DUCKER CARLISLE

# Global Energy Transition Outlook

**Moving to a cleaner, more electrified world**

July 2025

# By 2030, the *majority (~60%+) of global electricity generation* will be from *clean sources*; data centers will drive substantial electricity demand growth

## Solar PV, Wind & Nuclear

Solar PV and Wind will be the predominant modes of clean electricity generation followed by nuclear as their economics continue to improve; by 2030 the LCOE* of Solar PV and Wind installations will be less than the LCOE of coal and natural gas turbine installations

| By 2030 | | | CAGR |
|---|---|---|---|
| Solar PV | will account for at least | 17% of global electricity generation, up from 5% in 2023, a | 19% |
| Wind | | 13% of global electricity generation, an up from 8% in 2023, a | 10% |
| Nuclear | | 9% of global electricity generation, matching 9% in 2023, a | 2% |

- For Solar PV, utility scale installations will dominate given their scale and economic advantages; by 2030, 55% of global solar PV electricity generation will come from utility scale installations
- For Nuclear, a new generation of large-scale nuclear reactors is being built in several countries with enhanced features, and small modular reactors are under development
- For Wind, onshore installations will dominate with over 75% of new installed capacity through 2030

## AI & Data Centers Growth

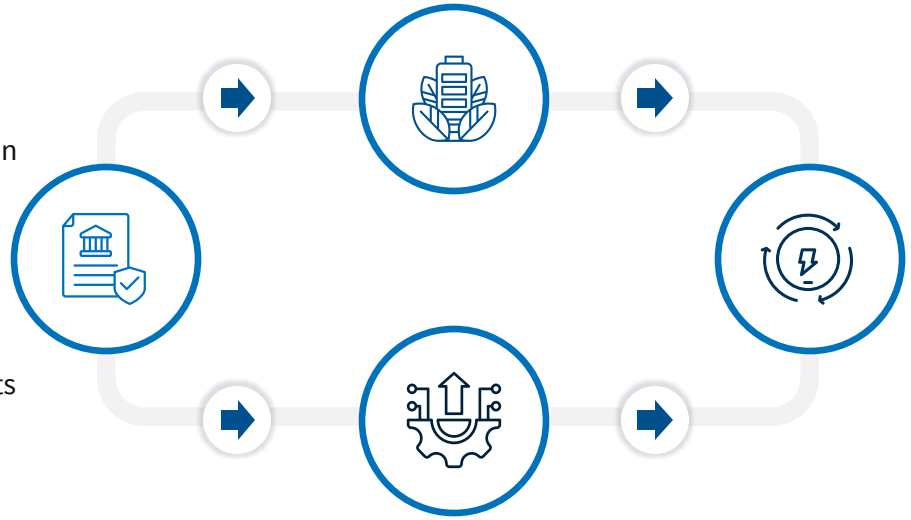
- Data centers, especially hyperscale data centers, will drive significant electricity demand growth globally
  - Between 2024 and 2030, US data center electricity demand is expected to increase by ~400TWh (23% CAGR)
  - Chinese data centers are expected to consume 380 Billion kWh of electricity by 2030; goal is to power new data centers with 80% green energy in 2025

*Levelized Cost of Electricity

# Outlook hinges on government policy driving technology advancements and favoring clean energy sectors

### Technology Advancements
- Battery storage
- Grid capacity & resiliency
- Energy management

### Government Policy
- Regulations favoring clean energy & electrification
- Subsidies for clean energy sectors
- R&D investments or incentives to drive technology advancements
- Reduction in bottlenecks



### Energy Transition Future State
- Economically viable clean energy sectors
- Consistent & reliable clean energy
- Electrification

### Favored Clean Energy Sectors
- Mandates for clean energy sectors
- Cost advantages for clean energy sectors
- Taxes on traditional energy sources

# As such, 3 forecast scenarios are modeled based on different levels of government policy effects

## Stated Policies Scenario *(most likely)*

- Reflects current policy based on a sector-by-sector and country-by-country assessment of the energy-related policies that are in place as of 2024, as well as those that are under development
- Scenario also considers currently planned manufacturing capacities for clean energy technologies

*Most Conservative*

*Follows Actual Policies*

*No Pledges or Aspirational Goals*

## Announced Pledges Scenario

- Assumes all climate commitments made by governments and industries around the world as of 2024 will be met in full and on time, including…
  - Nationally Determined Contributions (NDCs)
  - Longer-term net zero targets
  - Targets for access to electricity and clean cooking, will be met in full and on time

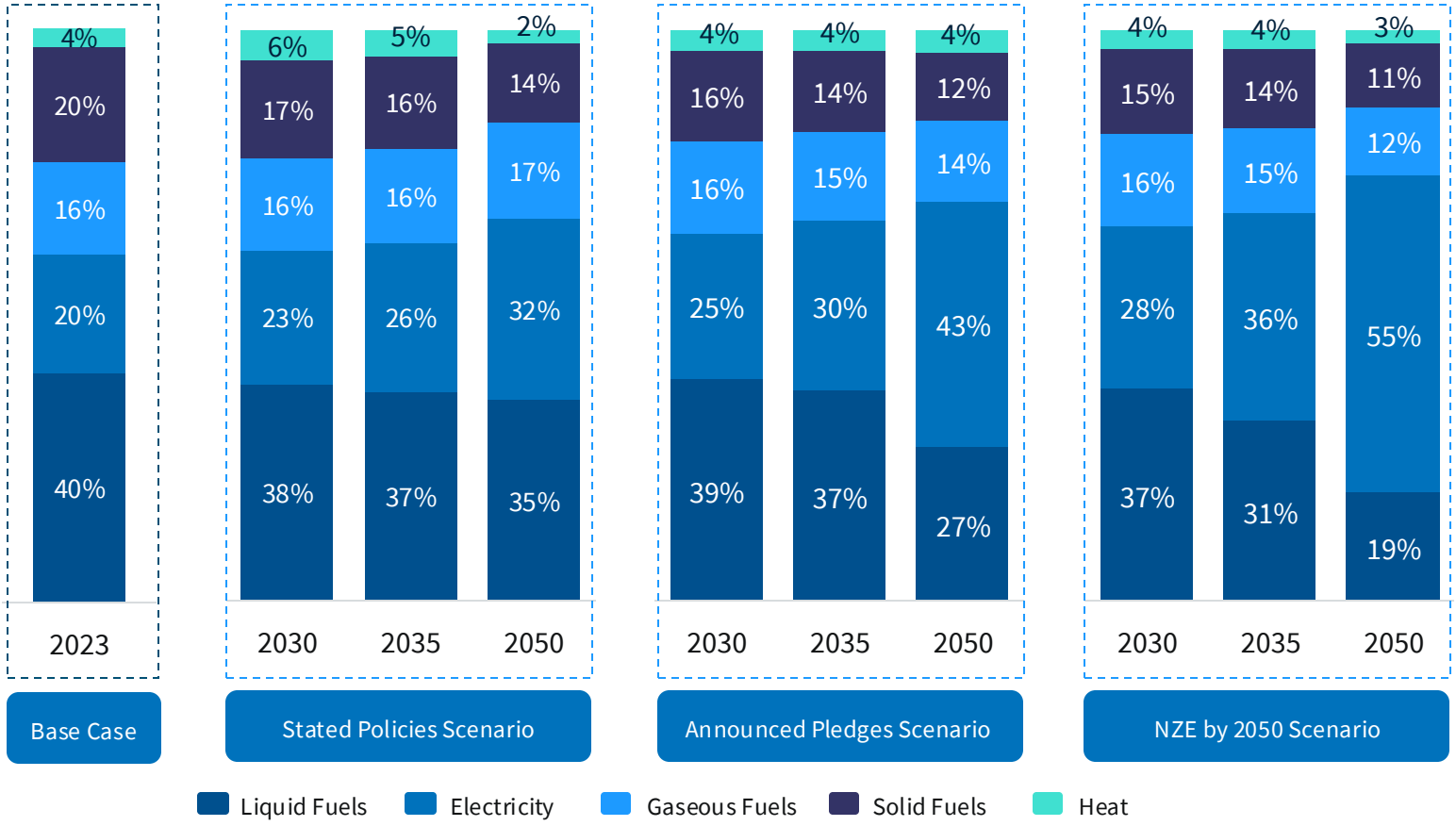
## Net Zero Emissions by 2050 Scenario

- Pathway for the global energy sector to achieve net zero $CO^2$ emissions by 2050
- Does not rely on emissions reductions from outside the energy sector to achieve its goals

Source: IEA

# Electricity consumption is expected to rise leading to a more electrified world by 2050

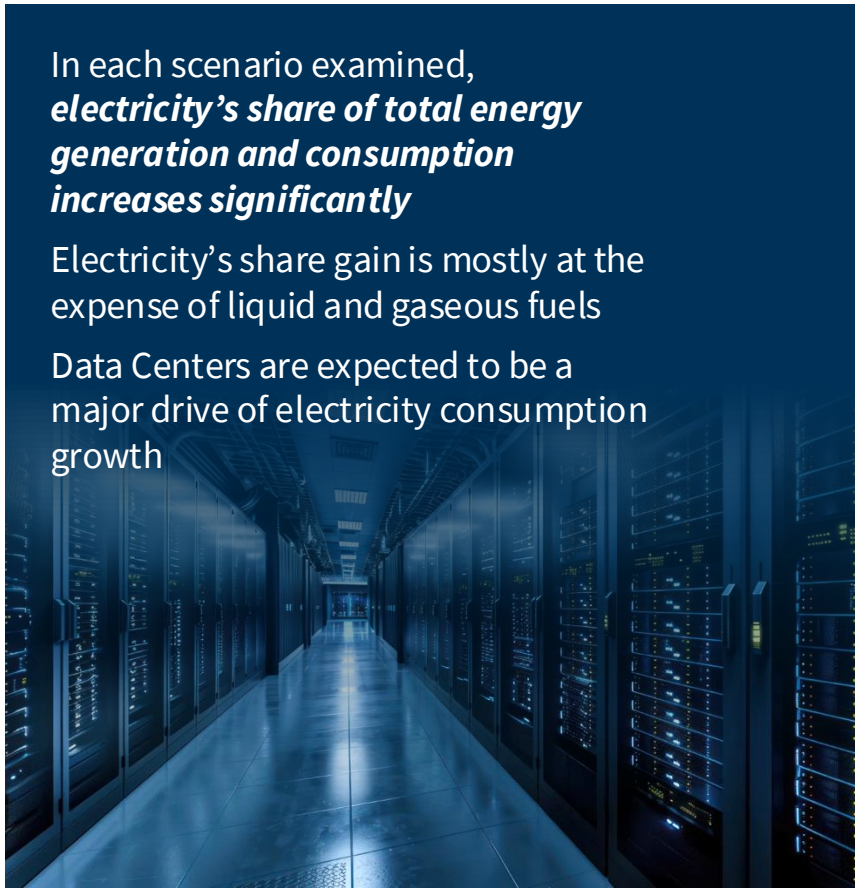
## Share of Energy in Total Final Consumption by Type by Scenario




In each scenario examined, ***electricity's share of total energy generation and consumption increases significantly***

