

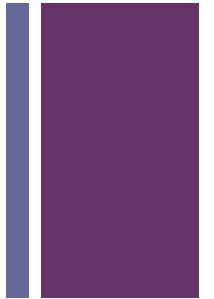


Craig Heidrich, ADAA,
Australia
Thomas Adams, ACAA,
USA
Jinder Jow, CCAPC,
China
Joachim Feuerborn,
ECOBA, Europe



Coal Combustion Products Worldwide – Trends in sustainable production and construction

+ > 90% coal use in phased out by 2050



- COP 28 significant [200 countries] agreement reached on 'first time' net zero by 2050
- Kyoto Annex I countries
 - E.g. EU 15 by 2038, Australia by 2040
- Kyoto Annex II countries
 - E.g. China still expanding CFPS grow, commitments beyond +2030



Resource harvesting & conservation opportunities with CCPs



- Mt Everest ~1,400 Billion M^3
- Global Construction Materials use, ~48 Billion M^3
- Mt Everest consumed every 30 years
- Harvestable CCPs today, ~100 Billion M^3
- ~ 100-150 years of resources if economic



World Wide Coal Combustion Products Network



 ACAA American Coal Ash Association	 ADAA Ash Development Association of Australia	 Asian CAA Asian Coal Ash Association	 CCAPC China Coal Ash Professional Committee
 CAII Coal Ash Institute of India	 ECOBA European Coal Combustion Products Association e.V.	 IACEE MPEI - Russia Informational & Analytical Center "Ecology of Power Engineering" of MPEI	 JCOAL Japan Coal Energy Center
 NCAB National Coal Ash Board	 UPS Polish Union UPS	 SACAA South African Coal Ash Association	 UKQAA UK Quality Ash Association

www.wwccpn.net



Why we exist...



- **Stimulate** sharing/transfer of technical information;
- **Co-operate** internationally for harmonization of appropriate codes, specifications and guides;
- **Promote** internationally consistent appropriate regulations; and
- **Facilitate** awareness and understanding of the environmental, economic, engineering, manufacturing and societal benefits derived from use of CCPs.



COP - Conference of the Parties



- COP is the supreme decision-making body of the Convention. All States that are Parties to the Convention are represented at the COP, at which they review the implementation of the Convention and any other legal instruments that the COP adopts and take decisions necessary to promote the effective implementation of the Convention, including institutional and administrative arrangements.
- A key task for the COP is to review the national communications and emission inventories submitted by Parties. Based on this information, the COP assesses the effects of the measures taken by Parties and the progress made in achieving the ultimate objective of the Convention.



Selected milestone COP 21 Paris



- At COP 21 in Paris, on 12 December 2015, Parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future.
- The **Paris Agreement's central aim** is to strengthen the global response to the threat of climate change by **keeping a global temperature rise this century well below 2 degrees Celsius** above pre-industrial levels and **to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius**.

+ Selected milestone COP 28 United Arab Emirates



🕒 16:00 📅 13 Dec, 2023

⬆ Show less

COP28 Agreement Signals “Beginning of the End” of the Fossil Fuel Era



COP28 closed today with an agreement that signals the “beginning of the end” of the fossil fuel era by laying the ground for a swift, just and equitable transition, underpinned by deep emissions cuts and scaled-up finance.

In a demonstration of global solidarity, negotiators from nearly 200 Parties came together in Dubai with a decision on the world’s first ‘global stocktake’ to ratchet up climate action before the end of the decade – with the overarching aim to keep the global temperature limit of 1.5°C within reach.

“Whilst we didn’t turn the page on the fossil fuel era in Dubai, this outcome is the beginning of the end,” said UN Climate Change Executive Secretary Simon Stiell in his closing speech. “Now all governments and businesses need to turn these pledges into real-economy outcomes, without delay.”

<https://unfccc.int/cop28>

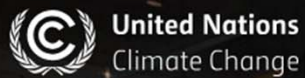


COP 28 – Global tracking indicators



- 3 x **renewable power capacity** globally by 2030
- 2 x global rate of **energy efficiency improvement** by 2030
- Accelerate efforts globally towards **net zero emission by 2050**
- Accelerate **phase out coal power**: but in a **just, orderly** and **equitable** manner
- Accelerate **zero and low-emissions technologies**
- Substantially **reduce methane emission** by 2030
- Accelerate the **reduction of emission from road transport** (electrification?)
- Phase out **fossil fuel subsidies**

+ United Nations Framework Convention on Climate Change (UNFCCC)/UN Climate Change



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[SB 62](#)

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Welcome to the June Climate Meetings

62nd Sessions of the Subsidiary Bodies (SB 62)

[Main conference page](#)

[SB 62](#)

[Session documents](#)

[SB 62](#)

[Schedule of meetings](#)

[COP 30 Belém](#)

[The Road to Belém](#)

+ UNFCCC Subsidiary Bodies (SB62) / Bonn



The 62nd session of the UNFCCC Subsidiary Bodies (SB 62) will take place in Bonn, Germany, from 16-26 June 2025. A pre-session coordination week will run from 10-15 June.

Mon, 16 Jun 2025 - Thu, 26 Jun 2025
Bonn, Germany

At the 2025 Bonn Climate Change Conference, IIED's climate diplomacy team will be on the ground to support the Least Developed Countries (LDC) Group in securing more ambitious and inclusive global climate action.

SB 62 will play a critical role in shaping outcomes for **COP30 in Belém, Brazil**, especially on finance and adaptation.



UN Climate Change
Conference - Bonn
(UNFCCC SB62)



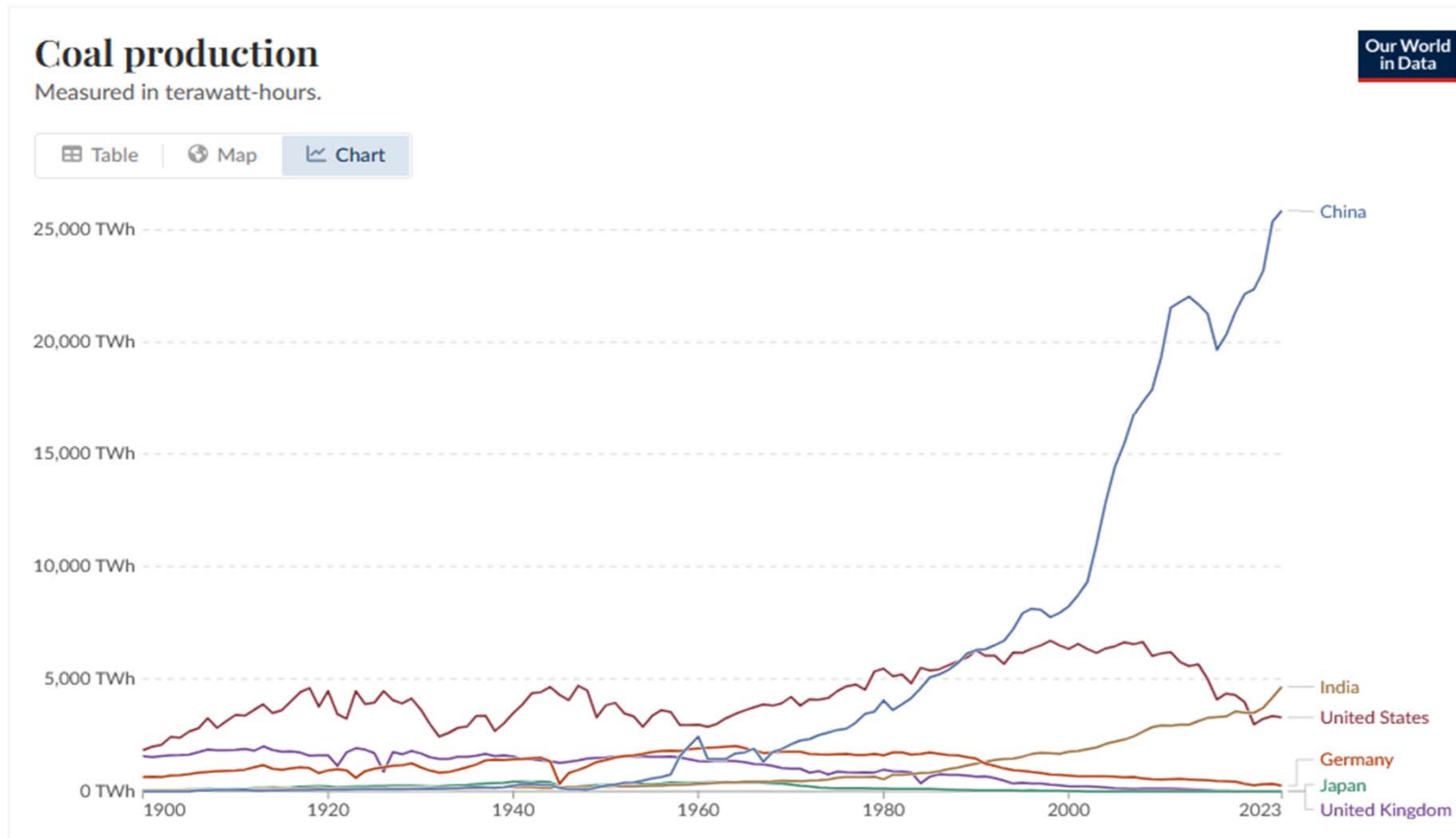
IIED at the 2025 Bonn Climate Change Conference (SB 62)



