Inevitable Policy Response 2023 Policy Forecast

Preparing financial markets for climate-related policy and regulatory risks

Deep dive on transition implications in APAC region

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INEVITABLE POLICY RESPONSE

WHILE SOME SECTORS HAVE SIGNIFICANT CLIMATE POLICY, SUCH AS POWER AND LDVS, OTHERS HAVE MANY GAPS, SUCH AS COAL PHASE OUT AND HGVS

Policy gap assessment relative to IPR 2023 forecast[1] — FPS policy gap | Acceleration | Confirmatory | Supportive | Deceleration

	Country[2]	Economy wide		Power			Build-ings	Transport		Indu-stry	Agri	Land use		Nature	
		Net Zero CO_2 emissions	Carbon price	New coal phase out	All coal phase out	Clean power	Zero-carbon heating	Light duty vehicles	Heavy duty vehicles	Industry decarb.	Low-carbon agriculture	Net deforestation [3]	Deforestation free supply	Protection[4] & restoration	Nature incentives
Advanced Economies	Japan	Legislated	Announced	Policy gap	Announced	Announced	Announced	Announced	Policy gap	Announced	Legislated	Policy gap	Policy gap	Legislated	Policy gap
	South Korea	Legislated	Legislated	Announced	Announced	Announced	Policy gap	Announced	Policy gap	Announced	Announced	Policy gap	Policy gap	Legislated	Policy gap
	Australia	Legislated	Legislated	Policy gap	Policy gap	Announced	Policy gap	Announced	Policy gap	Legislated	Legislated	Legislated	Policy gap	Announced	Announced
Emerging Markets & Developing Economies	China	Announced	Legislated	Policy gap	Policy gap	Announced	Announced	Announced	Policy gap	Announced	Legislated	Announced	Policy gap	Legislated	Legislated
	India	Announced	Announced	Announced	Policy gap	Announced	N/A	Policy gap	Policy gap	Legislated	Policy gap	Announced	Policy gap	Legislated	Policy gap
	Indonesia	Announced	Announced	Announced	Announced	Announced	N/A	Announced	Policy gap	Policy gap	Policy gap	Policy gap	Policy gap	Legislated	Policy gap
	Vietnam	Announced	Announced	Announced	Announced	Announced	N/A	Announced	Announced	Announced	Announced	Announced	Policy gap	Legislated	Legislated

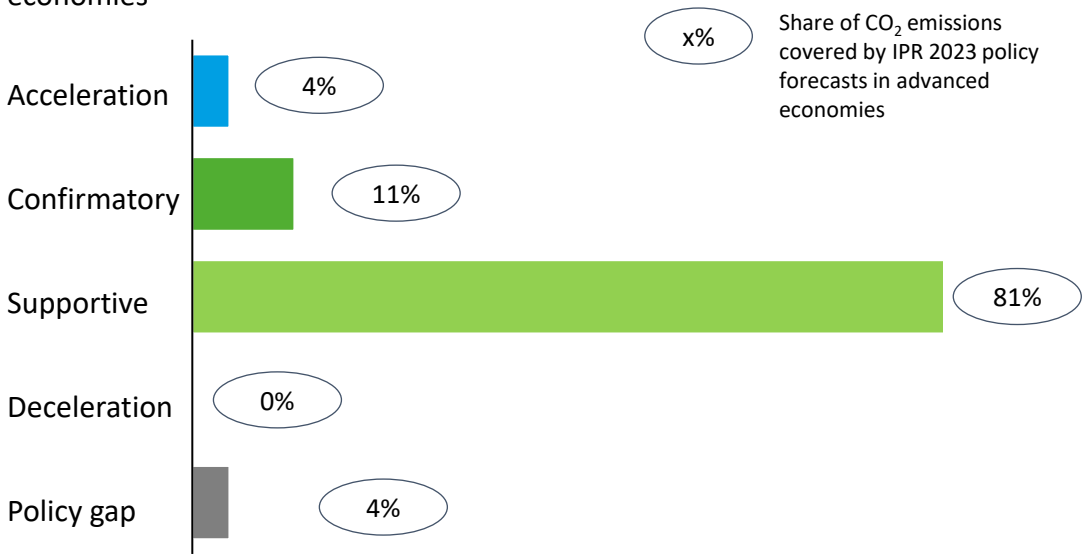
Gaps in policies to phase out existing and new coal in Asia particularly distinct relative to rest of the world

1. Based on major announcements and developments tracked in IPR 2021 Policy Forecast Detailed resource (March 2021) and 2022 and 2023 QFTs
2. Countries in each bucket (AE and EMDE) are ranked in order of CO_2 emissions, European Commissions Emissions Database
2. End of deforestation is defined as reduction in average annual deforestation by more than 95% versus the 1990-2020 level, alongside a net increase in forest cover
4. Policy gap assessment is shown for land protection only

INEVITABLE POLICY RESPONSE

ADVANCED ECONOMIES HAVE CLOSED NEARLY ALL THE POLICY GAPS…

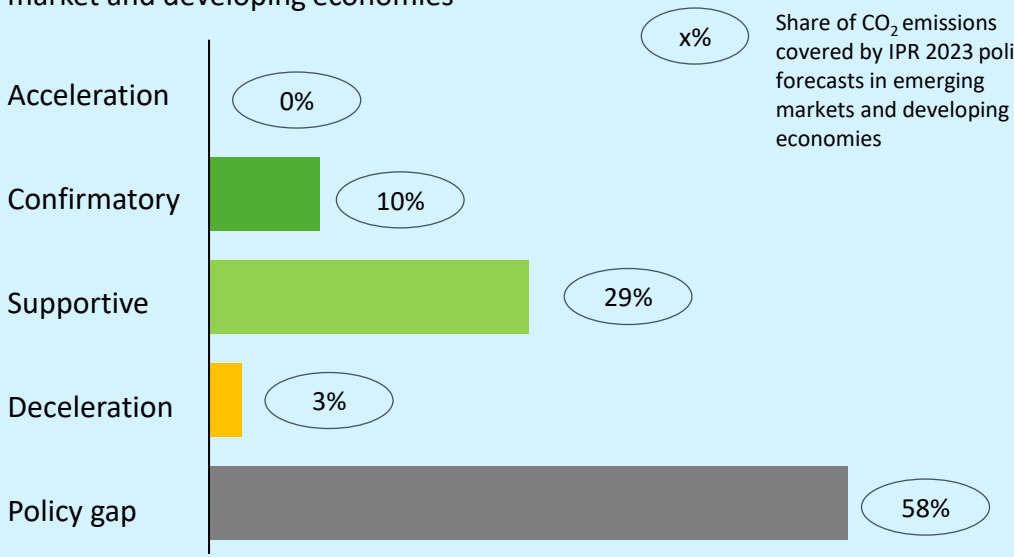
Policy forecasts relative to existing policy announcements[1], IPR advanced economies



- >90% of CO_2 emissions in IPR advanced economies (AE) are covered by existing climate policy that meets, or moves in the direction of meeting, IPR's Forecast Policy Response (FPS)
  - 4% accelerates beyond FPS towards IPR's 1.5°C Required Policy Response (RPS)
  - 11% is confirmatory of FPS, of which ~40% is legislated, while 81% moves in the direction of meeting it, of which ~30% is legislated
- 4% of CO_2 emissions in IPR AE are not covered by existing climate policy that aims to reduce them

…BUT THE KEY CHALLENGE IS IN EMERGING & DEVELOPING ECONOMIES

Policy forecasts relative to existing policy announcements[1], IPR emerging market and developing economies

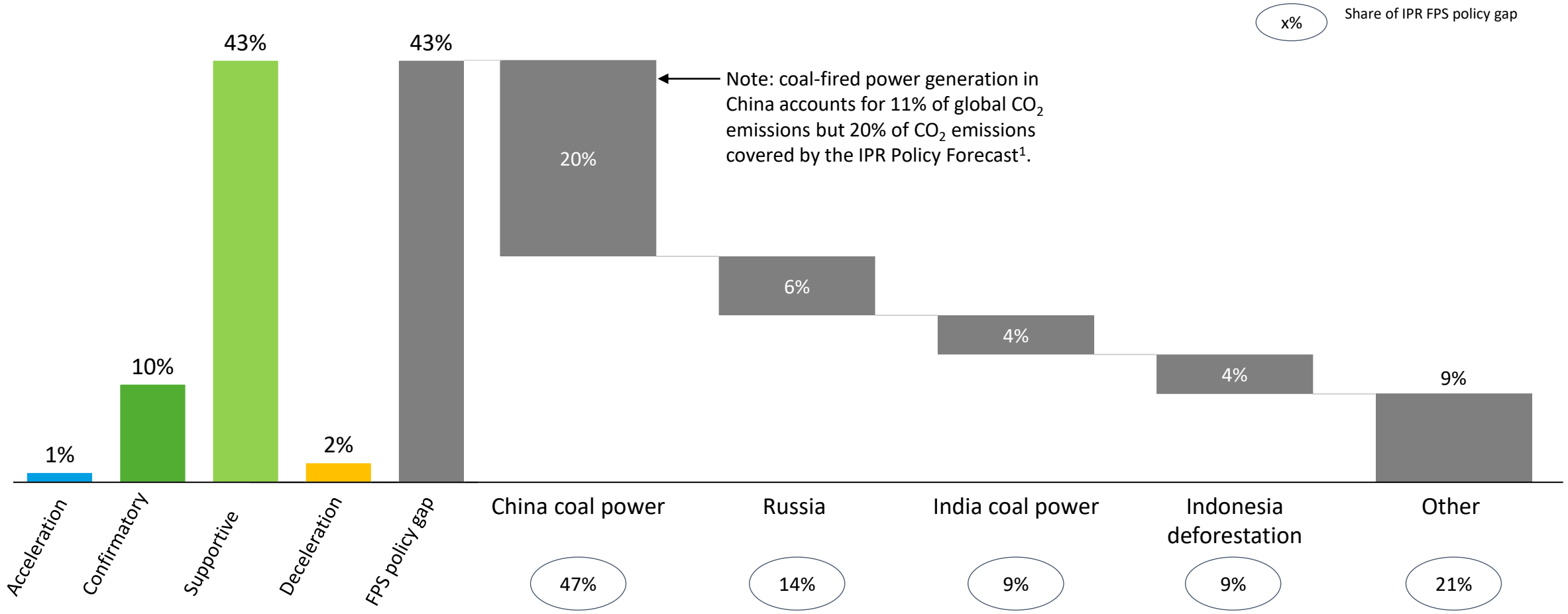


- 39% of CO_2 emissions in IPR emerging market and developing economies (EMDE) are covered by existing climate policy that meets, or moves in the direction of meeting, IPR's FPS
  - 10% meets the forecast (confirmatory), of which ~15% is legislated, while 29% moves in the direction of meeting it, of which ~25% is legislated
- 58% of CO_2 emissions in IPR EMDE are not covered by existing climate policy that aims to reduce them

1. Weighted by CO_2 emissions covered by IPR countries and policy forecasts. The % of emissions is based on those covered by the IPR policy forecast and therefore excludes some such as aviation & shipping

