

# Dr. Ali Izadi-Najafabadi

Head of APAC, Bloomberg NEF

Join Dr. Ali to explore the global energy transition. Gain data-driven insights on markets, technologies, and policy, and learn how businesses can navigate risks, seize opportunities, and lead in a low-carbon economy.



Moderated by:

**Dr. Gary Theseira**

Chair of the Council, CGM



Co-Moderated by:

**Wong Seng Kee (SK)**

Council Member, CGM



## The State of Energy Transition

Climate Governance Malaysia's  
Global Summit 2025

Dr. Ali Izadi, Head of Asia-Pacific

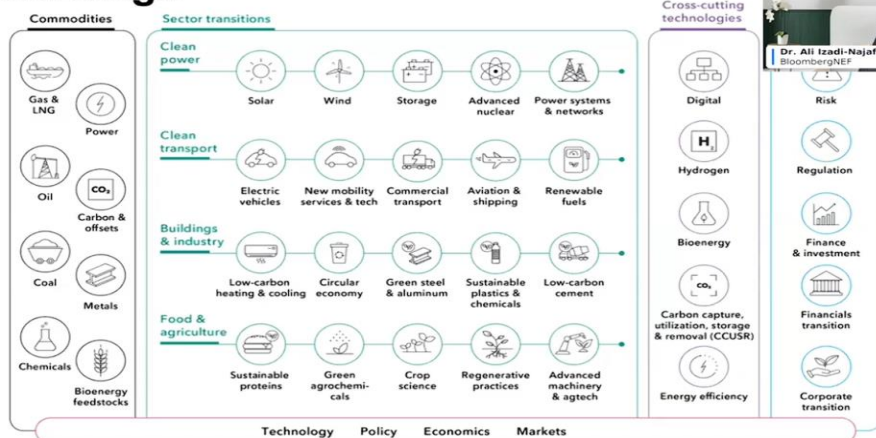
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September 29, 2025



BloombergNEF

## BNEF coverage



- **Where are we at today?**
- **Where are we heading?**
- **Where do we want to arrive at in 2050?**

Source: Alamy



## Global energy transition investment exceeded \$2 trillion for the first time in 2024

Global investment in energy transition, by sector



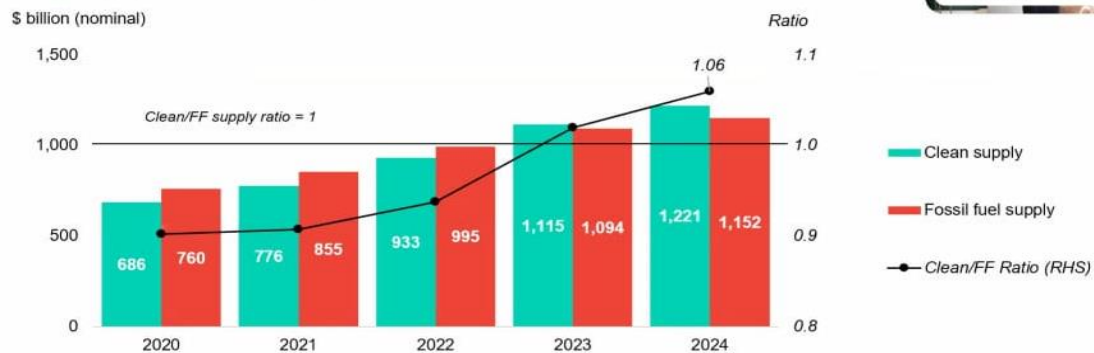
Source: BloombergNEF. Note: Start years differ by sector but all sectors are present from 2020 onward. Most notably, nuclear figures start in 2015 and power grids in 2020. CCS refers to carbon capture and storage.

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## Clean energy relative to fossil fuel energy supply investment ratio hits 1.1

Energy supply: investment comparison



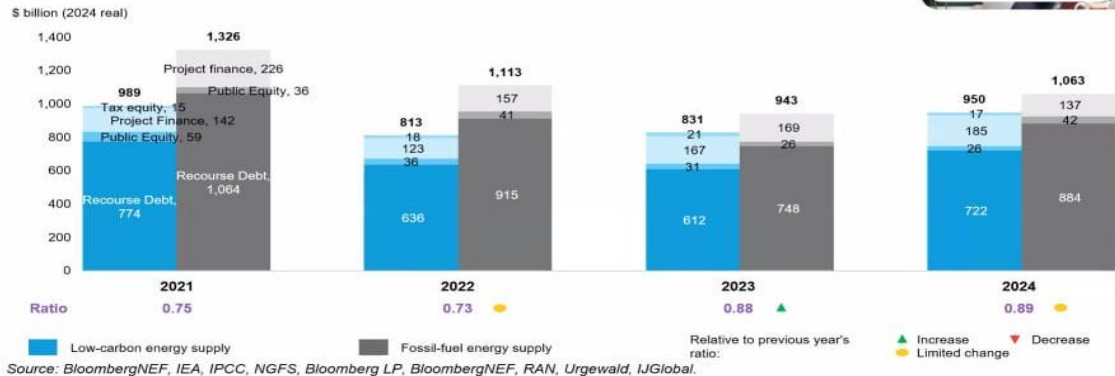
Source: BloombergNEF, Bloomberg Intelligence, IEA. Note: FF stands for fossil fuels. RHS stands for right hand side. Dollar values have been adjusted to nominal terms.

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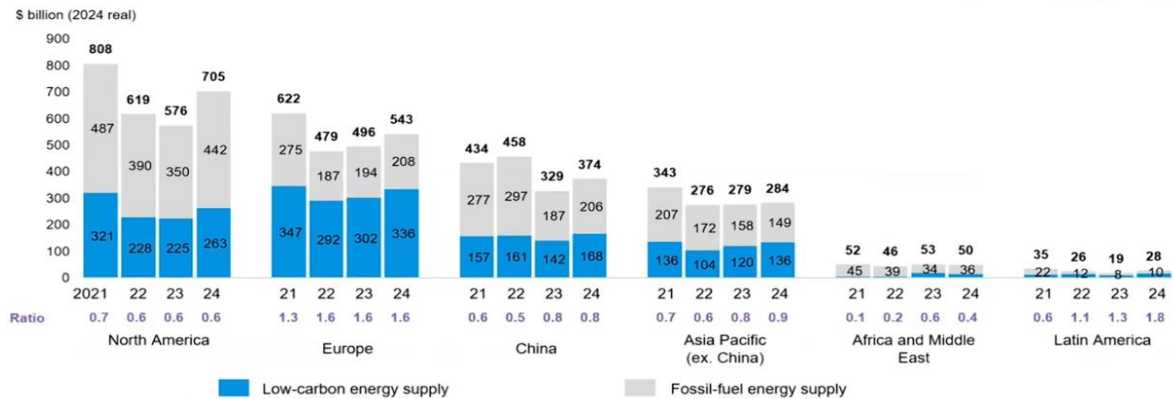
## Banks continue to finance fossil fuel projects

### Global energy supply investment versus energy supply financing, 2021-24



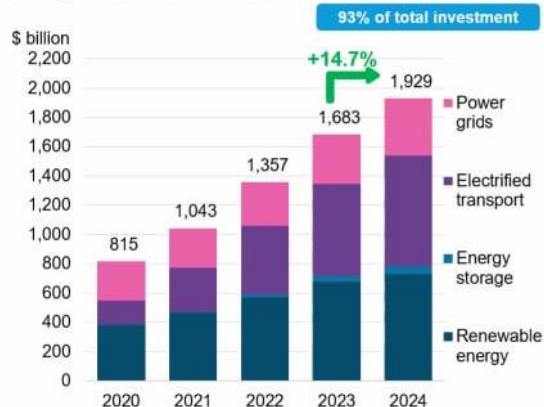
## Banks headquartered in Asia continue to provide more support to fossil fuels than renewables

### Energy supply financing by bank headquarters, 2021-24

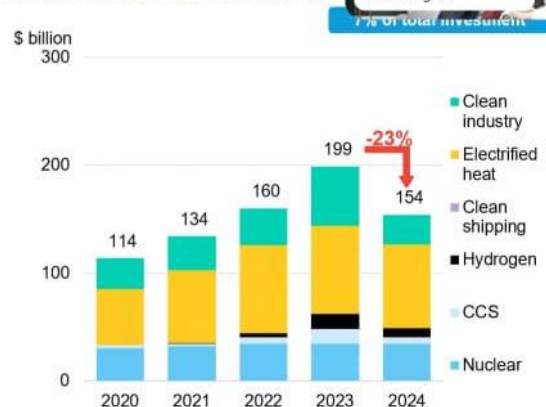


## Energy transition investment trends are diverging by sector maturity

### Energy transition investment trends: "mature" sectors



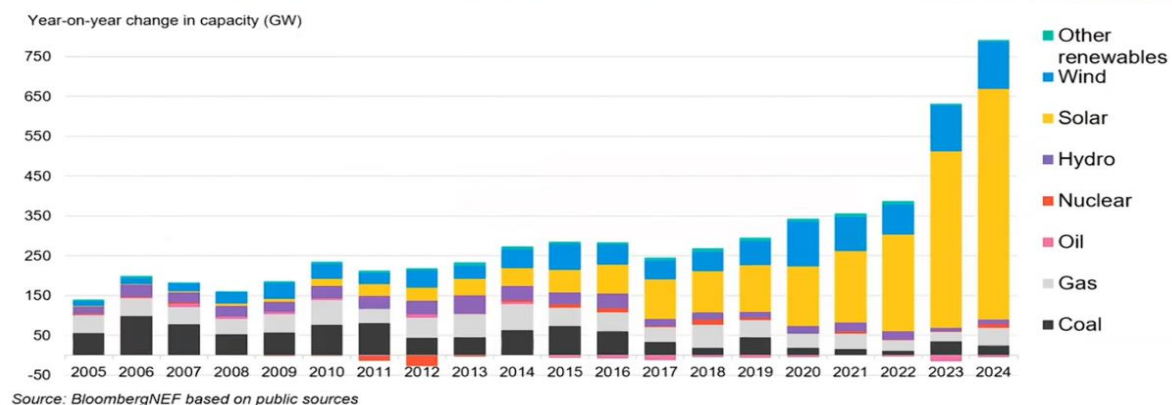
### Energy transition investment trends: "emerging" sectors





## Most power capacity added since 2012 came from renewables

### Year-on-year net change in global power capacity by technology

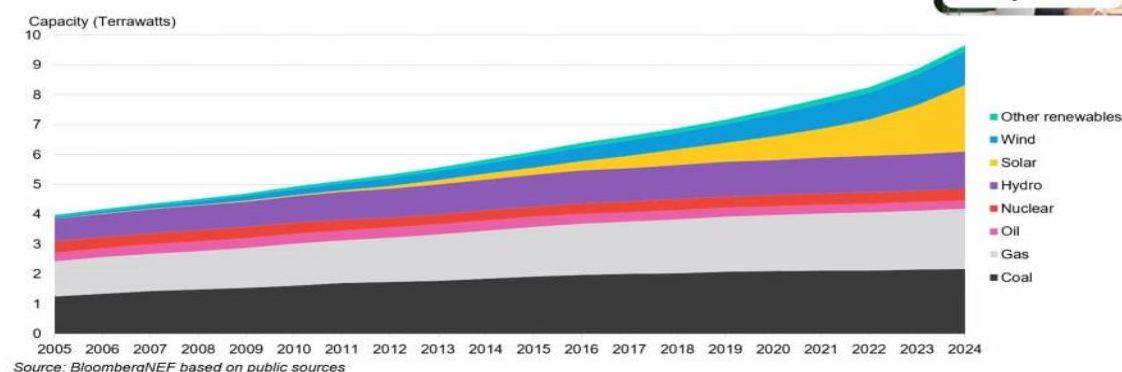


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## More solar than coal capacity is now installed globally

