the IEA's Stated Policies Scenario (STEPS), almost 80 GWh of batteries will be available for recycling in 2030. The global recycling capacity reached more than 300 GWh/year in 2023, of which more than 80% was in China, which was far in front of Europe and the United States, with less than 2%. Many technology developers and industry entities who are sure about the

Chart 14 – Lithium-ion Batteries Dominate Electric Vehicles



Source: Global EV Outlook 2024, IEA

Note: Behind-the-meter – battery storage is situated at the customer behind the electricity meter.

transition to electromobility are trying to position themselves on the future electric vehicle end-of-life management market and have announced significant expansions of capacities. If all the announced projects are implemented in full and on time, the global recycling capacity could exceed 1,500 GWh in 2030, of which 70% will be in China and around 10% each in Europe and the United States.

It is expected that until 2030 the main sources for recycling plants will be scrap from battery production for electric vehicles (50%) and end-of-life batteries for electric vehicles (20%). Despite the forecast increase in scrap from battery production and end-of-life electric vehicles, there is a potential risk of a significant overcapacity in the recycling sector until 2030. This could lead to financial problems for recycling companies and market consolidation, if stable sources of discarded batteries are not ensured.

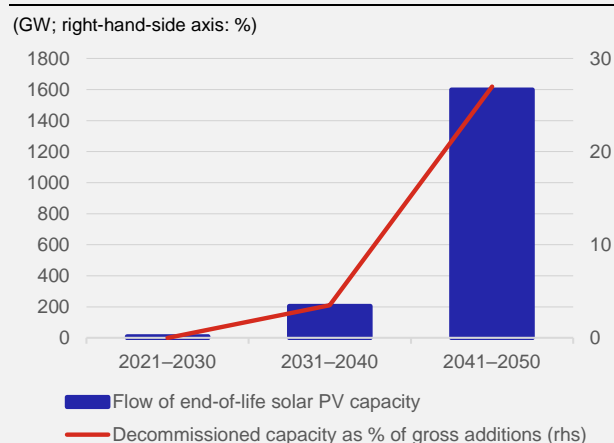
The geographic distribution of end-of-life batteries introduces uncertainty into recycling efficiency and may differ from where they were originally purchased due to the used battery market or secondary applications. Developments in chemical technologies for batteries will also influence recycling, as some chemical technologies are more suitable for recycling thanks to the content of valuable metals. To effectively manage battery recycling, regulations need to be put in place to address issues related to battery transportation and tracking, and environmental safety. For example, the European Union's current approach in the field of the circular economy for electric vehicle batteries may prevent electric vehicles and electric vehicle batteries from leaving the European Union, which brings benefits in terms of energy security, but may limit their reuse. In this regard, advanced economies and developing countries should strengthen their cooperation, to facilitate trading in used batteries and also to ensure corresponding strategies for the end of their life. For example, there could be incentives or contributions linked to extending the lifetime of vehicles through their use on international markets in used vehicles before recycling, if recycling in the destination market is guaranteed or if an EV battery is returned at the end of its lifetime.

Solar Panel Recycling

Solar panel recycling will play a key role in the wider context of the circular economy, where emphasis is placed on reducing the quantity of waste and material recovery. The industry's ability to efficiently recycle and reuse solar panels will be of essential importance for maximising the environmental benefits of solar energy. In the last decade, there has been fast global expansion of photovoltaic systems, which has led to a large quantity of panels, whose lifetime is around 30 years¹⁰. At the current time, most solar panels are still within their operational lifetime, so the volume of panels being removed from operation is relatively low. It is expected, however, that this will change as soon as early installations reach the end of their lifetime (Chart 15).

Recycling of photovoltaic modules is technically complicated due to the non-homogeneous nature of end-of-life modules from the size, technology and composition viewpoints. Current panels were not designed with regard to recycling, which complicates the separation of elements. Various recycling practices have been developed, in particular in the European Union and the United States, but many of them still face economic problems because the income from the materials recovered often does not cover the recycling costs. The recycling of photovoltaic panels brings a number of benefits, including providing a secondary source of raw materials (e.g. aluminium, copper, glass, silicon and silver), reducing pressure on primary supplies, increasing energy security by providing a domestic supply alternative and mitigating the environmental, social and health impacts linked with raw material mining. In addition, recycling could cover 3–7% of the photovoltaic industry's demand for certain materials in 2031–2040 and more than 20% in 2041–2050. Policies and regulations are still catching up with the need for comprehensive programmes for recycling solar panels. Some regions, such as the European Union, have introduced instructions in accordance with the directive on waste electrical and electronic equipment¹¹, which orders the recycling of photovoltaic panels. However, global regulations are still being developed. At the current time, the most common method is to mechanically break solar panels into separate materials such as glass, aluminium and semiconductor materials. This process includes crushing panels and separating various components using sorting techniques. Advanced recycling methods include the use of heat and chemical treatments to obtain valuable materials, such as silicon, silver and other metals. These processes can achieve higher

Chart 15 – First Wave of Solar Panels for Recycling Will Come in 2030



Source: Special Report on Solar PV Global Supply Chains, IEA

¹⁰ <https://www.energy.gov/eere/solar/end-life-management-solar-photovoltaics>

¹¹ Waste Electrical and Electronic Equipment Regulation (WEEE): <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:02012L0019-20180704>

recovery rates for such critical materials in comparison with mere mechanical recycling. Research is also taking place into the most effective recycling processes, such as those which can obtain almost 100% of the materials used in solar panels. This includes innovations in chemical leaching processes that can more efficiently recover silicon and other rare materials. At the current time, the costs of recycling solar panels can be higher than the value of the materials obtained, which is uneconomic. This is partially caused by the small volume of end-of-life panels available for recycling and the complicated nature of the recycling process. The collection, transport and processing of panels can be demanding, in particular in regions with a less-developed recycling infrastructure. Effective logistics are of fundamental importance so that recycling operations are cost-effective. Some manufacturers of solar equipment and specialised recycling companies have started to establish specialised recycling facilities. Companies like First Solar, which uses thin-film cadmium telluride technology, have developed proprietary recycling processes that enable the recovery of up to 90% of materials. It is expected that governments and regulatory bodies will introduce stricter requirements for recycling and incentives, which will further support the development of effective recycling processes.

In the future, the solar panel recycling market can also be expected to grow as more panels reach the end of their lifetime and as demand for the critical materials obtained from these panels increases. The first large wave of installed solar panels will reach the end of its lifetime in 2030, when the volume of panels available for recycling will rise sharply (Chart 15). This will probably lead to further investments in recycling infrastructure and technology.