Electricity's share gain is mostly at the expense of liquid and gaseous fuels

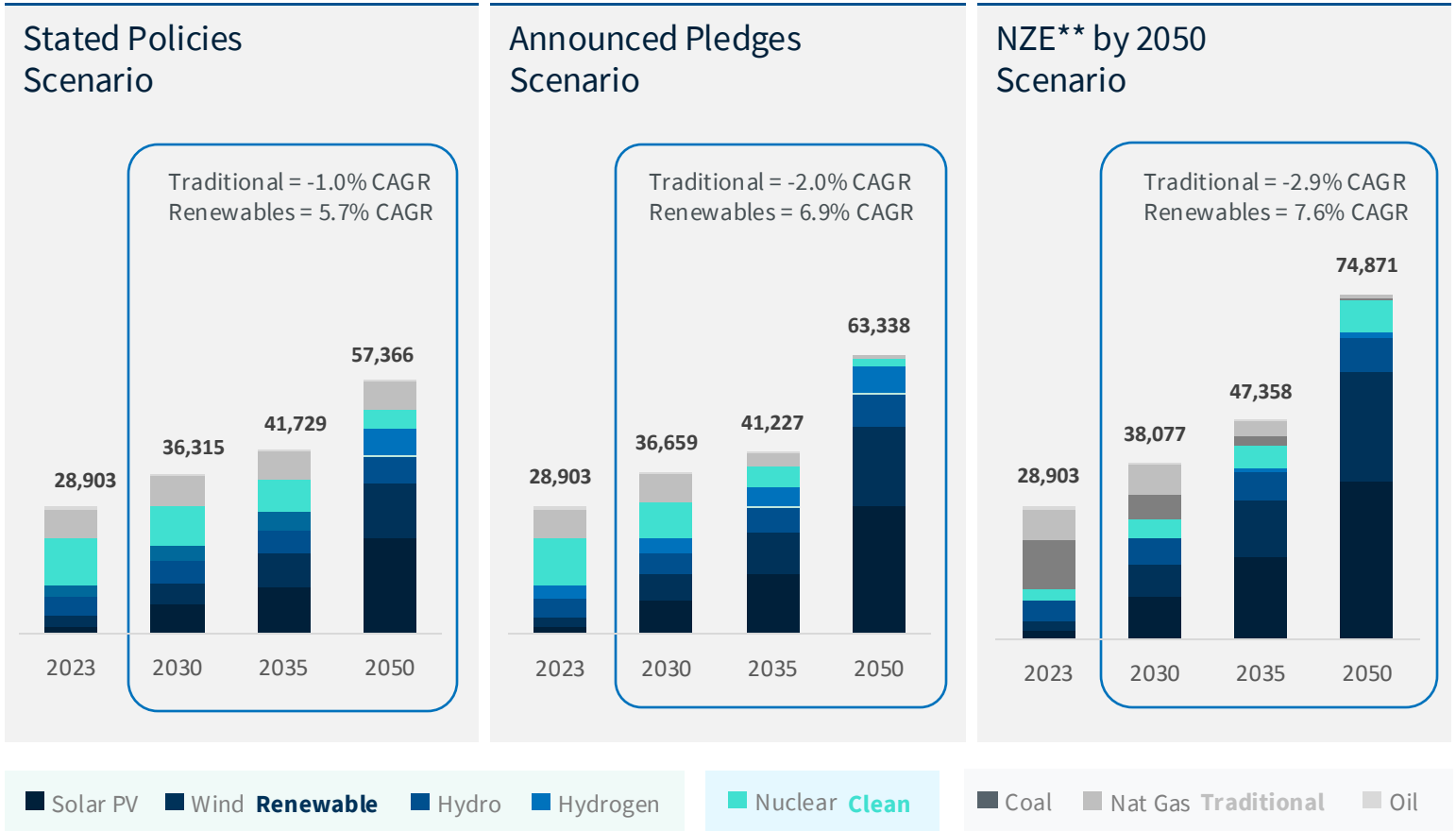
Data Centers are expected to be a major drive of electricity consumption growth



IEA World Energy Outlook 2024, Ducker Carlisle Analysis
Liquid Fuels – biofuels, ammonia, synthetic oil, oil
Gaseous Fuels – biomethane, hydrogen, synthetic methane, natural gas
Solid Fuels – solid bioenergy, coal

# Electricity generation will both grow and shift from traditional to clean & renewable sources

## Growth of Electricity Generation by Source by Scenario, TWh*



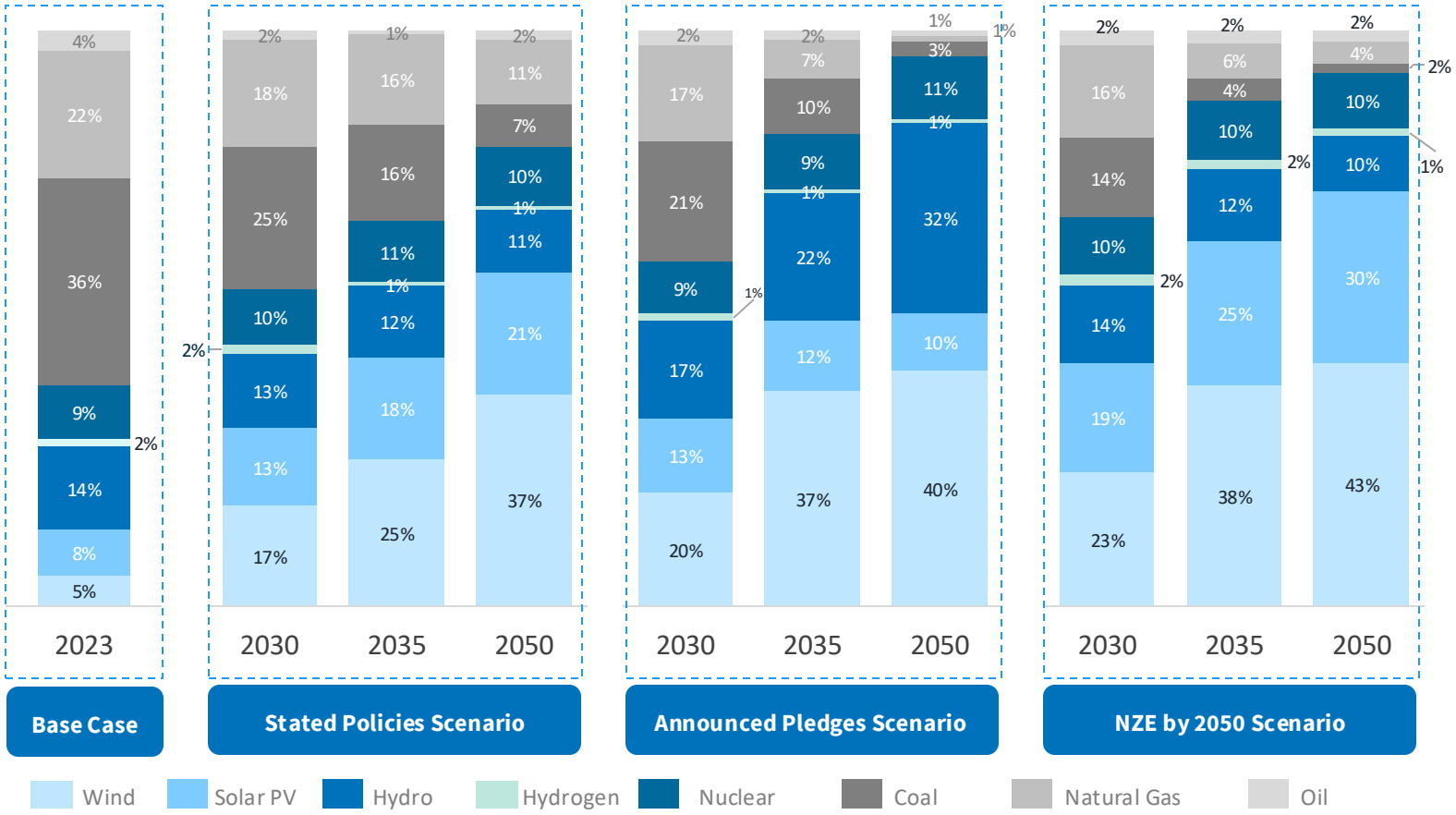

### Key Drivers of Clean Electricity Generation Growth:

- Supportive government policies as governments across the globe are pledging to increase spending on clean sources to reduce greenhouse gas emissions
- Energy security considerations amidst escalating geo-political tensions are favorable for clean electricity generation; wind and solar are localized, while fossil fuels like oil and gas are supplied globally
- Cost profile and economics of clean energy generation, especially solar and wind, are expected to be at par or better than traditional fossil fuel sources by 2030
- Overall increasing electricity demand to power growing, developing economies and energy intensive sectors such as data centers and other AI applications

IEA World Energy Outlook 2024, Ducker Carlisle Analysis
* TWh – Terawatt-hours | **NZE – Net Zero Emission | *Renewables: Solar PV, Wind, Hydro, Hydrogen | *Clean (no CO2): Nuclear
* Traditional Sources: Coal, Natural Gas, Oil

# Clean & renewable electricity sources will surpass traditional sources by 2035 at the latest

## Share of Electricity Generation by Source by Scenario, TWh*





IEA World Energy Outlook 2024, Ducker Carlisle Analysis
TWh – Terawatt-hours
*Renewables: Solar PV, Wind, Hydro, Hydrogen | *Clean (no $CO_2$): Nuclear \ * Traditional Sources: Coal, Natural Gas, Oil

# The Stated Policy Scenario

Focusing on the
“Most Likely” Scenario

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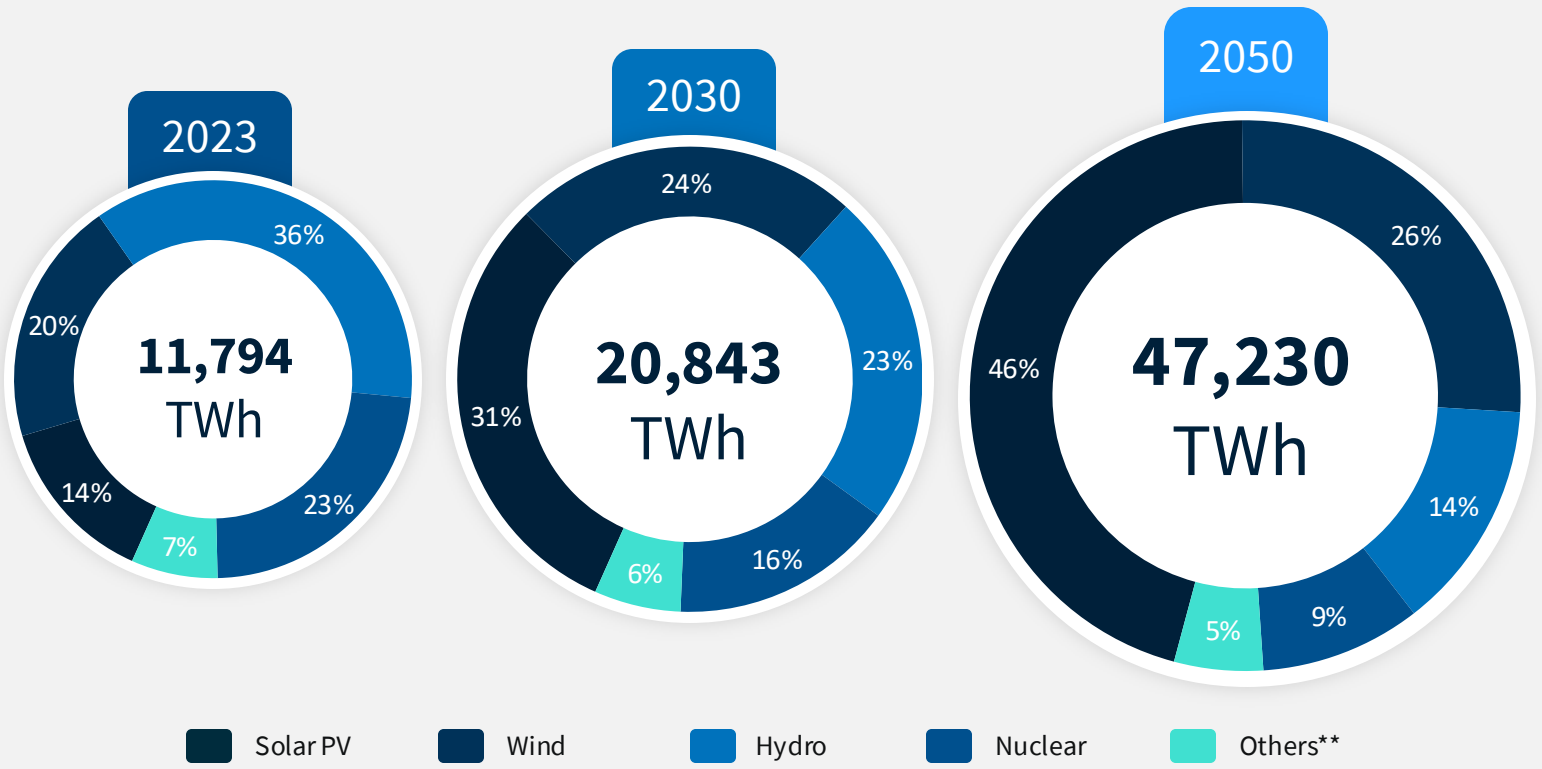
# Solar PV will be the leading clean electricity source, followed by wind