### Global cumulative installed capacity

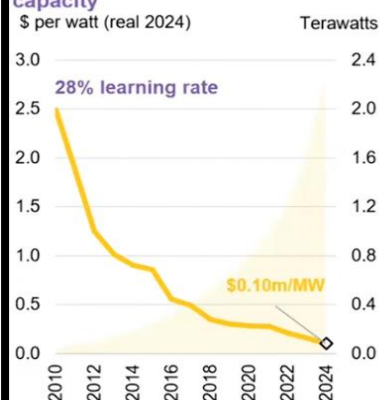


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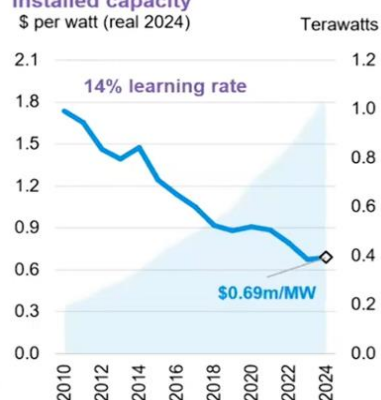
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## Solar, batteries and wind turbine costs have significantly declined

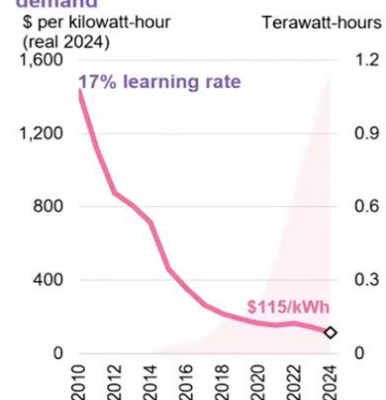
### PV module price and installed capacity



### Onshore wind turbine price and installed capacity



### Lithium-ion demand



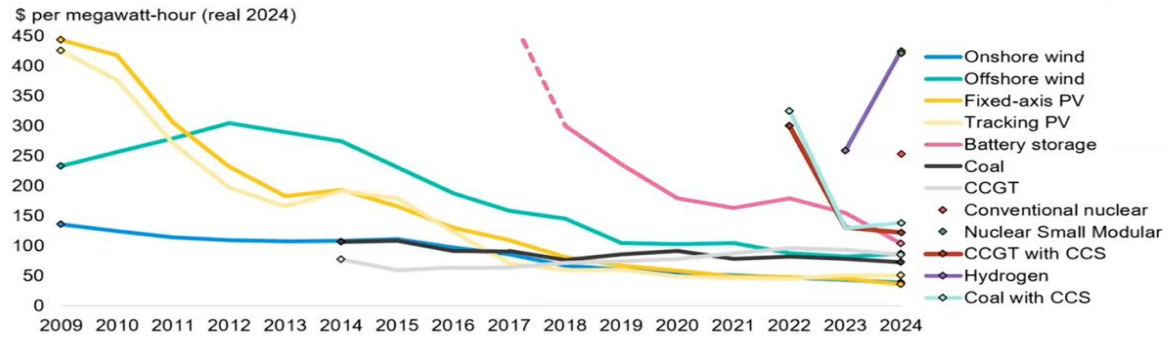
Source: BloombergNEF. Note: Prices are from 4Q 2024 Global PV Market Outlook, Wind Turbine Price Index 2H 2024, and 2024 Lithium-Ion Battery Price Survey.

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## Batteries approach \$100/MWh, while wind and solar electricity generation costs continue to get cheaper

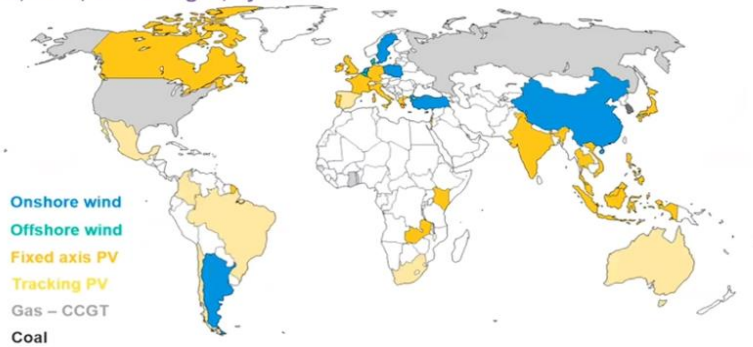
Global benchmarks for the levelized cost of electricity, 2009-2024



Source: BloombergNEF. Note: Global benchmarks are capacity-weighted averages using the latest market estimates – apart from nuclear, hydrogen and CCS, which are simple averages. Offshore wind includes offshore transmission costs. Carbon pricing is included where policies are already active. Subsidies and tax credits are excluded. Levelized costs of electricity shown by financing date. CCGT is combined-cycle gas turbine, CCS is carbon capture and storage, PV is photovoltaic solar.

## Renewables are the cheapest source to meet new demand almost everywhere

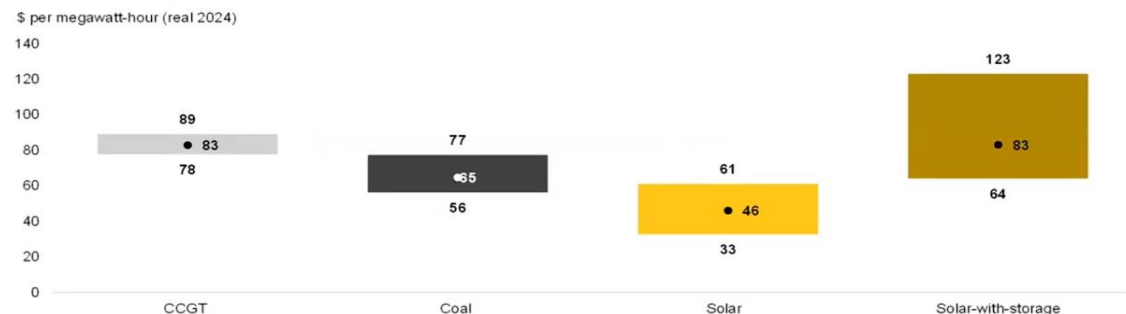
Cheapest source of bulk generation, 2024  
New-build solar, wind, coal and gas, by market



Source: BloombergNEF. Note: The map shows the technology with the lowest levelized cost of electricity (or auction bid for recent delivery) for new-build plants in each market where BNEF has data. LCOEs exclude subsidies, tax credits and grid connection costs, and include a carbon price where applicable. CCGT is combined-cycle gas turbine. Mapped data are for distinct economies.

## Solar is the cheapest source of bulk power generation in Malaysia

Levelized cost of electricity of new power plants in Malaysia in 2025, by technology

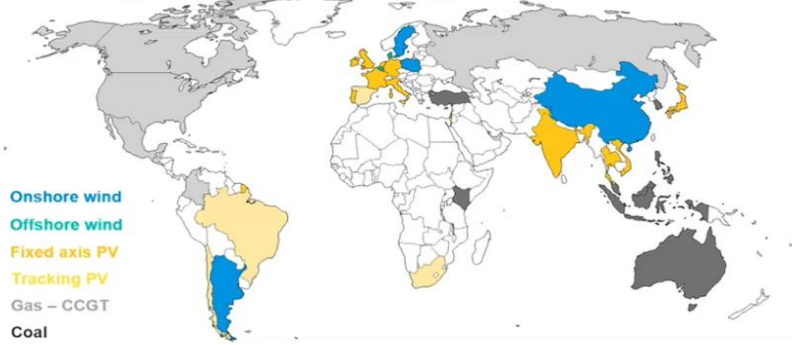


Source: BloombergNEF. Note: Solar-with-storage is modeled with a four-hour battery. The low, mid and high points of our solar-with-storage estimate assume a 25%, 50% and 100% capacity ratio between the battery and the solar plant, respectively. CCGT is combined-cycle gas turbine.

## Building solar is cheaper than continuing to run thermal power plants in India, Japan and Thailand

Cheapest source of bulk generation, 2024

New-build solar and wind versus existing coal and gas, by market

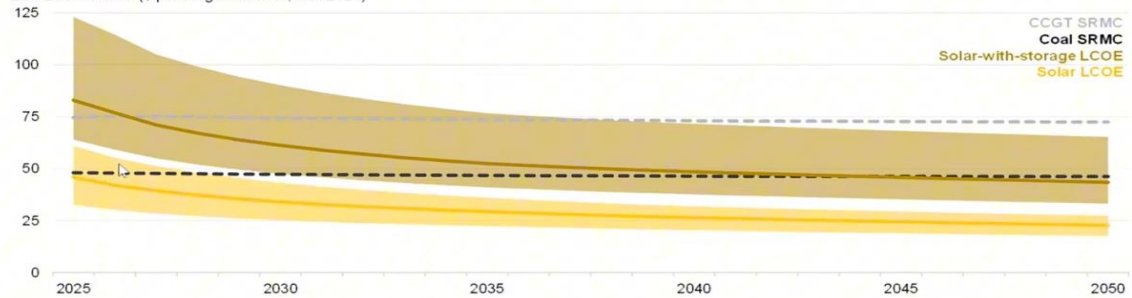


Source: BloombergNEF. Note: The map shows the technology with the lowest levelized cost of electricity (or auction bid for recent delivery) for new-build renewable plants or short-run marginal costs for coal and gas-fired power plants in each market where BNEF has data. LCOEs exclude subsidies, tax credits and grid connection costs, and include a carbon price where applicable. CCGT is combined-cycle gas turbine. Mapped data are for distinct economies.

## A new solar power plant in Malaysia can already generate electricity cheaper than existing thermal power

Levelized cost of electricity of new solar and solar-with-storage plants compared with short-run marginal costs of existing coal and combined-cycle gas turbine plants in Malaysia

LCOE and SRMC (\$ per megawatt-hour, real 2024)

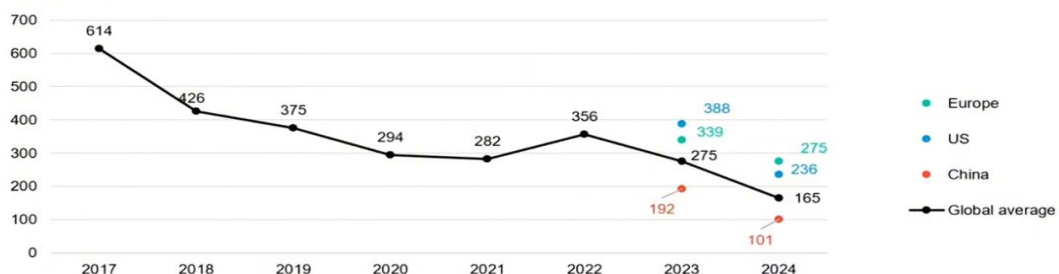


Source: BloombergNEF. Note: LCOE is levelized cost of electricity and SRMC is short-run marginal cost. CCGT is combined-cycle gas turbine.

