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# Towards 2050: Megatrends For Energy

Tuesday, 15th August 2023

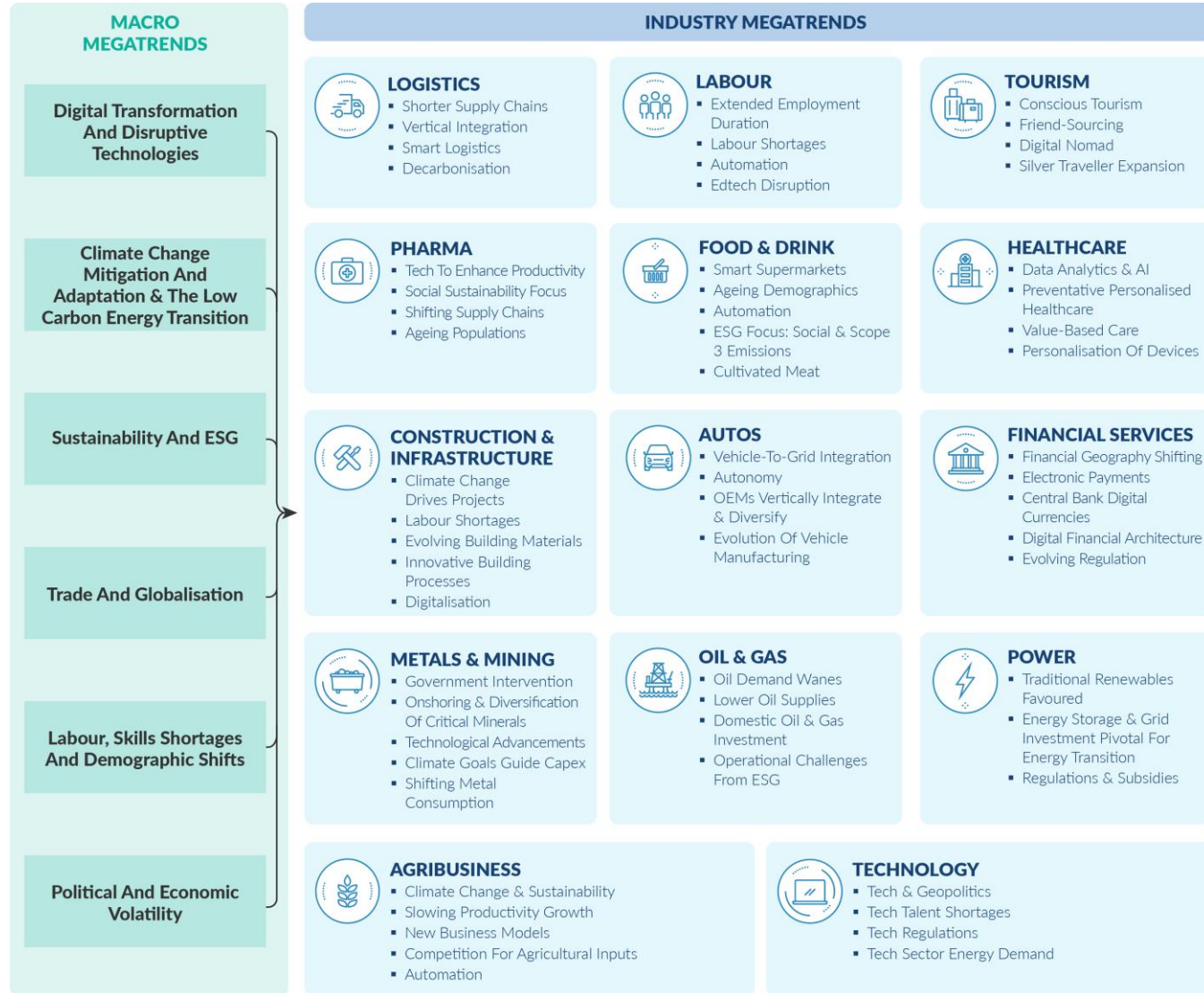


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# 2023 Megatrends



The Megatrends coverage aims to understand how **industries, economies and geopolitics** will evolve over the coming decades to 2050

4<sup>th</sup>  
Edition of  
Megatrends

14  
Industry  
Megatrends

6  
Macro  
Megatrends

9  
Global Economic &  
Geopolitical  
themes

# Megatrends Survey

5

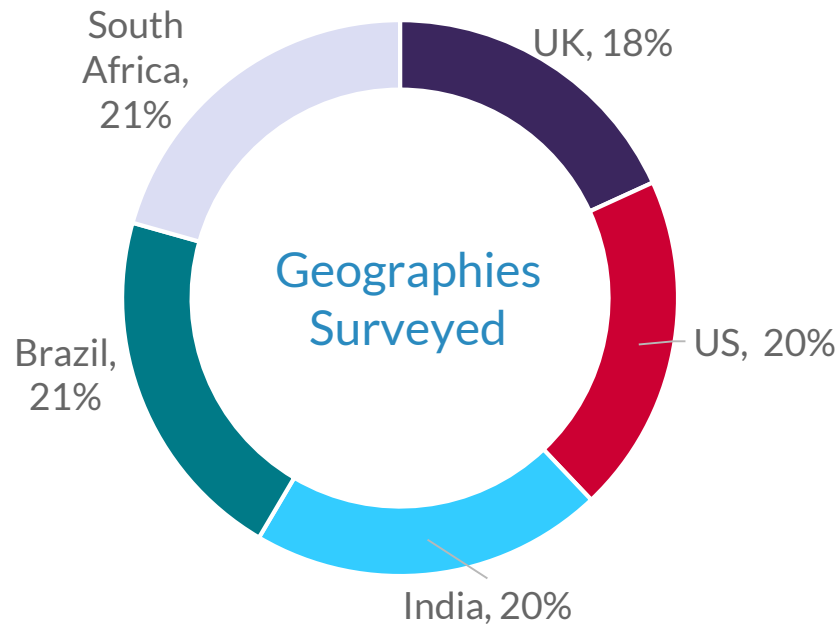
Geographies

15

Industries

1,000+

Middle & Upper  
Managers

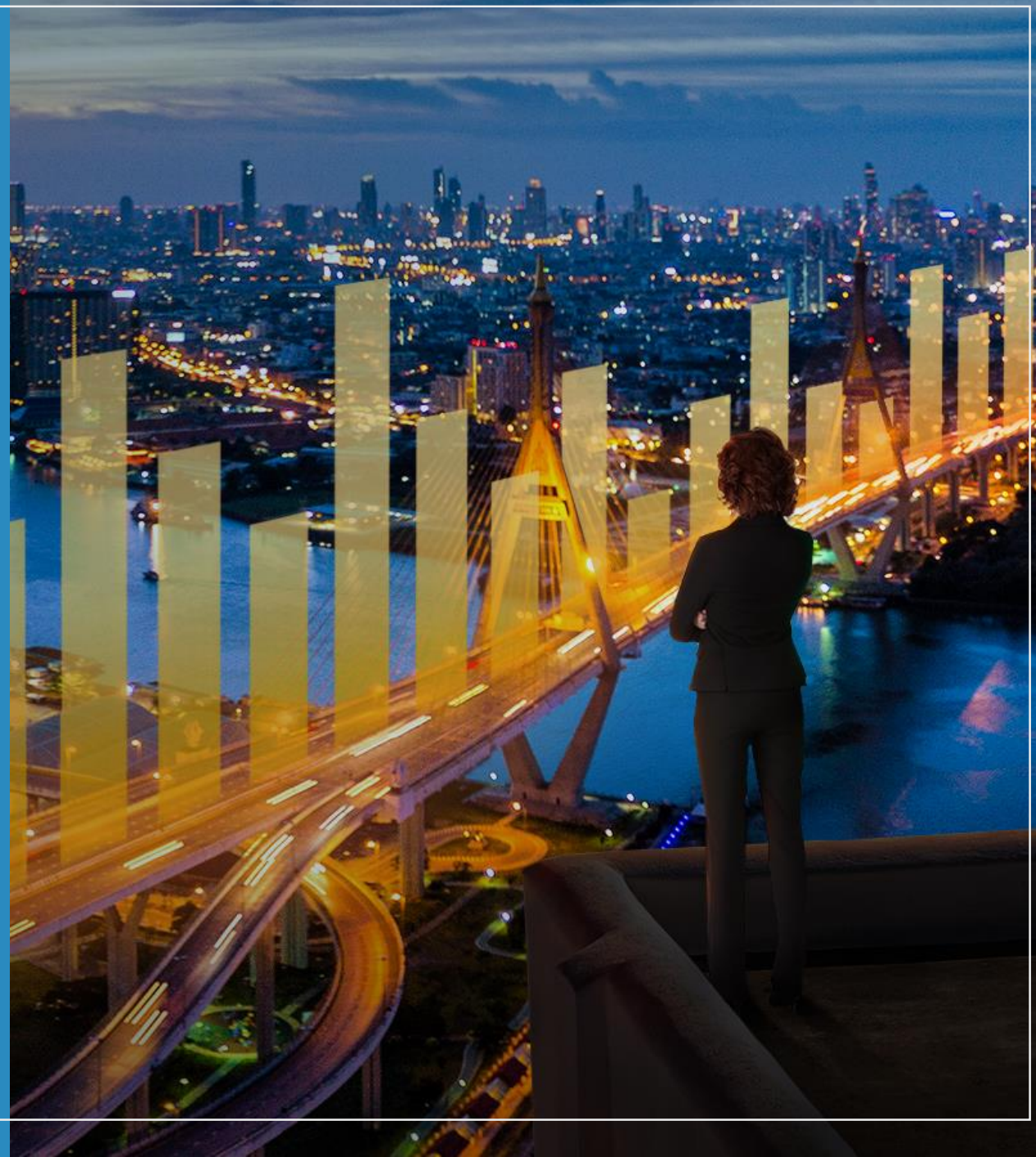


## Industries Surveyed

- Agriculture/Livestock
- Automotive
- Banking/Financial Services
- Industrial Manufacturing
- Telecoms/Tech/IT
- Construction
- Professional Services
- Education/Training
- Energy, Utilities & Environment
- Food/Beverage/Restaurant
- Travel/Tourism/Hospitality
- Pharmaceuticals/Healthcare
- Metals & Mining
- Consumer/Retail
- Transport/Transportation/Logistics

# Contents

1. Power & Renewables Outlook
2. Energy Transition Resource & Supply Chain Risks
3. Policy Making & Clean Hydrogen
4. Global Oil & Gas Outlook
5. Q&A





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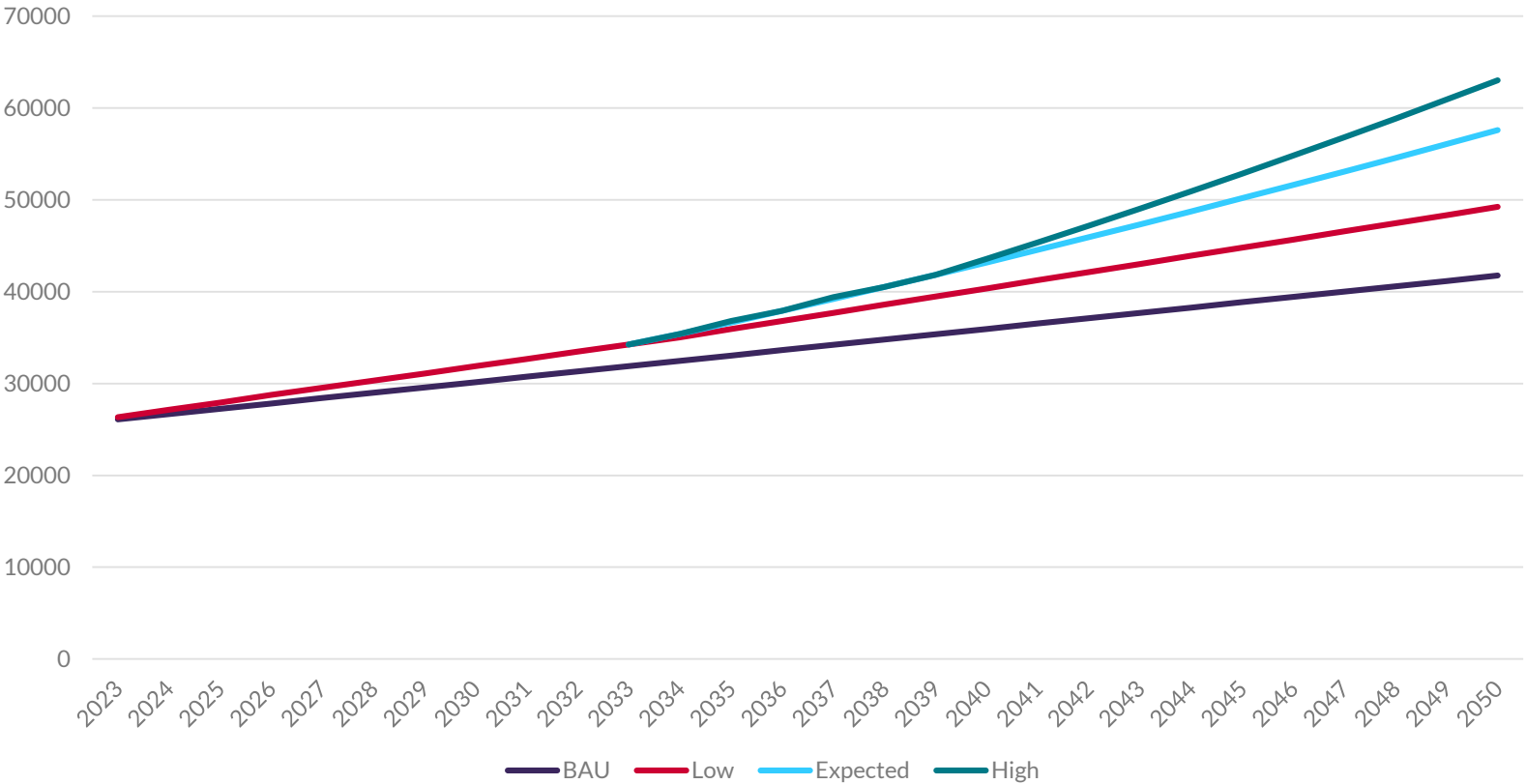
# Power & Renewables Outlook



# Electrification Of Industries To Shift Trends In Demand

## Energy Transition Shifting Power Sector Dynamics, Driving New Consumption Patterns

Global - Total Electricity Consumption by Scenario, TWh



Source: EIA, IRENA, World Bank, local sources, BMI

### Megatrends For Power Markets:

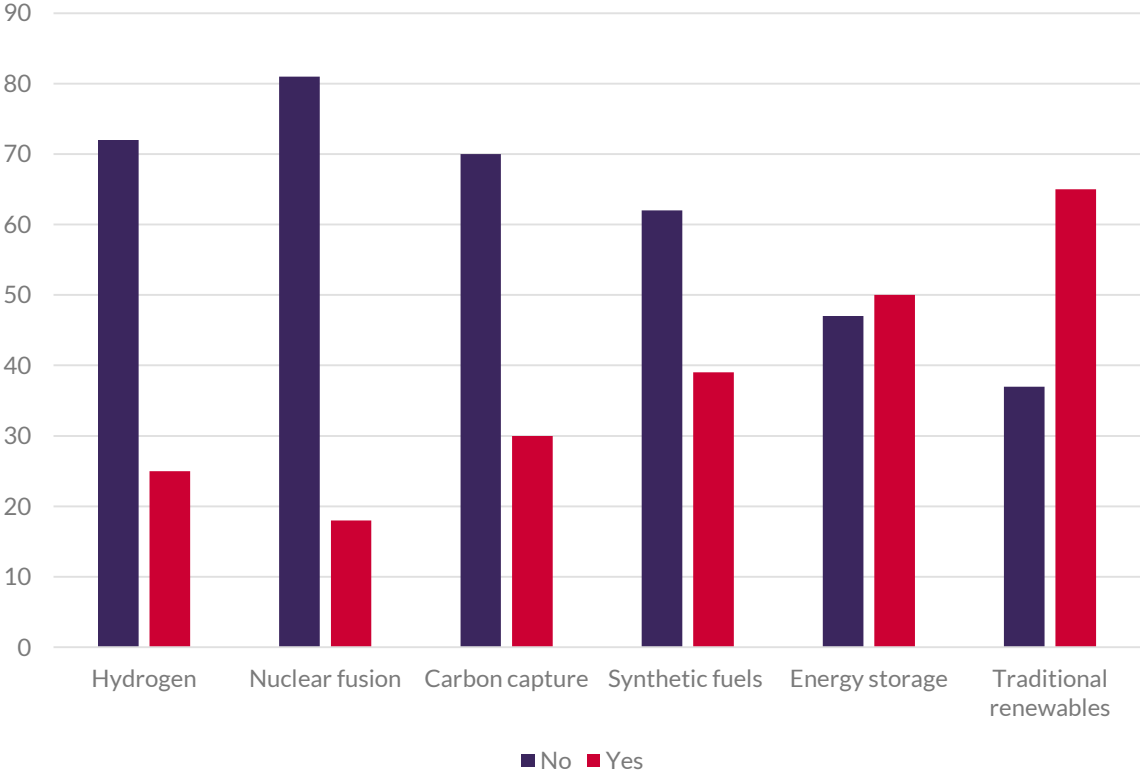
- Traditional renewables favored over disruptive technologies in energy transition
- Energy storage key to enabling renewables growth and a key concern
- Grid infrastructure to require vast and immediate investment to enable renewables growth