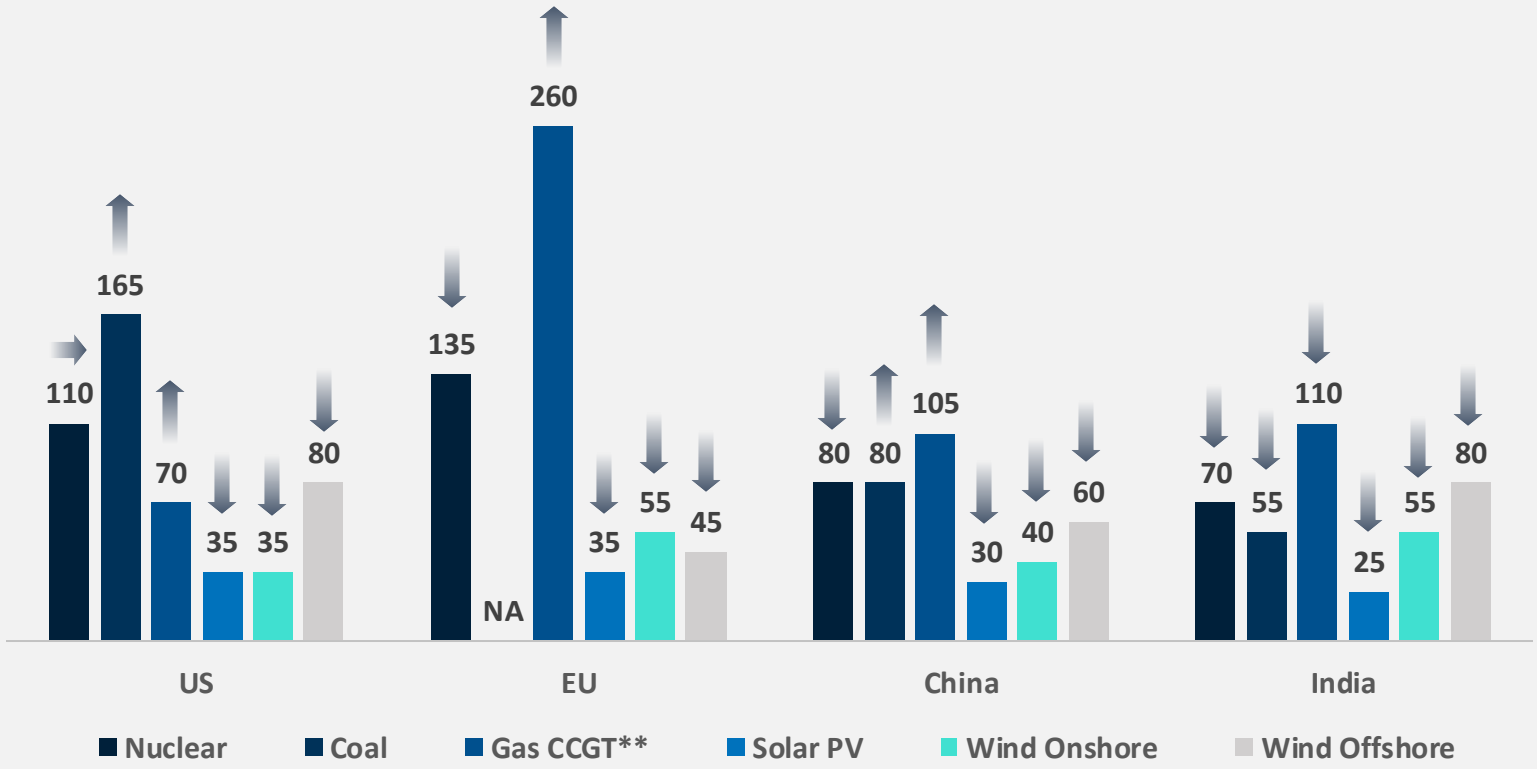

## Key drivers of solar PV, wind power and nuclear growth:

- China has committed to increasing its non-fossil fuel energy share to 20% by 2030, necessitating significant expansion in nuclear, wind, solar, and other zero-emission generation capacities.
- China eased project permitting process and has identified areas for large scale deployment of utility scale solar PV as well as onshore and offshore wind.
- US inflation reduction act (IRA) 2022 provides policy support & tax credits for solar PV and wind power until 2030.
- The EU is setting new renewable energy targets for 2040, though these plans face challenges due to differing views on including nuclear power in the renewable energy mix.

# Cost of solar PV and wind generation is declining and will be cheaper than traditional sources by 2030; cost of nuclear becoming very competitive in China and India

**LCOE# of Renewable Electricity by Source in 2030**

*2023 USD / MWh* (arrows indicate LCOE movement from 2023)*



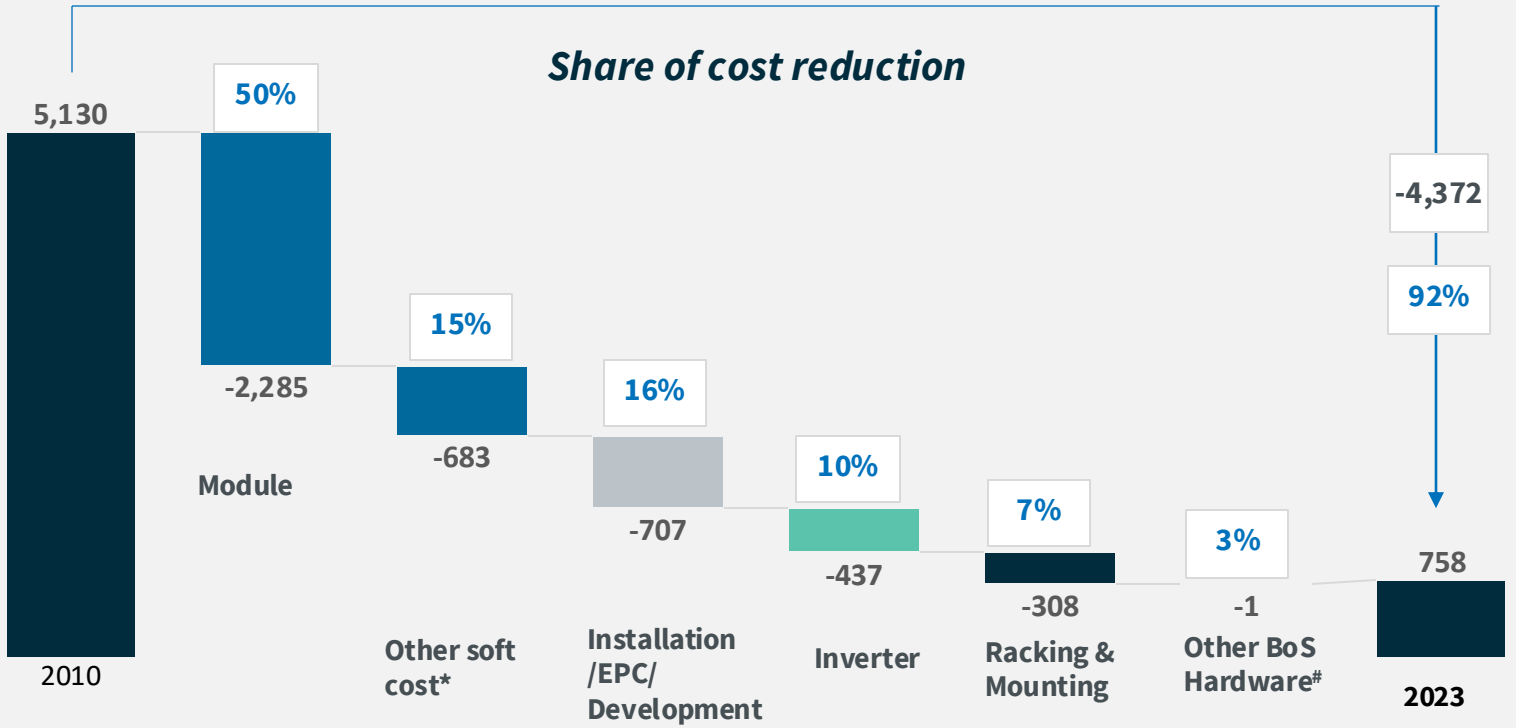


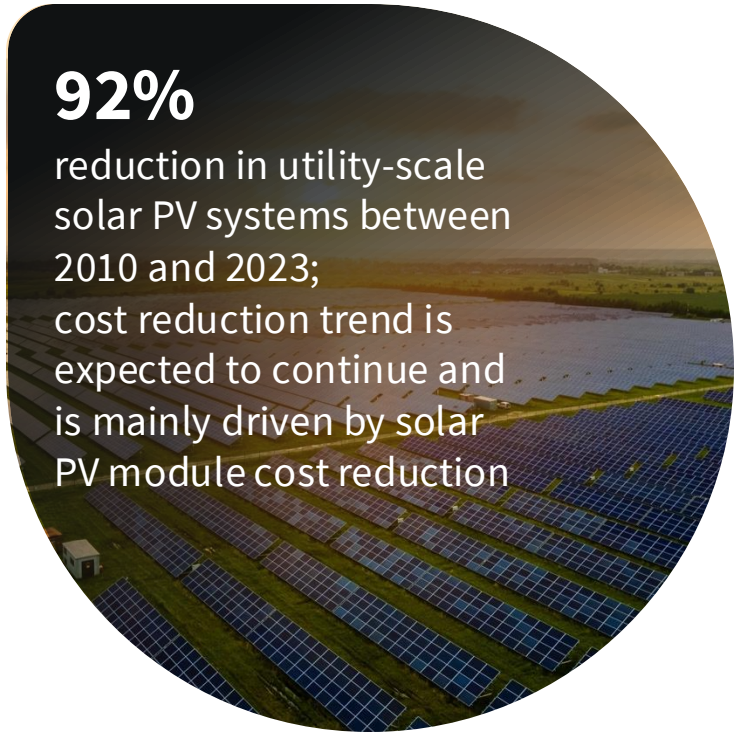
IEA Global Energy and Climate Model Documentation 2023, Ducker Carlisle Analysis
# Levelized Cost of Electricity, * MWh: Megawatt-hour, ** combined-cycle gas turbine
Under stated polices scenario

# PV module cost reduction is the main driver of the declining cost of solar PV electricity generation

**Global Weighted Average Total Installed Cost of Utility-scale Solar PV**

*Cost Reduction by Source, 2023 USD per KW*



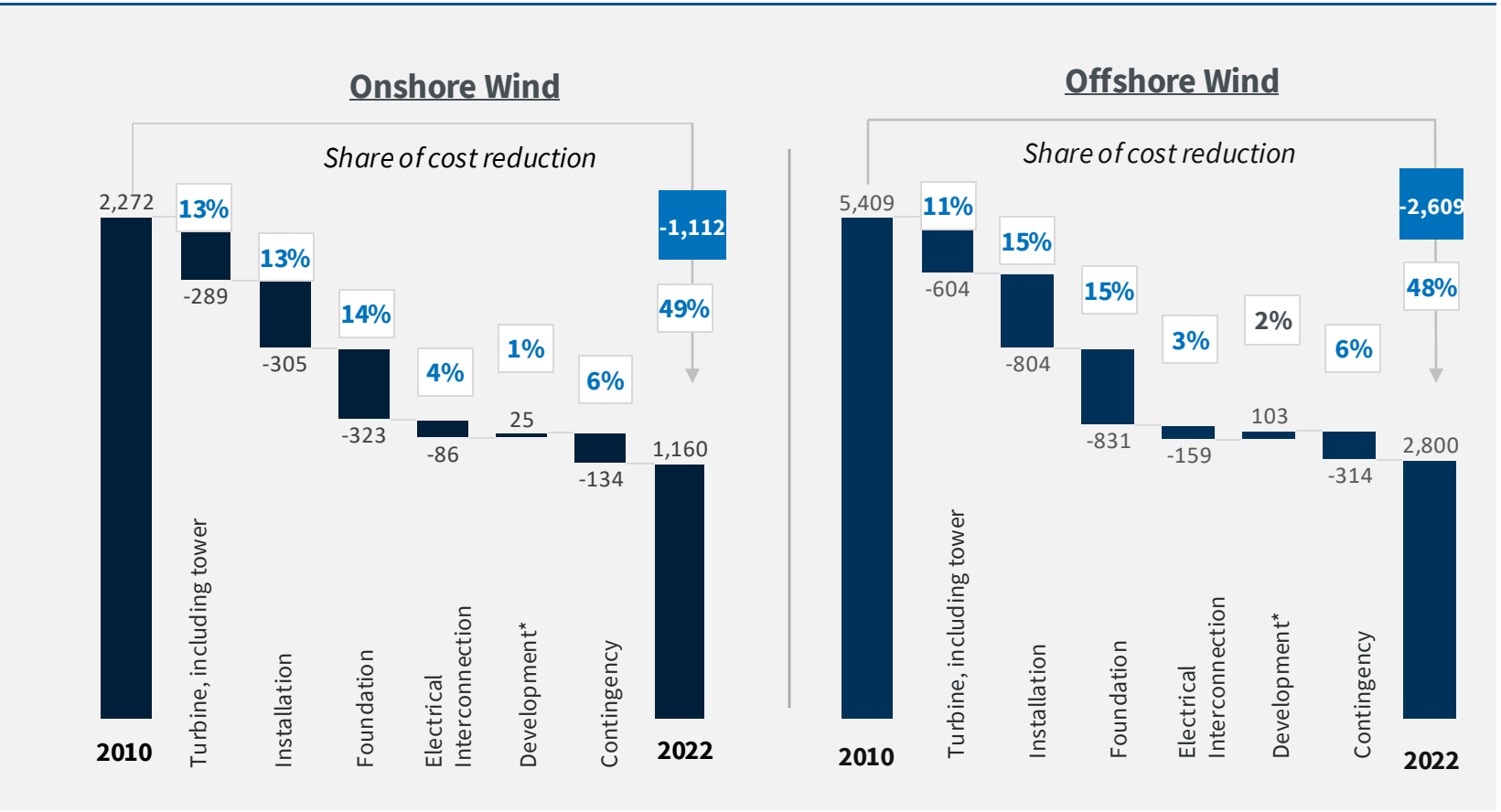




IRENA, Ducker Carlisle Analysis
* Soft costs, like, financing costs, system design, permitting, margins, etc.
# Other BoS, like, cabling, safety and security, structures and components for grid connection, etc.

