

Renewable Energy and Solar Research Report: What's in Store for



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Foreword from our CEO

As we anticipate an exciting year for the renewable energy sector in 2022, we took the opportunity to look back at the past year's challenges. We spoke with over 100 sector professionals as a representative sample of the industry to ask them some questions about this year's trends and technologies. Renewable energy specialists worldwide answered our queries, and we are glad to see that their views align with our beliefs and thoughts.

The industry is proving that a future powered only by renewables is possible. More and more companies that would pollute are changing the way they operate, moving towards more renewable initiatives.

In the new year, we expect the transition to clean energy to provide a massive boost to solar—both for residential and utility-scale installations. Floating photovoltaics and agrivoltaics are exciting approaches that will expand the viability of solar energy systems in various parts of the world where there are challenges in securing land use.

Energy storage also remains an important theme for 2022. I'm excited to see what the storage companies are going to come up with in terms of new technologies and developments. I believe that a strong part of the future of the renewable industry depends on the future of storage, but as our interviews showed there's still much to be done. There needs to be more investment and development in this critical area of renewable adoption.

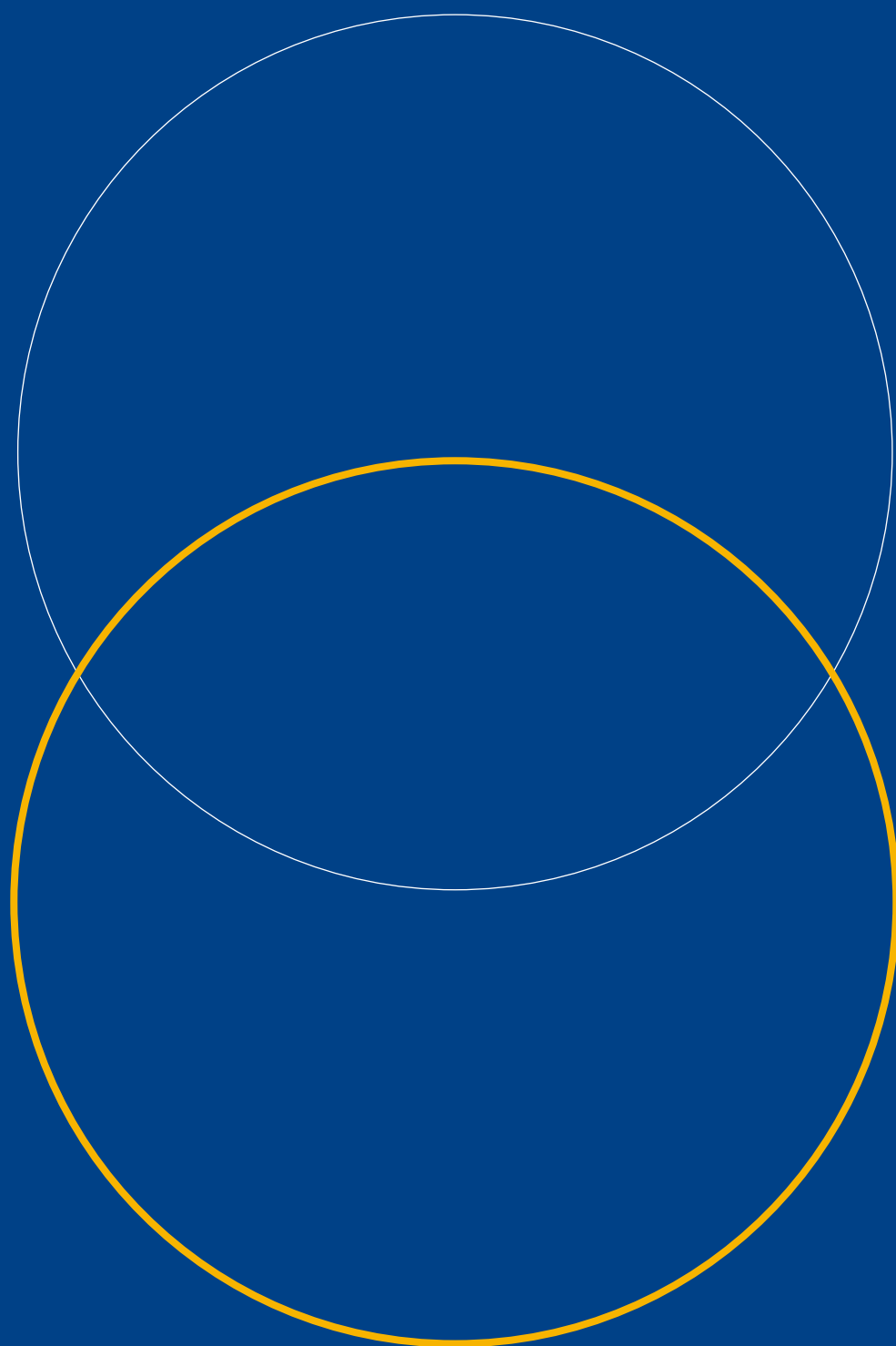
In fact, one of these technologies, green hydrogen, is going to be key and has a lot of potential. It still needs extensive development and financing, but we're on the right path.

I believe the main challenge for 2022 will be keeping pace with the fast growth of the energy sector, satisfying demand with renewable and sustainable solutions. At the same time, the disruption to global logistics caused by the COVID-19 pandemic has resulted in ongoing equipment shortages, and prices are rising for the first time after a prolonged period of declining costs.

We'll be keeping an eye on the European Green Deal, which aims to make the EU climate neutral by 2050. Our expectations are high, and we would like to see it succeed with all of our contributions.



Andrea Barber — CEO & CO-FOUNDER



Introduction

After the turmoil of 2021, with the COVID-19 pandemic continuing to cause disruptions around the world, the renewable energy industry has settled into a new reality. Clean energy took up a larger share of the generation mix with power demand falling during lockdowns. Social awareness of the environmental impact of regular human activity increased, and governments have committed to investing in renewables to help spur economic recovery.

Clean energy took up a larger share of the generation mix with power demand falling during lockdowns.

At RatedPower, we were keen to hear from experts in the renewable energy industry about their outlook for 2022. We carried out a survey at the end of the year to find out for ourselves what the sector looks like on the ground for companies of all shapes, sizes, and locations across the globe. A picture emerged of some of the major concerns that industry professionals have about the future development of the sector and the areas with the most potential for growth. Their answers show where the industry needs to invest its resources in 2022 and how government policy can support the continued transition to clean energy around the world.

“

With more financial help from EU, there is opportunity for more investments, and thus more renewable energy projects.”

SOLAR PV ENGINEER (FRANCE)

The renewable industry faces a unique set of challenges in the year ahead. The equipment supply chain has experienced constraints and logistics problems that have seen prices rise after a decade of decline, making solar and wind financially competitive with new fossil fuel generation without subsidies. As one of our industry specialists, Alejandro Parra from Lightsource BP, has said, “There is a challenge in material availability and logistics costs that may break the markets.” Moreover, new COVID-19 variants have emerged, prompting new lockdowns and restrictions in various parts of the world.

“

2022 will be an interesting year with high prices in energy, raw materials, pv panels and logistics.”

OPERATIONS DIRECTOR, PV DEVELOPMENT (SPAIN)

There are also opportunities to advance the renewable agenda. Record high energy costs across Europe in 2021 emphasized the advantages of low-carbon generation, increasing calls for an acceleration in installing wind and solar systems. New forms of solar generation, such as colocation with battery storage, floating photovoltaics, and agrivoltaics, have emerged to provide solutions to some of the limitations of traditional solar installations.

“
Europe should start investing in storage solutions. Is hydrogen the way to go? If so, why are we not seeing a spike in hydrogen technologies. It is the foundation of renewable success but we are still doubting the technology.”

Alba Maqueda Mateos — PV ENGINEER, E2-ENERGIE (THE NETHERLANDS)

Challenges



Logistic constraints



Price increase



COVID-19 variants and lockdowns

Opportunities



Increasing calls for accelerating in installing wind and solar systems.




Battery storage



Floating photovoltaics



Agrivoltaics



Many industry professionals expect batteries to play a key role in enabling the widespread adoption of intermittent renewable generation worldwide. Experts are also optimistic about the long-term development of green hydrogen as a solution for energy-intensive industries, which will rely on the renewable power supply to keep carbon emissions down.

“
Hydrogen solutions seem preliminary, but considering the size of the players that have announced investments on hydrogen plants, it will certainly become closer than anyone imagined before COVID-19.”

Guilherme Castro – HYBRID PROJECTS’ ENGINEER, CASA DOS VENTOS (BRAZIL)

Technological advances promise to create new capabilities and efficiencies for managing renewable projects and maintaining installed systems. Automation and digitalization offer benefits throughout the supply chain and will play a key role in the future, from development through to construction and operations and maintenance (O&M). Most industry experts believe that digitalization will have an essential role in the development of renewables.

Automation and digitalization offer benefits throughout the supply chain and will play a key role in the future.