# Investment Gap Widening For Emergent Technologies

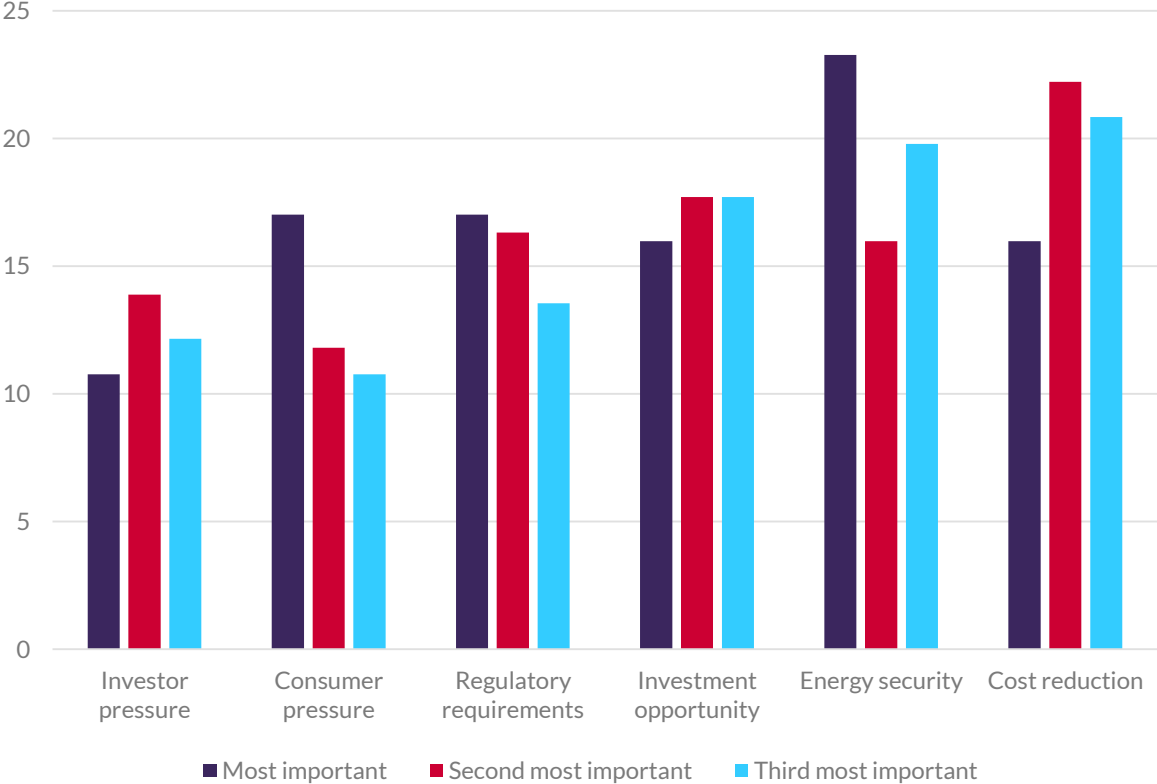
## Traditional Renewables Taking The Bulk Of Investment

Megatrends Survey – Which Low-Carbon Technologies Are You Considering Investment In? (% Respondents)



## Energy Security Issues Amid Rising Costs Driving Shifts Towards Storage In Company Needs

All Companies – What Are Your Company’s Motivations For Investing In Low Carbon Energy? (% Respondents)

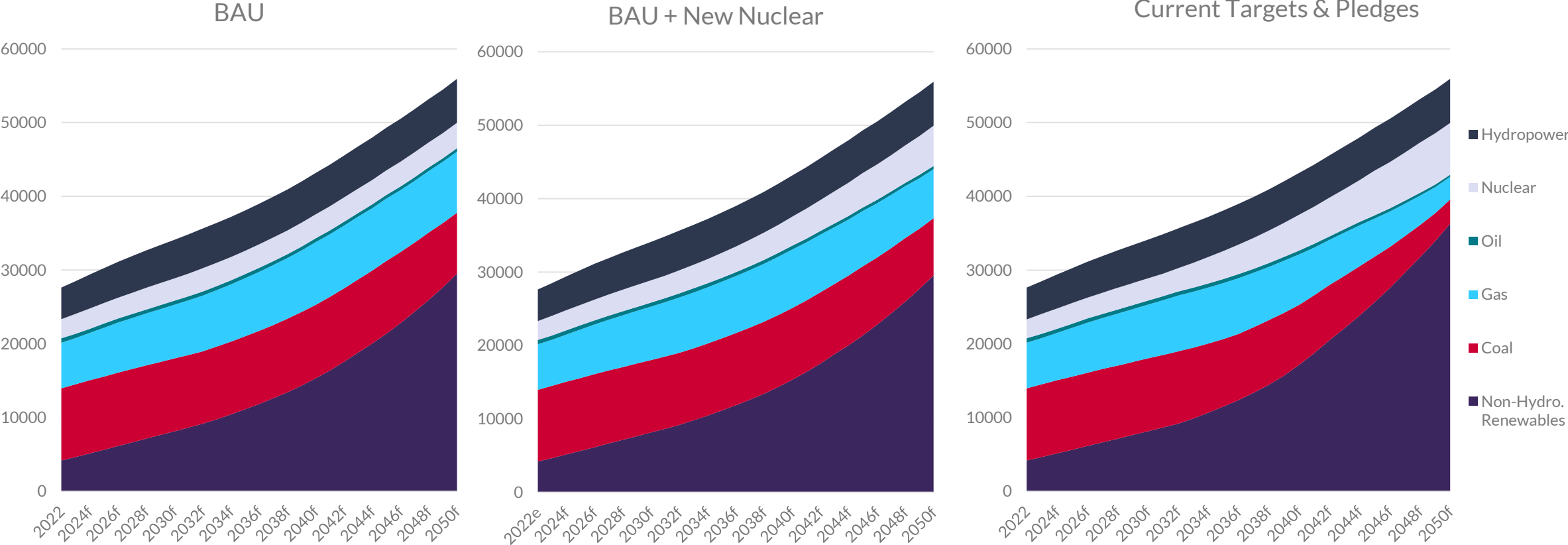


Note: The BMI Megatrend Survey is a B2B survey conducted in March 2023 and assesses the responses of 1,000 respondents across the UK, US, India, Brazil and South Africa. Source: Corporate announcements, BMI Key Project Database, BMI Megatrend Survey



# Net Zero Power Supply By 2050 Looks Unlikely With Current Policy

**BAU And Current Targets And Pledges Will Not Be Enough To Decarbonise The Global Power Mix**  
 Global - Three Scenarios For Power Generation By Type, TWh

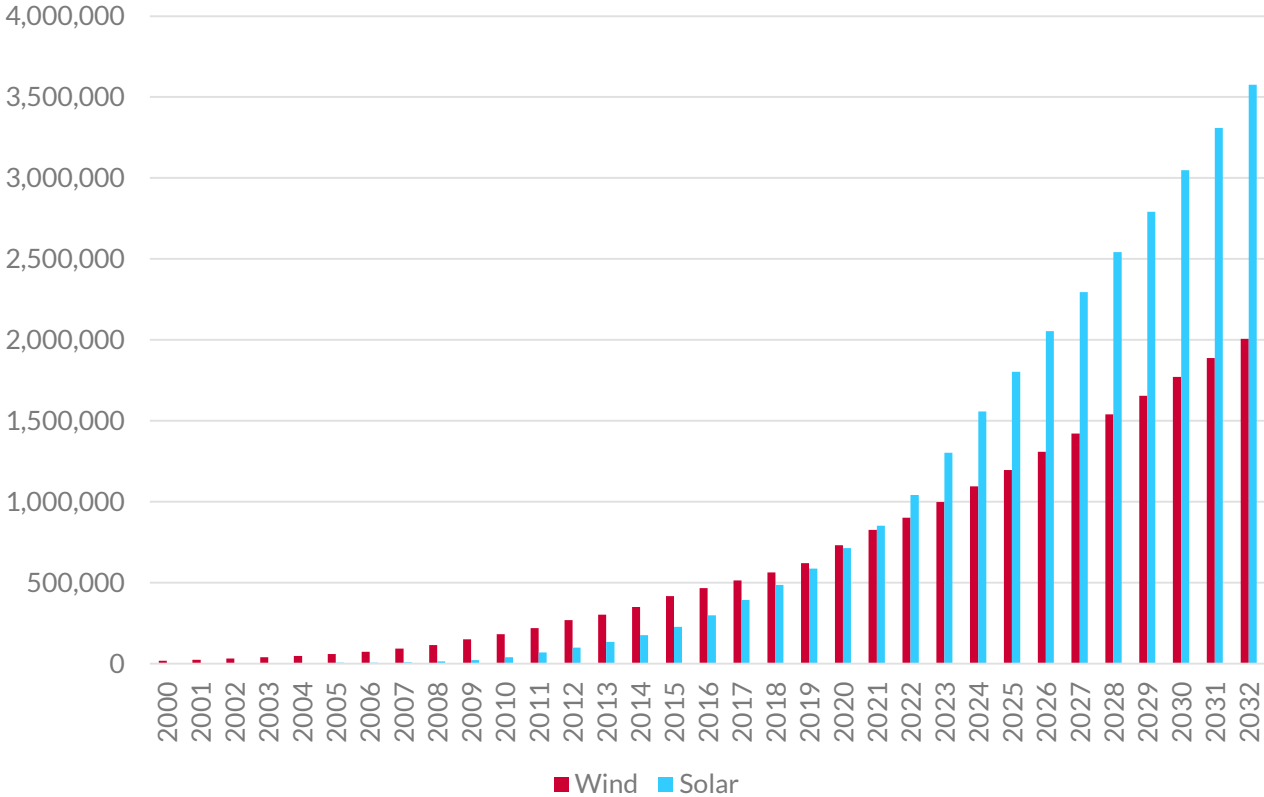


Note: BAU = Business As Usual. f = BMI forecast. Source: EIA, IRENA, World Bank, Local sources

# Critical Limitations Arising To Confront Energy Transition

## Solar Outperforms As Wind Growth Falters

Global – Cumulative Wind & Solar Capacity Growth, MW



## Global Renewables Growth Faces Several Large Challenges:

- Grid limitations including connection wait times, curtailment & inefficiency.
- Permitting process is far too long, posing risks to developers, exacerbated by high debt costs.
  - As of December 2022, there is a total 1350GW of planned generation capacity awaiting interconnection in the US.
- Inflationary pressures and monetary policy could impact capital flows placing emphasis on guarantees.
- Material costs & supply chain pressures.

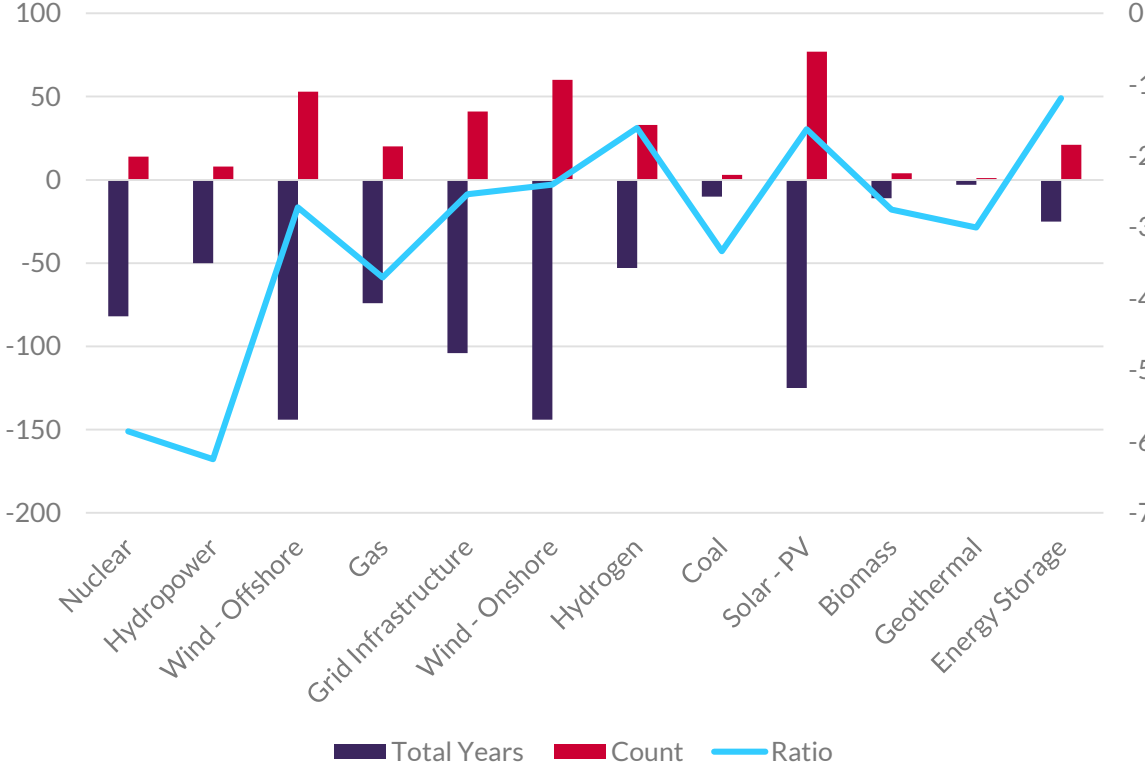
e/f = BMI estimate/forecast. Source: EIA, national sources, BMI



# Permitting & Grid Limitations Risk DM Energy Transition

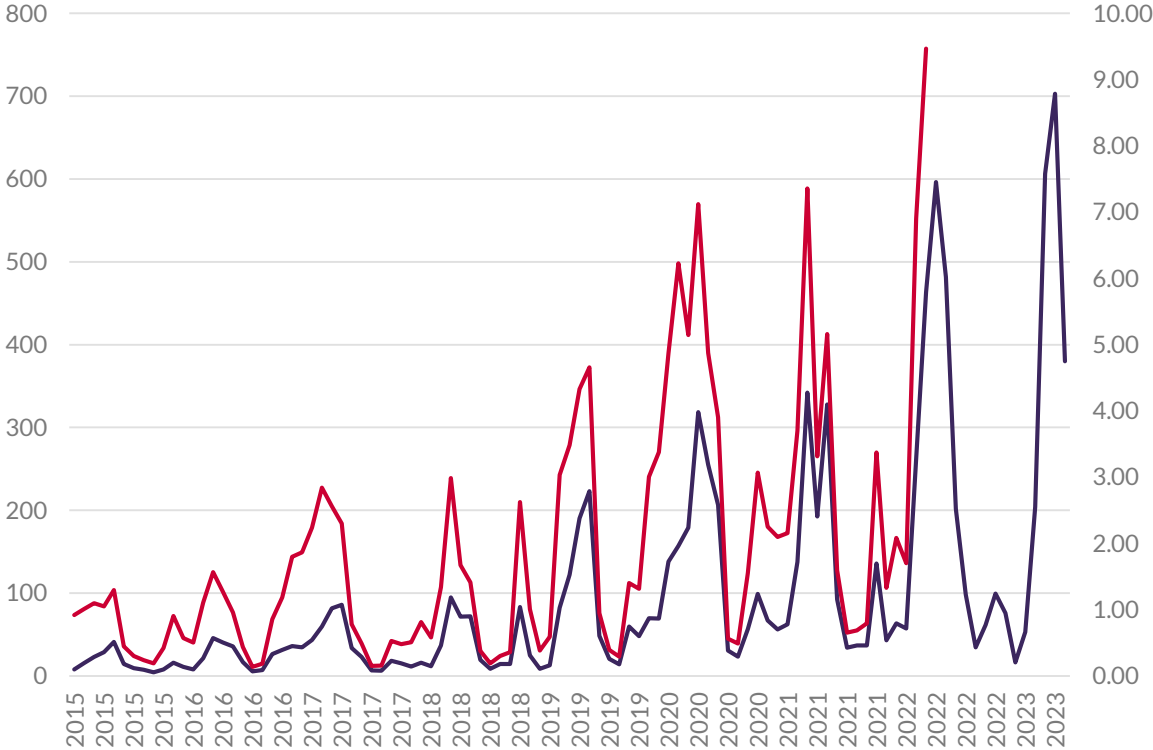
## Permitting Delays Holding Up Project Deployments With Wind Most Affected