Turbine Recycling

Wind turbine recycling is an increasingly important aspect of the wind energy sector. Their recycling includes the handling of various materials used in their design, such as steel, concrete, fibreglass and rare earth elements (Chart 16). This process is complicated with regard to the diversity of the materials used and the large dimensions of turbine parts. Seeing that the first wave of wind turbines built at the end of the 90s and start of the new millennium is being removed from operation, the importance of recycling turbines is even more urgent. A total of 85% to 95% of turbine materials such as steel, aluminium and copper can be easily recycled, but the blades require a more complicated process. At the current time, blades are ordinarily disposed of at landfills, but this option is becoming harder and harder to execute, because a number of countries, in particular Germany and Holland, have prohibited this practice. They are made from fibreglass and coated with a tough epoxy resin that is designed to withstand years of exposure to the elements.

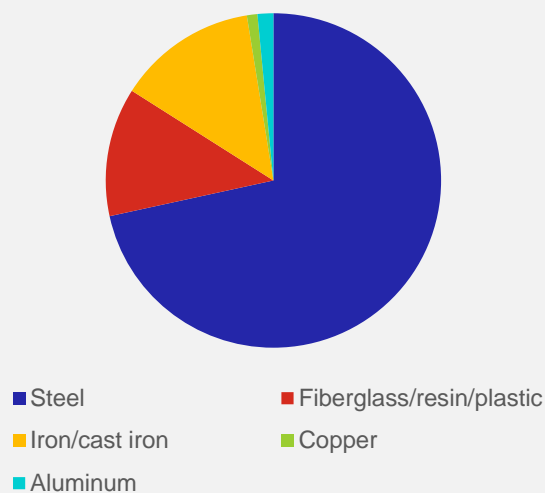
According to Cooperman et al. (2021), by 2050 the quantity of waste from blades in the USA will be 2.2 m tonnes. Globally, it could be approximately 43 m tonnes by 2050 (Reuters, 2021). Recently, a number of companies have developed various technologies for the economical recycling of blade waste. One of the methods is the use of a liquid chemical solution to break down the blades into epoxy fragments and fibres. The epoxy resin is then made into high-quality epoxide. This technology is now being tested in Europe and the result would be low process costs with minimal greenhouse gas emissions. Further attempts are focused on a change to materials used to produce turbines, so that a new generation of blades that are easier to recycle is produced.

Conclusion

The transition to a green economy is a major challenge and opportunity for global society. Achieving the climate goals set out in the Paris Agreement requires a coordinated effort at international level, including reducing greenhouse gas emissions by transitioning to renewable energy sources and increasing energy efficiency. Despite rising investments and technological progress, the current attempts are insufficient to keep the global temperature under 1.5 °C above pre-industrial levels. The transformation to sustainability is not only necessary to protect the environment, but will also lead to significant economic and social benefits. It will create new jobs, increase energy security and improve public health thanks to reductions in pollution. Although renewables and clean technologies are on the rise, insufficient investment in critical materials and infrastructure, lax legislation and the concentration of supplies are significant risks for long-term stability and successfully meeting the targets set out in the Paris Agreement. Effective recycling and innovation in materials and clean energy are crucial to alleviating the pressure on the mining of natural resources and reducing environmental and geopolitical risks. In the coming years, it is necessary to strengthen international cooperation and accelerate political measures that will support the transition to a sustainable economy.

Chart 16 – Composition of Wind Turbines

(units)



Source: 2015 Cost of Wind Energy Review, www.nrel.gov

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Keywords

critical minerals, mineral raw materials, clean energy, recycling, global warming

JEL Classification

Q54, Q42, Q34

A1. Change in predictions for 2024

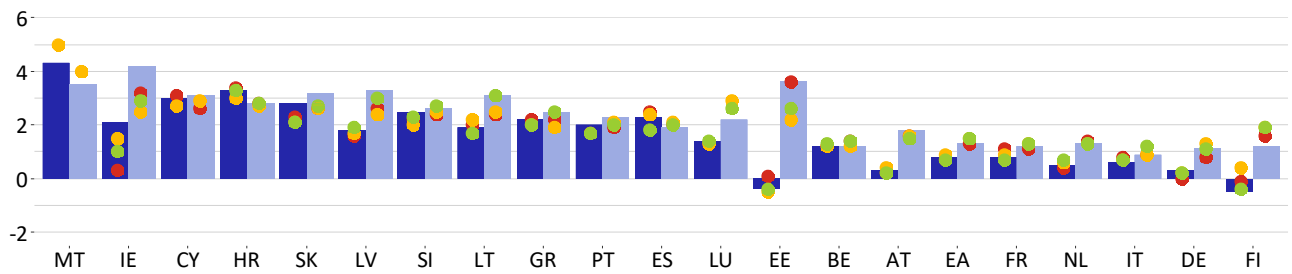
	GDP growth, %				Inflation, %			
	CF	IMF	OECD	CB / OE	CF	IMF	OECD	CB / OE
EA	-0.1	+0.1	+0.1	-0.1	0	-0.9	-0.3	0
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/9 2024/6	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/9 2024/6
US	0	-0.1	+0.4	0	0	+0.1	+0.3	+0.2
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/6 2024/3	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/6 2024/3
UK	0	+0.2	-0.3	+0.8	0	-1.2	0	+0.3
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/8 2024/5	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/8 2024/5
JP	0	-0.2	-0.5	-0.2	0	-0.7	-0.5	-0.3
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/7 2024/4	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/7 2024/4
CN	-0.1	+0.4	+0.2	0	0	-0.7	-0.8	0
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/9 2024/8	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/9 2024/8
RU	+0.2	0	+0.8	0	+0.7	+0.6	0	+0.1
	2024/8 2024/7	2024/7 2024/4	2024/5 2024/2	2024/9 2024/8	2024/8 2024/7	2024/4 2023/10	2024/2 2023/11	2024/9 2024/8