A session at the Bonn Climate Conference in 2023 (Photo: UNclimatechange, via Flickr, CC BY-NC-SA 2.0)

source: <https://www.iied.org/iied-2025-bonn-climate-change-conference-sb-62>

+ Coal Production Worldwide



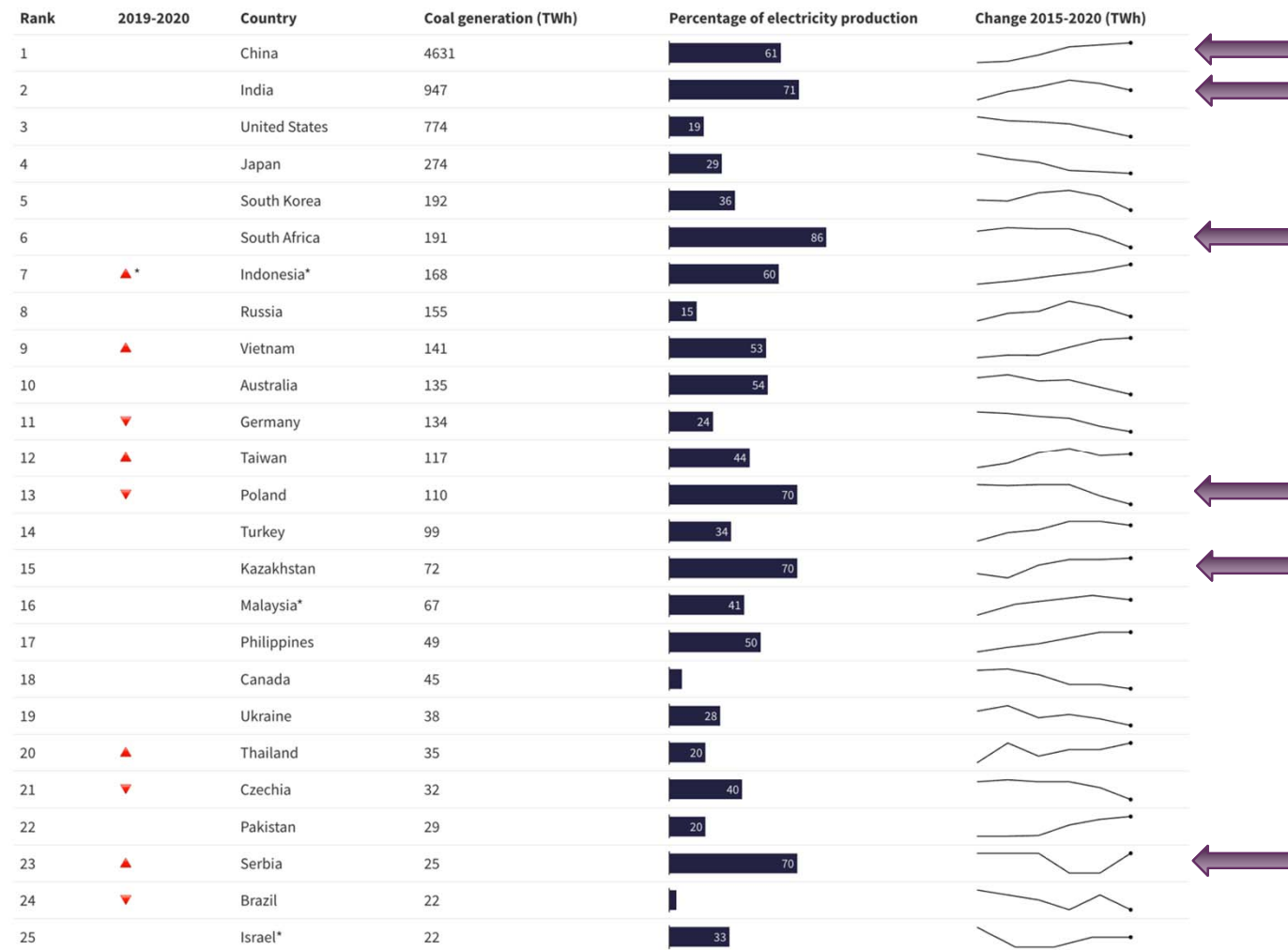
Data source: Energy Institute - Statistical Review of World Energy (2024);

source: <https://ourworldindata.org/grapher/coal-production-by-country>

Top 25 Coal Power Countries

Ranking of countries by coal generation (TWh) in 2020

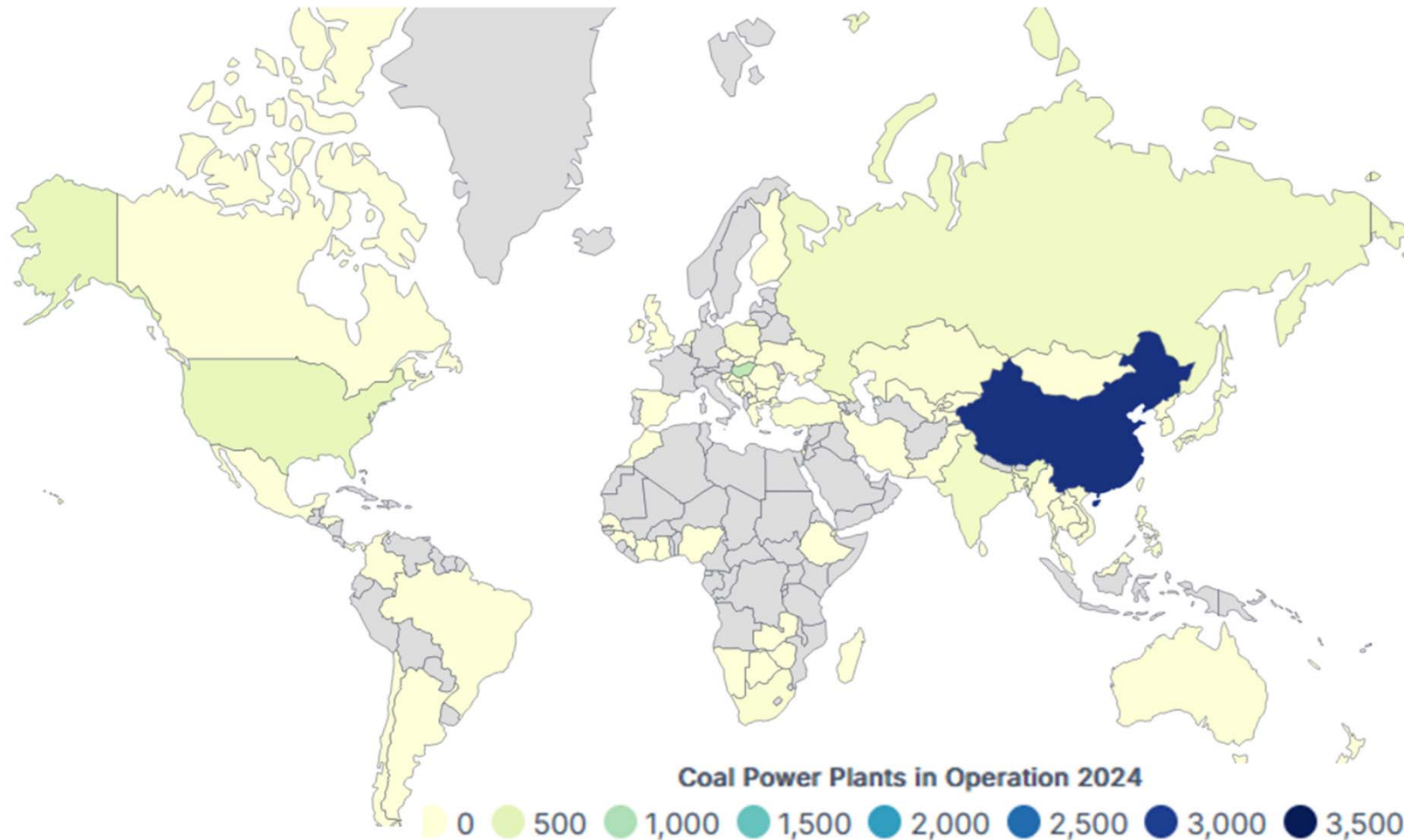
EMBER



Source: [Ember Global Electricity Review 2021](#) • *For Indonesia, Malaysia and Israel, 2019 is used as no 2020 data exists.



