
WIND POWER & GREEN RECOVERY

Wind can power 3.3 million new jobs over next five years

In addition to providing affordable, clean and zero-carbon electricity, wind energy has the capacity to bring tremendous socioeconomic benefits to local communities. Large-scale onshore and offshore wind projects generate sustainable jobs which require a variety of skills, across the full value chain of the sector.

Major industry expansion over the next five years

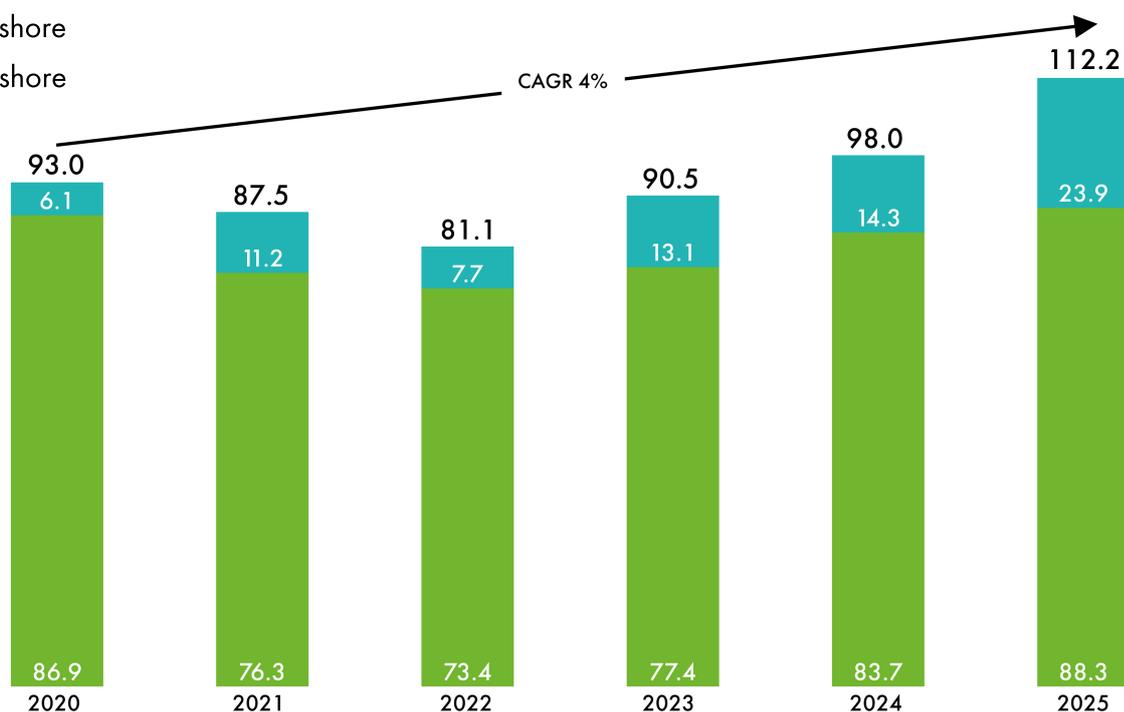
Wind power will continue to deliver record growth of new installations over the next five years, and make crucial contributions to economic recovery around the world. A historic 93 GW of new wind capacity was installed in 2020 despite the impacts of COVID-19, making last year a record year for onshore wind growth and the second-best year for offshore wind growth. This not only demonstrates the incredible resilience of the wind industry, but a clear signal that the industry and global supply chain can continue to deliver in the years to come.

While installations are forecast to decline slightly in 2021 to 88 GW of new wind capacity, it will still be the second-best year for wind growth in history, largely driven by installation rushes in the US for onshore wind and China for offshore wind. Over the next five years, wind energy will continue proving to be resilient with compound annual growth (CAGR) of 4 per cent. For offshore wind, annual installations are set to quadruple by 2025 with CAGR of 31.5% over the next five years.

New global wind power installations outlook 2020-2025

GW

- Onshore
- Offshore



Annual installations are set to exceed 110 GW by 2025, bringing the total volume of new installations from 2021-2025 to a whopping 470 GW. These additions are equivalent to two-thirds of all current wind installations worldwide – meaning the wind industry is set for significant expansion over the next five years.