CHINA'S COAL-FIRED ELECTRICITY FLEET CONTRIBUTES NEARLY HALF OF THE GAP TO BE ADDRESSED IN IPR'S 2023 POLICY FORECAST

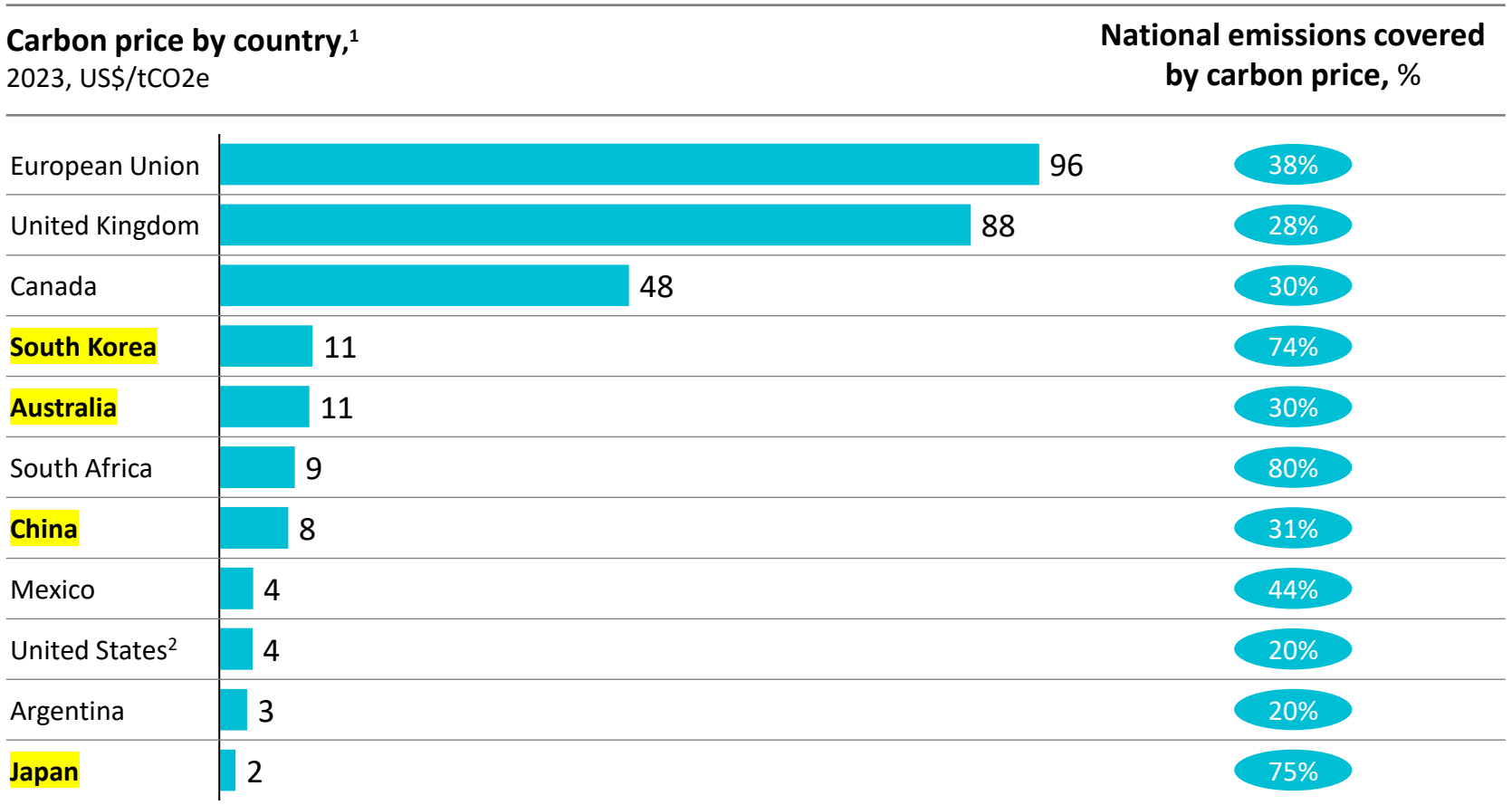
Breakdown of IPR policy forecasts with no existing policy announcements to meet them, weighted by CO_2 emissions[1]



1. Weighted by CO_2 emissions covered by IPR's policy forecasts. IPR policy forecasts do not cover all CO_2 emissions and therefore the percentage breakdowns shown will likely be higher than if this analysis was done for all countries and sectors, covering all global emissions. For example, coal-fired power generation in China accounts for 11% of global CO_2 emissions but 20% of emissions covered by IPR policy forecasts.

INEVITABLE POLICY RESPONSE

OF THE IPR COUNTRIES, ONLY THE EU AND THE UK HAVE CARBON PRICES THAT ARE HIGHER THAN $50/TCO2E IN 2023



1. 7 IPR countries do not currently have carbon prices, including India, Vietnam, Turkey, Nigeria, Brazil, Russia, and Saudi Arabia.
2. The US carbon price is calculated as the weighted average price per state based on the share of power and industry emissions.

Source: World Bank Carbon Pricing

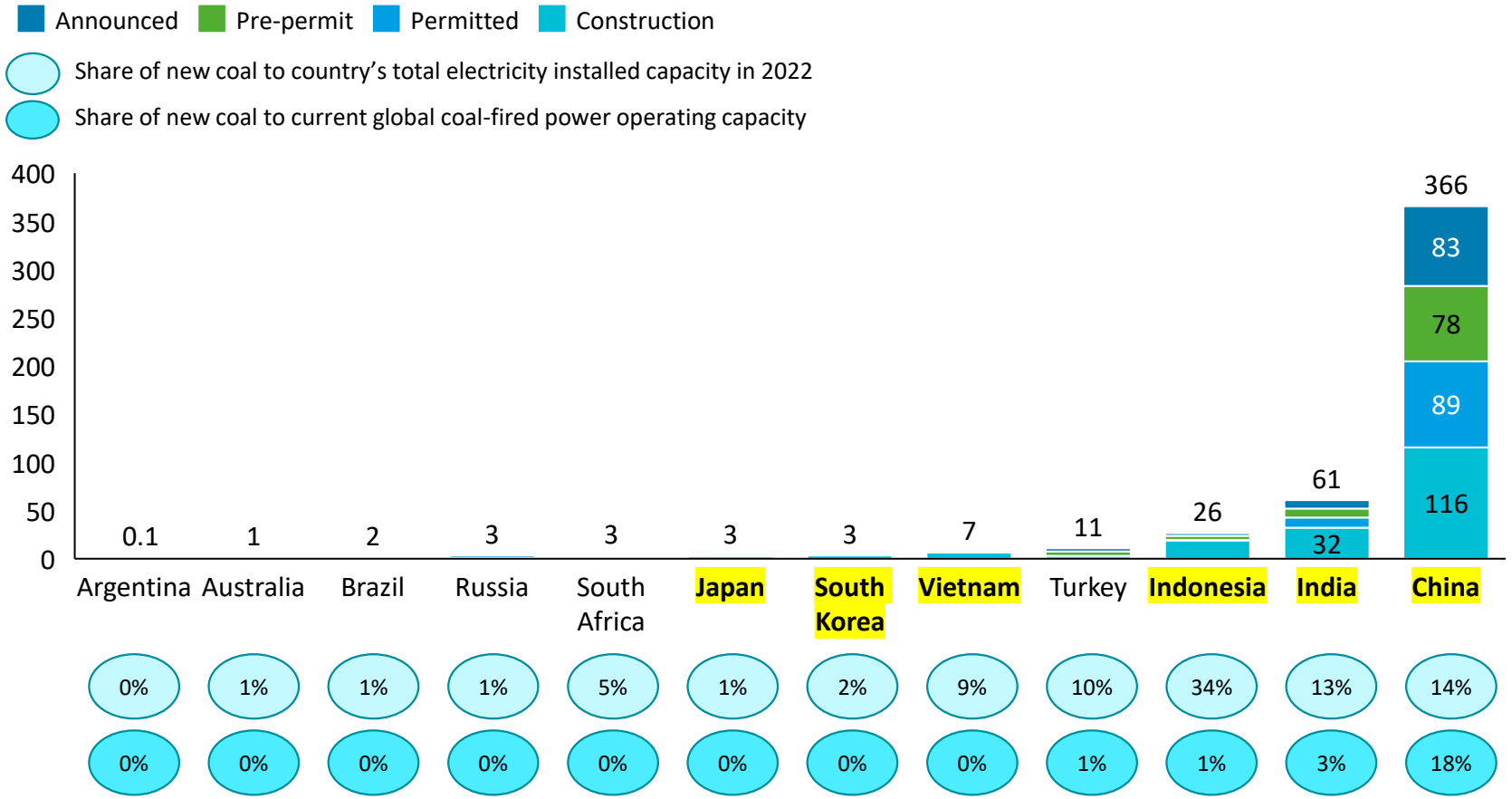
Key Insights

1. The EU and the UK have carbon price mechanisms with the highest prices of IPR countries in 2023, at US$96/$tCO_2e$ and US$88/$tCO_2e$, respectively.
2. South Africa, Japan and South Korea's carbon price initiatives cover the highest share of national emissions of IPR countries, at 80%, 75% and 74%, respectively.
3. Mexico, the US, Argentina and Japan all have carbon price initiatives that are below $5/$tCO_2e$.

INEVITABLE POLICY RESPONSE

THERE IS ~500 GW OF NEW COAL POWER PLANTS IN THE PIPELINE IN IPR COUNTRIES, MAINLY IN CHINA AND INDIA

Coal power plants pipeline as of Jan 2023,[1] GW



1. "**Announced**: Projects that have appeared in corporate or governmental planning documents but have not yet moved actively forward by applying for permits or seeking land, coal, or financing. **Pre-permit**: Projects that have actively moved forward in one or more of the following ways: applying for environmental permits, acquiring land, acquiring coal, acquiring water rights, acquiring transmission arrangements, or securing financing**. Permitted**: Projects that have secured all environmental permits but have not broken ground**. Construction:** Projects where physical construction (i.e. concrete and steel, not just a ground-breaking ceremony or early site preparation) has begun.

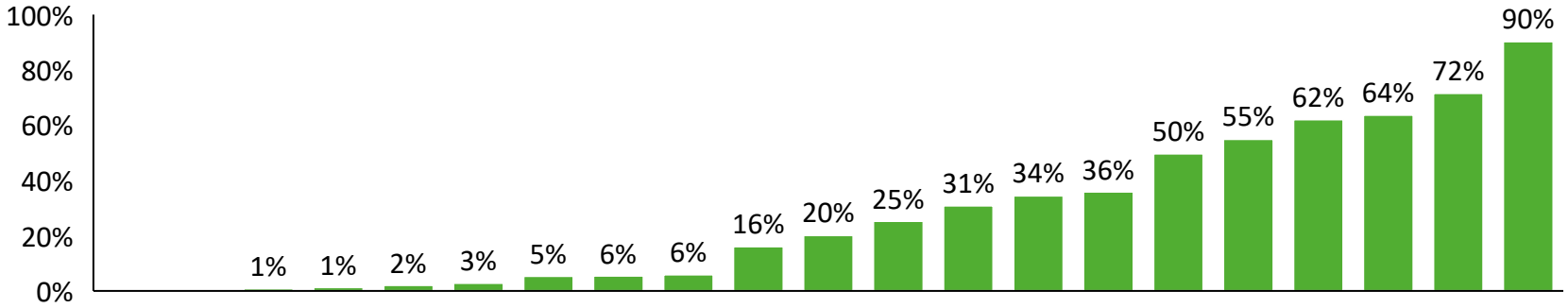
Source: Global Energy Monitor, IRENA

Key Insights

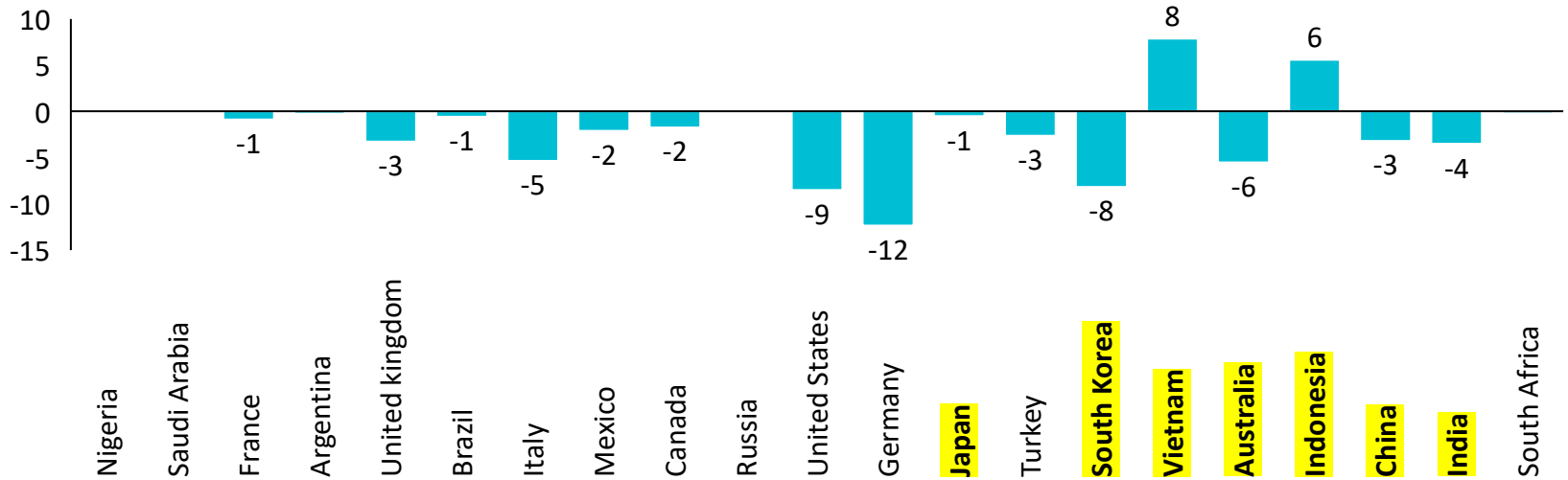
1. 12 IPR countries have new coal in the pipeline.
2. China and India have pipelines collectively amounting to ~430 GW of new coal plants, which accounts for 88% of all coal-fired power capacity in the pipeline of IPR countries.
3. Indonesia has the highest share of new coal to total power generation, with the capacity in the pipeline amounting to 34% of the country's total electricity installed capacity.
4. China's new coal in the pipeline is equivalent to ~20% of current global coal-fired power capacity.