Number Coal Power Plants by Country 2025



5 Countries with the most coal power plants in operation

 China
3,168

 Hungary
845

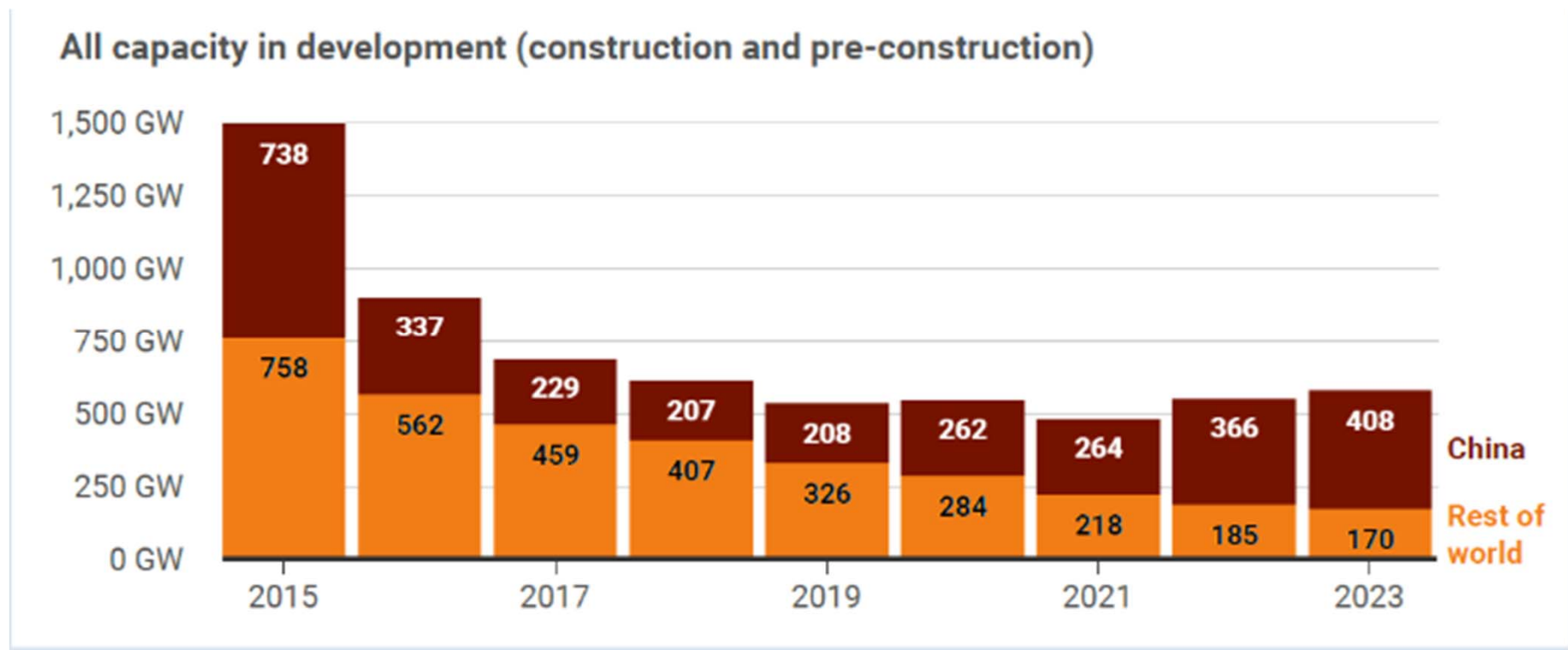
 United States
408

 Russia
289

 India
256

<https://worldpopulationreview.com/country-rankings/number-of-coal-power-plants-by-country>