# Reduction in turbine, foundation, and installations costs are the main drivers of the declining cost of wind electricity generation

**Global Weighted Average Total Installed Cost of Onshore & Offshore Wind**

*Cost Reduction by Source, 2023 USD per KW*




**49%** and **34%**

**reduction in onshore and offshore systems respectively** between 2010 and 2023; cost reduction trend is expected to continue

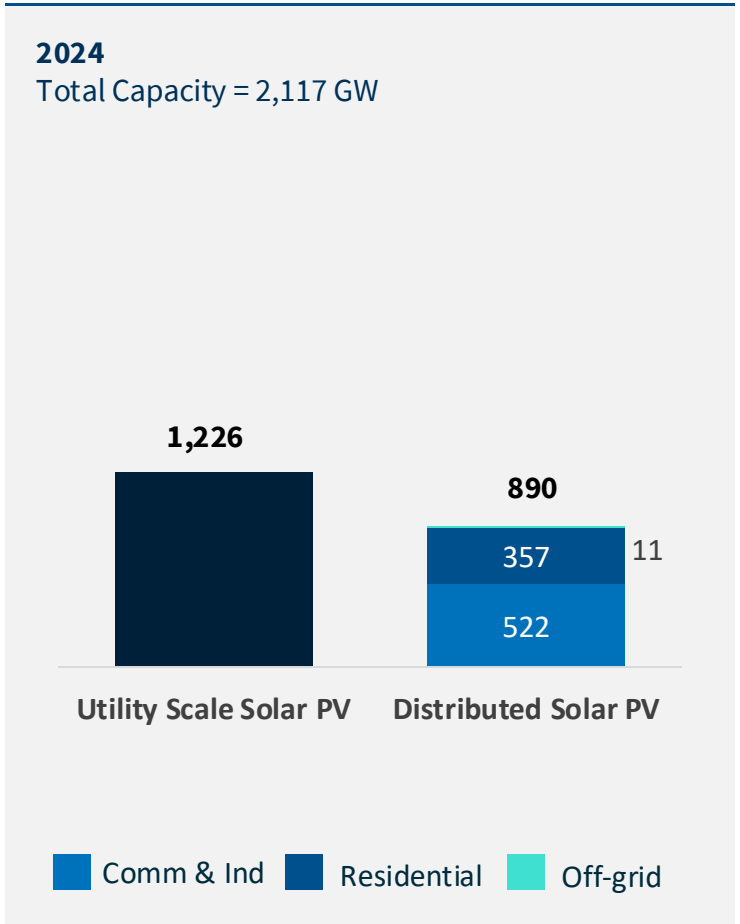
IRENA, Ducker Carlisle Analysis

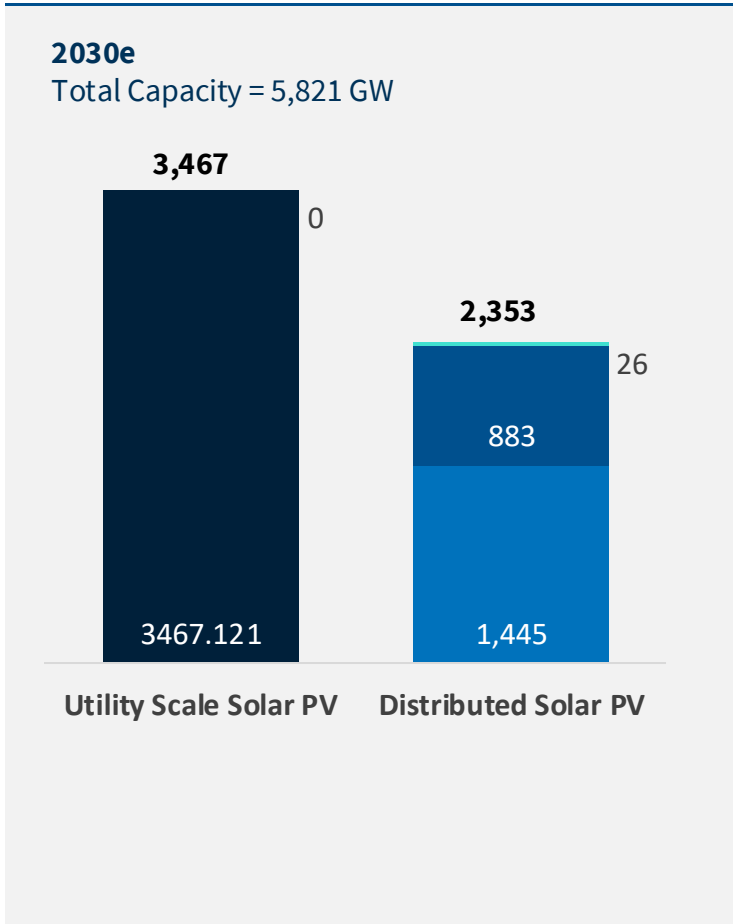
* Development costs include planning, project management and other administrative costs

NOTE – due to large variation in costs between onshore and offshore wind projects as well as between various projects and geographic locations, these values should only be treated as indicative.

# Utility-scale solar PV will provide the majority share of solar PV generation going forward

## Global Grid Connected Vs. Distributed Solar PV Cumulative Capacity, GW



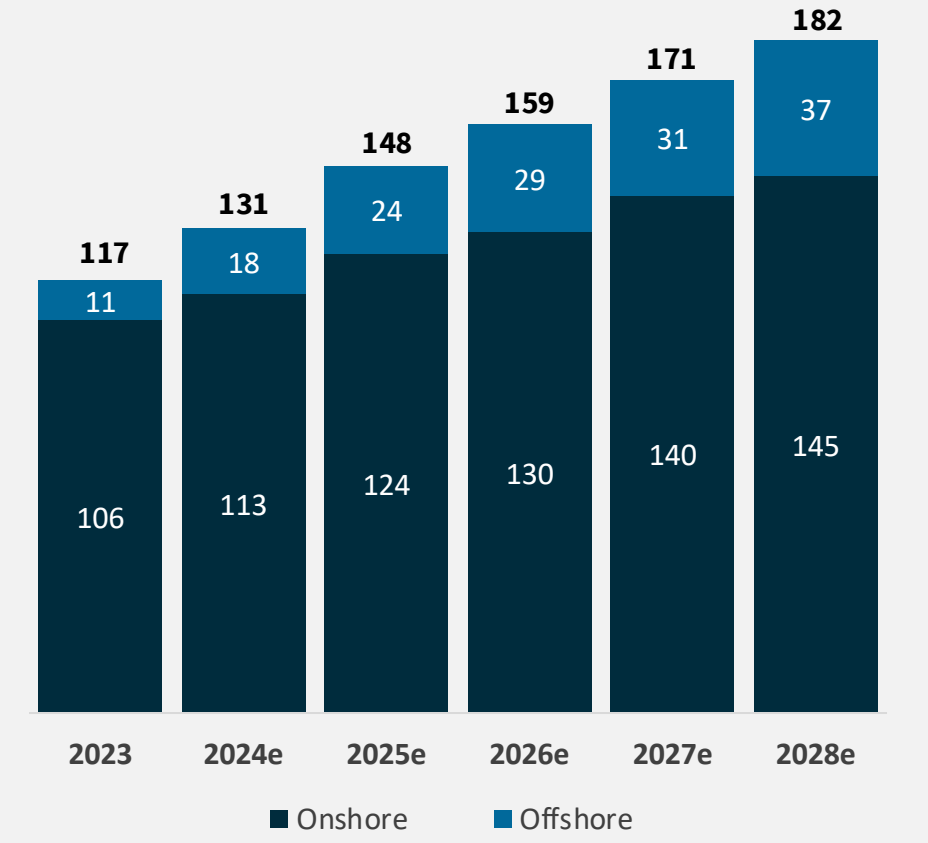

**Utility-scale solar PV will continue to provide majority of solar PV generation**

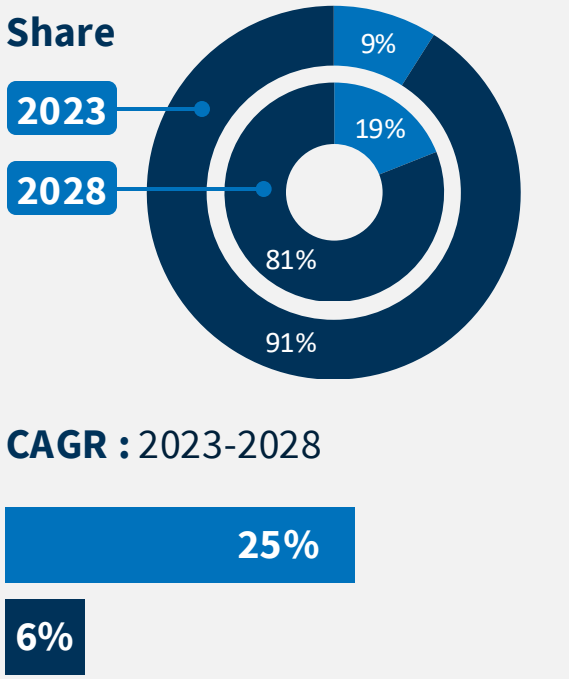
**Within distributed solar PV deployment, commercial & industrial will provide 61% of capacity, & residential 38% of capacity**

IEA, Ducker Analysis
* Grid connected = utility scale + distributed commercial & industrial + distributed residential
Utility-scale solar PV – large scale solar power plants, sell directly to the utility market (T&D companies), usually ground mounted
Distributed solar PV – small scale solar power plants, for on-site use / supply to grid, usually roof-top mounted

# New wind power installations will grow over the coming 5 years, with onshore installations accounting for the majority of GW installed

## Global Annual New Wind Power Installation, GW



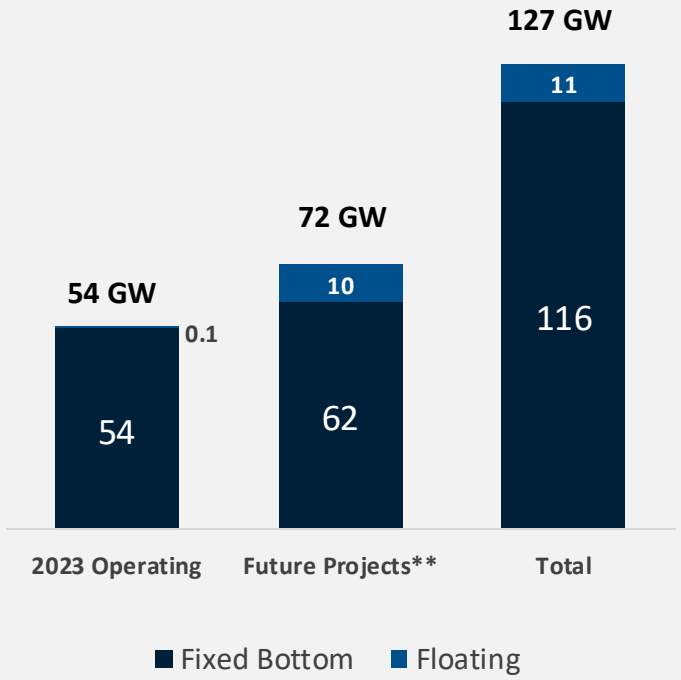





GWEC, Ducker Carlisle Analysis

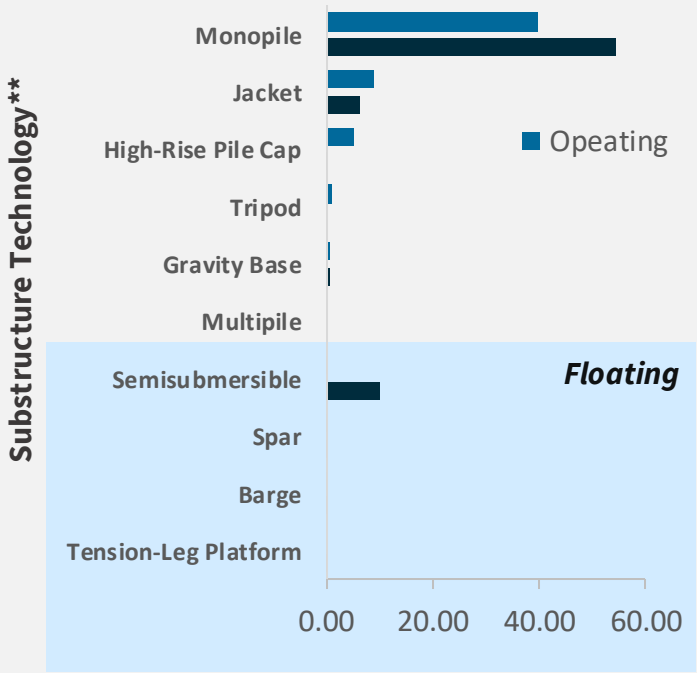
# Offshore Wind: Fixed bottom substructure will remain dominant while floating substructure is expected to rise modestly

## Global Offshore Wind Capacity* Substructure Share, 2023




** Proposed projects with / without commercial operation dates (CODs)*

## Global Offshore Wind Capacity* by Substructure Technology, 2023




Global Substructure Capacity, GW

Fixed substructure is expected to dominate as it is **~86%** of the announced **future offshore wind power capacity globally**

For fixed substructure, monopile technology is most common, accounting for **70%** of current capacity and **88% of announced capacity**

For floating substructure, semisubmersible is expected to be the most common technology, accounting for **98% of announced capacity**

The National Renewable Energy Laboratory, US DOE, Ducker Carlisle Analysis
* Excludes unreported capacity
**See appendix for details on various offshore wind substructure technologies
Footnote: Descriptions of various offshore wind substructures are in the appendix.