North America & Western Europe Project Completion Date Delay & Count By Technology



## While Curtailment Persists, Damaging Profit Margins

US - CAISO (LHS) Curtailment Of Output, GWh & (RHS) Share Of Generation (RHS), %

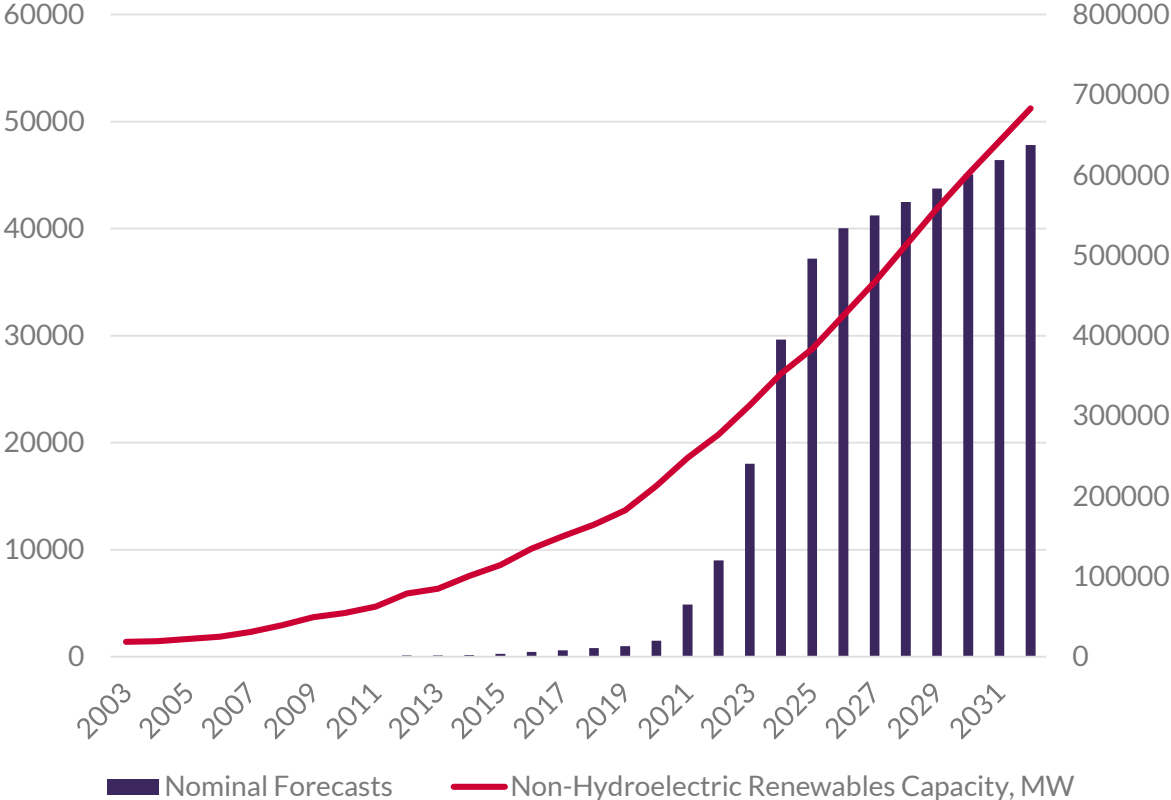


Source: CAISO, BMI Key Projects Data

# Different Forms Of Grid Storage Key To Unlocking Growth

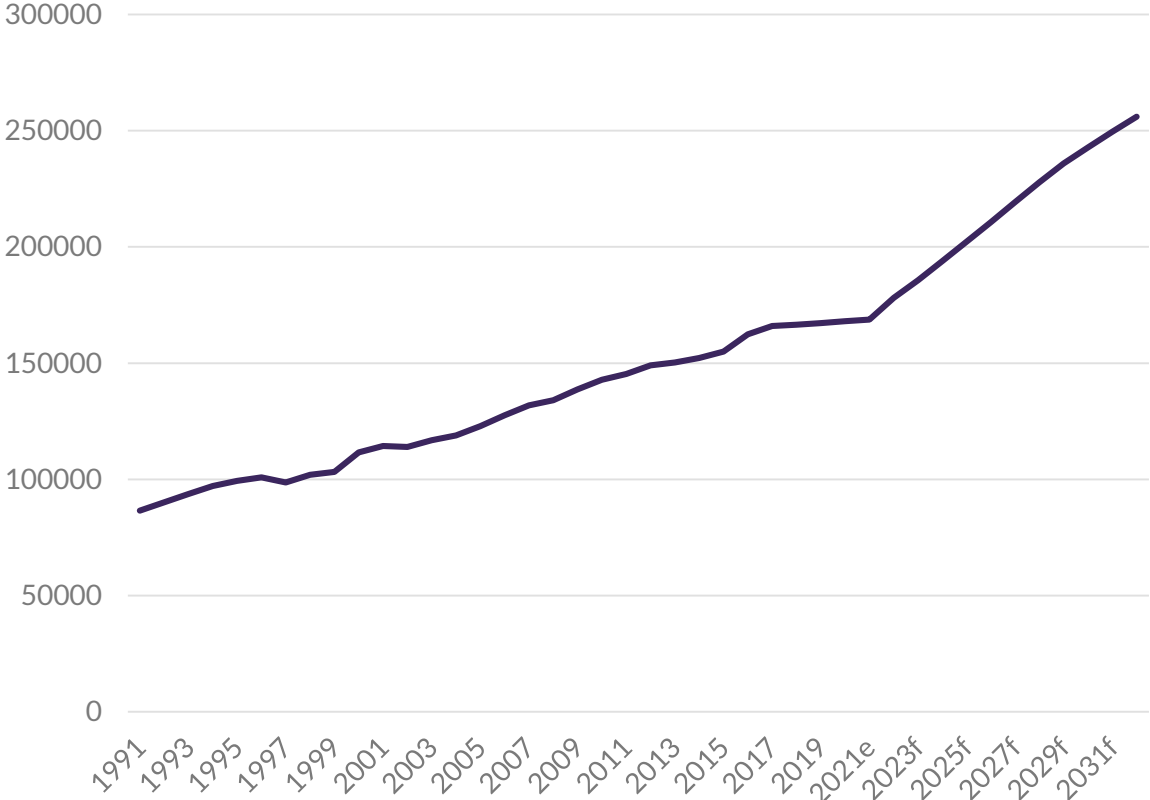
## Battery Storage Expansion To Fill Transmission Gaps

US - Battery Storage & Renewables Capacity, GW



## Long Duration Storage Crucial And Set To Increase Sharply

Global - Pumped Hydropower Capacity, MW



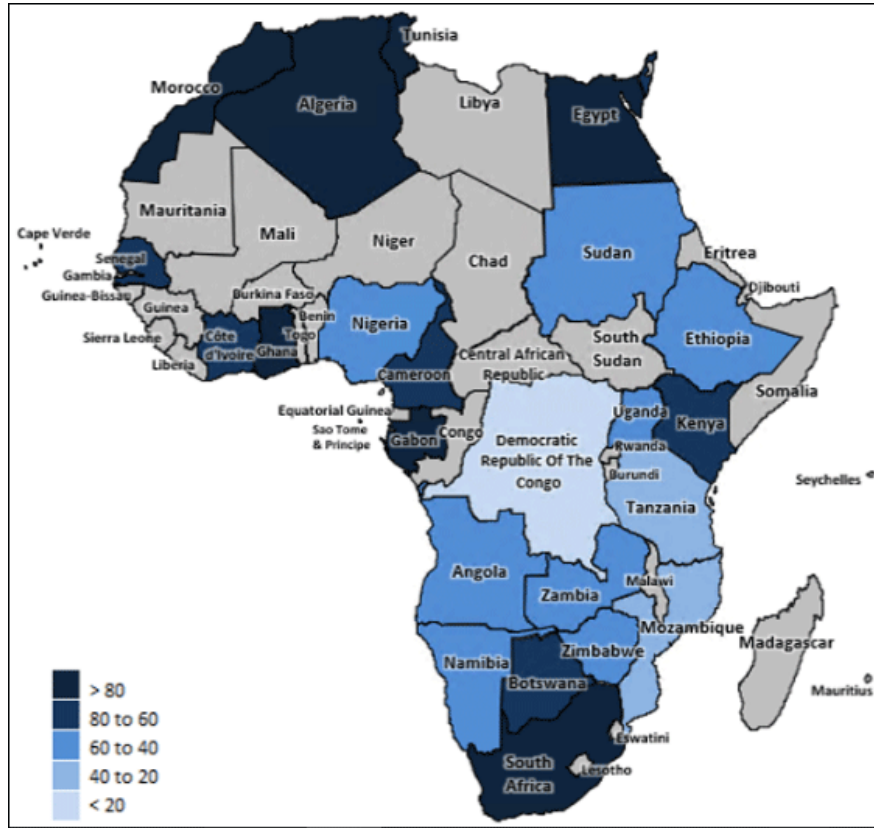
Source: BMI Key Projects Database, IEA



# Transmission Investments Needed, Yesterday

## Wide Contrast Between African Markets' Access To Electricity

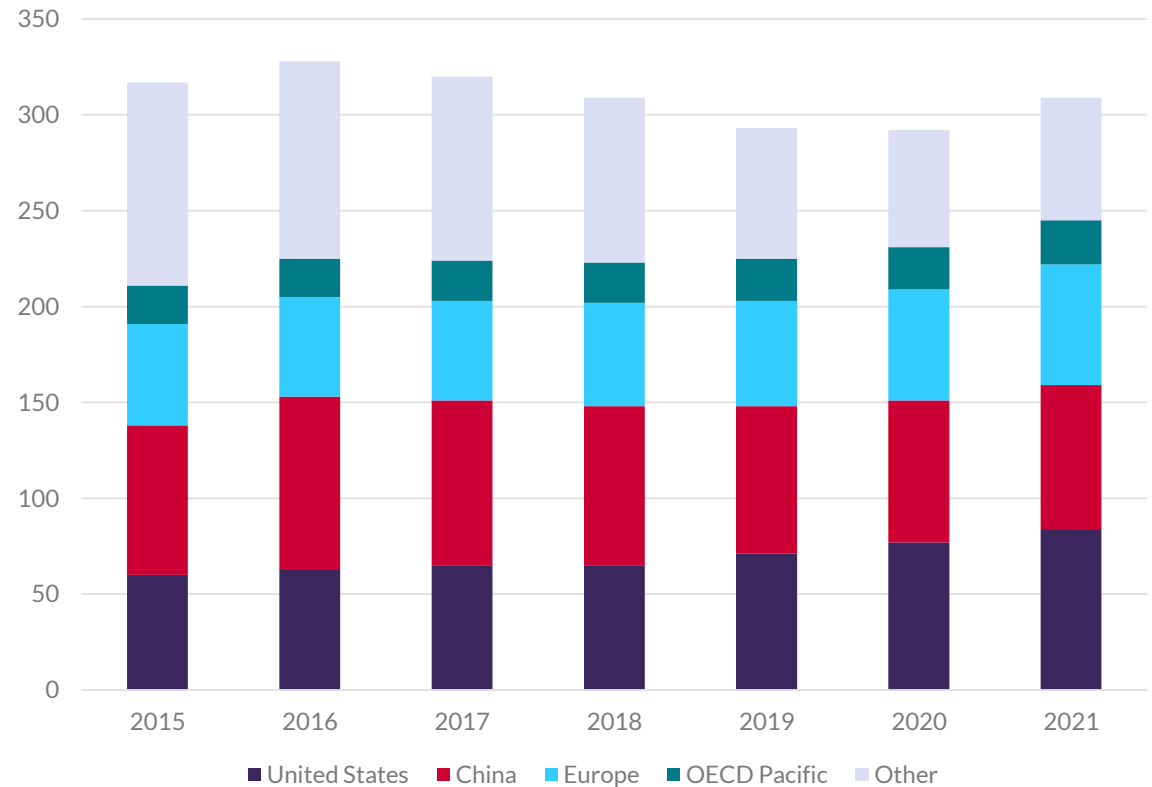
Africa - Access To Electricity, % of population



Source: EIA, IRENA, World Bank, local sources, BMI, IEA

## Grid Investments To Rise But Not Fast Enough Amid Years Of Stagnation

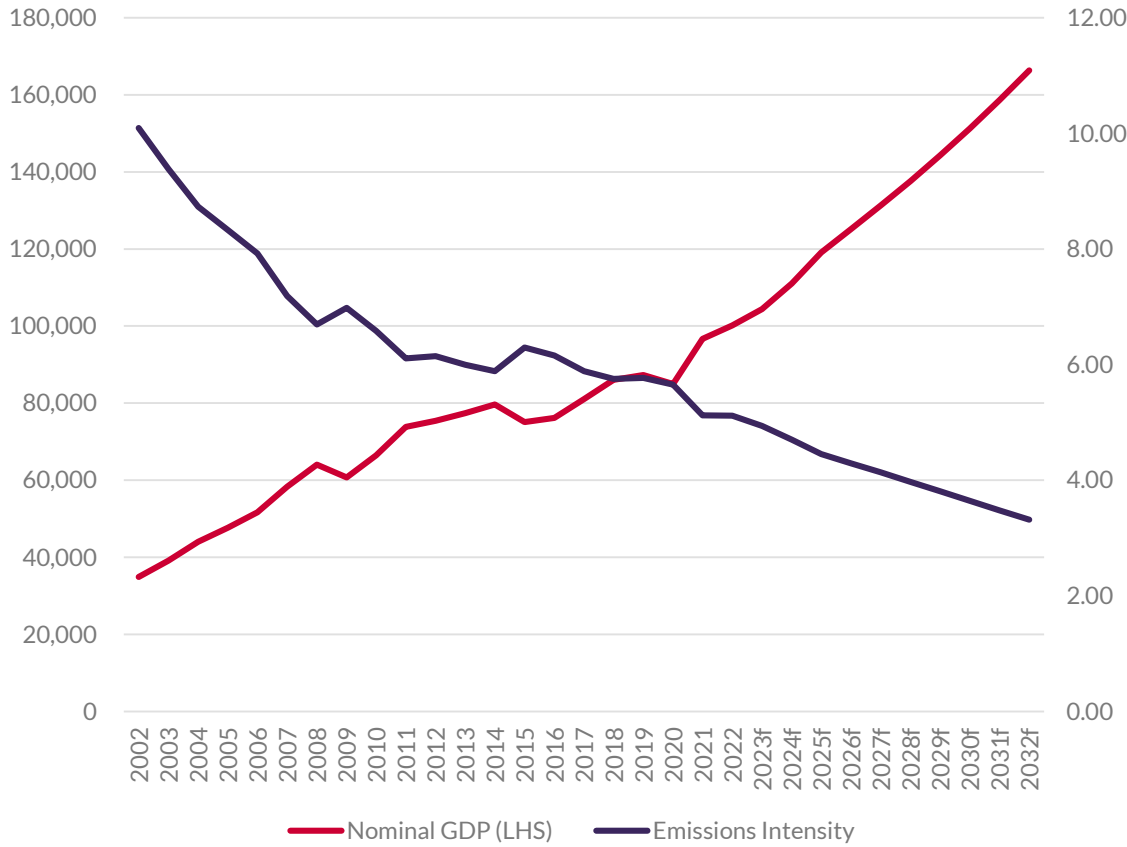
IEA Tracker - Investment spending on electricity grids, 2015-2021