In addition to providing affordable, clean and zero-carbon electricity, wind energy has the capacity to bring tremendous socioeconomic benefits and industrial development to local communities. Large-scale onshore and offshore wind projects generate a wide variety of sustainable jobs across the full value chain of the sector.¹

The additional 470 GW of wind capacity through 2025 could equate to the creation of more than 3.3 million direct jobs in a dynamic supply chain around the world, based on existing datasets regarding job creation for onshore and offshore wind.

By 2025, GWEC expects more than 1,210 GW of installed onshore and offshore wind capacity around the world. As policymakers consider best “value for money” in their stimulus plans for economic recovery, they should recognise the enormous economic benefits and direct value creation stemming from the expansion of the global wind market.

With increased investment and policy ambition for onshore and offshore wind energy, the employment potential could exceed 3.3 million jobs, offering a rung on the ladder to green recovery.



The additional 470 GW of wind capacity through 2025 could equate to the creation of more than **3.3 million direct jobs** in a dynamic supply chain around the world



Photo Credit: Vestas

Dollars go farther for renewables

Peer-reviewed studies have found that investment in renewable energy creates more jobs than equivalent investment in fossil fuels. A 2017 [article](#) in the journal *Economic Modelling* determined that US\$1 million in spending on renewables generated 7.49 full-time equivalent (FTE) jobs – three times more than the 2.66 FTE jobs generated by the same amount of spending on fossil fuels. That means a “brown-to-green” shift in US\$1 million in spending results in added value creation of 5 jobs.

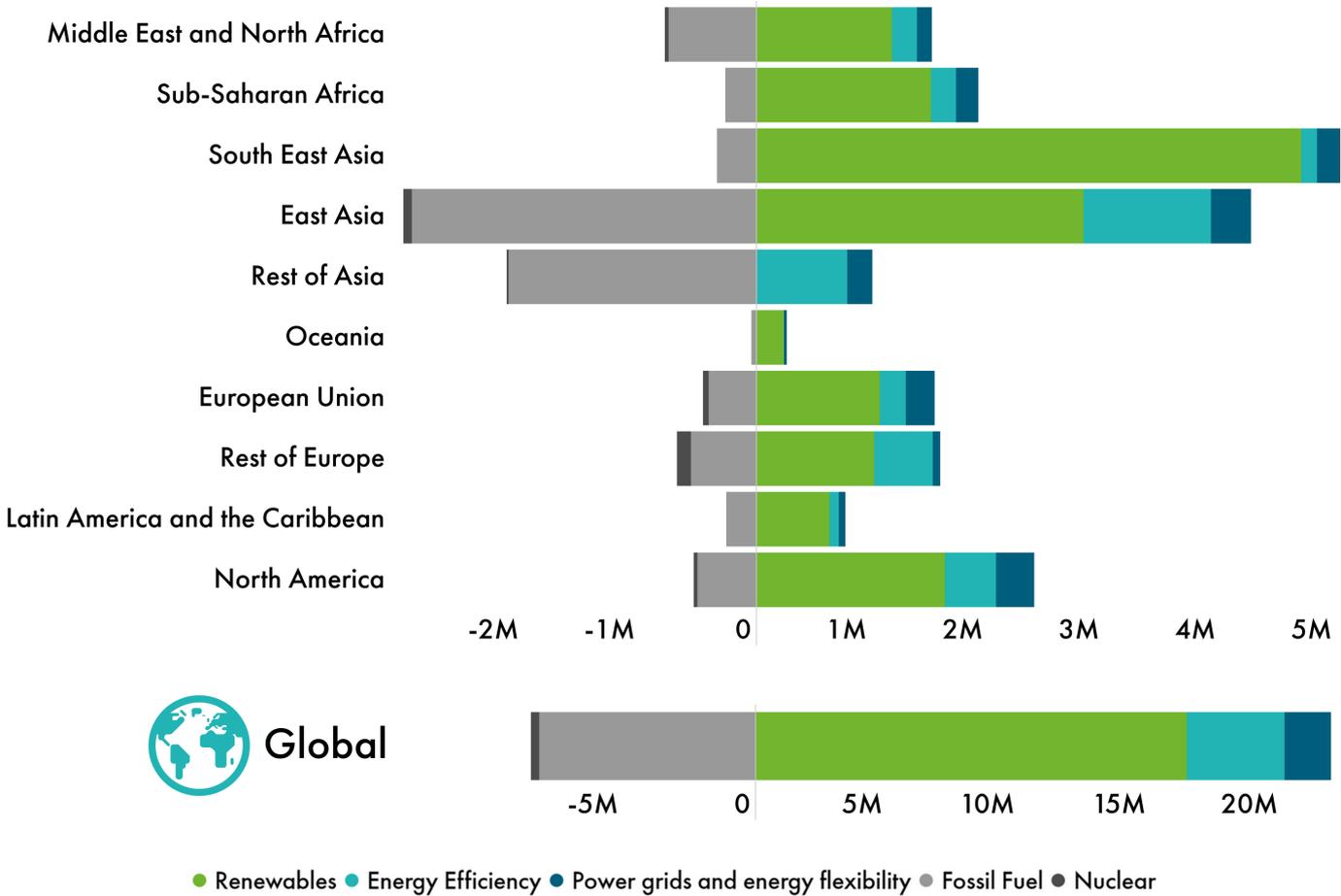
In March 2021, the International Renewable Energy Agency (IRENA) published its [outlook](#) report for a Paris-compliant energy transition scenario to 2050 which reaches global carbon neutrality by 2050. Under this scenario, US\$1.14 trillion is invested in renewable energy on an annual basis between 2021 and 2050, by which point wind power generates one-third of the world’s electricity.