THE SHARE OF COAL IN ELECTRICITY GENERATION REMAINS HIGH IN SOME IPR COUNTRIES BUT IS DECLINING IN MOST

Share of coal in total electricity generation, 2020, %



Change in coal's share of total electricity generation, 2018 – 2020, percentage points



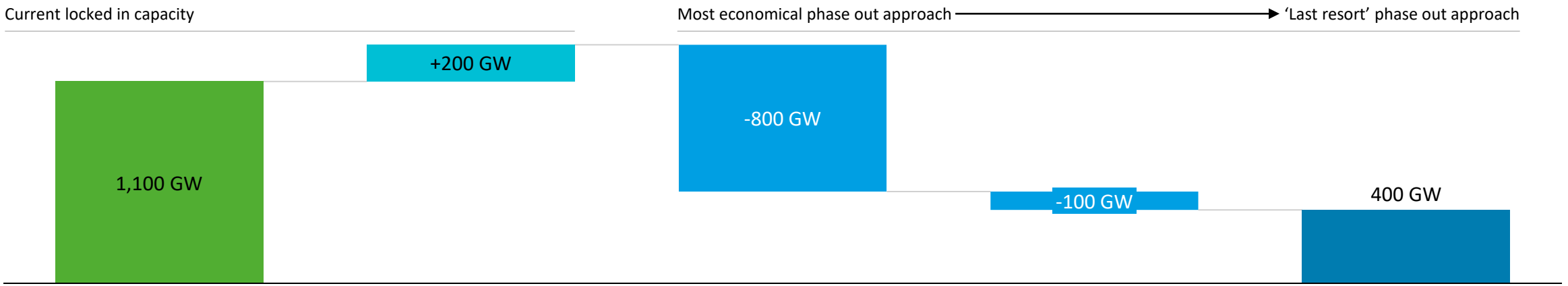
Source: IEA World Energy Balances

Key Insights

1. Coal-fired power accounts for 50% or more of power generation in 6 IPR countries in 2020.
2. China's share of coal in the country's grid has decreased by 3 percentage points between 2018 to 2020.
3. Germany and the USA saw the largest decline in coal power between 2018 and 2020, by 12 and 9 % points, respectively.
4. Indonesia and Vietnam, two Just Energy Transition Partnership (JETP) countries, are the only IPR countries where coal's share of generation increased between 2018 and 2020.

IN FPS, CHINA RETIRES 800GW OF COAL POWER BY 2045, RETROFITS 100GW WITH CCS, AND HAS 400GW IN RESERVE THAT IS "ECONOMICALLY STRANDED"

IPR's pathway for China's unabated coal fleet from 2020-45, GW



China currently has ~1100 GW of coal-fired generation capacity – all of which is unabated.

China has 366 GW of new unabated coal in the pipeline.

FPS forecasts that the 116 GW under construction, and half of the 167 GW of permitted capacity is built by 2030. The remaining ~165 GW pipeline is cancelled.

In FPS, Chinese coal plants are retired, on average, after 30 years.

This is a 5-10 years increase in the historical lifetime of Chinese coal plants[2].

Policy supports the build out of ~100GW of CCS in FPS.

China is already running large scale CCS pilot projects, for example starting construction on the country's first 1.5Mt coal CCS site in 2022.

China places 100s of GW of unabated coal in reserve in FPS.

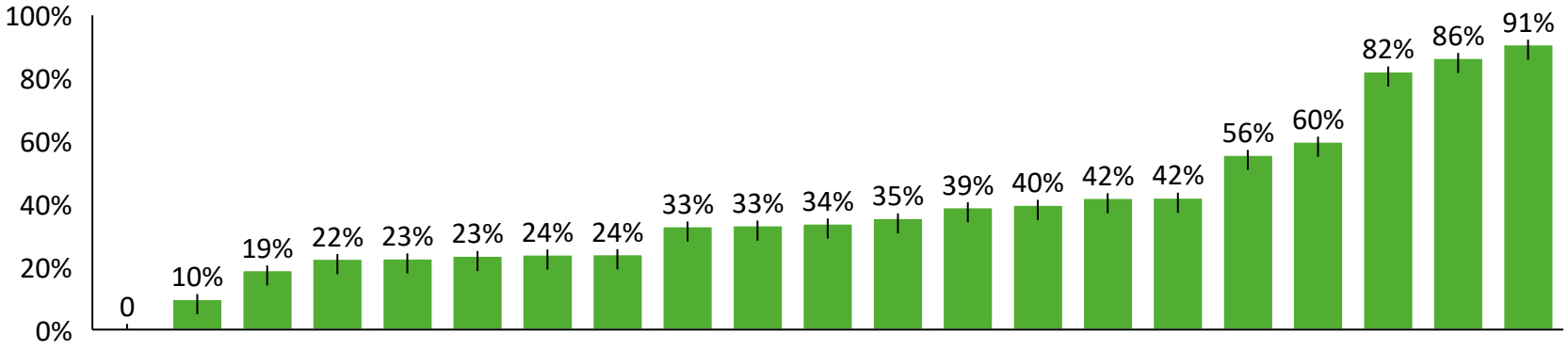
China can run up to 400 GW of reserves at an average aggregate capacity factor of ~10% and be in line with the coal phase out forecast.[1]

1. IPR coal phase out definition: 97% of dispatched power generation comes from sources other than unabated coal. Coal is considered abated when installed with CCS with a capture rate of 90% or equivalent.
2. Historical retirement age of coal plants has been 20-25 years. Future Chinese coal plant lifetime is modelled to be longer given the higher efficiency of China's existing coal fleet, compared with historically retired plants.
3. Plants which would no longer be economic and would otherwise shut-down without policy incentives to keep them in reserve

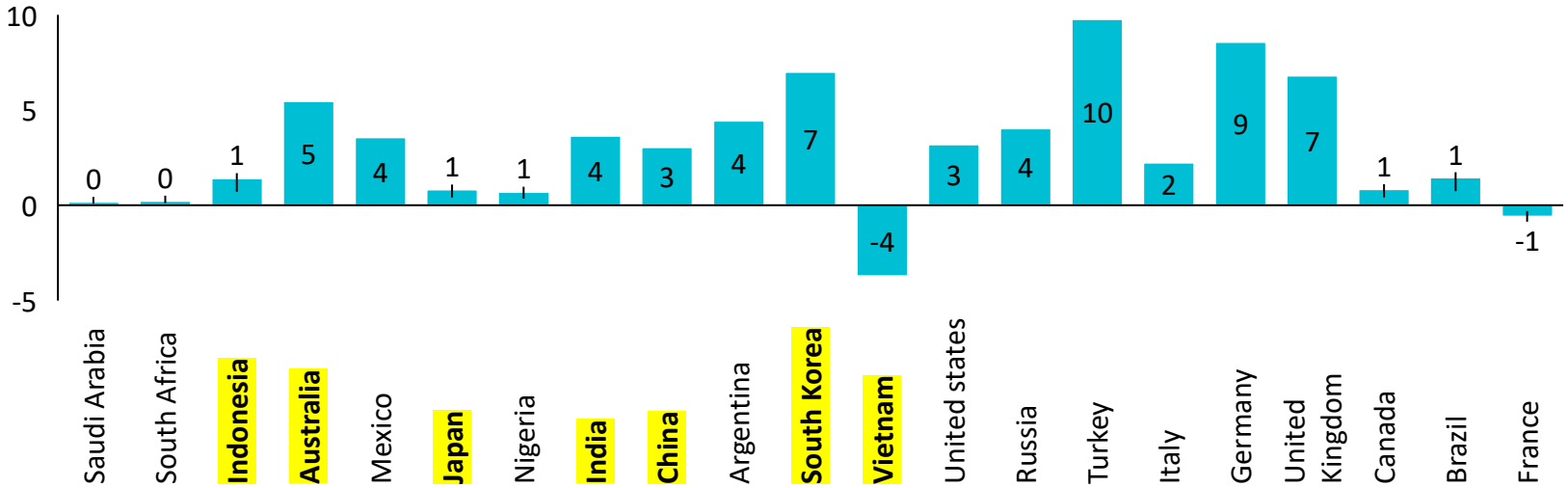
Sources: China coal pipeline: GEM, China coal plant lifetime: source, Distribution of China coal plant age: GEM, China modelled reserve capacity in 2050: source, UK coal capacity factor: DUKES, China CCS suitability: IEA, China coal spatial location: IEA, China CCS pilots: CHN Energy

19 OUT OF 21 IPR COUNTRIES INCREASED THEIR SHARE OF LOW-CARBON GENERATION BETWEEN 2018 AND 2020

Share of low-carbon generation by country, 2020, %



Change in share of low-carbon generation by country, 2018 – 2020, percentage points



Source: IEA World Energy Balances

Key Insights

1. Canada, Brazil, and France had more than 80% of their electricity generation from low-carbon sources in 2020.

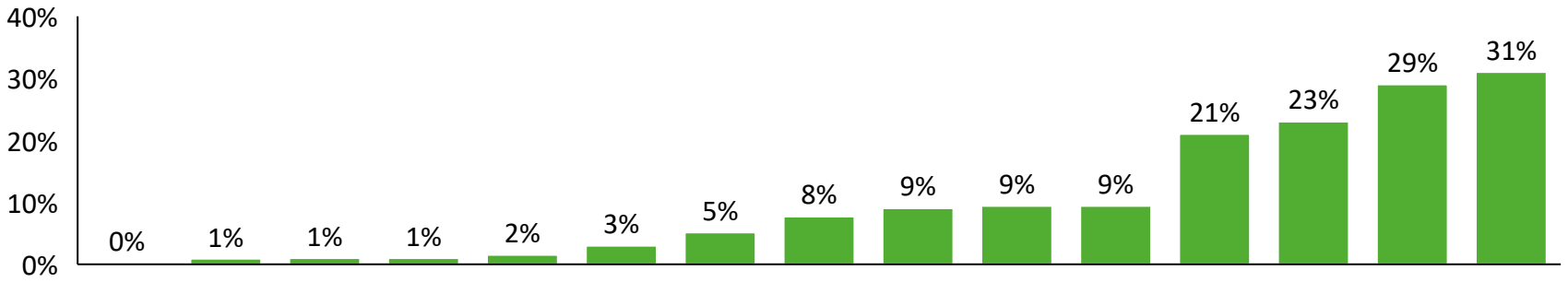
2. 8 countries had less than 30% of their electricity generation from low-carbon sources in 2020. Saudi Arabia has the lowest share at 0%.

3. Between 2018 and 2020, five countries saw a 5 percentage point increase in the share of low-carbon generation, with Turkey having the highest change of 10 % points.

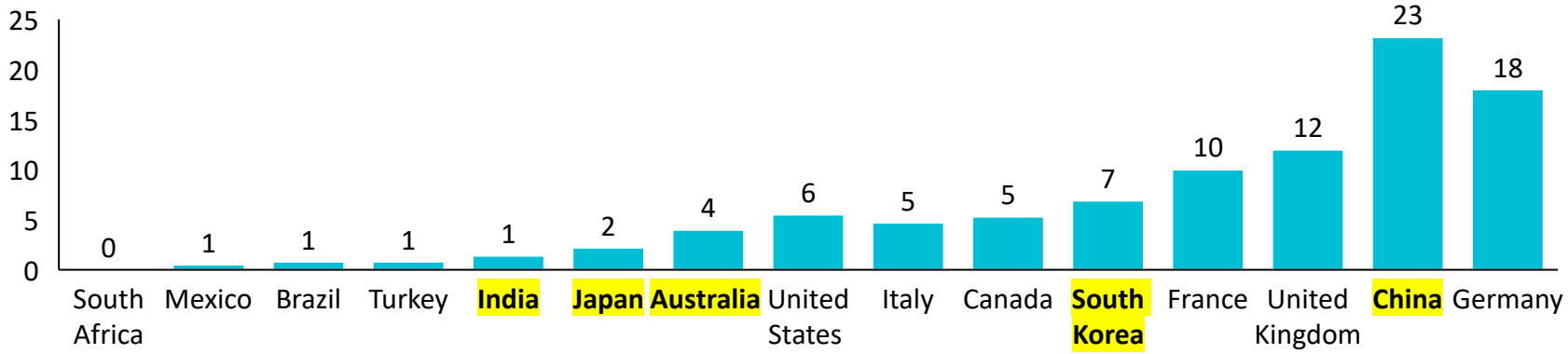
INEVITABLE POLICY RESPONSE

EV SHARE OF NEW CAR SALES IS RISING, REACHING OVER 20% IN CHINA AND PARTS OF EUROPE IN 2022

EVs share of new car sales by country, 2022,[1] %



Change in EVs' share of new car sales by country 2020-2022, percentage points



1. 6 IPR countries are not included due to limited availability of data, including Argentina, Indonesia, Nigeria, Russia, Saudi Arabia, and Vietnam.