In this report, we break down and analyze the survey results to demonstrate the significant themes for the renewable energy industry in the coming year, as identified by experienced professionals.



Verdicts from industry professionals

We interviewed +100 industry professionals from more than 30 countries around the world to hear their thoughts and predictions for the global renewable energy sector as we go into 2022.

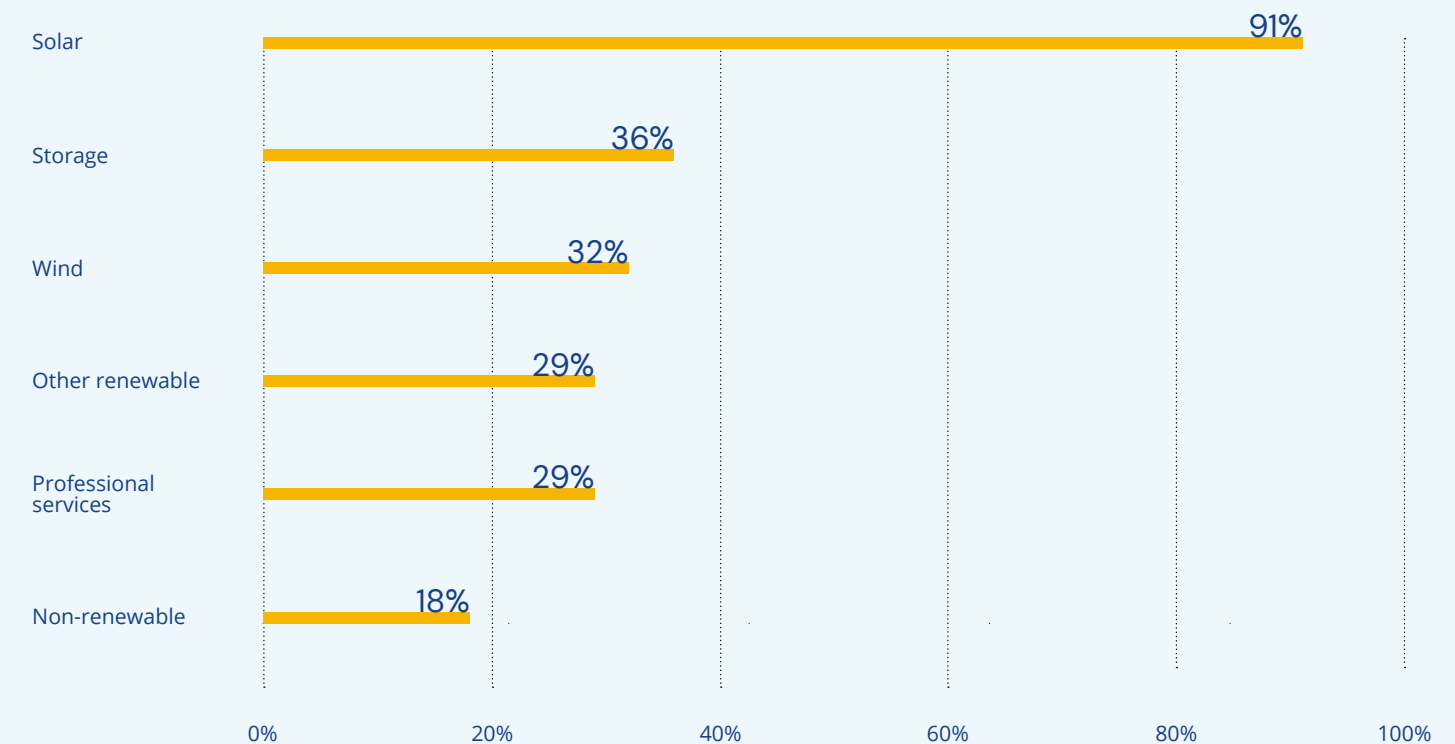
+100
industry professionals

+30
countries

- What are their expectations for the growth of renewables, especially solar power?
- What role will technology play in the sector's development?
- What impact has the COVID-19 pandemic had on their organization's investment plans?
- What key technologies will make a difference in the industry?

We asked these and other questions to build up a picture of the key themes for the year ahead.

The experts who we interviewed come from a range of backgrounds within the renewable industry. Around half of them work for small companies with less than 150 workers, with the other half split between mid-sized organizations of 150-1,000 workers and large organizations with more than 1,000 workers. They are located across key markets such as Spain, Australia, the US, Germany, France and Brazil, as well as the Middle East, Africa and Asia-Pacific region.





Around 32% of the professionals we interviewed work exclusively in solar energy, with another 11% working across the solar and wind sectors and the remaining respondents working in other energy sectors such as nuclear, oil and gas, or energy storage as well as solar. This reflects the fact that companies in traditional energy industries are investing in renewables, whether to expand their portfolios or transition from fossil fuels to low-carbon generation.

Around 40% of the respondents have 5-15 years of experience in the renewable sector, with 34% working in the sector for less than five years and 23% with more than 15 years of experience.

Around half of the survey respondents work for companies that operate within their local markets, with the other half operating in multiple countries and 12% of those working across more than 20 countries.

What view of the renewable energy industry do their responses provide? Let's break down the themes revealed in the survey results.



VERDICTS FROM INDUSTRY PROFESSIONALS

Renewable industry challenges

While the adoption of renewable energy is expected to accelerate in 2022, the industry faces several challenges that could prevent the planned capacity from going into operation.

Bottlenecks in the development process, such as long permitting and other regulation processes, present the biggest challenge to the sector in the coming years, according to 68% of respondents both in terms of project development and adoption of technology innovations.

“

Cost reduction, although impressive, should continue to make storage competitive. Regulations in some countries do not help a widespread growth of storage solutions. The industry should, at least in continental Europe, lobby to promote favorable regulatory policies.”

Fernando Teigell — **MANAGING DIRECTOR, ENTIBA ENERGY (SPAIN)**

In Europe, many believe that the European Green Deal policy will help precisely to introduce a well structured regulatory framework to accelerate the adoption of renewable technologies.

“

Green Deal will help facilitate processing, promote plants, and create a secure framework for investors.”

OPERATIONS DIRECTOR, PV DEVELOPMENT (SPAIN)

The impact of permitting rules on the capacity installation has been seen in the UK in recent years, where solar projects have primarily been 50MW or smaller. Installations with capacities above 50MW have been defined as Nationally Significant Infrastructure Projects, which require a more rigorous permitting process that takes longer than smaller projects that can receive approval at the local level. The UK Department for Business, Energy and Industrial Strategy (BEIS) is considering changing the planning rules to remove the barrier to larger projects.

53% of industry experts also view grid saturation as a significant challenge, as countries with inadequate grid infrastructure or large renewable capacity face difficulties in maintaining grid stability.

In Australia, where rooftop solar capacity has grown rapidly, energy authorities have had to remotely switch off household solar panels on days of abundant solar generation. And in Germany, high renewable output has resulted in negative wholesale power prices in some hours, as well as power flowing into neighboring countries and impacting their power systems.

In Australia, where rooftop solar capacity has grown rapidly, energy authorities have had to remotely switch off household solar panels on days of abundant solar generation.

A lack of government incentives for investment in some countries can make it difficult to get renewable projects off the ground. In countries where renewable energy has taken off, government subsidies made it possible for investors to cover the additional cost of installations until costs have fallen to a point where they have become competitive with fossil fuel generation.

Lack of high-quality equipment and limited resources are challenges cited by 40% and 26% of respondents, respectively.

According to the International Renewable Energy Agency (IRENA), the cost of utility-scale solar dropped by 82% in the decade to 2020. But the prices began to rise in 2021 as the COVID-19 pandemic caused supply chain bottlenecks and disrupted raw material production. Only 6% of industry professionals agreed that they would compromise on quality in favor of saving on production costs. So, they need to balance these rising costs against consumer expectations of lower prices, which makes it harder for projects to achieve profitability. This will be a key challenge for 2022 as supply chain disruptions persist.

“

We cannot always rely on petroleum countries. Europe has to start creating its own renewable market and be less dependent on external economies. If taxes are placed on those markets, Europe might finally be competent. For example, if there is a supply crisis or a price spike in other markets, it can be tackled better. It is always better to organize locally.”

Alba Maqueda Mateos — PV ENGINEER, E2-ENERGIE, (THE NETHERLANDS)

The prices began to rise in 2021 as the COVID-19 pandemic caused supply chain bottlenecks and disrupted raw material production.

Lack of land availability also presents challenges according to 24% of the survey respondents. The growth of floating solar and agrivoltaics are emerging as potential solutions to the lack of available land for large-scale solar installations. In southeast Asia and Africa, where solar projects compete with the agricultural industry for land, these solutions provide the opportunity to make use of reservoirs and farmland to co-locate solar without losing water and food resources.

“
Floating PV is a welcome development in the sense that it will certainly reduce the pressure on the available land for agriculture.”