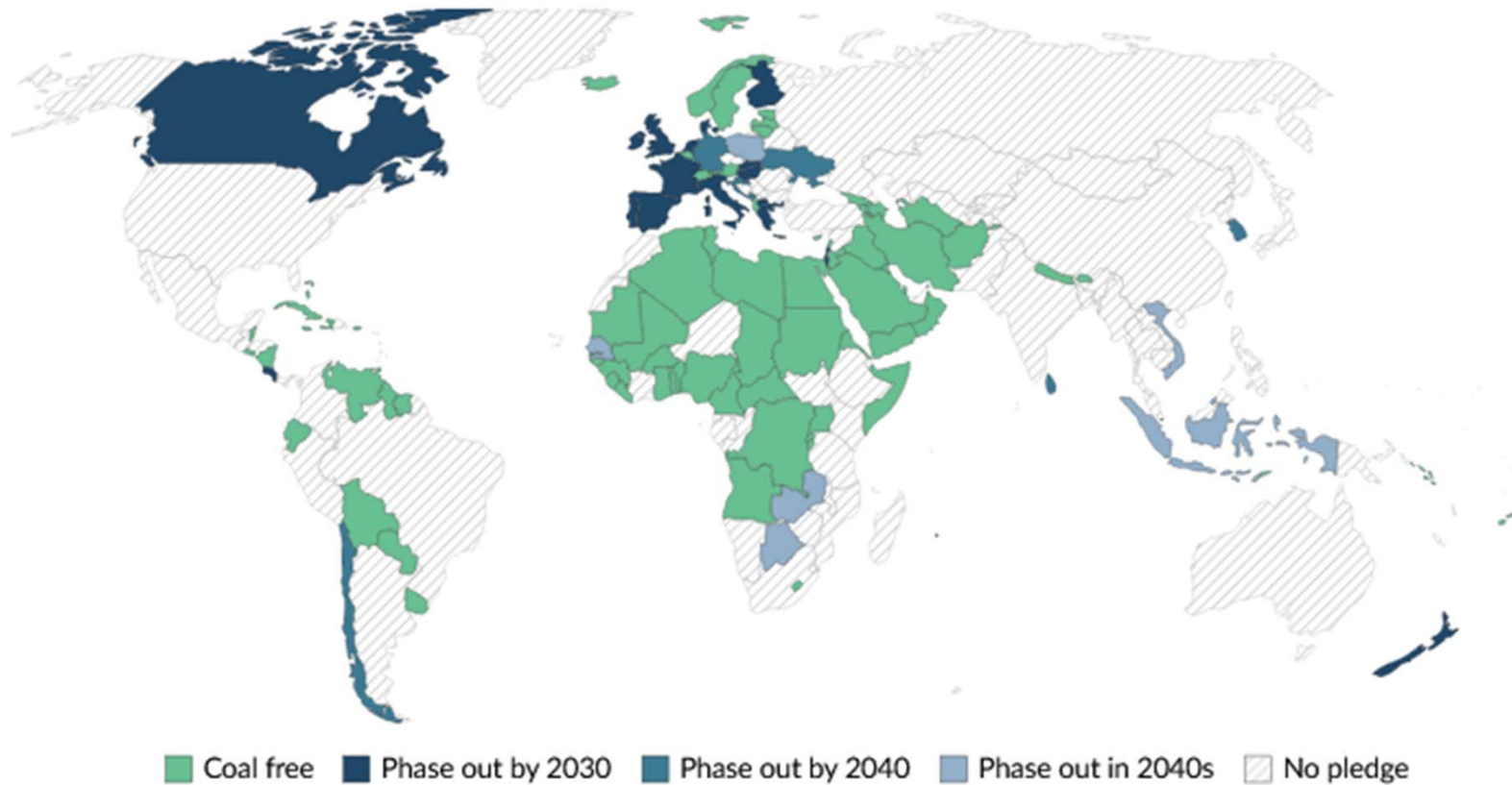
+ Trends in new coal power



Source: Boom and Bust Coal 2024, Global Energy Monitor, April 2024



Coal phase-out announcements worldwide



<https://ourworldindata.org/coal-phase-out>



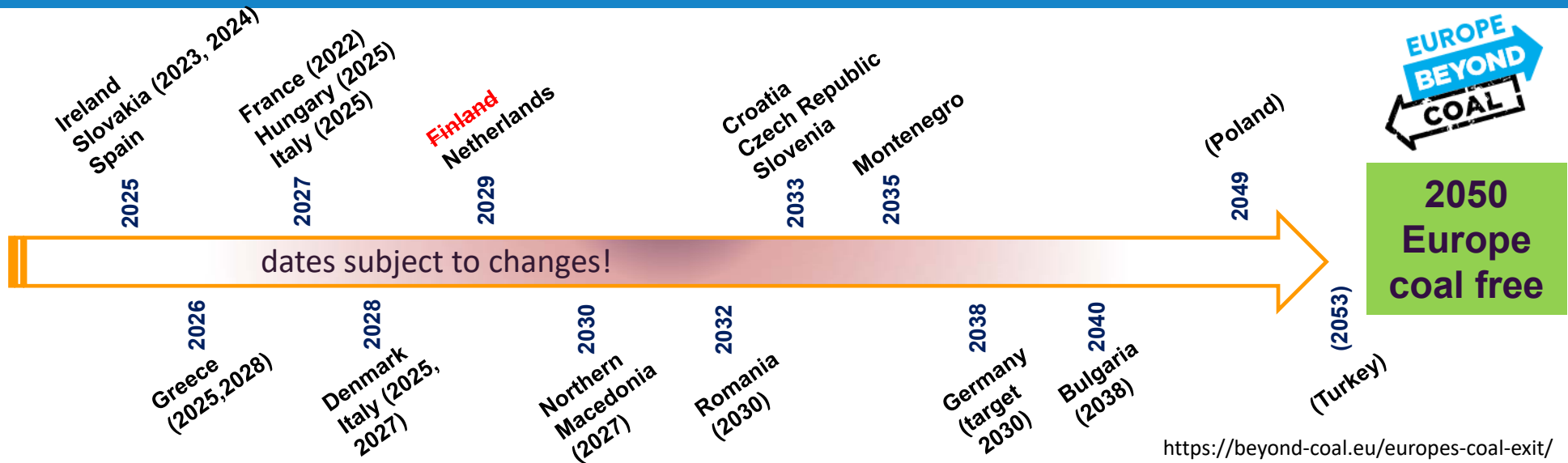
Coal phase-out announcements in Europe



No coal in energy mix: Albania, Cyprus, Estonia (oil shale), Iceland, Latvia, Lithuania, Luxembourg, Malta, Norway, Switzerland

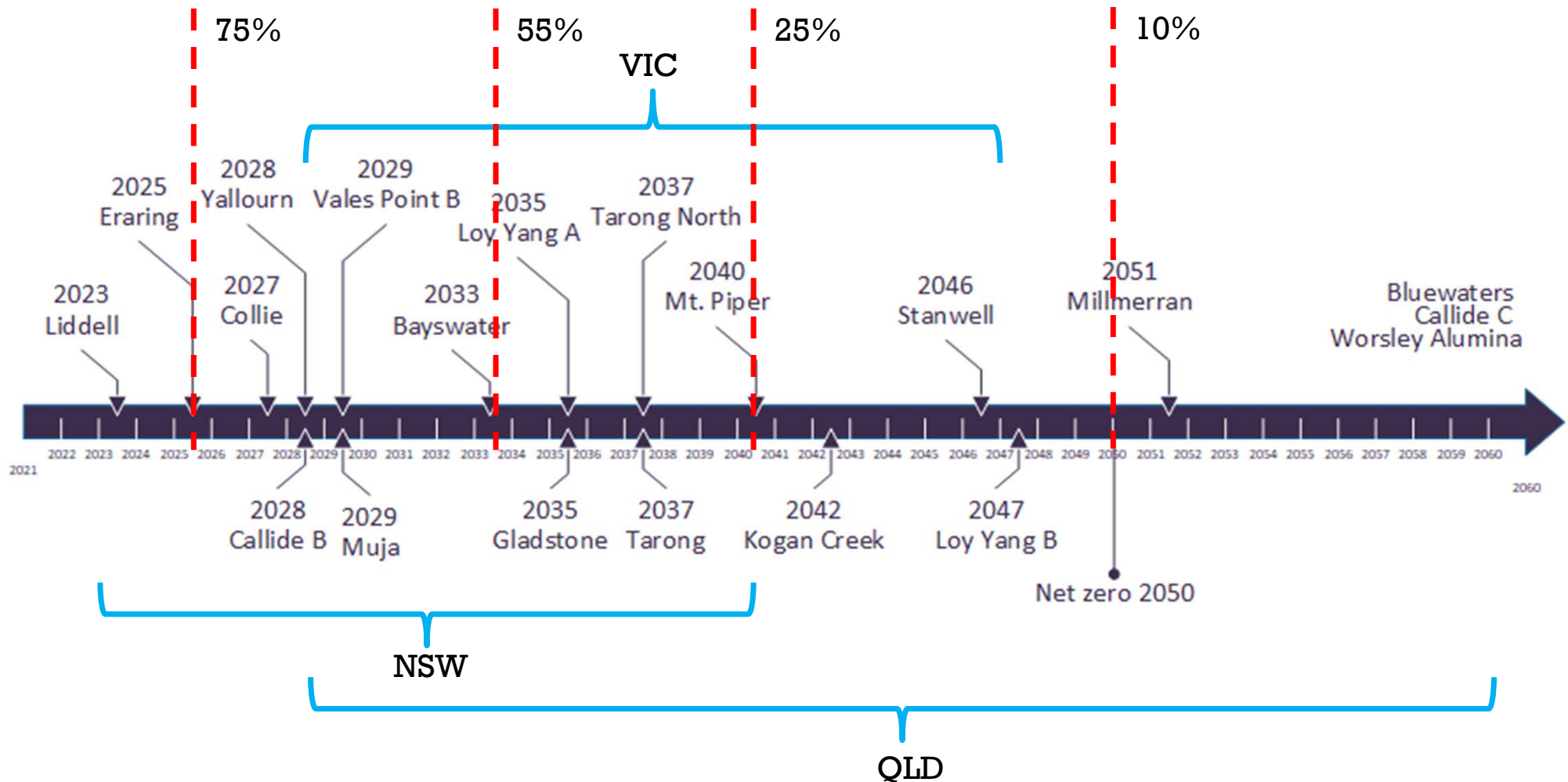
No phase out under discussion: Bosnia-Herzegovina, Kosovo, Serbia, (Poland), (Turkey)

Phased out: 2016 Belgium; 2020 Austria, Sweden; 2021 Portugal; 2024 United Kingdom; 2025 Finland (1st April)





Coal phase-out announcements in Australia

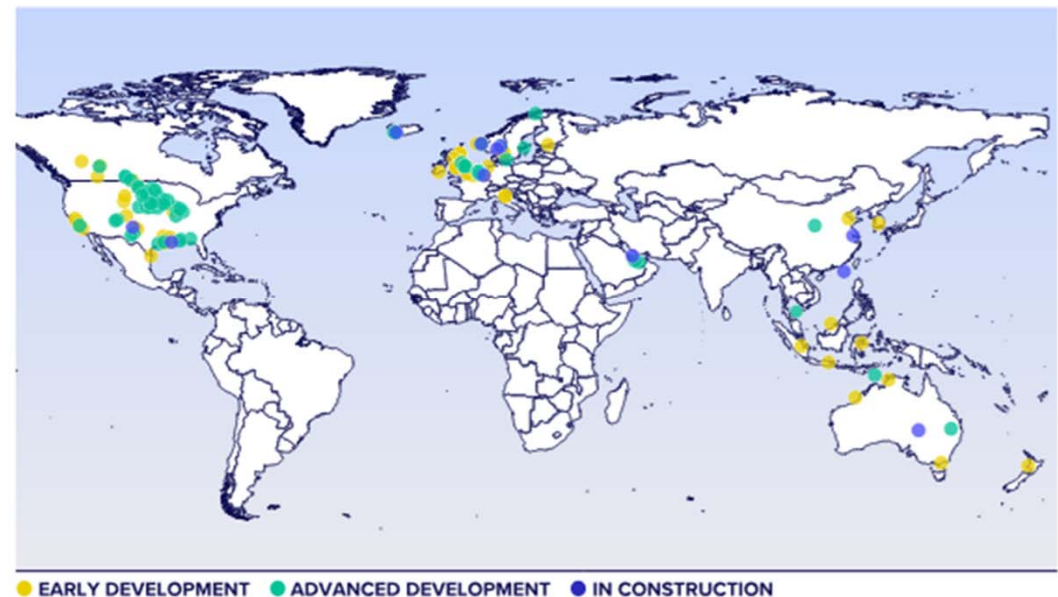
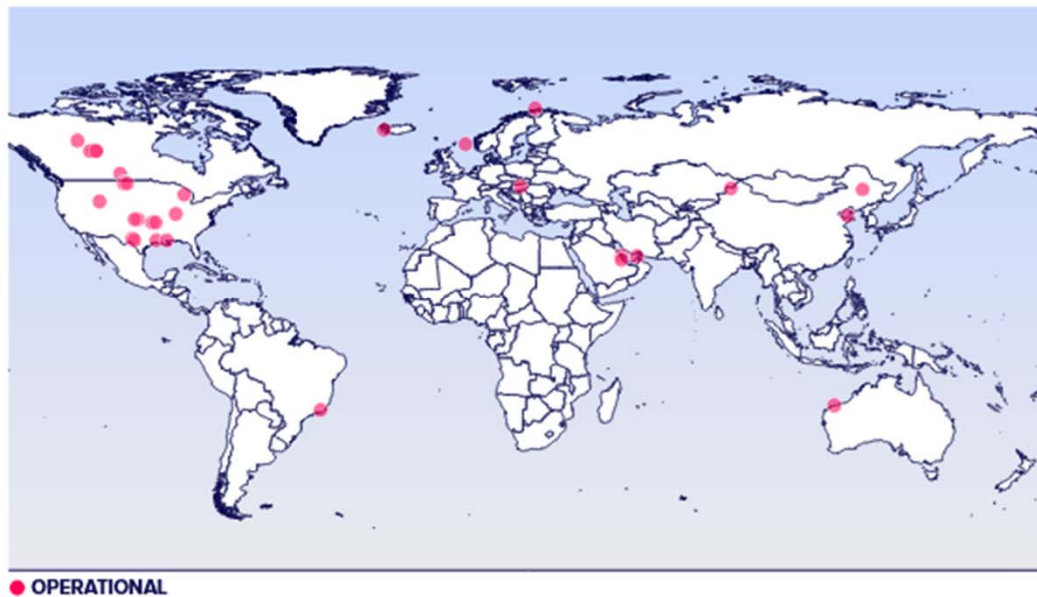