Source: IEA

Key Insights

1. In 2022, 4 IPR countries had an EV share of new car sales greater than 20%, with Germany highest at 31%.

2. 11 IPR countries saw less than a +10 percentage point increase in share of EVs of new car sales between 2020 and 2022.

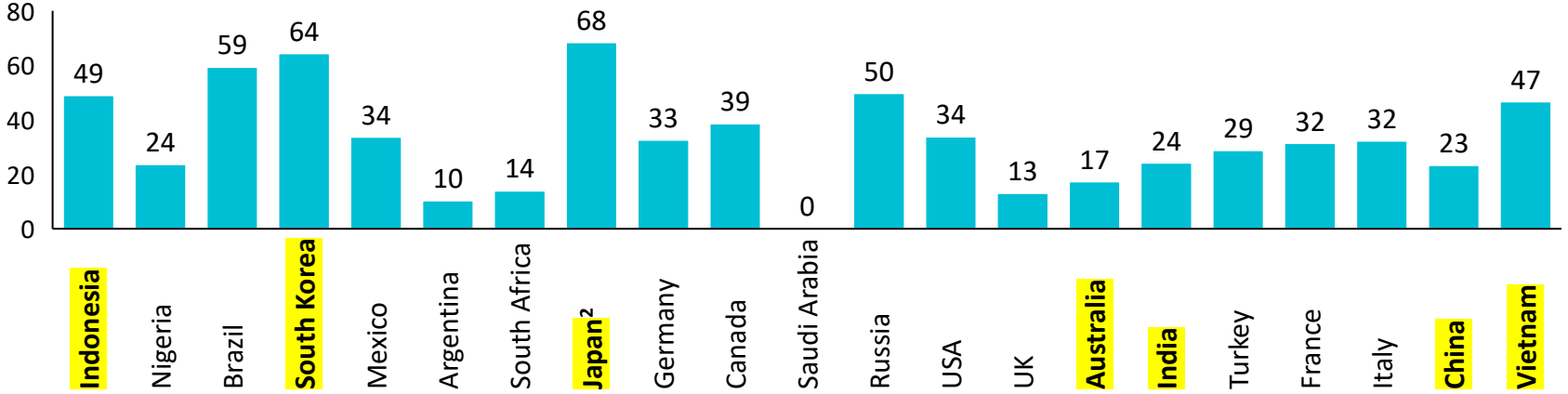
3. China recorded the highest change in EV share of new car sales between 2020 and 2022, with a 23 percentage point increase.

INEVITABLE POLICY RESPONSE

14 OUT OF 21 IPR COUNTRIES HAVE ENDED NET DEFORESTATION[1]

Change in forest cover 2010-2020, percentage points

Forest cover as a share of total land area 2020, %



Source: World Bank

1. End of deforestation is defined as a reduction in average annual deforestation by more than 95% versus the 1990-2020 level alongside net increase in forest cover.
2. Japan is classified as having reached net zero due to small margin

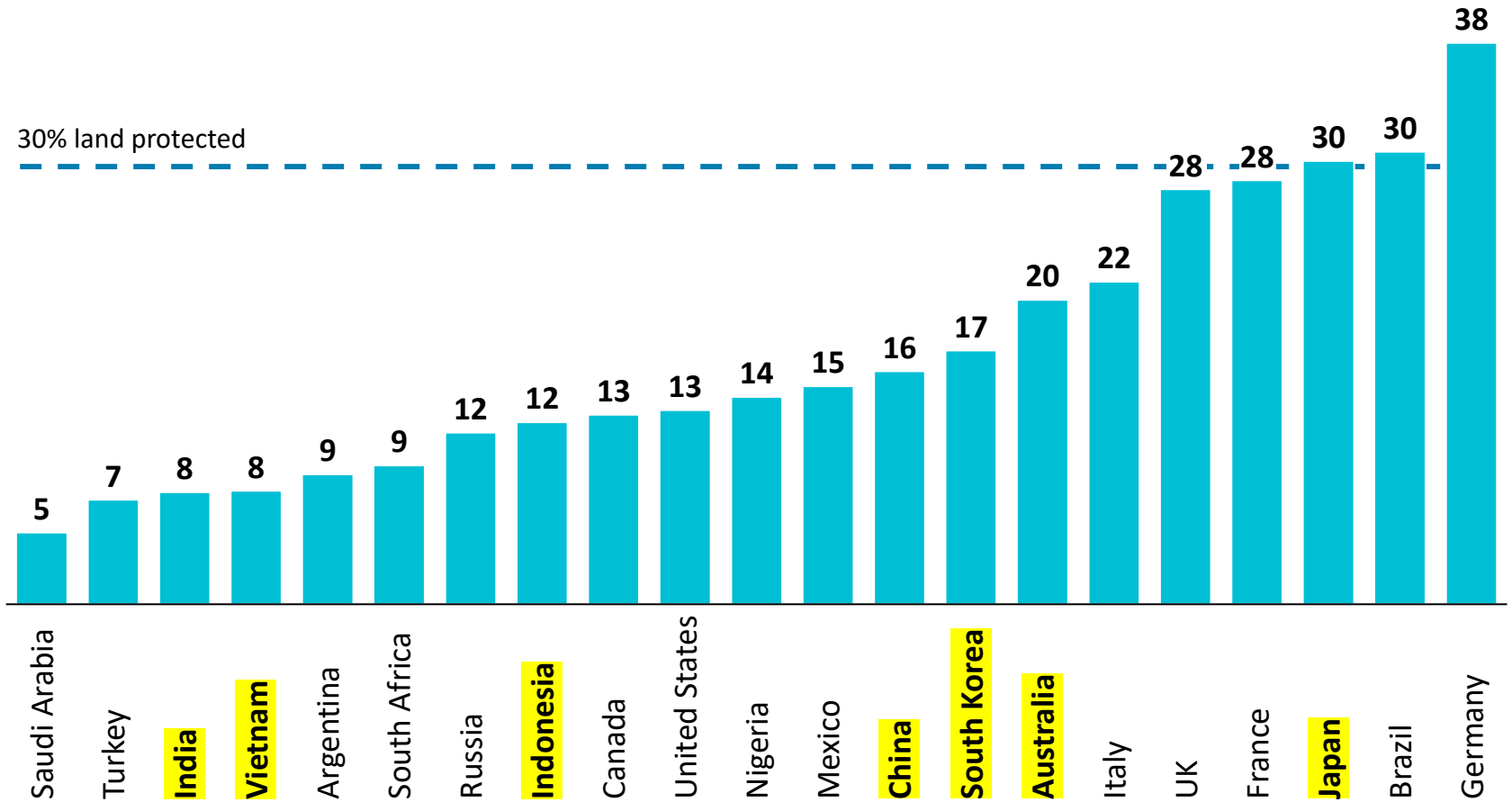
Key Insights

1. In 7 IPR countries, the forest share of land area fell by more than 0.2 % points between 2010-20. Of these countries, Indonesia had the greatest fall at -4 % points of land area.

2. Vietnam had the highest increase in forest cover as a share of land area between 2010-20 of IPR countries, at +4 % points.

7 IPR COUNTRIES HAVE MORE THAN 20% PROTECTED AREA COVERAGE

Terrestrial and inland waters protected area coverage, 2022, %



Sources: World Bank, Protected Planet

Key Insights

1. Germany, Japan and Brazil had 30% protected area coverage in 2022.
2. 7 IPR countries had protected area coverage 20% or greater of total terrestrial and inland water in 2022.
3. 6 IPR countries had less than 10% protected areas of terrestrial and inland waters in 2022.

IPR 2023 POLICY FORECAST: NET ZERO CO_2 EMISSIONS ACHIEVEMENT YEAR

IPR 2023 forecast for net zero CO_2 emissions

Tier	Country	2023 Policy Forecast
Tier 1	Germany	Net zero CO_2 emissions to be achieved by 2045
	UK	Net zero CO_2 emissions to be achieved by 2050
	France	
	Canada	
	Italy	
	South Korea	
	USA	
	Japan	
	Australia	
	Brazil	
Tier 2	Argentina	Net zero CO_2 emissions to be achieved by 2060
	Vietnam	
	Turkey	
	China	
	Saudi Arabia	
	Indonesia	
Tier 3	**India**	Net zero CO_2 emissions to be achieved by 2065
	South Africa	Net zero CO_2 emissions to be achieved beyond 2065
	Mexico	
	Nigeria	
	Russia	

Details on country tiering system

1 **Tier 1** countries have a net zero target by 2050 or before and a strong track record of implementing climate policy

Germany **By 2045**

In 2021, Germany accelerated its net zero target date from 2050 to 2045.

South Korea **By 2050**

In 2021, South Korea legislated a carbon neutrality target for 2050.

2 **Tier 2** countries have a net zero target by 2060 and a moderate track record of implementing climate policy

China **By 2060**

In 2020, China announced a net zero target for 2060.

3 **Tier 3** countries have made little or no progress on reducing emissions to date

India **By 2065**

In 2021, the Indian government pledged to achieve net zero emissions by 2070, however IPR expects India to reach net zero 5 years earlier than the announced target given falling technology costs and its exposure to climate change.

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: CARBON PRICING FOR POWER AND INDUSTRY

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for carbon pricing

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	France	↑	↑	Explicit carbon price signal or backstop covering industry and power of US$120 by 2030
	Germany	↑	↑	
	Italy	↑	↑	
	UK	↑	↑	
	Canada	↑	—	US$100 by 2030
	Australia	—	—	US$70 by 2030
	Japan	↓	—	
	South Korea	↓	—	
Tier 2	India	↓	↓	US$50 by 2030
	Brazil	—	—	
	Indonesia	↓	—	
	Vietnam	•	—	
	China	↓	↓	
Tier 3	USA	—	↓	US$30 by 2030
	Argentina	•	↓	
	Mexico	•	↓	
	South Africa	↓	↓	
	Turkey	•	↓	
	Nigeria	•	↓	US$20 by 2030
	Saudi Arabia	•	↓	
	Russia	•	↓	US$0 by 2030

…which has 14 changes since IPR 2021

Information on key changes

France **Germany** **Italy** **UK** **↑ ($85 to $120)**

The EU and UK have implemented more stringent emissions caps for their ETS since IPR 2021, and expert evidence also indicates an upgrade in the forecast.

USA **↓ ($65 to $30)**

The US has not implemented a federal carbon price, with focus at the federal level being on low-carbon incentives, e.g., the IRA. However, IPR still expects some carbon prices at the state-level in the US, resulting in a forecast of $30 which is a weighted average of state-level forecasts.

China **↓ ($60 to $50)**

China's carbon price trajectory is aligned with a lower carbon price by 2030 compared to IPR 2021, with expert survey evidence also indicating a downgrade.

South Africa **Mexico** **Turkey** **↓ ($50 to $30)**

Limited policy developments and expert survey evidence indicating a deceleration in the forecast.

Nigeria **Saudi Arabia** **↓ ($35 to $20)**

Nigeria and Saudi Arabia do not have any form of carbon pricing.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey question: What will the national carbon price pathway be for the power and industry sectors in 2030 in the following countries?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: ENDING CONSTRUCTION OF NEW UNABATED COAL

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for the phase out of new unabated coal

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	USA	↓	—	Actual and anticipated policy signals (bans, EPS, carbon pricing), and market reforms end new unabated coal build before 2023
	Germany	—	—	
	France	—	—	
	Italy	•	—	
	UK	—	—	
	Canada	—	—	
	Mexico	•	—	
	Australia	↓	—	Actual and anticipated policy signals and market reforms end new coal build from 2023
	Argentina	•	—	
Tier 2	**South Korea**	•	↓	Actual and anticipated policy signals and market reforms end new coal build by 2025
	India	↓	↓	
	Japan	—	—	
	Brazil	↓	↓	
	Vietnam	•	—	
	South Africa	↓	—	
	Indonesia	—	↑	
Tier 3	Turkey	•	↓	Actual and anticipated policy signals and market reforms end new coal build by 2030
	Russia	•	—	
	China	↓	↓	
	Nigeria	•	—	
	Saudi Arabia	•	—	No coal in use or expected

…which has 6 changes since IPR 2021

Detail on key changes

South Korea ↓ **2020 to 2025**

South Korea does not have policy to end new coal plants and has 3 GW in the pipeline.