A2. Change in predictions for 2025

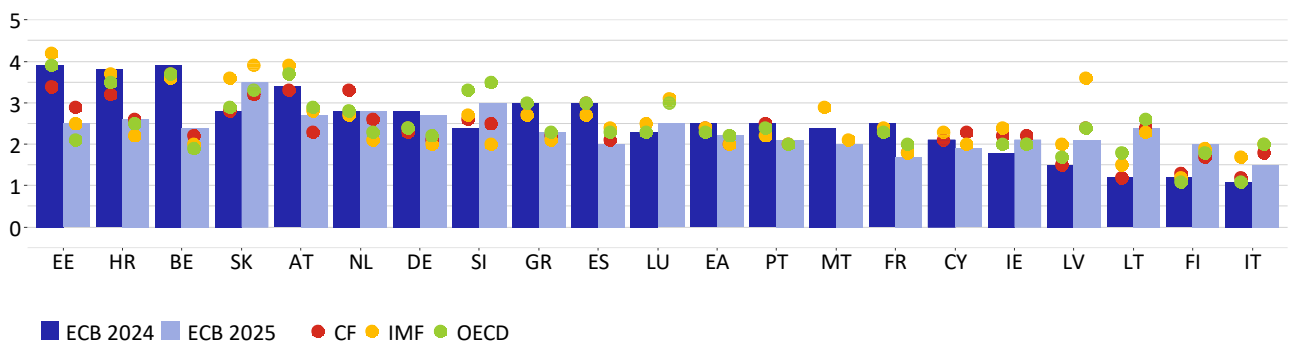
	GDP growth, %				Inflation, %			
	CF	IMF	OECD	CB / OE	CF	IMF	OECD	CB / OE
EA	0	0	+0.2	-0.1	0	-0.2	0	0
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/9 2024/6	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/9 2024/6
US	0	0	+0.1	0	0	-0.4	+0.1	+0.1
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/6 2024/3	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/6 2024/3
UK	0	0	-0.2	0	+0.1	-0.1	-0.1	0
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/8 2024/5	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/8 2024/5
JP	0	0	+0.1	0	0	+0.2	-0.1	+0.2
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/7 2024/4	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/7 2024/4
CN	0	+0.4	+0.3	0	0	-0.2	-0.2	0
	2024/9 2024/8	2024/7 2024/4	2024/5 2024/2	2024/9 2024/8	2024/9 2024/8	2024/4 2023/10	2024/5 2024/2	2024/9 2024/8
RU	0	-0.3	0	0	+0.3	+0.5	0	+0.1
	2024/8 2024/7	2024/7 2024/4	2024/5 2024/2	2024/9 2024/8	2024/8 2024/7	2024/4 2023/10	2024/2 2023/11	2024/9 2024/8

A3. GDP growth and inflation outlooks in the euro area countries

GDP growth in the euro area countries in 2024 and 2025, %



Inflation in the euro area countries in 2024 and 2025, %

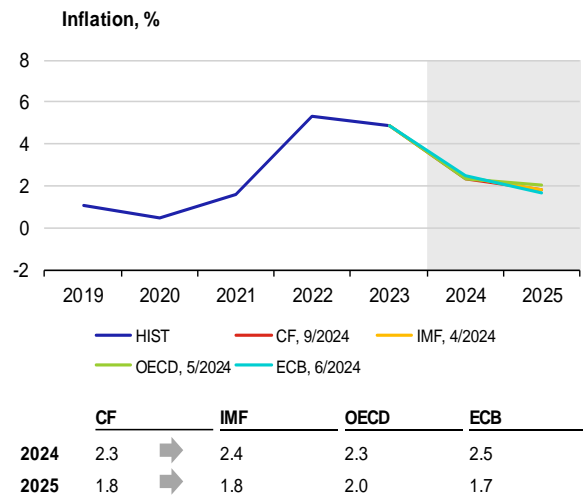
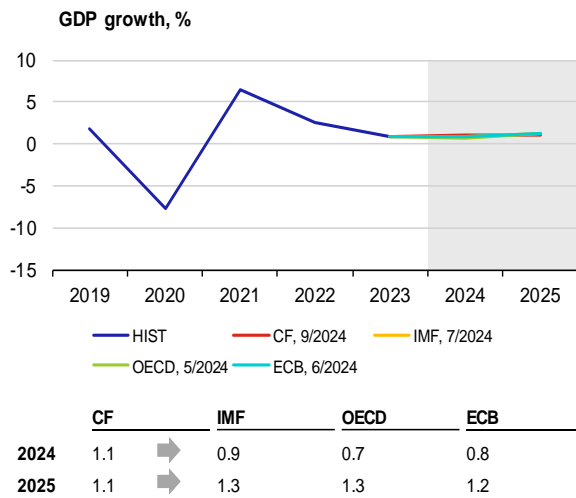


Note: Charts show institutions' latest available outlooks of for the given country.

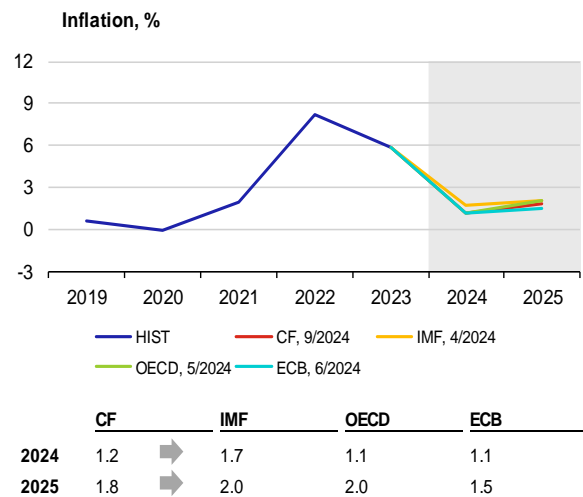
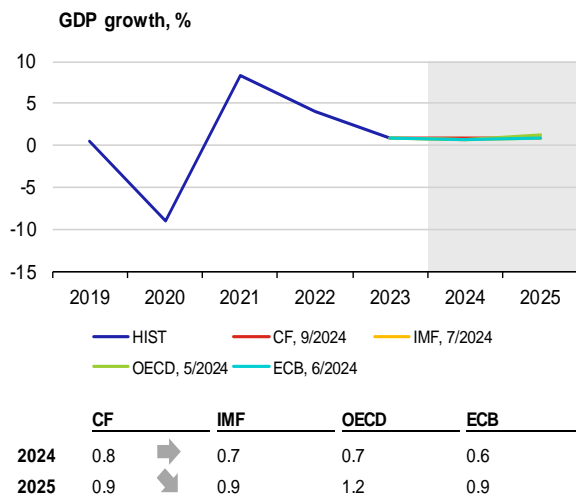
A4. GDP growth and inflation in the individual euro area countries