# Energy Needs & Climate Imperatives Coming Into Conflict

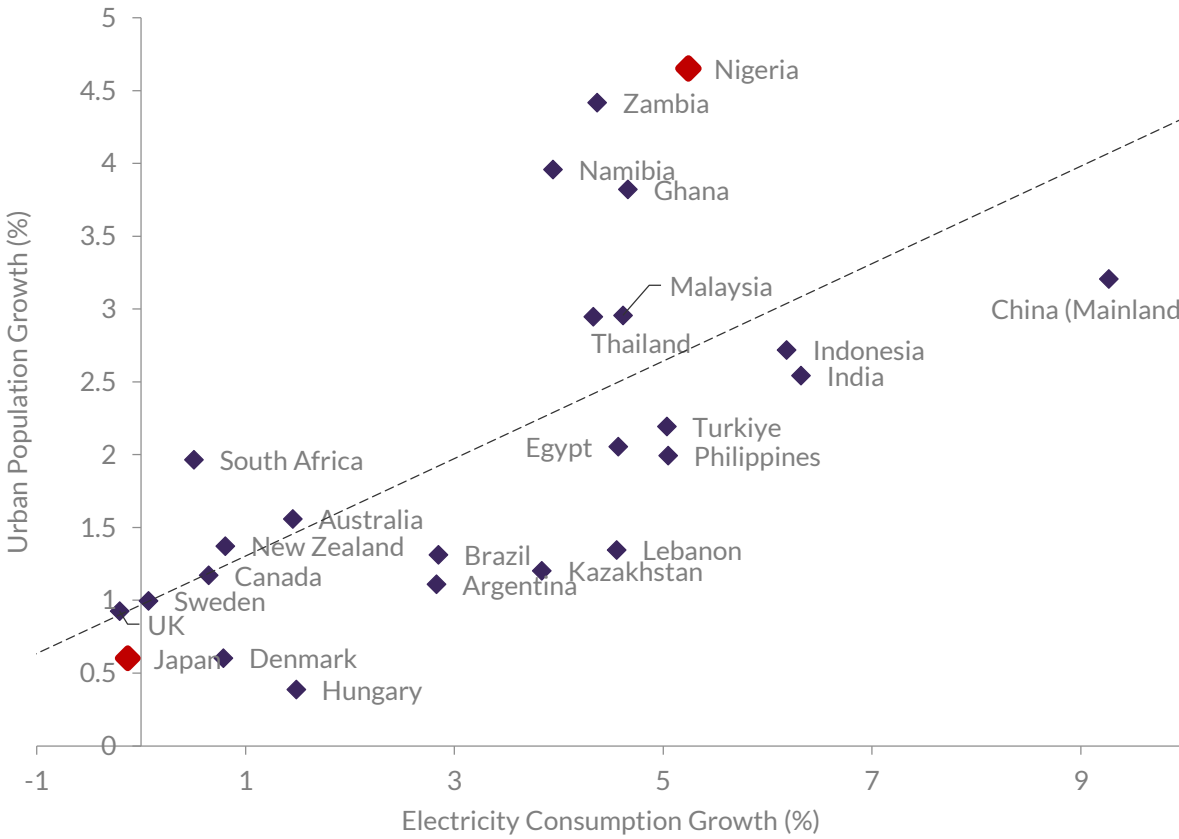
## Efficiency Key As Energy Demands Roam Higher

Global - Nominal GDP, USDbn & Emissions Intensity Of GDP\*



## Demographic Shifts Putting Pressure On The System

Select Markets - Average Urban Population & Electricity Consumption Growth, % y-o-y (2000-2022)



\*mBTU of fossil fuels consumed per USD1,000 of GDP. f = BMI forecast. Source: EIA, IRENA, World Bank, local sources, BMI



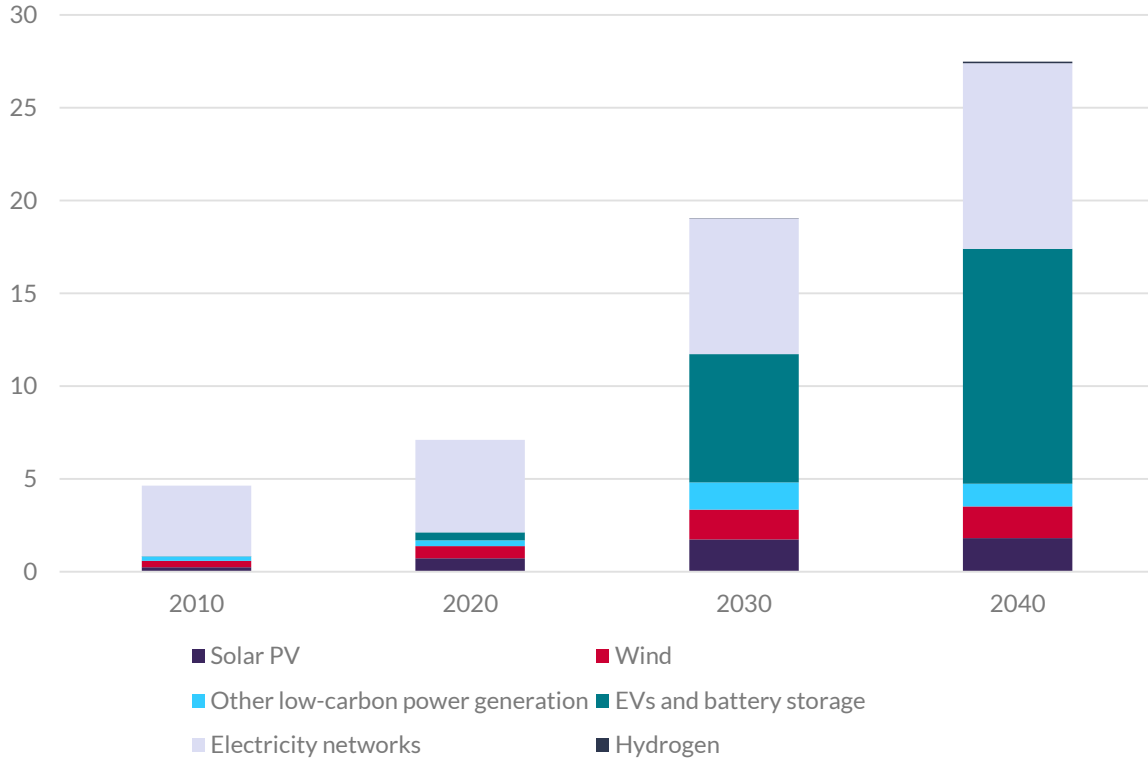
# 2

## Energy Transition Resource & Supply Chain Risks

# Materials Demands Shifting, As Energy Mix Evolves

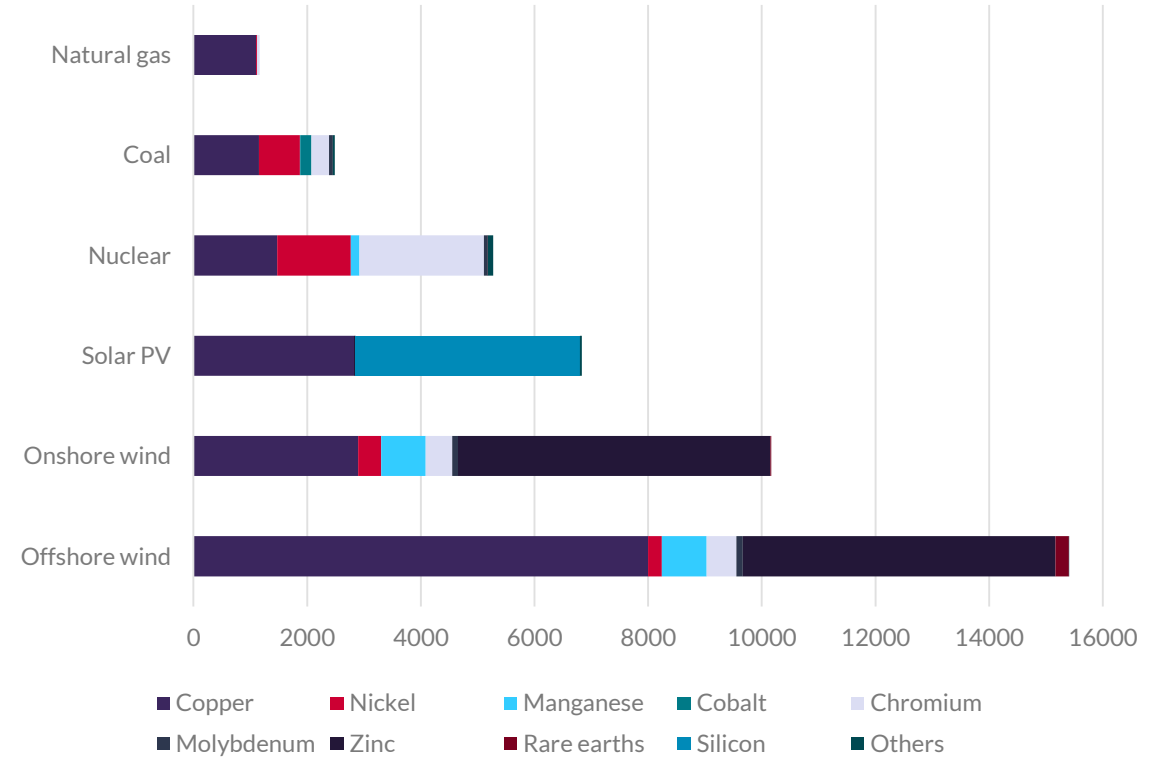
## Critical Minerals At The Crux Of Net Zero

Global - Critical Mineral Demand (Sustainable Development Scenario), mnt



## Renewables Coming At A Heavy Cost To Metals

Global - Critical Mineral Inputs By Fuel Type, kg

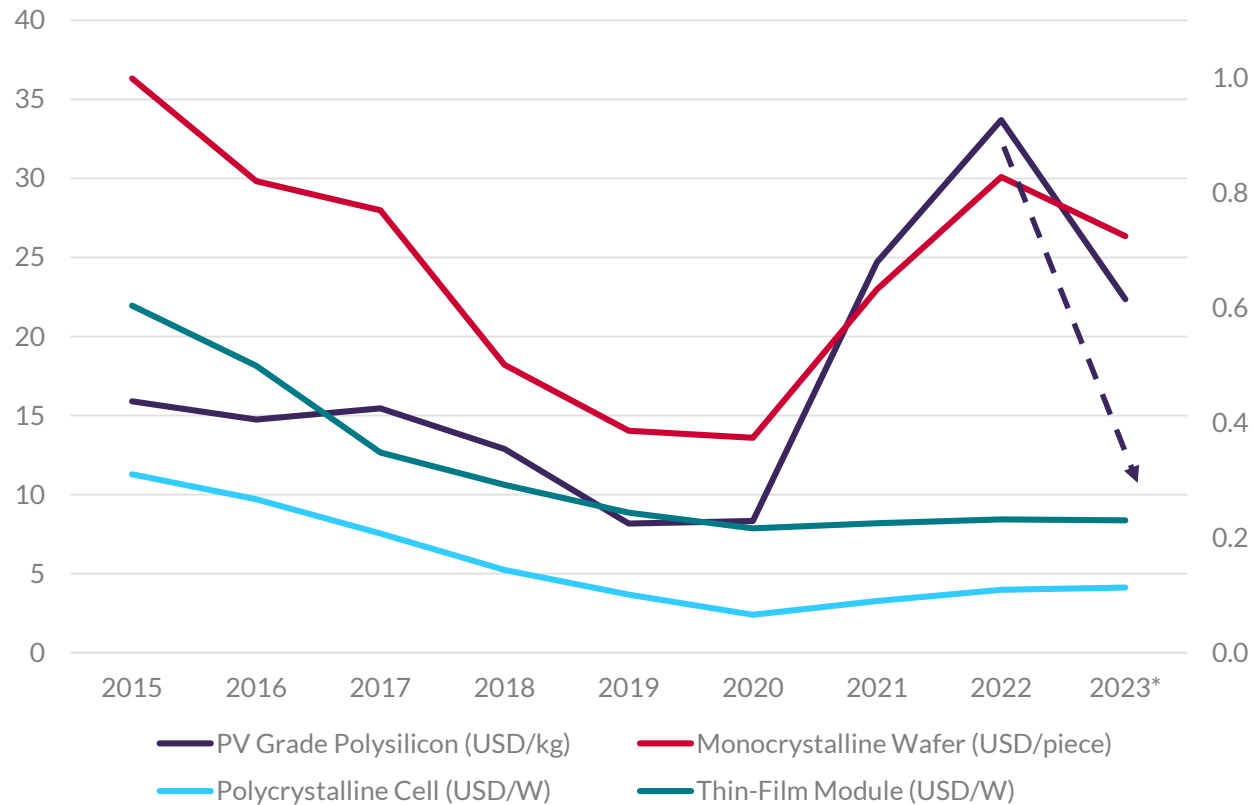


Source: IEA, BMI



# Increase In Polysilicon Prices Spur Shifting Supply Chains

**Elevated Solar Prices Post-2020, To Ease From 2023**  
Global - Solar Equipment Cost by Type, USD/unit



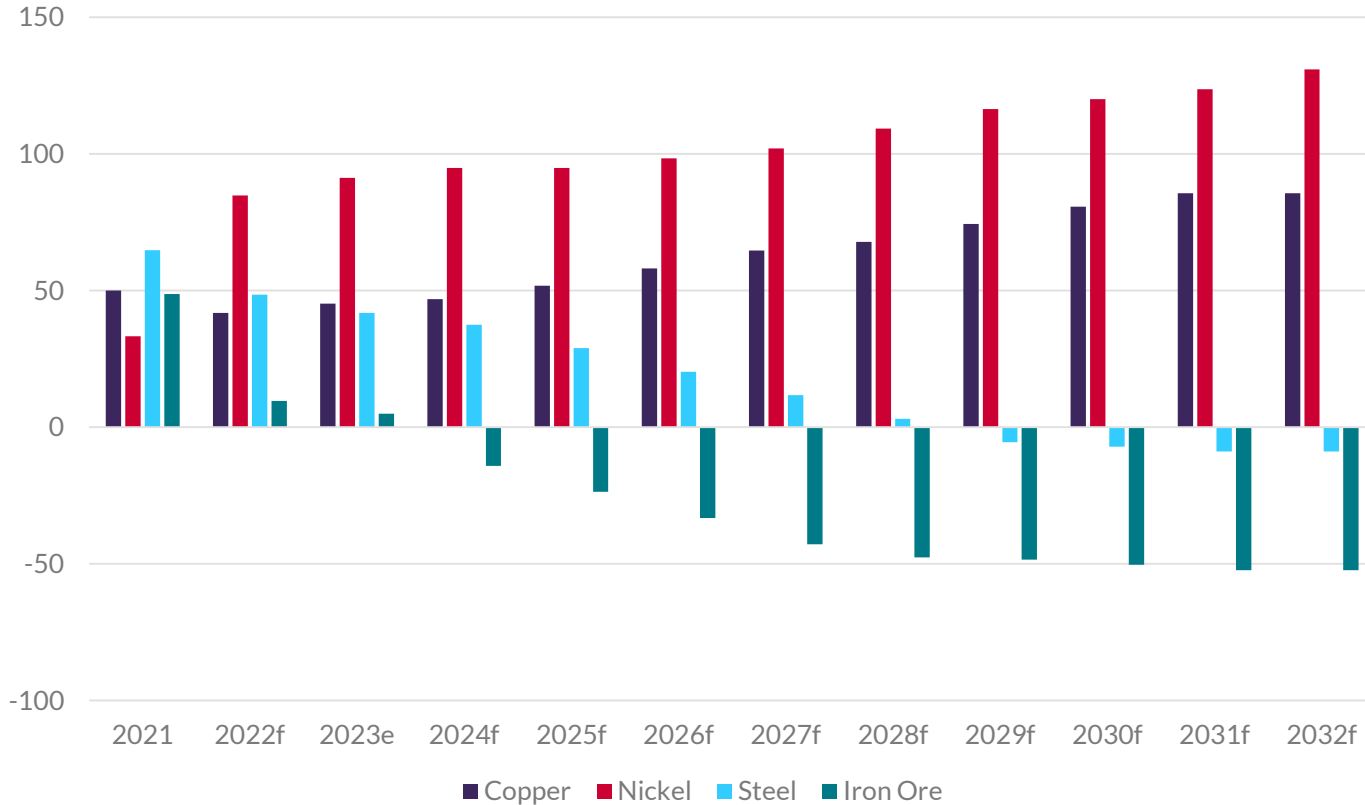
- Over 2021 and 2022, polysilicon prices surged by more than four times.
- Shortfall in domestic production capacity amid supply chain disruptions, hindered sourcing of materials.
- Dependence on Mainland China for solar equipment, further exacerbating the supply situation given fall in manufacturing output from its stringent Covid-19-related lockdowns.
- Reshoring and emergence of new domestic manufacturing will supply solar markets with readily available equipment.