India ↓ **2020 to 2025**

In 2023, India announced an intention to halt the addition of new coal power plants apart from those already in the pipeline. India has 61 GW in the pipeline. Expert survey indicates a deceleration.

Brazil ↓ **2020 to 2025**

Brazil does not have policy in place to phase out coal power and has 2 GW of new coal plants in the pipeline. Survey indicates deceleration.

Indonesia ↑ **2030 to 2025**

In 2021, Indonesia announced a target to phase out all unabated coal power by 2056 with potential acceleration to 2040.

Turkey ↓ **2025 to 2030**

Turkey does not have policy to end new coal plants and has 11 GW in the pipeline.

China ↓ **2025 to 2030**

China does not have policy to end new coal power plants and has >350 GW in the pipeline. Expert survey indicates deceleration to 2030.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey question: What target year will policymakers set in the following countries for ending construction of new unabated coal generation capacity?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: PHASE OUT OF ALL UNABATED COAL GENERATION

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for the phase out of all unabated coal

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	France	—	—	Strong policy signal that coal generation will be made unlawful or unprofitable or held in reserve before 2030
	UK	—	—	
	Italy	•	—	
	Canada	—	—	By 2030
Tier 2	USA	↓	—	Coal to be made unlawful or unprofitable or held in reserve by 2035
	Germany	—	↑	
	Australia	—	—	Coal to be made unlawful or unprofitable or held in reserve by 2038-40
	Mexico	•	—	
	Turkey	•	—	Coal to be made unlawful or unprofitable or held in reserve by 2045
	Argentina	•	—	
	Brazil	↑	—	
	South Korea	•	—	
	China	—	—	
	Japan	—	—	
	Nigeria	•	—	
Tier 3	South Africa	↓	↓	Coal to be made unlawful or unprofitable or held in reserve by 2050
	Vietnam	•	↓	
	Indonesia	—	↑	
	India	—	—	Coal to be made unlawful or unprofitable or held in reserve by 2060
	Russia	•	—	
	Saudi Arabia	•	—	No coal in use or expected

…which has 4 changes since IPR 2021

Detail on key changes

USA — **2035** DEEP DIVE TO FOLLOW

New EPA emissions standards support IPR's 2021 forecast.

Germany ↑ **2038-40 to 2035**

In 2022 the German government announced an acceleration of its coal phase out target to 2030. Details of the target are not yet clear, and it has not been legislated.

China — **2045** DEEP DIVE TO FOLLOW

China does not have policy to phase out coal. IPR consortium forecasts 2045 phase out.

South Africa ↓ **2038-40 to 2050**

South Africa had a 90% share of coal in the system in 2020. South Africa has not set a target to phase out coal. Survey indicates a deceleration to 2050.

Vietnam ↓ **2045 to 2050**

In 2023, the government restated plans to phase out coal by 2050.

Indonesia ↑ **2060 to 2050**

In 2021, Indonesia announced a target to phase out unabated coal by 2056. This target will be accelerated to 2040 conditional on international support through JETPs.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey question: What target year will policymakers in the following countries set for ending all existing unabated coal generation?

Sources: full forecast evidence base can be found in the annex.

IPR 2023 POLICY FORECAST: CLEAN POWER FORECAST

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for clean power

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	Canada	—	—	Policy to deliver 97% clean power by 2035
	France	—	—	
	UK	↑	↑	
	Germany	↑	↑	Policy to deliver 97% clean power by 2040
	USA	—	—	
Tier 2	Italy	•	—	Strong policy signal to deliver 97% clean power by 2045
	Japan	—	—	
	Australia	—	—	
	South Korea	•	—	
Tier 3	Vietnam	•	↓	Strong policy signal to deliver 97% clean power by 2050
	Argentina	•	—	
	Mexico	•	—	
	Brazil	—	—	
	China	—	—	
	South Africa	↓	↓	
	Indonesia	—	↑	
	Turkey	•	—	
	Nigeria	•	—	
	India	—	—	Strong policy signal to deliver 97% clean power by 2060
	Russia	•	—	
	Saudi Arabia	•	—	

…which has 5 changes since IPR 2021

Details on key changes

UK ↑ 2040 to 2035

In 2021, the UK set a target to achieve a zero-carbon electricity system by 2035. The UK already has 60% share of renewable electricity generation and survey results indicate an acceleration.

Germany ↑ 2045 to 2040

In 2023, the German government announced a target to expand renewables to reach 80% of power consumption by 2030. Germany has legislated a target to phase out all coal by 2038. Germany has a low-carbon share of electricity generation of 56% and survey results also indicates an acceleration.

Vietnam ↓ 2045 to 2050

In August 2023, Vietnam released a National Energy Master Plan for 2021-2030 which includes a target for 15-20% of energy to come from renewables by 2030 and 80-85% by 2050.

South Africa ↓ 2040 to 2050

Coal's share of electricity generation was 90% in 2020 and survey results also indicate a deceleration.

Indonesia ↑ 2060 to 2050

In 2021, Indonesia announced that it aims to build 587 GW of CO2-free power plants by 2060.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey Q: What target year will policymakers in the following countries set for achieving a nearly zero-carbon electricity system?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: PHASE OUT OF LIGHT DUTY VEHICLES WITH CO_2 EMISSIONS

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for the phase out of LDVs with CO_2 emissions

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	UK	↓	—	97% of new sales are ZEVs from 2030
	Canada	—	—	97% of new sales are ZEVs from 2035
	France	—	—	
	Germany	—	—	
	Italy	•	—	
	South Korea	•	—	
	China	—	—	
Tier 2	Australia	—	—	97% of new sales are ZEVs from 2040
	USA	—	—	
	Vietnam	•	—	
	Argentina	•	—	
	Mexico	•	—	
	India	—	—	
	Japan	—	—	
	South Africa	↓	—	
	Saudi Arabia	•	↑	
	Turkey	•	—	
Tier 3	Brazil	—	—	97% of new sales are ZEVs from 2045
	Nigeria	•	—	
	Indonesia	↓	↓	
	Russia	•	↓	97% of new sales are ZEVs from 2050

…which has 3 changes since IPR 2021

Details on key changes

Canada — 2035

Canada has set a target for 100% zero-emissions vehicle sales of new light-duty vehicles by 2035.

France, Germany, Italy — 2035

The EU has mandated that all new cars and vans registered in the EU are to have zero CO2 emissions by 2035.

Saudi Arabia ↑ 2050 to 2040

Saudi Arabia has set a target of ensuring that 30% of the cars on its capital city's roads are electric by the end of 2030. In addition, KSA is investing in EV and battery manufacturing.

Indonesia ↓ 2040 to 2045

In 2021, the Indonesian government set a goal for 100% sales of new cars to be electrically-powered by 2050.

Russia ↓ 2045 to 2050

Russia has not announced policies or targets to phase out the use of CO_2 cars and vans.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey Question: What target year will policymakers set for more than 95% of sales of new cars and vans to be zero-CO_2 emissions?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: PHASE OUT OF HEAVY-DUTY VEHICLES WITH CO_2 EMISSIONS

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for the phase out of HDVs with CO_2 emissions

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	UK	↓	↓	97% of new sales are ZEVs by 2040
	Canada	↑	↑	
	France	—	—	
	Germany	—	—	
	Italy	•	—	
	South Korea	•	—	
	China	—	—	
	Japan	—	—	
Tier 2	USA	—	—	97% of new sales are ZEVs by 2045
	Vietnam	•	—	
	Argentina	•	—	
	Mexico	•	—	
	India	—	—	
	Australia	—	—	
	South Africa	↓	—	
	Saudi Arabia	•	↑	
	Turkey	•	—	
Tier 3	Brazil	↓	↓	97% of new sales are ZEVs by 2050
	Nigeria	•	—	
	Indonesia	—	↓	
	Russia	•	↓	97% of new sales are ZEVs by 2055

…which has 6 changes since IPR 2021

Details on key changes

UK ↓ **2035 to 2040**

In 2021, the UK announced that it will phase out sales of new petrol, diesel, and hybrid HDVs by 2040.

Canada ↑ **2045 to 2040**

Canada has signed a non-binding memorandum of understanding for 30% of medium- and heavy-duty vehicles to be zero-emission by 2030 and 100% by 2040.

Saudi Arabia ↑ **2055 to 2045**

Saudi Arabia is investing in the manufacturing of EVs and batteries. IPR forecasts Saudi Arabia to phase out HDVs with CO_2 emissions 5 years after it achieves IPR's forecast of phasing out LDVs with CO_2 emissions by 2040.

Brazil ↓ **2045 to 2050**

Brazil has not announced policies to end the sale of HDVs with CO_2 emissions. Survey results also indicate a deceleration. IPR forecasts Brazil to phase out HDVs with CO_2 emissions 5 years after it achieves IPR's forecast of phasing out LDVs with CO_2 emissions by 2045.

Indonesia ↓ **2045 to 2050**

Indonesia has not announced policies to end the sale of HDVs with CO_2 emissions.

Russia ↓ **2050 to 2055**

Russia has not announced policies to end the sale of HDVs with CO_2 emissions.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey Question: what target year will policymakers set for more than 95% of sales of new heavy-duty vehicles to be zero-CO_2 emissions?

Sources: full forecast evidence base can be found in the annex.

IPR 2023 POLICY FORECAST: PHASE OUT OF NEW FOSSIL FUEL HEATING SYSTEMS

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for ending the sale of fossil fuel heating systems

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	Germany	↑	↑	By 2030
	Australia	—	—	97% of new heating sales are zero carbon by 2035
	Canada	↓	—	
	France	—	—	
	Italy	•	—	
	UK	—	—	
	Japan	—	—	97% of new heating sales are zero carbon by 2040
	South Korea	•	—	
	USA	—	—	
Tier 2	Argentina	•	↓	97% of new heating sales are zero carbon by 2045
	China	↓	—	
Tier 3	Russia	•	—	97% of new heating sales are zero carbon by 2050
	South Africa	•	↓	
	Turkey	•	—	
	Brazil	•	—	Space heating not used
	India	•	—	
	Indonesia	•	—	
	Mexico	•	—	
	Nigeria	•	—	
	Saudi Arabia	•	—	
	Vietnam	•	—	

…which has 3 changes since IPR 2021

Details on key changes

Germany ↑ 2035 to 2030

Survey results indicate acceleration in forecast to before 2030. In 2023 the German government approved a bill that bans new oil and gas heating systems in new buildings in areas of residential development from 2024. Enforcement of the rules for existing buildings will come in after municipal authorities submit their decarbonisation heating plans, which are not required until 2028. The bill is still to be finalised at the time of IPR publishing in September 2023.

Argentina ↓ 2040 to 2045

Argentina has not set a target and does not have policies in place to end the sale of new fossil fuel heating systems in buildings. IPR forecasts the end of the installation of new fossil heating systems 15 years before net zero given their average lifetime of around 10-15 years. The IPR net zero forecast for Argentina is 2060.

South Africa ↓ 2035 to beyond 2050

Survey results indicate deceleration in forecast to beyond 2050. South Africa has not set a target and does not have policies in place to end the sale of new fossil heating systems in buildings. IPR forecasts the end of the installation of new fossil heating systems 15 years before net zero given their average lifetime of around 10-15 years. The IPR net zero forecast for South Africa is beyond 2065.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey Question: What target year will policymakers in the following countries set to end the installation of new fossil heating systems in existing and new buildings?

Sources: Policy evidence base can be found in the annex

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: INDUSTRY FUEL COMBUSTION EMISSIONS REDUCTION

Survey responses — Inconclusive • N/A[1]

This is a new IPR policy forecast

IPR 2023 forecast for the reduction of industry fuel combustion emissions

Tier	Country	Survey[2]	2023 Policy Forecast
Tier 1	Germany	—	By 2050
	Japan	2040-50	Policy or anticipated policy signals deliver 97% emissions reduction in industry fuel combustion by 2055
	France	2035-40	
	Australia	2045-50	
	Canada	2050	
	UK	2040	
	South Korea	•	
	USA	2045-50	
	Brazil	2050	By 2060
	Italy	•	
Tier 2	China	2050	Policy or anticipated policy signals deliver 97% emissions reduction in industry fuel combustion by 2070
	Argentina	•	
	Turkey	•	
	Vietnam	•	
	Saudi Arabia	•	
	Indonesia	Beyond 2050	
Tier 3	South Africa	Beyond 2050	Policy or anticipated policy signals deliver 97% emissions reduction in industry fuel combustion beyond 2070
	Russia	•	
	Mexico	•	
	Nigeria	•	
	India	Beyond 2050	

Information on country tiering system

1 **Tier 1:** countries with an IPR net zero forecast for 2050 or earlier. The forecast is accelerated if countries have an ETS covering industry and low-carbon hydrogen incentives in place.