## Regional trends continue to show significant discrepancy between China and non-China markets

Historical prices for turnkey energy storage systems, by delivery year

Real 2024 \$/kWh, usable

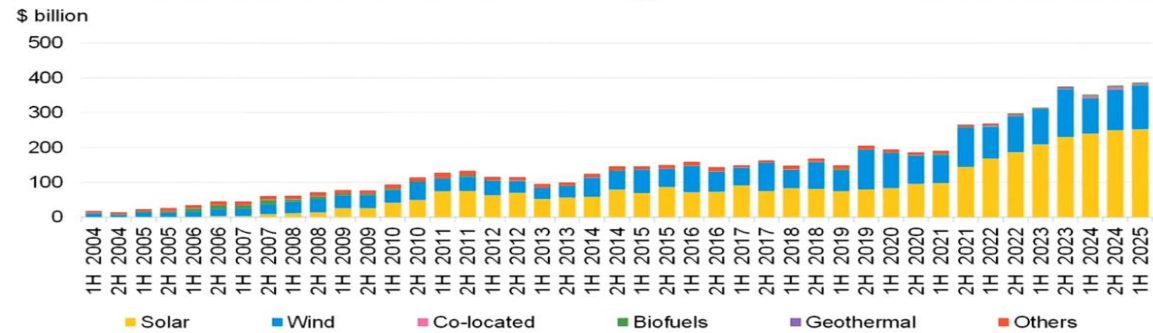


Source: BloombergNEF. Note: Pricing based on usable capacity. Prices in 2023 and 2024 show all durations and are global volume-weighted averages of survey pricing data based on BNEF's annual regional installation forecast (2023 price was updated this year). Prices between 2017-2022 are only for four-hour systems. Historical prices have been adjusted using June to June inflation rates based on the US Consumer Price Index (CPI). Prices converted using exchange rates at the end of October each year.



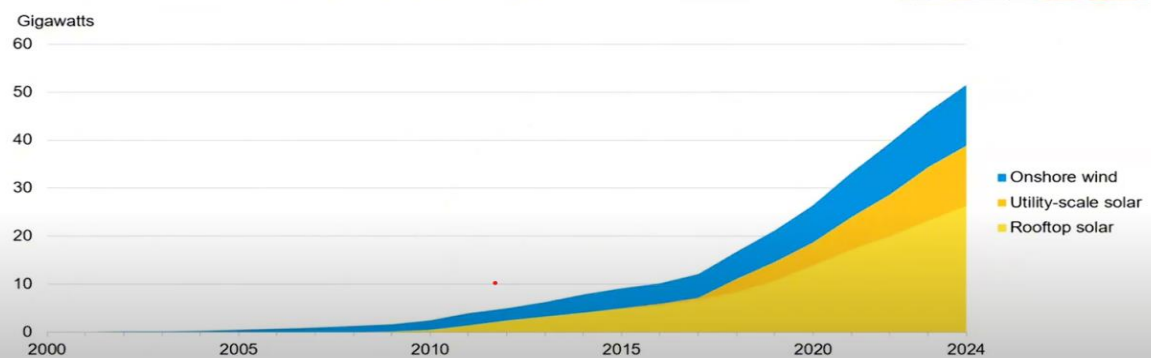
## Renewable energy project investment hits a record \$386 billion in 1H 2025

### Global biannual investment in renewable energy



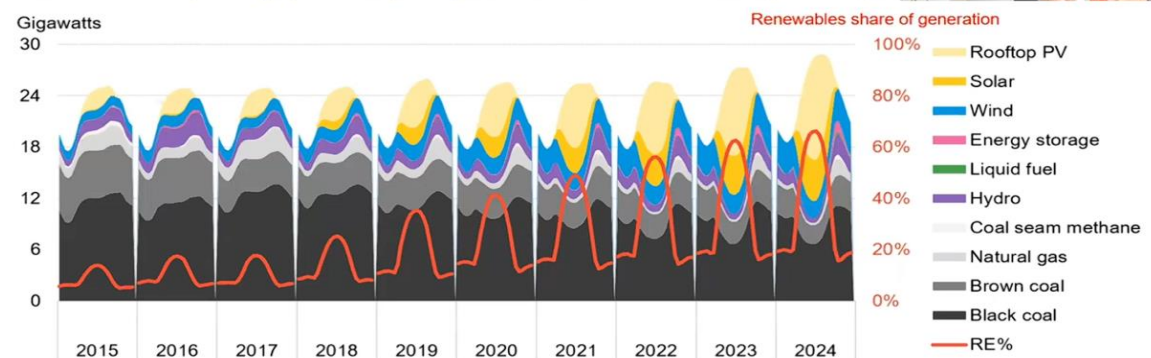
## Renewable energy capacity in Australia has soared over the past 20 years

### Cumulative renewable energy capacity by technology



## Rooftop solar has reshaped Australia's power market

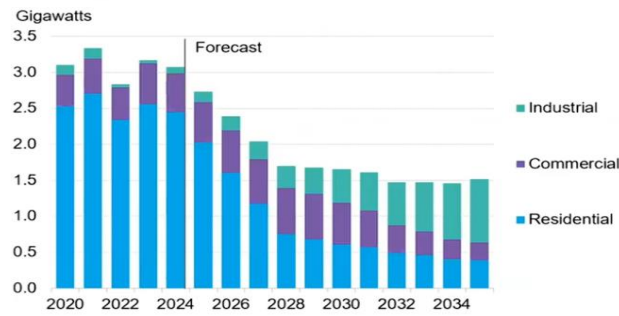
### Evolution of hourly average power dispatch profiles in the National Electricity Market (NEM)





## Australia's rooftop solar market has already peaked

Historical and forecast annual small-scale solar capacity additions in Australia



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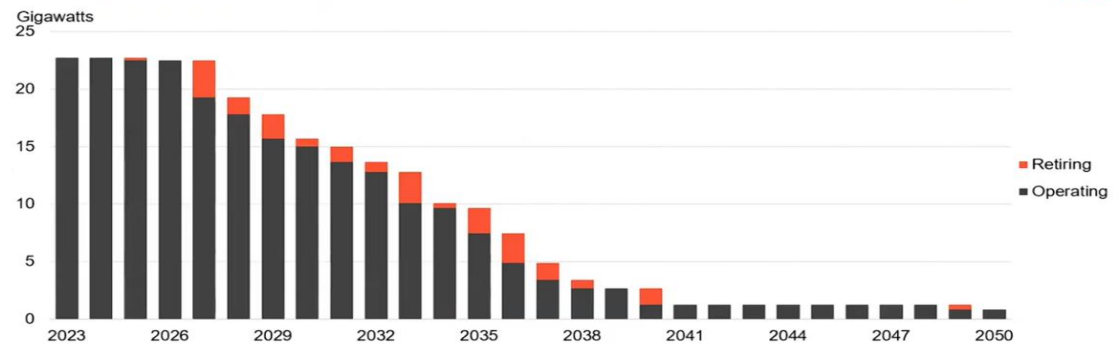


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## Nearly 70% of Australia's coal-fired power capacity could retire by 2035

BNEF's outlook on retirement schedule for Australia's coal-fired capacity



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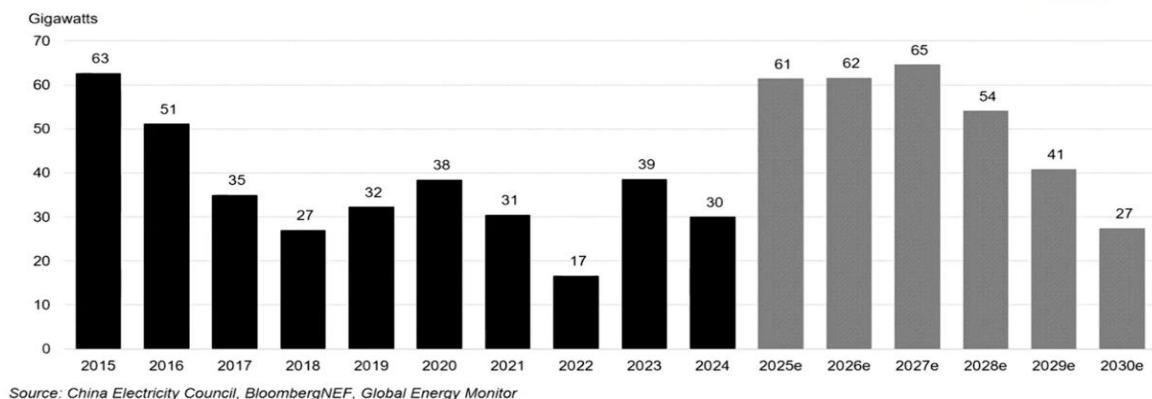


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## What about China? China is indeed building more coal power plants

China coal power capacity net additions, historical and forecast



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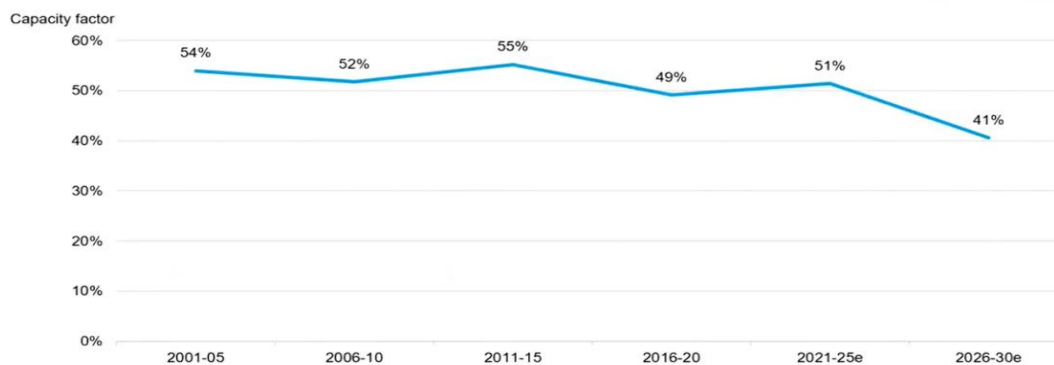


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## China's coal power capacity is growing but capacity factors are declining

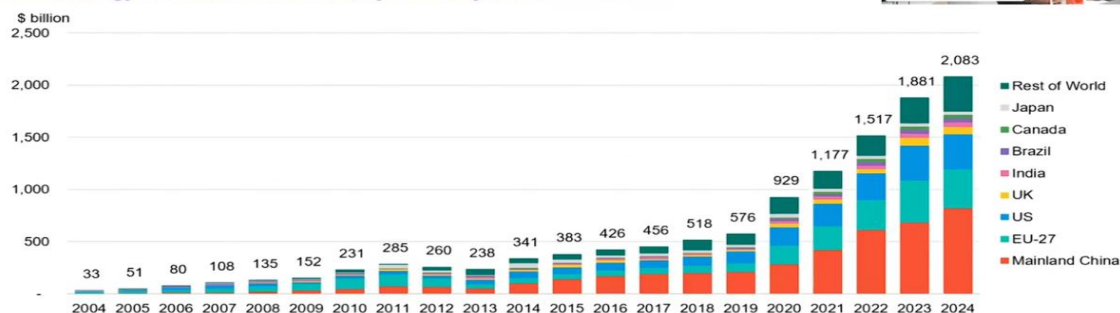
Average thermal power capacity factor during each Five-Year Plan, historical and outlook



Source: China Electricity Council, BloombergNEF

## China has been leading the world in energy transition investment since 2013

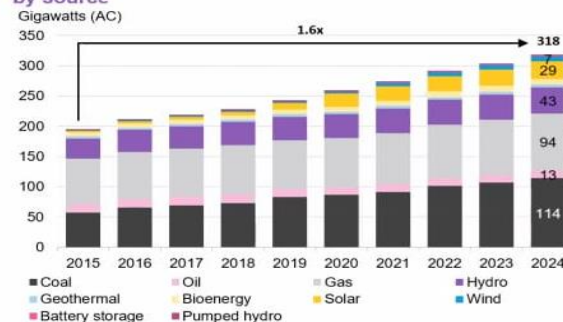
Global energy transition investment, by economy/bloc



Source: BloombergNEF. Note: Start-years differ by sector, but all sectors are present by 2020. The step-change in 2020 is caused in part by the addition of power grids into the scope from that year onward. (EU investment total corrected on March 5, 2025.)