\*up to end-May 2023. Source: Bloomberg, PVinsights, PV InfoLink, Local sources, BMI

# Higher Input Costs Drive Shift In Turbine Competitive Landscape

## Cost Pressures To Remain For Turbine Manufacturers

Global - Metal Price (USD/tonne) Forecast Increase Compared To 2020, %



- Prices for key metals used in wind turbine construction such as copper and steel have surged compared to 2020 levels.
- Steel prices expected to ease over the near term, copper and nickel will remain elevated long term.
- Wind development costs exposed to commodity price volatility due to high metals usage in turbines and other project components.
- Higher commodity prices will drive upward pressures on wind manufacturing costs and capital expenditures.

Source: Bloomberg, IRENA, IEEFA, BMI



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# Policy Making & Clean Hydrogen



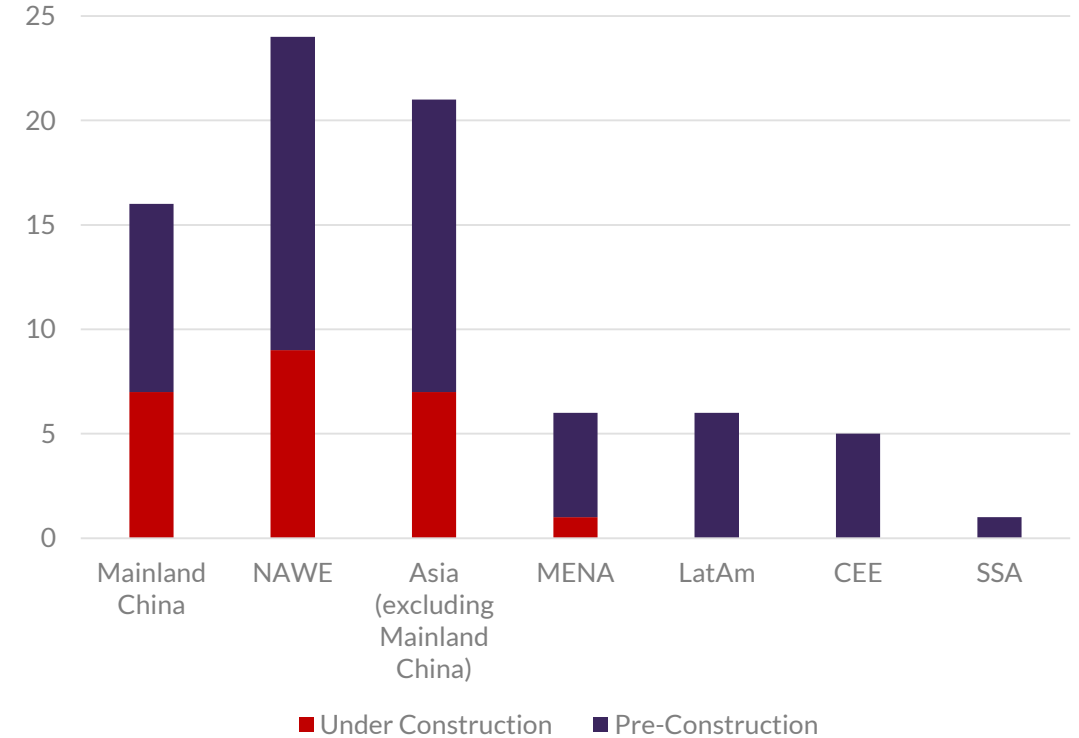


# Policy Landscape To Fragment Global Low-Carbon Industry

- Rise in support and regulation for the energy transition, spurring new policies and subsidies across global market.
  - US – Inflation reduction act
  - EU – The Green Deal Industrial Plan
- Fragmented approach creates challenges for achieving long-term 2050 goals
  - Winners: Markets with ability to support with lucrative subsidies
  - Losers: Limited access to capital, unable to transition thermal generation
- Collaboration of geopolitical ‘partners’ is fundamental to enabling an equitable energy transition

## Markets To Shake A Heavy Reliance On China

Global - Number Of Renewables Equipment Manufacturing Facilities By Region & Status, 2023

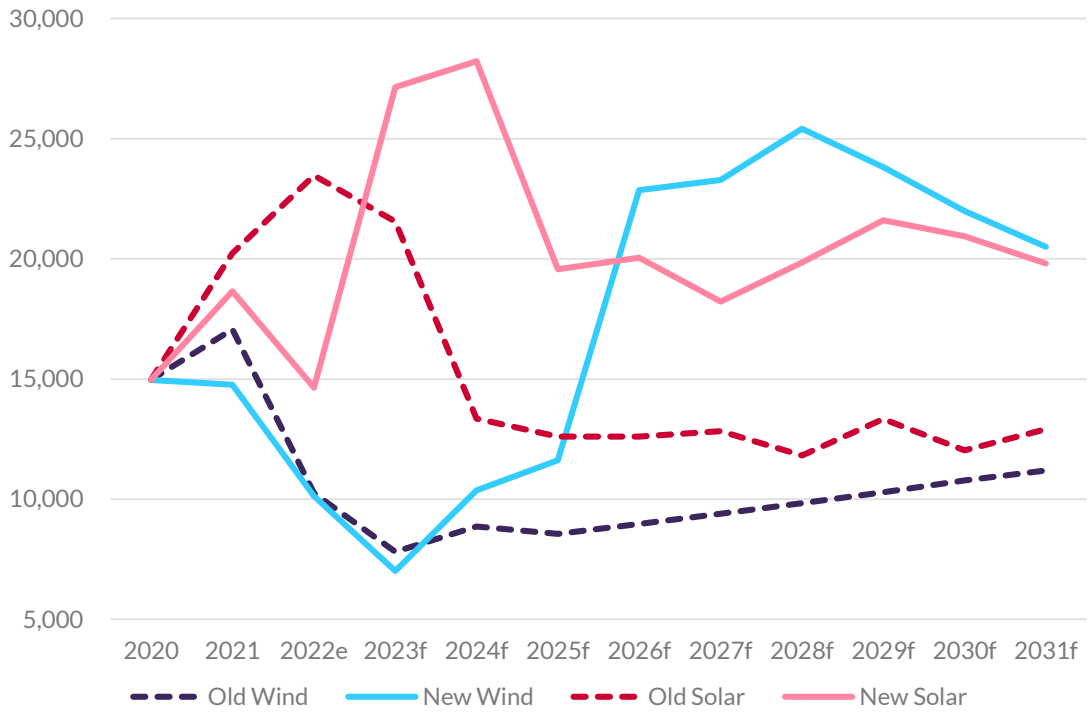


Source: Fitch Solutions Key Projects Database

# Impacts Of Subsidies & Regulation Clearly Visible In Sector Growth With Varying Degrees Of Success

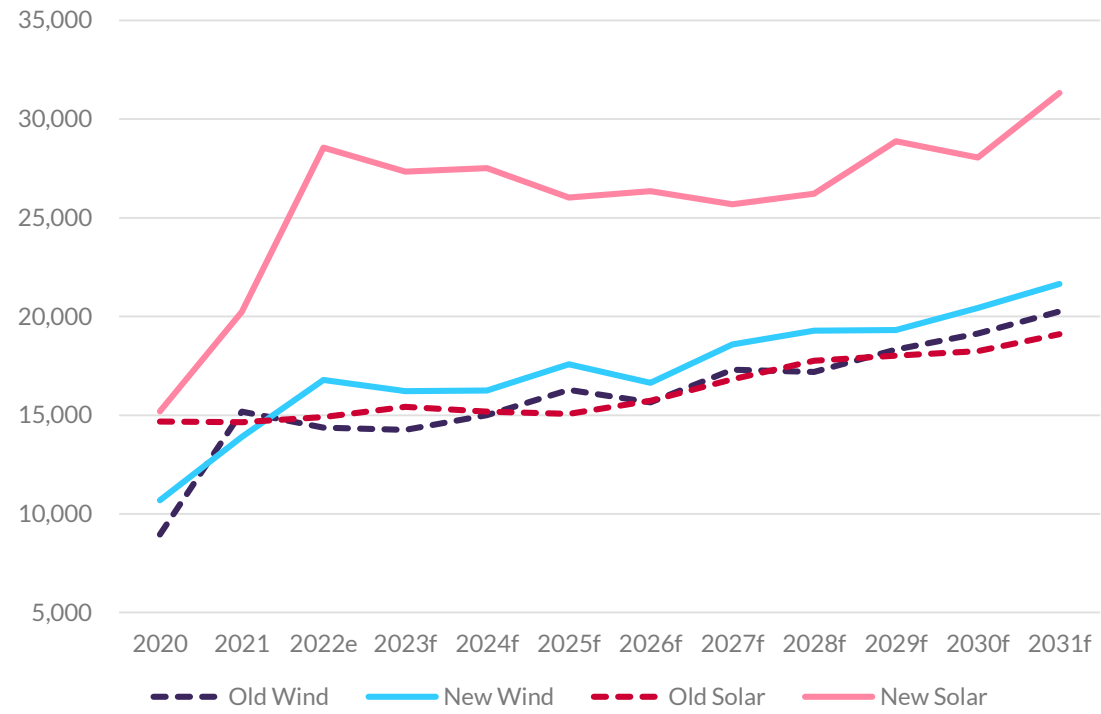
## Renewables Deployment Accelerating Amid IRA Launch

North America - Annual Capacity Growth Change Between Old (Q222) & New (Q223) Forecast, MW



## EU Wind Sector Faces Lingering Headwinds

Western Europe - Annual Capacity Growth Change Between Old (Q222) & New (Q223) Forecast, MW



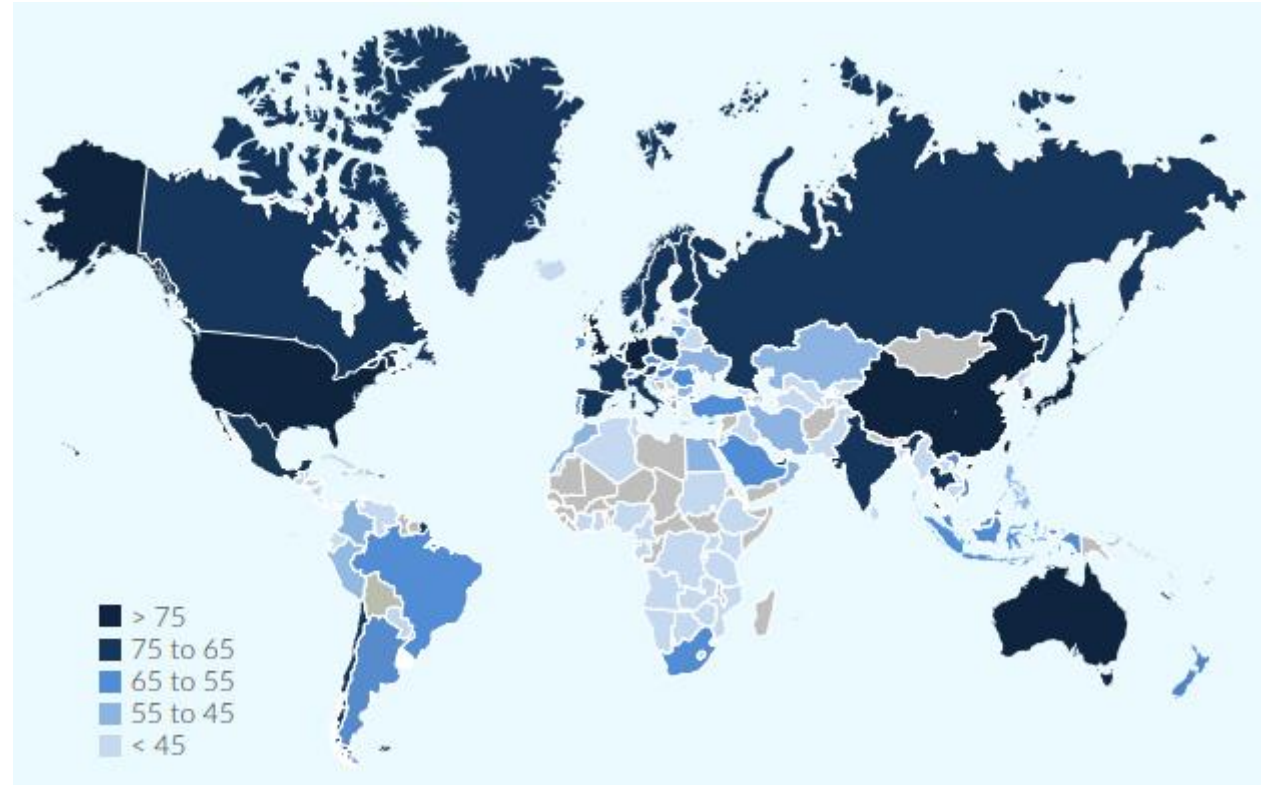
e/f = BMI estimate/forecast. Source EIA, IRENA, Local sources, BMI

# Green Hydrogen Policies To Drive Development of Industry

- Markets increasingly incorporating green hydrogen in energy targets.
- Hydrogen policies and subsidies to boost industry
  - US - Inflation Reduction Act (IRA)
  - EU - European Hydrogen Bank.
  - Canada - Clean Hydrogen Investment Tax Credit
  - Australia - Hydrogen Head Start program
  - India Green Hydrogen Transition (SIGHT) programme
- We expect that green hydrogen will reach cost parity with fossil fuel-based hydrogen by 2030, or sooner.