Germany **2050**

The EU ETS covers industry emissions and Germany has a 2045 net zero target. Germany has announced US$54 bn to support industrial decarbonisation through carbon contacts for difference.

Japan **2055**

Japan is trialing an ETS covering industry. Japan has a 2050 net zero target and US$ 108 bn of investment available to support the development of hydrogen.

USA **2055**

The IRA provides US$ 61bn for clean tech including a tax credit which provides up to US$ 3 per tonne of clean hydrogen. The USA has a net zero by 2050 target, and several states have carbon pricing covering industrial emissions.

2 **Tier 2:** countries with an IPR net zero forecast for 2060 that do not have both an ETS covering industry and hydrogen incentives in place.

China

China has a 2060 net zero target. China is planning to expand its current ETS to cover industry but has not done so yet. China does not have hydrogen incentives in place.

3 **Tier 3:** countries with an IPR net zero forecast for later than 2060 that do not have both an ETS covering industry and hydrogen incentives in place.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey question: What target year will policymakers in the following countries set for all iron and steel production facilities to be nearly zero-carbon?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: INDUSTRY FUEL PROCESS EMISSIONS REDUCTION

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for the reduction of industry process emissions

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	Germany	↑	↑	By 2060
	Australia	↑	—	Policy or anticipated policy signals deliver >80% reduction in all industry process emissions by 2065
	France	↑	—	
	South Korea	•	—	
	UK	↑	—	
	Japan	—	—	
	Canada	↑	—	
	USA	↑	—	
Tier 2	Brazil	↑	—	By 2070
	Italy	•	—	
Tier 3	**China**	↑	—	Policy or anticipated policy signals deliver >80% reduction in all industry process emissions beyond 2070
	Argentina	•	—	
	Turkey	•	—	
	Vietnam	•	—	
	Saudi Arabia	•	—	
	Indonesia	—	—	
	South Africa	—	—	
	Russia	•	—	
	Mexico	•	—	
	Nigeria	•	—	
	India	—	—	

…which has 1 change since IPR 2021

Detail on key changes

Germany ↑ **Beyond 2060 to by 2060**

The EU ETS covers industry emissions and Germany has a 2045 net zero target. Germany has announced US$54 bn to support industrial decarbonisation through carbon contacts for difference. The survey evidence indicates an acceleration in the forecast.

Japan — **Beyond 2060 to by 2065**

Japan is trialing an ETS covering industry. Japan has a 2050 net zero target and a target for 6-12MtCO_2 annual CCUS capacity by 2030, which is supported by subsidies.

USA — **Beyond 2060 to by 2065**

The IRA provides US$ 61bn for clean tech including tax credits of up to US$ 85 per tonne of CO_2 permanently stored from CCS. The USA has several state level carbon pricing schemes that cover industry emissions, and the survey evidence indicates an acceleration in the forecast.

China — **Beyond 2060 to by 2070**

China has a 2060 net zero target. China is planning to expand its current ETS to cover industry but has not done so yet. China has run large scale CCUS pilot projects but does not have CCUS incentives in place.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey question: what target year will policymakers in the following countries set for all cement production facilities to be nearly zero-carbon?

Sources: full forecast evidence base can be found in the annex.

IPR 2023 POLICY FORECAST: LOW-CARBON AGRICULTURE

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for low carbon agriculture

Tier	Country	Survey vs 2021[2]	Change vs 2021	2023 Policy Forecast
Tier 1	UK	↓	—	Policy delivers significant nationwide market incentives to encourage farmers to reduce emissions from crop production and livestock by 2025
	Germany	—	—	
	France	↓	—	
	Italy	•	—	
	Japan	—	—	
	Canada	↓	—	
Tier 2	Australia	↓	↓	Policy delivers significant nationwide market incentives by 2030
	USA	↓	↓	
	China	↓	↓	
	South Korea	↓	↓	
	Vietnam	•	—	
	Brazil	↑	↑	
Tier 3	Mexico	•	↓	Policy delivers significant nationwide market incentives by 2035
	Turkey	•	↓	
	Indonesia	↓	—	
	Russia	•	—	
	South Africa	↓	—	
	India	↓	↓	
	Argentina	•	—	
	Nigeria	•	—	
	Saudi Arabia	•	•	Minimal agriculture

…which has 8 changes since IPR 2021

Information on key changes

USA Australia ↓ **(2025 to 2030)**

While market incentives to reduce agricultural emissions exist in both the US and Australia, they are limited in scale. Survey evidence indicates a deceleration in forecast relative to IPR 2021 for both countries to 2035.

Brazil ↑ **(2035 to 2030)**

Government has set a target to reduce agricultural emissions by 1 gigaton of CO_2 by 2030, implement 12.5 million hectares of zero tillage, and utilize bio-inputs on 13 million hectares. Survey evidence indicates an acceleration in forecast relative to IPR 2021 for Brazil to 2030.

China ↓ **(2025 to 2030)**

Limited funding for agricultural emissions reduction in China. Survey evidence indicates a deceleration in forecast relative to IPR 2021.

South Korea ↓ **(2025 to 2030)**

Limited funding for agricultural emissions reduction in South Korea.

Mexico Turkey ↓ **(2030 to 2035)**

Limited existing incentives to reduce agricultural emissions and no evidence of strategies in place to implement in future.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. Survey questions: By what year will there be policies in place in the following countries that encourage farmers to significantly reduce emissions from fertiliser and livestock?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: ENDING NET DEFORESTATION AND DELIVERING AFFORESTATION OR REFORESTATION AT SCALE

Change in forecast vs IPR 2021 — No change ↑ Acceleration ↓ Deceleration • N/A[1]

IPR 2023 forecast for ending net deforestation[2]

Tier	Country	Survey vs 2021[3]	Change vs 2021	2023 Policy Forecast
Tier 1	Canada	•	—	End net deforestation and deliver afforestation or reforestation at scale by 2025
	China	↓	—	
	France	—	—	
	Italy	•	—	
	Japan	•	—	
	UK	—	—	
	USA	↓	—	
	Turkey	•	—	
	Vietnam	•	—	
	Australia	↓	—	End net deforestation by 2025 and deliver afforestation or reforestation at scale by 2030
	Germany	↓	—	
Tier 2	Russia	•	—	End net deforestation by 2025 and deliver afforestation or reforestation at scale by 2035
	India	↓	—	
	Argentina	•		End net deforestation by 2030 and deliver afforestation or reforestation at scale by 2030
	Brazil	—	—	
	Mexico	•	—	
	Saudi Arabia	•	—	
	South Korea	•	↓	
	Indonesia	↓	—	
Tier 3	Nigeria	•	↓	End net deforestation by 2035 and deliver afforestation or reforestation at scale by 2035
	South Africa	↓	↓	

… which has 3 changes since IPR 2021

Details on key changes

China — **2025**

Large scale afforestation programmes in place, with forest area increasing between 2010-20.

South Korea ↓ **2025 to 2030**

South Korea is yet to end net deforestation and has no clear afforestation or reforestation policies or strategy in place.

Nigeria ↓ **2030 to 2035**

Nigeria is yet to end net deforestation and has no clear afforestation or reforestation policies or strategy in place.

South Africa ↓ **2030 to 2035**

No clear government ambition to end net deforestation or deliver large-scale afforestation and expert survey results indicate a deceleration in forecast relative to IPR 2021.

1. 12 geographies have survey results. 'N/A' is shown for countries without results or with inconclusive results. Inconclusive: results are randomly distributed with an approx., equal number of results showing an acceleration and deceleration vs FPS 2021.
2. End of deforestation is defined as a reduction in average annual deforestation by more than 95% versus the 1990-2020 level alongside net increase in forest cover.
3. Survey Question: By what year will there be policies in place that encourage farmers to carry out significant afforestation of agricultural land in the following countries?

Sources: Policy evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: 100% DEFORESTATION-FREE SUPPLY CHAINS

Survey responses — Inconclusive • N/A[1]

IPR 2023 forecast for 100% deforestation-free supply chain

Tier	Country	Survey[2]	2023 Policy Forecast
Tier 1	France	2030	100% deforestation-free supply chains by 2030
	Germany	2030	
	Italy	•	
	UK	2035	
	Australia	2030	
Tier 2	Canada	2030	100% deforestation-free supply chains by 2035
	Japan	2035	
	USA	—	
	Brazil	2030	
	China	2030/2035	
Tier 3	**South Korea**	•	100% deforestation-free supply chains beyond 2035
	Turkey	•	
	Russia	•	
	Mexico	•	
	South Africa	Beyond 2035	
	Indonesia	Beyond 2035	
	Vietnam	•	
	Argentina	•	
	Nigeria	•	
	India	Beyond 2035	
	Saudi Arabia	•	

Information on country tiering system

1 **Tier 1** countries have mostly existing mandates for deforestation-free supply chain policies.

France Germany Italy **By 2030**

The EU requires that products placed on their market are not associated with deforestation in the supply chain for importers of cattle, cocoa, coffee, palm-oil, soya and wood.

2 **Tier 2** countries have not mandated deforestation-free supply chains but do have survey evidence indicating policies will be implemented by 2035 or have a track record of implementing supply chain due diligence regulations.

USA **By 2035**

The USA has not set deforestation-free supply chain regulations at the federal level but has a track record of implementing supply chain due diligence policy, for example in prohibiting the import of goods produced using forced labour.

3 **Tier 3** countries have neither introduced nor announced policies for deforestation-free supply chains and survey evidence indicates this will be implemented beyond 2035.

Mexico **Beyond 2035**

Mexico has not set deforestation-free supply chain regulations or announced an intention to do so.

1. 12 geographies have survey results. 'N/A' is shown for countries without results. Inconclusive: results are randomly distributed.
2. Survey question: By what year will policies enter force that require agricultural commodities imports to be deforestation-free in the following countries?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: 30% LAND PROTECTION AND RESTORATION ACHIEVED

Survey responses — Inconclusive • N/A[1]

This is a new IPR policy forecast

IPR 2023 forecast for land protection and restoration

Tier	Country	Survey[2]	2023 Policy Forecast
Tier 1	Germany	Before 2030	By 2025
	Australia	2030	30% protection of all land achieved, and 30% of degraded land under effective restoration or restored by 2030
	Brazil	2030	
	France	—	
	Italy	•	
	Japan	2035	
	UK	—	
Tier 2	**China**	2030	30% protection of all land achieved, and 30% of degraded land under effective restoration or restored by 2035
	USA	2035	
	Canada	2030-2035	
	Argentina	•	30% protection of all land achieved, and 30% of degraded land under effective restoration or restored by 2040
	India	2035	
	Mexico	•	
	Saudi Arabia	•	
	South Africa	•	
	South Korea	•	
Tier 3	**Indonesia**	•	30% protection of all land achieved, and 30% of degraded land under effective restoration or restored beyond 2040
	Nigeria	•	
	Russia	•	
	Turkey	•	
	Vietnam	•	

Details on country tiering system

1 **Tier 1** countries have announced a target or strategy to protect 30% land by 2030, and increase land restoration rates, with at least 20% land protection achieved to date.

UK **By 2030**

The government has committed to protecting at least 30% of land and sea for nature by 2030, and to set legally binding targets for nature recovery.

2 **Tier 2** countries have announced a target or strategy to increase land protection and land restoration rates, with less than 20% land protection achieved to date.

China **By 2035**

China has set out a series of objectives for national ecological protection and restoration in a 2020 master plan but only 16% of land is currently protected.

3 **Tier 3** countries have no clear policy or strategy in place to increase land protection and restoration and have less than 15% land protection achieved to date.

Indonesia **Beyond 2040**

Indonesia does not have a target in place to increase land protection and has 12% land protected as of 2022.

1. 12 geographies have survey results. 'N/A' is shown for countries without results. Inconclusive: results are randomly distributed.
2. Survey question: By what year will the following countries achieve the Dec 2022 Biodiversity COP 15 target of protecting 30% of land and marine area?