## What about Southeast Asia? Thermal power plants continue to dominate but renewables are rising

Historical installed power capacity in Southeast Asia, by source



Southeast Asia's historical installed power capacity, by country

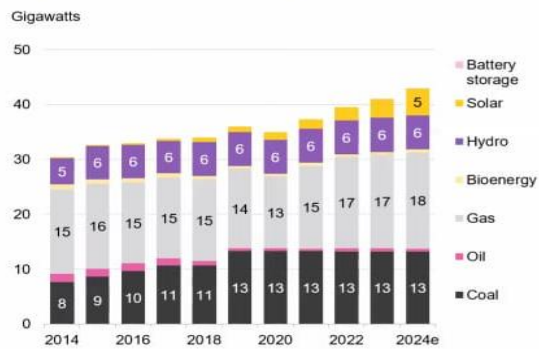


Source: Vietnam Electricity Group (EVN), Vietnam Ministry of Industry and Trade, Philippines Department of Energy, Thailand Electricity Generating Authority, Thailand Department of Alternative Energy Development and Efficiency, Indonesia Ministry of Energy and Mineral Resources, Malaysia Energy Commission, Singapore Energy Market Authority, BloombergNEF.



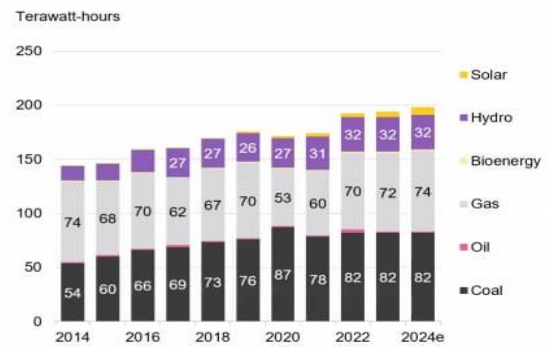
## Coal continues to lead electricity generation in Malaysia although solar is growing

Malaysia's historical installed power capacity



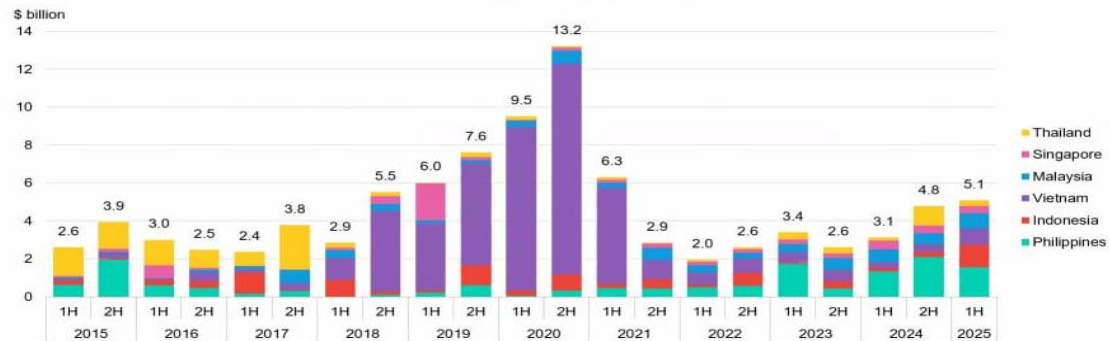
Source: BloombergNEF, Energy Commission. Note: Figures for 2023-2024 are BNEF estimates.

Malaysia's historical electricity generation mix



## Renewable investment across Southeast Asia has gone through boom-bust cycles due to changes in policy

Asset finance raised in Southeast Asia's clean energy sector, by country

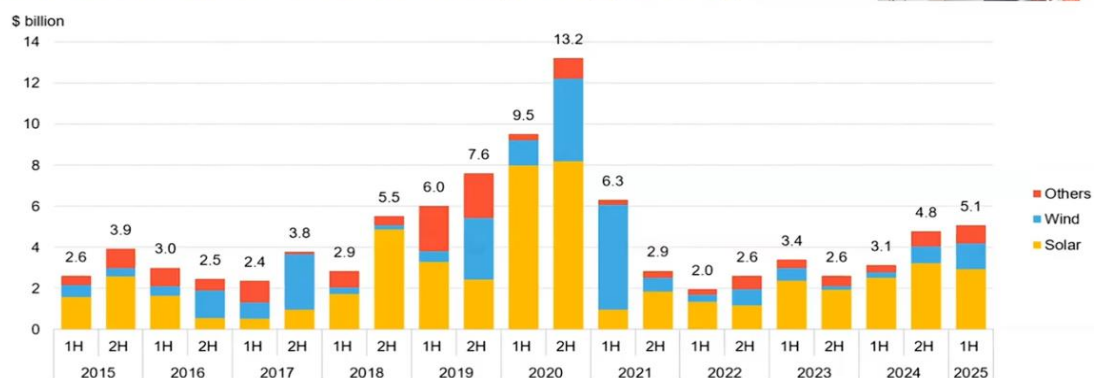


Source: BloombergNEF. Note: Includes only new investment.



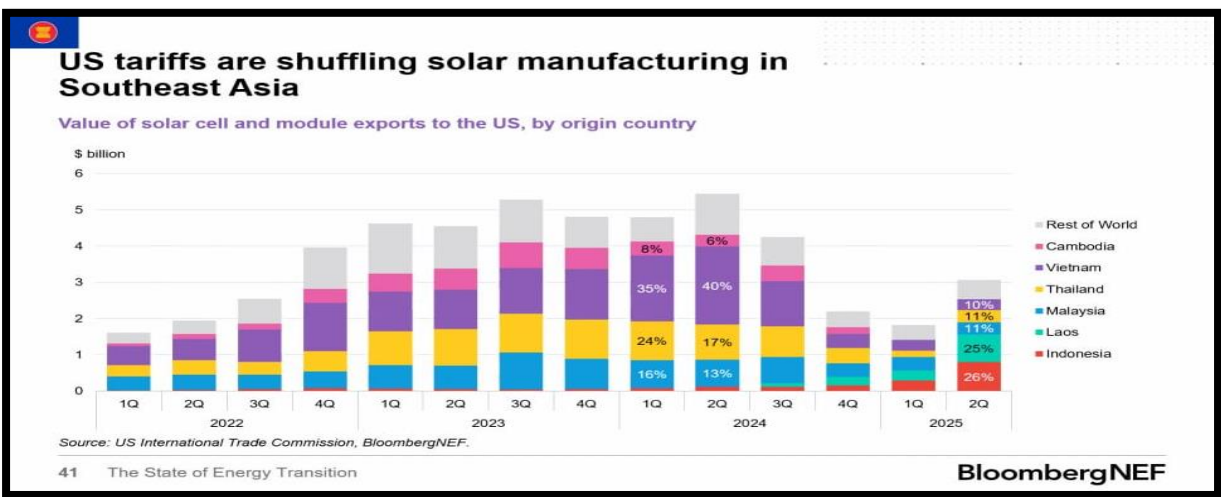
## Solar remains the dominant renewable technology across Southeast Asia

Asset finance raised in Southeast Asia's clean energy sector, by technology



Source: BloombergNEF. Note: Includes only new investment. 'Others' include small hydro (projects with a capacity of 50 megawatts or less), geothermal, biomass waste-to-energy projects, and collocated power plants.

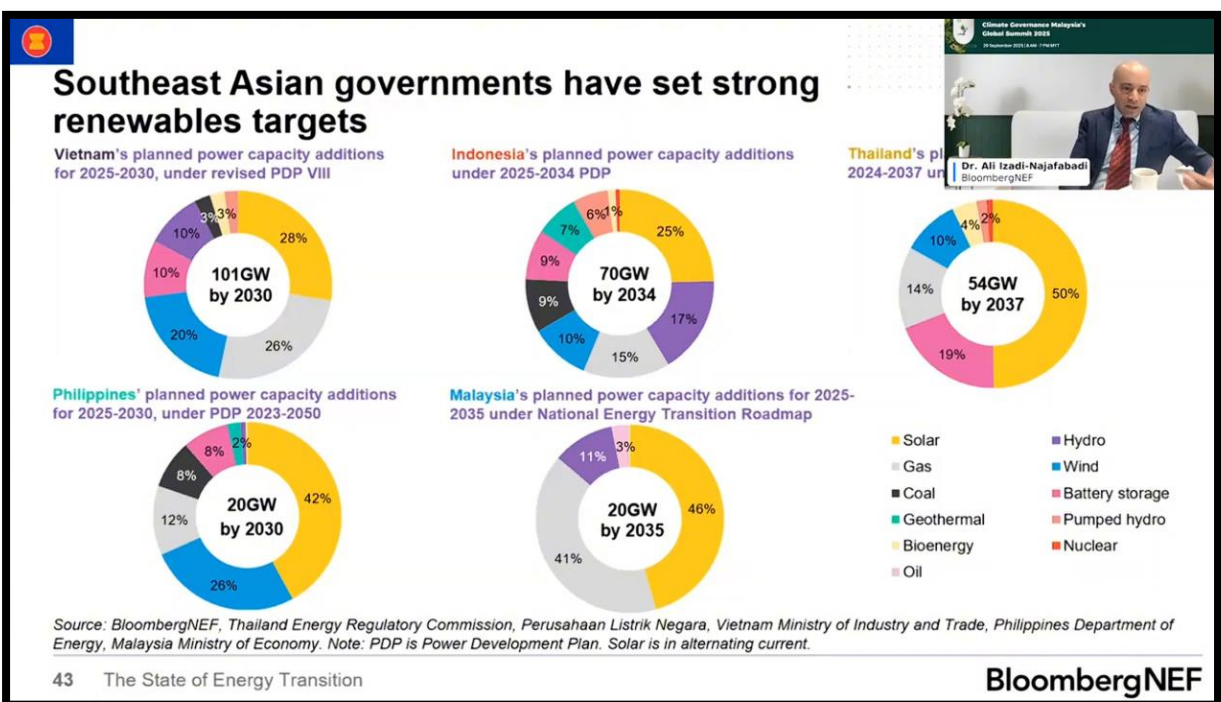




- Where are we at today?
- **Where are we heading?**
- Where do we want to arrive at in 2050?

Dr. Ali Izadi-Najafabadi  
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Source: Alamy

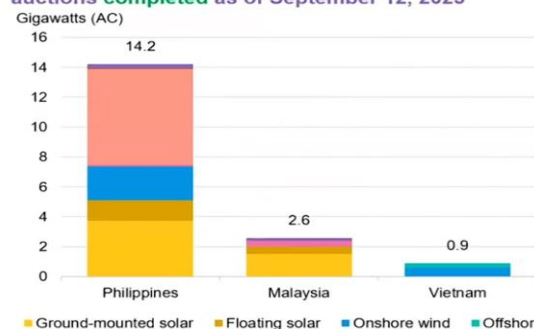






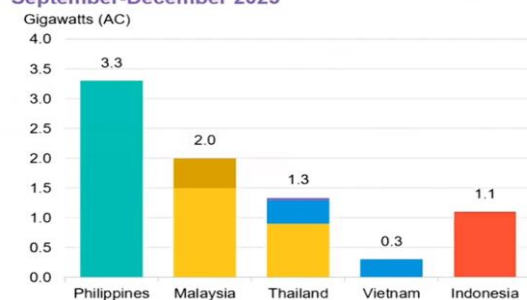
## Southeast Asia auctions 26.7GW of clean energy and storage in 2025, enabling \$43 billion of investment

Southeast Asia's clean power and energy storage auctions **completed** as of September 12, 2025



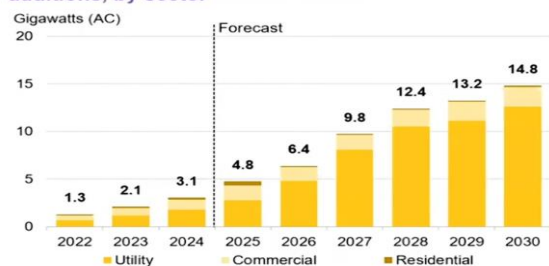
Source: Philippines' Department of Energy, Indonesia's Ministry of Energy and Mineral Resources, Sustainable Energy Development Authority Malaysia, Energy Commission of Malaysia, Thailand's Energy Regulatory Commission, Vietnamese local governments, BloombergNEF. Note: Vietnam offshore wind means nearshore. 'Other renewables' include hydro and bioenergy.

