Energy Transition Investment Framework 2.0

Presentation to the European Foundations Financial and Investment Officers, New York City

By Stan Miranda, Founder and Chairman of Partners Capital

11 April 2024

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Introduction to Partners Capital
Executive Summary

PARTNERS CAPITAL

Partners Capital is a Global Independent Outsourced Investment Office with a cohort of sophisticated institutional and private clients – where we are responsible for overall portfolio construction, asset allocation, investment selection and portfolio management.

$55B
in assets under management

Globally we manage $55B in assets, across seven offices in Europe, North America and Asia.

7
Offices

We are truly global in scope across seven locations covering North America, Europe, and Asia. Our on the ground presence is essential for sourcing best-in-class investment opportunities.

104
Client Portfolio Managers

Our 104-person Client Portfolio Management Team creates bespoke investment programs, ranging from fully custom direct multi-manager portfolios to combinations of discretionary pooled vehicles covering all asset classes.

56
Research Professionals

Our 56-person Investment Research Team is comprised of veteran investors located in North America, Europe and Asia tasked with asset class investment strategy development, implementing tactical investment themes and asset manager due diligence. We aim to partner with asset managers in a value-added role to facilitate fee reductions, access to co-investments, the launch of new products and establishment of customized mandates.

196
Operations Professionals

Our 196-person Operations Team provides turn-key operational portfolio management that handles all aspects of investment execution, provides transparency of portfolio allocations and performance attribution.

Notes: Data as of December 31, 2023.

EFFIO Presenter

Stan Miranda

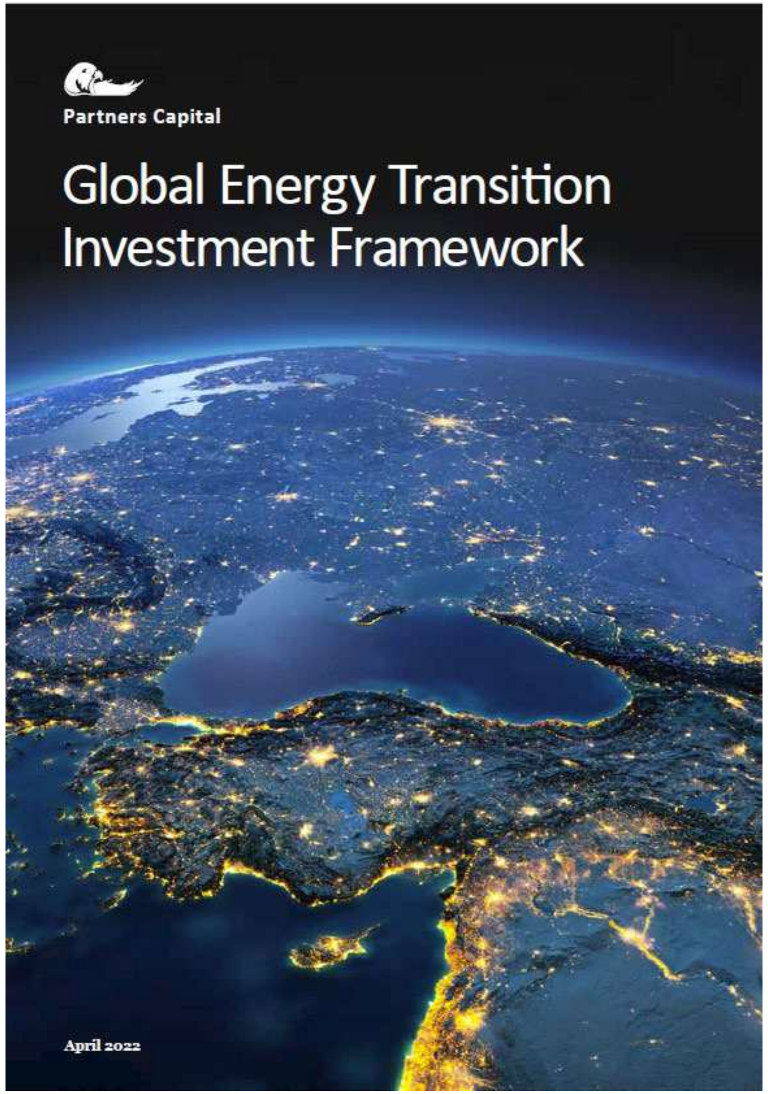
Founder and Chairman, London

Stan Miranda founded Partners Capital in 2001 and is Chairman of the firm's Board of Directors. He was previously the Chief Executive Officer from 2001 until June 2020 and also held the Chief Investment Officer position until 2016. He is a former member of the firm's Global Investment Committee and was the senior advisor to the Private Equity asset class team since the firm's founding. Previously, Stan was a Co-Founder and Managing Director of Evolution Global Partners, a Kleiner Perkins and TPG affiliated venture capital firm; Director of Bain & Company and member of its Worldwide Executive Committee (Chairman in 1997-98); and member of Bain & Company's Private Equity Practice and Private Equity Investment Committee member. Stan is a Certified Public Accountant and holds an MBA from Harvard.

Location: **London**

Partners Capital Energy Transition Macro Investment Framework

- Two years in the making
- Consolidated, what we believe to be, the best thinking from IEA, IPCC, IRENA, CATF, NGFS, BloombergNEF, Goldman Sachs, McKinsey, Bain and others
- "Peer reviewed" by many of our energy transition specialist asset managers and the Clean Air Task Force, our main partner on this research.
- First edition distributed to clients and asset managers - primary tool for training asset managers in Oct 2022
- Today is the first preview of the second edition of the ETIF (v2.0)



Global Energy Transition Whitepapers completed and in-progress

Wind & Solar penetration**	Battery and Long Duration Storage*	EV Penetration*	Building Efficiency
Clean Hydrogen**	Carbon Capture and Sequestration*	Nuclear*	Carbon taxes, credits and trading**
Financing	BioEnergy*	Industrial Electrification	Carbon Offsets**

** Whitepapers Completed

* Whitepapers in Progress

Energy Transition Investment Insights

Audience Polling Question #1

93% of European Pensions have net zero goals; 50% in 5 years and 90% in 10 years.

How many of you are affiliated with investment institutions where you have a "net zero" policy in place (formally or informally)?

a) Yes

b) No

c) Discussing at present

With targets set for what time frame?

a) By 2030

b) By 2050

c) Later

High level conclusion

1. The investors' "lens" focuses on what is most likely to happen, not what needs to happen, in the emissions reduction pathway.
2. The most valuable guide to what will happen, is cost – i.e., the most likely future cost vs the current high emission alternative of wind, solar, nuclear, batteries, carbon capture, hydrogen, EVs, heat pumps, transmission, SAF, EAFs, etc.
3. Approximately 50%, or ~25Gt of CO_2e, has a cost-effective alternative including, wind, solar, batteries and EVs.
4. The likely economics don't support the other 50% of the transition – beyond renewables and EVs, the technology platforms are not breaking through on cost (H_2, CCS, bioenergy, LDES).
5. But even the first 50% has financing challenges as the largest emitting poorer nations have other priorities.
6. Financing, regulation, taxes and subsidies required to get the next 50% have to overcome massive political barriers.
7. Corporate management are not investing nearly enough in lower carbon processes and products.
8. Venture capitalists are not well suited for taking the technologies further -- not patient capital and too much of it needed.

Q1. Who will provide the capital to developing nations to decarbonize?

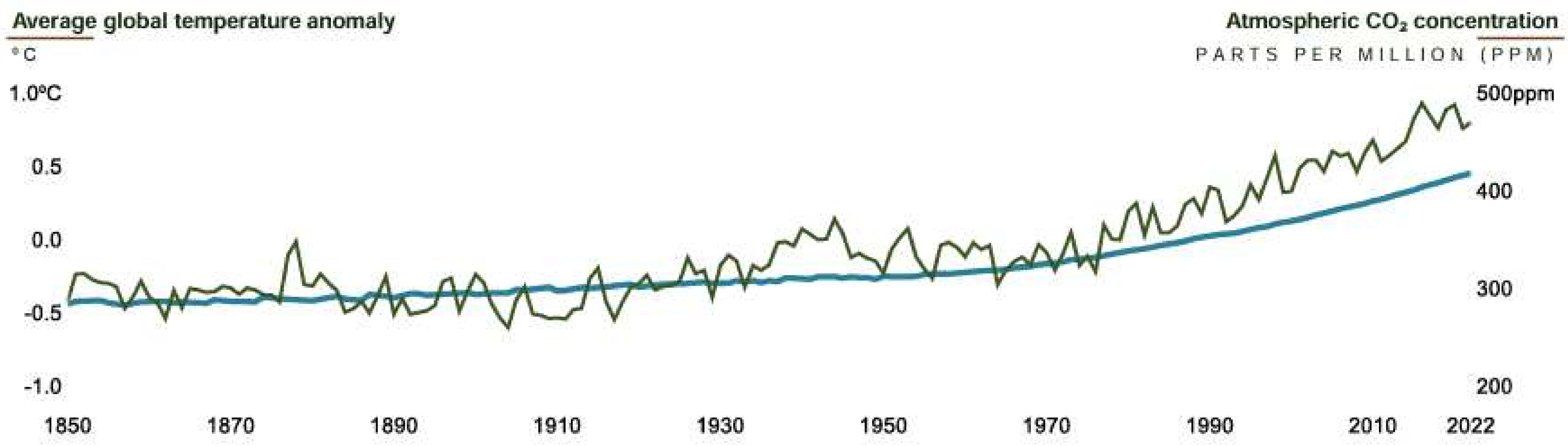
Q2. Who will provide the capital to develop the core technology platforms?

Q3. How do we motivate the largest corporations to most profitably decarbonize?

Part I:

Where are we today in the global energy transition?

Atmospheric CO2 concentration rises has caused 1.2°C average warming since pre-industrial times (1850)



Note: The green line represents the median average temperature deviation, or anomaly, vs. the 1961-1990 baseline (average) value. Atmospheric CO_2 concentration reflects the annual average.
Source: Bain & Company analysis; Hadley Center; NOAA; IPCC, Sixth Assessment Report (AR6), *Climate Change 2021: The Physical Science Basis, Summary for Policymakers*, A.1.2 (2022); Our World in Data

The Energy Transition has left the station:

Countries responsible for more than 87% of global emissions have made policy commitments. US, Europe, Japan, Germany, and Canada have codified into law

Proposed / In Discussion

Top 10 Emitting Countries	NZ Target Date	% of Global GHG
Indonesia	2060	2.3%
Pakistan	2050	1.0%
Bangladesh	2050	0.5%
Myanmar	2040	0.3%
Sudan	2050	0.3%
Belgium	2050	0.2%
Chad	2050	0.2%
Tanzania	2050	0.2%
Israel	2050	0.2%
Bulgaria	2050	0.1%
Total Emissions % of World GHG (all)		6.8%
Number of Countries		54

Declaration / Pledge

Top 10 Emitting Countries	NZ Target Date	% of Global GHG
South Africa	2050	1.0%
Kuwait	2060	0.3%
Bahrain	2060	0.1%
Ghana	2070	0.1%
Denmark	2045	0.1%
Sri Lanka	2050	0.1%
Haiti	2050	0.0%
Estonia	2050	0.0%
Armenia	2050	0.0%
Micronesia	2050	0.0%
Total Emissions % of World GHG (all)		1.7%
Number of Countries		10

In Policy Document

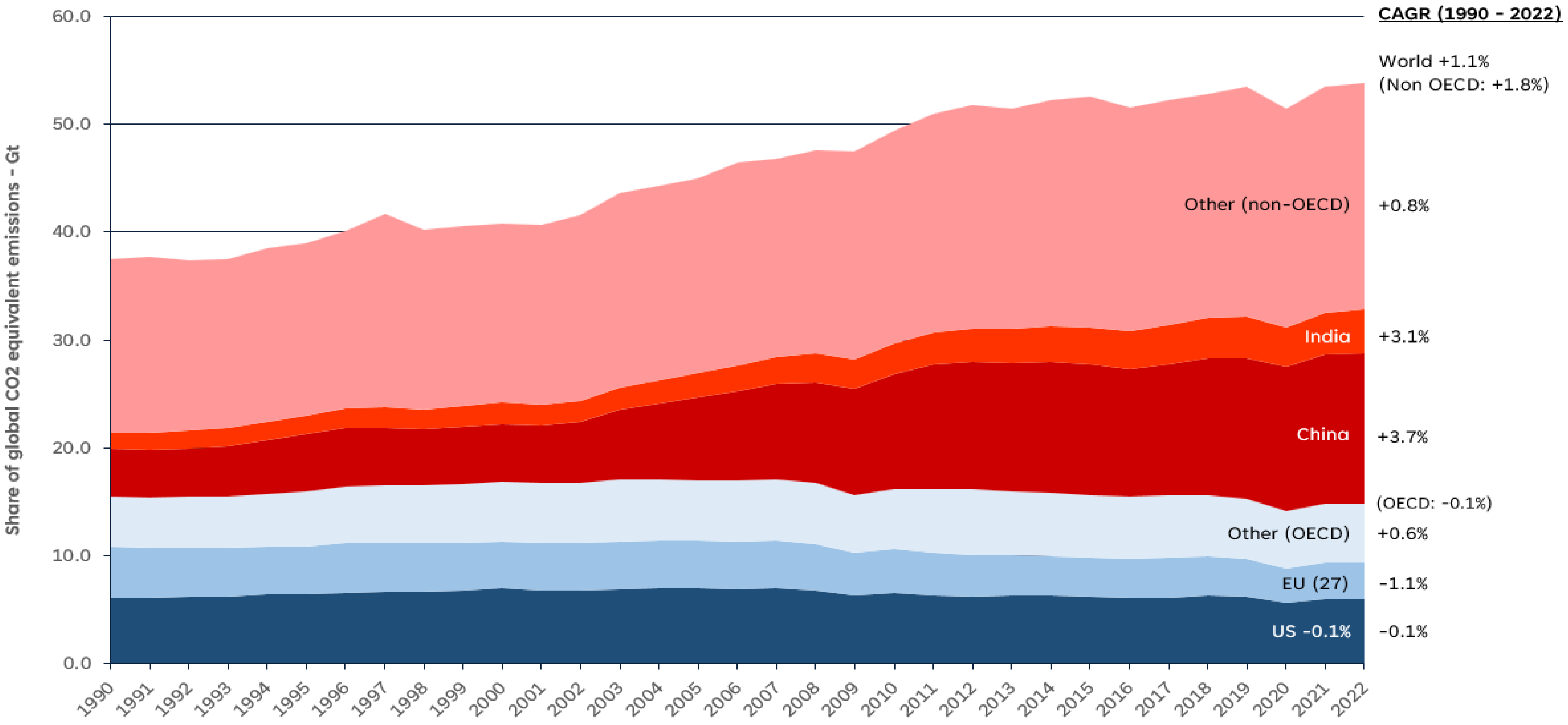
Top 10 Emitting Countries	NZ Target Date	% of Global GHG
China	2060	29.2%
India	2070	7.3%
Russia	2060	4.8%
Brazil	2050	2.4%
Saudi Arabia	2060	1.5%
Turkey	2053	1.3%
Vietnam	2050	0.9%
Thailand	2065	0.9%
Italy	2050	0.7%
Argentina	2050	0.7%
Total Emissions % of World GHG (all)		54.0%
Number of Countries		49

In Law

Top 10 Emitting Countries	NZ Target Date	% of Global GHG
United States	2050	11.2%
European Union	2050	8.0%
Japan	2050	2.2%
Germany	2045	1.5%
Canada	2050	1.4%
South Korea	2050	1.3%
Australia	2050	1.1%
France	2050	0.8%
United Kingdom	2050	0.8%
Nigeria	2070	0.8%
Total Emissions % of World GHG (all)		31.6%
Number of Countries		29

Note: Emissions are shown for all countries within each group
Source: Energy & Climate Intelligence Unit, EDGAR – Emissions Database for Global Atmospheric Research

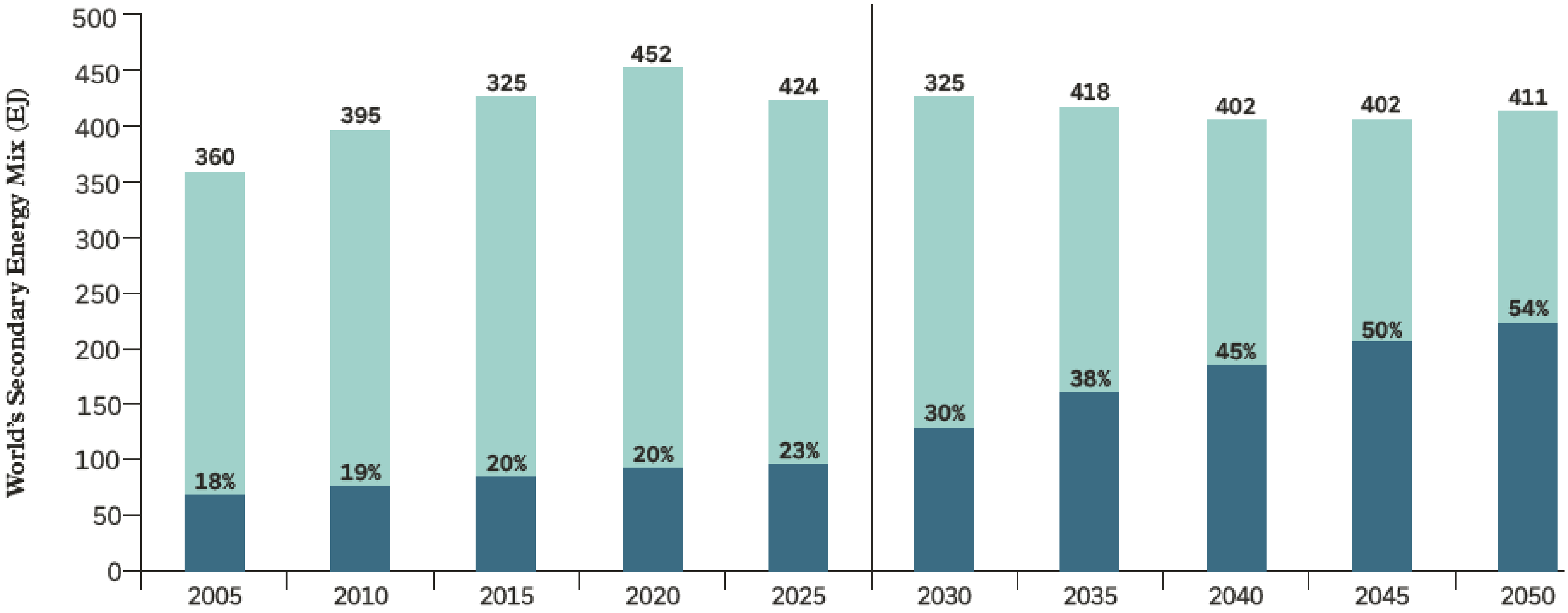
Growth in GHG levels have been driven by non-OECD countries (+1.8% growth), while OECD countries have flattened the curve (-0.1% decline)



Source: Our World in Data

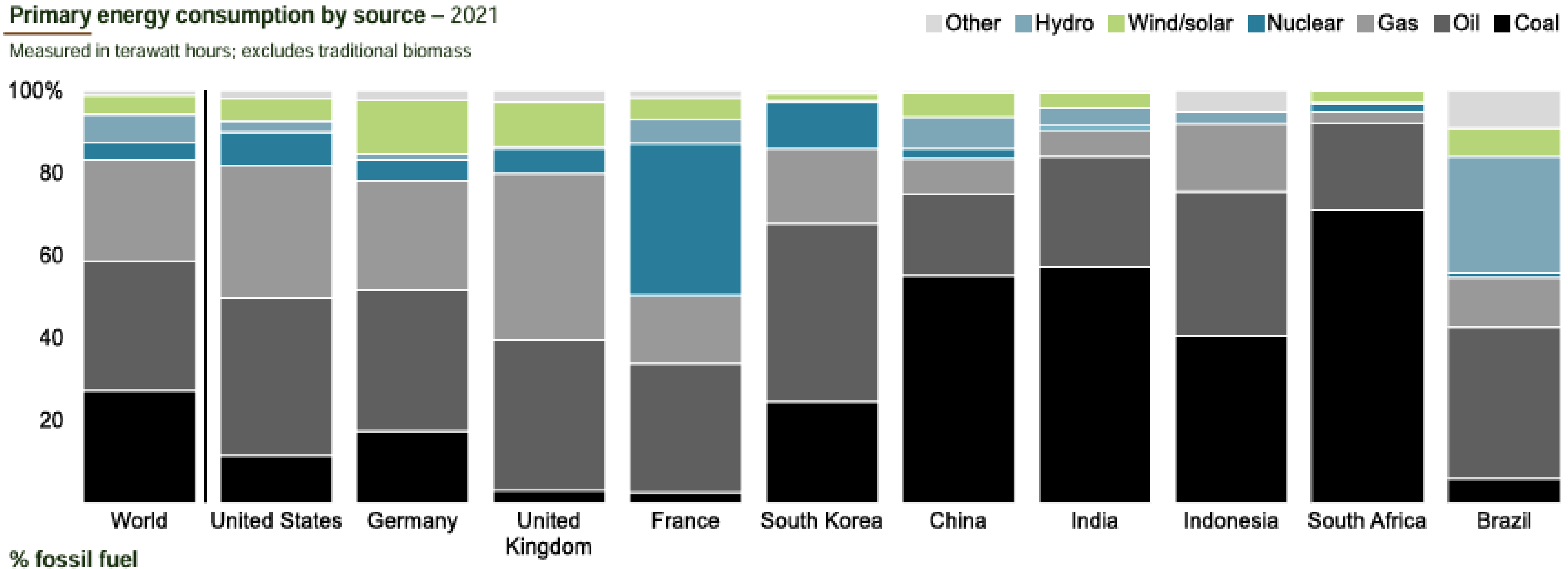
The aim of the global energy transition is to substitute fossil fuels with electricity where economically possible and convert the rest to clean fuels

Our analysis suggests that electricity generation will grow from the current 22% to 54% of all secondary energy by 2050



Source: Network for Greening the Financial System (NGFS). The 54% electricity share in 2050 assumes 62,000 TWh of electricity consumption. Primary energy describes energy in its original natural form (e.g., crude oil, sun, nuclear), while secondary is the form in which it is consumed (e.g., diesel, gasoline, electricity). Global primary energy demand is approximately 600 EJ, in contrast to secondary consumption of 425 EJ today.

Fossil fuels still account for 83% of global primary energy consumption with wind and solar at 7% (in 2023); hydro and nuclear being 10%



% fossil fuel

World	United States	Germany	United Kingdom	France	South Korea	China	India	Indonesia	South Africa	Brazil
83%	82%	78%	80%	50%	86%	83%	90%	92%	95%	55%

Note: Excludes traditional biomass. “Other” includes other renewables and biofuels
Source: Bain & Company analysis; Our World in Data; BP Statistical Review of World Energy, 2021

The biggest obstacles

1. While developed markets cut emissions, emerging markets are increasing emissions
2. Insufficient capital – especially in emerging economies, also for capital-intensive new technologies
3. Wind and solar penetration is blocked by transmission infrastructure roll out obstacles
4. There is no viable long-duration (>4 hours) renewable energy storage solution likely in the future
5. Clean hydrogen is prohibitively expensive
6. Carbon capture, utilisation and storage (CCUS) is still early in its adoption and cost prohibitive for all but a small % of applications
7. EV penetration and solar PV penetration will be slowed by geopolitics (China dominates both)
8. Electric building heat pumps will take 100 years to retrofit into existing buildings at current rates
9. Carbon Offsets (e.g., reforestation) have a high opportunity cost for land and have a bad reputation

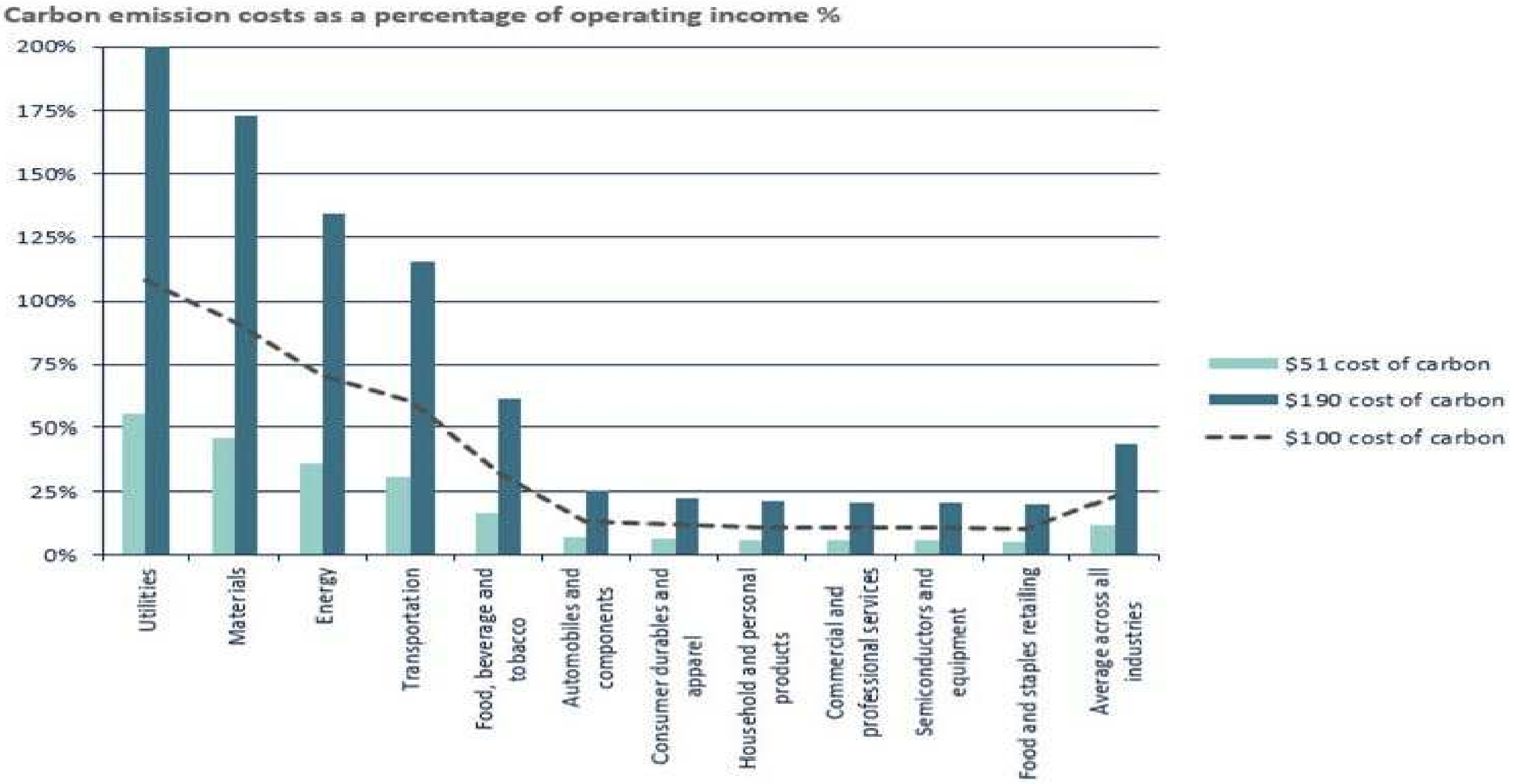
Most asset managers do not adequately understand the energy transition to be investing our capital. They need to know 3 key things:

1. **The scale and scope of this opportunity** by sector, geography, technology, stage of investment, etc.