Sources: Policy evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IPR 2023 POLICY FORECAST: NATURE INCENTIVES

Survey responses — Inconclusive • N/A[1]

This is a new IPR policy forecast

IPR 2023 forecast for nature incentives

Tier	Country	Survey[2]	2023 Policy Forecast
Tier 1	France	2030	Policy delivers significant market incentives to landowners to preserve nature by 2025
	UK	2035	
	Australia	2035	
	Germany	2030	Policy delivers significant market incentives to landowners to preserve nature by 2030
	Italy	•	
	Canada	2030	
	USA	—	
	China	2040	
	Vietnam	•	
	Brazil	—	
	Japan	2040	
	South Korea	•	
Tier 2	Indonesia	2040	Policy delivers significant market incentives to landowners to preserve nature by 2035
	South Africa	—	
	Argentina	•	
	Mexico	•	
Tier 3	Nigeria	•	Policy delivers significant market incentives to landowners to preserve nature beyond 2035
	Turkey	•	
	India	Beyond 2035	
	Russia	•	
	Saudi Arabia	•	

Information on country tiering system

1 **Tier 1** countries that have a national biodiversity market in place by 2025 under current proposals.

France **UK** **2025**

The UK and France are collaborating to create an international biodiversity market which is scheduled to be ready by COP 16 in Turkey in 2024.

2 **Tier 2** countries are those that have announced intentions to develop market incentives to preserve nature but have not announced national biodiversity markets

Argentina **2035**

Argentina has implemented a voluntary national-level payment for eco-system services (PES) program but has not announced a national biodiversity market with significant incentives.

3 **Tier 3** countries have neither introduced nor announced incentives for nature and survey evidence indicates forecast beyond 2035 where it exists.

India **Beyond 2035**

India has not implemented market incentives for nature conservation and the survey evidence indicates that such policies may be introduced beyond 2035.

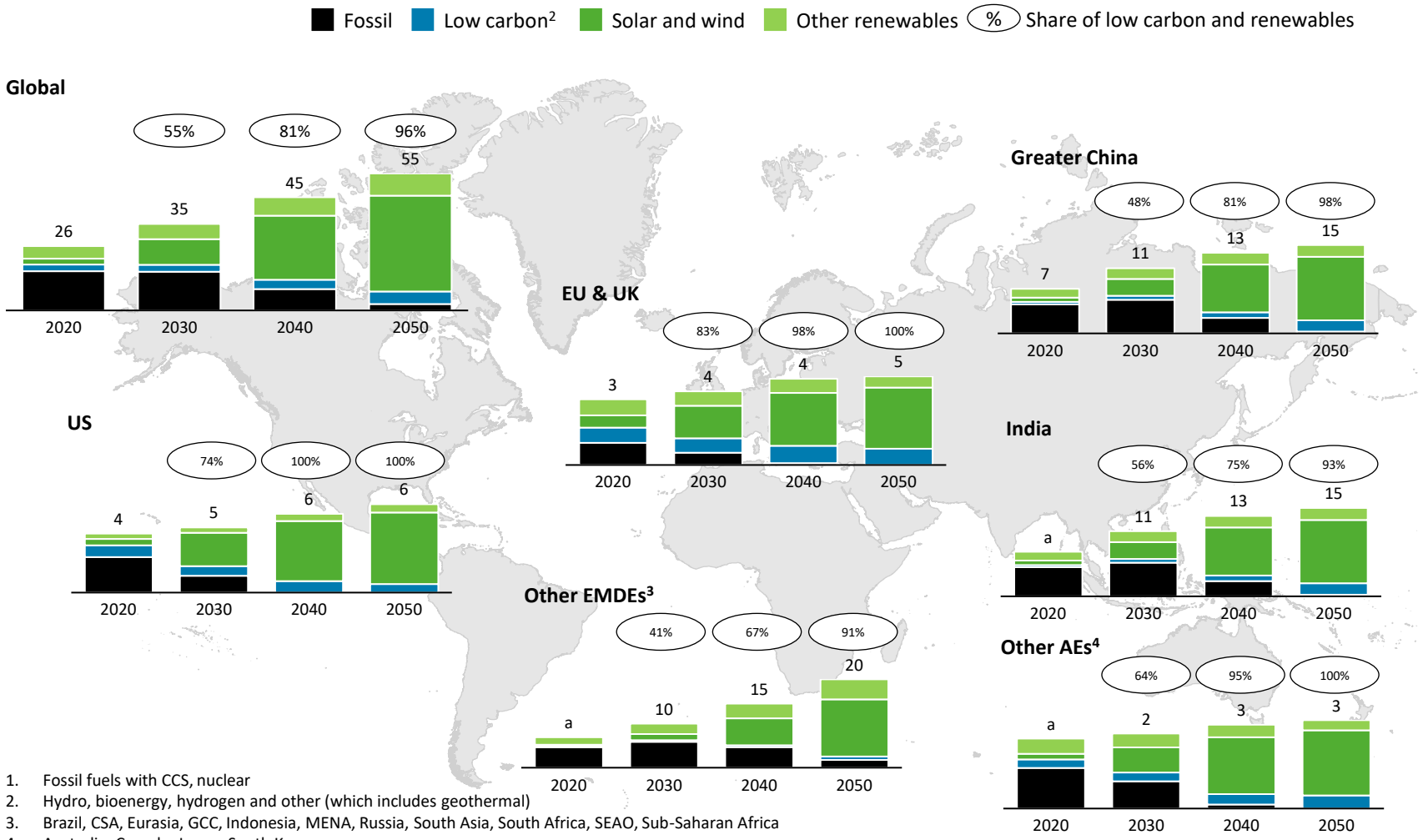
1. 12 geographies have survey results. 'N/A' is shown for countries without results. Inconclusive: results are randomly distributed
2. Survey question: By what year will there be compliance mechanisms in place that require most businesses (>80%) with a significant impact on nature to offset nature damages they cause e.g. biodiversity loss, or pay for ecosystem services?

Sources: full forecast evidence base can be found in the annex.

INEVITABLE POLICY RESPONSE

IN THE FPS, MOST AES ACHIEVE CLEAN POWER BY 2040, WHILE UNABATED FOSSIL REMAINS IN SOME EMDES IN 2050

Regional electricity generation mix, Thousand TWh



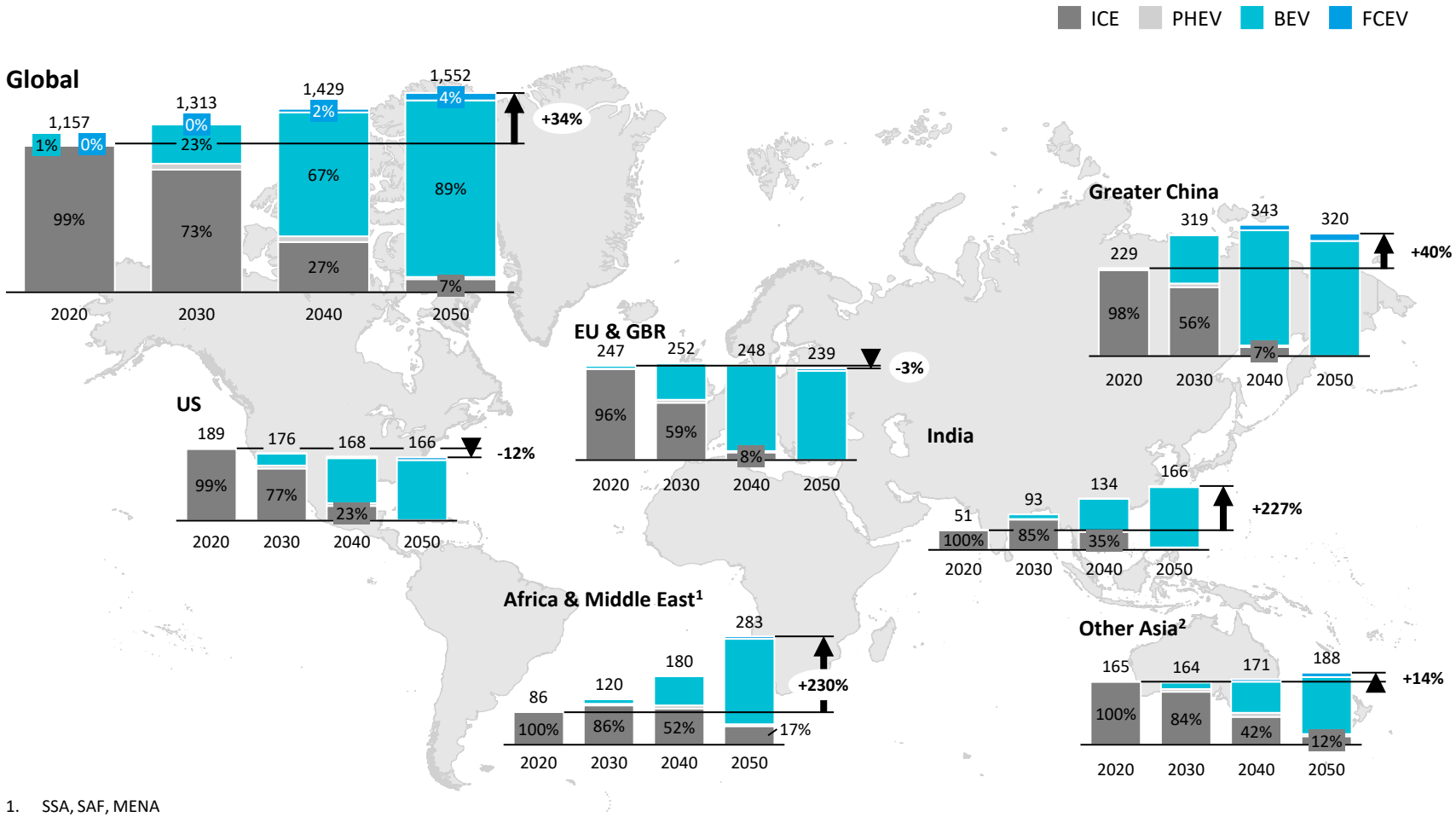
1. Fossil fuels with CCS, nuclear
2. Hydro, bioenergy, hydrogen and other (which includes geothermal)
3. Brazil, CSA, Eurasia, GCC, Indonesia, MENA, Russia, South Asia, South Africa, SEAO, Sub-Saharan Africa
4. Australia, Canada, Japan, South Korea

- By 2040, AEs have phased out close to all unabated fossil fuels for power generation. Due to later policies, EMDEs reach this level of decarbonisation after 2050
- The most rapid solar and wind growth occurs in areas with the fastest unabated fossil decline and best resource endowments – primarily USA, EU & UK, India, Greater China, MENA (other EMDEs) and Australia (other AEs)
- While most regions rely mostly on gas CCS as a source of fast dispatchable power, some regions with high gas prices and limited gas infrastructures such as India could also use hydrogen in similar amounts
- By 2050, all of bioenergy is BECCS. It is located mostly in regions with both demand carbon removals and a source of sustainable local biomass supply. The largest sources of BECCS for power by 2050 are thus the USA, China and Brazil