Southeast Asia's clean power September-December 2025



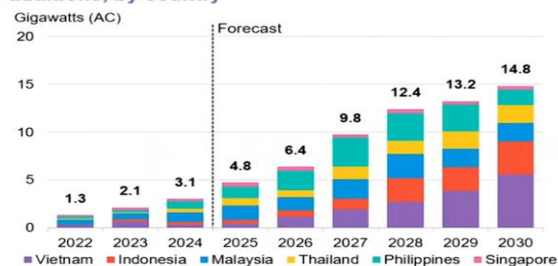
## Southeast Asia to add 61 gigawatts of solar capacity from 2025 to 2030

Southeast Asia's historical and forecast solar additions, by sector



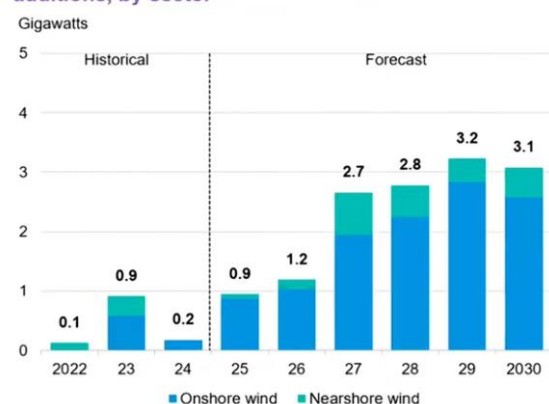
Source: Vietnam Electricity Group, Vietnam's Ministry of Industry and Trade, Indonesia's Ministry of Energy and Mineral Resources, Energy Commission of Malaysia, Electricity Generating Authority of Thailand, Thailand's Department of Alternative Energy Development and Efficiency, Philippines' Department of Energy, Singapore's Energy Market Authority, BloombergNEF. Note: Solar capacity is shown in megawatts (alternating current). Historical solar capacity additions have been converted from direct to alternating current using the following ratios: 1.3 for Indonesia and the Philippines, 1.2 for Thailand, and 1.25 for Vietnam. BNEF estimates are used for historical values if official figures are unavailable.

Southeast Asia's historical and forecast solar additions, by country



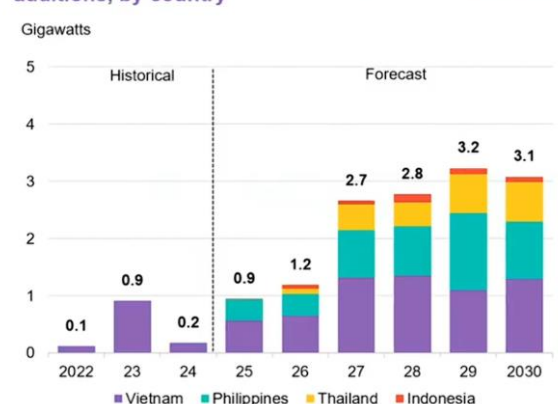
## Southeast Asia is set to add 13.9GW of wind from 2025 to 2030

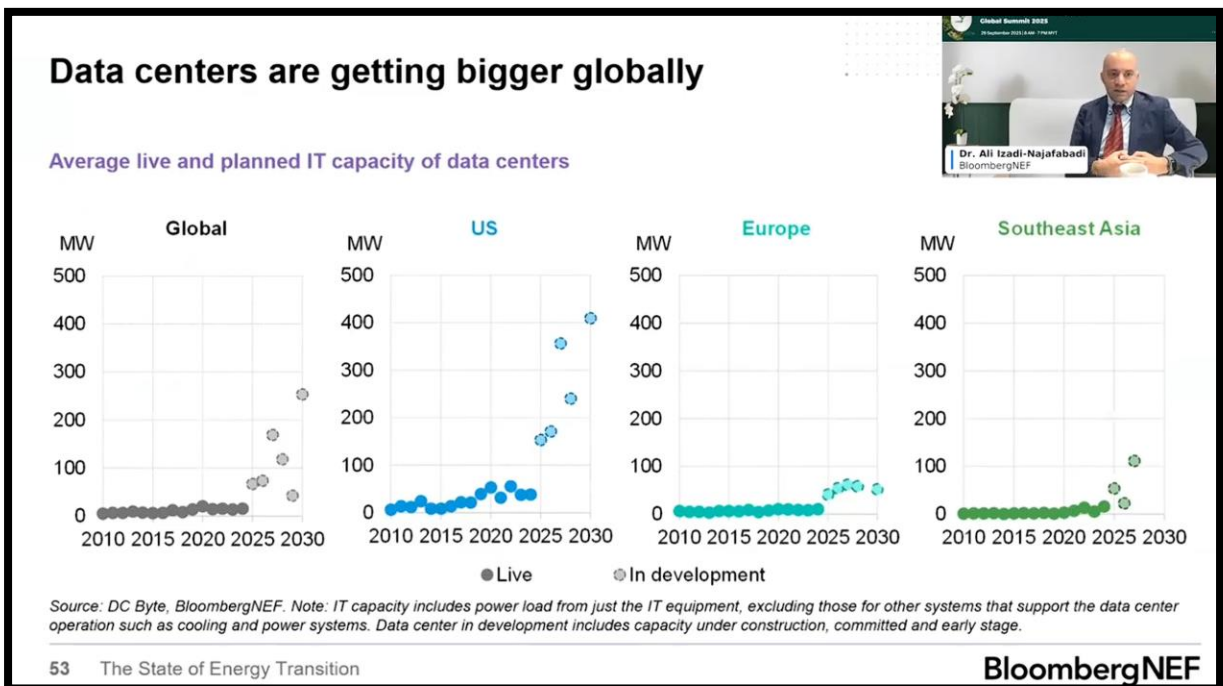
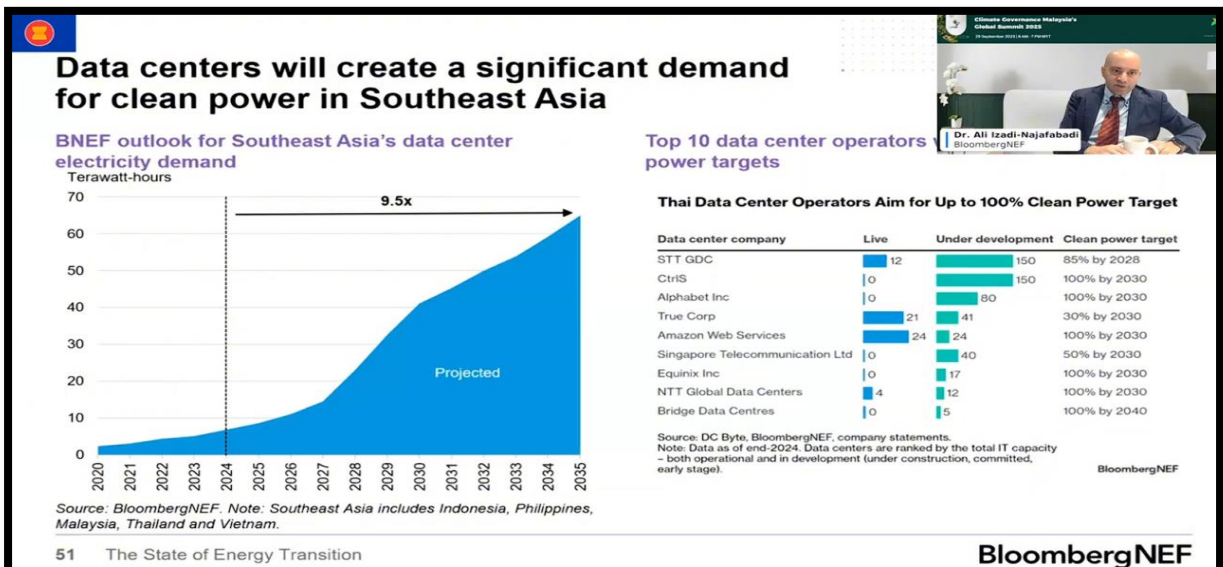
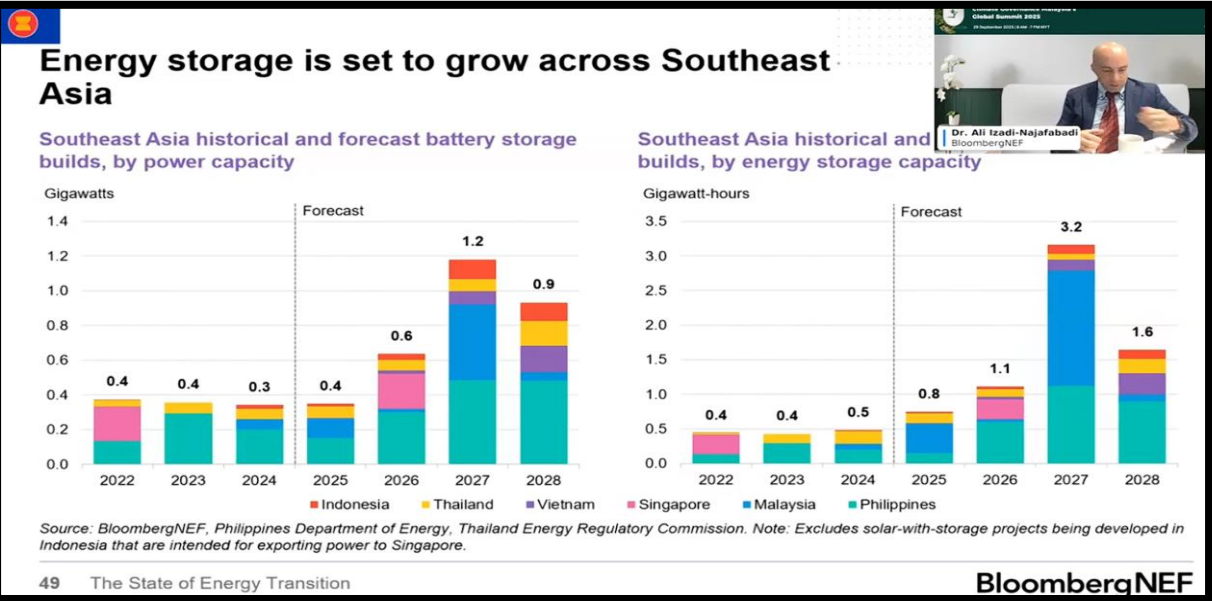
Southeast Asia's historical and forecast wind additions, by sector



Source: Philippines Department of Energy, Vietnam Electricity Group (EVN), BloombergNEF. Note: Nearshore wind built within 11 kilometers from the shore.