## North America & Western Europe Leading Green Hydrogen Sector Attractiveness

Global - Green Hydrogen Suitability Index\*



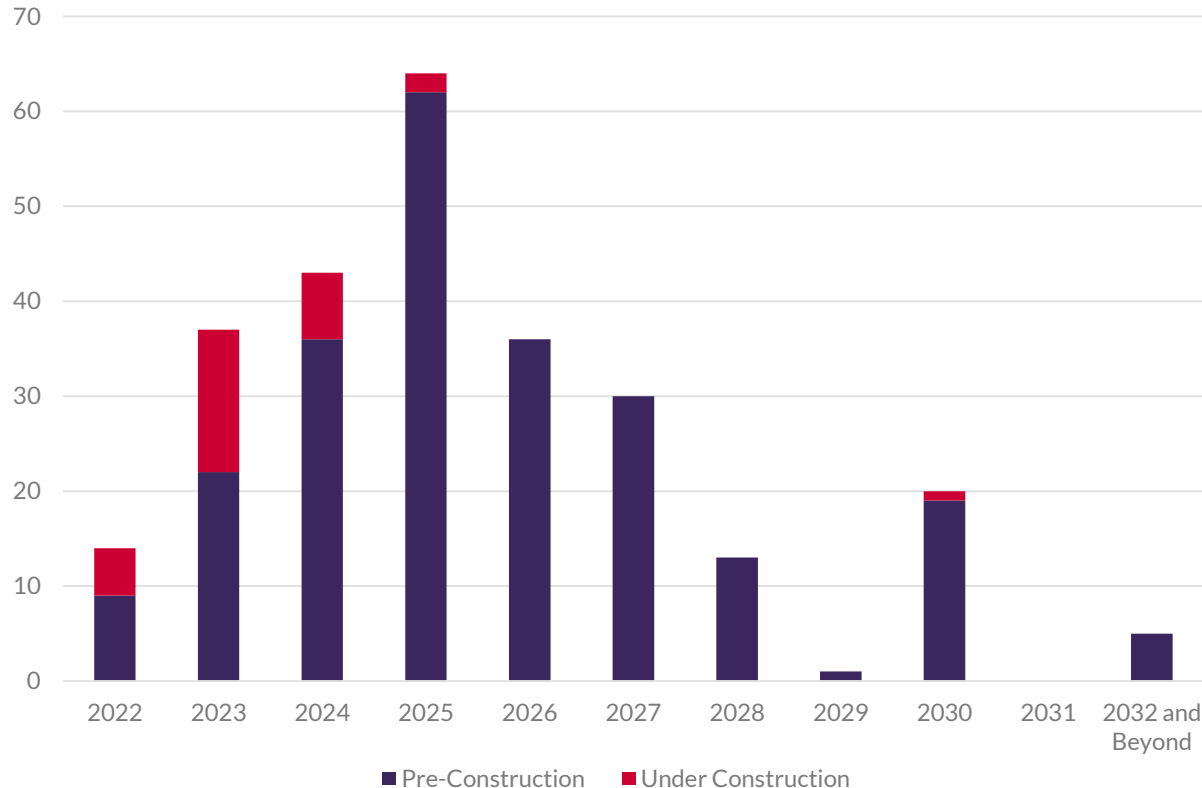
\*scores out of 100; higher score = more attractive market. Source: BMI Hydrogen Suitability Index



# Hydrogen Pipeline Largely In Pre-Construction Stages

## Projects Slow To Move To Construction

Global - Number of Hydrogen Projects By Status & Planned Completion (2022-2032)



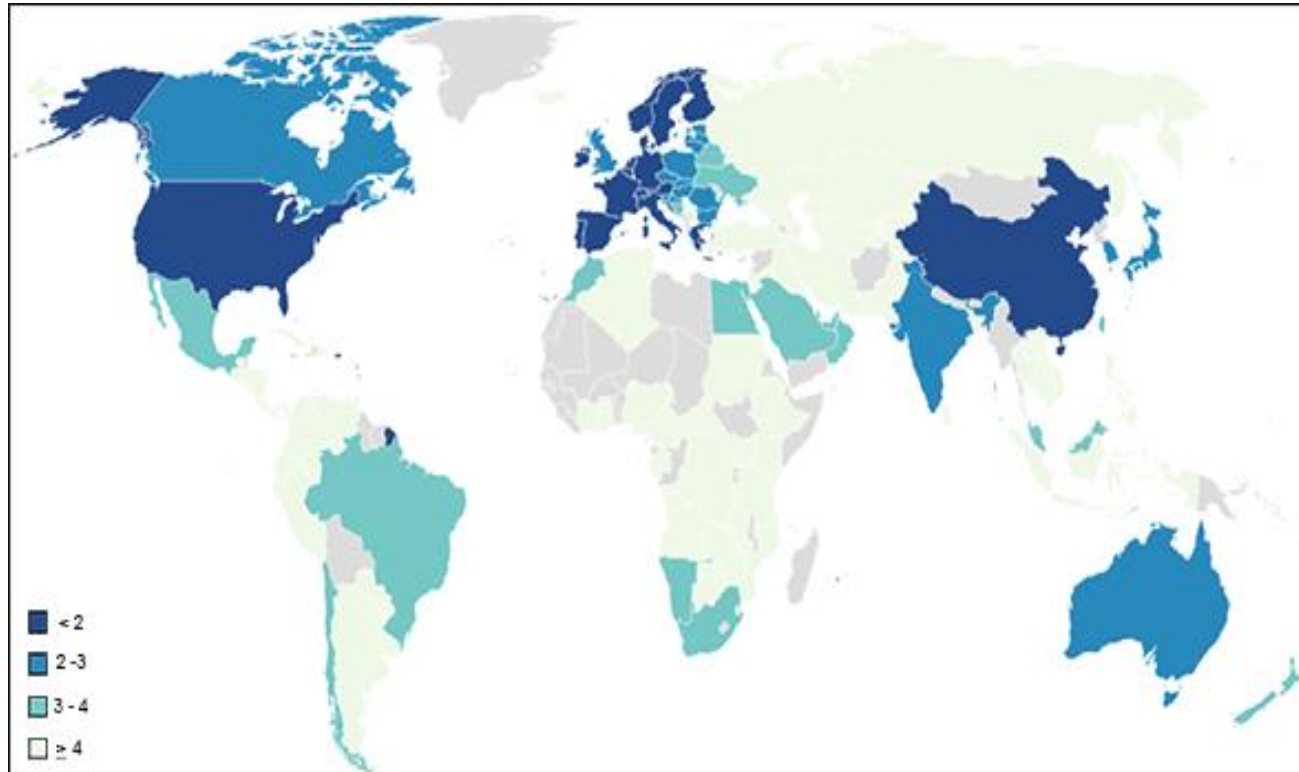
- Despite growth uptake in 2023, projects face challenges moving to construction stages.
- Large multi-billion dollar projects facing financing burdens and risks with export hurdles.
- Far more small-scale projects in Europe at early stages showing a more considered development with an emphasis on reducing risks, financing burden and proving project success.

Source: BMI Infrastructure Key Projects Data

# However, Policies Will Polarise The Global Hydrogen Industry

## Green Hydrogen Subsidies To Create Four-Tiered Market

Global - Green Hydrogen Industry By Tier , USD & MW



- Large difference in the subsidies, demand, manufacturing and production capacities
- Variations to result in four-tiered global hydrogen industry
  - Tier one: “Influencers”
  - Tier two: “Reactors”
  - Tier three: “Observers”
  - Tier four: “Others”

Source: National sources, BMI



# 4

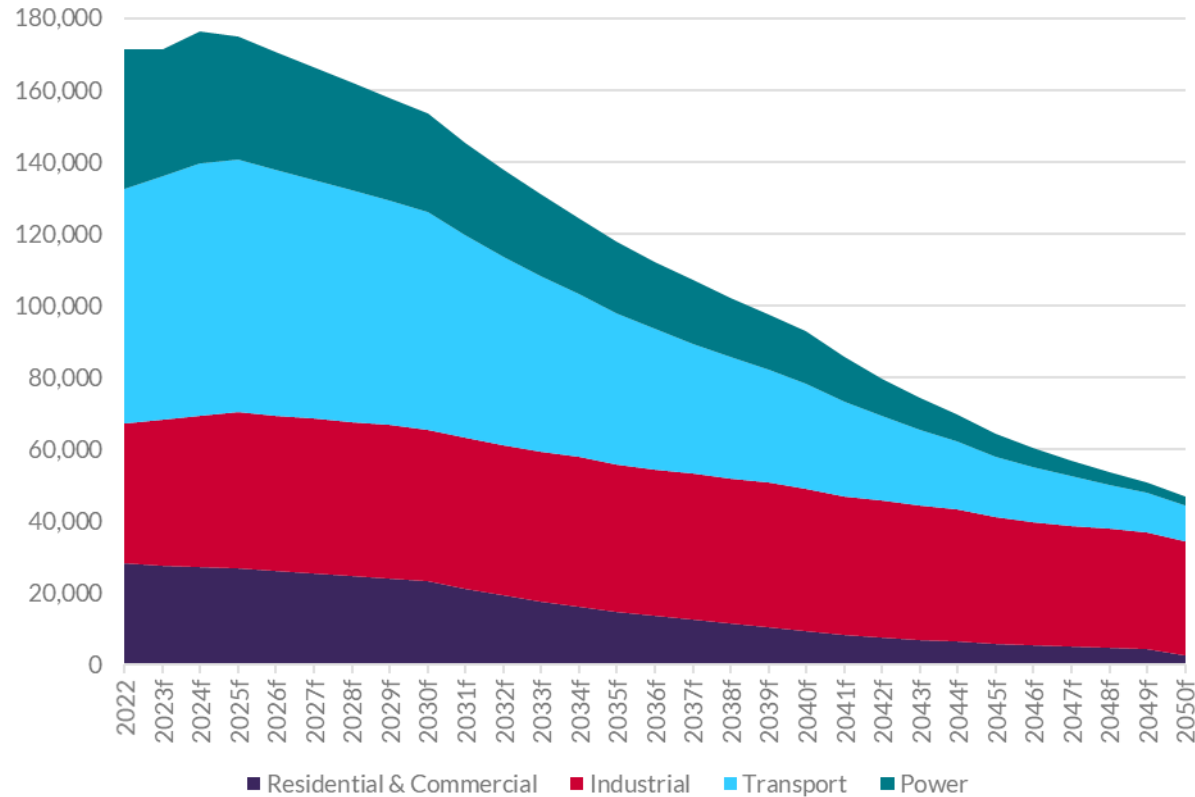
## Global O&G Outlook



# O&G Sector Far Adrift Of Paris Agreement Alignment

## Net-Zero Pathway Signals Deep Declines For O&G

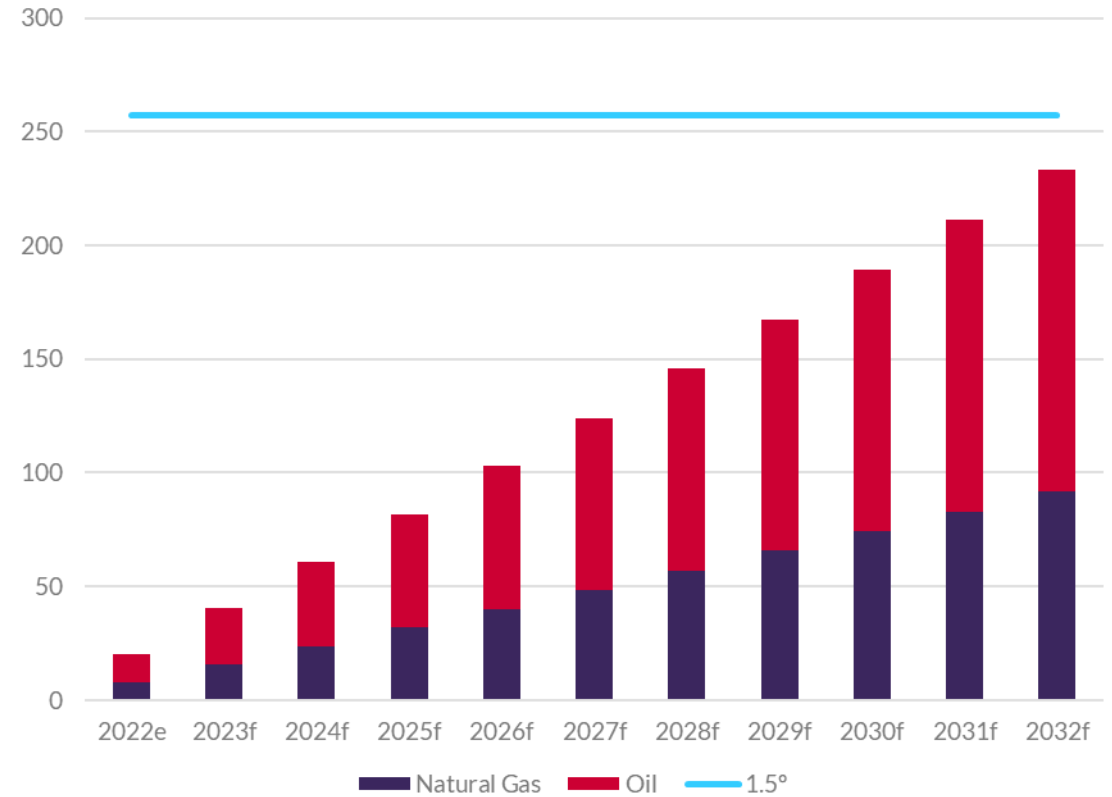
Global – Net-Zero 2050 Scenario For O&G Demand By Sector, '000boe/d



f = BMI forecast. Source: BMI

## Carbon Budgets Being Rapidly Exhausted

Global – O&G Sector Carbon Emissions & 1.5C Carbon Budget, GtCO2



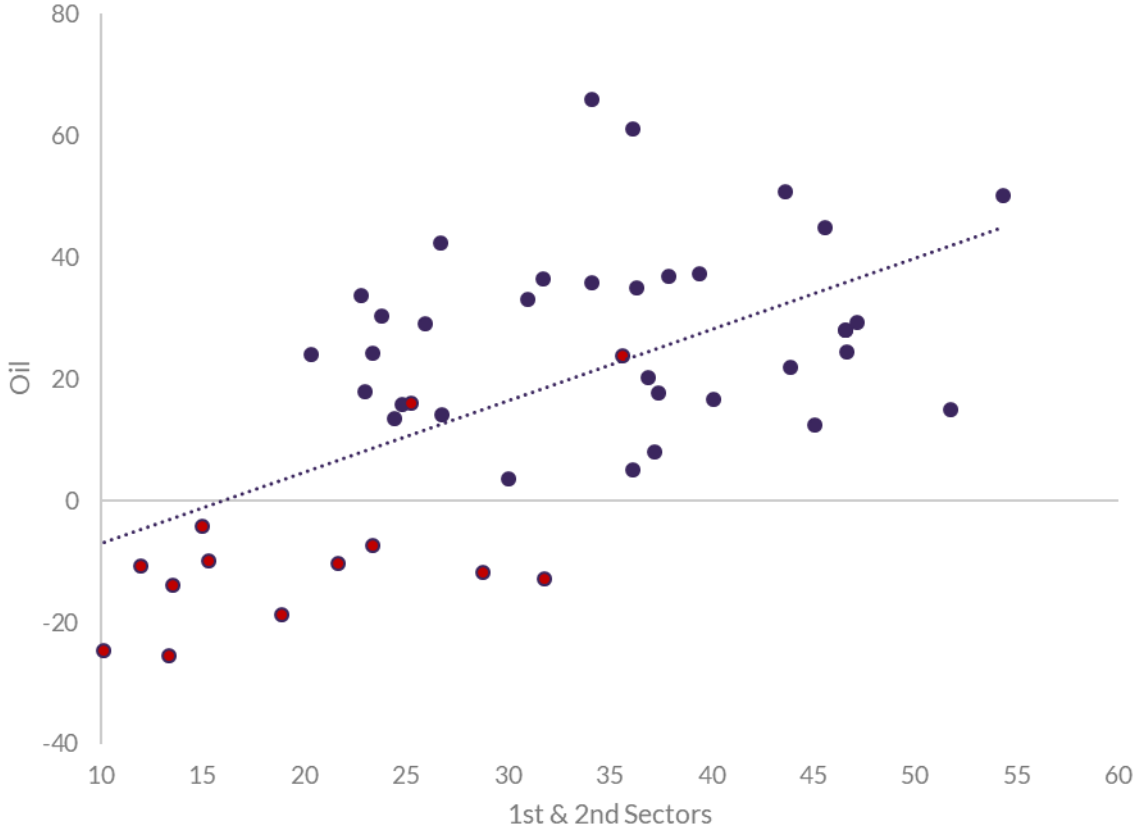
f = BMI forecast. Source: BMI



# Economic, Demographic Trends Driving EM Energy Needs

## EMs Struggling To Decouple Economic Growth From Emissions

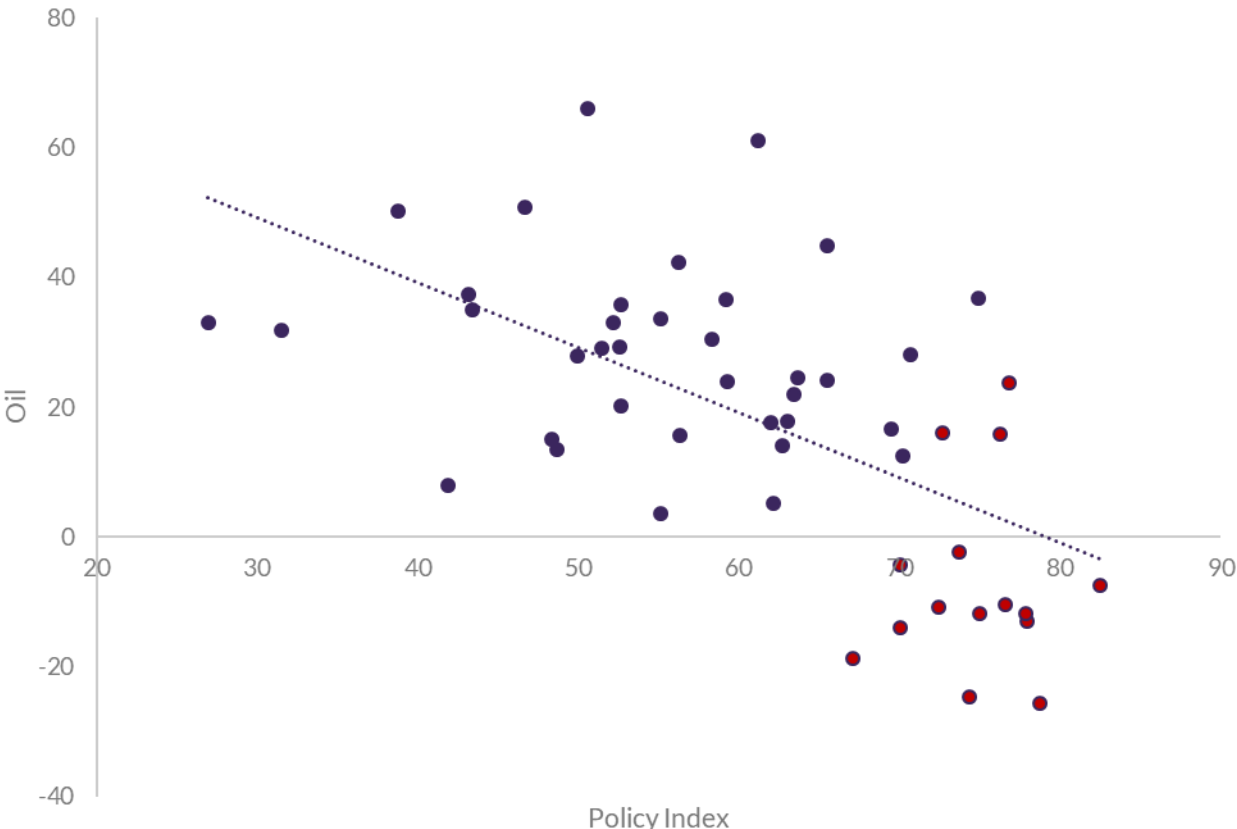
Global – Share Of Primary & Secondary Sectors In Total GDP, 2023f, And Growth In Oil Demand, 2023f-2032f, %