# Regional Breakdown

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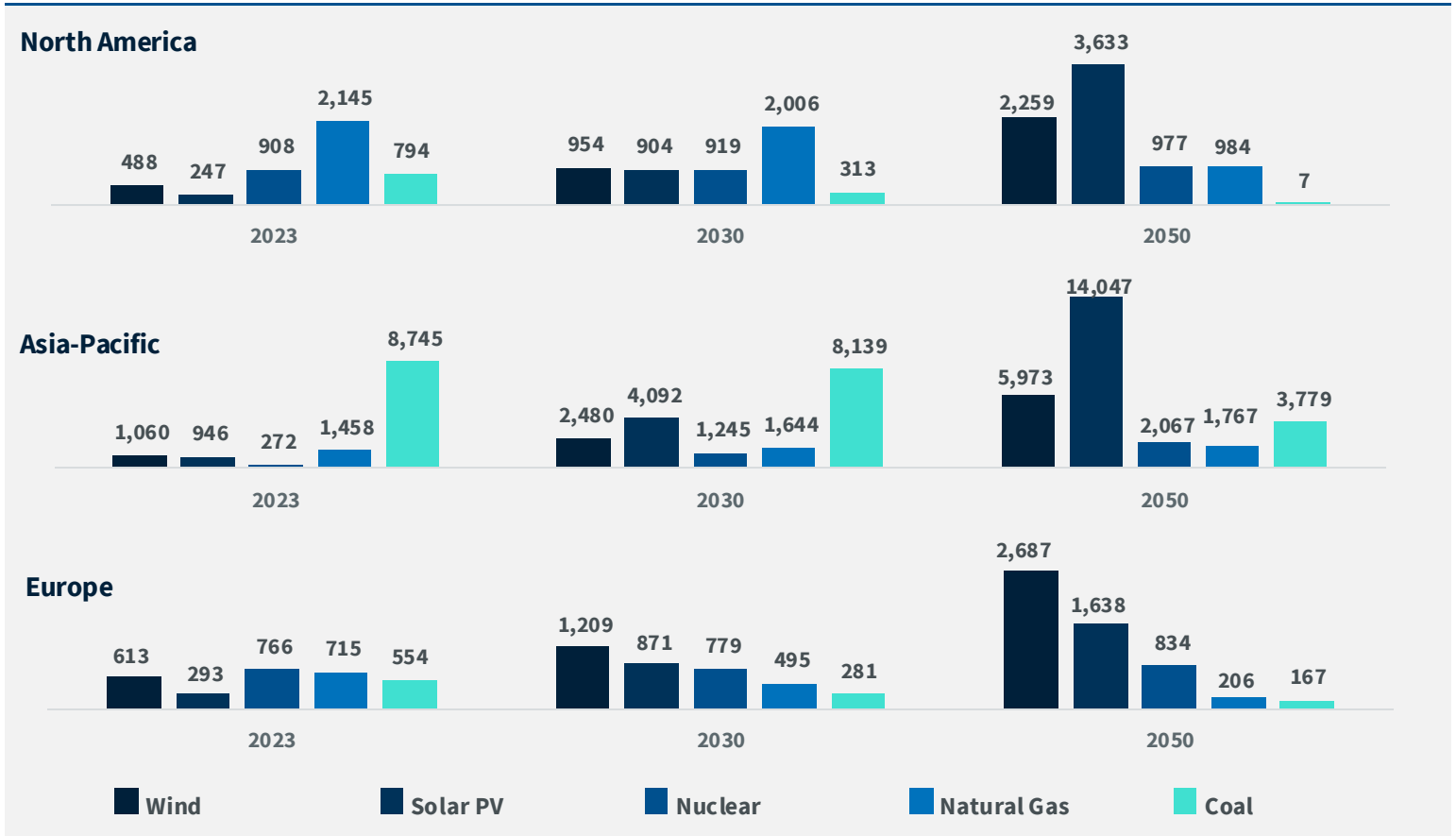
# By 2050, renewable electricity generation sources will lead in each major global region

## Electricity Generation by Source by Region, TWh*



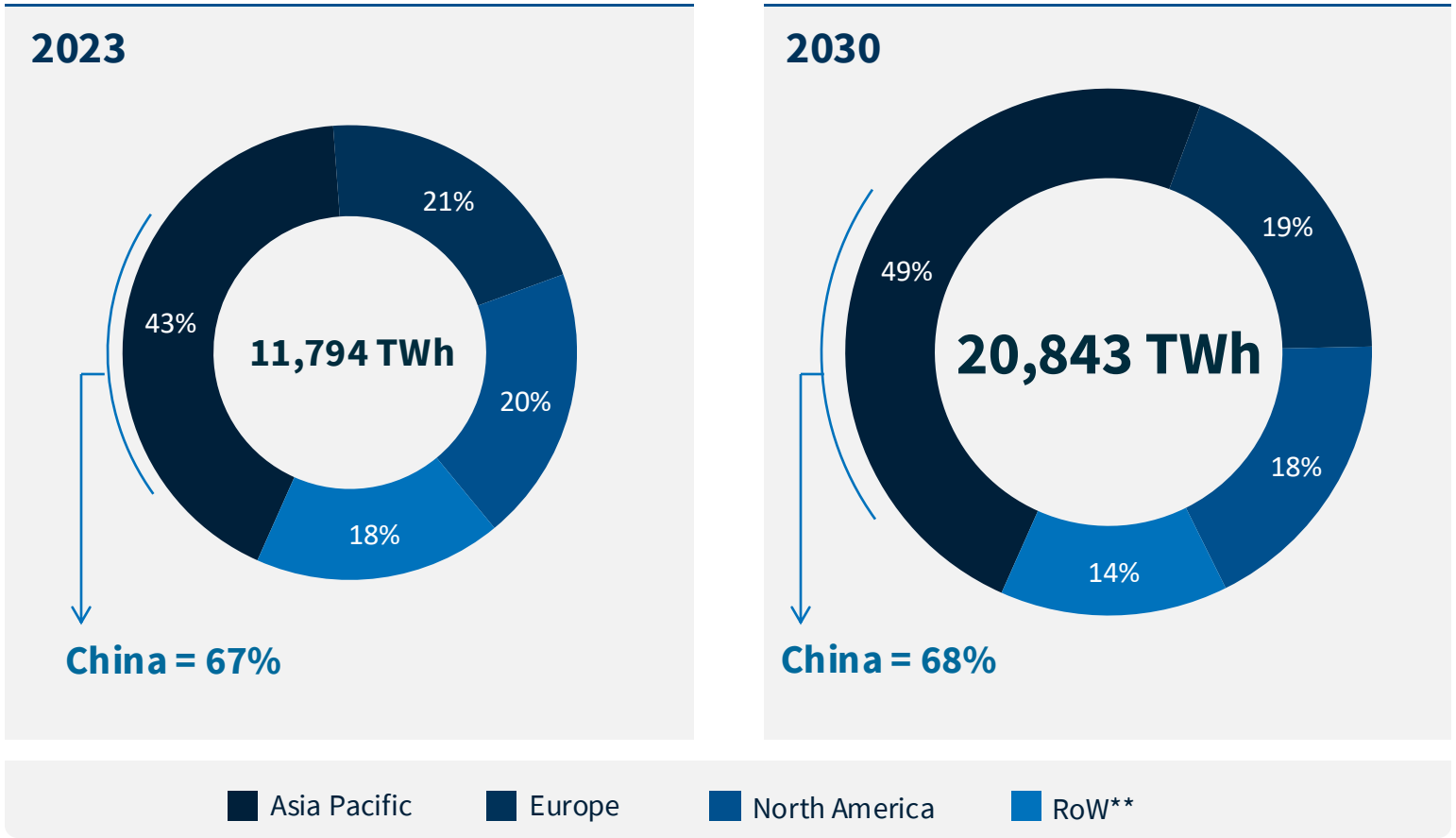

### Ever increasing demand and need for clean sources is the likely future scenario:

- Renewable sources are forecasted to be leading electricity generation source by 2050 in each major global region
- While solar is expected to dominate in North America and Asia-Pacific, Wind will lead in Europe
- Growth in renewables is mostly at the expense of coal and natural gas sources

IEA World Energy Outlook 2024, Ducker Carlisle Analysis
* TWh – Terawatt-hours
* Clean: Wind, Solar PV and Nuclear
* Traditional Sources: Natural Gas

# Asia Pacific region, especially China, will lead global clean electricity generation growth

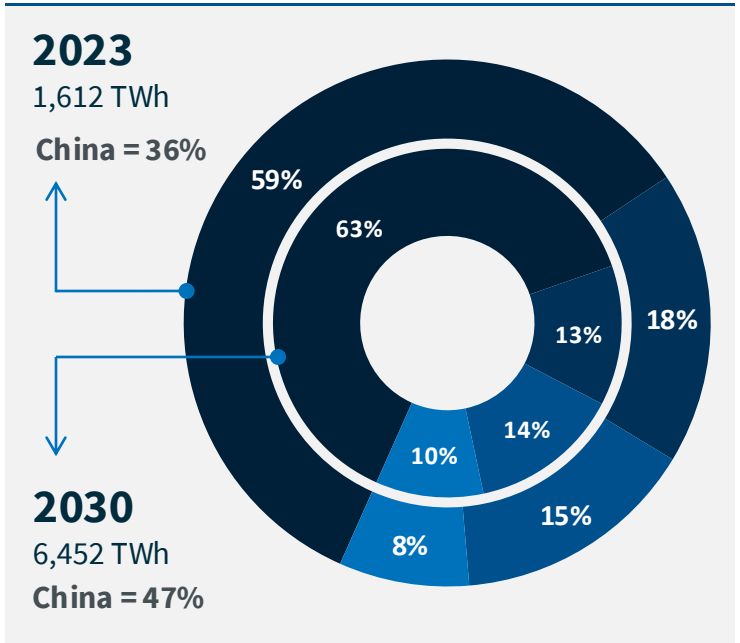
## Share of Clean Electricity Generation by Region (TWh)*



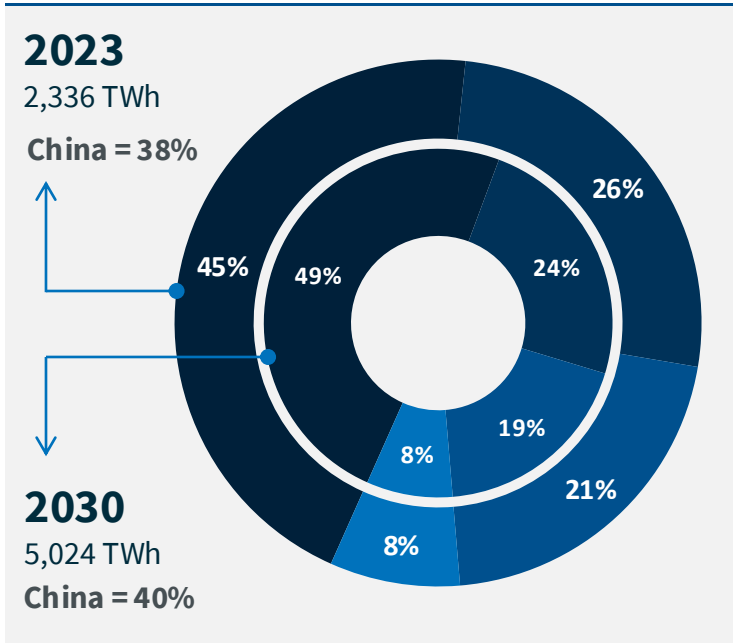

IEA World Energy Outlook 2024, Ducker Carlisle Analysis
* TWh – Terawatt-hours
**NZE – Net Zero Emission
*Renewables: Solar PV, Wind, Hydro, Hydrogen
*Clean (no CO2): Nuclear
* Traditional Sources: Coal, Natural Gas, Oil