2. **The divergent set of scenarios for the path of the global energy transition**
   - policy support (subsidies, taxes, credits, regulation, etc.)
   - technological breakthroughs, tech development pace and cost
   - capital sources
   - foreign competition (esp. China)
   - consumer backlash
   - costs and prices

3. **Translate energy transition pathway scenarios into asset valuation models**

A $190 price of carbon wipes out the profitability from the majority of US energy, materials, and transport, utilities, and food companies



Source: Department of Economics, University of Chicago, Chicago, IL, USA. National Bureau of Economic Research, Cambridge, MA, USA. Booth School of Business, University of Chicago, Chicago, IL, USA. Centre for Economic Policy Research, London, UK. Business School, University of Mannheim, Mannheim, Germany. August 2023 issue of Science magazine.

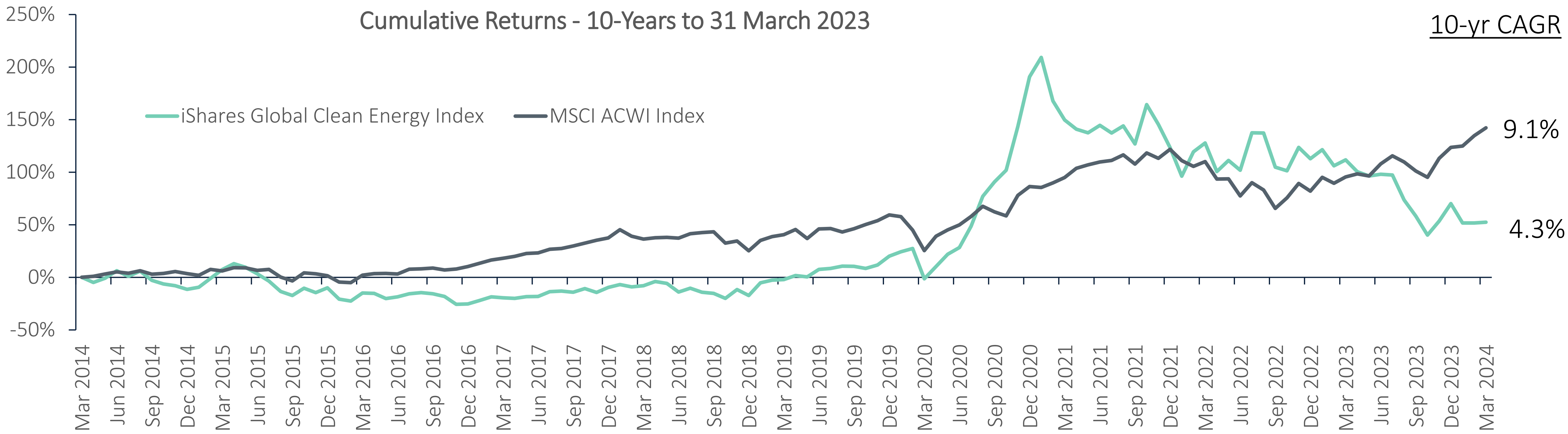
Past performance is not indicative of future returns, your capital is at risk and you may not get back the full amount invested

Cleantech bubble No 1 (2005 to 2013):
How have cleantech investments performed historically?

Cleantech 1.0	Cumulative 9-year Return 2005-2013	Average Annual Return 2005 - 2013
Private Cleantech Investment	**23.4%**	**2.4%**
Venture Capital Cleantech	*-14.7%*	*-1.8%*
Growth / Buyout Cleantech	*47.4%*	*4.4%*
Public Cleantech Investment	**-38.4%**	**-5.2%**
S&P 500	**81.6%**	**6.9%**

Source: Private cleantech performance sourced from Cambridge Associates. Public cleantech investments a mix of public equity indices: S&P 500 Utilities Index from 01/01/2000 to 31/12/2000, WilderHill Clean Energy from 01/01/2001 to 30/11/2003, S&P Global Clean Energy 01/12/2003 onwards. Note that private and public returns are not comparable given the public returns are not matched to private capital flows to create a public market equivalent performance.

Cleantech bubble No 2 (2020-2024): vulnerable to huge volatility due to inherent uncertainty, low liquidity, sentiment swings and rising rates



Annualised Net Returns in USD to 31 March 2023				
	1-Year	3-Years	5-Years	10-Years
S&P Clean Energy Index	-28.0%	-15.2%	9.3%	4.3%
MSCI ACWI Index	23.8%	7.5%	11.5%	9.1%
Out/underperformance	-51.8%	-22.6%	-2.2%	-4.8%

Source: Bloomberg

S&P Global Clean Energy Index: Companies driving underperformance

Top 10 Detractors over 3-Years to 31 March 2023						
Company	Business Description	Market Cap ($B)	Avg % Wgt	Cum. Return (%)	Fwd PE (Dec-20)	Fwd PE (Mar-23)
ISHARES GLOBAL CLEAN ENERGY			100	-38.6	45.9x	19.9x
PLUG POWER INC	Hydrogen Fuel Cells	$2.2	3.6	-90.4	44.9x	20.0x
SOLAREDGE TECHNOLOGIES INC	Solar Panel Inverters	4.0	5.3	-75.3	17.1x	27.3x
ORSTED A/S	Danish Renewable Energy	23.8	4.5	-64.4	57.7x	16.1x
SUNRUN INC	Solar PV and Batteries	2.7	2.2	-78.2	255.0x	NA
ADANI GREEN ENERGY LTD	Indian Renewable Energy	36.7	0.6	-84.4	NA	172.6x
ENPHASE ENERGY INC	solar micro-inverters, battery energy storage, EV charging stations	16.4	7.6	-25.4	44.7x	20.1x
BALLARD POWER SYSTEMS INC	proton exchange membrane (PEM) fuel cell products	1.0	0.7	-87.0	NA	NA
ENERGY ABSOLUTE PCL-NVDR	Thailand Biodiesel	3.2	0.9	-63.5	43.3x	16.8x
SUNNOVA ENERGY	Solar Energy	0.6	0.8	-85.0	32.5x	16.8x
SHOALS TECHNOLOGIES GROUP	electrical balance of systems (EBOS) solutions for solar, storage, and electric vehicle charging	1.8	1.1	-66.2	109.4x	15.3x

Source: Bloomberg
Holdings data based on iShares Global Clean Energy ETF.

Audience Polling Question #2

Will the Energy Transition investment opportunity be bigger or smaller than the digital transformation investment opportunity has been?

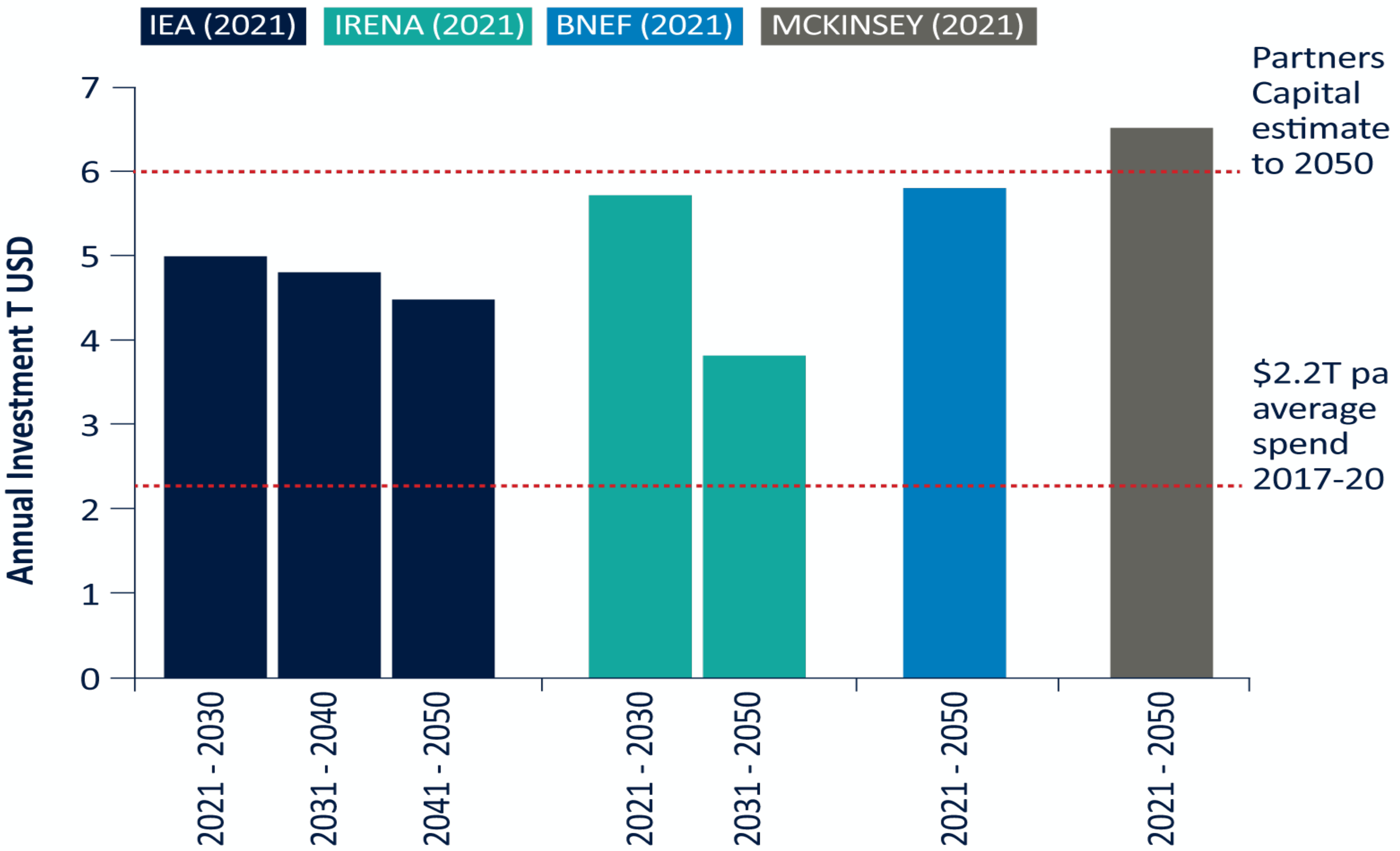
a) much smaller

b) about the same

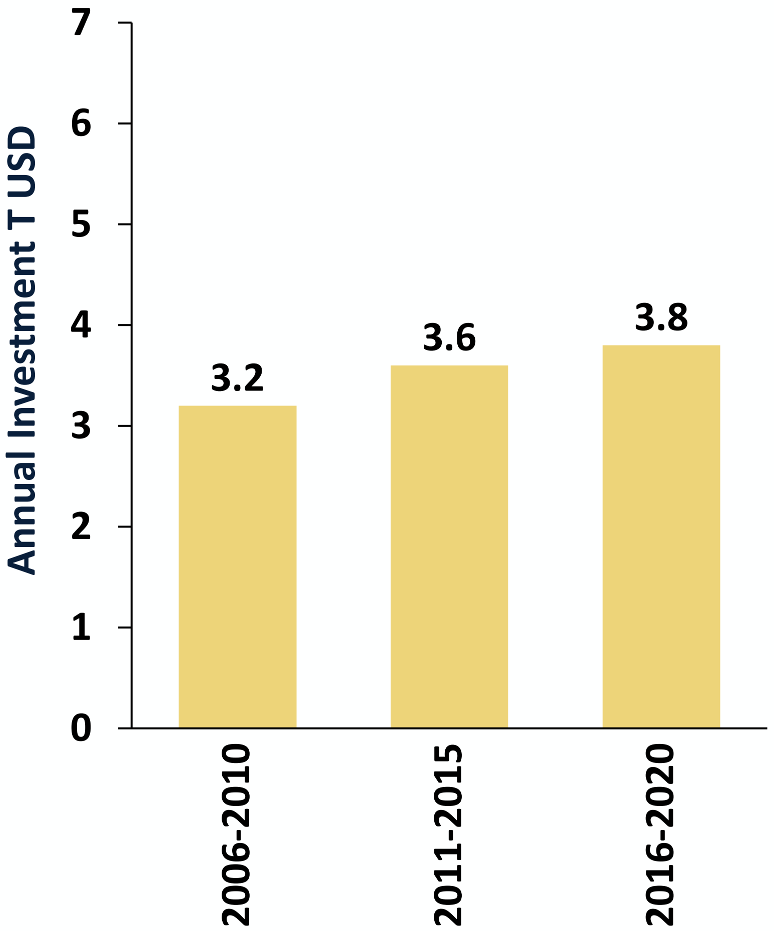
c) much larger

The Energy Transition is a megatrend the size of the digital transition

Estimated Annual Energy Transition Investment 2021 - 2050

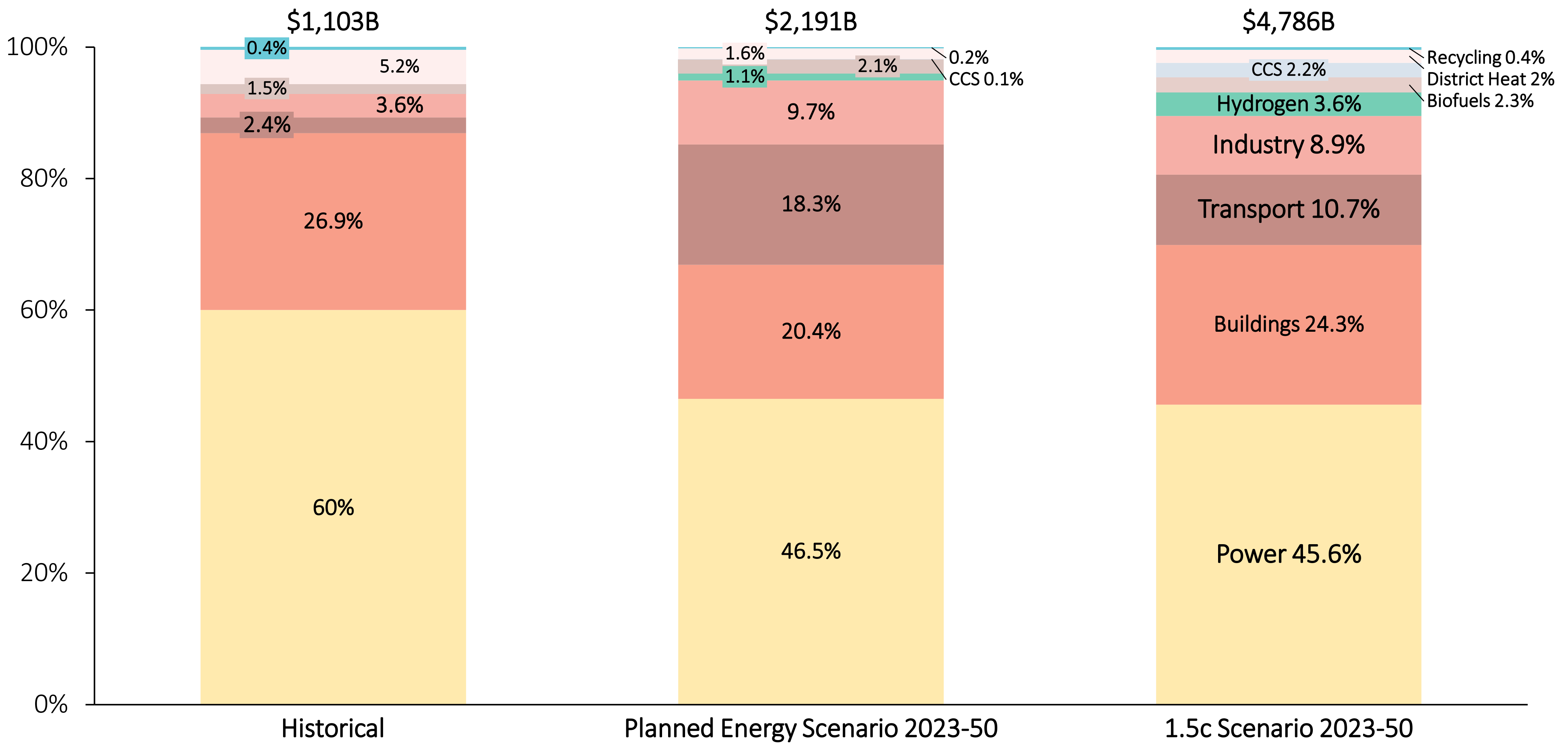


Annual Global IT Investment 2005 - 2020



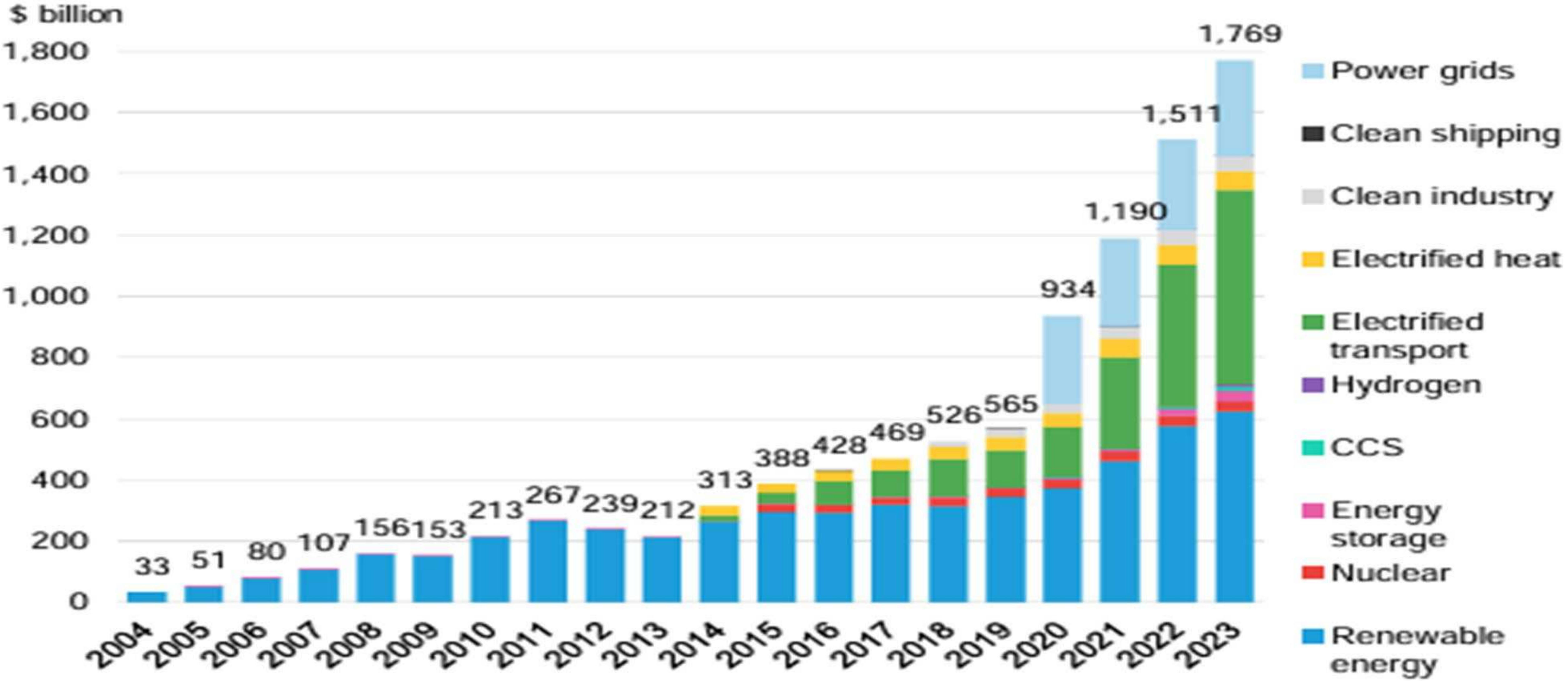
Source: IEA, International Renewable Energy Agency (IRENA), BloombergNEF, McKinsey, Financial Times. IT spending sourced from Statista.

Average Annual Investment in the Energy Transition by emitting sector



Source: IRENA World Energy Outlook 2023

2023 saw $1.8T in global energy capital investment, most deployed in renewables, power grids and EVs

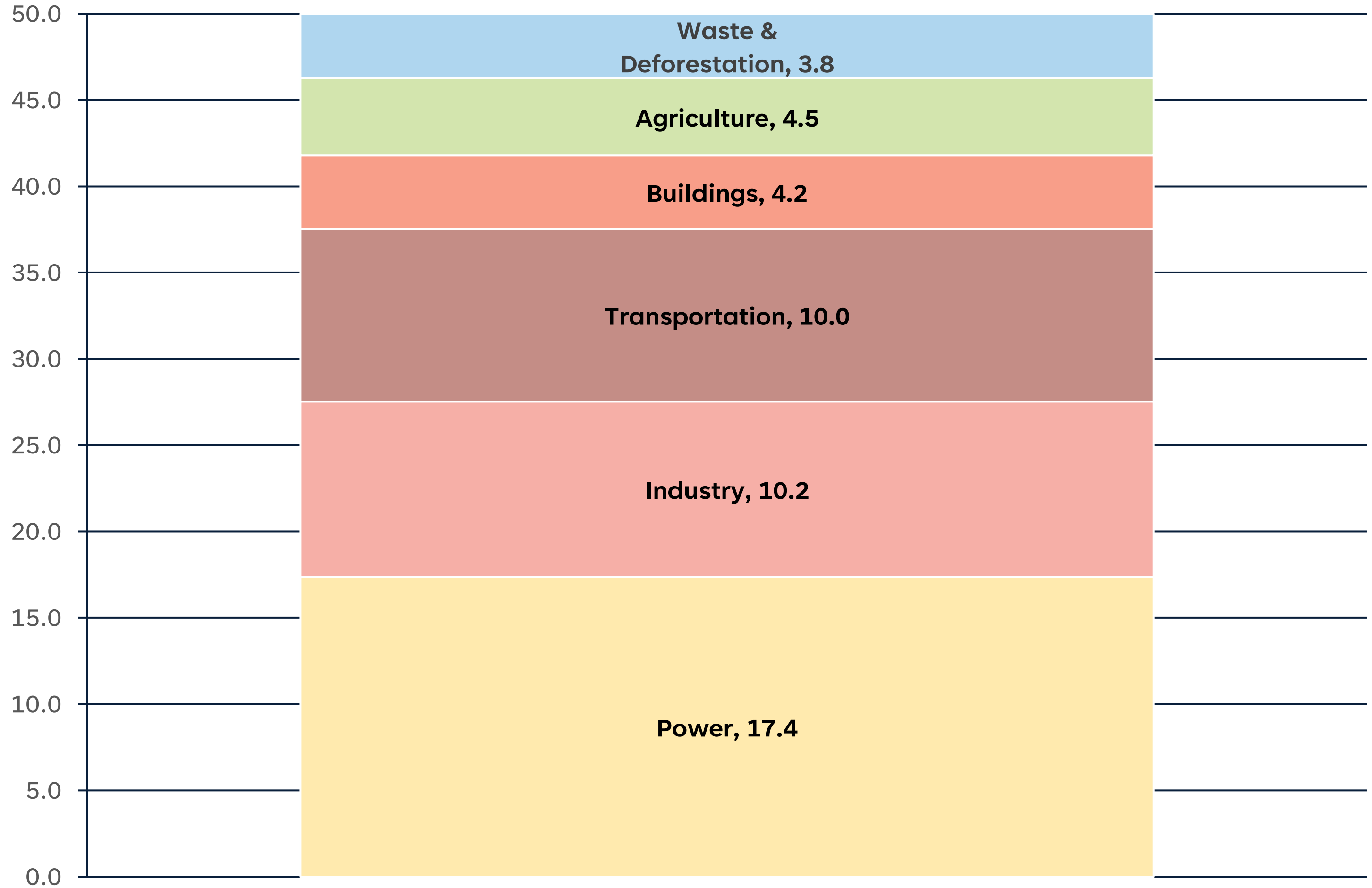


Source: BloombergNEF

Part II: What should investors assume to be the most likely path of the energy transition?