+ Global status of CCS



Selected outcomes:

- Capture capacity (on a 2022 basis) has grown substantially in the past 12 months.
- Advanced Development means projects have received significant funds for engineering
- By facility count growth, the US continues to lead the way globally, with 34 new projects since 2021. Other leading countries in the past year include Canada (19 new projects), the UK (13), Norway (8), and Australia, the Netherlands and Iceland (6 each)



World map of CCS facilities at various stages of development

source: https://status22.globalccsinstitute.com/wp-content/uploads/2022/11/Global-Status-of-CCS-2022_Download.pdf

Overview of announced CO₂ storage projects in Europe



International
Association
of Oil & Gas
Producers

BULGARIA

1. ANRAV (IF)

CROATIA

1. Petrokemija Kutina*
2. Bio-Refinery Project*
3. CCGeo (IF)
4. CO₂ EOR Project Croatia*
5. Geothermal CCS Croatia (PCI)
6. KODECO (IF)

CZECH REPUBLIC

1. CCS Moravia

DENMARK

1. Greensand*
2. Bifrost* (PCI)
3. Kalundborg CCS
4. Nørre (PCI)
5. Ruby
6. Greenstore

FRANCE

1. Pycasso* (PCI)

GREECE

1. Prinos CO₂ Storage Project (PCI)

HUNGARY

1. MOL-Hungary CCS Project*
2. Danube Removals (IF)

ICELAND

1. Orca
2. Silverstone (IF)
3. Coda Terminal (IF)
4. Mammoth

ITALY

1. Ravenna CCS (includes Callisto)* (PCI)

THE NETHERLANDS

1. Porthos* (PCI)
2. Aramis* (PCI)
3. I10 CCS*

NORWAY

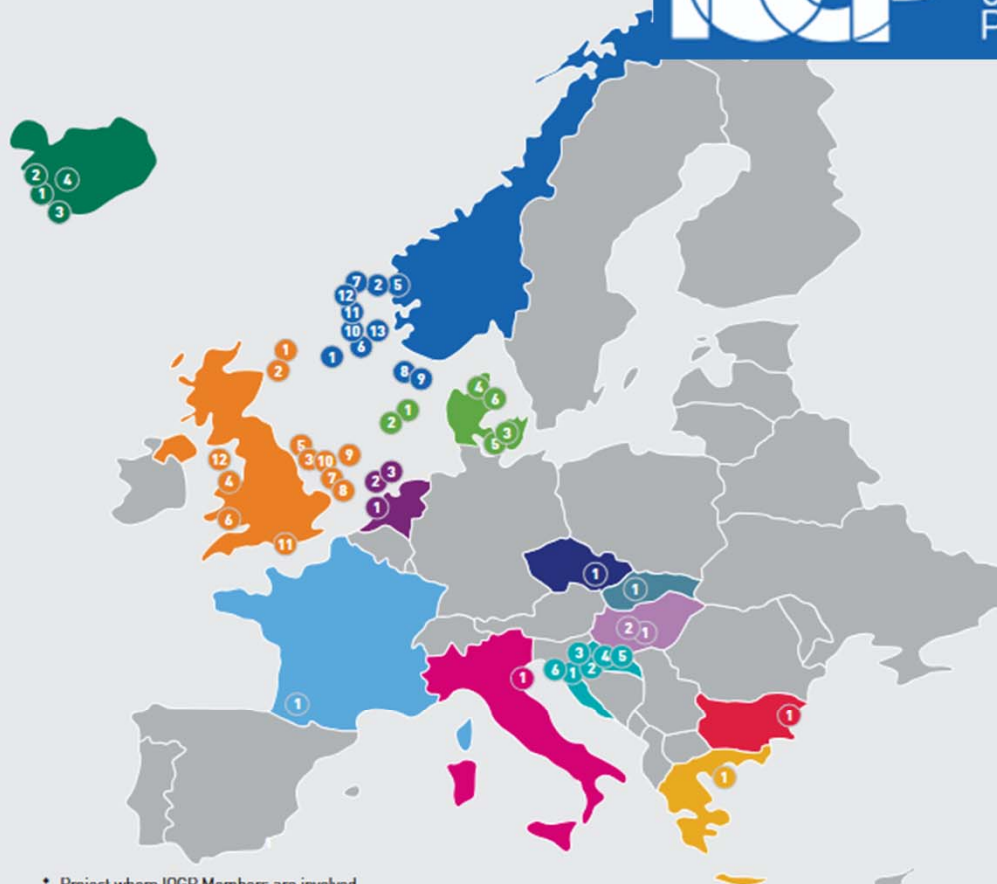
1. Sleipner*
2. Longship (includes Northern Lights)* (PMI)
3. Barents Blue (includes Polaris)
4. Snøhvit*
5. Smeaheia*
6. Trudvang*
7. Luna*
8. Havstjerne* (IF)
9. Poseidon (NO)*
10. Iroko*
11. Kinno*
12. Atlas*
13. Albondigas*

SLOVAKIA

1. Engas CCS

UK

1. Acorn*
2. Caledonia Clean Energy
3. Zero Carbon Humber*
4. HyNet*
5. Net Zero Teesside*
6. South Wales Industrial Cluster
7. Bacton Thames Net Zero*
8. Poseidon (UK)*
9. Viking CCS*
10. Orion*
11. Solent Cluster*
12. Morecambe Net Zero Cluster



* Project where IOGP Members are involved
Projects listed in **bold** are in operation