# Asia Pacific region, led by China, will dominate solar PV, wind and nuclear generation

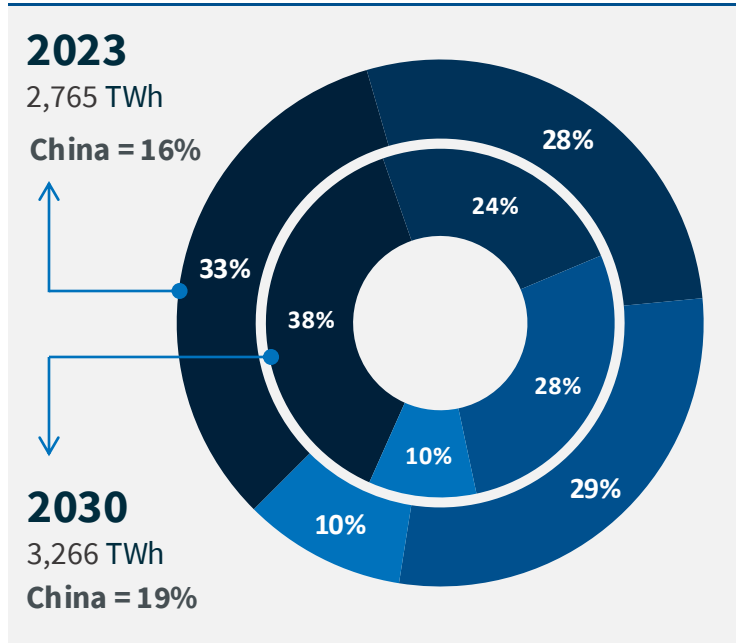
## Share of Solar PV Electricity Generation by Region (TWh)*




## Share of Wind Electricity Generation by Region (TWh)*




## Share of Nuclear Electricity Generation by Region (TWh)*



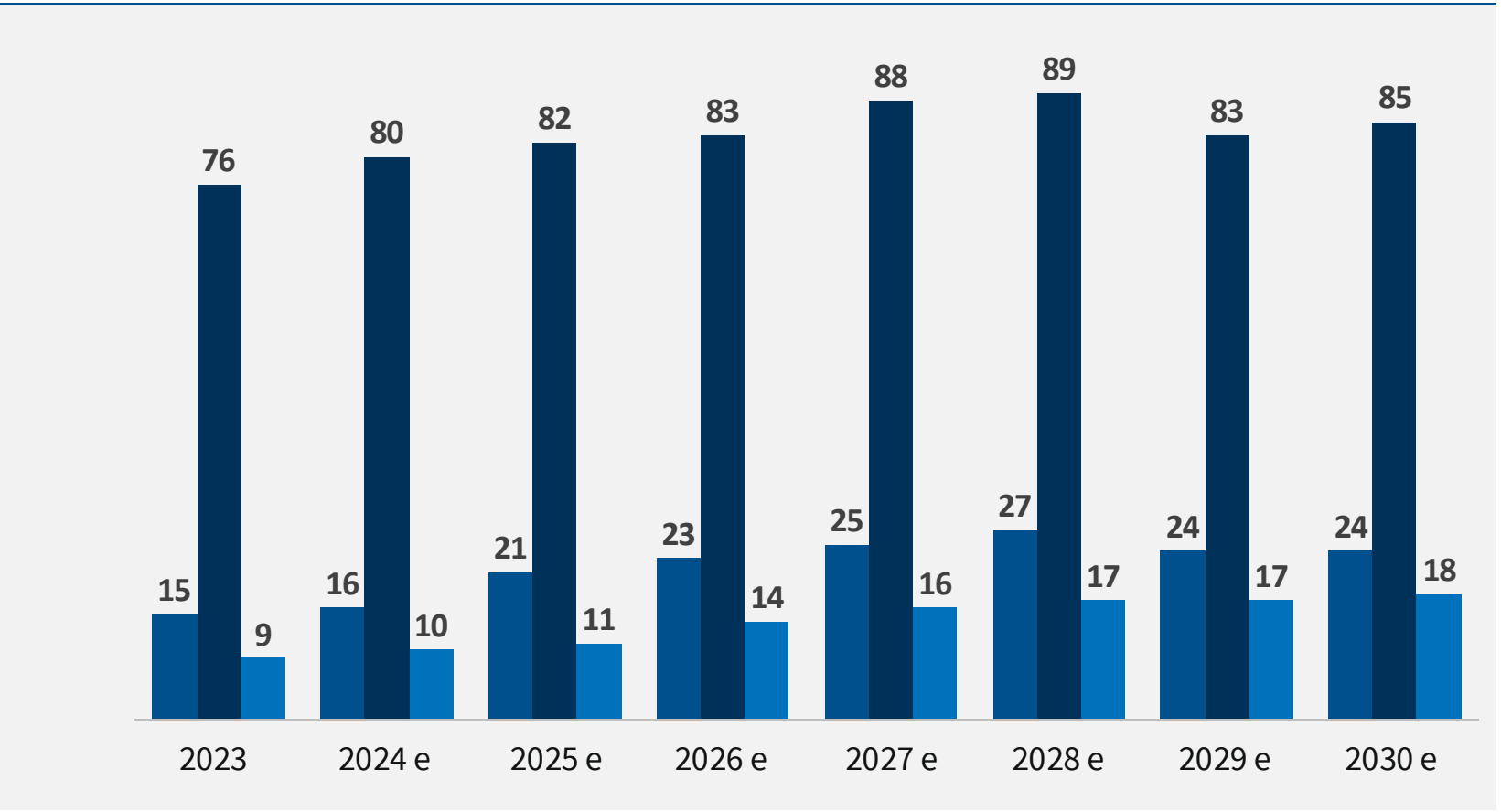

Asia Pacific | Europe | North America | RoW**

**Solar PV and wind growth in Asia Pacific will be driven by rapid electrification and strong growth in new economy sectors such as high-tech manufacturing, along with government policy guidelines and ambitious clean energy targets**

IEA World Energy Outlook 2024, Ducker Carlisle Analysis
TWh – Terawatt-hours | **NZE – Net Zero Emission | *Renewables: Solar PV, Wind, Hydro, Hydrogen | *Clean (no CO2): Nuclear | * Traditional Sources: Coal, Natural Gas, Oil

# Asia-Pacific region will be the growth engine for onshore wind installations

## Global Annual New Onshore Wind Installation, GW

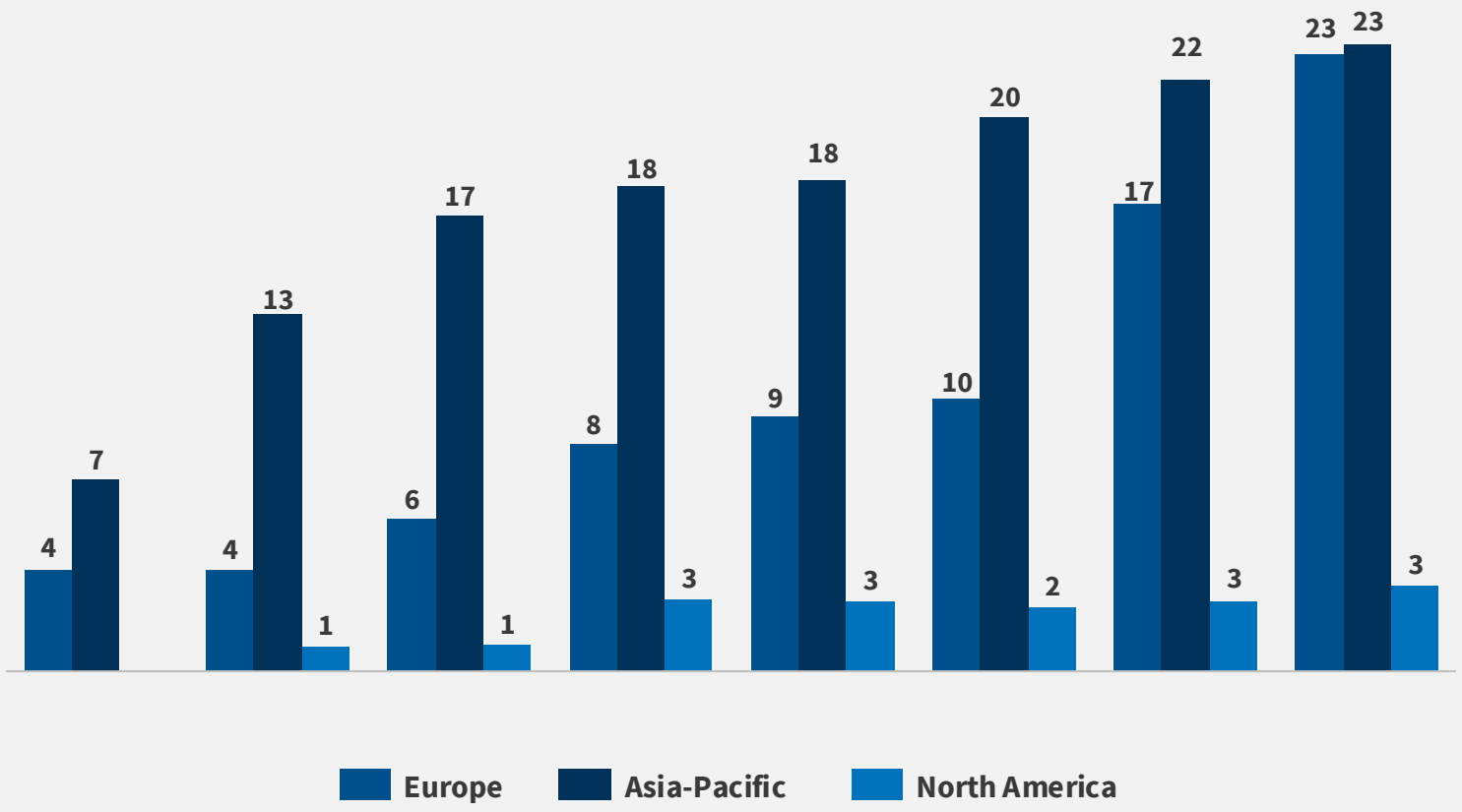




GWEC, Global Wind Report 2024, Ducker Carlisle Analysis

# Similarly, Asia-Pacific region will be the growth engine for offshore wind installations as well

## Global Annual New Offshore Wind Installation, GW

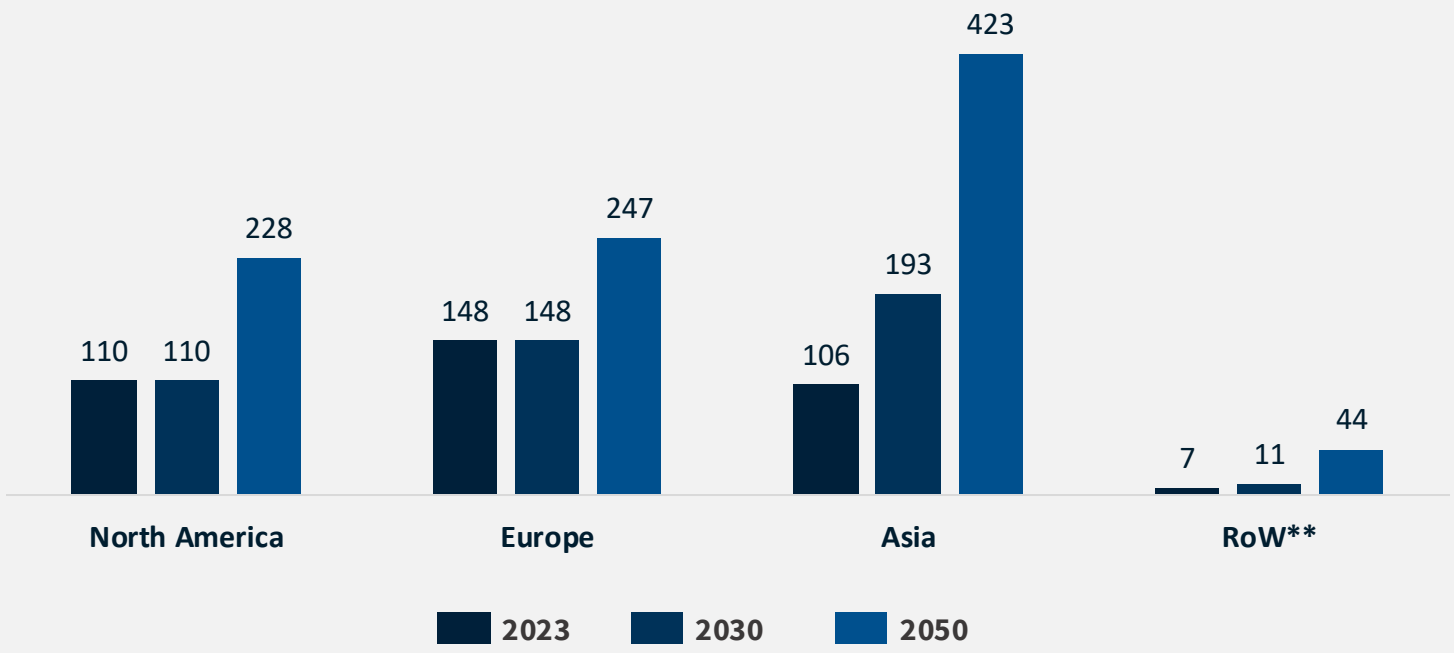




GWEC, Global Wind Report 2024, Ducker Carlisle Analysis

# Asia will lead in nuclear electricity generation capacity installation through 2050

## Total Installed Nuclear Electrical Generating Capacity by Region, GW(e)




***By 2050**, Asia is expected to lead nuclear installed capacity*

North America and Europe will not add new nuclear capacity by 2030, as permitting and installations take significant time; by 2050 there will be significant capacity increases