Bennet Akujobi — (NIGERIA)

“
Agrivoltaics solutions will ensure food security, and boost economies to poor countries — namely Africa and some of the middle east countries.”

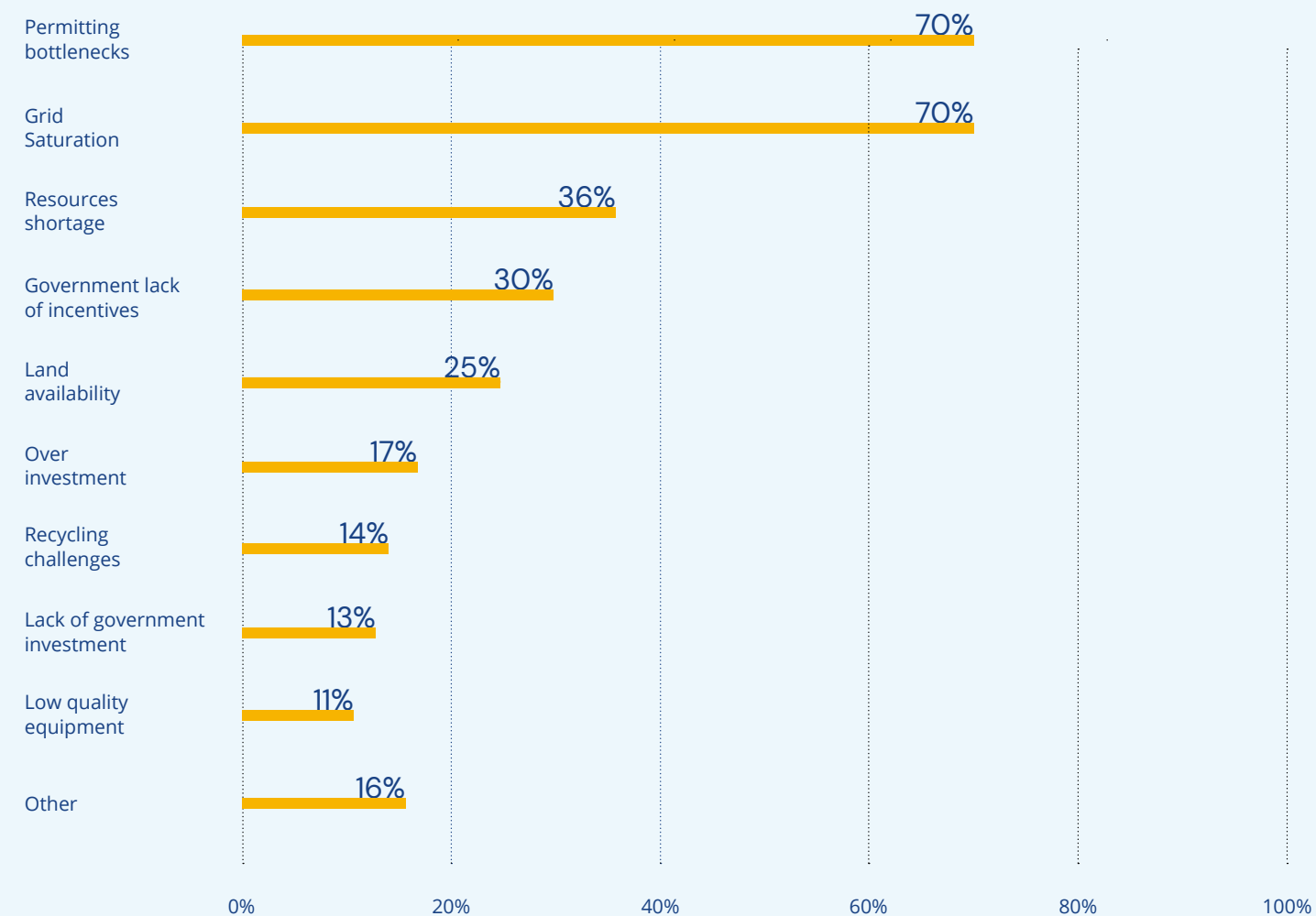
Mohamed Said Nachiwa — CEO ICS TECHNOLOGIES (TANZANIA)

Survey respondents identified other challenges including grid instability, public investments not being well targeted, a boom of overinvestment that limits opportunities for new projects, resource location, and the need to ramp up recycling. Around 10% of the responses also pointed to the challenge of convincing skeptics with power that renewable investment is vital.

“
We need to be more attentive to the recycling of the used equipment, as it could be a challenge in the near future. We expect recycling to go through changes (caused by social impact), in order to make its process more labor-friendly in the future.”

Olga Michelot — CEO, HELIOS STRATEGIA (BELGIUM)

Biggest renewable sector challenges for the coming years



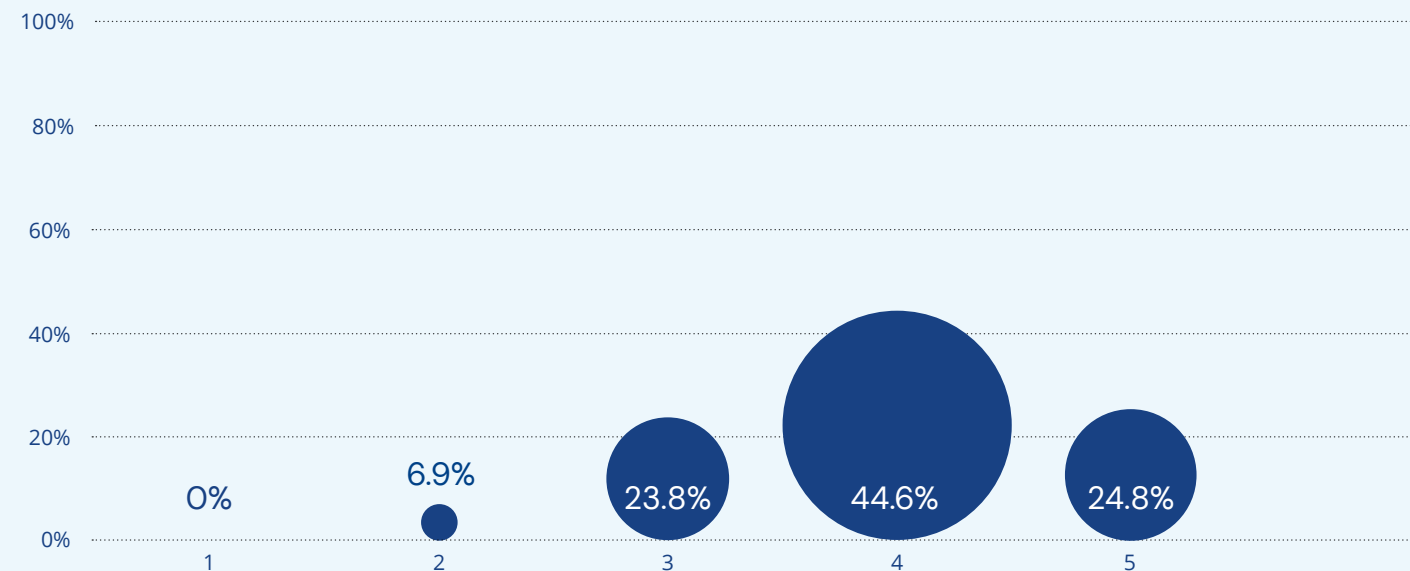


VERDICTS FROM INDUSTRY PROFESSIONALS

Confidence in the sector

How do industry experts feel about the potential for the renewable sector in the future? More than half (69.4%) of the survey respondents are confident in the outlook for renewables in their country.

Confidence in the sector in your country market



Compared to the sector confidence when we were going into 2021, experts have lowered their optimism by a 13.4% (from 82.8% to 69.4%) which might reflect the challenges of the COVID-19 recovery.

China has embarked on an aggressive renewable energy program and has the world's largest installed solar energy capacity. China is also investing in wind power capacity, as it looks to meet an ambitious target of 12TW of solar and wind generation by 2030, up from around 1TW at the end of 2021.



64% of the survey respondents pointed to China as a market outside their home country where they are confident in the growth potential.