(PCI) – Project of Common Interest

(PMI) – Project of Mutual Interest

(IF) – Project supported by the EU Innovation Fund

EU

23 projects - 41 MtCO₂/yr by 2030

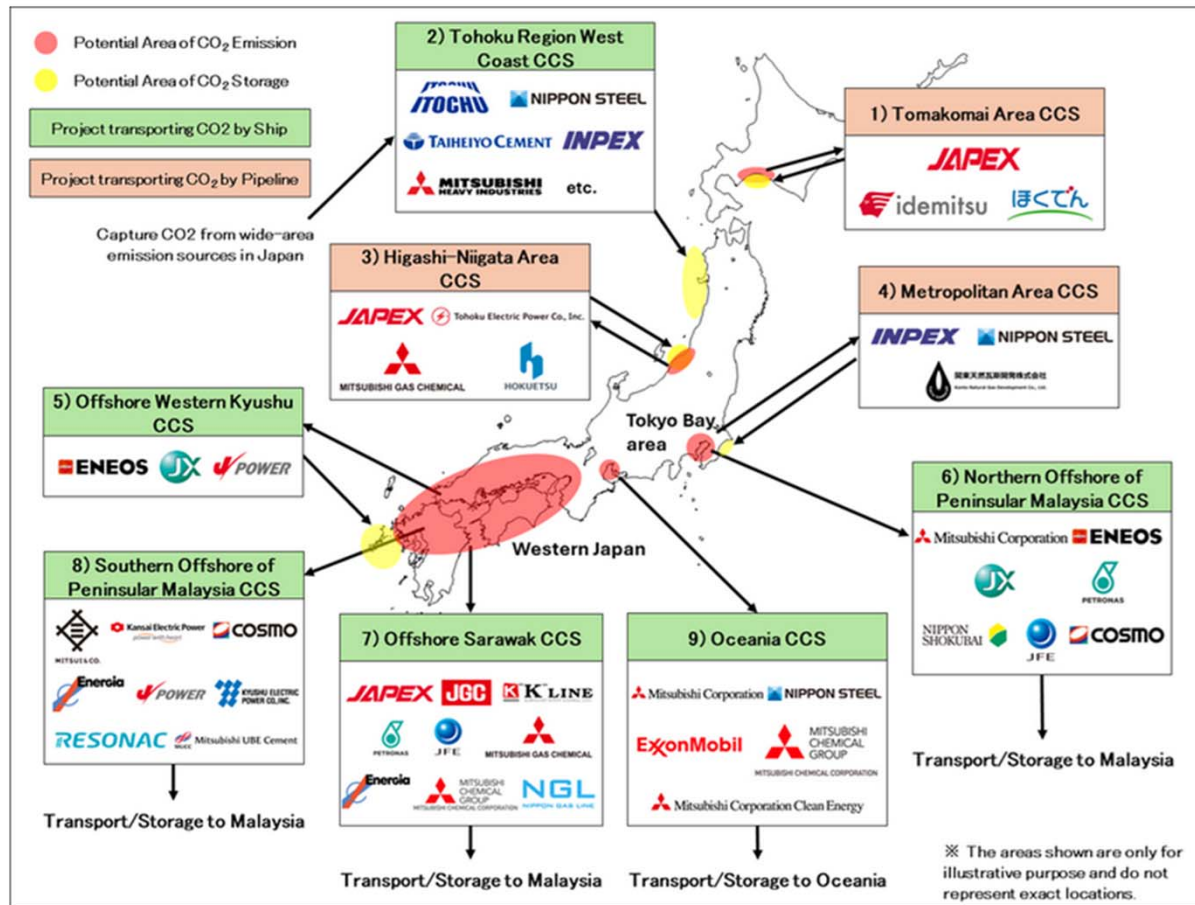
Europe

52 projects - 126 MtCO₂/yr by 2030

+ CCS projects in Japan



Locations of selected CCS projects in Japan



source: https://www.meti.go.jp/english/press/2024/0628_005.html

On June 28, 2024, the Japan Organization for Metals and Energy Security (JOGMEC) selected nine CCS* projects as an effort to establish a business model that can be horizontally applied in order to achieve **carbon neutrality by 2050**.

This initiative is part of the project undertaken by the Ministry of Economy, Trade and Industry (METI).

These successful projects aim to embark on commercialization of CCS by 2030.

* CCS: Carbon dioxide Capture and Storage



Worldwide CCUS Projects Database



Region
World

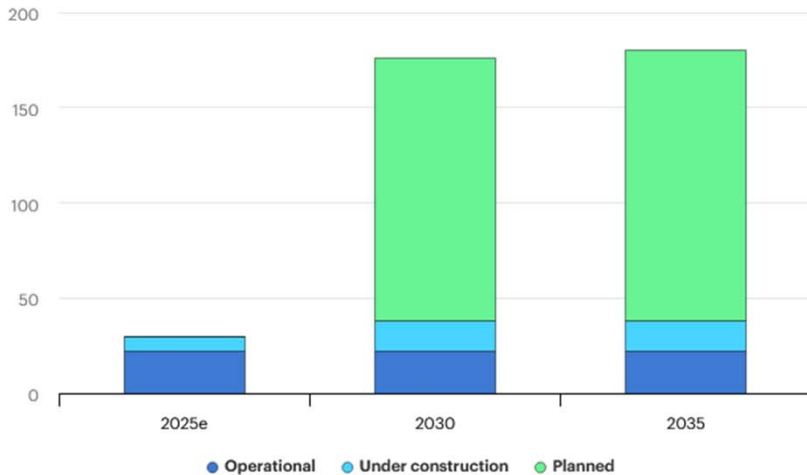
Country/economy
United States

Operational and planned capture capacity

By status

By project type

Mt CO₂ per year



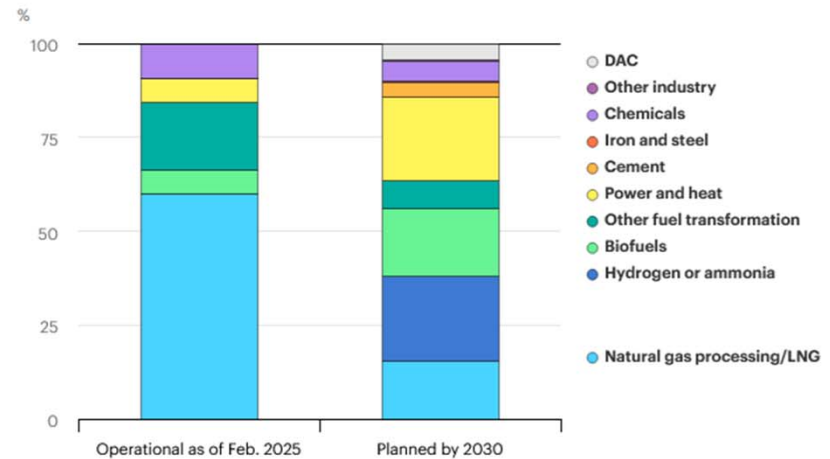
Notes

Includes all operational, under construction and planned CO₂ capture facilities with an announced capacity of more than 100 000 tonnes per year (or 10 000 tonnes per year for direct air capture facilities) and an announced timeline. Obtained by summing the estimated capacity of capture, full chain and CCU projects in the IEA CCUS Projects Database. 2025e includes announced capacity which could come online by the end of 2025.

Operational and planned capture capacity

By sector

By region



Notes

Includes all operational, under construction and planned CO₂ capture facilities with an announced capacity of more than 100 000 tonnes per year (or 10 000 tonnes per year for direct air capture facilities) and an announced timeline. Obtained by summing the estimated capacity of capture, full chain and CCU projects in the IEA CCUS Projects Database.

<https://www.iea.org/data-and-statistics/data-product/ccus-projects-database>



Global Production 2022

Table 3. Production and Utilisation Rates of CCPs by Country 2022

Country/Region	Production (Mt)	Utilisation (Mt)	Utilisation Rate %
Australia	10.6	6.6	62%
Asia	724.5		
- China	650.0	388.0	60%
- Korea	7.5	6.2	83%
- Other Asia	67.0		0%
Canada	3.4		0%
Europe	60.0		
- EU15	15.0	18.0	120%
India	282.8	282.7	100%
Japan	12.1	11.6	97%
Middle East & Africa	34.5	2.4	7%
Israel	0.5	0.5	100%
United States of America	45.5	29.3	64%
South America	8.6		0%
Russian Federation	17.4	5.0	29%
Total	1 199.9	750.7	62%



Global definition for CCPs

Table 1. WWCPN global definitions for coal combustion products^[1]

Term	Definition
Coal Combustion Products	Coal combustion products (CCPs) include fly ash, bottom ash, boiler slag, fluidized-bed combustion (FBC) ash, or flue gas desulfurization (FGD) material produced primarily from the combustion of coal or the cleaning of the stack gases of coal fired power stations. The term coal ash is used interchangeable for the different ash types.
Fly ash	The finer ash produced in a coal fired power station, which is collected using electro-static precipitators. This is also known as Pulverised Fuel Ash (PFA) in some countries. About 85+% of the ash produced is fly ash.
Furnace Bottom Ash (FBA)	The coarse ash that falls to the bottom of a furnace. The molten ash adheres to the boiler tubes, eventually falling to the base of the furnace. Usually <15% of the ash produced is FBA
Cenospheres	Hollow ash particles that form in the furnace gas stream. They float on water and are usually collected from lagoons, where ash/water disposal systems are being used.
Conditioned ash	Where fly ash is mixed with a proportion of water (10 to 20% by dry mass typically) in order that it can be transported in normal tipping vehicles without problems with dust for sale or disposal.
Flue Gas De-sulfurisation	Where a source of calcium is injected into the furnace gas stream to remove sulfur compounds. The sulfur compounds convert the calcium carbonate to calcium sulfate, or gypsum, which is used in the wallboard industry for general construction
Harvested CCPs (new)	The removal, or reclamation, of CCPs from an active or inactive storage area for the purpose of beneficial use.