**Nuclear energy will be an important complement to renewables, as it provides consistent base load and does not contribute greenhouse gases**

IAEA Energy, Electricity and Nuclear Power Estimates for the Period up to 2050, Ducker Carlisle Analysis
**RoW – Africa, Central & South America

# Summary Table – Stated Policies Scenario (1/2)

| REGION | SECTOR | | | DRIVERS | HEADWINDS |
|---|---|---|---|---|---|
| | Solar PV | Nuclear | Wind | | |
| China | 3001<br>23% | 623<br>5% | 1998<br>11% | • Eased project permitting process<br>• A draft of the 14th Five-Year Plan (2021-2025) released in March 2021 showed government plans to reach 70 GWe gross of nuclear capacity by the end of 2025.<br>• Power market reforms and green certification systems enabling utility-scale developers to command higher prices than under regulated contracts, improved project economics | • Grid development and integration challenges for new utility scape solar PV and wind power projects<br>• Economic growth concerns<br>• China imposed a moratorium on inland nuclear construction following the 2011 Fukushima accident |
| Rest of Asia Pacific | 1091<br>15% | 622<br>7% | 482<br>14% | • Improved grid access to commercial distributed solar PV projects in India<br>• Introduction of closed-envelope bidding process for wind projects in India<br>• Vietnam's new electricity development plan with significant wind power capacity deployment<br>• India is a pioneer in developing the thorium fuel cycle, and has several advanced facilities related to this<br>• Ambitious auction program of Philippines to boost utility-scale solar PV and onshore wind power growth | • Policy uncertainties and delayed policy responses<br>• Lack of access to affordable financing<br>• Complex and lengthy permitting process<br>• Grid development and integration challenges<br>• Lack of public acceptance to installation of nuclear plants |

# Summary Table – Stated Policies Scenario (2/2)

| REGION | SECTOR | | | DRIVERS | HEADWINDS |
|---|---|---|---|---|---|
| | Solar PV | Nuclear | Wind | | |
| North America | 904<br>18% | 919<br>28% | 954<br>9% | • Policy and tax credits through IRA 2022 for utility scale solar PV and wind power deployment<br>• Small modular reactors are under development in Canada and US<br>• Federal, state and utility level incentives for distributed solar PV deployment<br>• Federal lease auctions and state-level tenders to enable growth in offshore wind deployment | • Supply chain constraints leading to rising costs and project delays of solar PV and wind power projects<br>• Half of US nuclear generating capacity is over 30 years old, major investments are required<br>• Higher financing costs for developers with PPAs signed under low equipment and financing costs scenario<br>• Slow project permitting process resulting in delayed deployment |
| Europe | 871<br>15% | 779<br>24% | 1209<br>9% | • Streamlined auction process, raised ceiling costs to account for higher investment costs<br>• EC has proposed reforms under the net-zero industry act which calls for advancements in small modular reactors<br>• Contract indexation, helping developers to hedge against inflation during the project implementation<br>• Alterative routes to market for developers, like, corporate PPAs | • Rising costs led by supply chain constraints<br>• Anti-nuclear sentiment is still prevalent since Fukushima incident<br>• Higher financing costs for developers with PPAs signed under low equipment and financing costs scenario<br>• Slow and complex permitting process for solar PV and wind power projects |

# Challenges to Overcome to Realize Clean Energy Future

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# Keys to Realizing the Clean Energy, Electrified Future
## *How can your company position itself in these 3 areas to create value?*

### Battery/Storage Technology

- Current battery storage technology is not sufficient; various newer and innovated technologies in consideration, including hydrogen storage and flow batteries
- Government regulation and incentives needed in short term to get new technologies off the ground and lower costs

*"The cost of getting storage implemented cancels out value prop of solar. We get requests to price storage and more times than not, the costs are too high."*

**– Executive Director, Renewables, Major Utility**

*"We don't see LI ion as the longer-term solution. We've looked at flow batteries. The future will probably be a mix of LI ion, flow batteries, thermal storage, or hydrogen storage."*

**– VP Global BD, Major Wind Manufacturer**

### Grid Capacity & Resiliency

- Aging grid and related components, especially in transmission, cannot handle higher and more fluctuating loads in a future cleaner, more electrified world
- Investment in grid capacity and resiliency will be required; however, there are significant bottlenecks in new grid connection projects for renewables

*"Queues are bottlenecked. There's not enough supply to go around, but demand continues to increase. There are still supply chain constraints, still transmission constraints."*

**– Executive Director, Renewables, Major Utility**

*"Majority of the circuits are 30-40 years old. As load increases and fluctuates, you must account for the transmission level to connect the load."*

**– Sr. Power Systems Design Consultant**

### Energy Management

- Monitoring & controls for load balancing and management
- Hybrid, integrated systems including wind/solar plus storage to balance load
- Artificial Intelligence (AI) may have a significant role

*"How to balance and manage the variability of the resources is critical. You need smart management."*

**– Sales Executive, Major Wind Manufacturer**

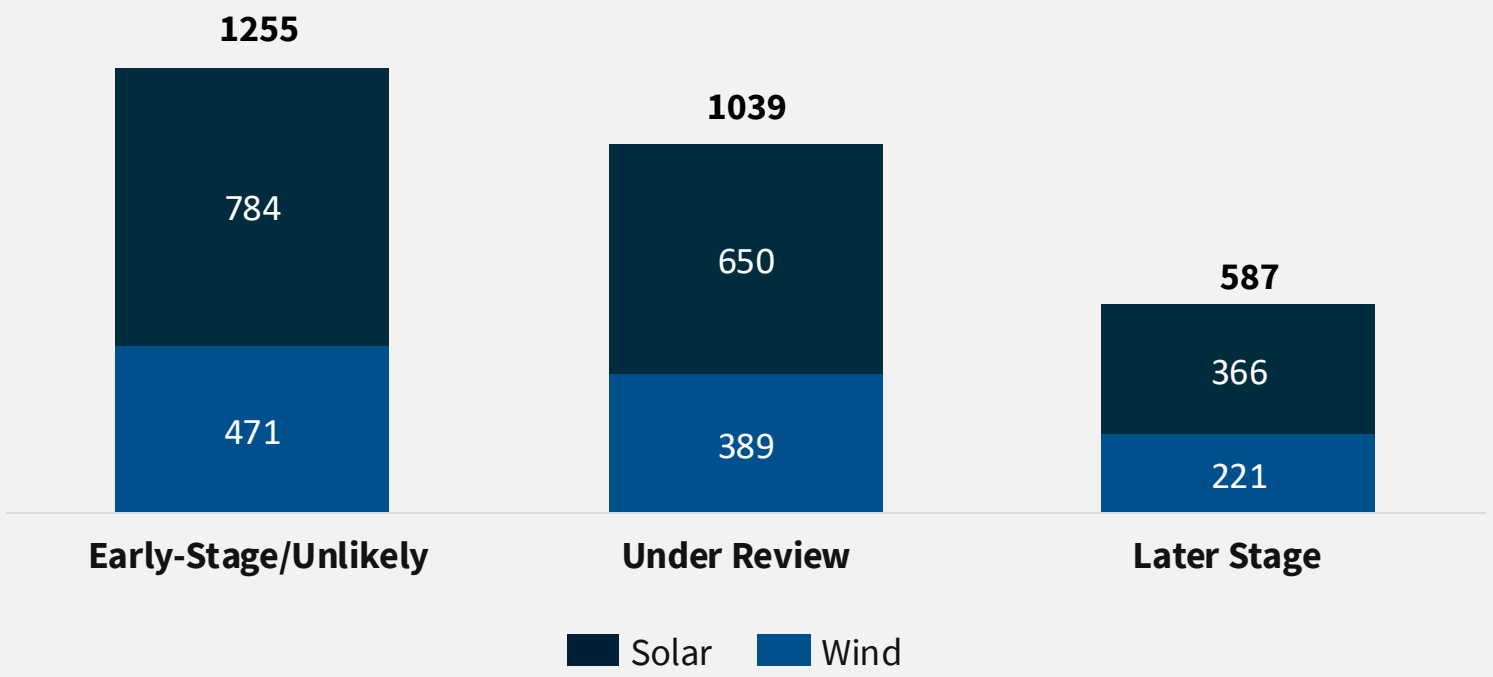
*"Next markets to be developed will be storage, grid, and energy management systems. That is where complex system integration will have to come as complexity increases in the grid."*

**– VP Global BD, Major Wind Manufacturer**

Ducker Carlisle Market Research, Ducker Carlisle Analysis

# Many advanced-stage renewable energy projects are awaiting grid connection, slowing the energy transition

**Capacity of Renewable Energy Projects in Connection Queues,** *2024, (GW)*




Solar PV remains the dominant technology waiting for grid connection followed by wind. However, late-stage wind project capacity has fallen nearly 15% as supply chain delays and a slow-to-refresh project pipeline impact new project development

For projects under grid connection review and in the late stages of development, capacity has increased almost 8%, while for those in the early stages it has decreased nearly 15%, with major reductions the United States, Brazil and Mexico

**Globally, governments have addressed connection queue bottlenecks through grid improvements, implementing new measures to accelerate connection times, regulations to reduce speculative projects, & allowing projects to exit queues without penalties**

IEA, Ducker Carlisle Analysis.
Early- Stage/Unlikely Projects: Projects in early development with low chances of completion.
Under Review Projects: Projects currently being evaluated for feasibility and potential progression.
Later Stage Projects: Projects close to construction or operation.

# Key Questions for Industry Leaders Affected by the Energy Transition

## FOCUS

Where can and should my company play in the clean energy value chain?

Where are our capabilities the best fit, and where is the strongest opportunity for profitable growth?

## VALUE PROP

What should be our offering and value proposition where we choose to play in the clean energy value chain?

## PRODUCT

How should product management and new product development be directed to develop products & solutions for our differentiated offering in the clean energy value chain?

## COMMERCIAL

Is our commercial organization set up to capture share and growth in the clean energy ecosystem?

How do we build awareness of our differentiated offering in the space?

What sales & commercial skills, expertise, and structure are needed to sell our value proposition?

## OPERATING MODEL

What additional operating model elements need to be designed/refined to support our growth in the clean energy ecosystem?

## RISK TO CORE

How does the energy transition affect our core business?

Does it create risks for our core business, and how can these risks be mitigated?

Does our core business need to be repositioned in the growing and evolving clean energy ecosystem?

# Contact Us

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**Industrials Practice Lead**

Kevin is a Managing Director at Ducker Carlisle, leading the Industrials Practice. He has over 20 years of management consulting experience and has led a multitude of engagements focused on profitable revenue growth across several industrial sectors, including building products, chemicals, climate technologies, electrical products and services, manufacturing equipment, materials processing, security solutions, and water management. Clients value Kevin's capabilities devising market- and customer-backed growth strategies and building leading commercial capabilities to maximize profitable growth and market share gains. Kevin holds a B.S. in Medical Science and History from the University of Notre Dame, an M.A. in Applied Economics from the University of Chicago Booth School of Business. Kevin is an active member of the Association for Corporate Growth (ACG).