Germany

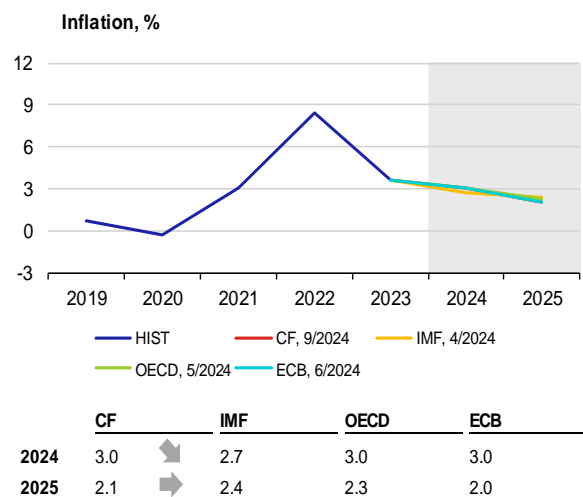
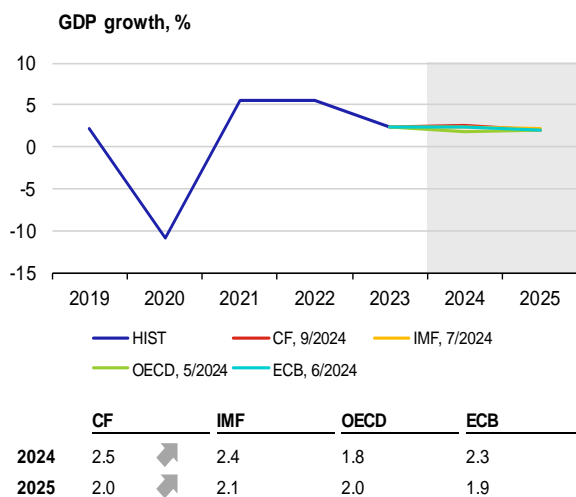
France