+ International Standards



COUNTRY	Europe		USA		India		Australia			China		Russia		Japan					
Standard	EN 450-1		ASTM C 618		IS 3812-1		AS 3582.1			GB/T 1596		GOST 25818		JIS 6201					
Classification	Cat N	Cat S	Class F	ClassC	siliceous	calcareous	spec.grade	grade1	grade2	Class F	ClassC	siliceous	calcareous	type I	type II	type III	type IV		
							fine	medium	coarse										
Loss on ignition, max,%	<5; <7; <9 (cat A;B;C)		6.0 (12.0)		5.0 (7.0 ²⁾)		3	4	6	≤5; ≤8 ¹⁾ ; ≤10 (class I; II; III)		<10;<15 (type I;II) ¹⁾		<3;<5 (type I;II)	≤ 3	≤ 5	≤ 8	≤ 5	
CaOfree, max,%	1.5 (>1.5)									≤ 1.0		≤ 4.0		<5 (type I;II)					
SO3, max,%	3.0		5.0		3.0 (5.0 ²⁾)		3			≤ 3.0 (≤ 3.5 ¹⁾)		<3;<5 (type I;II)		<5 (type I;II)					
Cl, max, %	0.1				0.05														
CaO, %			≤ 18	> 18			<10 (AS) / < 25 (NZS)				2)								
Reactive CaO, max,%	10				< 10	> 10						< 10		> 10					
Reactive SiO2, min,%	25				20														
SiO2, min %					35	25								≥ 45					
SiO2 + Al2O3 + Fe2O3 min,%	70		70	50	70	50	70 (AS) / 60 (NZS)			≥ 70	≥ 50	≥ 70							
Na2O equ., max,%	5				1.5							< 3		< 1,5 (type I;II)					
MgO, max,%	4		MgO, max,%		5							< 5							
P2O5 sol., max, mg/kg	100																		
P2O5 %	5																		
Moisture %			3.0		2.0		0.5			≤ 1.0		≤ 1.0		≤ 1					
Amount retained on 45µm, max,%	40 (+/-10%)	12	34 (+/-5%)		34 (50 ²⁾)		15	25	45	≤12; ≤30; ≤45 (class I; II; III)				≤ 10	≤ 40	≤ 40	≤ 70		
Amount retained on 80µm, max,%												<20;<30 (type I;II)		<20 (type I;II)					
Amount retained on 150µm, max,%			10 ¹⁾																
Fineness: specific surf. area cm²/g					min. 3200 ¹⁾ (2000 ²⁾)							>2500/1500 (type I/II)		>2500/2000 (type I/II)		≥ 5000	≥ 2500	≥ 2500	≥ 1500
Particle density, kg/m3	+/- 2001)		5% ¹⁾							≤ 2.6									
Specific gravity, min														≥ 1.95					
Soundness, max	10 mm ²⁾		0.8% ²⁾		0.8%					≤ 5 mm									
Setting time, max minutes to ref.	120 ³⁾																		
Strength (Activity) Index β7d min,%			75 ³⁾																
Strength (Activity) Index β28d min,%	75 ⁴⁾		75 ³⁾		80					≥ 70				≥ 90	≥ 80	≥ 80	≥ 60		
Strength (Activity) Index β90d min,%	85 ⁴⁾																		
Strength (Activity) Index β91d min,%														≥ 100	≥ 90	≥ 90	≥ 70		
Relative Strength, Mpa min							105% (1)	75% (1)											
Lime reactivity Mpa					4.5														
Water requirement, max, % of control	95 ⁵⁾		105		105					≤95; ≤105; ≤115 (class I;II;III)				≥ 105	≥ 95	≥ 85	≥ 75		