Global annual GHG emissions by sector (CO_2 equivalent gigatons – “CO_2e Gt”) – the biggest solutions are targeted on the biggest emitters

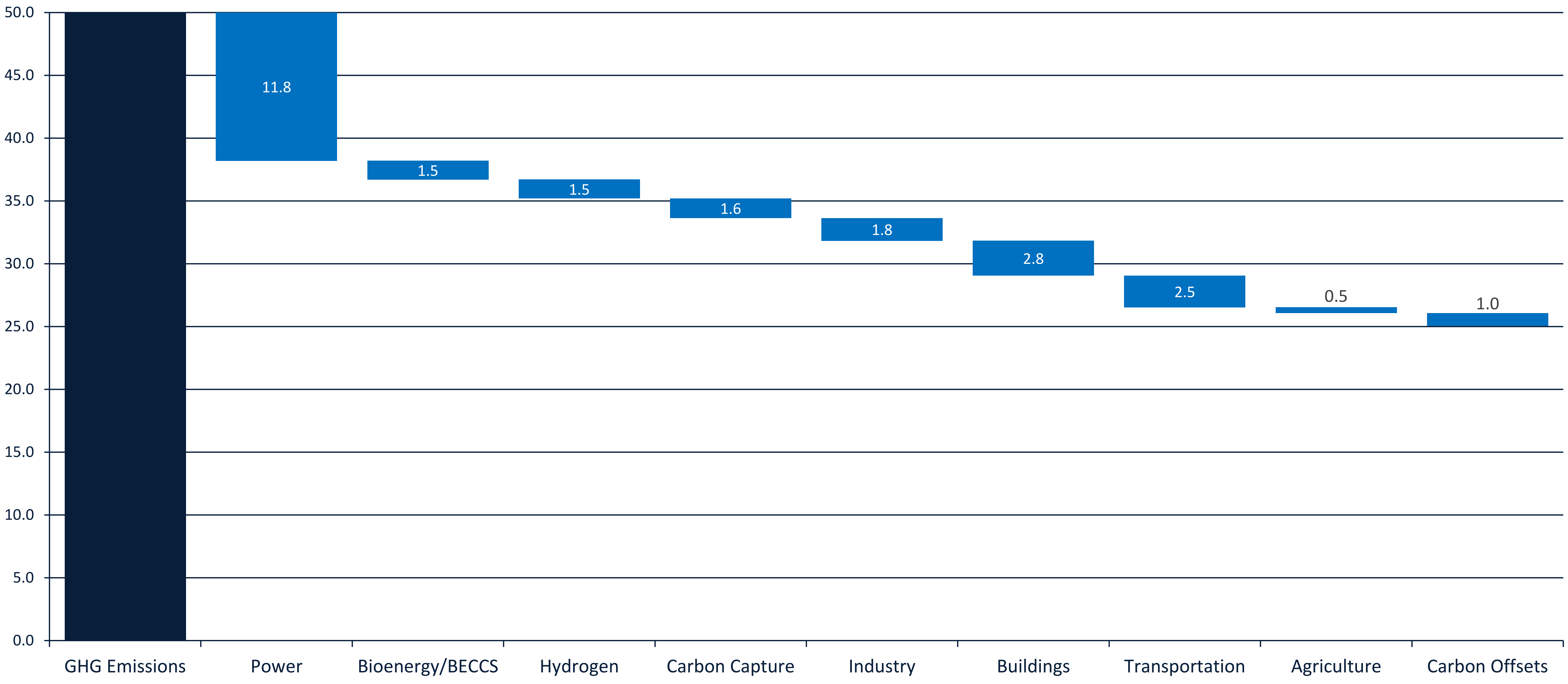
50 CO_2e Gt



Source: Partners Capital analysis from IEA, IRENA, IPCC

The global decarbonization Waterfall – 50% is achievable economically

Metric tonnes of carbon abatement by 2050 WITHOUT government policy support

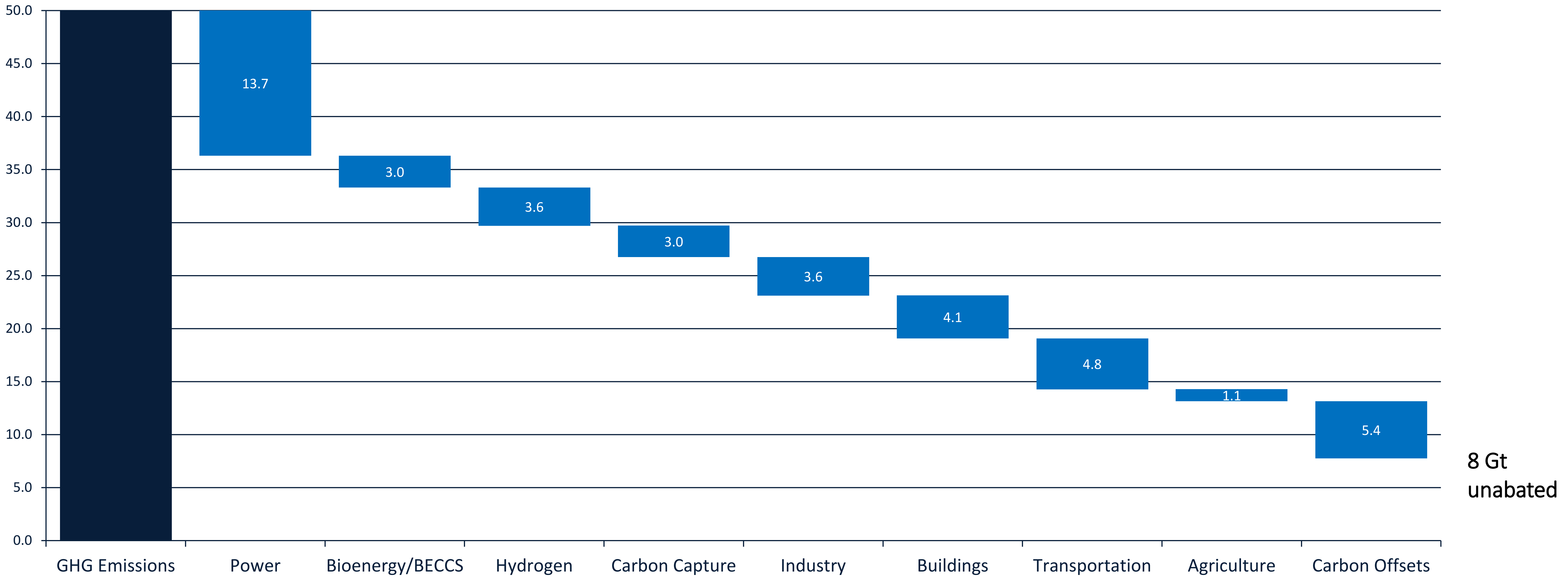


25 Gt
left unabated

Source: Partners Capital Analysis

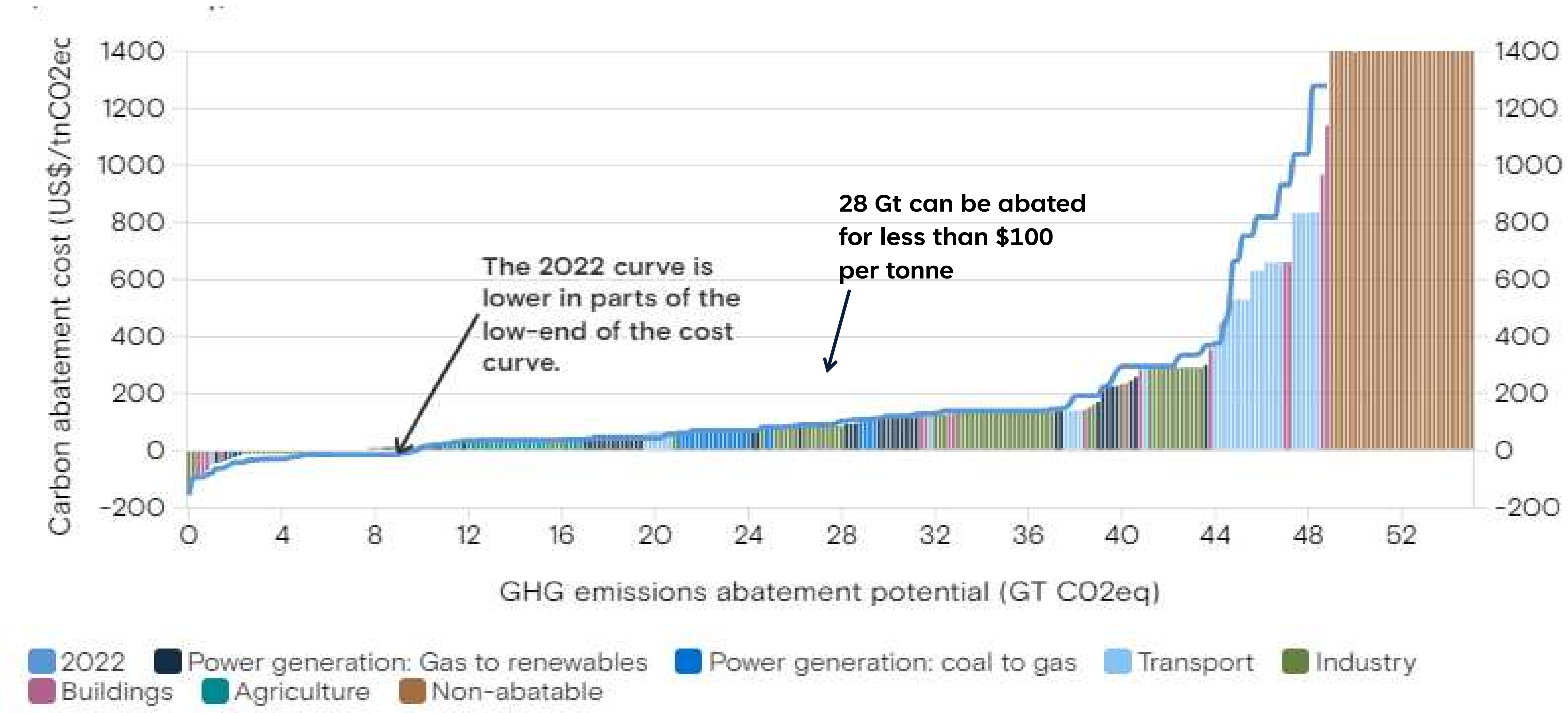
The global decarbonization Waterfall – 84% achievable with Policy Support

Metric tonnes of carbon abatement by 2050 with government policy support



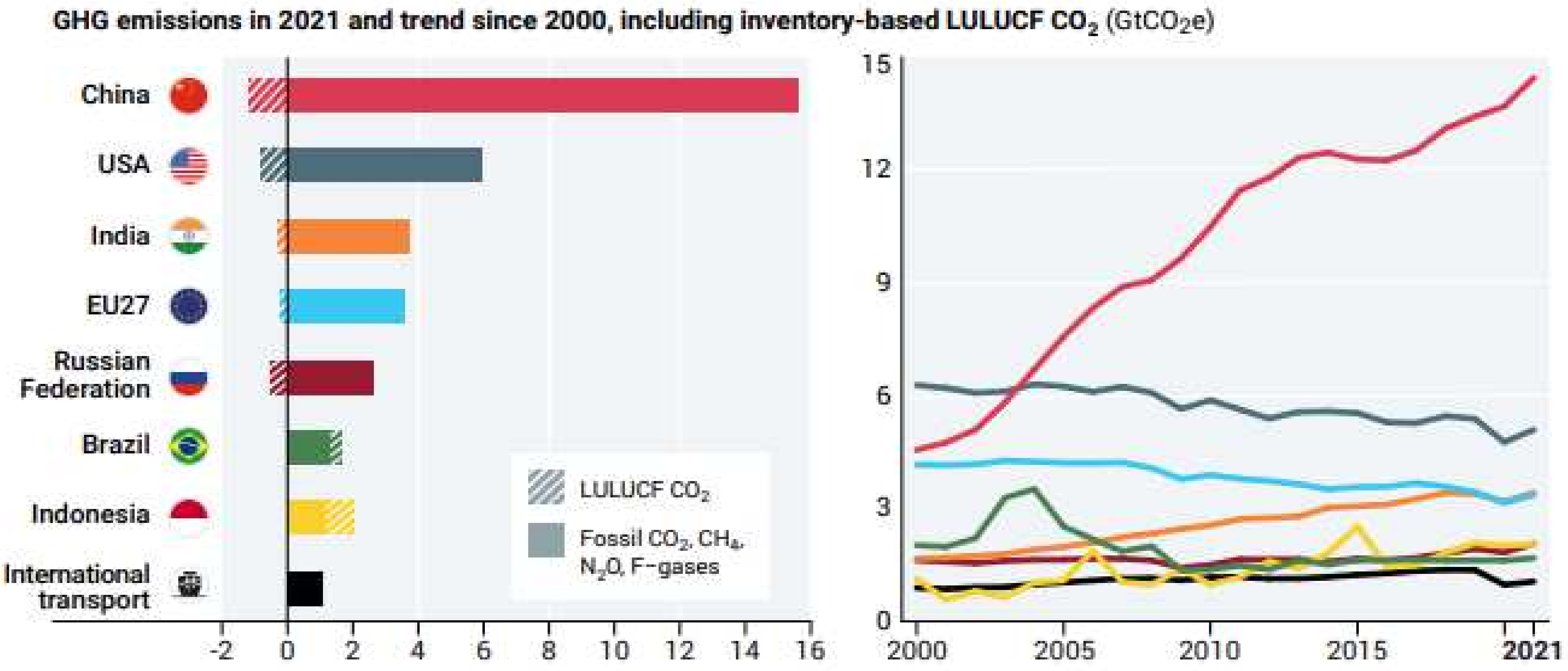
Source: Partners Capital Analysis

The marginal cost of abatement is <$100/t for over half of all emissions - much is simply too expensive to abate or impossible



Source: Goldman Sachs 2022

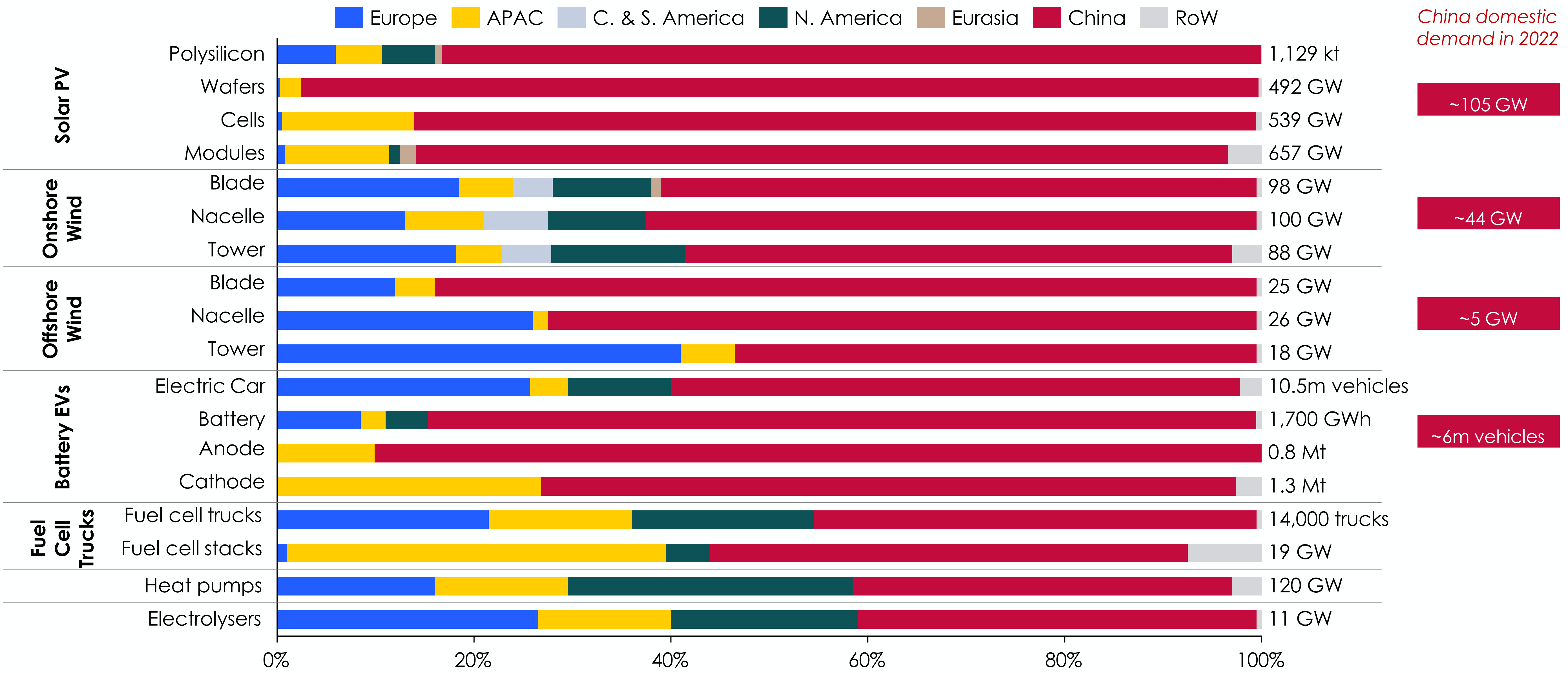
China was the elephant in the room at COP28 (and will be for COP 29)



Source: United Nations Emissions Gap Report 2023

China currently dominates most critical inputs to the global energy transition

Share of global manufacturing capacity for clean energy technologies, 2021/22



Source: IEA (2023), Energy technology perspectives; BNEF (2023), Interactive data tool; BNEF (2022), Localizing clean energy supply chains comes at a cost

Climate Technology

In his book, “How to avoid a climate disaster”, Bill Gates provides a list of the technologies that he believes are crucial to making the transition to net zero emissions, which are listed 1 to 18 below, plus 5 that we have added

Technologies needed

1. Green Hydrogen
2. Grid-scale electricity storage that can last a full season
3. Electrofuels
4. Advanced biofuels
5. Zero-carbon cement
6. Zero-carbon steel
7. Plant-and cell-based meat and dairy
8. Zero-carbon fertilizer
9. Next-generation nuclear fission (SMRs)
10. Nuclear fusion
11. Carbon capture (both direct air capture and point capture)
12. Underground electricity transmission
13. Zero-carbon plastics
14. Geothermal energy
15. Pumped hydrothermal storage
16. Drought-and flood-tolerant food crops
17. Zero-carbon alternatives to palm oil
18. Coolants that don’t contain F-gases
19. Super conducting transmission to increase grid capacity
20. Low-cost graphene for greater battery density and solar efficiency
21. Long duration heat storage
22. Farming innovations to cut methane and nitrous oxide
23. Ocean decarbonization

Audience Polling Question #3

What major part of the Energy Transition are you most confident will happen rapidly and at scale?

a) solar penetration

b) wind penetration

c) carbon capture technology

d) green hydrogen

e) electric vehicle (including charging infrastructure) penetration

f) bioenergy

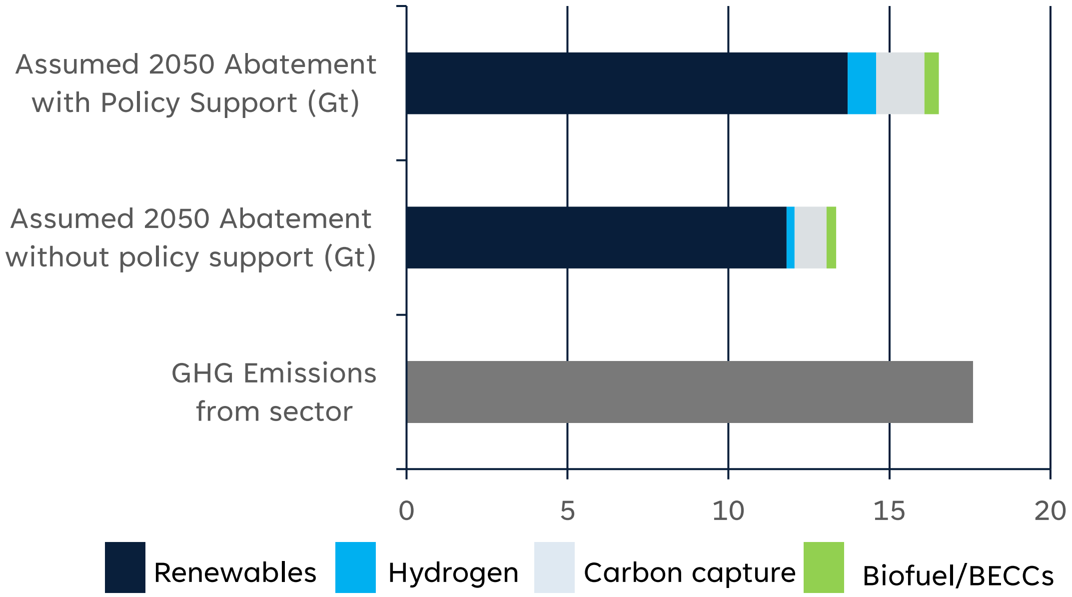
g) nuclear

h) Improvements in energy efficiency

i) building heating converted to electric heating (via heat pumps)

27% (14Gt)* of CO2 reduction is expected from renewables alone – with all the growth from wind and solar, not hydroelectric or nuclear

Abatement potential for renewables (Gt CO2 equivalent)



Tail winds

- 28,000 TWh grows to 72,000 TWh by 2050 from EM economic growth and electrification of transport, buildings and industry
- Cost of renewables is competitive with gas and coal power (c. $48/MWh)
- Short duration grid batteries help with intraday wind and solar power intermittency (adding 7% further renewables penetration)
- Up to 7 Gt of emissions avoidance may be possible from grid and end use efficiency improvements

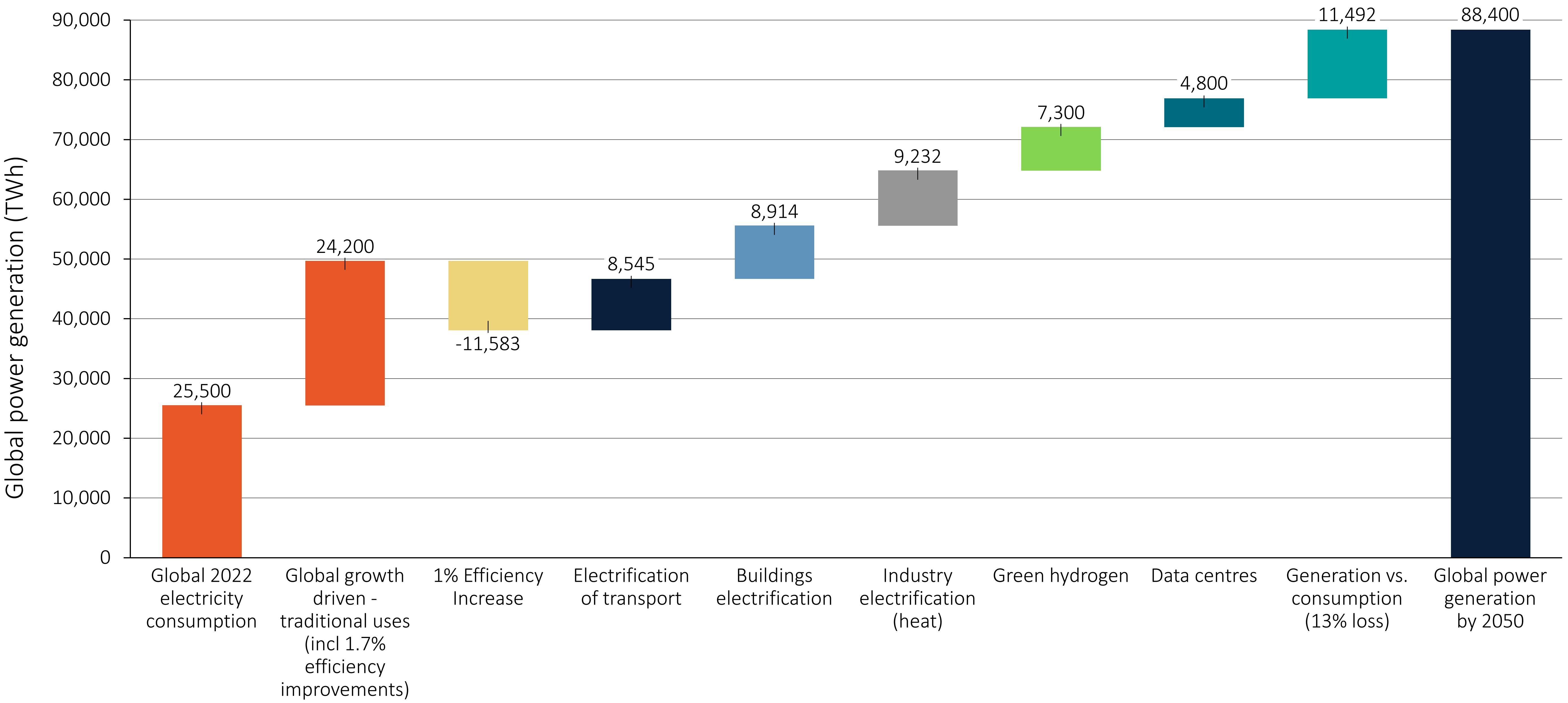
Head winds

- Transmission infrastructure build out will fall short due to land availability, permitting, and NIMBYism.
- Long duration (>6 hrs) storage will take longer to adopt than expected
- Much of the emerging world do not have the capital to invest

*14Gt is the impact of renewables adoption, including grid efficiency and use of storage. In total, 17Gt (including the impact of hydrogen, CCS and biofuels) is expected to be abated by 2050

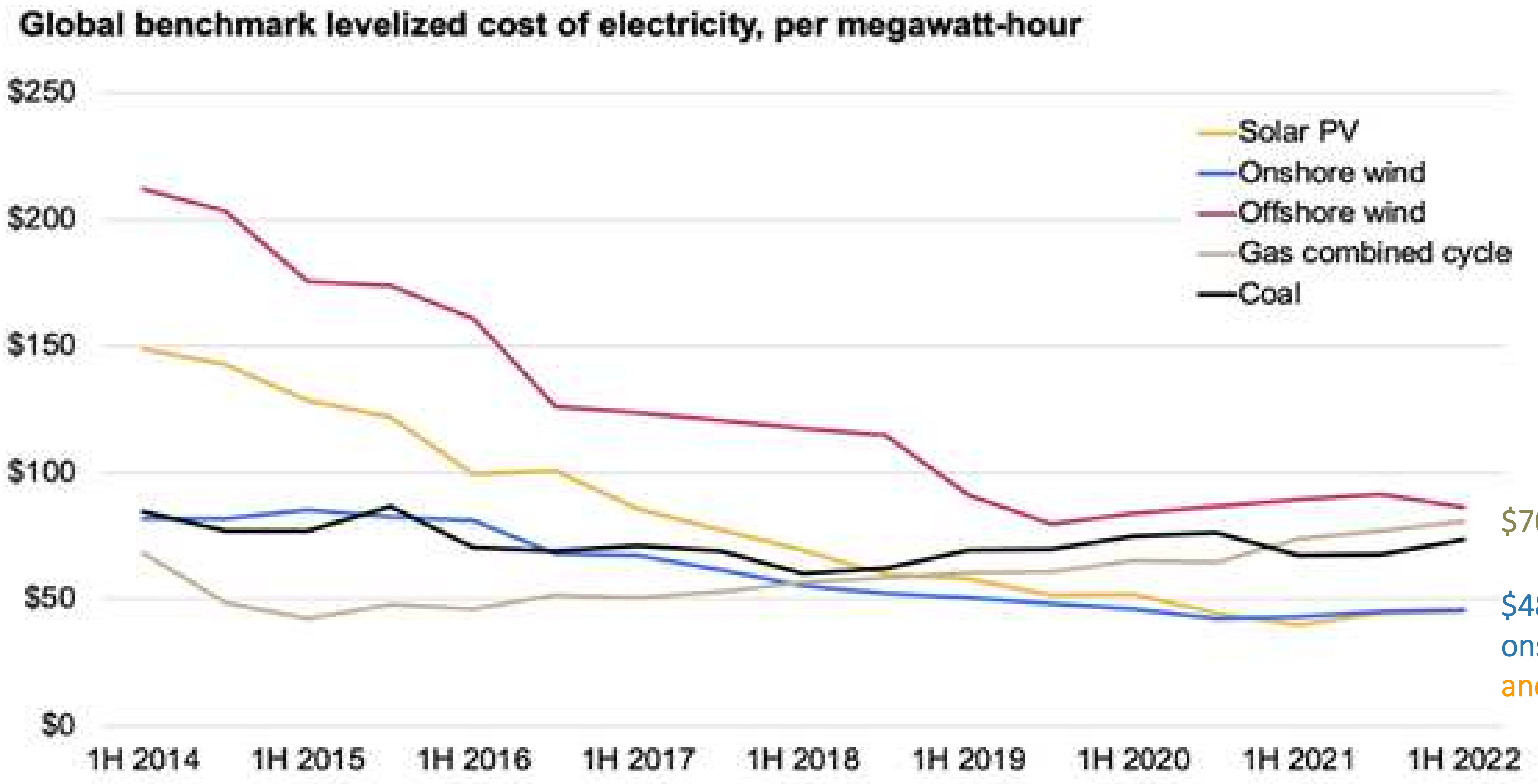
Source: Partners Capital Analysis

We expect total electricity generation to exceed 88,000 TWh by 2050



Source: Partners Capital analysis (Clean Hydrogen Investment Framework whitepaper), BloombergNEF for buildings, industry and transport, Bain & Co for Green H2, Journal of Cloud Computing for data centres.