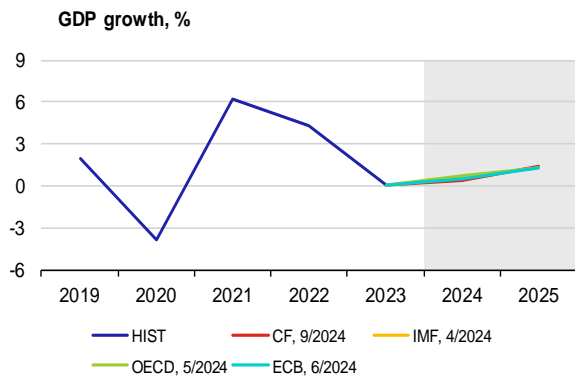
Italy



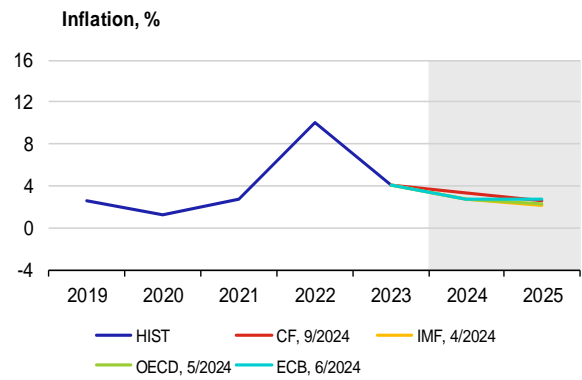
Spain



Netherlands

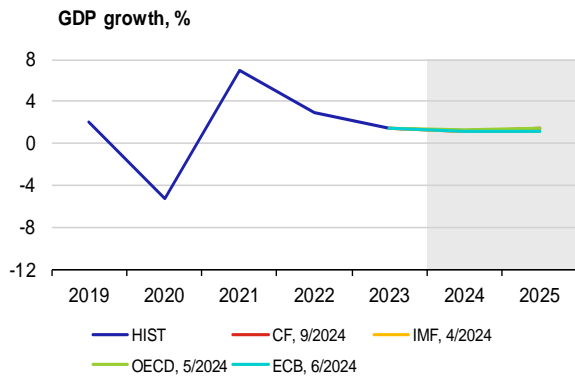


	CF	IMF	OECD	ECB
2024	0.4	0.6	0.7	0.5
2025	1.4	1.3	1.3	1.3

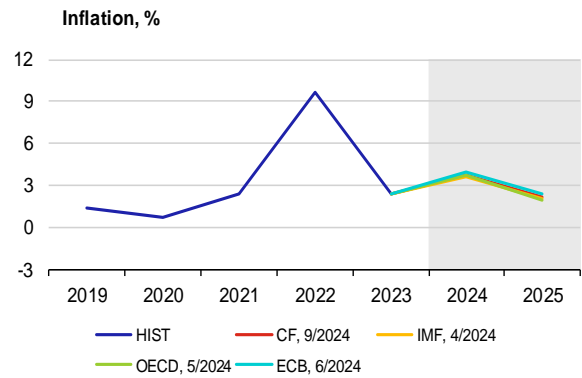


	CF	IMF	OECD	ECB
2024	3.3	2.7	2.8	2.8
2025	2.6	2.1	2.3	2.8

Belgium

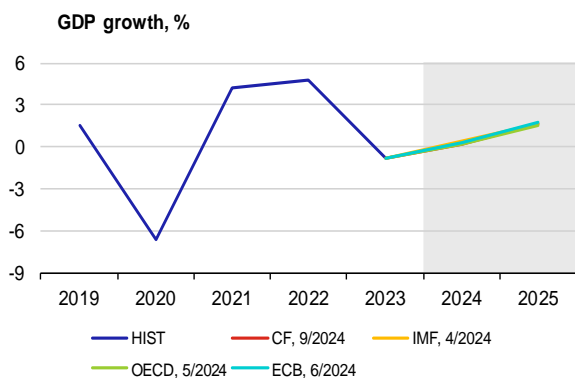


	CF	IMF	OECD	ECB
2024	1.2	1.2	1.3	1.2
2025	1.4	1.2	1.4	1.2

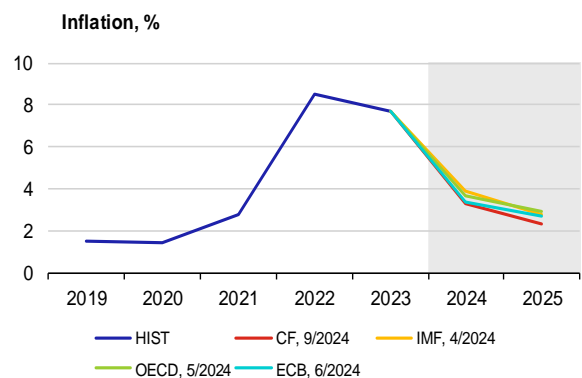


	CF	IMF	OECD	ECB
2024	3.7	3.6	3.7	3.9
2025	2.2	2.0	1.9	2.4

Austria

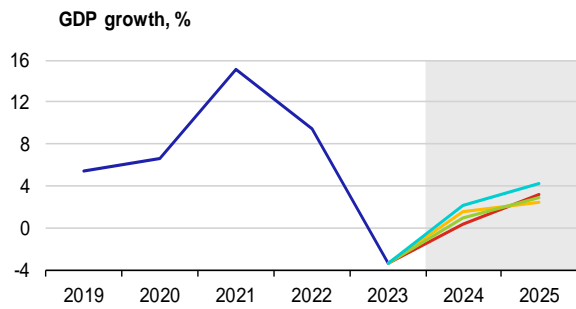


	CF	IMF	OECD	ECB
2024	0.2	0.4	0.2	0.3
2025	1.6	1.6	1.5	1.8

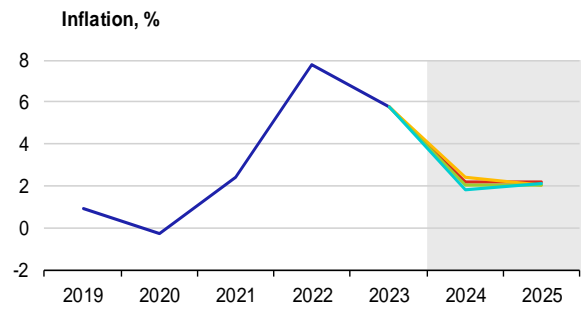


	CF	IMF	OECD	ECB
2024	3.3	3.9	3.7	3.4
2025	2.3	2.8	2.9	2.7

Ireland

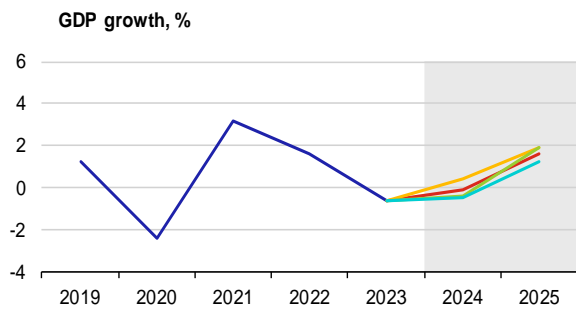


	CF	IMF	OECD	ECB
2024	0.3	1.5	1.0	2.1
2025	3.2	2.5	2.9	4.2

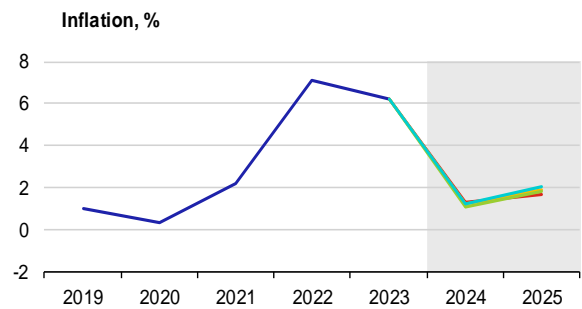


	CF	IMF	OECD	ECB
2024	2.2	2.4	2.0	1.8
2025	2.2	2.0	2.0	2.1

Finland

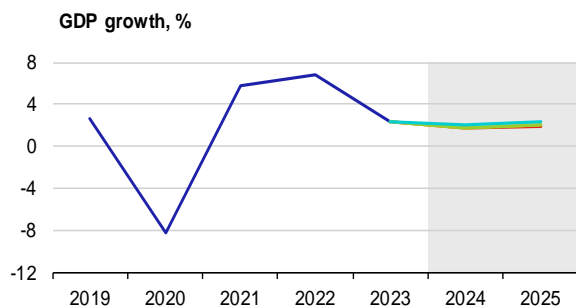


	CF	IMF	OECD	ECB
2024	-0.1	0.4	-0.4	-0.5
2025	1.6	1.9	1.9	1.2

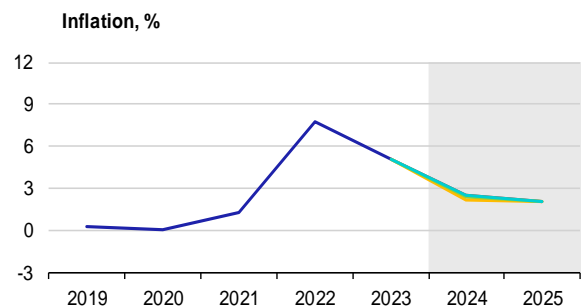


	CF	IMF	OECD	ECB
2024	1.3	1.2	1.1	1.2
2025	1.7	1.9	1.8	2.0

Portugal

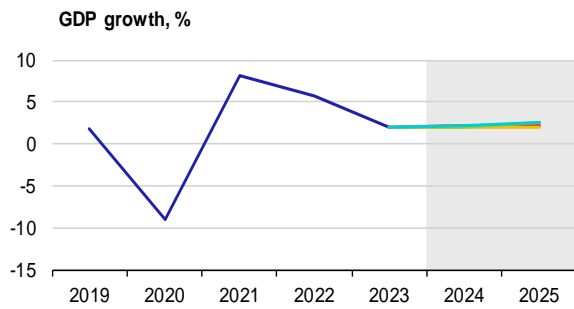


	CF	IMF	OECD	ECB
2024	1.7	1.7	1.7	2.0
2025	1.9	2.1	2.0	2.3



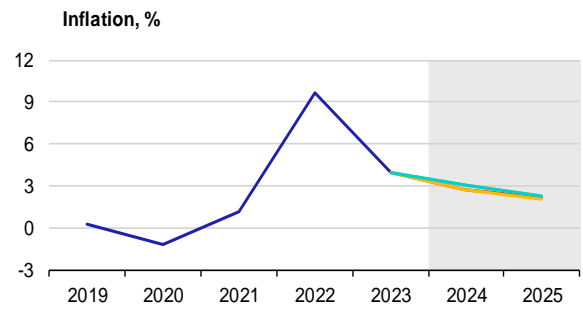
	CF	IMF	OECD	ECB
2024	2.5	2.2	2.4	2.5
2025	2.0	2.0	2.0	2.1