These outcomes would not only keep global warming to 1.5 degrees above pre-industrial levels, but would quadruple worldwide employment in renewables to tens of millions of sustainable jobs. There would be net employment gains globally, as job losses in the conventional sectors would be dramatically surpassed by job creation in renewables.

In a 2020 roadmap for an energy transition scenario, IRENA provides a regional breakdown of the share of transition-related job creation in the renewable energy sector. Job creation would be particularly high in South East Asia and Latin America – two fast-growing regions for wind power. With sufficient policy support for an ambitious energy transition, the long-term net employment gains range from a 20 per cent job increase in East Asia and Latin America to as much as 380 per cent in Oceania.

Energy sector job gains: Exceeding losses in every region

Difference in energy sector employment in 2050 between IRENA's Transforming and Planned Energy Scenarios, by region and sector



Source: Global Renewables Outlook: Energy Transformation 2050, IRENA (2020)

The economic gains from wind power also extend to mitigation of energy-related carbon emissions on a massive scale. Deploying 6 TW of wind power by 2050 would mitigate 6.3 gigatonnes of CO2 emissions annually – more than any other renewable technology, energy efficiency or electrification solution. On a national level, this in turn would generate huge cost savings in healthcare, infrastructure, social welfare and system resilience, as the emissions savings would help to mitigate the most harmful impacts of climate change, including pollution-related illness and frequency/intensity of natural disasters.



Deploying 6 TW of wind power by 2050 would **mitigate 6.3 gigatonnes of CO2 emissions annually** and generate huge cost savings in healthcare, infrastructure, social welfare, and system resilience.

Global job creation potential in wind energy

The world's leading wind energy countries are already home to hundreds of thousands of people employed in direct jobs in the wind industry. As of 2020, there were approximately 550,000 wind energy workers in China, 260,000 wind energy workers in Brazil, 115,000 in the US and 63,000 in India, according to a global survey by GWEC Market Intelligence.²

GWEC estimates that if 470 GW of wind installations are delivered on-time through 2025, including 70.4 GW of offshore wind, these projects would generate more than 3.3 million jobs over project lifetimes.³ These estimates are based on global studies by IRENA on job creation for onshore and offshore wind projects from 2017 and 2018, as well as market growth data from GWEC Market Intelligence; the studies, which surveyed stakeholders from Brazil, China, the EU, India, Japan, Mexico, South Africa and the US, calculate job creation over the 25-year lifetime of a typical 50 MW onshore wind project and 500 MW offshore wind project.