Onshore wind and Solar PV are cheaper than gas fired power



$70/MWh Gas

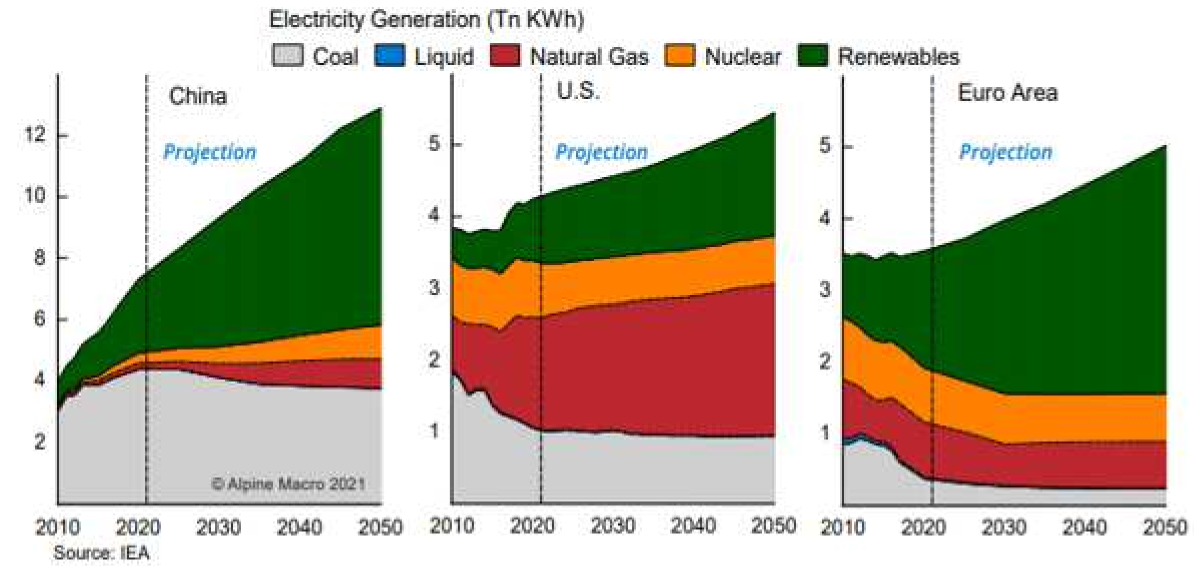
$48/MWh onshore wind and Solar PV

Source: BloombergNEF (June 2022). Note that the global benchmark is a country-weighted average using the latest annual capacity additions.

Nuclear will fall from its current 9% to 7% of total electricity globally

An artist's rendering shows Westinghouse's planned AP300 small modular nuclear power reactor, which the company officially unveiled on May 4, 2023

The US and Europe are expected to reduce their share of electricity from nuclear as it grows by 2.5% pa vs 3.4% pa for overall electricity



Source: IEA

- Most official forecasts, including the IEA's and IRENA's, suggest that nuclear fission's contribution to the grid will shrink from 9% to 7% as it continues to grow at c2.5% pa vs overall electricity at c.3.4% pa. This 2.5% is an acceleration relative to near zero growth in the past 22 years.

- The cost is the main impediment. US cost (LCOE) of nuclear power is estimated to be in the range of $141 to $221/MWh compared to $24 to $96/MWh for utility scale solar PV and onshore wind.

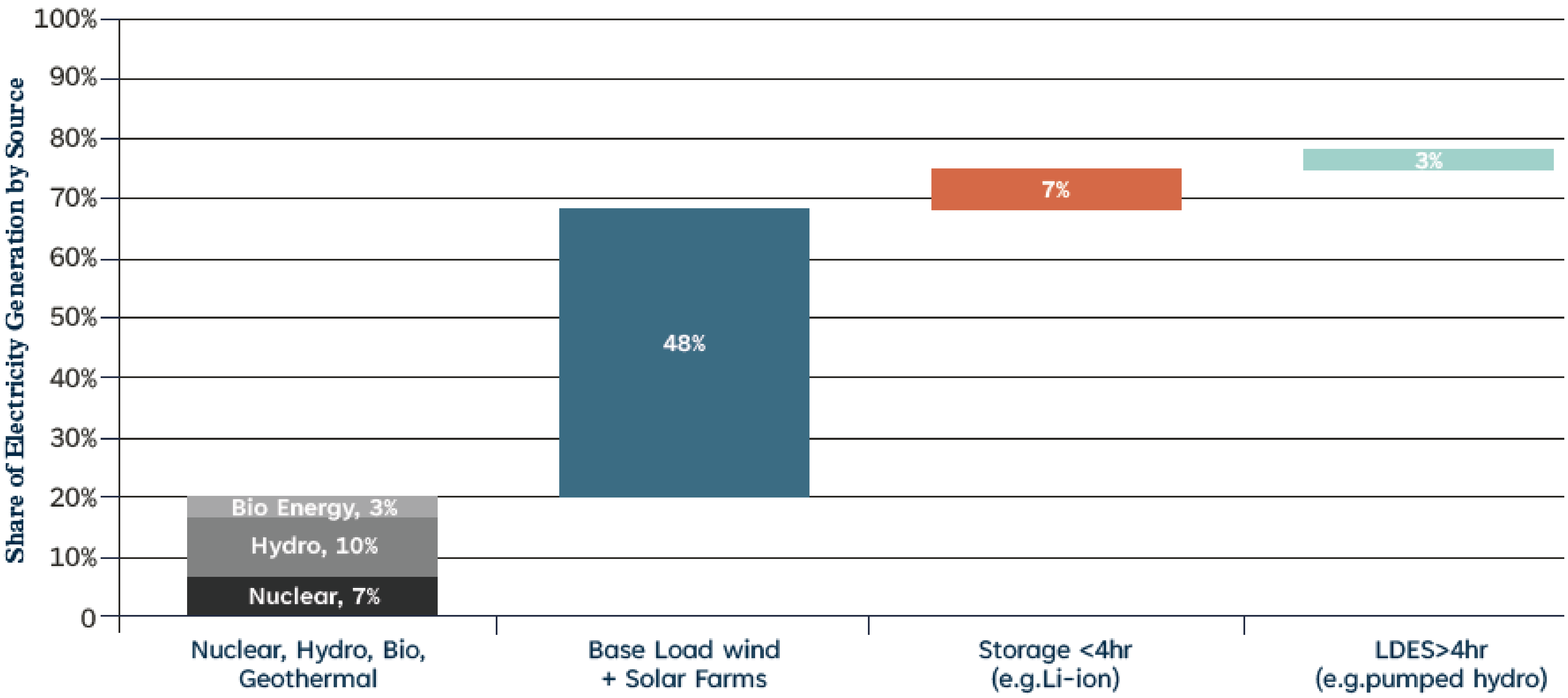
- Nuclear is baseload electricity, when the world needs a source of low-cost peak load electricity that can be turned on and off as needed.

- This outlook also reflects waste disposal and safety perception issues.

- Given the typical 15+ year construction period, nuclear is more likely to be a solution in the last decade running up to 2050 targets, unless **small modular reactors** (which have a much shorter development timeframe) reach commercial viability sooner.

- **Nuclear fusion has been just around the corner for about 30 years,** but has more capital being invested than ever before. Most experts state that, If we see a breakthrough, nuclear could be a larger contributor to decarbonization, but not until the third decade of the transition.

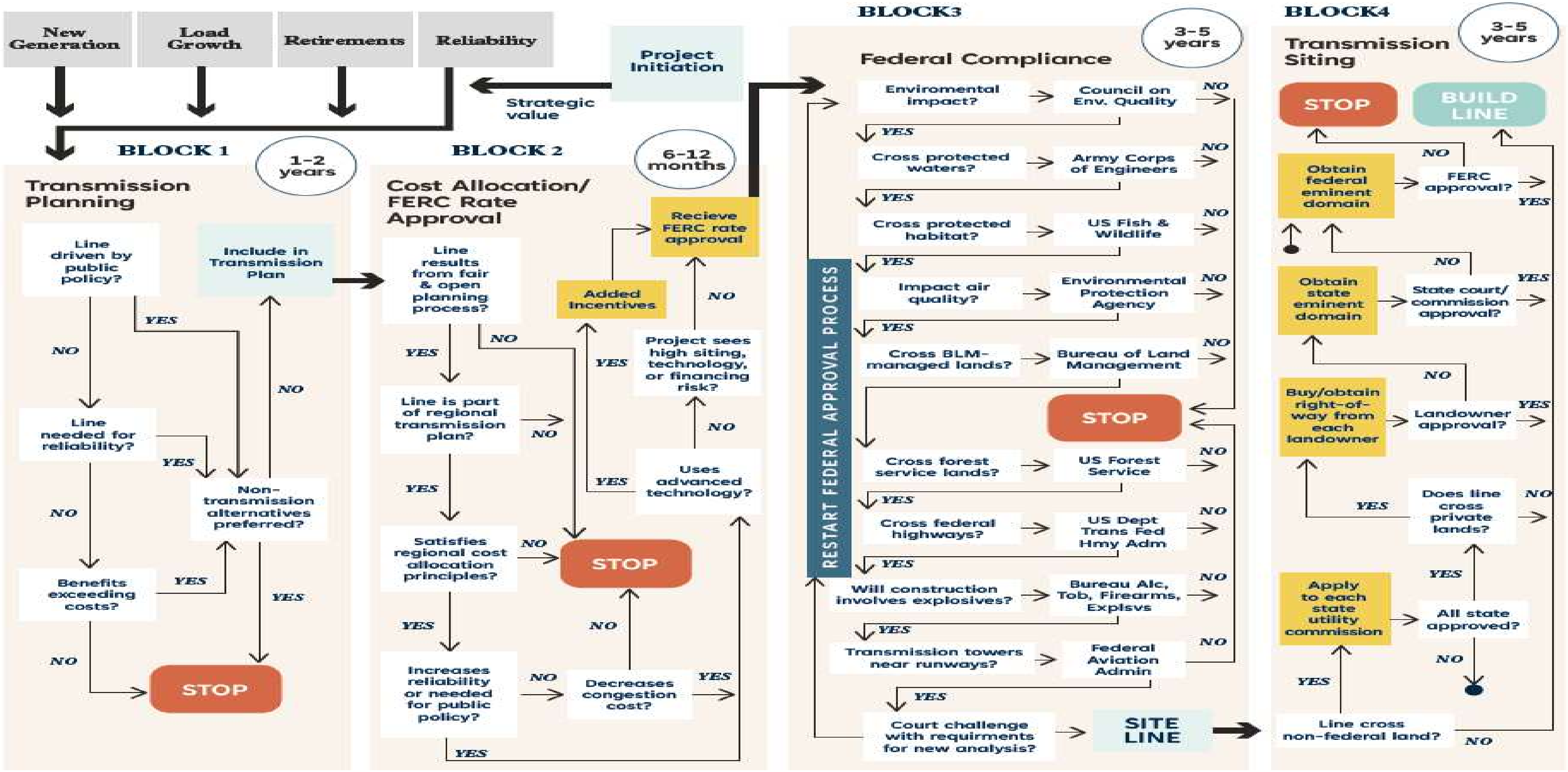
At a global level, the maximum penetrations from renewables should be expected to be around 77%, but this will vary hugely by region



Source: Partners Capital analysis. Enlarged interconnection impact is reflected in the maximum wind and solar live offtake estimate, which includes the projected benefits of cross-border grid interconnections but excludes battery and LDES storage.

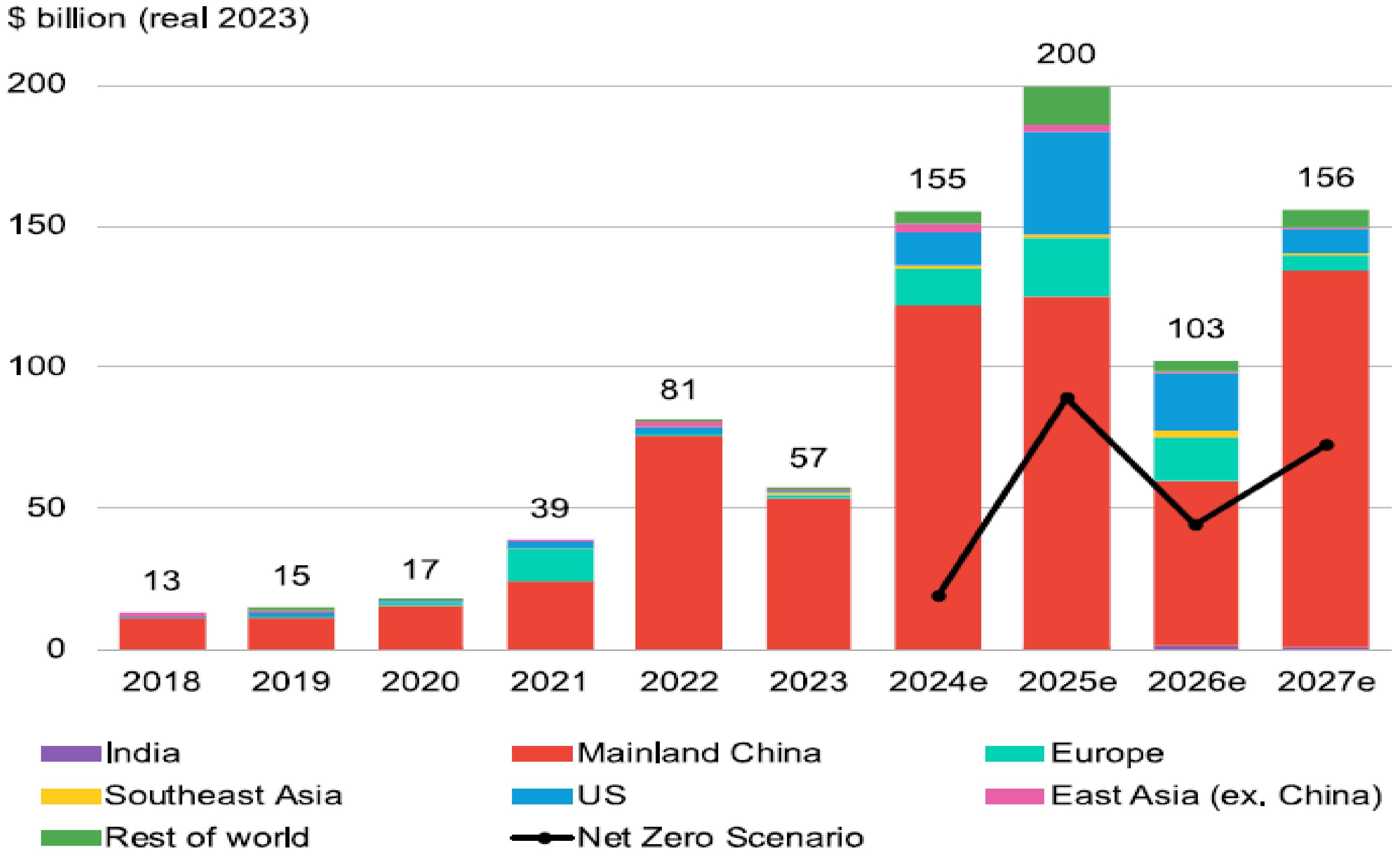
Renewables Expansion Bottleneck: US and European transmission planning, permitting and siting can take up to 10 years (pre-build)

1 - 2 yrs planning	1 year rate approval	3 - 5 yrs Fed regulatory compliance	3-5 yrs Transmission siting



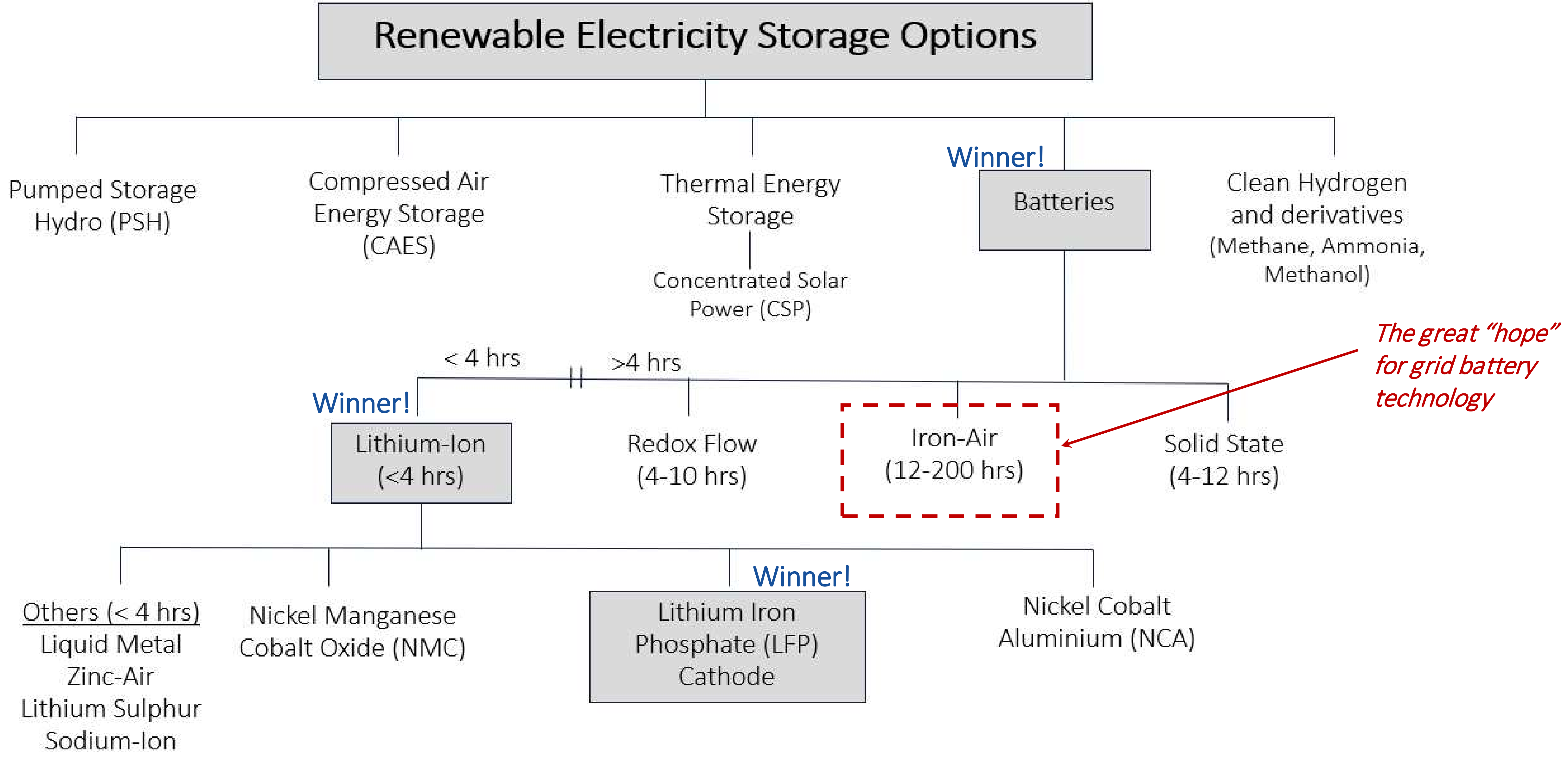
Source: Americans for a Clean Energy Grid, Macro Grids in the Mainstream: An International Survey of Plans and Progress

Global Li-ion battery plant (EV and grid) investments will average $150B pa with China making up 80%. US and Europe are trying to reduce dependency



Source: BloombergNEF. Note: Includes battery cell, anode, cathode, electrolyte and separator plants. Net Zero Scenario refers to BNEF's pathway to net-zero emissions by 2050 from New Energy Outlook 2022.

Lithium-ion dominates the battery space, but is a 4-to-6-hour solution



Source: Partners Capital Analysis

Metal or Iron-air grid electricity storage - Form Energy

Provided / Form Energy

The final beam is raised in the first phase of building out Form Energy's factory in February. The factory will begin manufacturing iron air batteries this spring.

- **The Iron-air technology.** When iron rusts, it swaps an electron for an oxygen molecule. Form is harnessing that exchange, rusting and un-rusting iron, enabling the storage and release of energy for up to 100 days.
- The company's target was to develop a battery that would last 100 hours and store energy for one tenth the cost of lithium-ion batteries. They forecast $10/Kwh by 2030.
- Form Energy was founded in 2017 by Mateo Jaramillo, former head of battery development for Tesla, MIT professor and battery scientist Yet-Ming Chiang, Ted Wiley, William Woodford and Marco Ferrara.
- Its first manufacturing plant site: 55-acres in Weirton, West Virginia will start manufacturing batteries in Spring 2024.
- Form has collected $800 million in venture capital funding to mass produce the solution it researched and developed.
- As of April 5, 2024, Form Energy's valuation is $1.9 billion, which was set in the $454.9 million Series E round in October 2022.
- Form Energy has raised $965.8 million in funding over 10 rounds, with California Energy Commission and NYSERDA being the most recent investors.
- Major shareholders include Gate's Breakthrough Energy Ventures, TPG Rise Climate, Coatue, Arcelor Mittal, NGP, Temasek, Energy Impact Partners, and others.

Long-duration Storage (across seasons) does not exist today

Long duration storage technologies are needed to address <u>seasonal</u> intermittency

Examples of Long Duration Energy Storage (LDES) Technology in Development - all are unproven except for pumped hydro

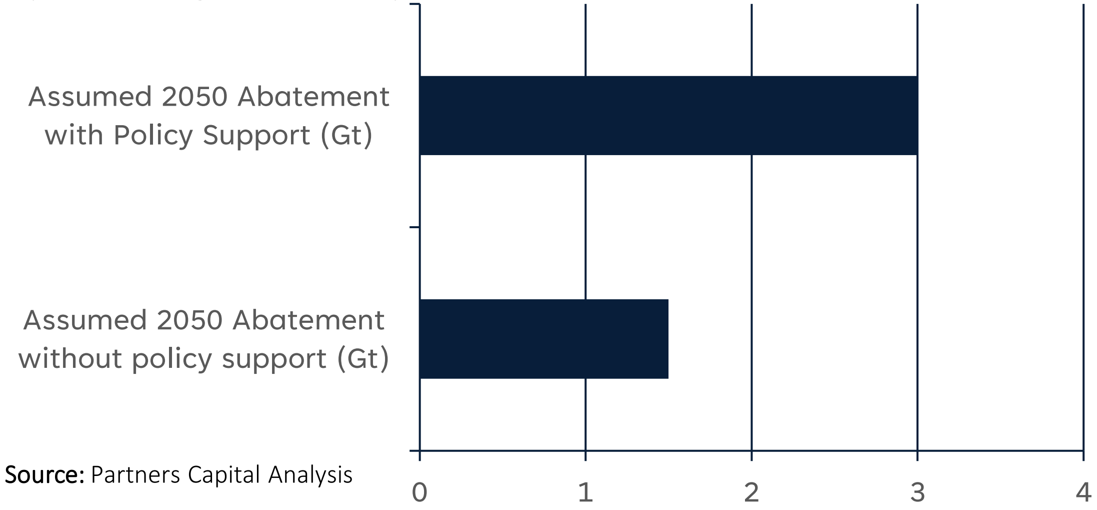
- Pumped Hydro
- Green Hydrogen
- Compressed Air Energy Storage (CAES)
- Gravity-based Energy Storage
- Liquid Air Energy Storage (LAES)
- Thermal Energy Storage
- Chemical Energy Storage

Source: BloombergNEF, MAN Energy Solutions marketing materials (Germany).