Greece



— HIST — CF, 9/2024 — IMF, 4/2024
— OECD, 5/2024 — ECB, 6/2024

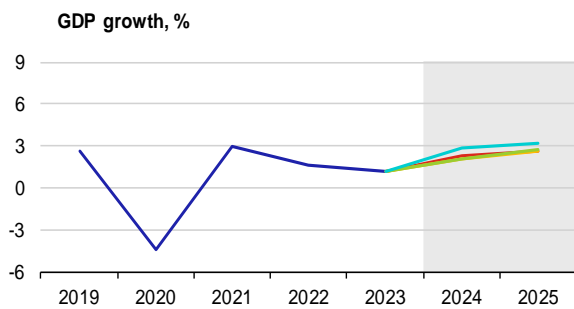
	CF	IMF	OECD	ECB
2024	2.2	2.0	2.0	2.2
2025	2.2	1.9	2.5	2.5



— HIST — CF, 9/2024 — IMF, 4/2024
— OECD, 5/2024 — ECB, 6/2024

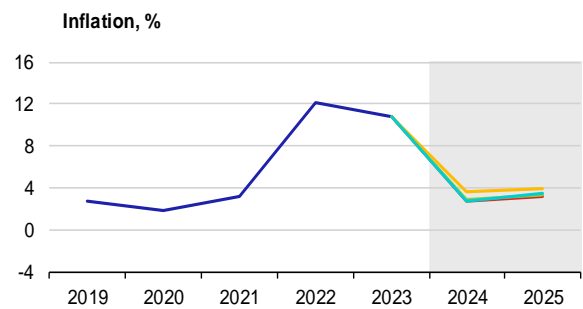
	CF	IMF	OECD	ECB
2024	2.7	2.7	3.0	3.0
2025	2.2	2.1	2.3	2.3

Slovakia



— HIST — CF, 8/2024 — IMF, 4/2024
— OECD, 5/2024 — ECB, 6/2024

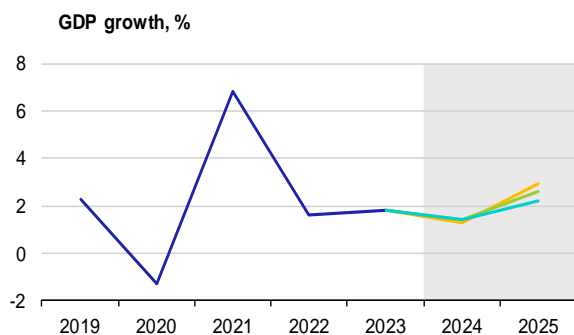
	CF	IMF	OECD	ECB
2024	2.3	2.1	2.1	2.8
2025	2.6	2.6	2.7	3.2



— HIST — CF, 8/2024 — IMF, 4/2024
— OECD, 5/2024 — ECB, 6/2024

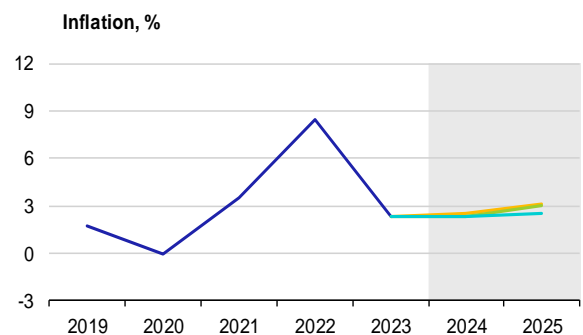
	CF	IMF	OECD	ECB
2024	2.8	3.6	2.9	2.8
2025	3.2	3.9	3.3	3.5

Luxembourg



— HIST — CF — IMF, 4/2024 — OECD, 5/2024 — ECB, 6/2024

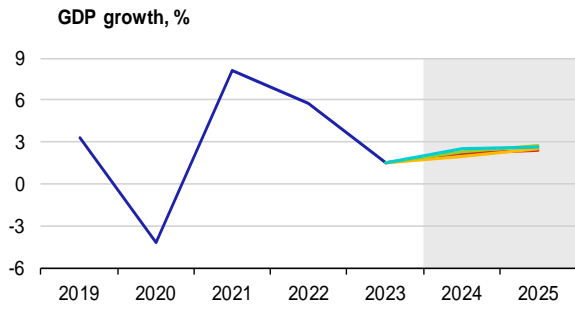
	CF	IMF	OECD	ECB
2024	n. a.	1.3	1.4	1.4
2025	n. a.	2.9	2.6	2.2



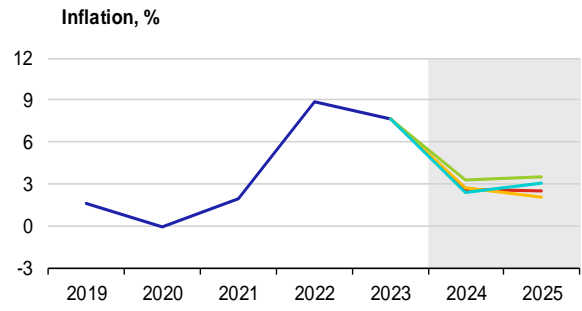
— HIST — CF — IMF, 4/2024 — OECD, 5/2024 — ECB, 6/2024