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|---|---|---|---|---|---|---|
| Through industry expertise and insights, we accelerate client planning decisions and implementation. | We leverage our proprietary data to drive strategy and solve clients' complex problems. | Practical frameworks and strategic programs increase operational performance, improve customer service, and reduce costs. | We deliver aligned brand and channel strategies, along with high, immediate ROI and advanced client capabilities for long term sustainability. | Deep industry expertise and primary research/access to industry provide recency-based market, customer and customer insights that support commercial diligence and value-creation. | Partner with experienced consultants to make your supply chain efficient, resilient, and better connected with your customers. | We empower businesses to harness AI's full potential by providing advanced, affordable, technology solutions. Leveraging over ten years of expertise, we deliver customized strategies that boost EBITDA. |

# Appendix

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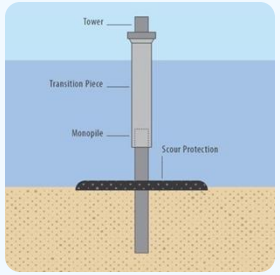
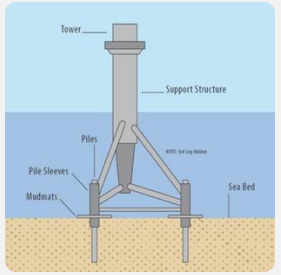
# **Fixed Bottom (Nearshore)** Wind Substructure Overview



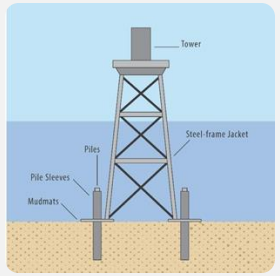

## Monopile

- A single, large diameter steel pipe, known as a pile, driven into the seabed to provide vertical and lateral support.
- Monopiles are typically prefabricated and transported to the site as a single structure.



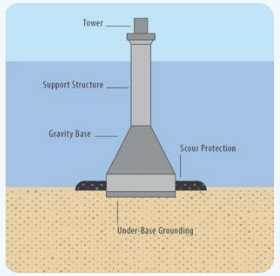

## Tripod

- Tetrahedral (pyramid-shaped) space frame constructed from tubular steel members.
- The tripod base and the central column constructed onshore as a single unit, transported to the site, and lowered to the seabed.



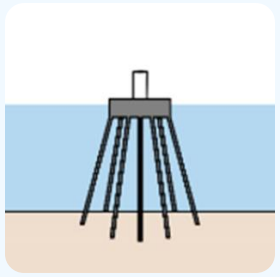

## Jacket

- Lattice-truss structures, like, the offshore oil platforms.
- Built onshore and transported to the site on a flat-top barge or specialty transport vessel. Jackets can also be floated and towed to the site.



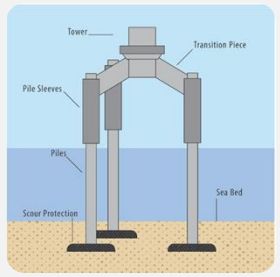

## Gravity Base

- Has a wide, heavy base sitting on the sea floor and supports the cylindrical central column raising above the waterline.
- Requires more seabed preparation compared to others, is prefabricated, built onshore, and towed to the site.



## High-rise Pile Cap

- Usually, made of concrete or a combination of steel and concrete.
- The cap is supported by large number of piles.

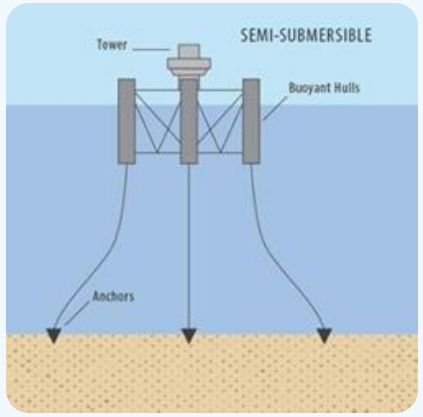



## Tri-Pile / Multi-pile

- Has more than one pile, smaller in size compared to monopile leg, connected to the structure above water.
- Built onshore as separate components and transported to the site,

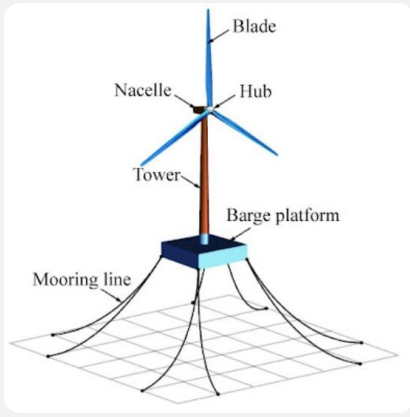
Bureau of Ocean Energy Management, U.S. Department of the Interior , National Renewable Energy Laboratory, U.S. Department of Energy (DOE)

# Floating Wind Substructure Overview



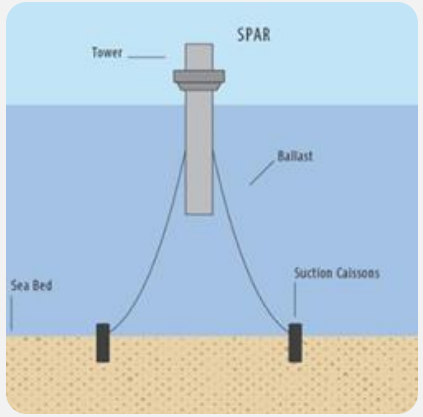

## Semi-Submersible

- Have multiple columns or hulls submerged and attached together with connecting braces.
- The submerged ballast keeps the structure upright.



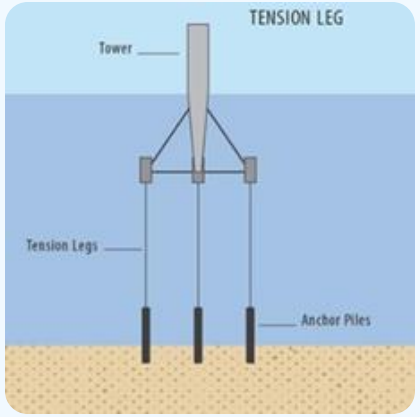

## Barge

- Concept is like a ship, beam and length are larger than draught (height).
- Has a large surface area in contact with the water, which gives it stability.




## Spar

- A single ballasted cylinder, supporting the tower and extends below water.
- Also called as spar buoys.



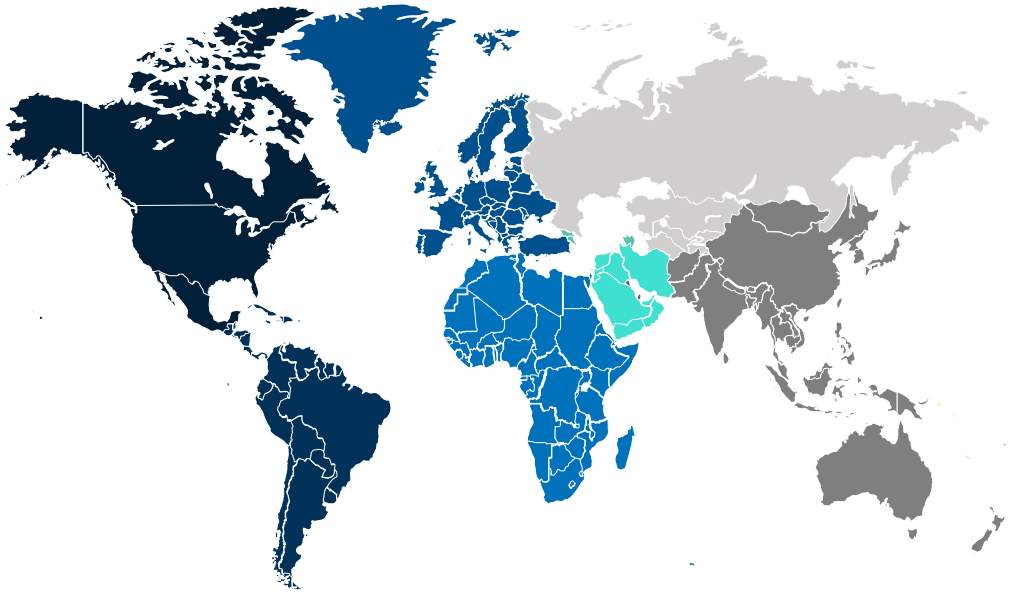

## Tension Leg Platform

- Multihull floating platform vertically moored to the seafloor by a group of tendons.
- Tendons stabilize the platform, minimizes vertical movement of the structure.

Bureau of Ocean Energy Management, U.S. Department of the Interior , National Renewable Energy Laboratory, U.S. Department of Energy (DOE), China Ocean Engineering, Iberdrola

# Regions

| Regions | Countries Included |
|---|---|
| **Asia Pacific** | **Australia, Bangladesh, Democratic People's Republic of Korea (North Korea), India, Japan, South Korea, Mongolia, Nepal, New Zealand, Pakistan, The People's Republic of China (China), Sri Lanka, Southeast Asia** *(Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam)*, **Chinese Taipei**, and **other Asia Pacific countries and territories** *(Afghanistan, Bhutan, Cook Islands, Fiji, French Polynesia, Kiribati, Macau (China), Maldives, New Caledonia, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga and Vanuatu).* |
| **Europe** | **European Union** *(Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden)*, **Albania, Belarus, Bosnia and Herzegovina, Gibraltar, Iceland, Israel, Kosovo, Montenegro, North Macedonia, Norway, Republic of Moldova, Serbia, Switzerland, Türkiye, Ukraine and United Kingdom.** |
| **North America** | Canada, Mexico and United States |
| **Rest of the World (RoW)** | **Africa** *(North Africa and sub-Saharan Africa regional groupings (Angola, Benin, Botswana, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Ghana, Kenya, Kingdom of Eswatini, Madagascar, Mauritius, Mozambique, Namibia, Niger, Nigeria, Republic of the Congo (Congo), Rwanda, Senegal, South Africa, South Sudan, Sudan, United Republic of Tanzania (Tanzania), Togo, Uganda, Zambia, Zimbabwe and other African countries and territories))*, **Central and South America** *(Argentina, Bolivia, Venezuela, Brazil, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay and other Central and South American countries and territories)*, **Eurasia** *(Caspian regional grouping and the Russian Federation (Russia))*, **Middle East** *(Bahrain, Islamic Republic of Iran (Iran), Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic (Syria), United Arab Emirates and Yemen).* |



- North America
- Central & South America
- Europe
- Africa
- Middle East
- Eurasia
- Asia Pacific

# Scenarios Details

## Stated Policies Scenario

- **Definition:** A scenario which reflects current policy settings based on a sector-by-sector and country-by-country assessment of the energy-related policies that are in place as of the end of August 2023, as well as those that are under development. The scenario also considers currently planned manufacturing capacities for clean energy technologies.
- **Objectives:** To provide a benchmark to assess the potential achievements (and limitations) of recent developments in energy and climate policy. The differences between the STEPS and the APS highlight the “implementation gap” that needs to be closed for countries to achieve their announced decarbonization targets.

  The Stated Policies Scenario (STEPS) are exploratory, in that they define a set of starting conditions, such as policies and targets, and see where they lead based on model representations of energy systems that reflect market dynamics and technological progress.

## Announced Pledges Scenario

- **Definition:** A scenario which assumes that all climate commitments made by governments and industries around the world as of the end of August 2023, including Nationally Determined Contributions (NDCs) and longer-term net zero targets, as well as targets for access to electricity and clean cooking, will be met in full and on time.
- **Objectives:** To show how close current pledges get the world to the target of limiting global warming to 1.5 °C. The differences between the APS and the NZE Scenario highlight the “ambition gap” that needs to be closed to achieve the goals of the Paris Agreement adopted in 2015. It also shows the gap between current targets and achieving universal energy access.

  The Announced Pledges Scenario (APS) is exploratory, in that they define a set of starting conditions, such as policies and targets, and see where they lead based on model representations of energy systems that reflect market dynamics and technological progress.

## Net Zero Emissions by 2050 Scenario

- **Definition:** : A scenario which sets out a pathway for the global energy sector to achieve net zero CO2 emissions by 2050. It does not rely on emissions reductions from outside the energy sector to achieve its goals. Universal access to electricity and clean cooking are achieved by 2030. The scenario was fully updated in 2023.
- **Objectives:** To show what is needed across the main sectors by various actors, and by when, for the world to achieve net zero energy-related CO2 emissions by 2050 while meeting other energy-related sustainable development goals such as universal energy access.

  The Net Zero Emissions by 2050 Scenario (NZE Scenario) is normative, in that it is designed to achieve specific outcomes – an emissions trajectory consistent with keeping the temperature rise in 2100 below 1.5 °C (with at least a 50% probability) with limited overshoot, universal access to modern energy services by 2030 and major improvements in air quality – and shows a pathway to reach them.