6% (3 Gt) of CO_2 reduction is expected from bioenergy and BECCs – the key constraint is land and water usage, which limits the potential

Abatement potential for biofuels/BECCs (gt CO2 equivalent)

Japan's first large-scale BECCS plant (Toshiba)



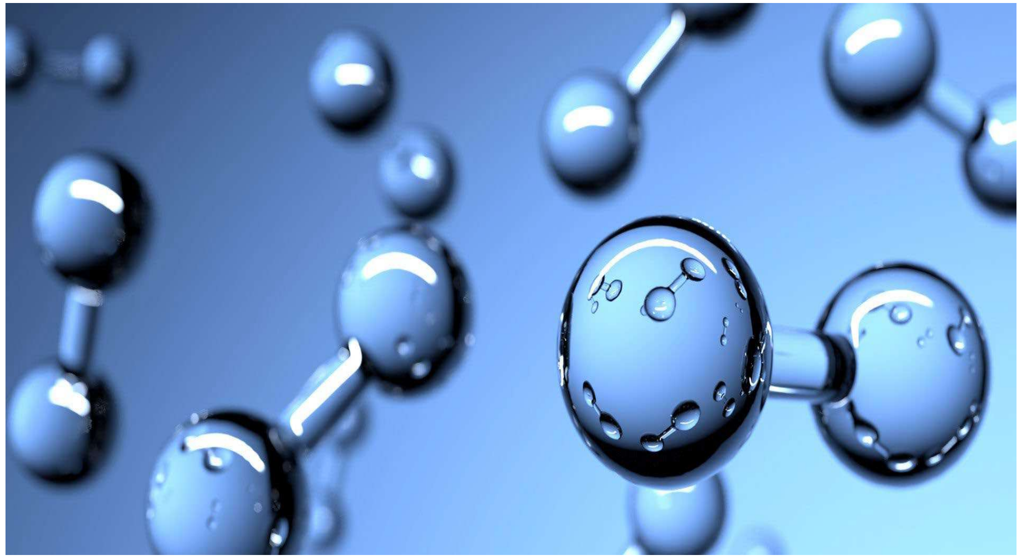
Source: Partners Capital Analysis

- Bioenergy is logically **carbon negative** in that the source (trees) absorb carbon while growing, carbon is emitted when burned and then captured via CCS.
- Includes solid biomass, biogas, renewable natural gas (RNG), biomethane, liquid biofuels and BECCs (bioenergy with carbon capture).
- BECCS involves burning biomass in a power plant where CO_2 is captured and permanently stored.
- There is only 2 Mt of biogenic CO_2 currently captured globally per year, mainly in bioethanol applications.
- Plans for around 20 facilities together capturing around 15 Mt CO_2 per year of biogenic emissions have been announced, globally, since January 2022 (vs the 1,500 Mt to 3,000 Mt expected by 2050; IEA).

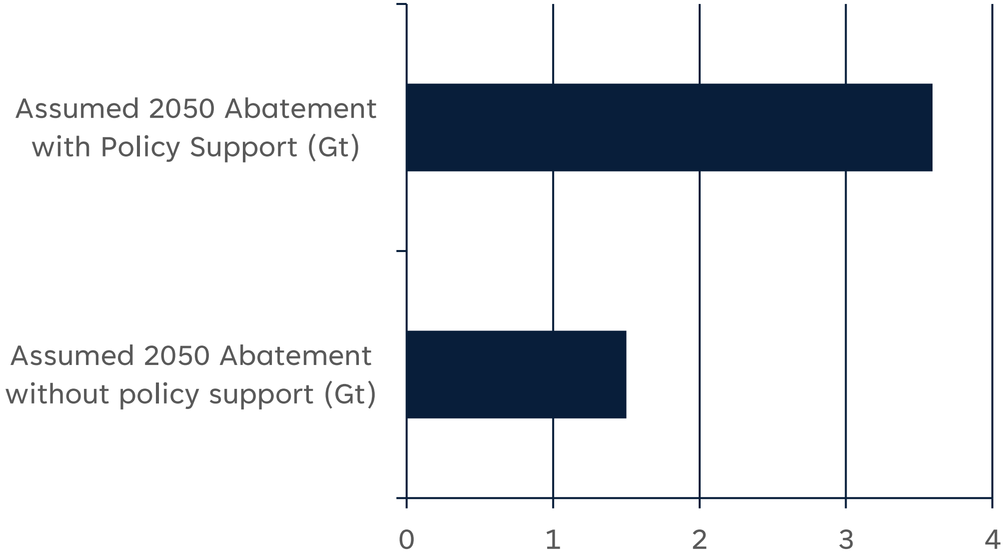
Head winds

- The penetration of bioenergy is limited by land and water constraints.
- To reach net zero targets of 10 Gt of CO_2 abatement potential, bioenergy would need upwards of 300M hectares of land, roughly the size of India.
- Our 3 Gt (6%) of abatement would require twice the amount of water used in the global agriculture industry.

7% (3.6Gt) of CO2 reduction is expected from clean hydrogen – applications for H_2 span power, transport, and industry sectors



Abatement potential for clean hydrogen (Gt CO2 equivalent)



Tail winds

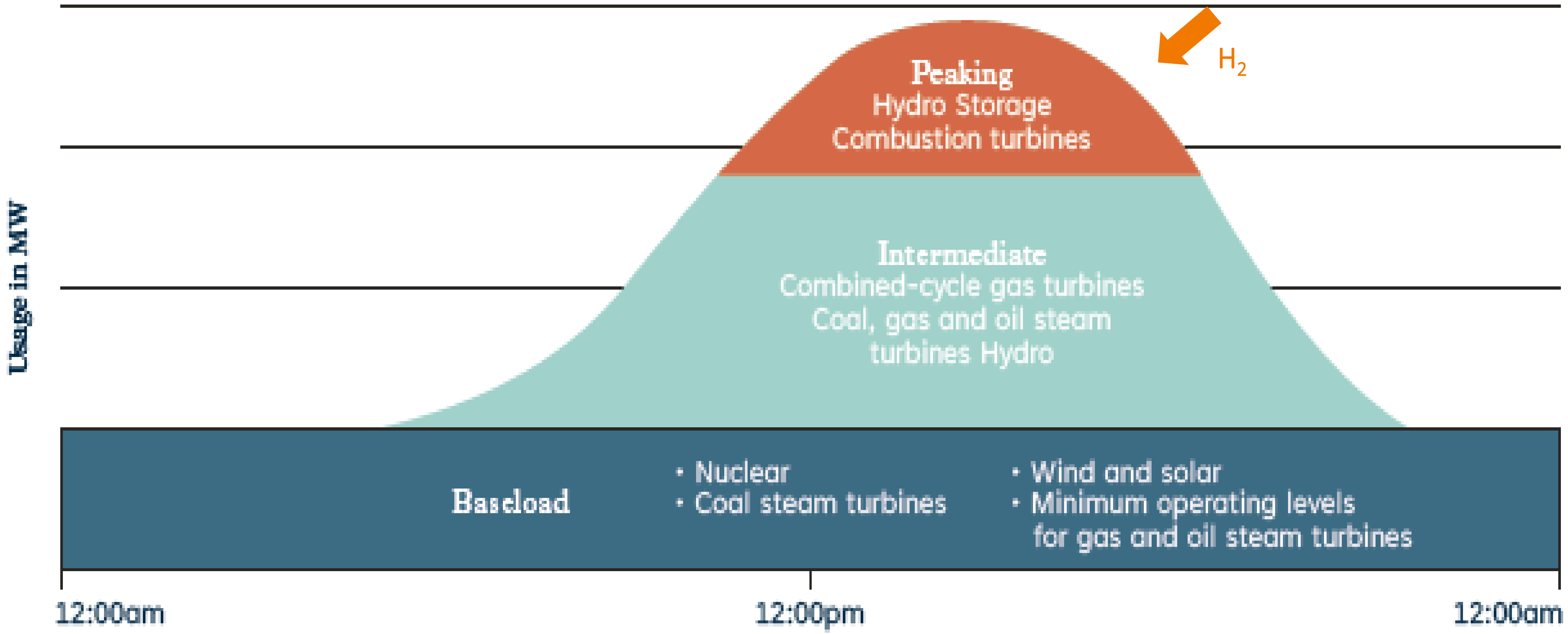
- We estimate that there will be 300 Mt of hydrogen demand by 2050, which translates into c.3.6 Gt of carbon abatement.
- 5% of electricity generation will come from H_2, replacing natural gas peakers to meet peak demand where renewables can't.
- H_2 will come to provide 30% of fuel for the long-haul trucking industry, with fuel cell electric vehicles (FCEVs) giving 500km on a single tank.
- Demand for H_2 in steel refining will increase from 5 Mt today to 25 Mt by 2050.
- Use in production of cement, ammonia, and methanol refining will also grow.

Head winds

- Cost: Green H_2 is 3x the cost of grey and Blue H_2 is 2x the cost, so requires taxes on grey H_2, subsidies or other policy incentives.

Source: Partners Capital Analysis

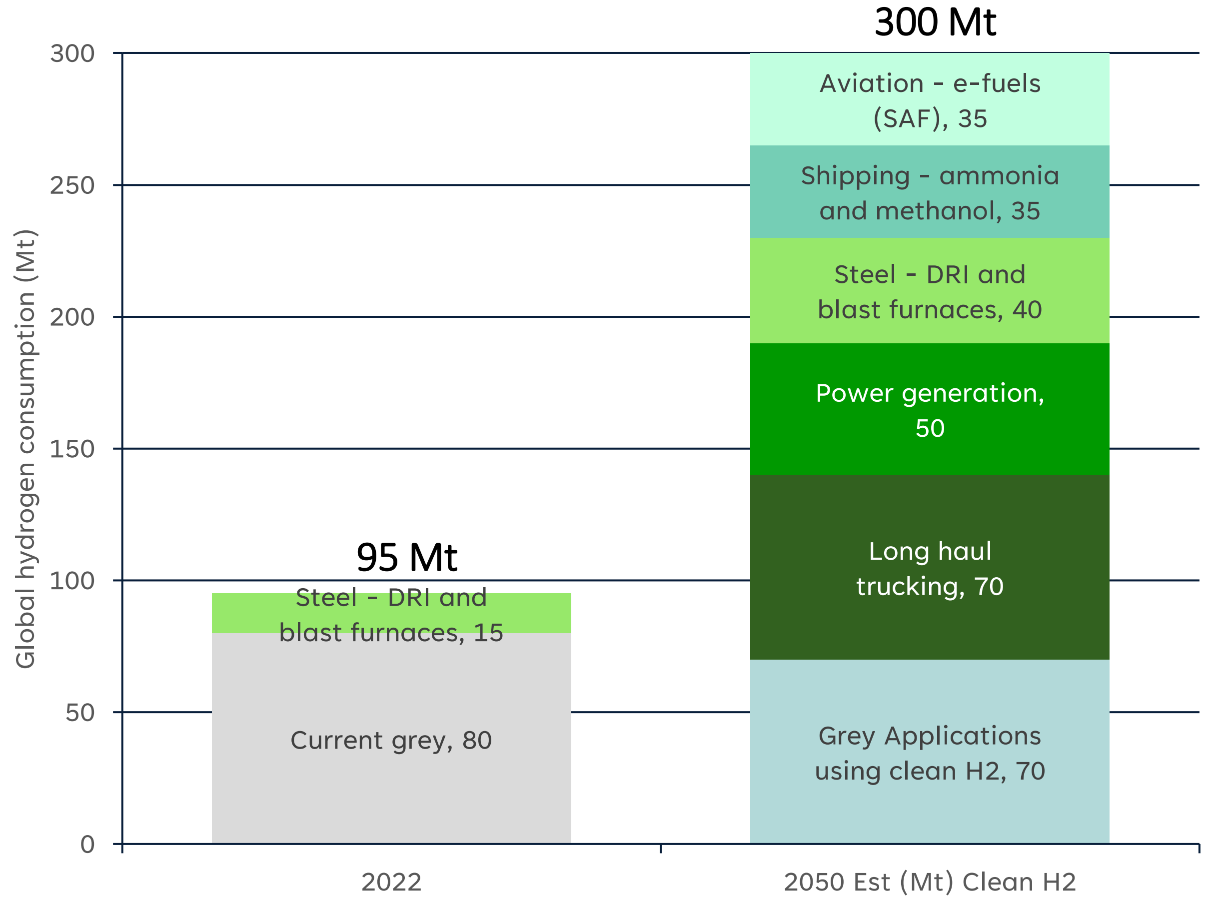
Clean hydrogen is only a solution for peak period power



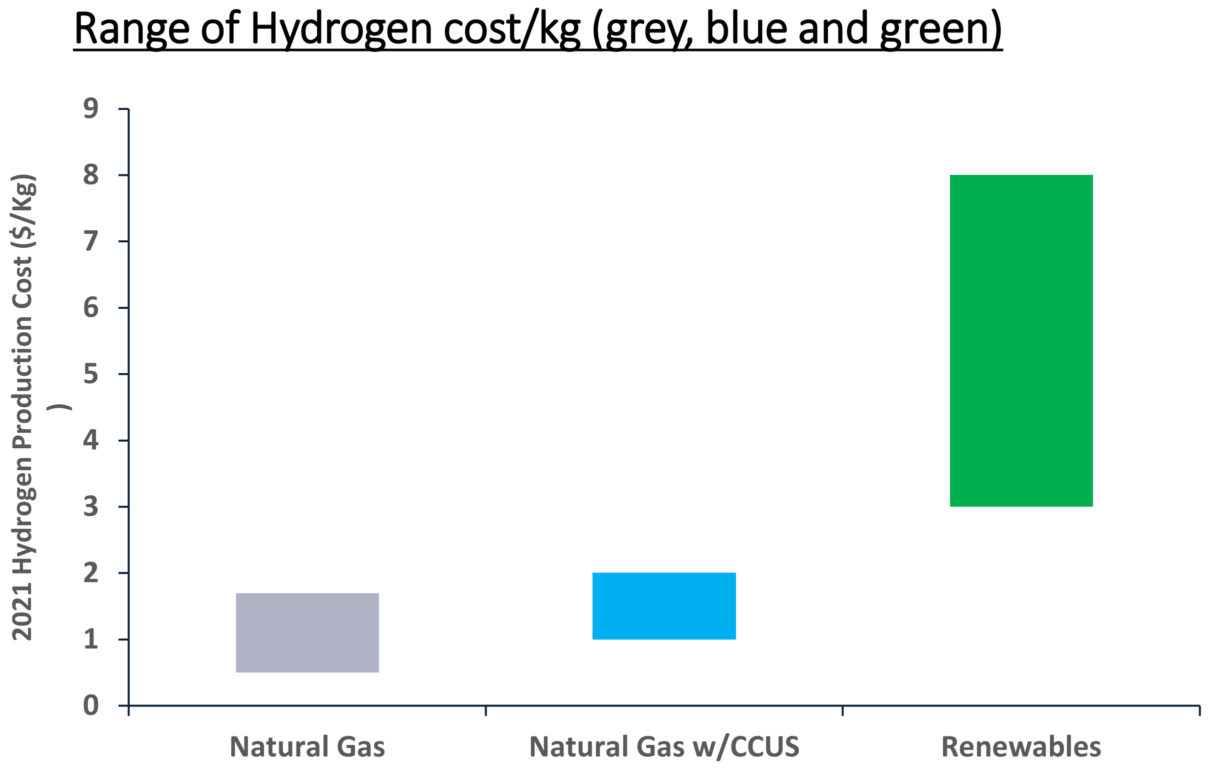
Source: Enerydynamics

Hydrogen is still in its infancy as a long-term wind and solar storage solution

Our forecast for clean hydrogen at 300 Mt in 2050 is 2x what many other experts estimate. Replacing current uses of grey hydrogen will be the priority and then shipping, aviation, long-haul trucking will grow its use. H_2 in power generation will be limited to 5% of all electricity.



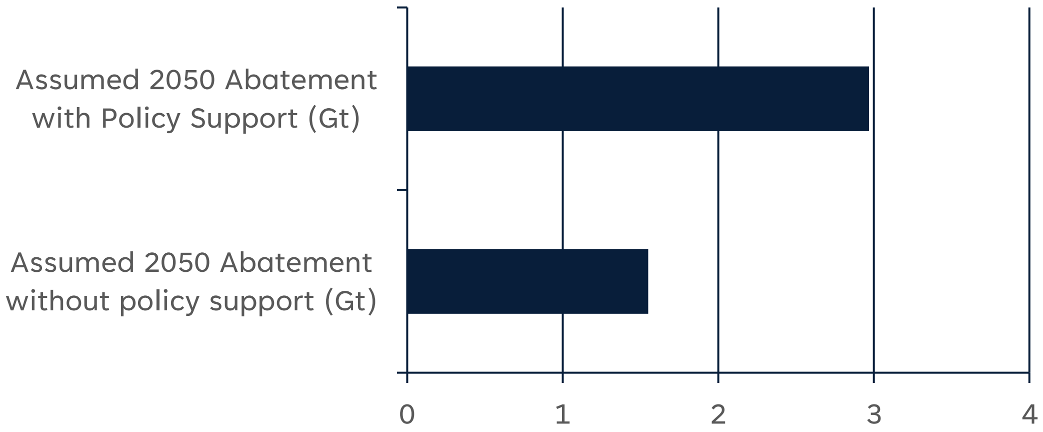
…to produce this, almost 7,000 TWh of renewable electricity will need to power 2,500 GW of hydrogen electrolyser capacity by 2050, up from just 0.3 GW today. Costs also need to come down significantly.



Source: IEA, HIS, IRENA, BNEF, EIA, NREL

6% (3 Gt*) of CO2 reduction is expected from carbon capture, utilization and storage (CCUS) – mostly from coal and gas plants

Abatement potential for carbon capture (gt CO2 equivalent)



Tail winds

- There may be no alternative for dispatchable power in peak periods. Renewables (incl. wind, solar, nuclear, hydro and geothermal) with Li-ion grid battery storage is limited to c. 77%, leaving 5% for H2 and 18% for CCUS on coal and gas plants. By 2050, this could require CCUS on 10Gt of CO2 from coal and gas plants (mostly in developing economies).
- There is 2023 US legislation proposed that would mandate CCS on all coal plants still operating in 2040 and new gas plants >300MW in capacity (under the existing EPA rule 111). Existing gas plants were dropped from the proposal in Feb 2024.

Head winds

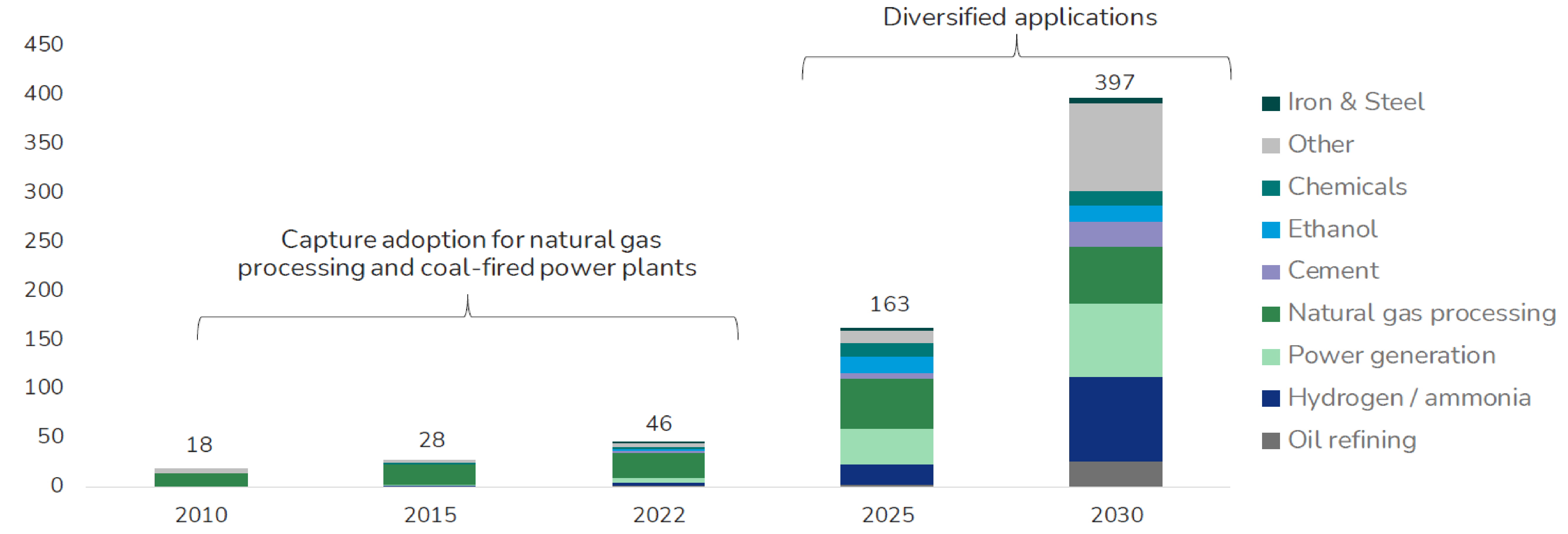
- The bulk of the operating coal and gas plants are and will be in China and other developing economies who may not have the capital or will to deploy CCUS.
- CCS adds between $45 and $120/t of CO2 to the cost of coal and gas-based electricity.
- It is more economic for high CO2 concentrations of emissions from industrial applications – e.g, $15-$35/t for natural gas processing; $50 - $120/t for cement and steel CCS.
- The technology is not fully commercially tested on power. Only two existing coal plants have CCS today and no gas plants.

Given the high cost, nascent nature of the CCUS technology and concentration of coal and gas being in the EMDEs, we expect just 3Gt of CO2 capture across all applications in rough proportion to the projections shown on the next slide.

* Source: Partners Capital Analysis. Note that 3 Gt excludes BECCs and blue hydrogen, which takes total CCS in the policy support scenario to 5.4 Gt.

Today, there is ~45 Mt pa of CCUS capacity globally with an announced project pipeline of 400 Mt to be operational by 2030 across a wide array of industrial and power applications

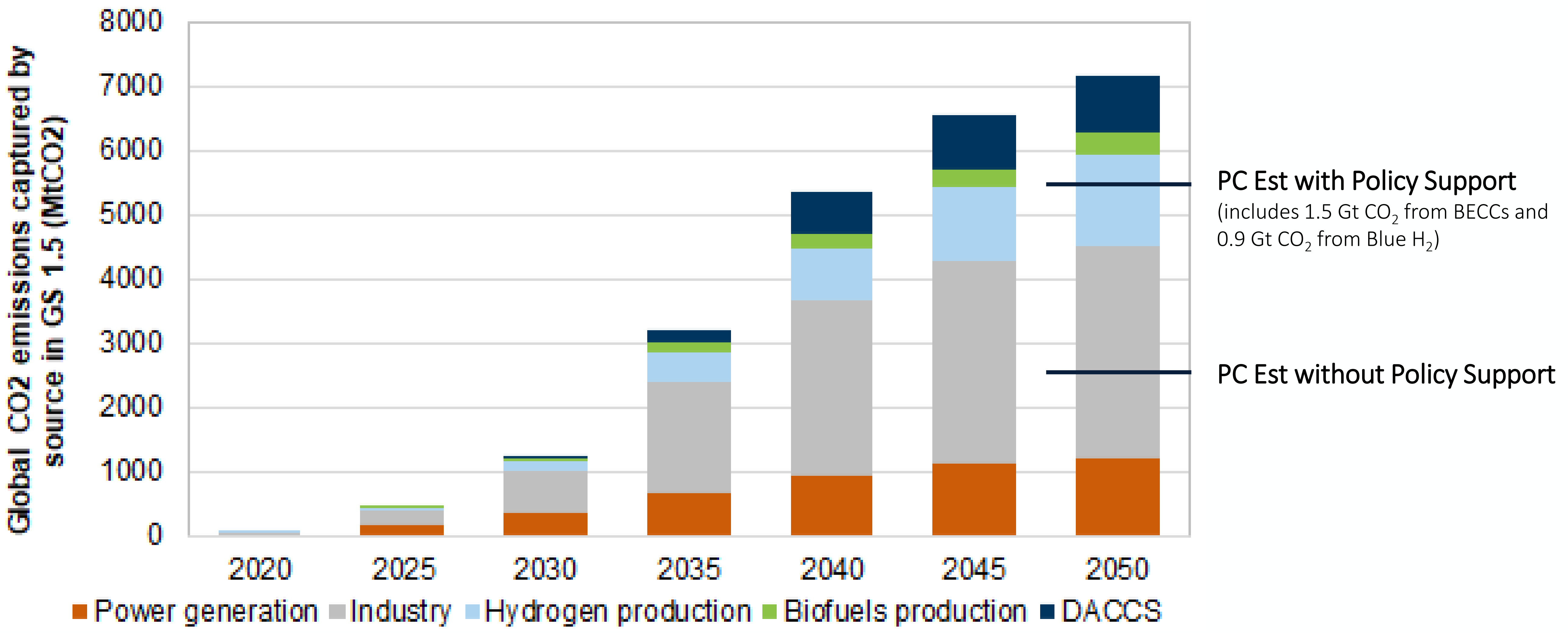
Cumulative operational and announced global point source capture capacity by year
(million metric tons)



Source: BNEF, "CCUS Market Outlook", 2023

Carbon Capture, Utilization and Storage (CCUS) is also still in its infancy

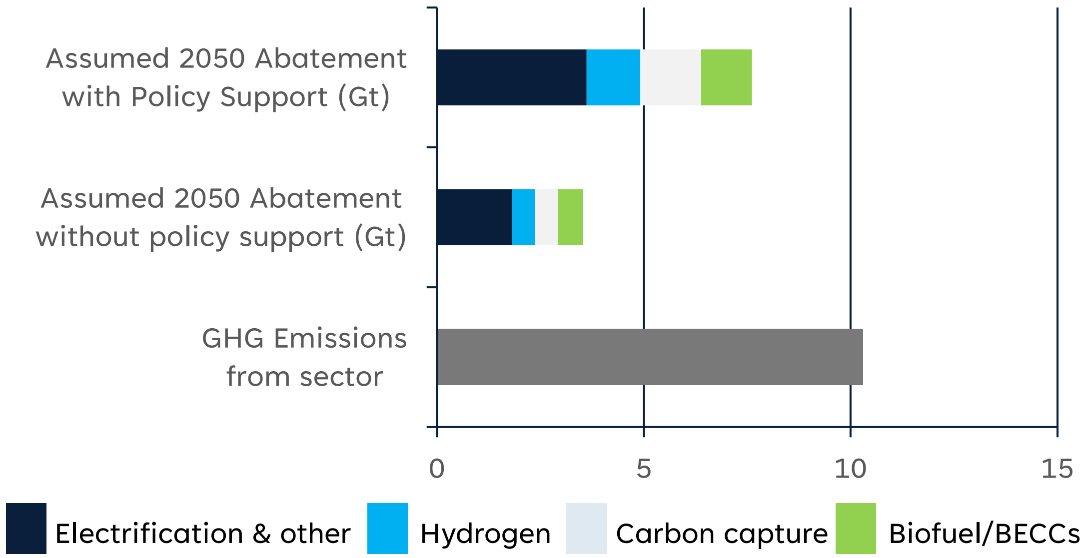
Goldman Sachs expects carbon capture and storage to grow from 0.04 Gt captured in 2020 to 7 to 8 Gt in 2050



Source: Goldman Sachs

10% (5Gt)* of CO2 reduction is expected from industry – mainly from abatement in the steel and cement industries

Abatement potential for industry (gt CO2 equivalent)



Tail winds

- Carbon capture is already happening, with up to 13% of steel manufacturing and the potential to abate 6% of cement emissions for less than $60 /tCO2.
- In steel, the increased adoption of direct reduction iron (DRI) and electric arc furnaces (EAFs) could abate up to 3.6 Gt out of 4 Gt of steel emissions.
- Substituting cement clinker with fly ash or slag can abate around 0.4 Gt CO2 from the cement industry.
- Potential for carbon capture, electrification, and efficiency to impact the petrochemical and paper & pulp industries.