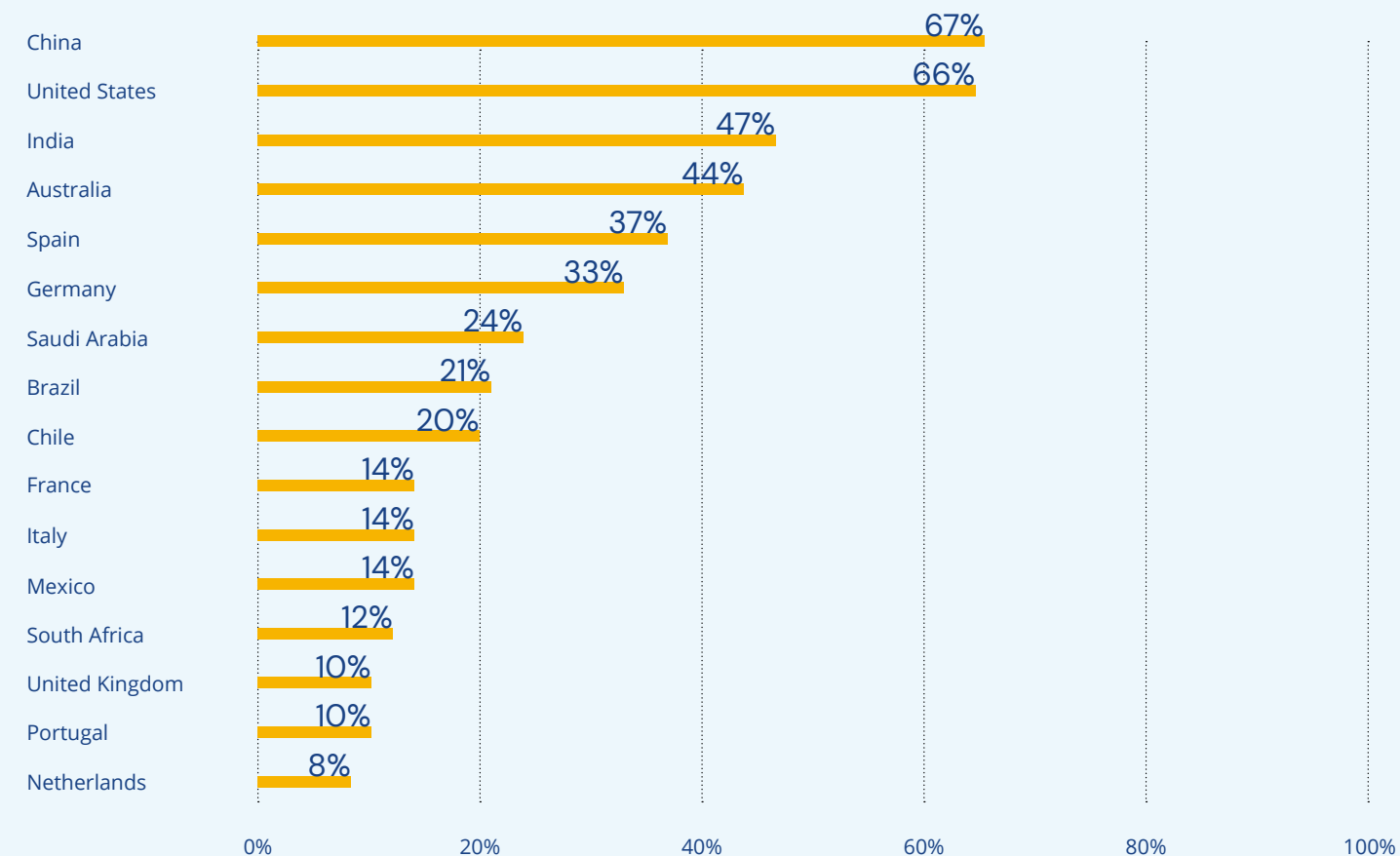
In line with the growth of the industry in China, 64% of the survey respondents pointed to China as a market outside their home country where they are confident in the growth potential. That was followed by 62% of the respondents identifying the US as a key growth market. The administration of President Joe Biden has set a target for the US to reach carbon pollution-free electricity generation by 2035, and renewables dominated the addition of new power generation in the first half of 2021.

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Experts also cited India and Australia as key growth markets. India has ambitious plans to reach 500GW of renewables by 2030. The country reached 48GW of solar in October 2021, up from 2.63GW in March 2014, according to the environment minister. And Australia exceeded its 2020 target for a 20% share of renewables in its generation mix. Several states and territories in the country have now committed to a 40% target for 2030. Australia installed a record 3GW of rooftop solar in 2020, which is expected to have exceeded that in 2021.

Experts were confident in the growth of the sector in Spain, Germany, Italy, and France in Europe, and in Latin America they looked to Brazil and Chile.

Top countries with the highest growth potential in renewables



Around 62% of the respondents are bullish on the overall outlook for solar energy in 2022, believing that it is realistic that the sector will reach 200GW of new capacity installations, up from 127GW in 2021. That is double the 31% who do not view the goal as realistic.

Check our State of Green Reports from these key markets to find out more!



VERDICTS FROM INDUSTRY PROFESSIONALS

Opportunities for growth

Solar industry professionals believe that battery storage and green hydrogen have the biggest potential to be successfully implemented around the world by 2030, with 64% of them identifying batteries and 53% of them pointing to green hydrogen. That was followed by 49% pointing to wind energy. Slightly more experts (28%) saw the potential for the adoption of offshore wind compared with floating solar technology (24%).

“

Batteries are so urgently needed! The regulators need to address legal frameworks and allow bidirectional electric vehicles to support the grids.”

Diego Lobo-Guerrero, Founder — [AYKA PROJECTS \(GERMANY\)](#)



Energy professionals expect that their companies are most likely to invest in wind, hydrogen, and battery storage alongside solar in the next five years.

Few industry experts expect tidal or geothermal energy to reach widespread implementation by 2030. Biofuels and biomass also garnered limited interest by comparison.

It's not surprising then that respondents expect that their companies are most likely to invest in wind, hydrogen, and battery storage alongside solar in the next five years.

Energy storage

Storage will be a key growth area, with combined solar and storage systems going some way to solve intermittency and grid instability problems. Respondents noted that the technology is at an early stage and needs support from government standards and incentives for large-scale adoption. As Hybrid Projects' Engineer Guilherme Castro has also said, "The development of batteries has improved a lot, but still has problems regarding costs and availability of raw materials." Battery costs have begun to come down, but if they fall further, there is potential for the adoption of storage systems to grow. That could put the technology among the most important for the energy transition, the respondents said.

“
The industry needs clearer standards and connection regulations: type, purpose... So that companies stop “speculating” during development stages.”

Víctor Alexi — PROJECT ENGINEER, SOLARIG (ITALY)

Industry experts are optimistic about the potential for green hydrogen as a promising early-stage technology, with Michal Porzuczek from Kruger Energy even comparing it to where battery storage was 5-10 years ago. While hydrogen has been used in oil refining and fertilizer production, research needs to be done on how the technology can best be deployed in the transport and power generation sectors to make a meaningful contribution to the energy transition.

Some experts caution that green hydrogen is not a magic bullet for energy-intensive industries, as it is inefficient and a long way from large-scale commercial viability. David Tipping from Vision énergetique Columbia warns “Although green hydrogen has potential, it is not an overnight solution. To date, we have only had pilot projects, and inherently it is inefficient (roughly 35% lost in the transformation), hence the reason why it shouldn't be seen as a magic bullet (despite being presented as such in many cases).”

Some experts caution that green hydrogen is not a magic bullet for energy-intensive industries, as it is inefficient and a long way from large-scale commercial viability.

“
Hydrogen has yet to realize its potential other than in oil refining or the production of fertilisers. It needs to be deployed in the transport and power generation sectors to have a meaningful contribution to energy transition. With the associated infrastructure being costly, the demand for international co-operation and regulatory synchronization is mandatory.”

Fernando Teigell — **MANAGING DIRECTOR, ENTIBA ENERGY (SPAIN)**

Energy storage pros and cons



Doable solution for grid instability issues.



Green hydrogen is a promising early-stage technology



Government subsidies required for large-scale adoption



Green hydrogen might not be suitable for tough-to-decarbonize sectors

Floating PV

Industry experts view floating photovoltaic solar as complementary to ground PV installations in the same way as offshore wind complements onshore wind. Some respondents noted that while floating PV presents challenges in installation and operational and maintenance (O&M) costs, there are advantages in areas where access to land is scarce while at the same time it reduces the pressure on the available land for agriculture. It may also receive social and regulatory support given the opposition of some environmental organizations to large ground-mounted installations.

“

Floating PV is great. These types of structures are improving to reduce fatigue effect. Floating PVs are helpful to not only reduce the temperature loss, but also reduce water loss due to the hot weather. Its development is increasing in many developed countries.”

Abolfazl Farsad — **SOLAR PV, ENERGY ENGINEER, AFRY (ITALY)**

While floating PV shows promise in reducing water loss in hot and dry climates, more research is needed to get definitive results about the impact of deployment, to see how it might affect the ecosystem.

“
Floating PV can help to increase the installed PV capacity, but, apart from some minor advantages and particular synergies, I don’t see anything disruptive in this technology (nowadays it has higher costs and lower production than traditional ground mounted plants).”

Michele Tavano — SOLAR PV, ENERGY ENGINEER, IBERDROLA (ITALY)

Floating PV pros and cons



Suitable for areas with scarce land available



Non-scientific evidence of increased energy yield and reduction of water evaporation



Higher O&M costs



Not enough research to prove higher performance

Agrivoltaics

Some industry experts view co-locating solar panels on agricultural land as a niche solution for specific areas such as Europe, while others view it as playing an important role in the future of farming.