We note that these estimates do not account for considerations which might impact job creation, such as technology evolution, local health and safety requirements, domestic labour productivity and economies of scale.

On a per unit basis, based on these IRENA studies, the job requirement for onshore wind is 5.24 jobs per MW over the 25-year lifetime of a typical 50-MW onshore wind project. Offshore wind offers compound value for investment, given longer project timelines and more complex construction, assembly and installation activities. The job requirement is 17.29 person-years per MW over the 25-year lifetime of a typical 500-MW offshore wind project. More precise studies which account for technology evolution curves, learning rates and other factors are required to calculate job creation on a national or project basis.

Jobs generated from wind projects span the full value chain of the sector, encompassing a variety of technical, professional and hard/soft skills. From project planning to manufacturing to operations and maintenance (O&M), the wind sector provides a range of jobs distributed along a diverse value chain.

Onshore and offshore wind projects can be broken down as outlined on the tables on Page 6 and 7 respectively, with the note that employment can be concurrent across different project stages.



Photo Credit: Mainstream Renewable Power

Breakdown of Job Creation Across a 50 MW Onshore Wind Project with 25-year Lifetime⁴

Segment of the Wind Value Chain	Example Activities	Example Jobs	Person-Days Required (% of total)	Full-time Jobs Required (% of total)
 Project planning and development	<ul style="list-style-type: none"> • Site Selection • Feasibility studies • Environmental impact assessments • Community engagement • Engineering design • Project development 	<ul style="list-style-type: none"> • Legal, property and tax experts • Financial analysts • Engineers • Environmental and geotechnical scientists 	2,580 (3.8%)	10.3 (3.8%)
 Procurement	<ul style="list-style-type: none"> • Design specifications • Sourcing 	<ul style="list-style-type: none"> • Sourcing specialists • Engineers 	N/A	N/A
 Manufacturing of components and systems	<ul style="list-style-type: none"> • Manufacturing and assembly of nacelles, blades and towers • Manufacturing of monitor and control systems 	<ul style="list-style-type: none"> • Factory workers • Quality control • Marketing and sales • Engineers • Management 	18,967 (27.9%)	73 (27.9%)
 Transport	<ul style="list-style-type: none"> • Transport of components 	<ul style="list-style-type: none"> • Drivers • Logistics experts • Technical personnel 	875 (1.3%)	3.4 (1.3%)
 Installation	<ul style="list-style-type: none"> • Project site preparation • Civil works • On-site assembly of components 	<ul style="list-style-type: none"> • Construction workers • Technical personnel • Engineers • Health and safety experts • Logistics and quality experts 	26,800 (39.4%)	103.1 (39.4%)
 Grid connection & commissioning	<ul style="list-style-type: none"> • Cabling and grid connection • Project commissioning 	<ul style="list-style-type: none"> • Construction workers • Technical personnel • Engineers • Health and safety experts 	7,680 (11.3%)	29.5 (11.3%)
 O&M	<ul style="list-style-type: none"> • Ongoing O&M over project lifetime (typically 25 years) 	<ul style="list-style-type: none"> • Operators • Engineers • Construction workers • Technical personnel • Lawyers • Management 	2,665 (3.9%)	10.3 (3.9%)
 Decommissioning <small>(in the case of repowering, moving back to the start of the value chain)</small>	<ul style="list-style-type: none"> • Planning or decommissioning or repowering • Dismantling the project on-site • Disposal and recycling of components • Site clearing 	<ul style="list-style-type: none"> • Construction workers • Technical personnel • Drivers • Engineers • Environmental scientists • Health and safety experts 	8,420 (12.4%)	32.4 (12.4%)
Total			67,987 days	262 jobs

Source: IRENA, 2017

Breakdown of Job Creation Across a 500 MW Offshore Wind Project with 25-year Lifetime⁵