	CF	IMF	OECD	ECB
2024	n. a.	2.5	2.3	2.3
2025	n. a.	3.1	3.0	2.5

Slovenia

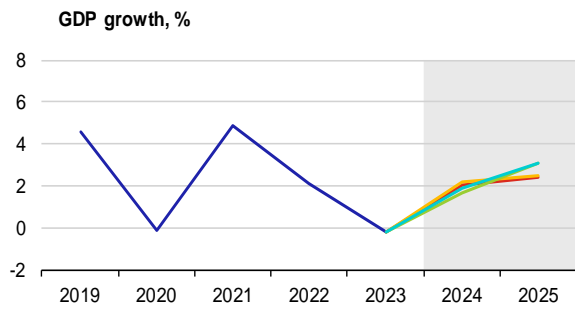


	CF	IMF	OECD	ECB
2024	2.2	2.0	2.3	2.5
2025	2.4	2.5	2.7	2.6

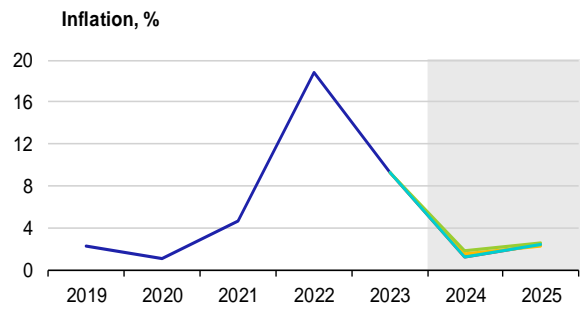


	CF	IMF	OECD	ECB
2024	2.6	2.7	3.3	2.4
2025	2.5	2.0	3.5	3.0

Lithuania

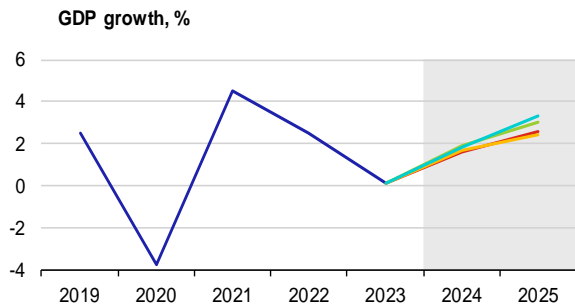


	CF	IMF	OECD	ECB
2024	2.0	2.2	1.7	1.9
2025	2.4	2.5	3.1	3.1

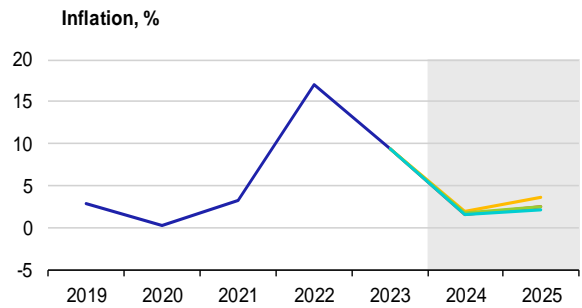


	CF	IMF	OECD	ECB
2024	1.2	1.5	1.8	1.2
2025	2.4	2.3	2.6	2.4

Latvia

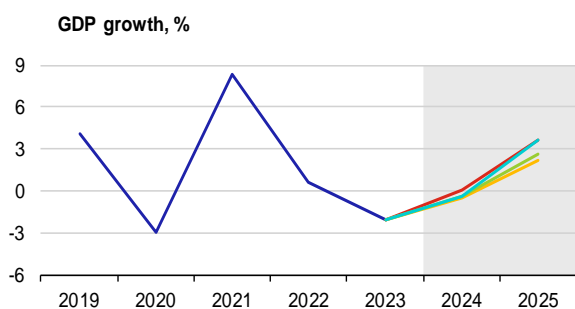


	CF	IMF	OECD	ECB
2024	1.6	1.7	1.9	1.8
2025	2.6	2.4	3.0	3.3

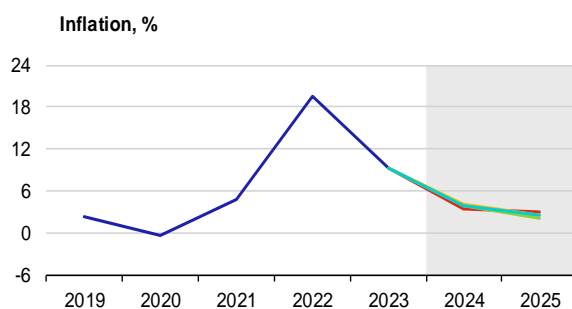


	CF	IMF	OECD	ECB
2024	1.5	2.0	1.7	1.5
2025	2.4	3.6	2.4	2.1

Estonia

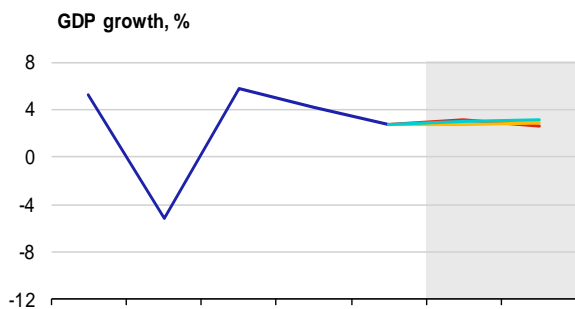


	CF	IMF	OECD	ECB
2024	0.1	-0.5	-0.4	-0.4
2025	3.6	2.2	2.6	3.6

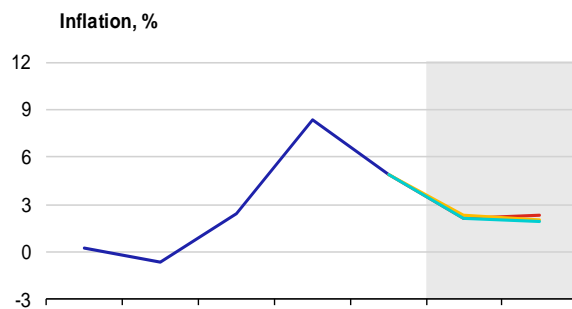


	CF	IMF	OECD	ECB
2024	3.4	4.2	3.9	3.9
2025	2.9	2.5	2.1	2.5

Cyprus

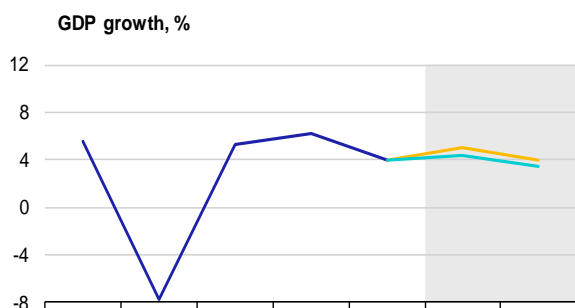


	CF	IMF	OECD	ECB
2024	3.1	2.7	n. a.	3.0
2025	2.6	2.9	n. a.	3.1

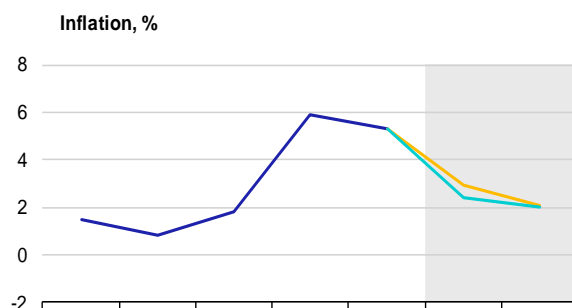


	CF	IMF	OECD	ECB
2024	2.1	2.3	n. a.	2.1
2025	2.3	2.0	n. a.	1.9

Malta



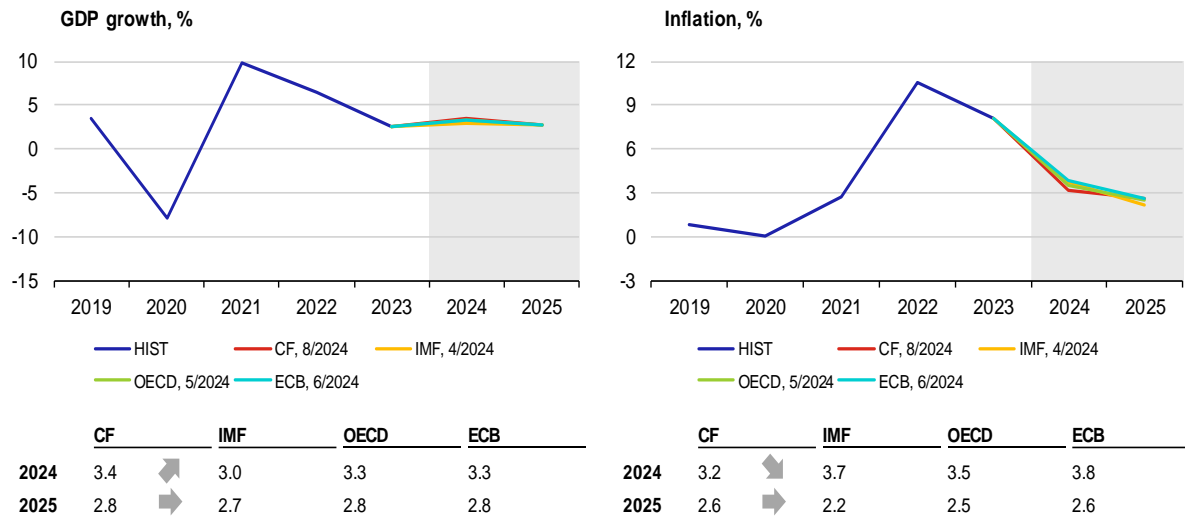
	CF	IMF	OECD	ECB
2024	n. a.	5.0	n. a.	4.3
2025	n. a.	4.0	n. a.	3.5



	CF	IMF	OECD	ECB
2024	n. a.	2.9	n. a.	2.4
2025	n. a.	2.1	n. a.	2.0

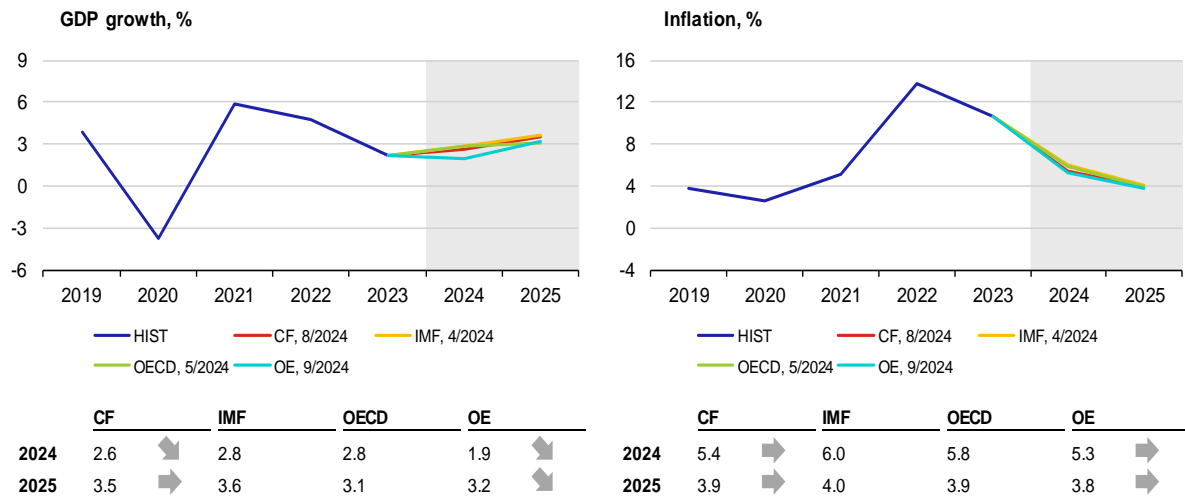
Ddd

Croatia



A5. GDP growth and inflation in other selected countries

Romania



A6. List of abbreviations

AT	Austria	IRS	Interest Rate swap
bbi	barrel	ISM	Institute for Supply Management
BE	Belgium	IT	Italy
BoE	Bank of England (the UK central bank)	JP	Japan
BoJ	Bank of Japan (the central bank of Japan)	JPY	Japanese yen
bp	basis point (one hundredth of a percentage point)	LIBOR	London Interbank Offered Rate
CB	central bank	LME	London Metal Exchange
CBR	Central Bank of Russia	LT	Lithuania
CF	Consensus Forecasts	LU	Luxembourg