Red dot = DM; blue dot = EM. f = BMI forecast. Source: BMI

## Energy Transformation Requires A Strong Policy Backdrop

Global – Country Risk Index\*, 2023f, And Growth In Oil Demand, 2023f-2032f, %

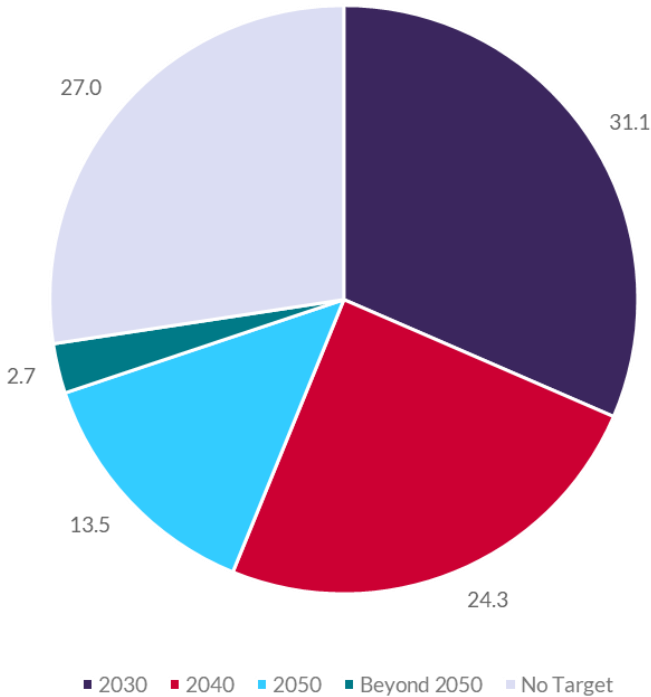


\*scores out of 100; higher score = more attractive market. Red dot = DM; blue dot = EM. f = BMI forecast. Source: BMI

# Government Support Crucial To Attaining Net-Zero Ambitions

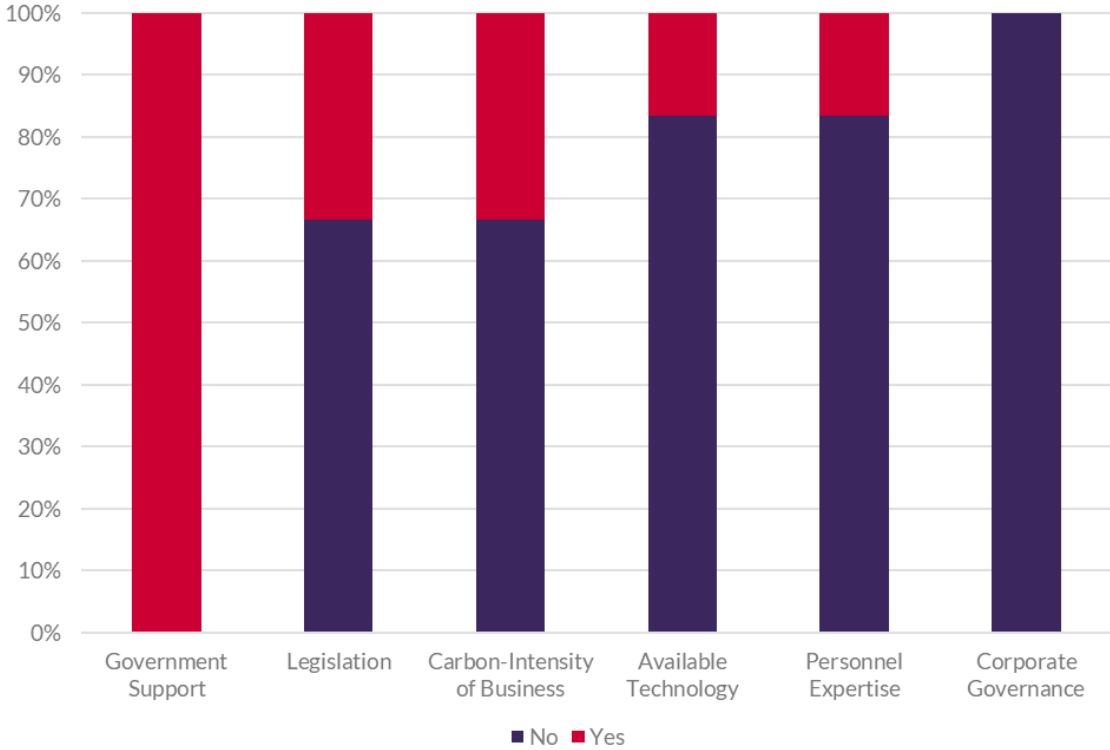
## Energy Companies Ramping Up Their Climate Commitments

Megatrends Survey – Energy & Utilities Companies, Net-Zero Targets, % Respondents



## Policy Evolution Progressing Too Slowly

Megatrends Survey – Energy & Utilities Companies, Obstacles To Achieving Net-Zero Targets, % Respondents

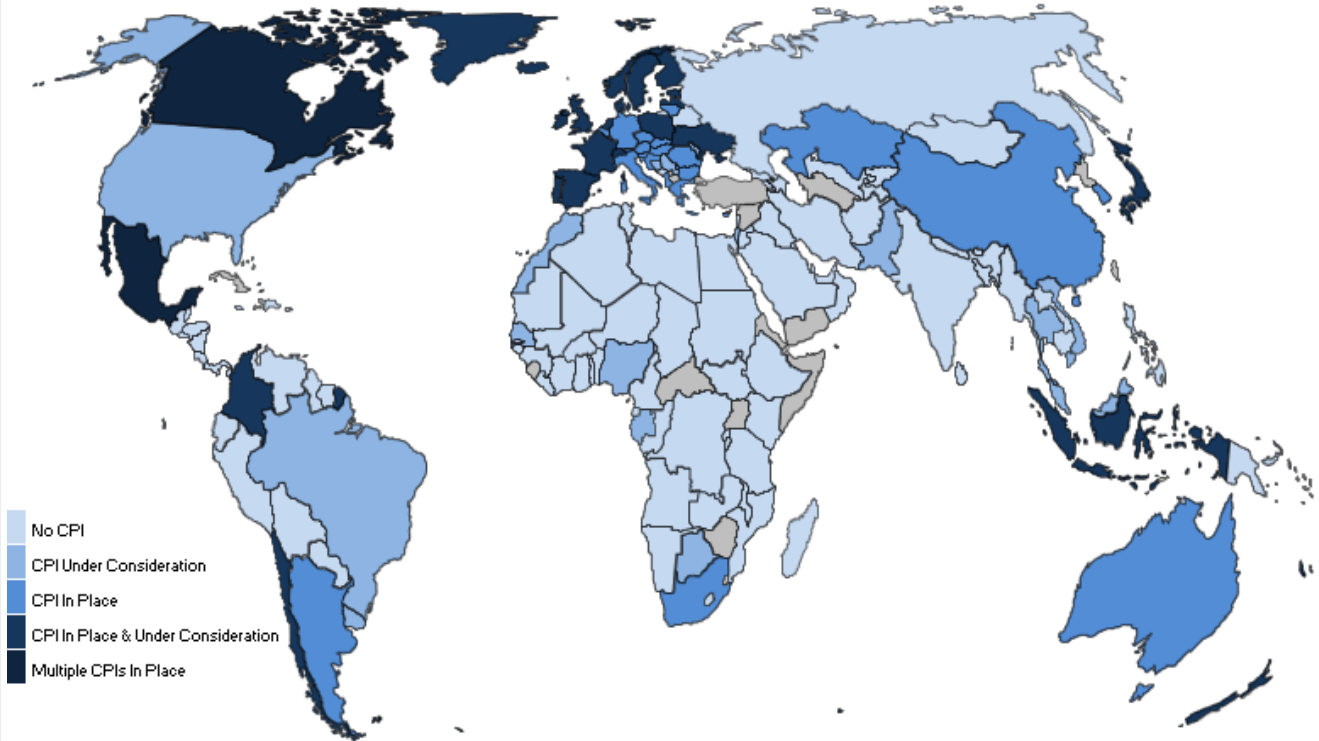


Note: the BMI Megatrend Survey is a B2B survey conducted in March 2023 and assesses the responses of 1,000 respondents across the UK, US, India, Brazil and South Africa. Source: BMI Megatrends Survey

# Carbon Market Reforms Spurring Deeper Decarbonisation

## CPIs Spreading, But Market Designs In Dire Need Of Improvement

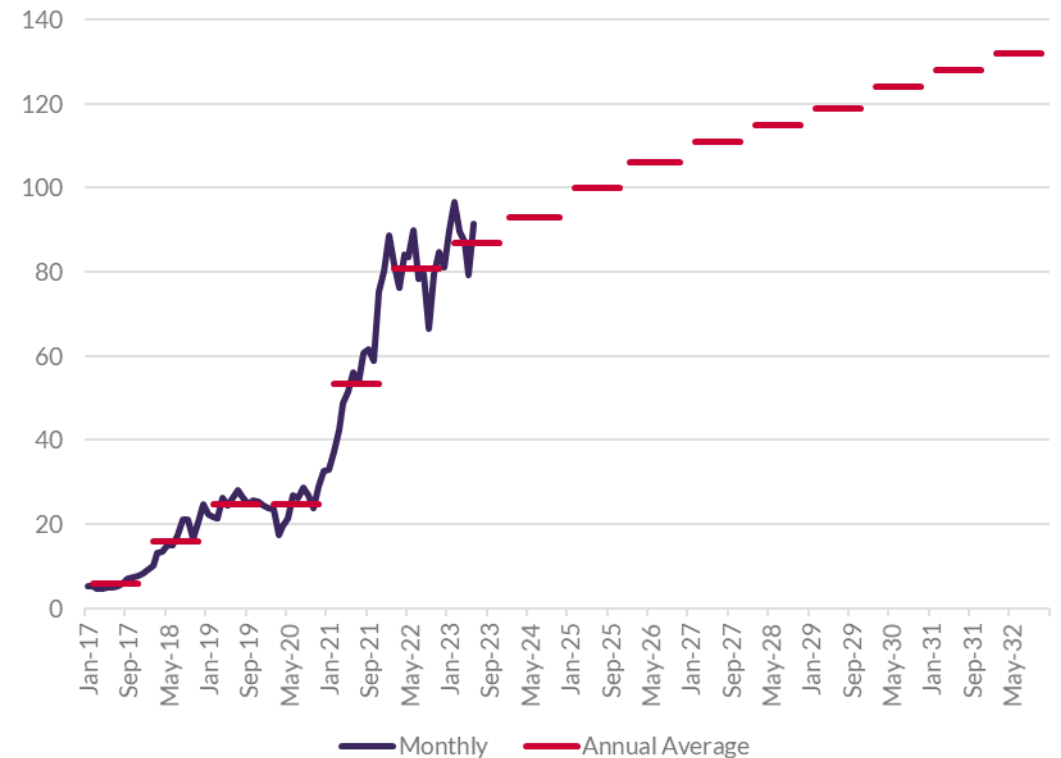
Global - Carbon Pricing Instruments In Place & Under Development