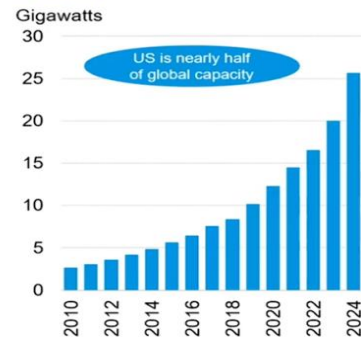
Southeast Asia's historical and forecast wind additions, by country





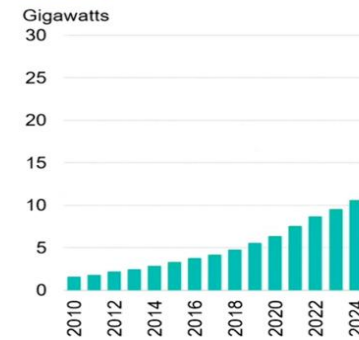
## Today, the US is by far the largest market for data centers, but other markets have also grown

### AMER data-center live IT capacity

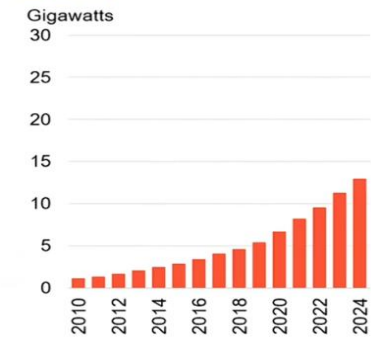


Source: BloombergNEF, DC Byte.

### EMEA data-center live IT capacity



### APAC data-center live IT capacity



## Ease of access to clean power depends on where you are

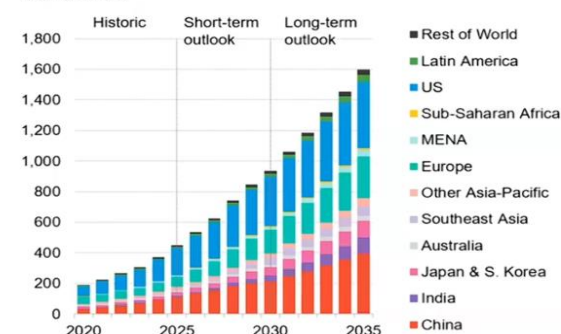
### Corporate clean power procurement options in Southeast Asian countries

| Country     | Onsite PPA | International RECs | Green tariff | Offsite PPA      | Net metering | Domestic RECs | Retail choice |
|-------------|------------|--------------------|--------------|------------------|--------------|---------------|---------------|
| Indonesia   | Yes        | Yes                | Yes          | No               | No           | No            | No            |
| Malaysia    | Yes        | Yes                | Yes          | Yes              | No           | Yes           | No            |
| Philippines | Yes        | Yes                | Yes          | Yes              | Yes*         | Yes           | Yes           |
| Singapore   | Yes        | Yes                | Yes          | Yes              | Yes          | Yes           | Yes           |
| Thailand    | Yes        | Yes                | Yes          | Under discussion | No           | No            | No            |
| Vietnam     | Yes        | Yes                | No           | Yes              | Yes          | No            | No            |

Source: BloombergNEF. Note: RECs are renewable energy certificates, which include issuance under voluntary standards. Onsite power purchase agreements (PPAs) include rooftop solar leasing. \*Only for systems of up to 100 kilowatts in capacity.

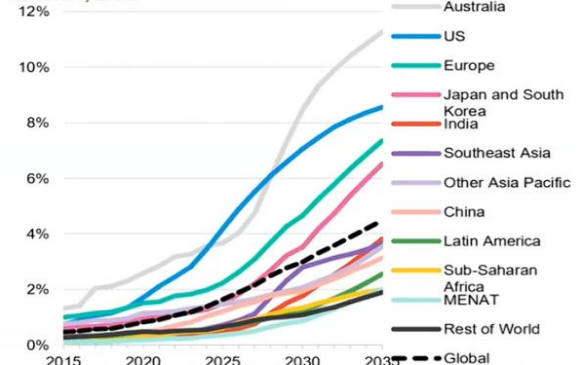
## Electricity demand from data centers to quadruple by

### Global data center power demand outlook by market, 2015-2035, Economic Transition Scenario



Source: BloombergNEF. Note: ETS on this slide refers to the Economic Transition Scenario from New Energy Outlook 2025. MENAT is Middle East, North Africa and Turkey.

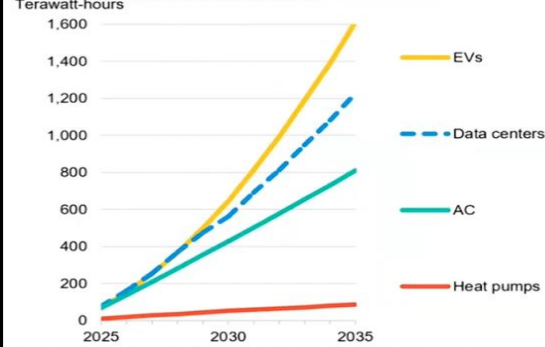
### Data center share of annual electricity demand, ETS



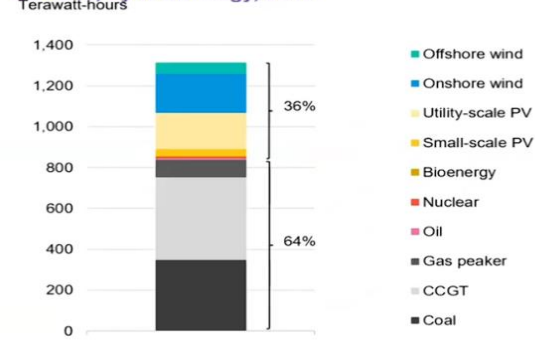


## Globally, electricity demand growth from data centers increase dependence on fossil fueled thermal power

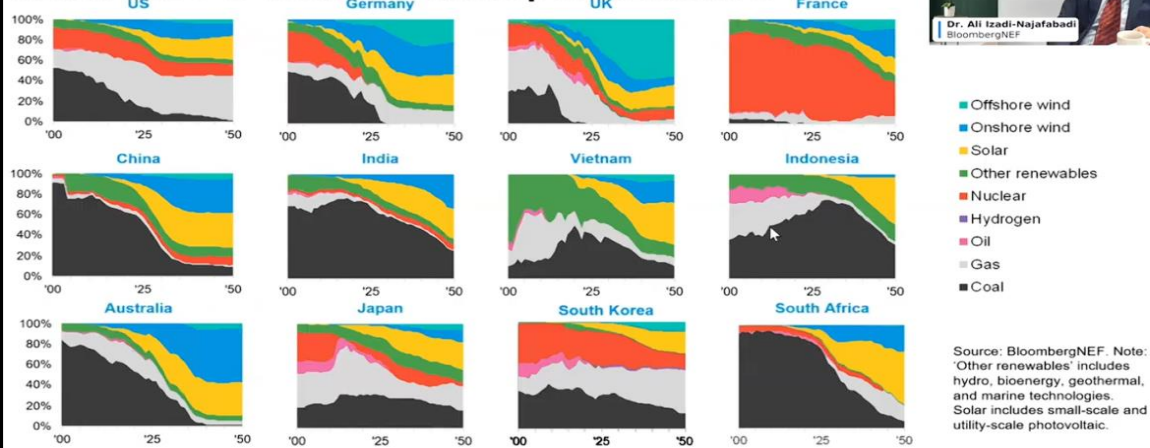
### Selected drivers of global electricity demand growth, Economic Transition Scenario



### Incremental generation needed to meet demand, by technology, 2035

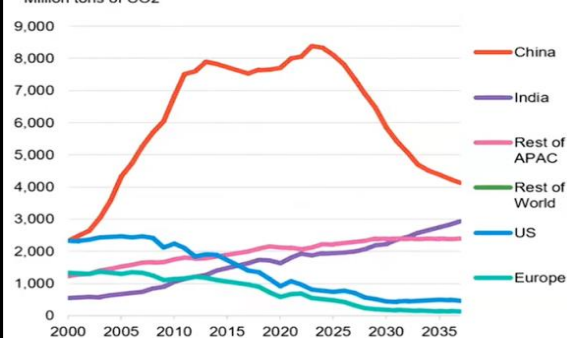


## BNEF's Economic Transition Scenario still expects renewables to dominate most power markets

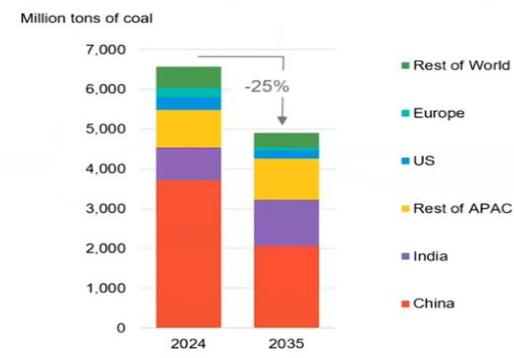


## Global coal consumption falls 25% over the next 10 years under BNEF's base case

### Global coal-based CO2 emissions, Economic Transition Scenario

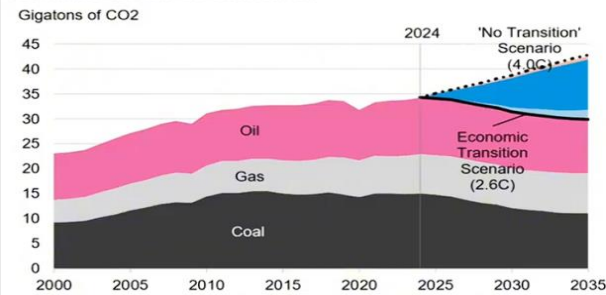


### Global coal demand, Economic Transition Scenario



## BNEF's economic transition scenario would not meet the Paris Agreement goal

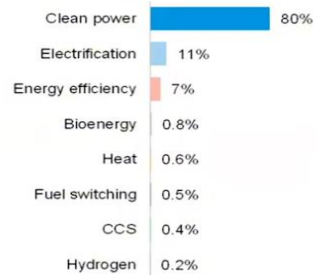
CO2 emissions reductions from fuel combustion by measure over the next 10 years, Economic Transition Scenario versus no transition



Source: BloombergNEF. Note: The 'no transition' scenario is a hypothetical counterfactual that models no further improvement in decarbonization and energy efficiency. In power and transport, it assumes the future fuel mix does not evolve from 2024 (2028 for shipping). 'Clean power' includes renewables and nuclear, and excludes carbon capture and storage (CCS), hydrogen and bioenergy, which are allocated to their respective categories. 'Energy efficiency' includes demand-side efficiency gains and avoided fossil-fuel processing demand