CN	China	LV	Latvia
CNB	Czech National Bank	MKT	Markit
CNY	Chinese renminbi	MNB	Magyar Nemzeti Bank (the central bank of Hungary)
ConfB	Conference Board Consumer Confidence Index	MT	Malta
CXN	Caixin	NBP	Narodowy Bank Polski (the central bank of Poland)
CY	Cyprus	NIESR	National Institute of Economic and Social Research (UK)
DBB	Deutsche Bundesbank (the central bank of Germany)	NKI	Nikkei
DE	Germany	NL	Netherlands
EA	euro area	OE	Oxford Economics
ECB	European Central Bank	OECD	Organisation for Economic Co-operation and Development
EE	Estonia	OECD-CLI	OECD Composite Leading Indicator
EIA	Energy Information Administration	OPEC+	member countries of OPEC oil cartel and 10 other oil-exporting countries (the most important of which are Russia, Mexico and Kazakhstan)
ES	Spain	PMI	Purchasing Managers' Index
ESI	Economic Sentiment Indicator of the European Commission	pp	percentage point
EU	European Union	PT	Portugal
EUR	euro	RU	Russia
EURIBOR	Euro Interbank Offered Rate	RUB	Russian rouble
Fed	Federal Reserve System (the US central bank)	SI	Slovenia
FI	Finland	SK	Slovakia
FOMC	Federal Open Market Committee	SPF	Survey of Professional Forecasters
FR	France	TTF	Title Transfer Facility (virtual trading point for natural gas in the Netherlands)
FRA	forward rate agreement	UK	United Kingdom
FY	fiscal year	UoM	University of Michigan Consumer Sentiment Index - present situation
GBP	pound sterling	US	United States
GDP	gross domestic product	USD	US dollar
GR	Greece	WEO	World Economic Outlook
HICP	Harmonised Index of Consumer Prices	WTI	West Texas Intermediate (crude oil used as a benchmark in oil pricing)
HR	Croatia	ZEW	Centre for European Economic Research
ICE	Intercontinental Exchange		
IE	Ireland		
IEA	International Energy Agency		
IFO	Leibniz Institute for Economic Research at the University of Munich		
IMF	International Monetary Fund		

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