“
A promising trend for the coming years is the “agrivoltaic”, since combining PV with agriculture can speed up the permitting processes. I think it’s the most attractive (more than floating PV) as it combines classical land installations with their benefits (e.g. higher bifacial gain due to higher installation and albedo on land) without renouncing to land cultivation.”

Michele Tavano — SOLAR PV, ENERGY ENGINEER, IBERDROLA (ITALY)

In underdeveloped regions such as sub-Saharan Africa, agrivoltaics could provide food security and boost economies, however much of the focus so far has been on European projects. Impact funds could provide a major source of financing to support development. State incentives will be crucial to help cover the higher construction cost of agrivoltaic systems compared with traditional ground-mounted systems.

Furthermore, experts believe that more technical awareness is needed as environmental engineers’ most demanded features in order to design PV plants as “agri” may limit some of the most recent mechanical improvements.

“
This adds great value due to its grid strengthening and voltage control in remote farming locations, as well as increasing overall system efficiency by having the generation of power close to the load center.”

Shaun Woolward — PROJECT MANAGER AT G7 RENEWABLE ENERGIES (SOUTH AFRICA)

Agrivoltaics pros and cons



Niche solution for certain geographies



Synergies between industries with a higher crop quality and energy yield performance



Financial support required in less developed countries



Higher construction costs





VERDICTS FROM INDUSTRY PROFESSIONALS

Industry leaders

Companies that become leaders in the renewable sector display certain qualities that others can learn from as they develop. Sixty-one percent of our survey respondents identified investing in digitalization and automation as a key factor that leading companies master, and similarly 60% cited diversification of renewable energy sources as a key to success.

Sixty-one percent of our survey respondents identified investing in digitalization and automation as a key factor that leading companies master.

“

Digitalisation, unleashing the potential of BESS, and grid booster solutions are necessary for reducing the cost of energy.”

Diego Lobo-Guerrero — FOUNDER, AYKA PROJECTS (GERMANY)

Combining solar with wind and hydropower along with batteries can help developers to mitigate some of the supply instability created by intermittent generation. For example, solar can maximize generation during hot and dry seasons, while hydropower generation can take over during rainy seasons. Investing in grid stabilization methods such as batteries was identified by 50% of the respondents.

Investing in innovative new materials or equipment was cited by 37% of the respondents. Advances in solar technologies such as bifacial panels, n-type TOPCon cells and perovskites offer high efficiencies to increase electricity output from a single solar panel. And solar building materials as well as fabrics create opportunities to maximize power generation in the future.

“
Change will happen through the use of new technology, better resource planning, and with use of high efficient and quality materials.”

Gajanan Sawant — **CLEANMAX (INDIA)**

Pricing strategies and diversification of operating countries were identified by 36% of the respondents as important for companies to master, while only 14% pointed to investing in a strong labor force as a key factor.

Pricing strategies and diversification of operating countries were identified by 36% of respondents as important for companies to master.

“

Developed countries should support underdeveloped countries to fully utilize available resources for renewable energy, like solar, hydro, wind, geothermal, and biomass.”

Mohamed Said Nachiwa — **CEO AT ICS TECHNOLOGIES (TANZANIA)**

Industry leaders have a role to play in reducing the cost of energy in response to recent record price spikes. They can push for the expansion of renewable capacity to replace fossil fuel generation and invest in projects that increase energy efficiency. Driving adoption of distributed energy systems will enable consumers to supply their own consumption, reducing demand from the grid. And ensuring the transition to digitalization can unleash the potential of battery storage systems and grid management solutions, energy professionals said.

Industry leaders have a role to play in reducing the cost of energy in response to recent record price spikes.



VERDICTS FROM INDUSTRY PROFESSIONALS

Investment across the industry

The rapid growth in renewable deployment anticipated for 2022 will require investment throughout the value chain.

Around one third of respondents felt that the COVID-19 pandemic has had little impact on their company's investment in clean energy (30.7%). But at the other end of the scale, 15% said that their investment had been affected. COVID-19 recovery has clearly had an impact on the sector as last year's results showed that 34.9% saw little impact on their company's investment in clean energy while 10.4% argued it had been affected positively.

Experts have seen an increase in their company's investment in clean energy during the COVID-19 recovery.

In some cases, renewable installations that have been delayed by government-ordered lockdowns during the pandemic have been delayed rather than canceled, so that investments will be rolled over into the future.

Looking ahead, more than half of respondents pointed to storage options (57%) and digitalization (54%) as needing more resources in the coming year.

“

Development is ongoing and it must go on, but we must think about how to reduce the cost to make batteries and how to recycle them.”

Michele Tavano — PV ENGINEER, IBERDROLA (ITALY)

Looking ahead, more than half of respondents pointed to storage options (57%) and digitalization (54%) as needing more resources in the coming year. Investing in better efficiencies will also be key, according to 45% of the respondents. More respondents, 31%, emphasized the importance of investing in utility-scale generation, compared with 25% who cited commercial and industrial (C&I) generation and 10% who cited residential-scale generation. The industry's workforce was cited by 19% respondents as requiring more investment, while 14% pointed to recycling as another key concern and 10% highlighted the need to invest in new materials.

More than half of respondents pointed to storage options (57%) and digitalization (54%) as needing more resources in the coming year.

“
We need so much more installed generation power worldwide to achieve the goal of Global Warming staying below 2°C–1.5°C as of Paris is getting beyond our reach... We need more RatedPowers in every segment of the industry!”

Several experts also cited the importance of investing in diversification of the supply chain, for example reducing reliance on imports from China for raw materials and equipment.

“

The whole process of recyclability of renewable components could be better investigated if Europe started creating its own market. Everything is now imported from China, a country that has not been and will not be completely transparent. Europe has the knowledge and the resources to build the first carbon neutral economy.”

Alba Maqueda Mateos — **PV ENGINEER, E2-ENERGIE (NETHERLANDS)**

Most of the respondents whose companies operate in Europe believe that the policies designed under the European Union's Green Deal will have an impact on the sector. The €1.3 billion framework aims to make Europe the world's first carbon-neutral region by 2050, extending across transport, construction, energy, biodiversity and food. The policy includes tariffs on countries that lag behind in reducing their greenhouse gas emissions and an action plan to implement a circular economy.

The EU's Green Deal includes tariffs on countries that lag behind in reducing their greenhouse gas emissions and an action plan to implement a circular economy.

The framework will encourage more international investment and obligate some municipalities to set policies contributing to the energy transition, with an emphasis on intelligent grids, battery storage and energy efficiency, respondents said. Countries will be prompted to implement renewable projects faster to avoid fines and create more detailed strategies to increase renewable production.

“
EU Green Deal policies will accelerate the electrification of the economy: with emphasis in activity in intelligent grids, battery storage and energy efficiency.”

David Edward Tipping — STRATEGY DIRECTOR AT VISION ENERGETIQUE (COLOMBIA)





VERDICTS FROM INDUSTRY PROFESSIONALS

Role of technology and digitalization

Digitalization is a key trend throughout the industrial and construction sectors, as automation and Internet of Things (IoT) devices introduce new functionalities and efficiencies known as the fourth industrial revolution, or Industry 4.0. In renewables, digitalization encompasses smart home energy systems, digital tools for plant-level forecasting, the use of drones in equipment maintenance, and smart grid management.

In renewables, digitalization encompasses smart home energy systems, digital tools for plant-level forecasting, the use of drones in equipment maintenance, and smart grid management.

Almost all our survey respondents agreed that there are areas of their work in which technology solutions could help them to achieve their objectives. Around half strongly agree that digitalization plays an important role in the growth of renewables.

Around 28% of industry experts view the development stage as the part of the supply chain where technology solutions are most needed. Digitalization can help by reducing soft costs, which according to the US Office of Energy Efficiency & Renewable Energy accounts for two thirds total costs of a renewable energy project.

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Automation can help developers to streamline the project design process by optimizing site layout and engineering, reducing the time it takes to plan each installation. Automation can also generate reports and send them automatically to key stakeholders, creating more timely reporting and freeing up resources to work on other tasks.

Around 28% of industry experts view the development stage as the part of the supply chain where technology solutions are most needed.

“

More development analysis softwares are needed with deeper scopes.”

Víctor Alexi — **PROJECT ENGINEER, SOLARIG (ITALY)**

Around 25% of survey respondents cited O&M as benefitting from technological advancements. Digitalization enables site managers to use remote monitoring sensors, satellite data, wireless communications and analytics software to optimize operations at a power generation facility. In a solar installation for example, digital solutions can simulate systems, analyzing data at the plant level as well as individual components including inverters, cabling and modules. Analytics can predict weather conditions as well as system failures, enabling managers to repair equipment before larger issues arise.

Perceived benefits of technology at every renewable project lifecycle stage



Development

Shortening project plan times and soft costs.



Construction

Better and more timely construction estimates.



O&M

Optimize operations at power generation through.