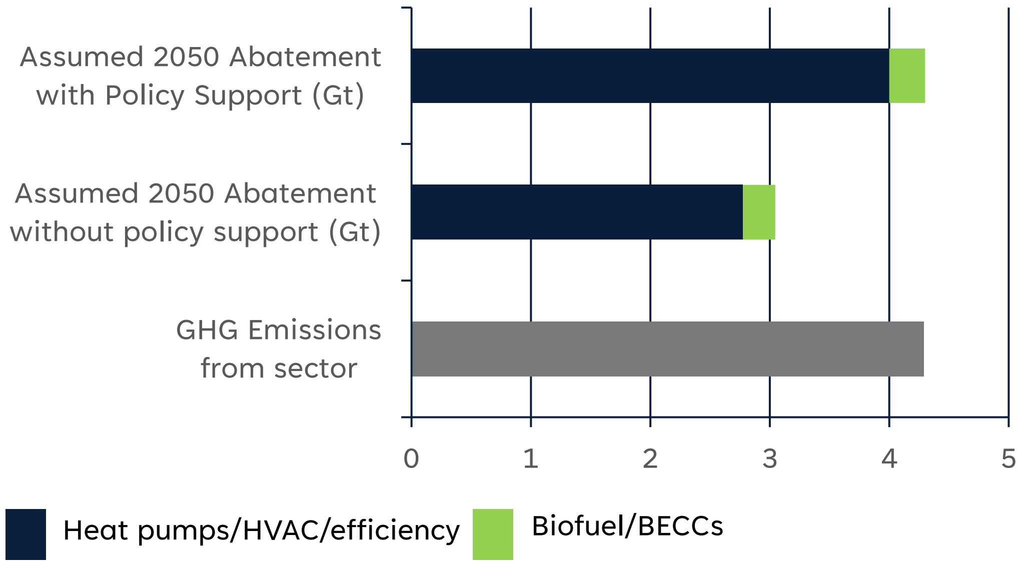
Head winds

- Whole industries are not going to volunteer to replace $trillions of existing infrastructure.

*Source: Partners Capital Analysis. Note that 5Gt is the impact of carbon capture, technology shifting, electrification and clinker substitution. In total, 8Gt (including the impact of hydrogen and biofuels) is expected to be abated by 2050. See appendix for breakdown.

8% (4 Gt)* of CO2 reduction is expected from buildings – efficiency gains and electrification of heat are the primary drivers

Abatement potential for buildings (gt CO2 equivalent)



Tail winds

- Retrofitting old buildings with new insulation and more efficient lighting has the potential to abate 1.2 Gt CO_2 alone.
- Electric heat pumps and HVAC to replace gas and oil-fired burners can abate up to 2.0 Gt CO2 and saves consumers money in new build.
- >10% of space heating globally is satisfied by heat pumps today.
- As of March 2024, 177M heat pumps have been installed worldwide vs 34M in 2018. China has the most installations at 33%, followed by North America at 23%, and Europe at 12%.
- The IEA projects that the number of heat pumps installed in buildings will increase to 600M by 2030.
- Regulations for energy efficiency and electrification are already common and spreading

Head winds

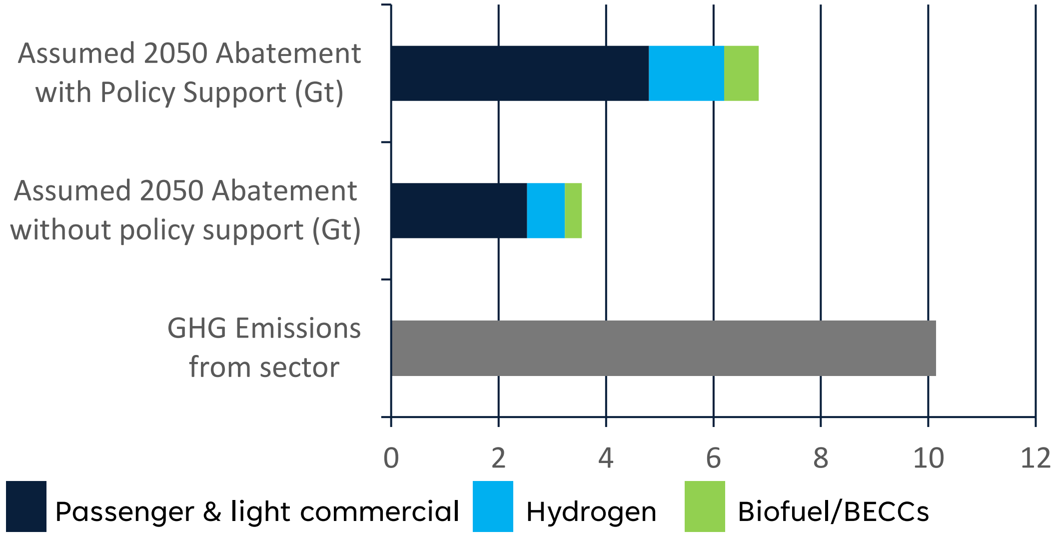
- Costs of building electric heat pump **retrofitting** vs gas boilers are 3x to 6x more expensive. Subsidies will be required to fund retrofits.

*4Gt is the impact of efficiency and electrification on the building sector. In total, 4.3Gt (including the impact of biofuels) is expected to be abated by 2050

Source: Partners Capital Analysis

10% (4.8 Gt)* of CO2 reduction is expected from transportation – the penetration of electric passenger & light commercial will continue to accelerate

Abatement potential for transportation (gt CO2 equivalent)



Tail winds

- BNEF estimates that 45% of the passenger and light commercial fleet will be EVs by 2040 and 95% by 2050.
- Battery technology continues to improve, extending range and improving charging times.
- EV battery prices continue to drop significantly -- 80% over last 10 years to $139/Kwh today.

Head winds

- Stock of EVs need to rise from 16M in 2021 to over 380M by 2030 and 1,800M by 2050.
- Public chargers' buildout may be a bottleneck: need to expand 6x to reach 15M units by 2030 from 1.8M today.
- Aviation is a challenging sector to abate – the weight/power ratio for aircraft make batteries and electrification unlikely. Biofuels and H2 based "e-fuels" will dominate SAF but are expected to cost $7.5-10 / gallon compared to $3 for kerosene-based fuels.
- Shipping will switch from mostly diesel-based bunker fuels to ammonia today, and methanol over the long-term, at 1.6x cost increase.

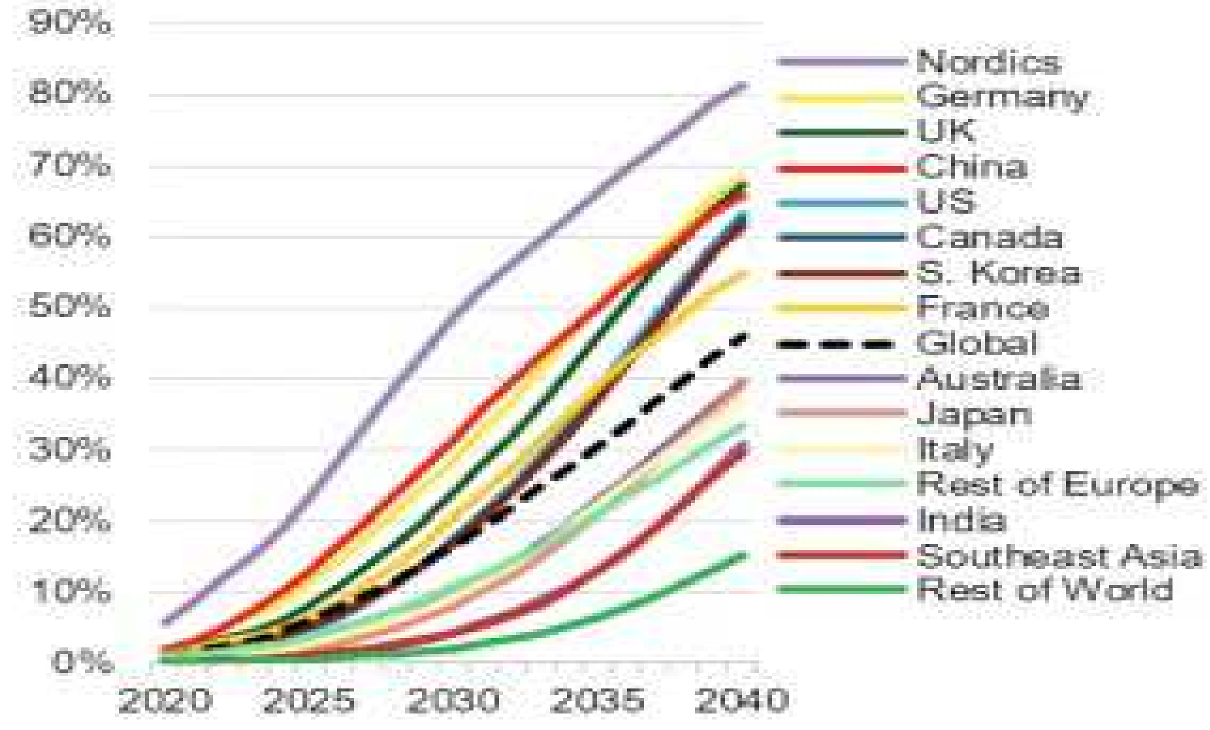
*4.8Gt is the impact of penetration of EV in passenger and light commercial. In total, 7Gt (including the impact of hydrogen and biofuels on the trucking, aviation, and shipping sectors) is expected to by 2050

Source: Partners Capital Analysis

The facts about Electric Vehicles (EVs) growth potential

Electric vehicle (EV) sales are expected to grow 21% in 2024, reaching 16.7 million passenger EVs and 1 million commercial Evs sold in that year. About 20% of new car sales in 2024 will be electric, and the number of EVs on the road should reach 57 million by the end of 2024 (4% of global fleet).

Global EV Share of Passenger Fleet

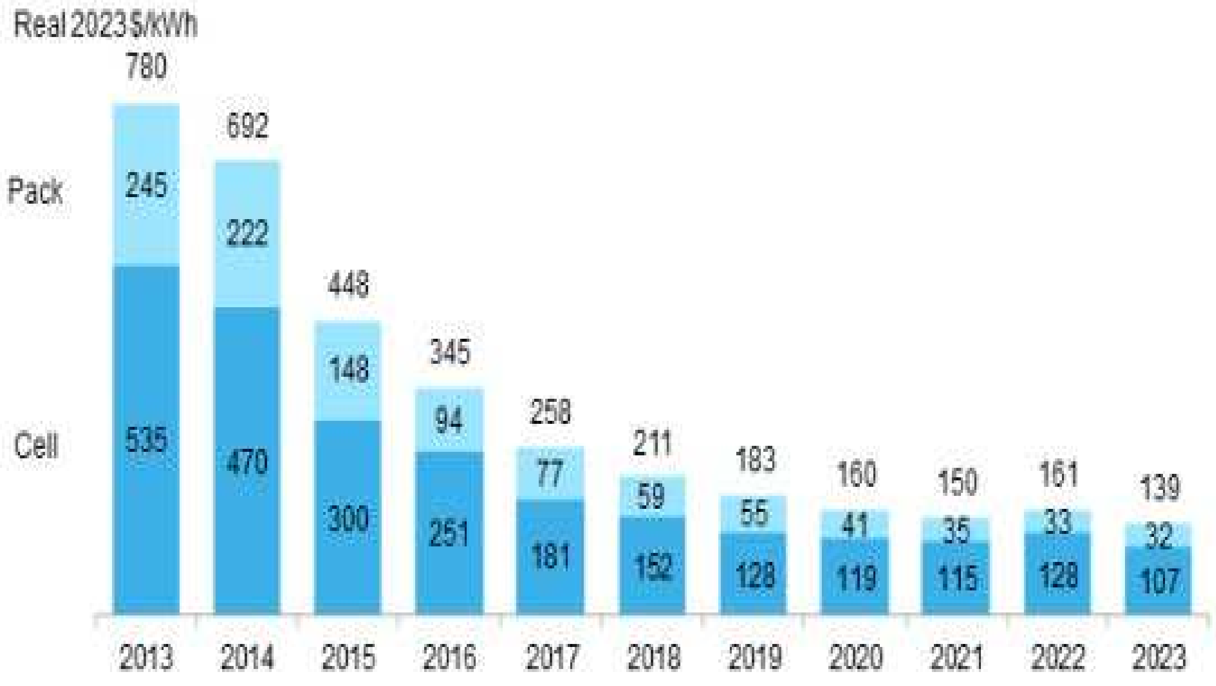


Source: BloombergNEF using Economic Transition Scenario in the 2021 Electric Vehicle Outlook (EVO).

Battery prices have fallen over 80% over the last 10 years.

On a regional basis, average battery pack prices were lowest in China, at $126/kWh. Packs in the US and Europe were 11% and 20% higher, respectively.

Average lithium-ion battery price 2013 - 2023



Source: BloombergNEF. Historical prices have been updated to reflect real 2023 dollars. Weighted average survey value includes 303 data points from passenger cars, buses, commercial vehicles and stationary storage.

Public chargers' buildout may be a bottleneck: need to expand 6x to reach 15M units by 2030 from 2.7M today; 60M by 2050

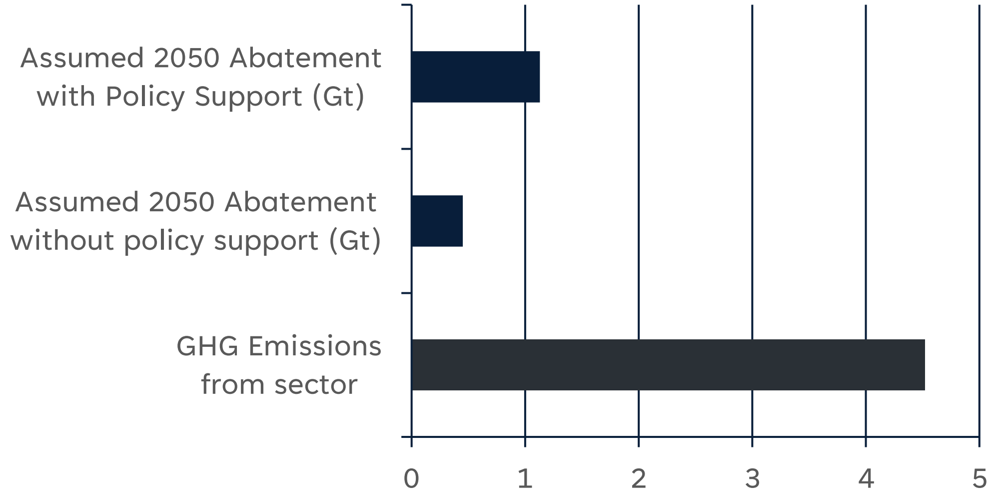
[1 Hour of Charge ~ 250 km of Driving Range]

- At the end of 2022, there were 2.7M DC fast-charging points (level 3 chargers) worldwide, more than 900,000 of which were installed in 2022.
- Public charging points needs to expand 6x to reach 15M by 2030 (30% CAGR) and 60M units by 2050.
- This ignores the vast number of residential charging stations required (level 1 and 2 chargers).
- ChargePoint has over 66,000 public and semi-public charging facilities in Europe and over 30,000 in the US (market cap $800M Apr 2024).

Source: IEA

2% of CO_2 reduction is expected from agriculture – primarily from changes to feedstock in the cattle & pork industry

Abatement potential for agriculture (gt CO_2 equivalent)



Primary pollutants are methane from cattle and pork; and nitrous oxide from fertilizer.

Tail winds

- Ag efficiency improvements and reducing tillage are the primary drivers of emission containment or reduction.
- The 2019 Global Agricultural Productivity Report states that agricultural productivity growth, which is the increase in output of crops and livestock with fewer or existing inputs, is growing globally at an average annual rate of 1.63%.
- In Europe point to falls in meat eating, with the amount expected to fall by 70% by 2030.

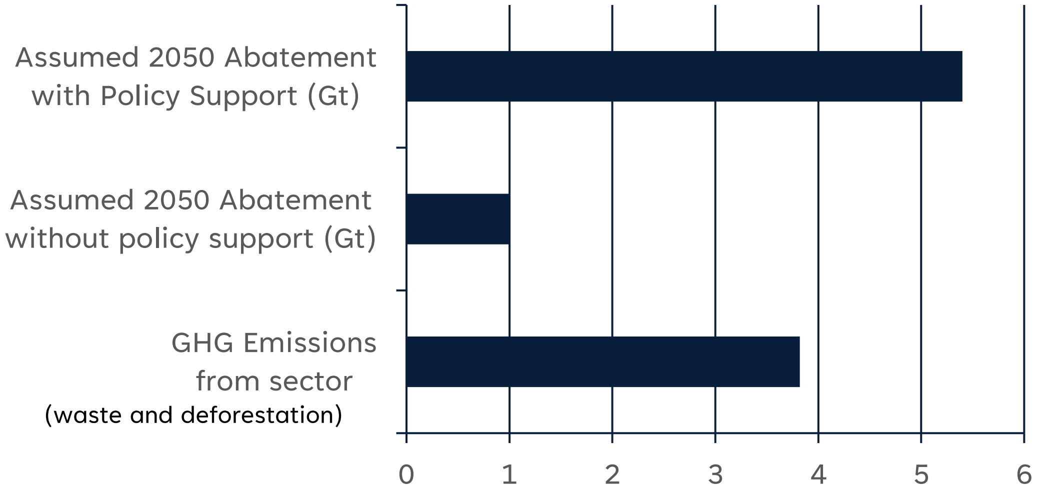
Head winds

- This is the most difficult to abate sector without end-user behavior change. Roughly 1/3 of methane comes from cattle, of which only 20% can be reduced through feed solutions.

Source: Partners Capital Analysis

11% of CO_2 reduction is expected from carbon offsets – will become an important part of the emissions puzzle

Abatement potential for carbon offsets (gt CO_2 equivalent)



- Carbon offsets are credits created by organized efforts to limit deforestation, reforest or reduce emissions in any way that would not otherwise happen if it were not for the credits being earned.
- Offsets are typically purchased by corporations seeking to offset their own emissions which may be too costly or too far in the future.
- These should ideally be permanent and "additional" – i.e., for real emissions reduction that would otherwise not have happened if it weren't for this corporation's purchase.
- Offsets are potentially a way to reduce global net emissions form purchasers from hard to abate sectors (e.g., airlines)

Tail winds

- The Carbon offset market is developing, with forecasts ranging from 1 Gt to 5 Gt of carbon abatement by 2050

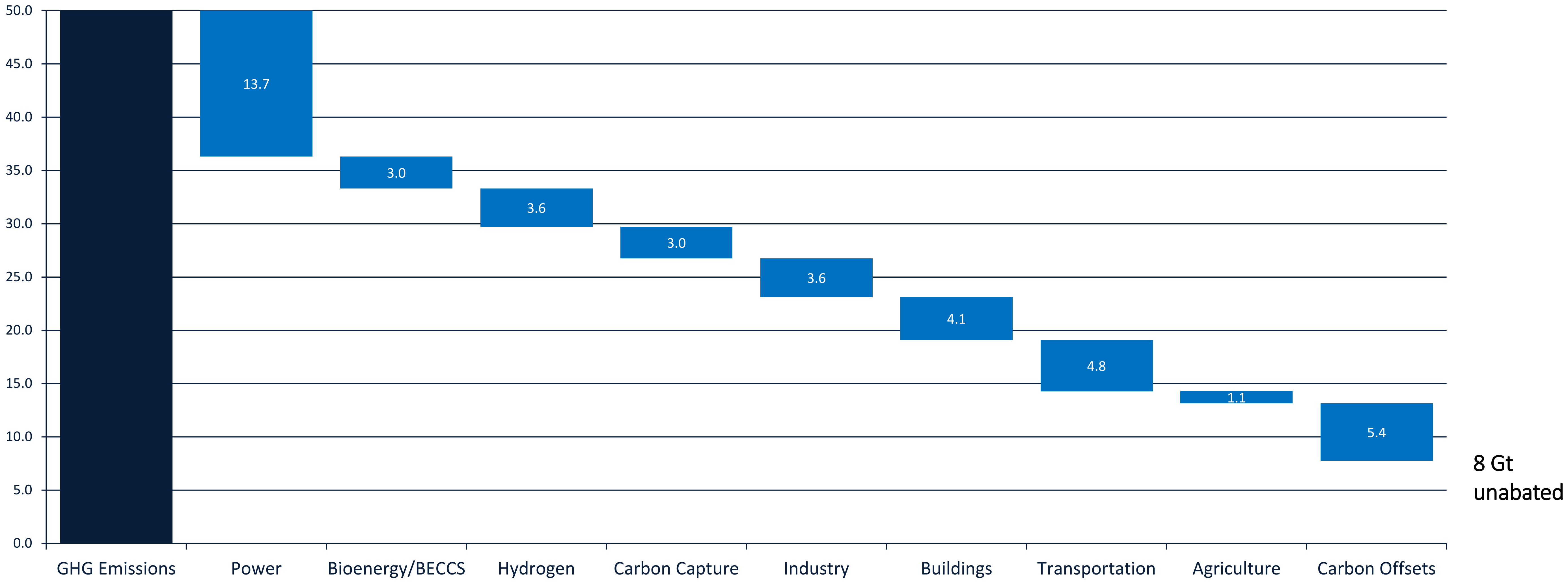
Head winds

- The offset industry is insufficiently regulated and do not have the confidence of buyers.
- Permanence and additionality is difficult to prove

Source: Partners Capital Analysis

The global decarbonization Waterfall – 84% achievable with Policy Support

Metric tonnes of carbon abatement by 2050 with government policy support

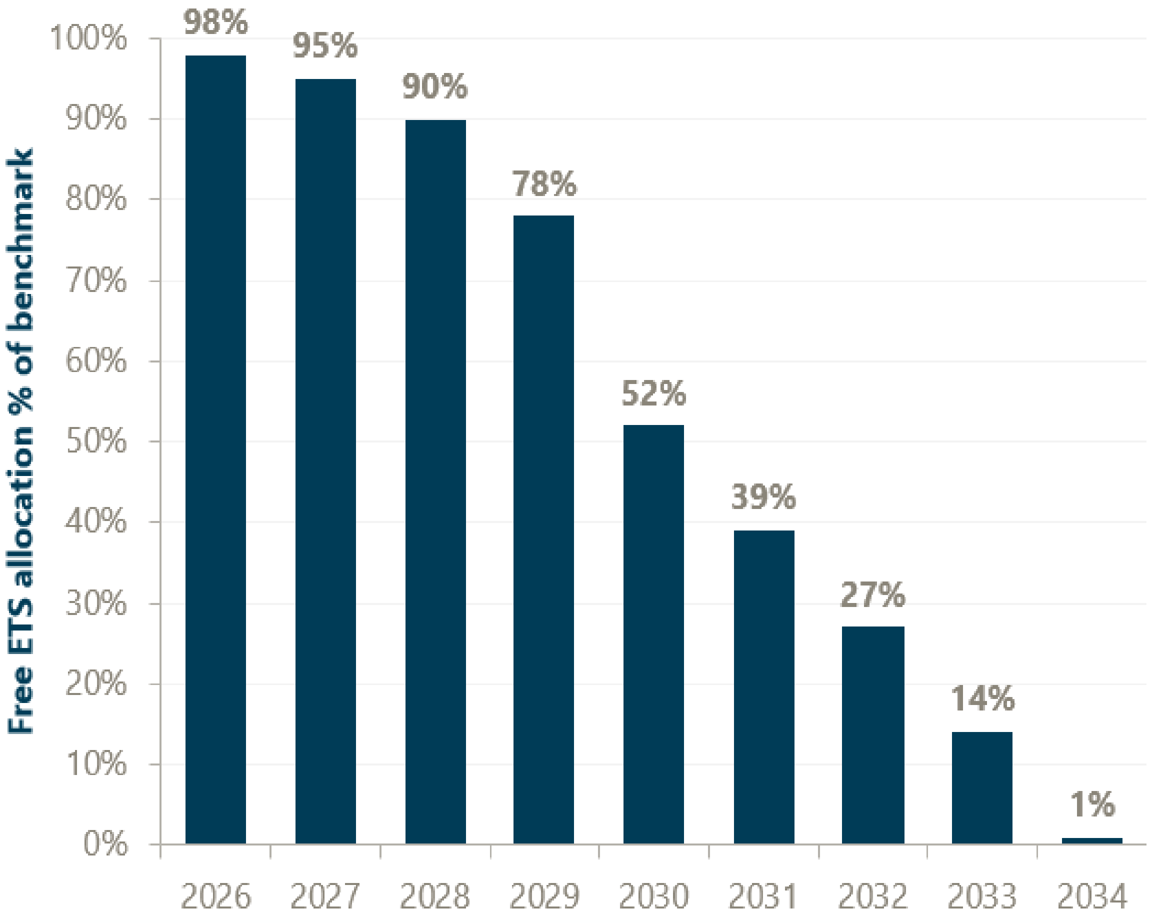


Source: Partners Capital Analysis

The EU has committed to carbon taxation and a border adjustment tax

Applied to most high emitting sectors by 2030

FREE ALLOCATION TO EU STEEL WILL BE PHASED OUT BY 2034



EU ETS CARBON TAXES HAVE INCREASED IN RECENT YEARS TO €60 - €100 PER TONNE

Source: Goldman Sachs

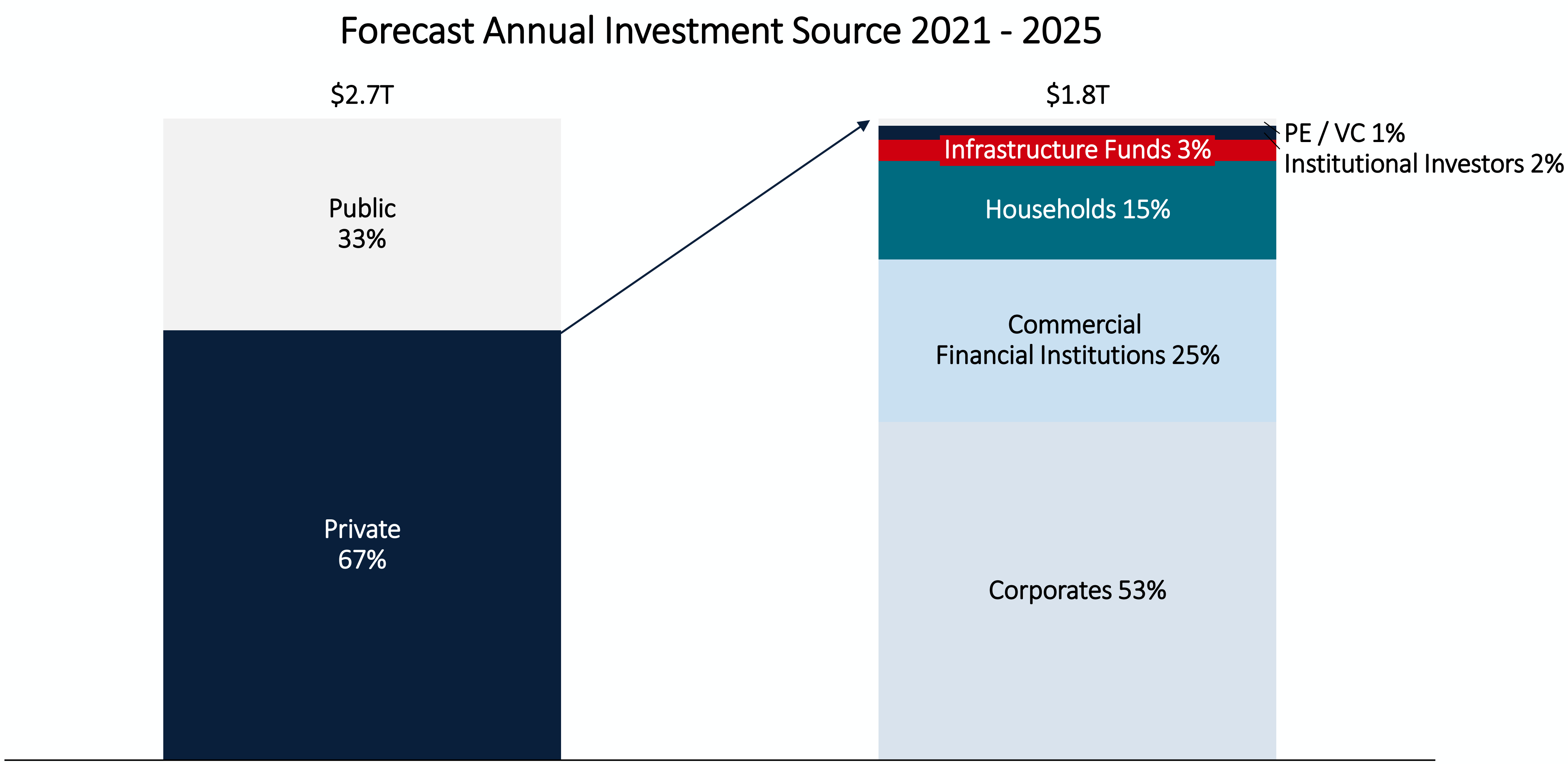
We are seeing some movement by the US Congress toward domestic carbon taxes