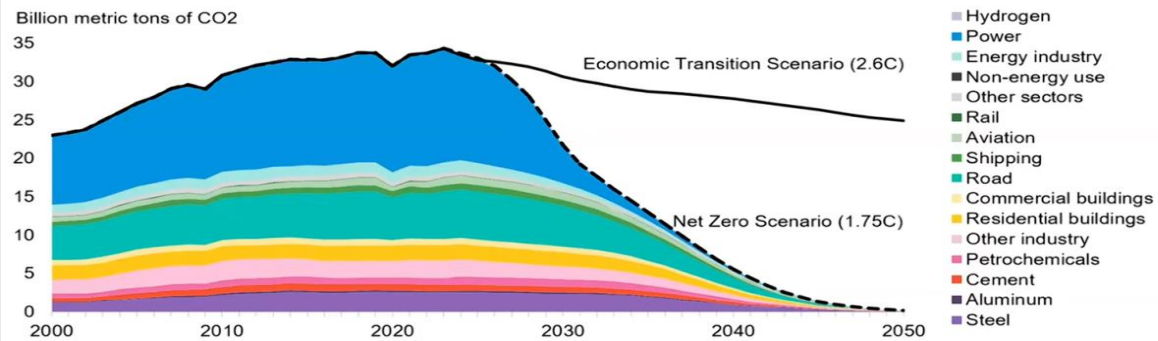
Emission reduction drivers over to 2035

Abated carbon emissions 2025-2035



## Plausible pathways to meet the Paris Agreement goal still exist

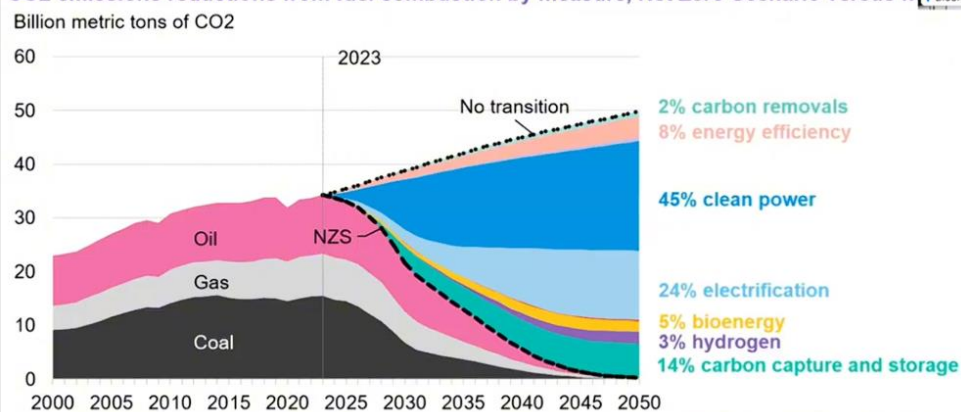
Energy-related emissions and net-zero carbon budget, ETS vs NZS



Source: BloombergNEF New Energy Outlook 2024

## The Net Zero Scenario requires multiple tech to succeed

CO2 emissions reductions from fuel combustion by measure, Net Zero Scenario versus no transition



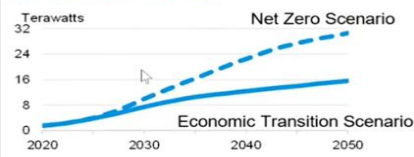
Source: BloombergNEF New Energy Outlook 2024. Note: The 'no transition' scenario is a hypothetical counterfactual that models no further improvement in decarbonization and energy efficiency. 'Clean power' includes renewables and nuclear. 'Energy efficiency' includes demand-side efficiency gains and more recycling in industry.



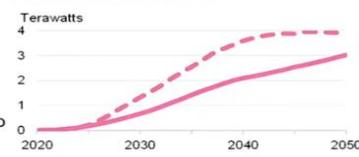
## Mitigating climate change requires a shift to low-main zero-fuel-cost renewables and battery-enabled techno

Selected clean-technology drivers and fossil-fuel consumption in BNEF scenario modeling

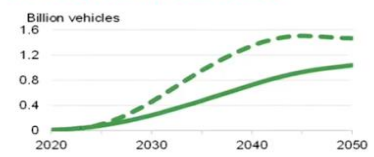
### Wind and solar capacity



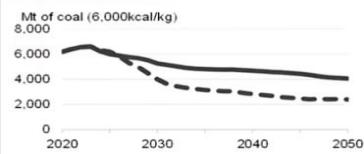
### Energy storage capacity



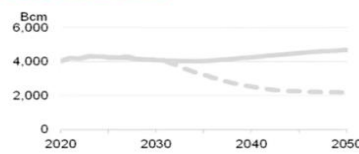
### Passenger electric vehicle fleet



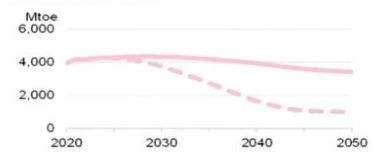
### Coal consumption



### Gas consumption



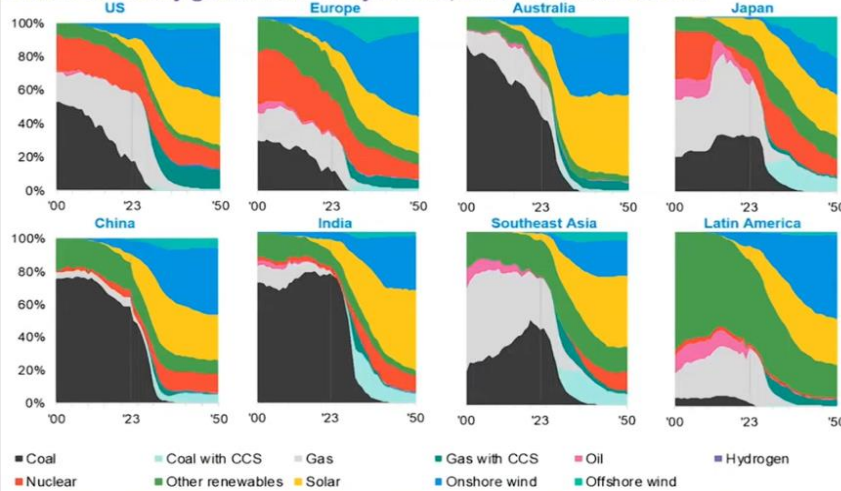
### Oil consumption



Source: BloombergNEF. Note: Mt is million metric tons, Bcm is billion cubic meters, and Mtoe is million metric tons of oil equivalent.

## The net zero power system would be dominated by renewables

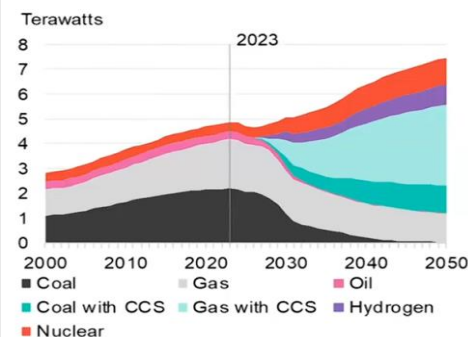
Annual electricity generation mix by market, BNEF Net Zero Scenario



Source: BloombergNEF New Energy Outlook 2024. Note: 'Includes electricity generation for hydrogen production. 'Other renewables' includes all other non-combustible renewable energy in electricity generation, including hydro, geothermal and solar thermal.

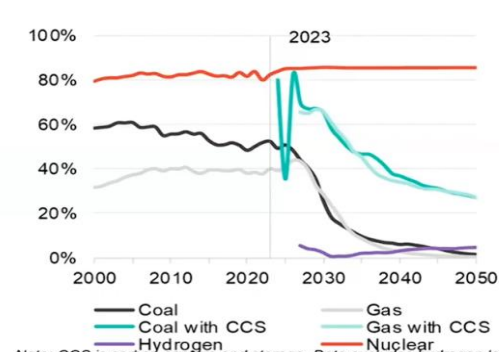
## ...but clean back-up is also needed

Global dispatchable capacity, Net Zero Scenario



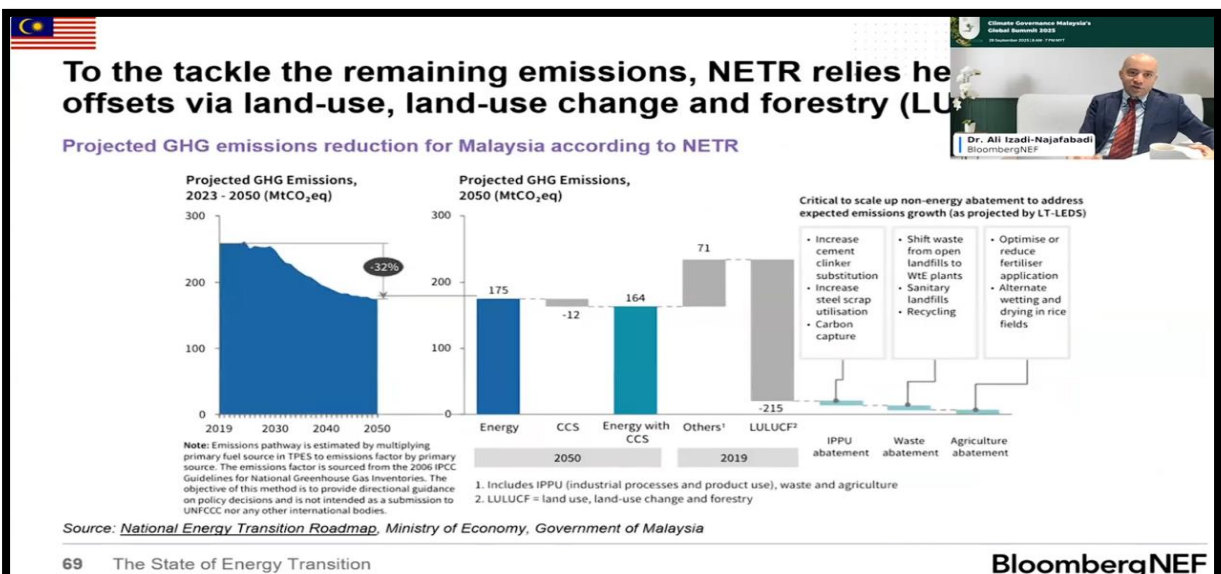
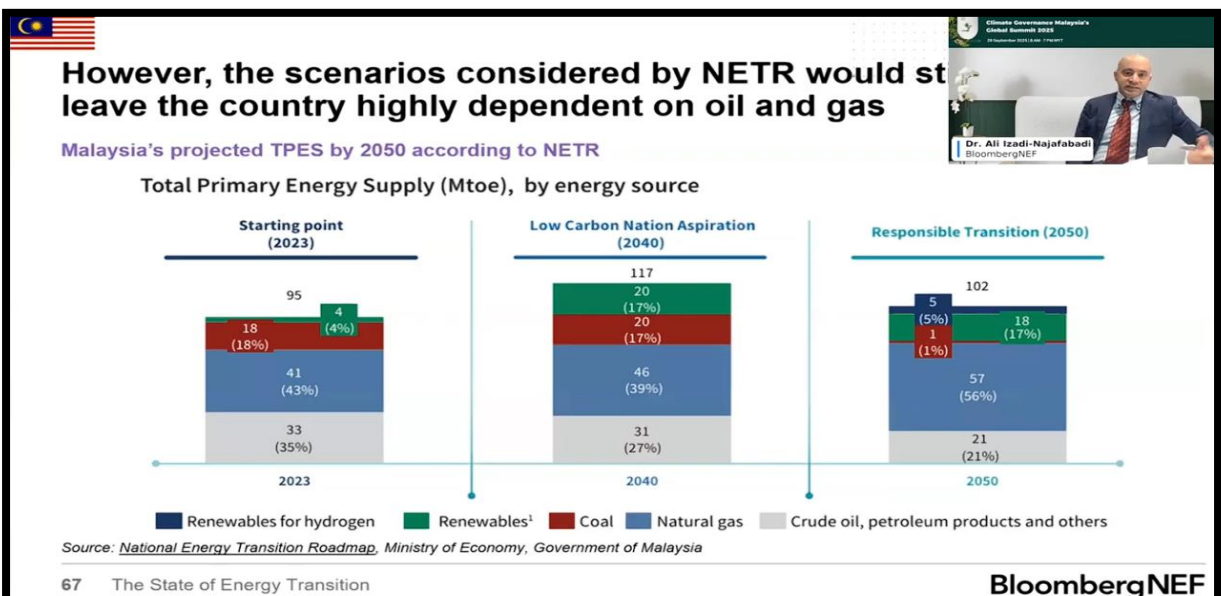
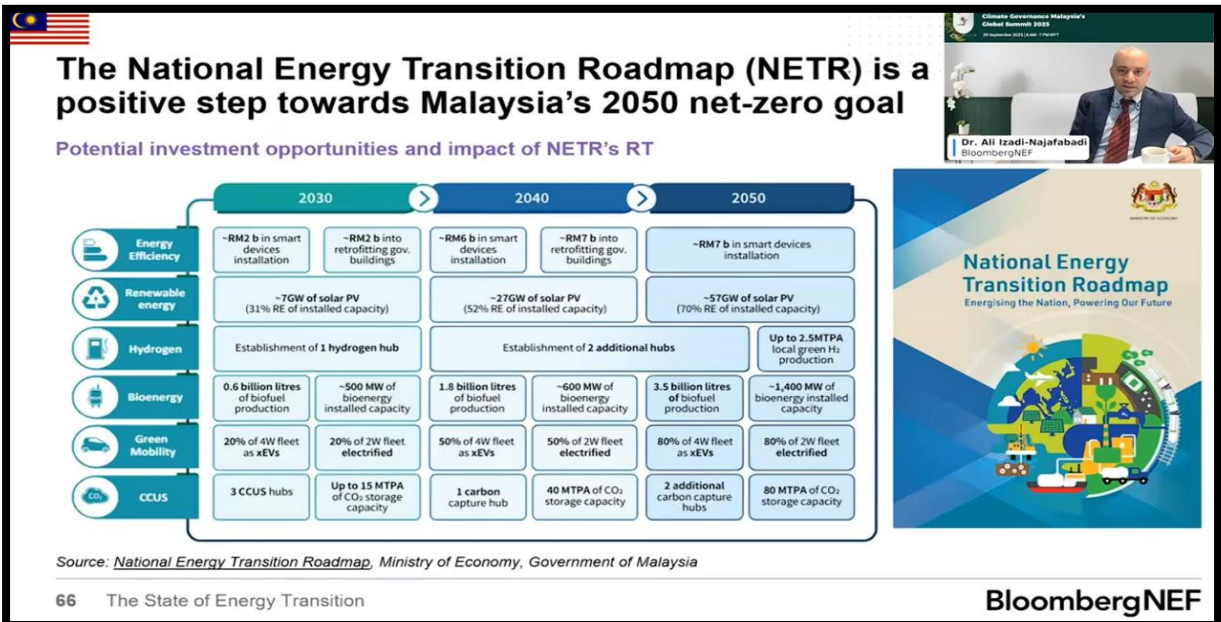
Source: BloombergNEF New Energy Outlook 2024