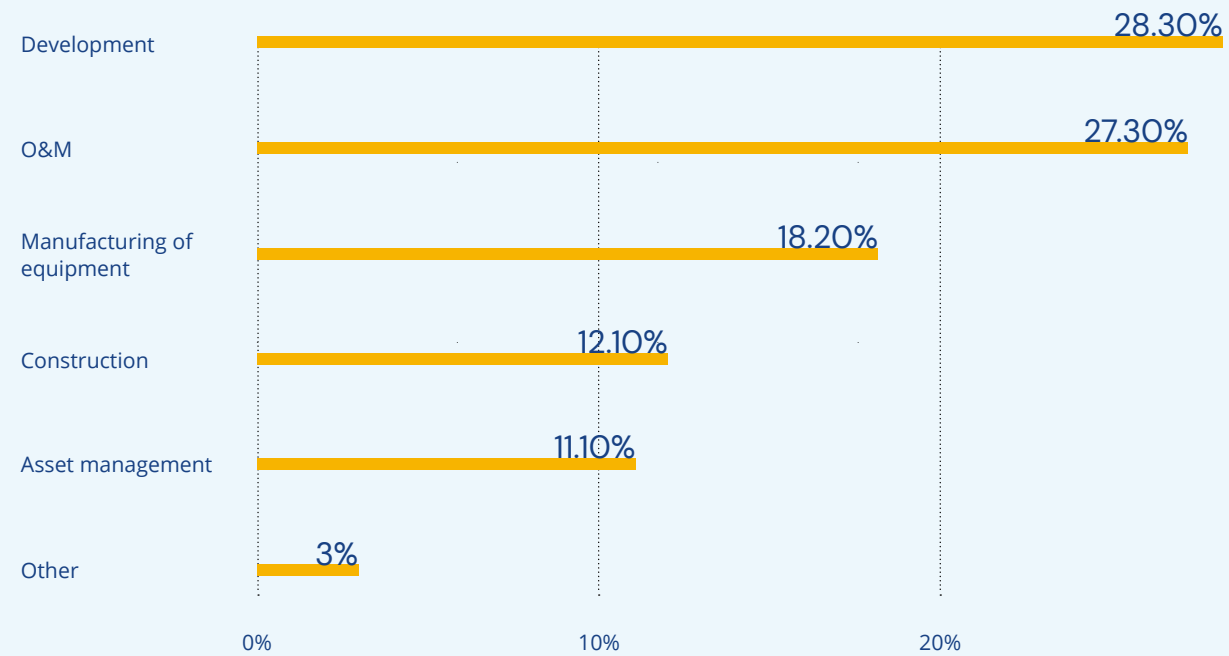
Asset management

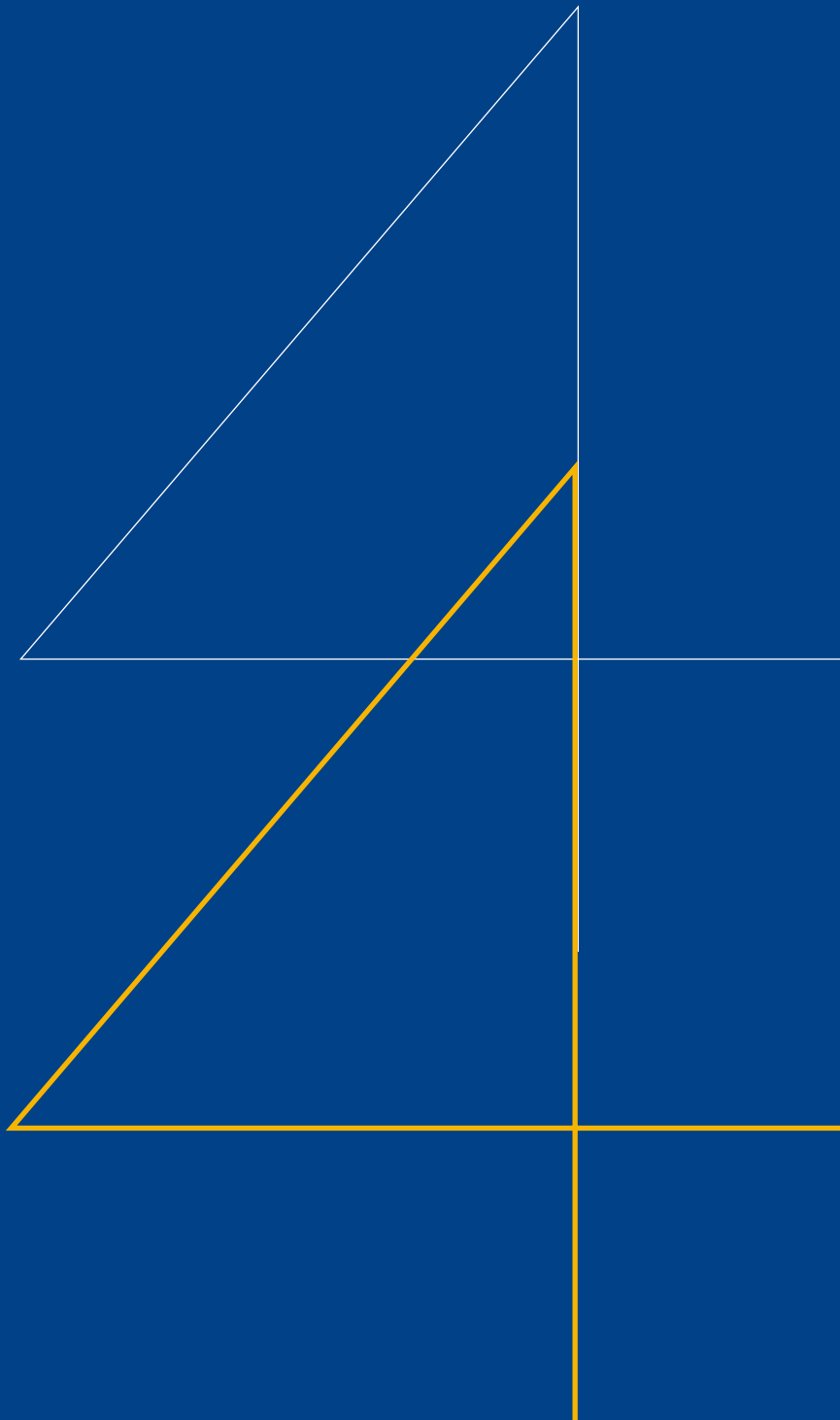
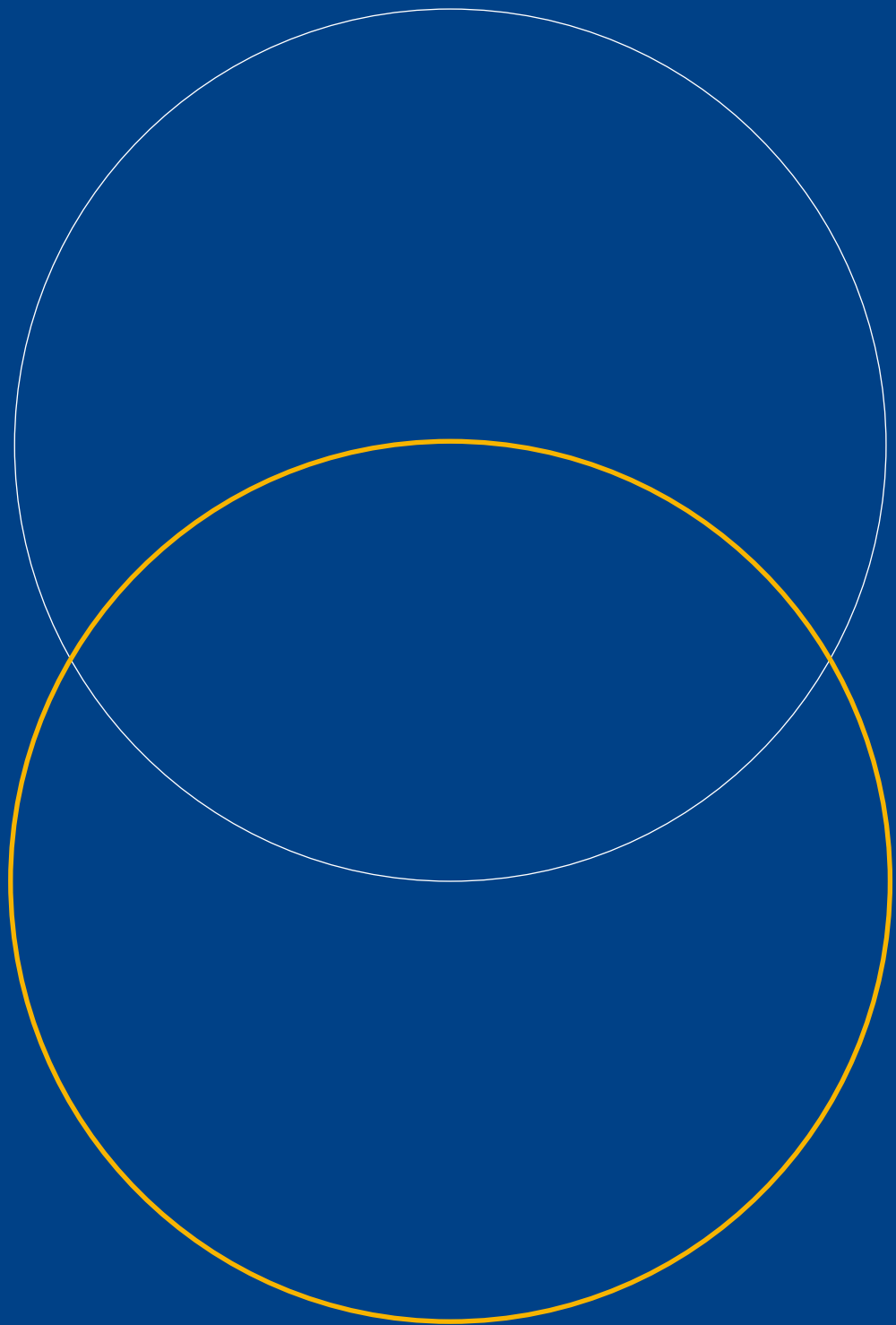
360° automated reporting at portfolio and project level.