Bill	Sponsors/Cosponsors	Introduced	Details
PROVE IT Act	Senators Chris Coons (D-DE), Kevin Cramer (R-ND), Angus King (I-ME), Lisa Murkowski (R-AK), Martin Heinrich (D-NM), Lindsey Graham (R-SC), Sheldon Whitehouse (D-RI), Bill Cassidy (R-LA), John Hickenlooper (D-CO), John Boozman (R-AR), Richard Durbin (D-IL)	June 7th, 2023	Marked up and out of committee with bipartisan support. Would require a study of the greenhouse gas (GHG) emissions intensity of certain industrial products produced in or imported into the U.S. An initial report would be required within two years of passage, with updates at least every five years.
Foreign Pollution Fee Act	Senators Bill Cassidy (R-LA), Lindsey Graham (R-SC)	November 2nd, 2023	Would apply a fee on some imported goods whose emissions intensity exceeds that of the same goods produced in the U.S.
Clean Competition Act	Senators Sheldon Whitehouse (D-RI), Brian Schatz (D-HI) and Martin Heinrich (D-NM) and Representatives Suzan DelBene (D-WA), Don Beyer (D-VA), Kathy Castor (D-FL) and Ami Bera (D-CA)	December 6th, 2023	Would apply a carbon intensity charge on some domestically produced and imported goods whose emissions intensity exceeds a certain benchmark.
MARKET CHOICE Act	Representatives Brian Fitzpatrick (R-PA), Salud Carbajal (D-CA)	December 7th, 2023	Would apply a tax on emissions from fossil fuel combustion, high emitting industrial facilities and products in certain sectors. Imports of fossil fuels and other covered products would be subject to a border tax adjustment.

Source: Partners Capital

Part III: Investment Opportunities

Majority of annual investment between 2021-25 is expected to come from the private sector, primarily corporates and financial institutions



Source: Vivid Economics based on IEA and additional modelling

Past performance is not indicative of future returns, your capital is at risk and you may not get back the full amount invested

The Energy Transition Investor's Dilemma

Exclude high emitting companies

Invest in high emitting companies

Past performance is not indicative of future returns, your capital is at risk and you may not get back the full amount invested

The Energy Transition Investor's Dilemma

Exclude high emitting companies

Alpha driven reasons:

- Avoid companies with the most uncertainty around cost of decarbonization
- Engagement is ineffective
- Emitters will rarely vote to reduce their short-term profits for long-term decarbonization related gains

Bad reasons:

- Morally opposed to owning
- Powerful signal to management
- Raises the cost of capital

Invest in high emitting companies

The Energy Transition Investor's Dilemma

<u>Exclude</u> high emitting companies

<u>Invest</u> in high emitting companies

Alpha driven reasons:

- Have access to strong active asset managers who are deep experts on the ET and will exploit misunderstandings; and avoid the bubbles
- Within heavy emitting sectors there are companies in stronger starting positions and balance sheets to affect the most profitable transition

Bad reasons:

- They will have the greatest carbon abatement (not all decarbonization is profitable in the long-term)

Kelly Shue (Yale SOM) study proves exclusion is driving higher emissions

Yale research shows increase in the cost of capital drives companies to invest in higher emitting parts of their business

Prof. Kelly Shue
Yale School of Mgmt

Prof. Samuel Hartzmark
Boston College

- Shue and Hartzmark reached this conclusion by studying emissions data from over three thousand large companies from 2002 to 2020. They divided firms into five different segments based on greenhouse gas emissions. Then, using historical data, they analysed how the highest- and lowest-emitting groups responded to changes in their cost of capital—like those the sustainable investing movement seeks to bring about.
- Yale business school prof Kelly Shue concludes that fossil fuel exclusion is driving higher amounts of short-term investment into fossil fuels. Brown firms, significantly increase emissions following an increase to their cost of capital.
- Rather than incentivizing improvements, starving brown firms of cheap money leads them to double down on existing methods of production, because continuing with old high-pollution production is how brown firms earn cash quickly to avoid bankruptcy. Punishing brown firms with expensive financing pushes them away from investments in new green technology that could reduce emissions.
- Additional evidence that the tide is moving away from exclusion and net zero targets for institutional investors -- here is a quote from PEI magazine:

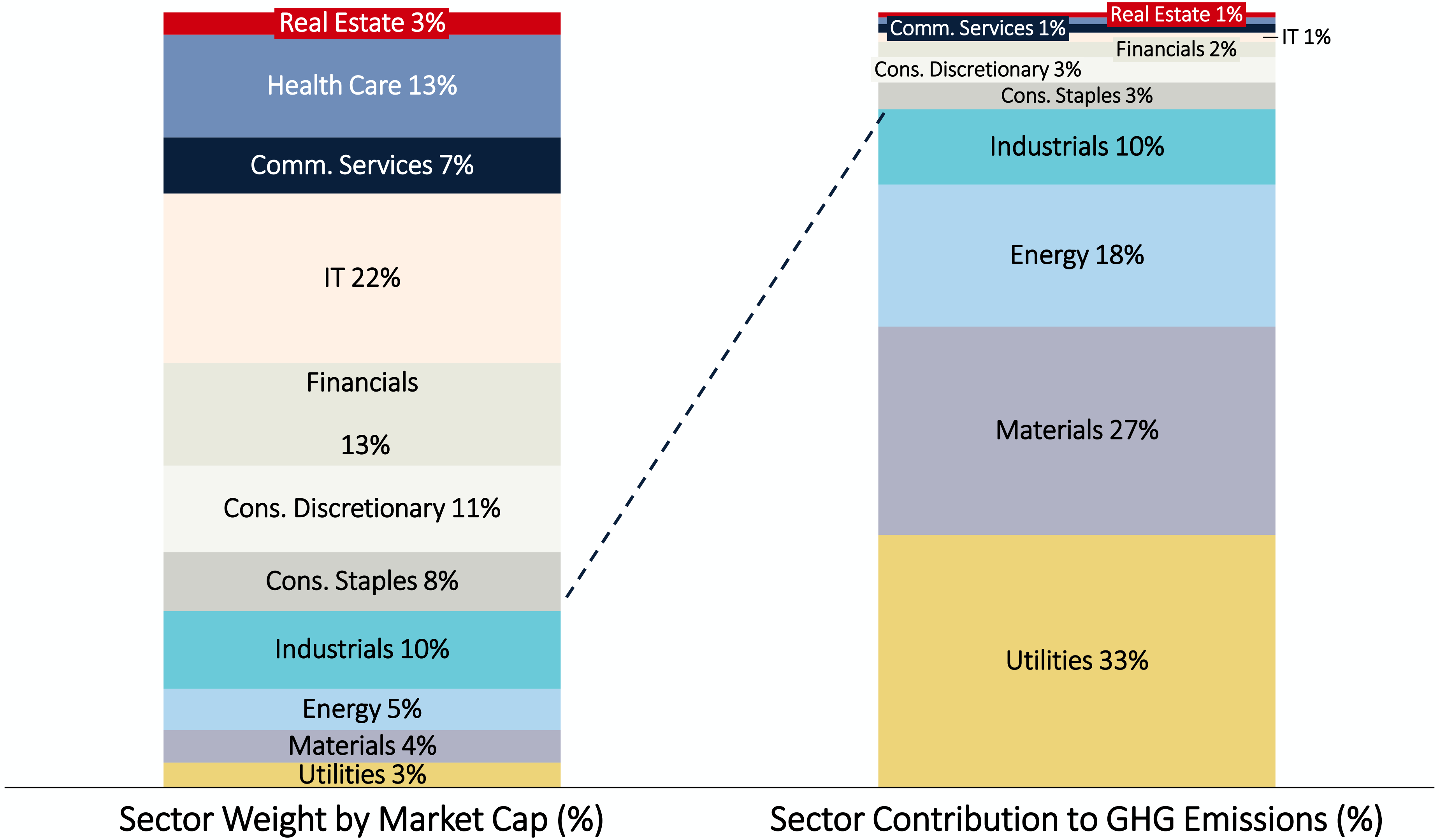
  "What seems clear is that net zero targets may be too blunt an instrument to incentivise the right sort of behaviour and, in some cases, push investors to make decisions that are detrimental to the global goal of decarbonization"

Source: Counterproductive Sustainable Investing: the Impact Elasticity of Brown and Green Firms (March 2023); Kelly Shue and Samuel Hartzmark

Our 6 Core Energy Transition Investment Strategies

1. **Brown-to-Green business conversions via deep experts (private and public equity)**
2. **The "first 10%" of Energy Infrastructure Development (pre-construction)**
3. **Picks and Shovels (e.g., Software and Services) needed for the infrastructure build out**
4. **Energy Efficiency and Optimisation**
5. **Private Equity – Corporate joint ventures**
6. **Specialist Climate Tech Venture Capital Firms**

Brown-to-green public equities thesis: 85% of public company emissions (scope 1 & 2) are derived from four sectors which account for 22% of the market

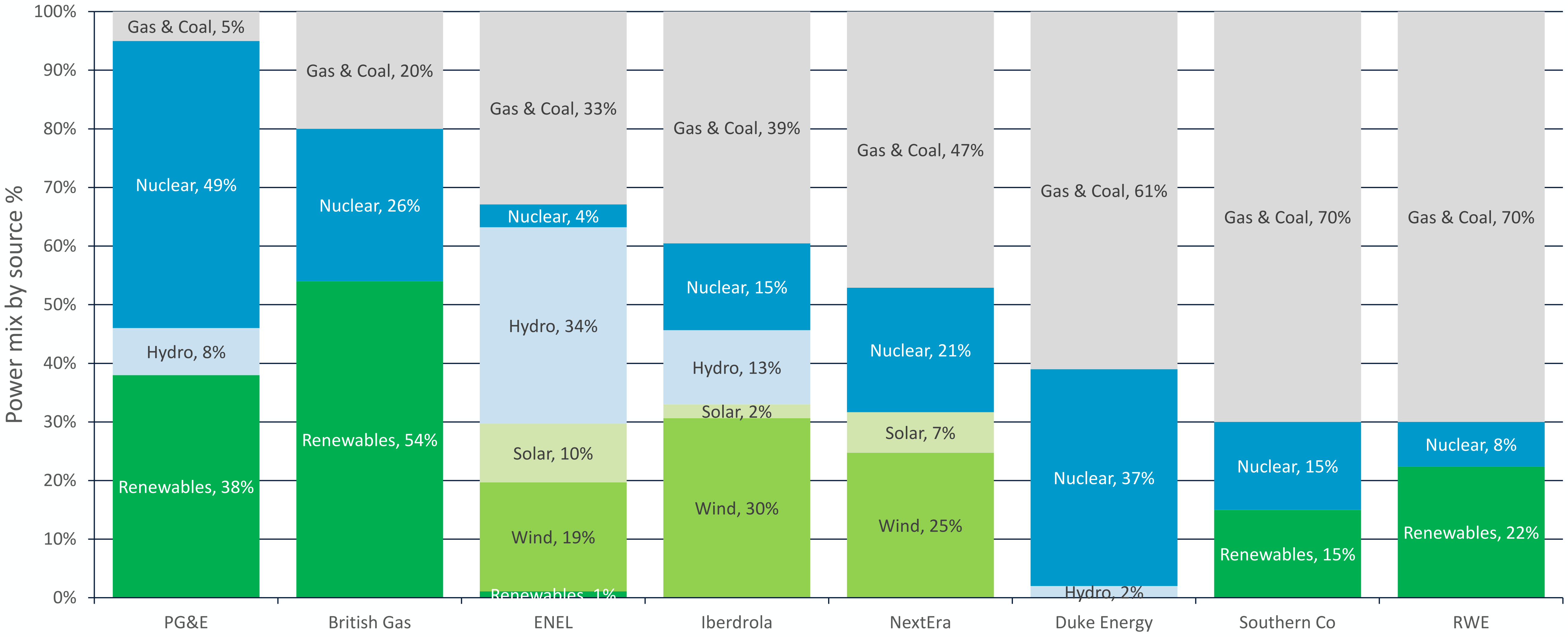


Notes: Carbon emissions shown here based on each company's most recently reported or estimated Scope 1 + Scope 2 greenhouse gas emissions measured in tons of CO_2 equivalent. Scope 1 emissions are those from sources owned or controlled by the company, typically direct combustion of fuel as in a furnace or vehicle. Scope 2 emissions are those caused by the generation of electricity purchased by the company. Carbon emissions data provided by MSCI, a third-party ESG data provider. Certain information ©2024 MSCI ESG Research LLC reproduced by permission. MSCI World holdings as of 30 September 2022.

Brown to Green (Decarbonization Leaders) – some of the "superheros"

Sector	Company Examples
Electric Utilities	RWE, Iberdrola, EDP, ENEL, NextEra
Industrial Gases	Linde, Air Liquide
Steel	SSAB, ArcelorMittal
Cement	Holcim
Aviation	Airbus, Ryan Air
Engineering	Siemens, Schneider Electric
Automotive	Toyota, Stellantis
Heating, Ventilation and Air Con	Carrier
Construction Equipment	Caterpillar, Deere
Metals and Mining	MP Materials, Alcoa

Large electric utilities are at very different places in their own transitions and with different balance sheets



Note: Renewables is wind + solar + hydro + geothermal + biomass, shown if company does not break out renewable sources
Source: NextEra, PG&E, Duke Energy, Southern Co, RWE, ENEL, Iberdrola, British Gas

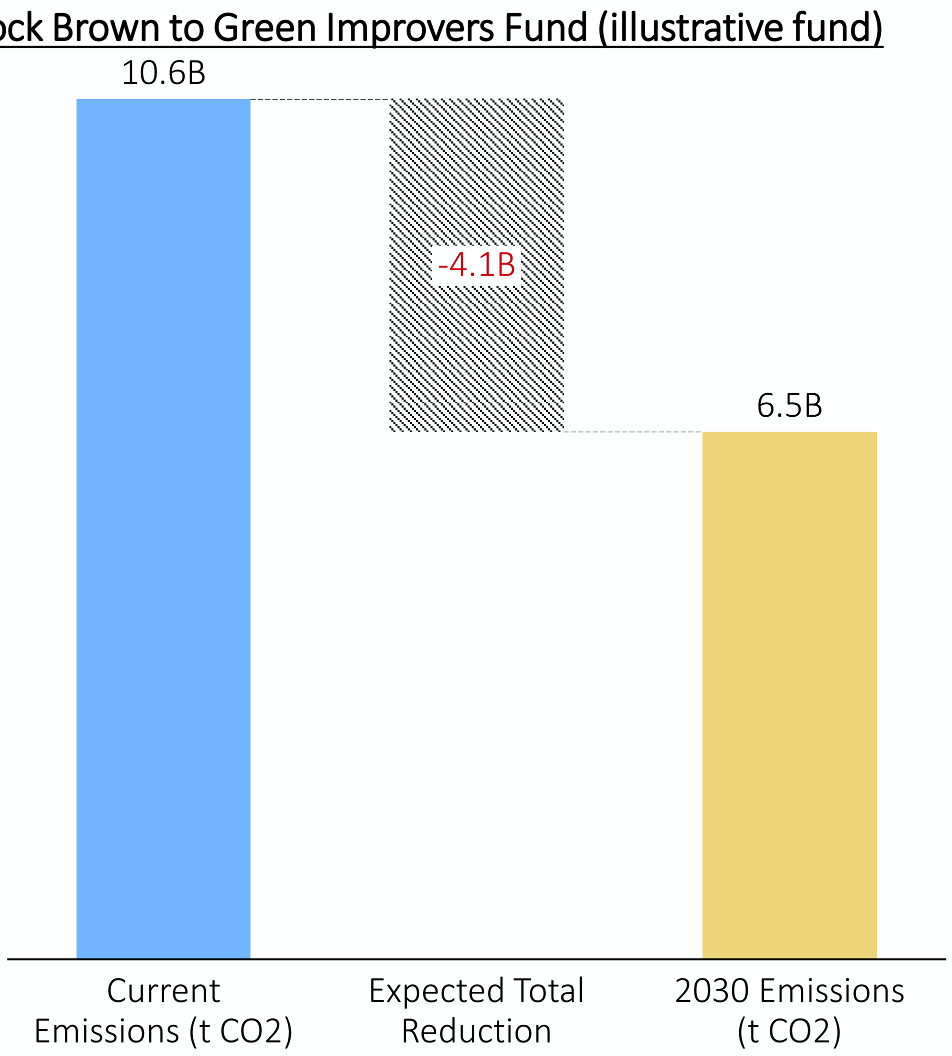
We avoid most of the S&P Global Clean Energy Index Companies

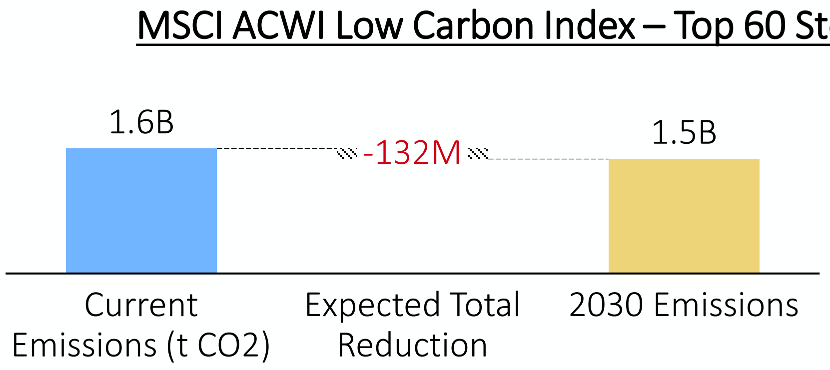
Top 10 Detractors over 3-Years to 31 March 2023						
Company	Business Description	Market Cap ($B)	Avg % Wgt	Cum. Return (%)	Fwd PE (Dec-20)	Fwd PE (Mar-23)
ISHARES GLOBAL CLEAN ENERGY			100	-38.6	45.9x	19.9x
PLUG POWER INC	Hydrogen Fuel Cells	$2.2	3.6	-90.4	44.9x	20.0x
SOLAREDGE TECHNOLOGIES INC	Solar Panel Inverters	4.0	5.3	-75.3	17.1x	27.3x
ORSTED A/S	Danish Renewable Energy	23.8	4.5	-64.4	57.7x	16.1x
SUNRUN INC	Solar PV and Batteries	2.7	2.2	-78.2	255.0x	NA
ADANI GREEN ENERGY LTD	Indian Renewable Energy	36.7	0.6	-84.4	NA	172.6x
ENPHASE ENERGY INC	solar micro-inverters, battery energy storage, EV charging stations	16.4	7.6	-25.4	44.7x	20.1x
BALLARD POWER SYSTEMS INC	proton exchange membrane (PEM) fuel cell products	1.0	0.7	-87.0	NA	NA
ENERGY ABSOLUTE PCL-NVDR	Thailand Biodiesel	3.2	0.9	-63.5	43.3x	16.8x
SUNNOVA ENERGY	Solar Energy	0.6	0.8	-85.0	32.5x	16.8x
SHOALS TECHNOLOGIES GROUP	electrical balance of systems (EBOS) solutions for solar, storage, and electric vehicle charging	1.8	1.1	-66.2	109.4x	15.3x

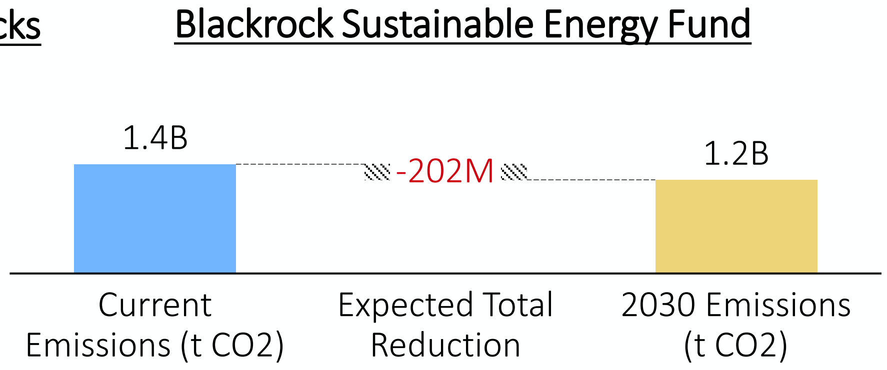
Source: Bloomberg
Holdings data based on iShares Global Clean Energy ETF.

The right measure of climate impact is carbon abated over time ("delta"), not the current look-through footprint ("spot")

- **60-stock brown to green fund ("decarbonization leaders")** are forecast to cut emissions by 4B tonnes c. 40% from 10.6B tonnes of CO2 to 6.5B by 2030.
- Based on company's stated targets/pledges, the top 60 stocks in the **MSCI Low Carbon Index** are expected to reduce scope 1, 2 and 3 emissions by c. 8% to 1.5B.
- By comparison **Blackrock's active Sustainable Energy Fund** which is predominantly comprised of Solutions companies is expected to enable others to cut emissions by c. 200M tonnes of CO2 by 2030.