Dispatchable capacity load factor



Note: CCS is carbon capture and storage. Data excludes hydrogen load factors pre-2026, which show marginal historic use in South Korea.

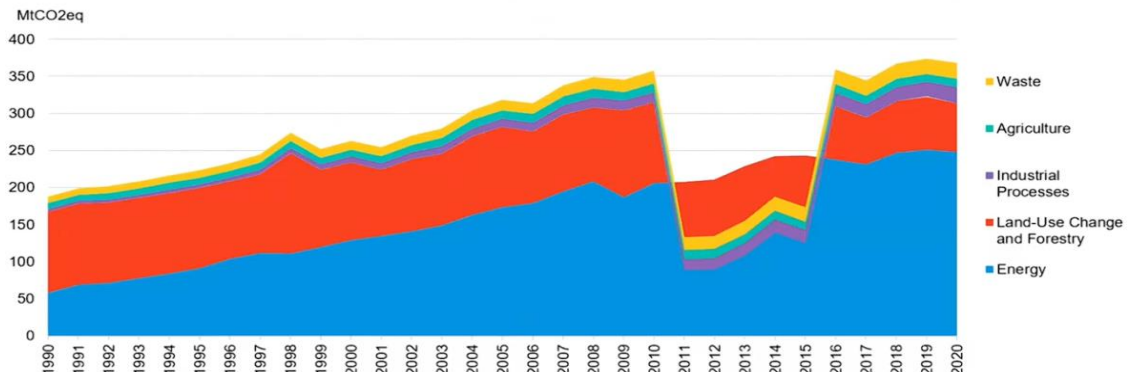






## Only during 2011-2015, LUCF emissions have been net negative. For the rest of the time it has been the 2<sup>nd</sup> largest source of emissions

Malaysia greenhouse gas emissions including Land Use, Land-Use Change & Forestry

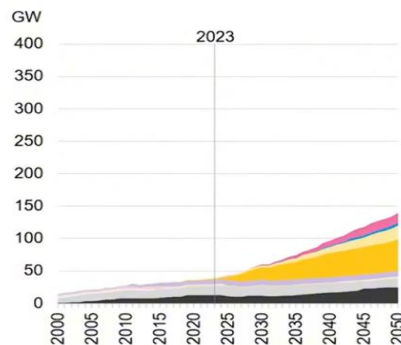


Source: Climate Watch. Note: for 2011-2015, the red colored area shows amount of energy emissions offset by negative emissions from land-use change and forestry



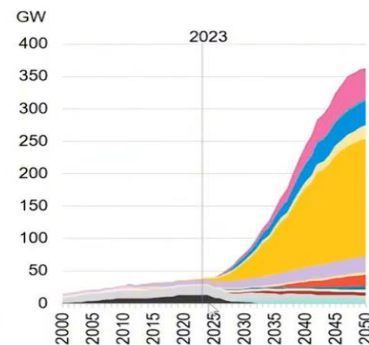
## BNEF sees significant potential for renewables in Malaysia while taking into account geographic constraints

Malaysia power capacity, Economic Transition Scenario



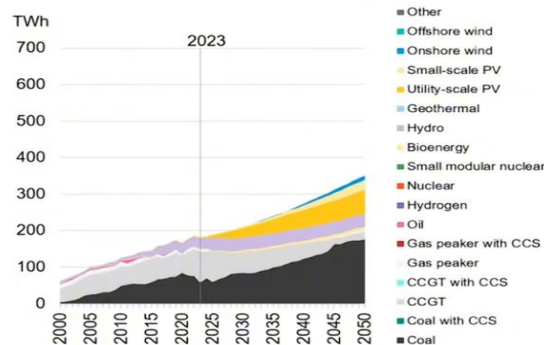
Source: BloombergNEF New Energy Outlook 2024

Net-Zero Scenario

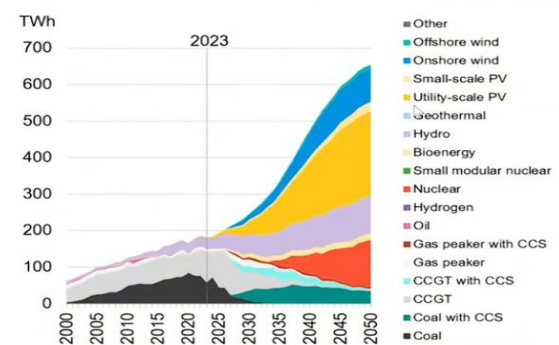


## Even under BNEF's economic transition scenario, renewables account for 42% of electricity generation in 2050, high

Malaysia annual generation, Economic Transition Scenario Net-Zero Scenario

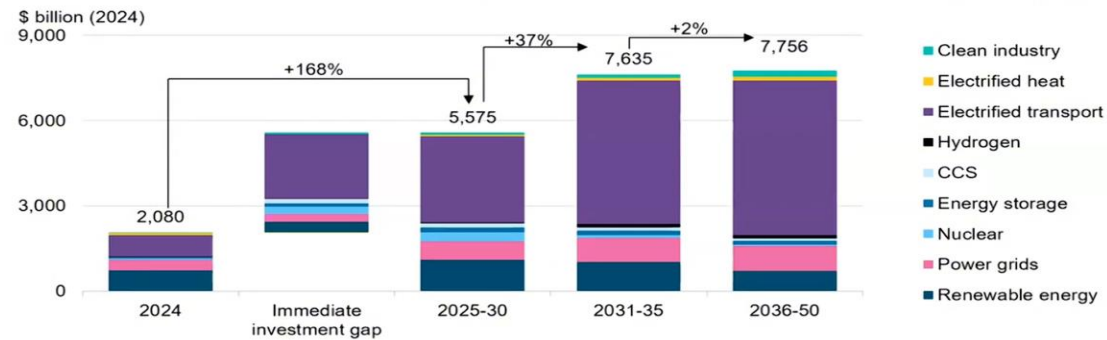


Source: BloombergNEF New Energy Outlook 2024



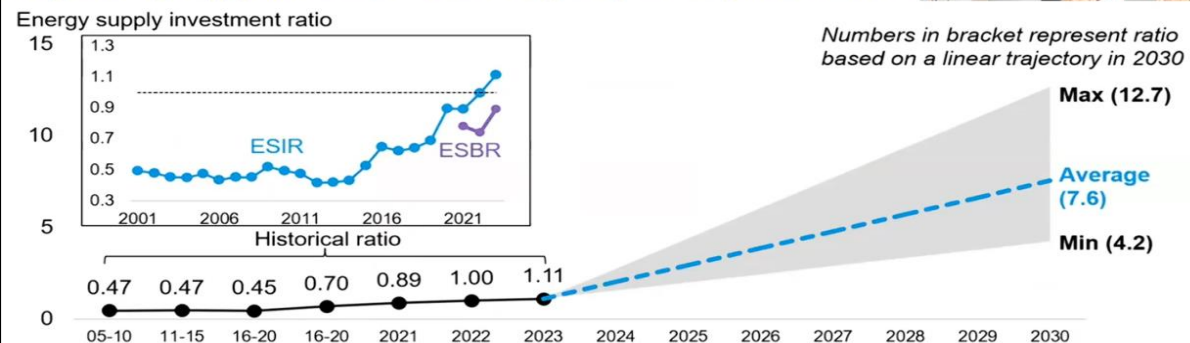
## Meeting the Paris Agreement goal requires almost a tripling of today's spending

Comparison: 2024 energy transition investment versus required annualized levels in NEO



## Banks also need to increase investment in energy transition

Range of energy supply investment ratios to 2030 implied by commonly referenced Paris-



## All economies need to scale up energy transition spending to fulfil the Paris Agreement goal

Comparison: 2024 energy transition investment versus required annualized levels in NEO

|             | \$ billion (2024) | 2024 actual | 2025-30 annualized | Multiplier |
|-------------|-------------------|-------------|--------------------|------------|
| China       | 816               | 816         | 1,521              | x1.9       |
| Germany     | 109               | 109         | 227                | x2.1       |
| UK          | 65                | 65          | 142                | x2.2       |
| Australia   | 23                | 23          | 59                 | x2.6       |
| France      | 50                | 50          | 141                | x2.8       |
| Brazil      | 37                | 37          | 115                | x3.1       |
| South Korea | 27                | 27          | 86                 | x3.2       |
| US          | 338               | 338         | 1,162              | x3.4       |
| Canada      | 35                | 35          | 141                | x4.0       |
| India       | 47                | 47          | 201                | x4.3       |
| Japan       | 28                | 28          | 201                | x7.1       |
| Vietnam     | 6                 | 6           | 47                 | x8.5       |

Source: BloombergNEF. Note: Future values are obtained from the New Energy Outlook (NEO) 2024. Excludes investment in fossil fuels supply, clean shipping, commercial and fuel cell vehicles. \*The multiplier shows the multiplication factor required for the 2024 investment levels to match the average annual investment needs across 2025 to 2030 to align for net zero.