Segment of the Wind Value Chain	Example Activities	Example Jobs	Person-Days Required (% of total)	Full-time Jobs Required (% of total)
 Project planning and development	<ul style="list-style-type: none"> • Site Selection • Feasibility studies • Environmental impact assessments • Community engagement • Engineering design • Project development 	<ul style="list-style-type: none"> • Legal, property and tax experts • Financial analysts • Naval engineers • Environmental and geotechnical scientists • Ship crew 	23,838 (1.1%)	91.6 (1.1%)
 Procurement	<ul style="list-style-type: none"> • Design specifications • Sourcing 	<ul style="list-style-type: none"> • Sourcing specialists • Engineers 	7,299 (0.3%)	28.1 (0.3%)
 Manufacturing of components and systems	<ul style="list-style-type: none"> • Manufacturing and assembly of nacelles, blades and towers • Manufacturing of monitor and control systems 	<ul style="list-style-type: none"> • Factory workers • Quality control • Marketing and sales • Engineers • Management 	1,252,514 (55.7%)	4,817.4 (55.7%)
 Transport	<ul style="list-style-type: none"> • Transport of components 	<ul style="list-style-type: none"> • Drivers • Ship Crew • Technical personnel 	2,159 (0.1%)	8.3 (0.1%)
 Installation	<ul style="list-style-type: none"> • Project site preparation • Civil works • On-site assembly of components 	<ul style="list-style-type: none"> • Construction workers • Technical personnel • Naval engineers • Ship Crew • Health and safety experts • Logistics and quality experts 	236,634 (10.5%)	910.1 (10.5%)
 Grid connection & commissioning	<ul style="list-style-type: none"> • Cabling and grid connection • Project commissioning 	<ul style="list-style-type: none"> • Construction workers • Technical personnel • Engineers • Health and safety experts 	615 (0.03%)	2.4 (0.03%)
 O&M	<ul style="list-style-type: none"> • Ongoing O&M over project lifetime (typically 25 years) 	<ul style="list-style-type: none"> • Operators • Electrical and naval engineers • Construction workers • Crane operators • Ship crew • Helicopter pilots • Technical personnel • Lawyers • Management 	626,825 (27.9%)	2,410.9 (27.9%)
 Decommissioning <small>(in the case of repowering, moving back to the start of the value chain)</small>	<ul style="list-style-type: none"> • Planning or decommissioning or repowering • Dismantling the project on-site • Disposal and recycling of components • Site clearing 	<ul style="list-style-type: none"> • Construction workers • Technical personnel • Drivers • Engineers • Ship Crew • Environmental scientists • Health and safety experts 	97,453 (4.3%)	374.8 (4.3%)
Total			2,247,327 days	8,643.6 jobs

Source: IRENA, 2018

These studies reflect the strong track record in the onshore and offshore wind sector for employment gains to date. For instance, investment in turbine assembly in Hull, UK, created more than 1,000 direct local jobs. A recent report by the Economic Council of the Labour Movement in Denmark and the United Federation of Danish Workers found that the permanent employment effects of offshore wind farms were among the highest of various green jobs, compared to other jobs like establishing biorefineries or replacing oil and gas-fired boilers.

Offshore wind provides particular value in revitalising coastal communities that are often far from urban economic centres. Local job opportunities and industrial development in these areas can contribute to a thriving municipal economy. A study by NYSEERDA on US job creation in offshore wind found that two-thirds of jobs required over the lifetime of an offshore wind farm would be localised and fulfilled by US-based workers.

That said, not all markets have a strong emphasis on the procurement and manufacturing segments of the value chain, due to lack of local production facilities and lack of capacity in trained workforce, among other reasons.



Green recovery actions which accelerate the permitting process for wind power projects can **unlock jobs** in the transport, installation and commissioning segments.

For these markets at an early stage of supply chain development, it is important to highlight pathways for maximising local value creation by leveraging existing capabilities, specialties and industries. Markets relying on imported components, for instance, would still require domestic mobilisation of workers for activities in the installation, grid connection, O&M and decommissioning segments of the wind value chain.

To maximise the short-term job creation potential in these areas, it will be important to identify the “shovel-ready” wind power projects, i.e. projects with planning permission and in pre-construction stage, in the domestic market. These are the projects which, once operational capacity and productivity returns, can quickly ramp up activity and engage a variety of local workers, from construction workers to drivers to technical personnel to engineers.