1) for coal ash that is harvested or containing bottom ash

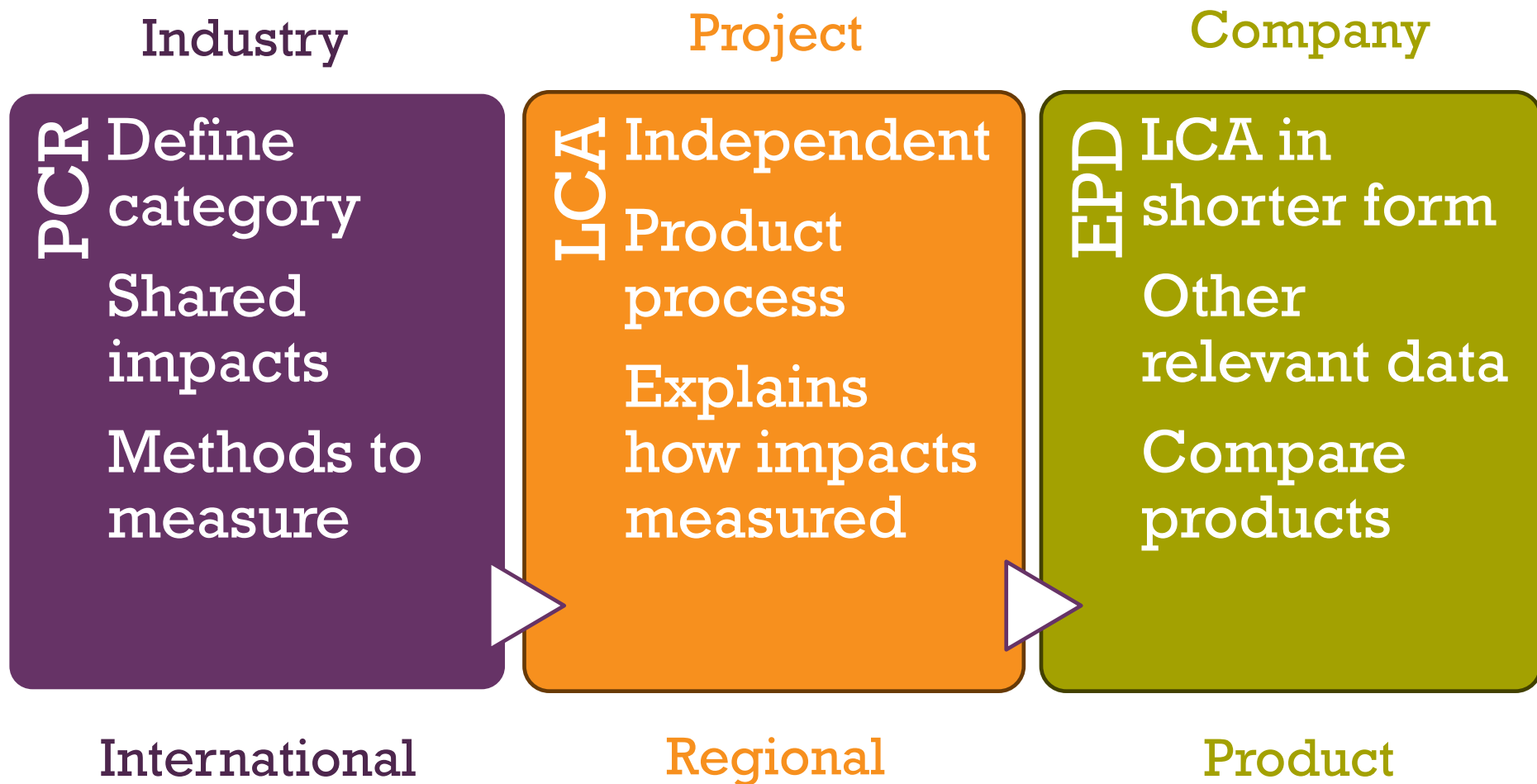


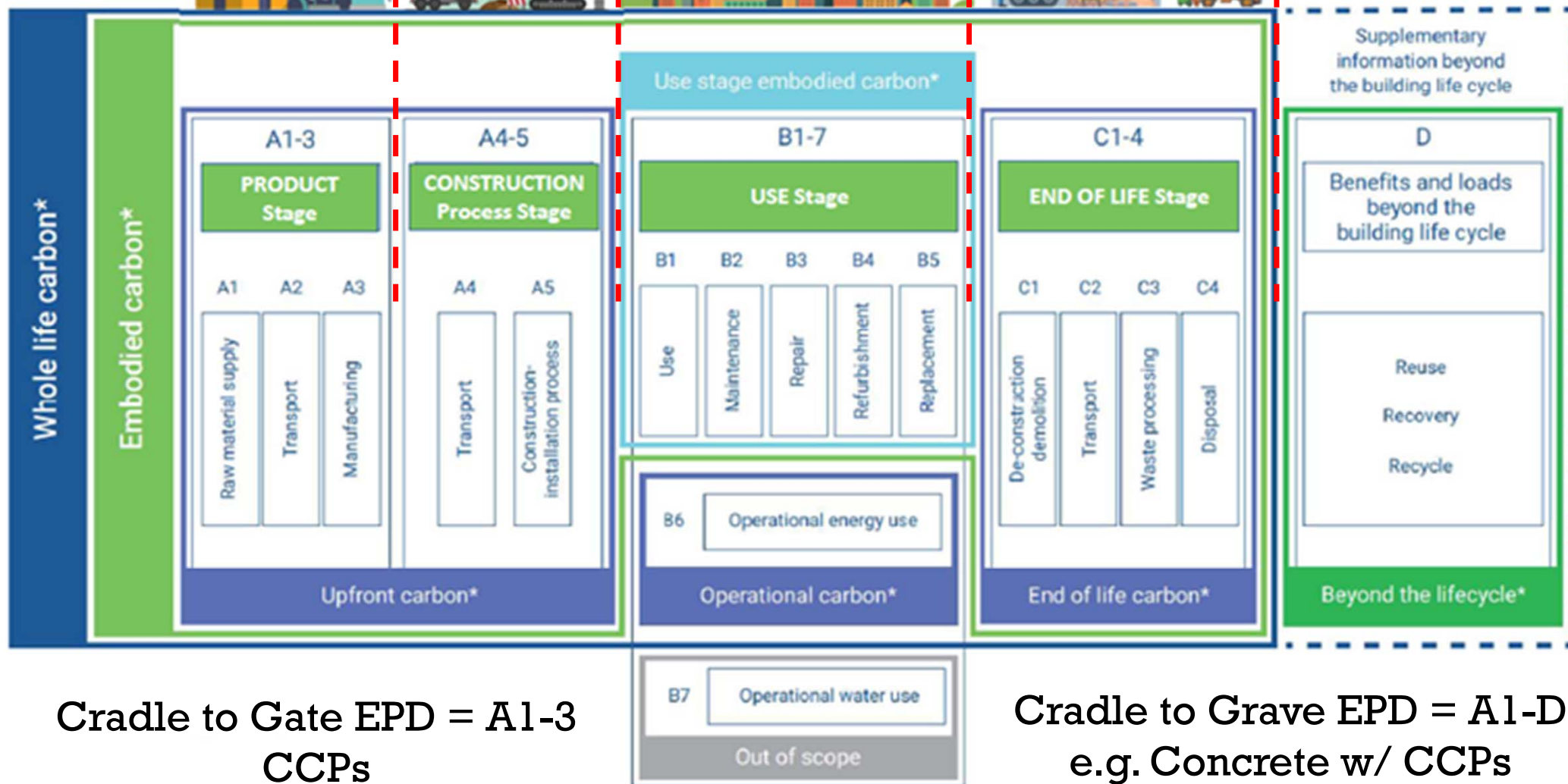
International Standards -- Summary

Country/Region	standard	date	Title/scope
Europe	EN 450-1	2012	Fly ash for concrete - Part 1: Definitions, specification and conformity criteria
USA	ASTM C 618	2023	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete for use in concrete, where cementitious or pozzolanic action, or both, is desired
Australia/New Zealand	AZ/NZS 3582	2016	Supplementary cementitious materials Part 1: Fly ash for use as a cementitious material in concrete, mortar and related application
Japan	JIS a 6201	2015	Fly ash to be used as the admixture in mortar or concrete standards contains also test procedures
Israel	SI 1209	2016	Fly ash for concrete - Part 1: Definitions, specification and conformity criteria Based on EN 450 with deviations on co-combustion (from coal only), and conformity criteria
South Africa	SANS50450-1	2014	Fly ash for concrete - Part 1: Definitions, specification and conformity criteria completely based on EN 450-1
India	IS 3812-part 1	2013	Pulverized Fuel Ash - Specification
	IS 3812-part 2	2013	Pulverized Fuel Ash - Specification (for mound ash and pond ash)
China	GB/T 1596	2017	Fly ash used for cement and concrete
Russia	GOST 25818	2017	Fly ash for concrete



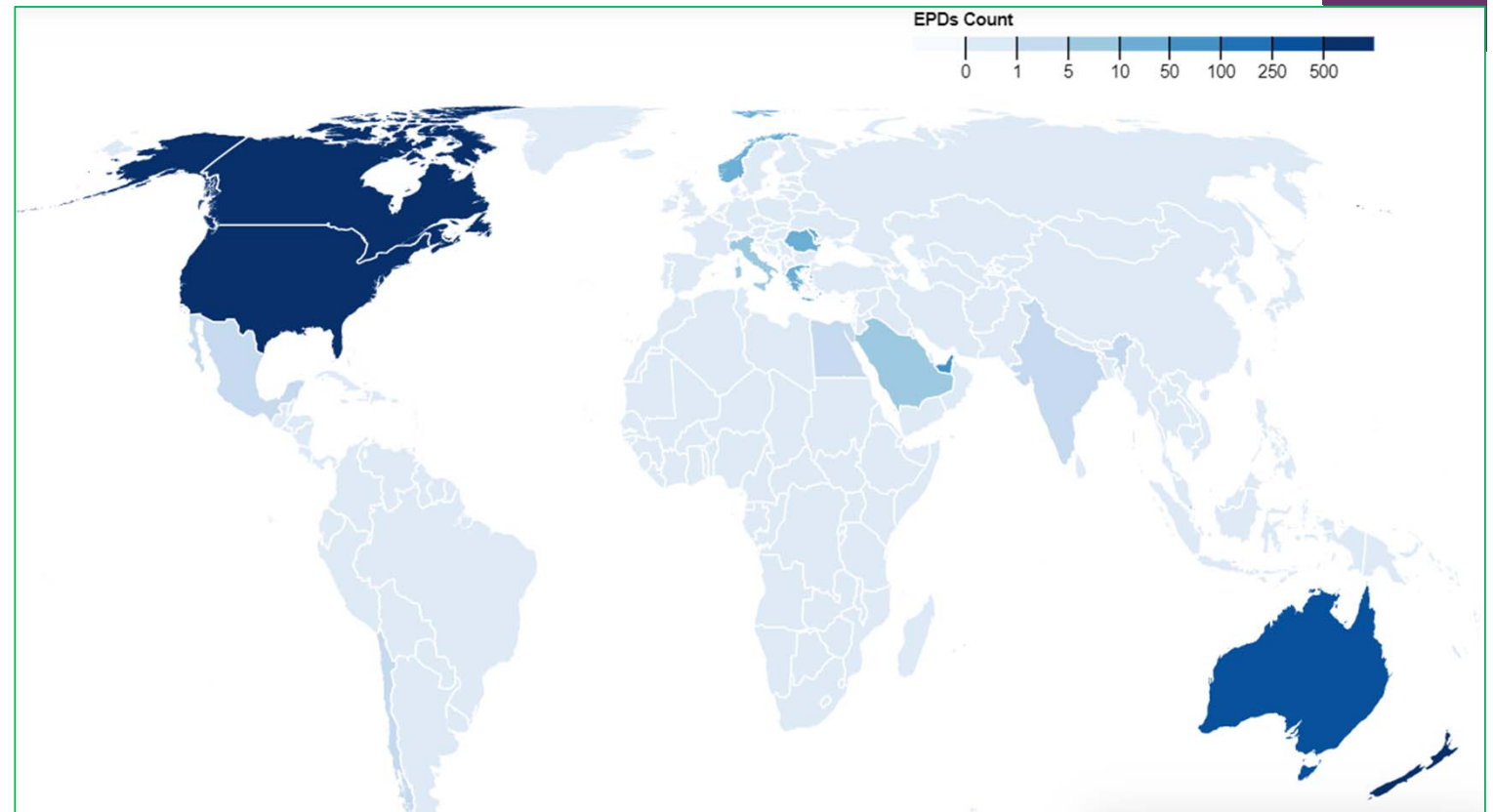
Relationship between PCR – LCA - EPD





+ EPD Uptake / Building Transparency – EC3 Tool

Country	EPD Count
NO	12
IT	9
GR	35
US	42,761
CA	1,539
SG	301
AU	481
AE	55
NZ	957
SA	6
IN	1
RO	16
MD	16
MX	1
EG	1
CL	1





PCR for SCM 2024



Publication announcement: Part B PCR for Supplementary Cementitious Materials

Smart EPD® is pleased to announce the publication of its Part B Product Category Rules (PCR) for:

Supplementary Cementitious Materials

The PCR is available for download at <https://smartepd.com/pcr-library> in addition to all open consultation and independent expert panel comments received during the review process and committee responses.

Please reach out to pcr@smartepd.com if you have any questions.

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+ Summay/Outlook



- **Coal still plays** an important role in worldwide energy production in Annex II countries; but significant > 90% **reduction** in Annex II [e.g. US, EU and Australia]
- CCPs production stabilising 1.2 BTPA. Embedded in construction materials @ 0.75 BTPA.
- Reduced CCPs production creating focus on **stored resource** which contribute to **Circular Economy** and sustainability of construction materials.
- Tools: **PCR, LCA's and EPD's** are of **critical importance** to stimulate use. Challenges ahead.



Global Aspects on
Coal Combustion Products

Coal Combustion Products
are global!

Thank you for your attention.

<http://www.wwccpn.com>