INEVITABLE POLICY RESPONSE

IN THE FPS, ZERO-EMISSION VEHICLES (ZEVS) REACH OVER 90% OF THE CAR FLEET BY 2050

Passenger car fleet, millions



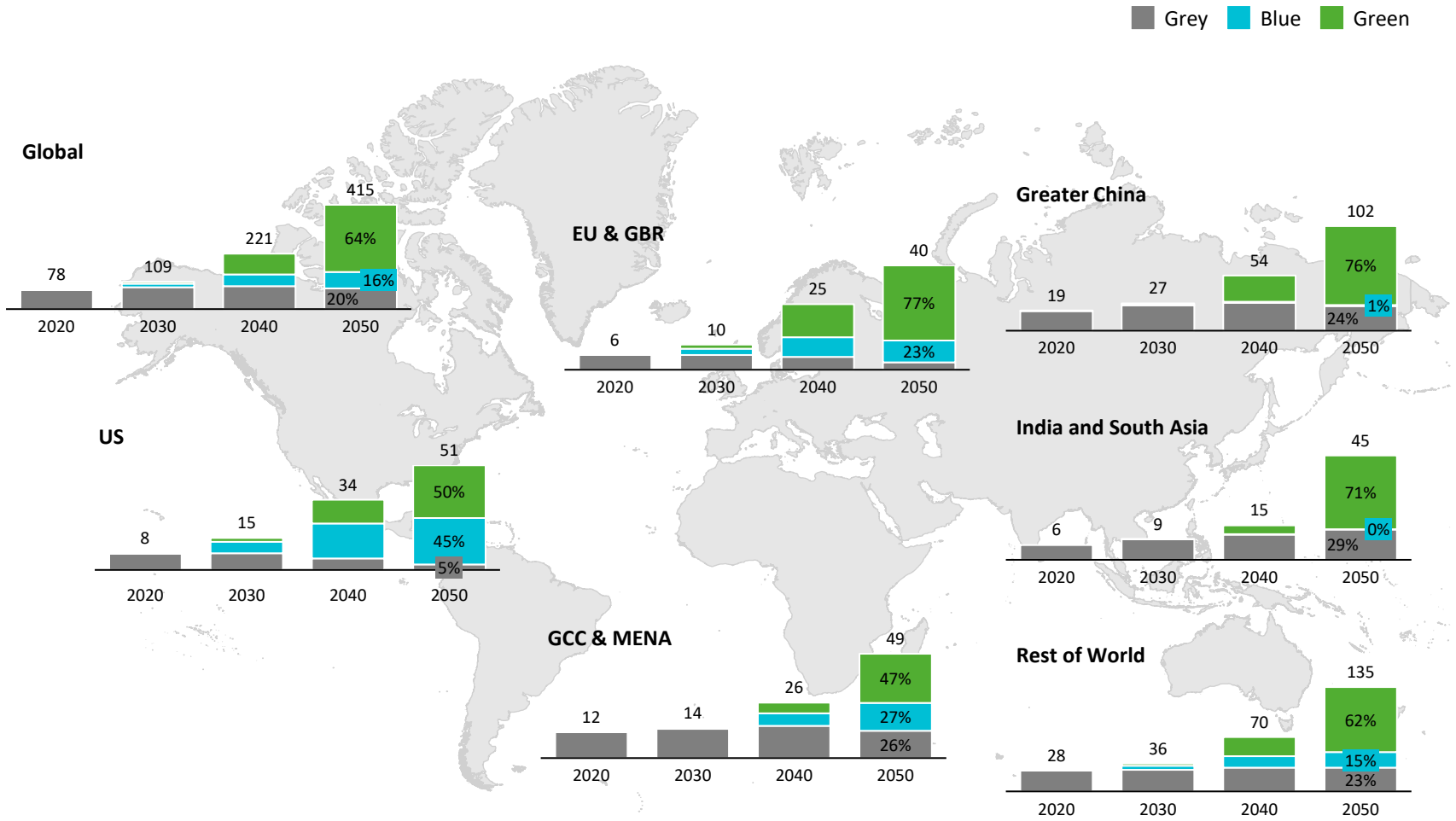
1. SSA, SAF, MENA
2. AUS, JPN, KOR, IDN, SEAO, SA, EURA

- **Car numbers in Africa and India more than triple** to 2050, while absolute numbers fall in the US and Europe
- China and Europe are almost fully decarbonised by 2040, after which the **majority of remaining ICE vehicles are in EMDEs**
- Pure **battery electric vehicles are the dominant technology**, however plug-in hybrid vehicles initially and later hydrogen fuel cell vehicles gain a small share in market segments with large travel distances

INEVITABLE POLICY RESPONSE

POLICY SUPPORT ENABLES GREEN H2 BUILD-OUT, WITH BLUE H2 ONLY COMPETITIVE IN CERTAIN REGIONS WITH FAVOURABLE CONDITIONS

Hydrogen production, Mt

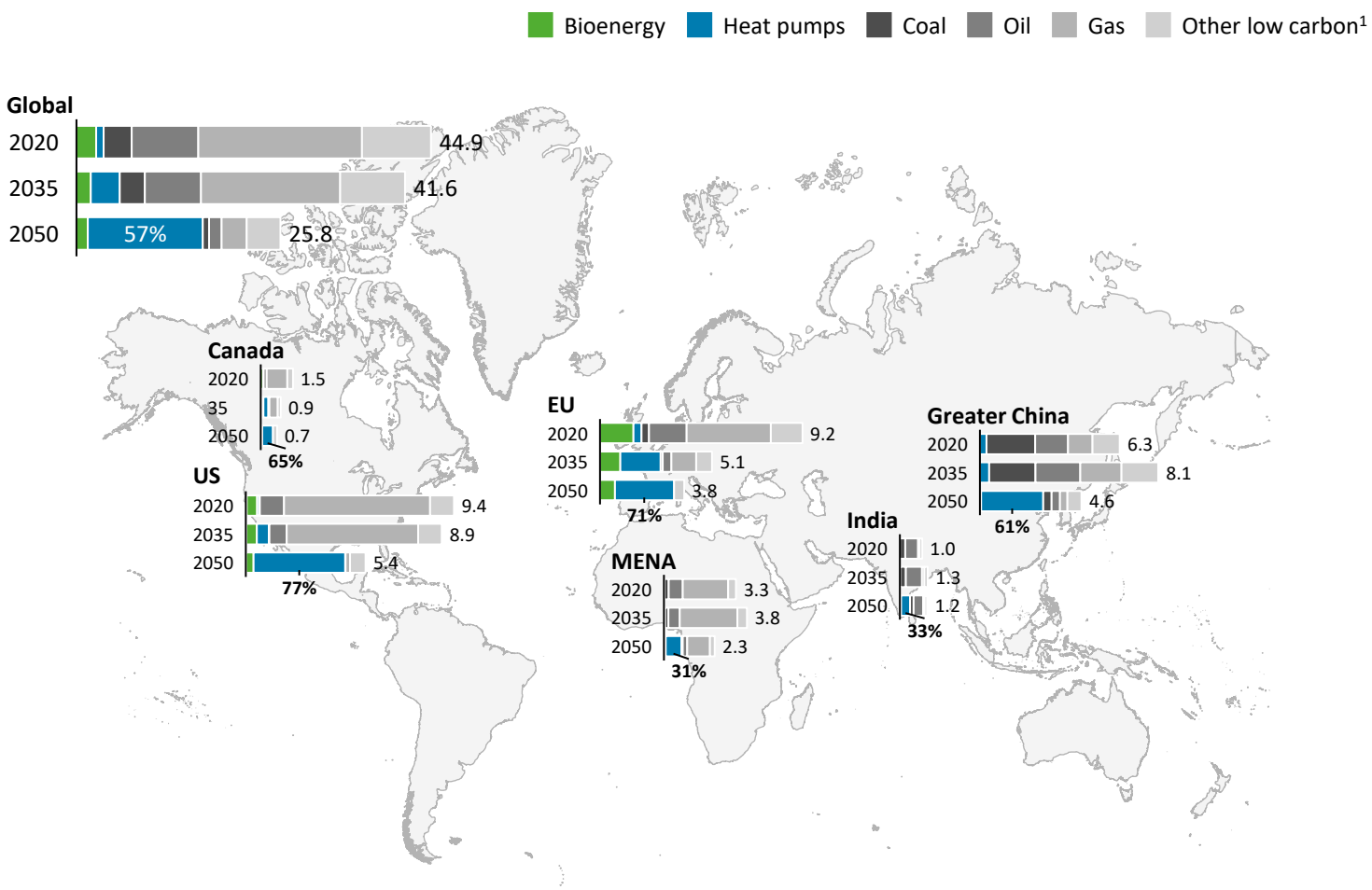


- **Green hydrogen grows to dominate hydrogen production by 2050 (64%)**, supported by policies such as the US's IRA, the EU's GDIP, and India's hydrogen strategy
- **Blue hydrogen is mostly used in regions with particularly favourable conditions**, such as MENA and the US where gas prices is lower
- **Grey hydrogen production also grows** towards 2040, but reduce by 2050, due to industrial decarbonisation and carbon pricing

INEVITABLE POLICY RESPONSE

EFFICIENT ELECTRIC HEAT PUMPS REPLACE FOSSIL HEATING SYSTEMS, WITH BIOENERGY AND HYDROGEN PLAYING A ROLE

Thermal output by technology, 2020-2050, TW/year



1. Includes electric resistive heating, hydrogen and district heating

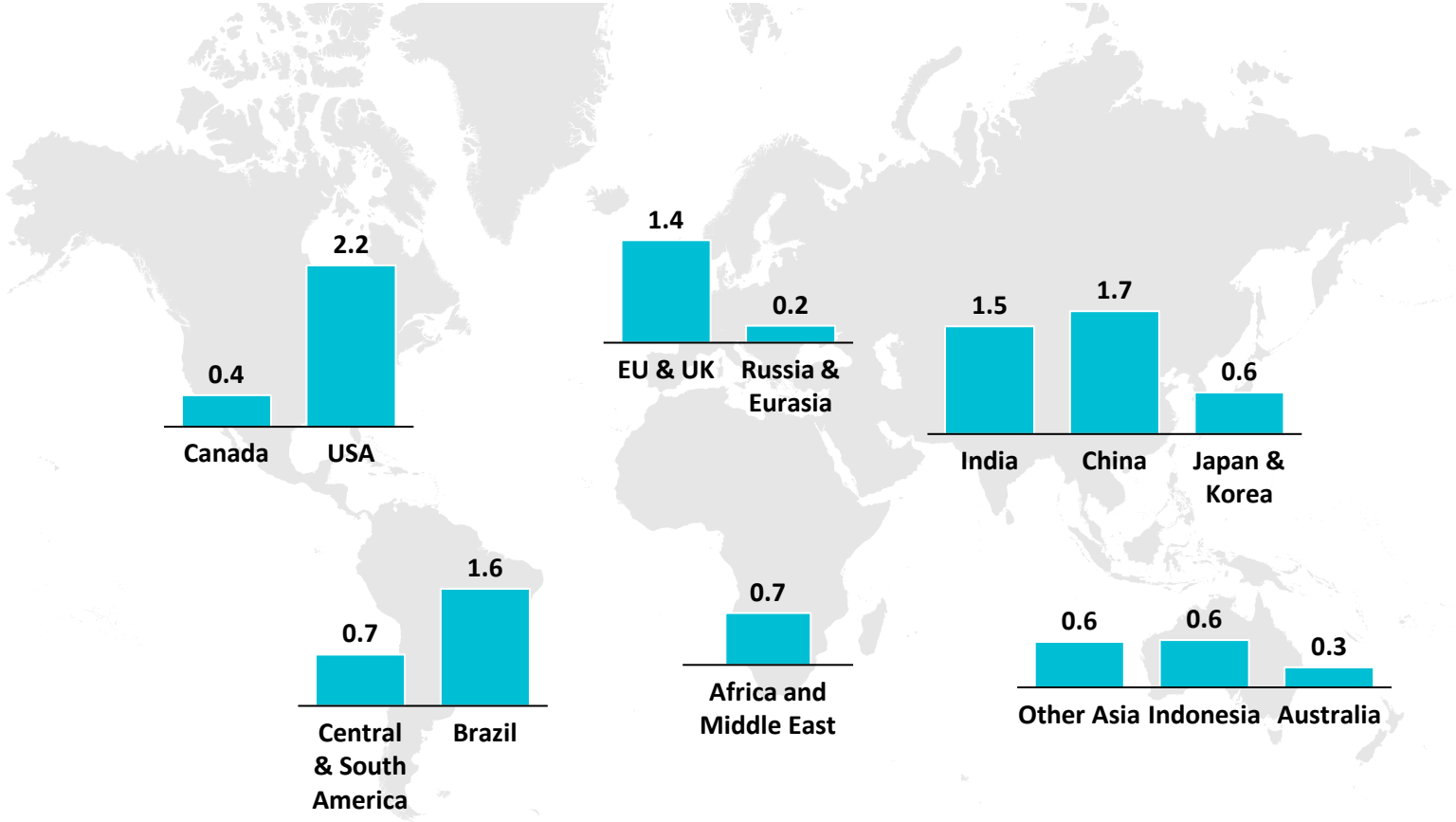
Source: IEA, European Commission

- Globally and in most regions, improving **envelope efficiency reduces demand for heating** over time
- **Heat pumps are the key decarbonization lever** for space heating, reaching 57% globally by 2050
- The **EU leads on heat pump deployment**, but there is strong **growth from 2035-2050 in the US and China**
- **Coal, oil and gas are mostly phased out** by 2050, with the last of these replaced by hydrogen in some regions

BECCS PLAYS A ROLE IN POWER WHERE REMOVALS ARE VALUED BY POLICYMAKERS AND SUPPLY IS AVAILABLE; FPS 2023 SEES ~1GT BY 2050

A detailed analysis of the role bioenergy across the energy and land systems is available in the bioenergy report

FPS 2023 bioenergy demanded for BECCS power generation in 2050, EJ



In the FPS, all bioenergy use in power is BECCS by 2050. Unabated biomass power cannot compete with renewable, baseload or dispatchable generation

BECCS is used to provide baseload power and seasonal flexibility under particular policy conditions

BECCS are incentivised where removals are most valued and where supply is readily available. It removes around **1GtCO$_2$/year by 2050**