Technology solutions are also important in equipment manufacturing, according to 18% of survey respondents. Construction and asset management were each cited by 11% of industry experts.

Solar equipment manufacturers use robotics to increase accuracy in the assembling of components and reduce costs. Automation enables the collection of detailed data on processes and efficiencies to help ensure that facilities run at their peak. There is potential for Internet-connected machinery and advanced analytics to further cut costs in the value chain. And automation can provide detailed quality control for individual solar cells and modules as they come off the production line.

In your opinion, in what part of the supply chain would implementing technology solutions be more needed





**Our data
insights**

Our data insights

Analysis of data extracted from RatedPower's solar plant simulation software highlights some of the key trends and top manufacturers in solar project development around the world in 2021.

There has been an increase in the volume of generation capacity simulated in RatedPower's software to almost 6.5TW in the past two years. Capacity simulations have been trending higher since the fourth quarter of 2020, after a dip in the third quarter reflecting project delays caused by the COVID-19 pandemic.

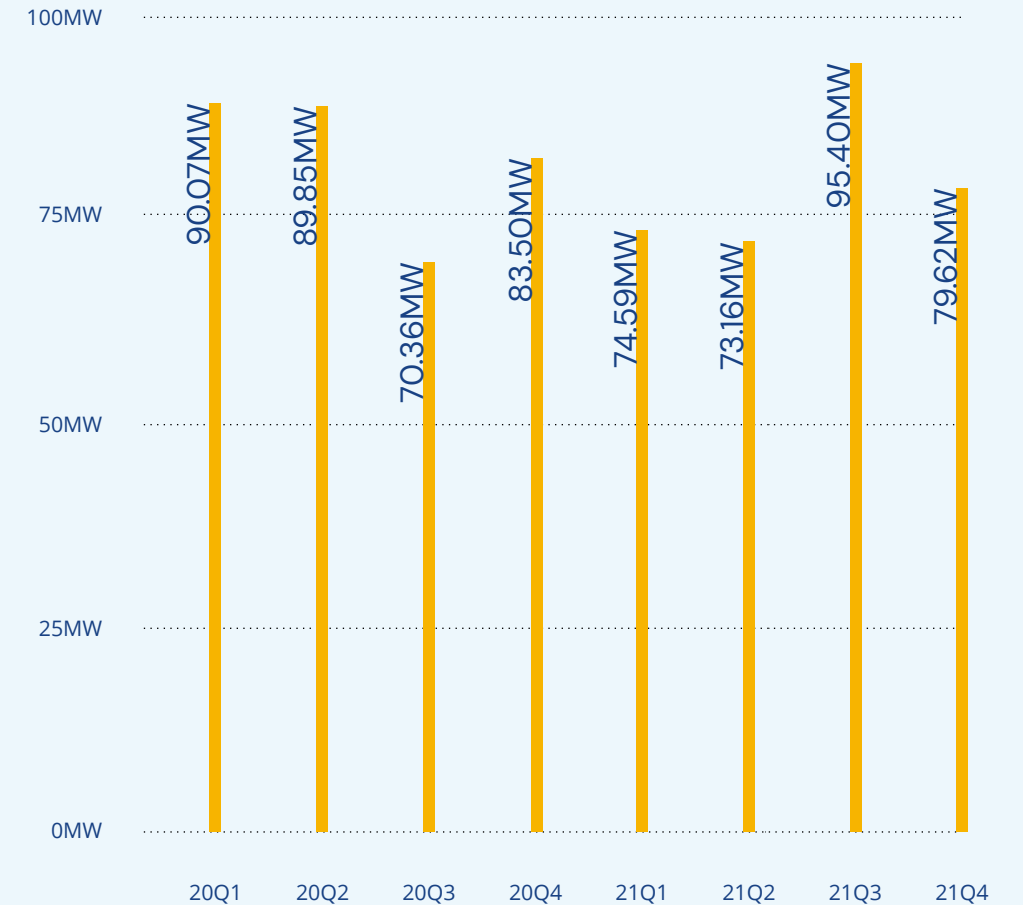




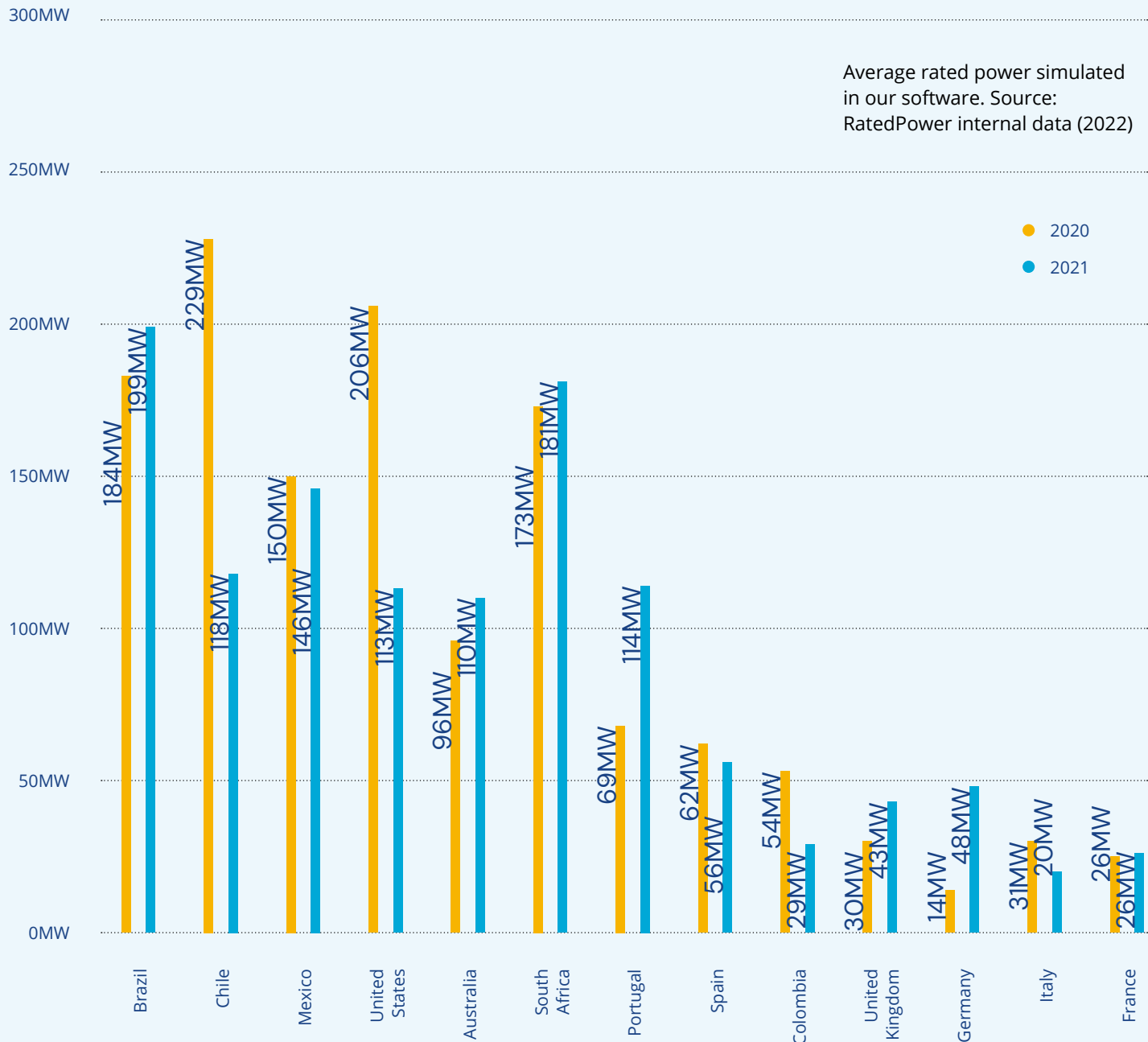
OUR DATA INSIGHTS

Changing project trends

Projects were simulated across the globe in more than 160 countries, starting from Spain and Portugal in Europe to the US, Brazil, Chile in the Americas, Australia and South Africa and including China, India or Vietnam. The average rated power capacity worldwide in 2021 was around 80MW, a decrease from 83.4MW in 2020.