Source: BMI, World Bank

## Europe Setting The Pace For Global Carbon Pricing

EU - EUA Monthly And Annual Average Prices\*, EUR, tCO2e

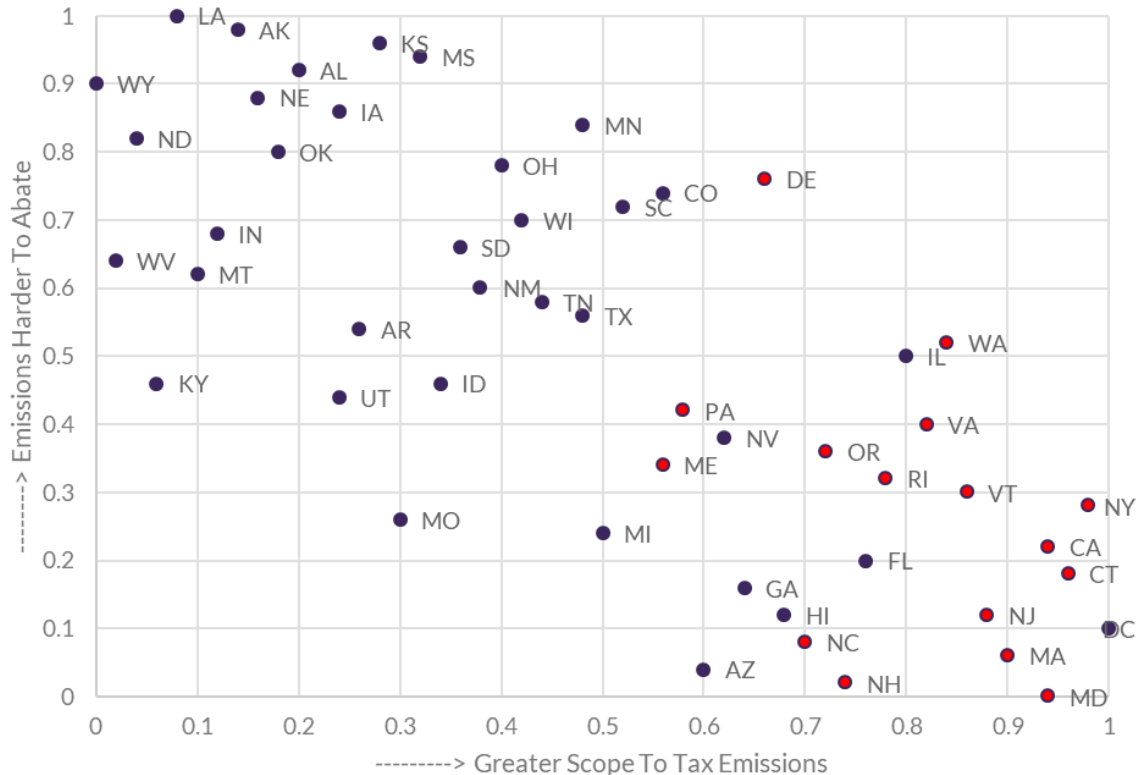


\*2023-2032 = BMI forecast. Source: Macrobond, BMI

# Partisan Climate Policies, Vested Interests Stunting Progress

## Emissions-Intensive Economies Slow To Act

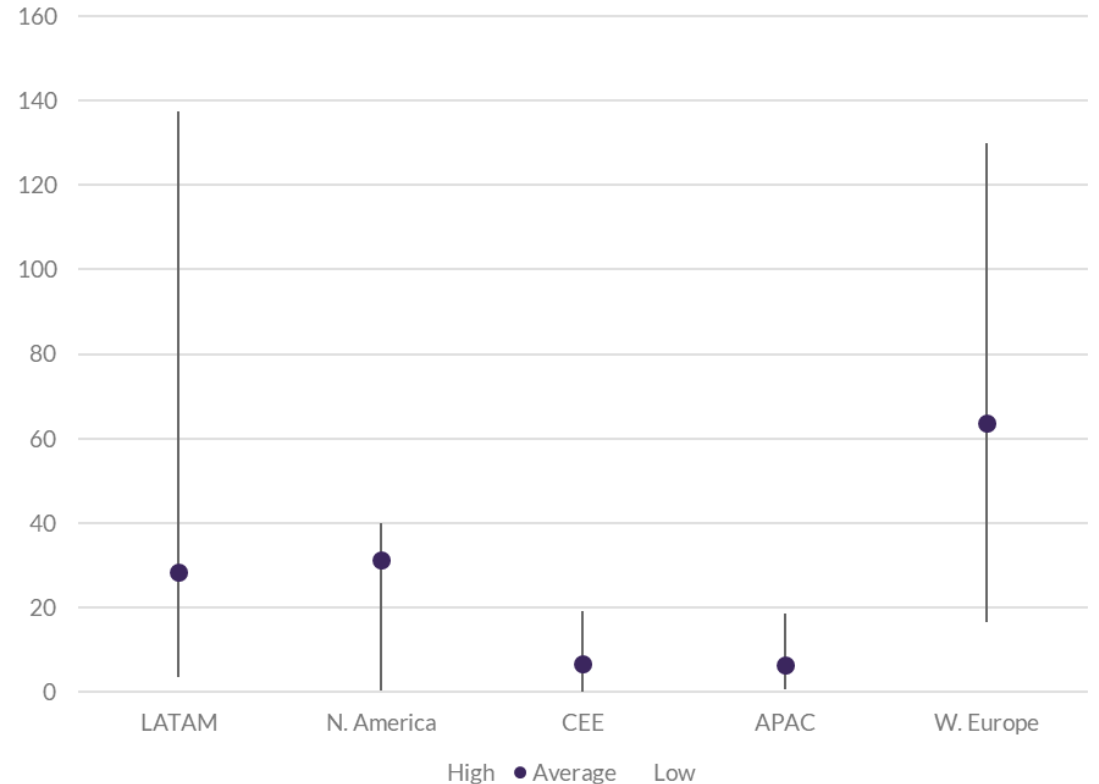
US - Ease Of Emissions Abatement Vs. Willingness & Ability To Abate Them By State\*



\*percentile rank; red dots = carbon pricing scheme in place or under development. Source: US Energy Information Administration, BMI

## Fossil-Fuel Exporters Dragging Their Feet On Reform

Global - Carbon Prices By Region, 2022, USD/tCO2e



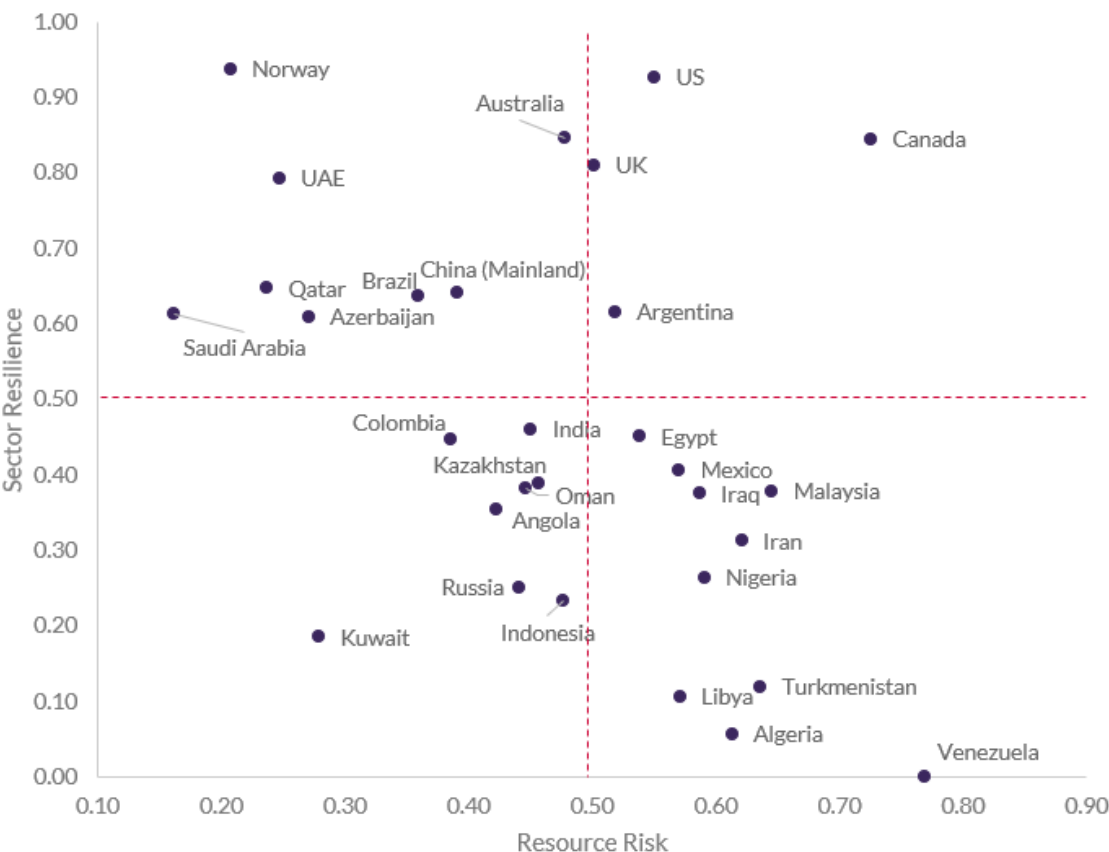
Source: World Bank, BMI



# Energy Transition Exposures Widely Varied

## Investment Risks Rising Among Heavy Emitters

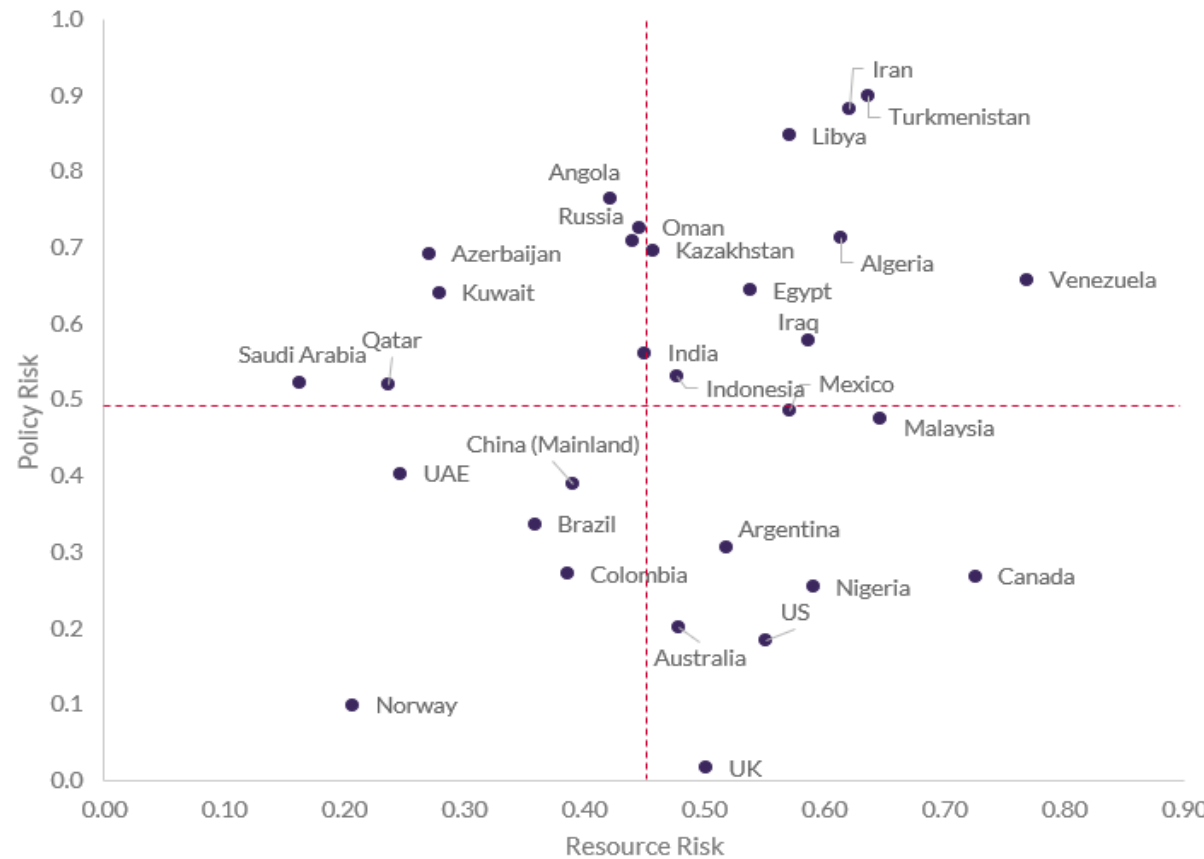
Global Upstream O&G Sector – Energy Transition Risk Index



Source: BMI

## Weak Climate Policies Threaten Market Access

Global Upstream O&G Sector – Energy Transition Risk Index

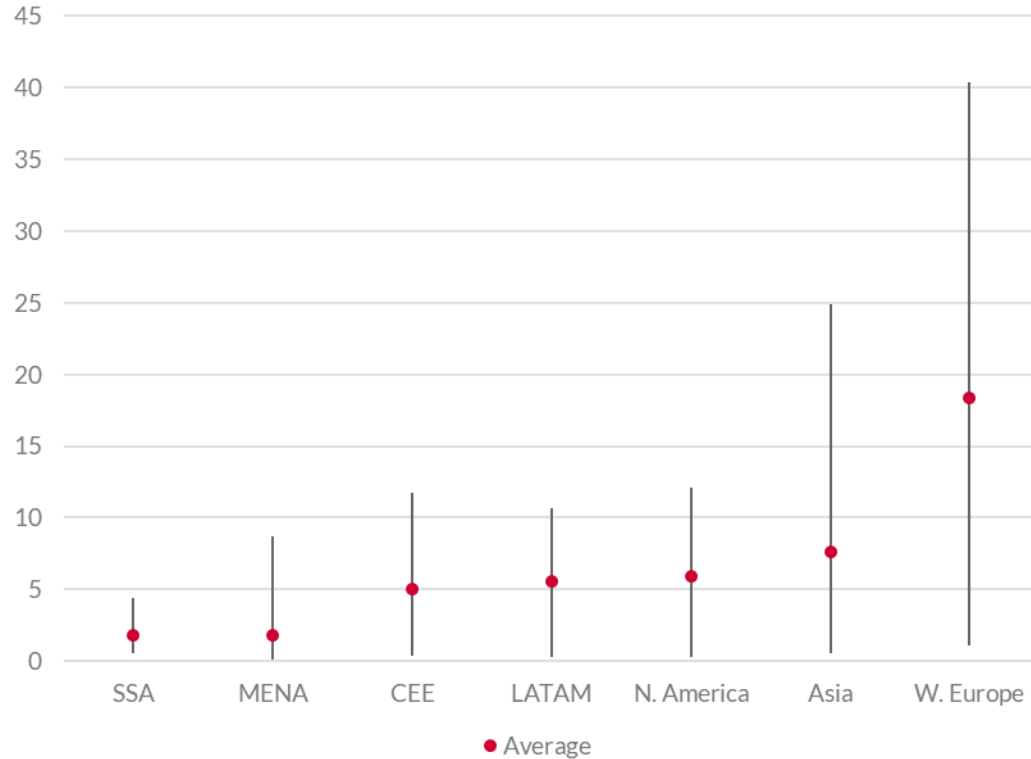


Source: BMI

# Credible Transition Strategies Generally Lacking

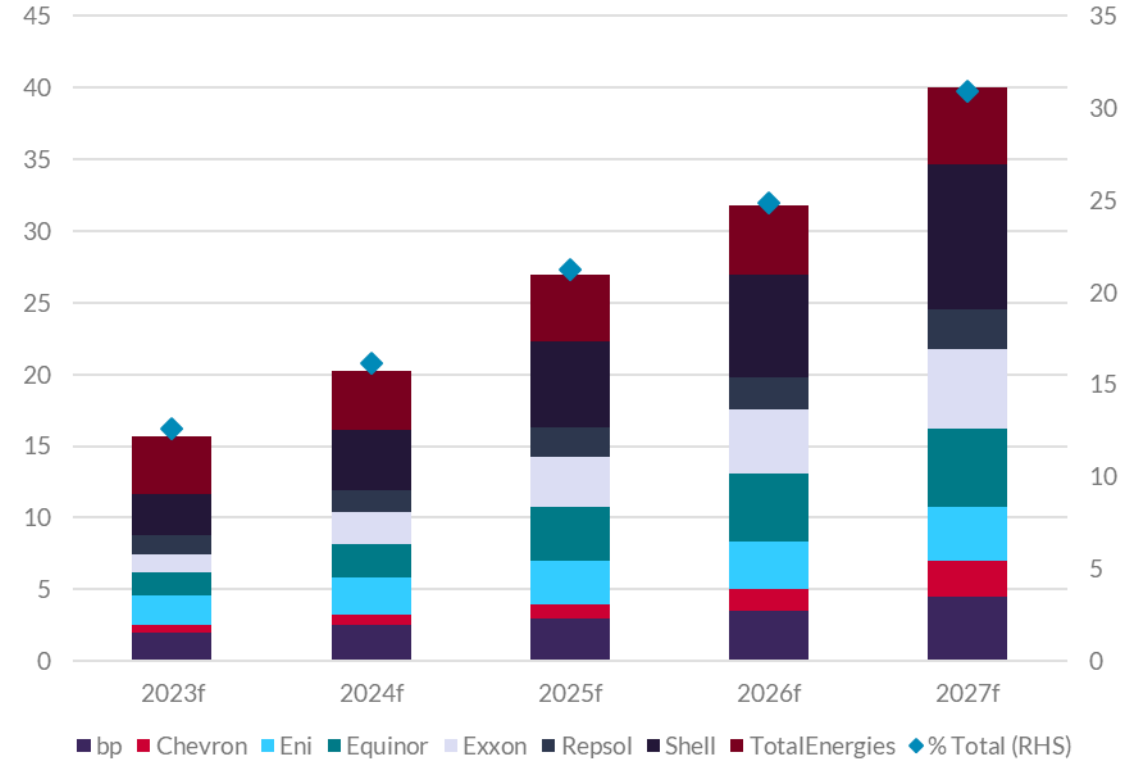
## NOCs Lagging In Climate Action

Global- High, Average & Low-Carbon Transition Scores\* For O&G Companies



## Majors Chasing Diversified Revenue Streams

O&G Majors - Low-Carbon Investments, USDbn, And % Total Capex



\*scores out of 60; higher score = greater Paris Agreement alignment. Source: World Benchmarking Alliance, BMI

f = BMI forecast. Source: Company data, Bloomberg, BMI



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Q&A

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# Towards 2050: Industry And Geopolitical Megatrends

**08**  
AUG

MEGATRENDS FOR FOOD & DRINK

**23**  
AUG

MEGATRENDS FOR TECHNOLOGY

**10**  
AUG

MEGATRENDS FOR GEOPOLITICAL RISK

**06**  
SEPT

MEGATRENDS FOR PHARMA  
& HEALTHCARE

**15**  
AUG

MEGATRENDS FOR ENERGY





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