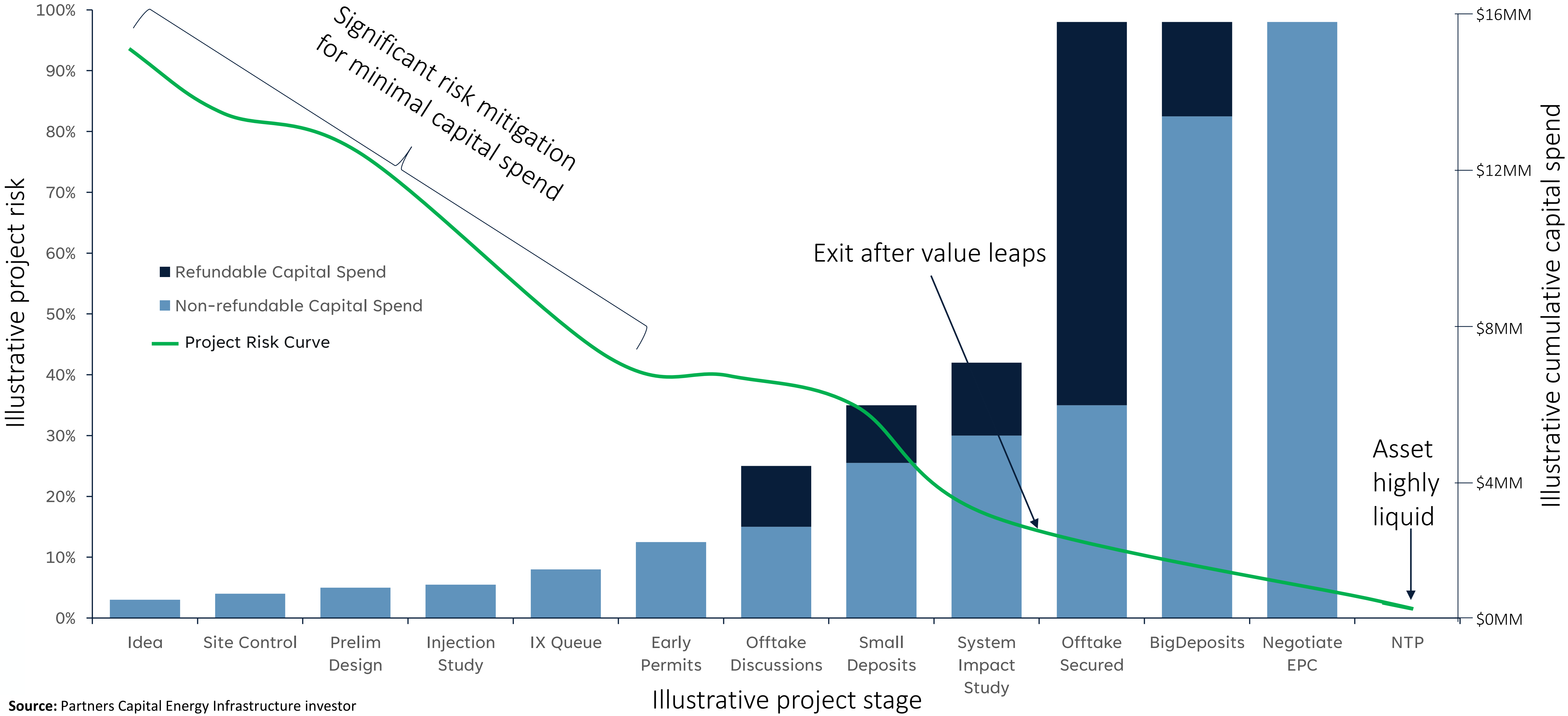






Sources:
1. CO2 Emission reductions show are estimates based on company's stated carbon reduction targets for Scope 1, 2 and 3 to 2030.
2. For targets/pledges further out than 2030, we assume the reduction is achieved in a linear fashion and adjust the reduction for the proportion of years captured to 2030.
3. For the ACWI Low Carbon Index 52/60 companies included have stated pledges / targets. For the Blackrock Sustainable Energy Fund we have targets for 41/47 companies.
4, The Illustrative Fund emission reductions are estimated by Trium leveraging decarbonization pledges and targets from companies.

Early-stage infrastructure development derisking example: Solar with storage



Source: Partners Capital Energy Infrastructure investor

New climate infrastructure fund AUM – 2021 to 2024 YTD ($B)

Source: Sightline Climate

“Picks and Shovels” investment examples - including energy efficiency

- Smart grid software with data analytics to optimise power output
- Dynamic line rating
- Solar panel efficiency software and hardware
- Flexible AC transmission systems (FACTS)
- AI for load prediction
- Power grid cybersecurity
- Overhead line monitoring
- Energy trading systems
- Methane tracking
- Energy transition consulting

POWERFACTORS

Develops software to empower all renewable energy stakeholders to collaborate, automate critical workflows, and make the best decisions.

Its four flagship solutions—Drive, Greenbyte, BluePoint, and Inaccess—represent an integrated suite of open and smart apps, that are purpose-built to support needs across the renewable lifecycle.

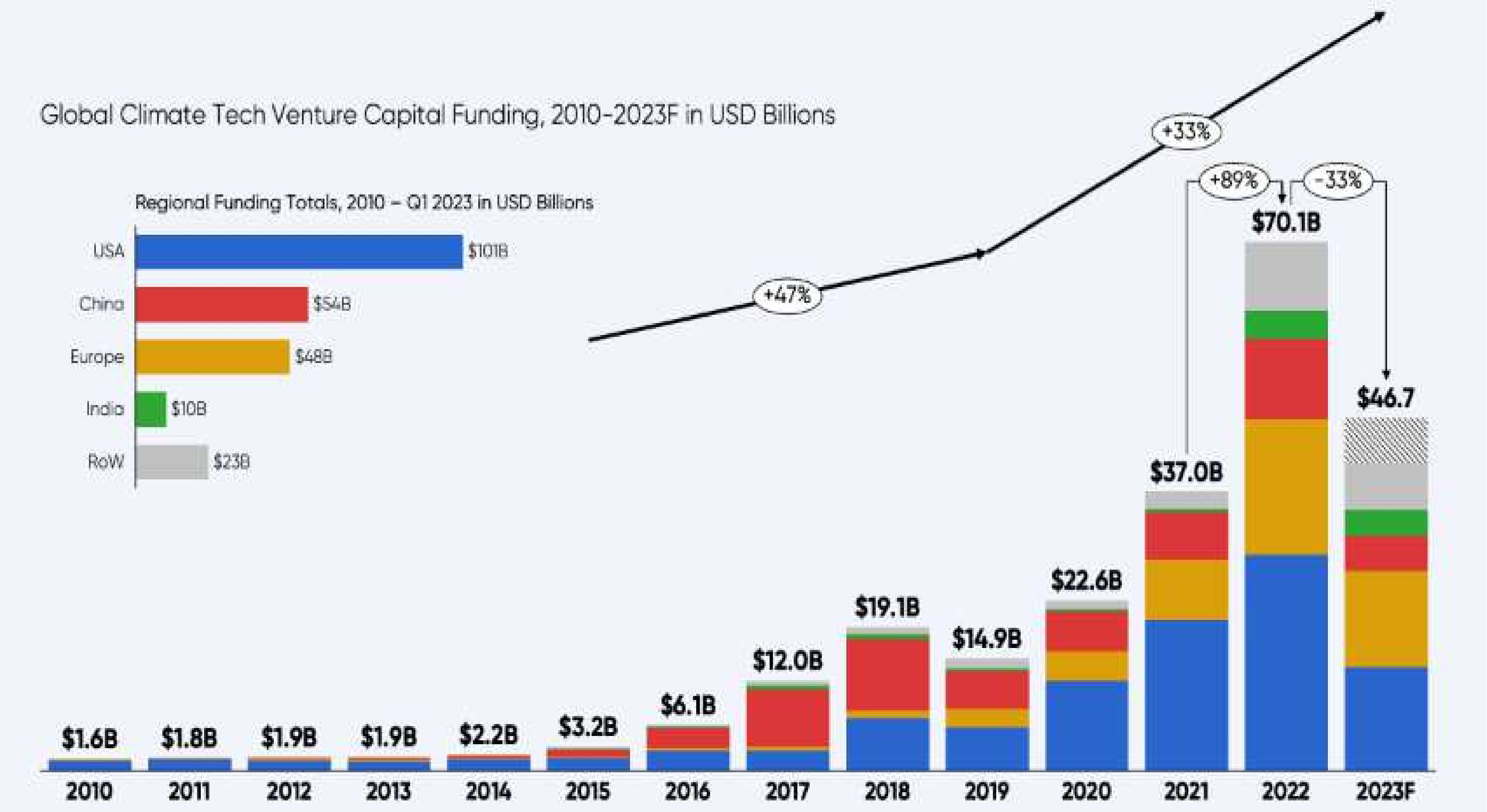
Over 220 GW of wind, solar, hydro, and energy storage assets managed worldwide.

Private equity is partnering with large public corporations to help fund corporate decarbonization - recent examples

Deal Name	Date	Description of the business	Corporate Partner	PE / Infra firm
Origin Energy Markets (Australia) take private (pending)	2023	serves one-third of the country’s retail electricity market; generator and retailer.	Origin	Brookfield and EIG
California Bioenergy (CalBio)	2023	A leading agricultural renewable natural gas (“RNG”) platform	CalBio	Brookfield
Aera Energy	2022	Previously controlled by ExxonMobil and Shell, the company accounts for one-fourth of California’s oil and gas production	California Resources Corp (CRC) merger with Aera	CPPIB (49%)
Occidental DACC	2023	Direct Air Carbon Capture	Occidental Petroleum	Blackrock
Cleantech Indian JV	2024	high-quality renewable development pipeline of wind and solar projects, situated in scarce, high-demand locations.	Axis Energy Ventures India	Brookfield
EcoCeres	2023	Waste to biofuel in Hong Kong	EcoCeres	Bain Capital
Chevron Baseload JV in Geothermal	Dec-22	Geothermal power infrastructure development in the US	Chevron	Baseload Capital

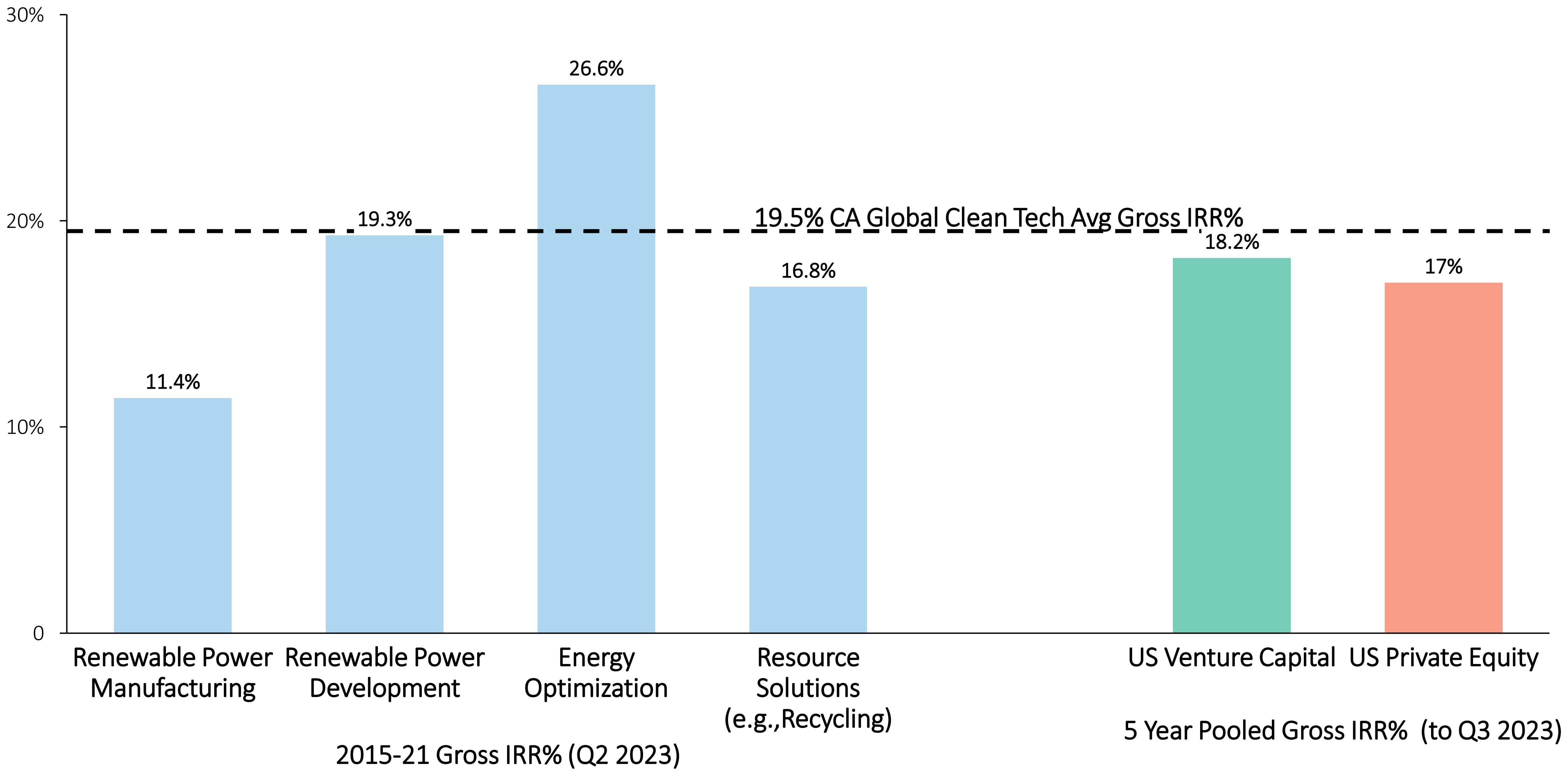
Source: Partners Capital

Climate Tech Venture Funding is now ~12% of all VC investing



Source: HolonIQ, Oct 2023. Numbers may not sum exactly due to rounding. Excluded PE transactions (ie, buyouts). All years calculated at historic FX spot rated on funding date.

Global Clean Tech Venture Capital performance averaged 19.5% from 2015-21



Source: Cambridge Associates (Q3 2023 Report)

Past performance is not indicative of future returns, your capital is at risk and you may not get back the full amount invested

Sample of recent climate tech venture investment marks

Vintage 2018-20: Performance by sector

Sector	Multiple on Invested Capital (MOIC)
Transportation	4.29
Hydrogen	3.17
Industry decarbonisation (ex-transport)	2.82
Energy Storage	2.82
Nuclear	2.75
Recycling (Circular economy)	2.19
Geothermal	1.69
Agritech	1.62
Solar	1.30
Electricity Generation (Other)	1.07
Wind	1.00
Building HVAC	0.92

Source: MOIC is multiple on invested capital and is equal to the current valuation divided by the total capital invested. This performance data has been assembled from several unnamed venture capital firms' reported results. Note that there have been very few actual distributions. These marks are unlikely to represent actual realizations.

Energy transition venture capital learning from last two bubbles

1. Most climate tech is hugely capital intensive which dilutes early-stage investor returns
2. Venture capital may not be the right early-stage backers as they are not patient capital
3. The Power Law (ie, the fund returning deal) may not apply to climate tech
4. Focus on “picks and shovels” including energy efficiency plays (grid, buildings, industry, transport, anything)
5. Corporate partnerships appear to be helping VCs

“Risky Business” – Large Green Technology Solutions (examples)

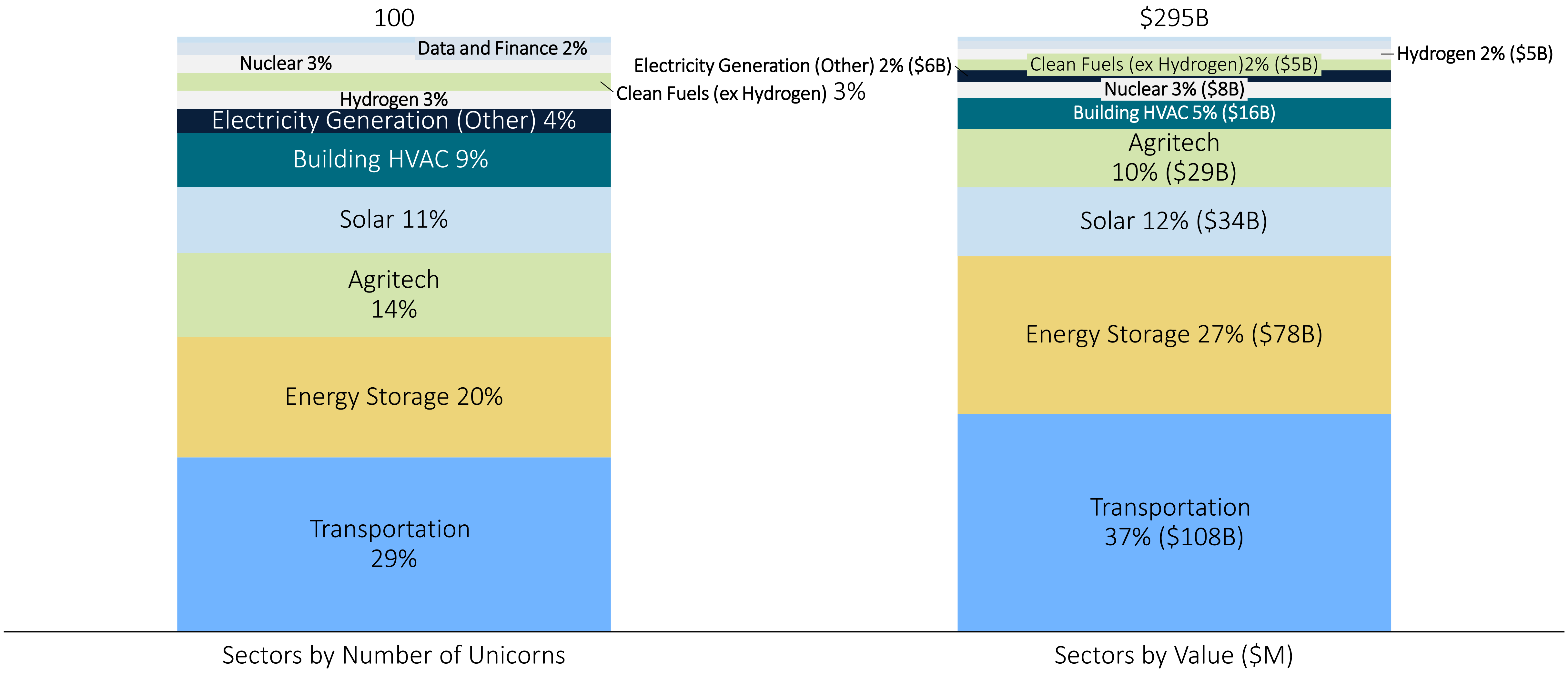
Examples of the very large scale of “venture capital” investments before they become viable. Most of these have involved over $400M in invested capital and most have no revenue

	Commonwealth Fusion Systems	Northvolt	Form Energy	Fervo	Twelve	ClimeWorks	Monolith
Description	Developer of small fusion power systems using heavy hydrogen molecules.	Swedish battery manufacturer, specialising in lithium-ion batteries for the EV market.	Developer of grid-scale energy storage with iron-air battery that delivers 100+ hours of discharge.	Producer of geothermal technology, using horizontal drilling techniques to improve energy efficiency.	Sustainable aviation fuel tech and project developer using CO2 electrolysis to produce fuel via power-to-liquids pathway.	Developer of large-scale direct air carbon capture and storage facilities.	Producer of clean carbon black and hydrogen by methane Pyrolysis – the first unit in the world at commercial scale.
Valuation	$7-11Bn	$20Bn	$3Bn	$554-831MM	$520-780MM	$2-3Bn	$1Bn
Total Funding Amount	$2B	$14B	$966M	$431M	$200M	$800M	$364M
Number of Funding Rounds	5	14	10	7	8	8	11
Investors	Bill Gates	Baillie Gifford	Breakthrough Energy Ventures	3x5 Partners	Breakout Ventures	Baillie Gifford	Azimuth Capital Management
	Breakthrough Energy Ventures	BlackRock	California Energy Commission	Breakthrough Energy Ventures	Capricorn Investment Group	BigPoint Holding	Cornell Capital
	Coatue	CDP Quebec	Coatue	Canada Pension Plan IB	Chan Zuckerberg Initiative	Carbon Removal Partners	Decarbonization Partners
	Fine Structure Venture	Chow Tai Fook	Hedonova	Capricorn Investment Group	DCVC	GIC	Mitsubishi Heavy Industries
	Helena	European Investment Bank	NYSERIDA	Congruent Ventures	Microsoft Climate Innovation	Global Founders Capital	NextEra Energy Resources
	Khosla Ventures	GIC	Prelude Ventures	DCVC	Munich Re Ventures	John Doerr	SK Group
	Larry Kubal	Goldman Sachs	The Engine	Elemental Excelerator	Northstar VC	M&G Investments	TPG Rise Climate Fund
	LowerCarbon	Nordic Investment Bank	the Rise Fund	Helmerich & Payne	Page One Ventures	Partners Group	
	Starbridge Venture Cap	OMERS Private Equity	TPG Rise Climate Fund	Prelude Partners	TGM Ventures	Swiss Re	
	Tamasek Holdings	Volkswagen Group	VamosVentures		TPG Rise Climate Fund	Zurcher Kantonal Bank	
	The Engine				Unruly Capital		
	Time Ventures						
	US Department of Energy						

Source: CrunchBase, DealRoom

Energy Transition Unicorns by Segment

% Unicorns by Valuation and Number



Source: HolonIQ

11 April EFFIO ETIF -- Most important takeaways

1. The Energy Transition is a megatrend that will have a material influence on investing for decades to come.
2. Many asset managers managing your assets today are not fully aware of the implications of the energy transition on asset prices.
3. Solar, Wind, Batteries and EVs all have huge momentum supported by superior economics vs carbon emitting alternatives which can abate nearly 50% of all emissions affordably.
4. Another 35% is abatable with a) policy support, b) institutional investors backing leading decarbonizing companies and c) emerging market financing solutions.
5. Clean hydrogen and carbon capture are not economically viable on their own.
6. Carbon taxation/subsidization is the most important catalyst – Europe has taken the lead on taxation, while the US tiptoes into subsidies. China is doing nearly nothing.
7. Relations with China are critical to the energy transition from two angles: they supply virtually all key components and may well lag in their own decarbonization (ironically).
8. The Investors' Dilemma – Option #1: avoid emissions due to the risks /uncertainty or, Option #2: invest in decarbonization leaders in each sector as a source of outperformance. Fossil fuel exclusion may make sense from a risk/return perspective but excluding this may be adding to emissions.
9. The best portfolio ET impact measure is the measured reduction of carbon emissions over time by the companies owned. ("spot vs delta").
10. Six core ET Investment opportunities: brown-to-green (leading decarbonizers), early-stage infrastructure, picks and shovels, corporate partnerships with PE/Infra firms, and specialist VCs. Be alert to risks of the pure "green" plays – 40% volatility is not being paid for.

Audience Polling Question #4

What is the biggest learning you should take away about investing in the Energy Transition?

- ❑ Any foundation investor needs to have at least a basic understanding of the energy transition, particularly focused on what has attractive economics.
- ❑ The widespread lack of investor understanding of the energy transition, exploited by deep ET experts, could be one of the best alpha-generating opportunities of this decade.
- ❑ Find the real deep energy transition expert asset managers, pursuing one or more of our 6 themes, and allocate capital to them.
- ❑ Make sure all of my current asset managers understand how the energy transition will affect their investments.
- ❑ Avoid net-zero goals in favour of net carbon emission reduction goals

Appendix: Abatement matrix of sources and solutions WITH government support

Base Case Scenario for 2050 -- WITH Policy moves

	Emissions CO2e Gt	Renewables	Hydrogen	Bioenergy	Carbon Capture	Heat Pumps	Battery Storage and LDES	Battery Electric Vehicles (BEVs)	Efficiency & Other Actions	Human behaviour changes	Carbon Offsets	Total	% decarbonised
Power	**17.4**	**5.4**	**0.9**	**0.4**	**1.5**		**1.3**		**7.0**			**16.5**	**95**
Industry	**10.2**		**1.3**	**1.2**	**1.5**				**3.6**			**7.6**	**75**
Steel	3.6		0.4	0.6	0.5				1.9			3.4	94
Cement	3.9			0.6	1.0				0.9			2.5	63
Refining, Ammonia, Methanol	0.9		0.9									0.9	100
Other industry	1.8								1.8			1.8	100
Transportation	**10.0**		**1.4**	**0.6**				**4.8**				**6.8**	**68**
EVs (passenger and LCVs)	5.0							4.8				4.8	96
Heavy Trucks	2.3		0.7									0.7	30
Shipping	1.5		0.4	0.6								1.0	64
Aviation	1.2		0.4									0.4	30
Buildings	**4.2**			**0.3**		**1.9**			**2.2**			**4.2**	**100**
Agriculture	**4.5**									**1.1**		**1.1**	**25**
Waste & Deforestation	**3.8**										**5.4**	**5.4**	**143**
Totals	**50**	**5.4**	**3.6**	**3.0**	**3.0**	**1.9**	**1.3**	**4.8**	**12.8**	**1.1**	**5.4**	**42**	**84**

Source: Partners Capital analysis; note that approximately 25% of clean hydrogen (0.9 Gt of CO2) will be from grey hydrogen with carbon capture (i.e., blue H2) and half of the bioenergy (1.5 Gt of CO2)will be combusted with carbon capture (i.e., BECCs).

Appendix – energy measurement definitions

Energy production or usage is usually measured in watts or joules

A watt-hour is the amount of energy produced by a one-watt source running for one hour.

A kilowatt-hour (kWh) is a unit of energy equal to one kilowatt (1000 watts) of power sustained for one hour. This is the measure typically shown on our electricity bills. US average household pay 10c/kWh, in the UK 17p/kWh, but has gone up to 28p in 2022 due to the energy supply shortages.

A megawatt-hour (MWh) is one million Wh or 1000 kWh. Electricity source cost comparisons are usually expressed using MWhs. Before carbon taxes or subsidies, the cost today averages between $25 and $40/MWh for various sources of energy including coal, solar, wind, and natural gas. This is 2.5 to 4c per kWh.

MW vs MWh: A 582 MW Capacity Plant refers to hourly production. In 24hrs, this plant will produce 13,968 MWh's (24 x 582)

The formula used to calculate megawatt-hours is Megawatt hours (MWh) = Megawatts (MW) x Hours (h). To convert megawatt hours to megawatts, you are going to need to divide the number of megawatt hours by the number of hours. In other words: Megawatts (MW) = Megawatt hours (MWh) / Hours (h).

A gigawatt-hour (GWh) is 1,000 MWh

A terawatt-hour (TWh) is one trillion Wh, or 1,000 GWh

A gigawatt (GW) is equal to one billion watts. The light bulbs in our homes are typically between 60 and 100 watts. So 1.21 gigawatts would power more than 10 million light bulbs.

I kWh = 3,600,000 or 1 joule = 2.77778-e7

Joule (J): The joule is a derived unit of energy in the International System of Units. It is equal to the amount of work done when a force of 1 newton displaces a body.

1 British Thermal Unit (btu) = 1055 Joules. A Btu is a measure of the heat content of fuels or energy sources. It is the quantity of heat required to raise the temperature of one pound of liquid water by 1 degree Fahrenheit at the temperature that water has its greatest density (approximately 39 degrees Fahrenheit).

Exajoule (EJ): 1 EJ = 10^{18} J

Most global emissions figures are shown in tonnes or billion tonnes of CO2 (GtCO2)

A Gigatonne (Gt) = 1 billion tonnes = 1×1015g = 1 Petagram (Pg)

A kg carbon (C) = 3.664 kg carbon dioxide (CO2)

Discussions around the cost of carbon emissions often price it between $30 and $100 per tonne.