Maximising local value creation in markets with lower levels of domestic manufacturing will require a steady pipeline of “shovel-ready” projects, developed through an expeditious and transparent permitting and consenting process. Therefore, green recovery actions which accelerate the permitting process for wind power projects can unlock jobs in the transport, installation and commissioning segments, which collectively represent more than half of the labour resource required for an onshore wind project.



Wind energy's role in fostering a just and inclusive transition

The impacts of the COVID-19 pandemic over the last year have ranged from fluctuating power demand to turmoil in oil and gas markets, contributing to evolving cost dynamics which strengthen the case for renewables.

These events have also made the urgency of the energy transition more acute – heightening the need for proactive reforms to enable system integration of renewable energy at large scales and accelerating the phaseout of coal-fired generation. Yet of energy stimulus spending committed by G20 governments since the COVID-19 pandemic, just more than one-third of funds have been earmarked to support clean energy.

The pandemic and its resulting recessionary impacts have exacerbated systemic inequalities worldwide, and sharpened the case for sustainable development. As policymakers pursue short-term economic gains to stay afloat, it is critical to maintain a people-centric lens. Stimulus spending and policy support for economic recovery must be aligned with a just and inclusive energy transition, which includes mainstreaming

principles of diversity and accounting for labour displacement in areas such as the conventional sector.

These pursuits are mutually reinforcing – a growing body of evidence shows that economic recovery which is socially and environmentally responsible can contribute to more resilient systems and future-proofed workforces.

Wind and renewable energy offer a strong investment proposition on the road to green recovery. GWEC Market Intelligence forecasts 470 GW of wind capacity built over the next five years, and millions of jobs will follow, but this will require enabling factors like ambitious renewable energy targets, long-term thinking on climate action and a regulatory environment which allows projects to proceed on-schedule.

Policymakers should ensure that support for clean energy is implemented in green recovery packages, which will contribute to a more inclusive and prosperous society in the long term.



Mitigate job dislocation with opportunities in offshore wind

Offshore wind offers compound value for investment in job creation, due to complex requirements in the manufacturing, installation, grid connection and O&M phase, as well as longer project timelines compared to onshore wind. The sector also offers a response to labour market disruptions from the energy transition, such as dislocation of jobs for offshore oil and gas and marine engineering workers.

Markets in the US, UK and North Africa have already invested in reskilling offshore conventional sector workers for the wind sector, taking advantage of skill and knowledge transfer in production platforms, marine surveying, offshore lifting and construction and other areas of overlap. For instance, the £14 million [Oil & Gas Transition Training Fund](#) in Scotland provided more than 4,200 workers with reskilling activities for green jobs, and resulted in 89% of participants gaining employment after programme completion.

Maximising local economic activity requires policymakers to make strategic choices on how existing capabilities and workers can be leveraged for high-growth areas. Where possible, reskilling offshore oil and gas workers with expertise in construction and installation in offshore environments for the growing wind sector should be a priority to encourage low-carbon economic growth and competitiveness.

Offshore wind can generate jobs in the manufacturing of steel for foundations, substations and installation vessels, sub-sea cables to evacuate electricity from offshore farms to onshore grids and trucks and vessels for transport of equipment and workers. All of these areas can leverage the capabilities and supply chains of an offshore oil and gas workforce.

One 2020 [study by the American Wind Energy Association \(AWEA\)](#) finds that “offshore wind jobs are good, well-paying jobs requiring a diverse technical workforce spanning an estimated [74 occupations](#). A sample of jobs the industry will create include electricians, welders, turbine technicians, longshoremen, truck drivers, crane operators, ironworkers, pipefitters, pile drivers, engineers, mechanics, scientists, and offshore equipment and vessel operators.”

Potential short-term investment areas include targeted education and training programmes, investment schemes, industrial upgrades and promotion of public-private partnerships and joint ventures. Long-term investment areas include supplier development programmes and roadmaps to develop industrial clusters in strategic areas of need.