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Drilling down into the data for specific geographies, and in relation to rated power values, countries in the Middle East such as Saudi Arabia are installing relatively large plants on average, with Saudi Arabia averaging 327.2MW. Projects in Brazil averaged 199MW, followed by China at 170MW, Chile at 168MW and India at 166 MW.

Top three countries by average rated power are Saudi Arabia (327.2MW), Brazil (199.9MW) and China (170MW).

At the other end of the spectrum, 24% of the respondents said it was a challenge to tackle lack of land availability. Countries with more developed renewable industries and lower land availability have smaller average sites, such as France with an average of 24MW, Italy at 25.1MW, Germany at 34.5MW, 38.3MW in Poland and 43MW in the UK. Land availability might yet be another reason why technologies such as floating PV and agrivoltaics are thriving in countries in Europe where average site sizes are smaller. Climate and meteorological restrictions are other factors for their success.

“

Floating PV is technologically consolidated, but may grow more when developers and the market face tougher land availability issues. For now, it will be niche solution for big hydro or a few pump storage projects.”

Guilherme Castro — HYBRID PROJECTS' ENGINEER, CASA DOS VENTOS (BRAZIL)



As seen in the survey, 45% of the experts interviewed believe that the industry needed to invest in better efficiencies. As the solar industry develops around the world, targeting maximum generation efficiency from each installation, the type of equipment used in installations is evolving. The use of tracker structures compared with fixed structures for mounting solar panels trended lower in 2021 compared with 2020.

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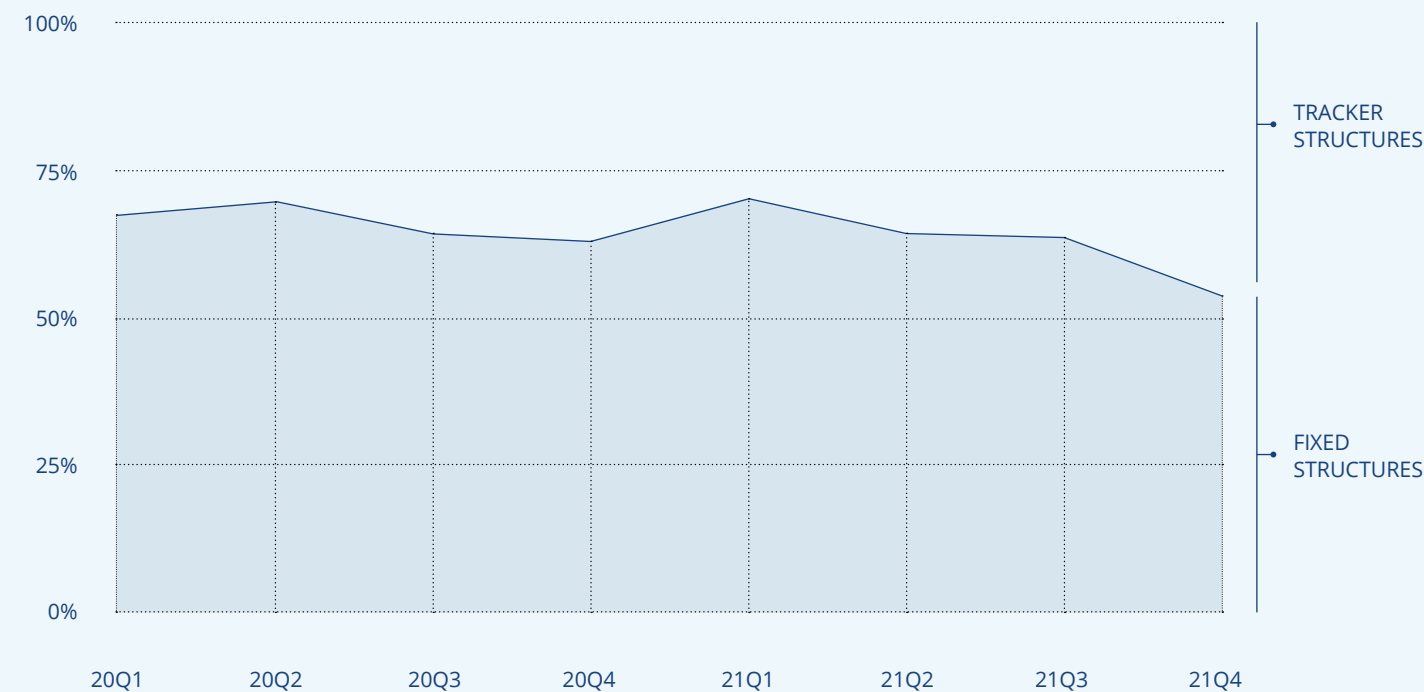
OUR DATA INSIGHTS

Structure preferences

The global trend highlights the use of tracker structures as around 65% of designs were carried out with this configuration out of the total of almost 6.5TW and 80,000 simulations in the past two years. But overall, although tracker structures are the most used, it seems that there is a growing trend towards the use of fixed structures, which increased by 3%.

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Use of trackers over fixed structures worldwide



While tracker structures increase electricity output by adjusting the angle of panels toward the sun, they are expensive and have more moving parts, which can require more maintenance. As solar equipment costs fall it can be more cost effective to install a larger number of fixed panels.

Furthermore, the trend toward fixed structures could also be justified by the simulation of specialized fixed structures to maximize land availability such as East-West structures, agrivoltaics or even floating PV.

In terms of tracking technology, European countries tend to use fixed structures. In Germany, fixed systems accounted for 93% of project simulations, in France 89% of simulations had fixed structures, in Greece 78.8% of simulations were fixed, and in the UK 67.3% were fixed.

Other countries such as Australia, Brazil, and South Africa are inclined to use tracker structures. This trend reflects the effect that the latitude of the different countries has on solar irradiation and the different meteorological conditions as well as sunlight hours throughout the year.

Overall, although tracker structures are mostly used worldwide, it seems that there is a growing trend towards the use of fixed structures (+3%). The countries that are encouraging this trend are Chile (+7%), Italy (+7%), Germany (+3%) and the United States (+2%).

Preferred structure in selected geographies

Fixed Structures

Germany
France
Greece
UK

Tracker Structures

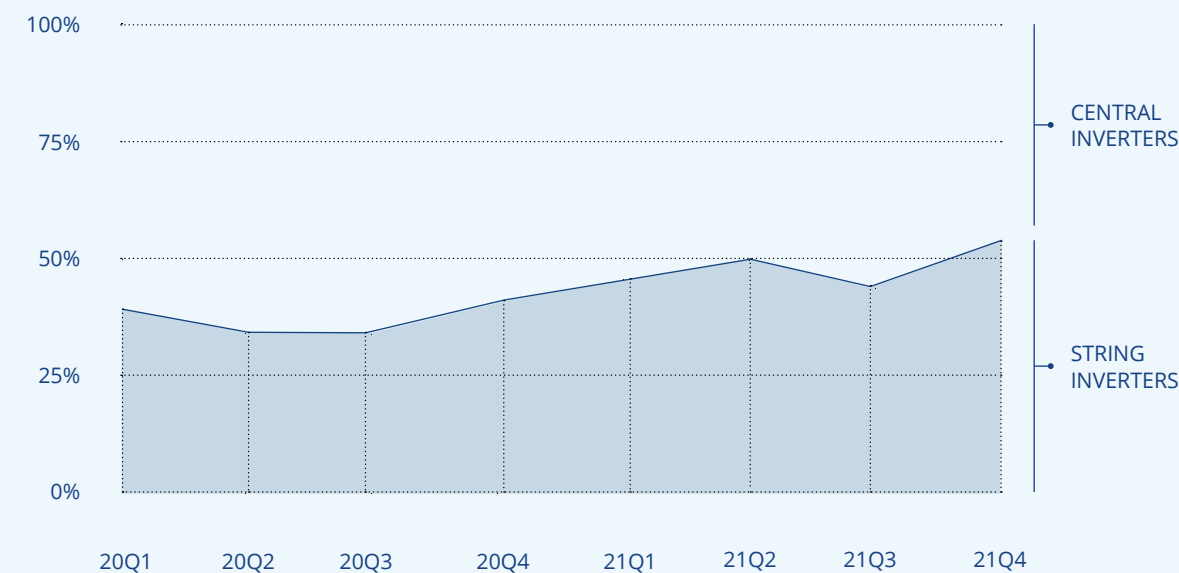
Australia
Brazil
South Africa
Mexico



OUR DATA INSIGHTS

Inverter type preferences

Use of string inverters over central worldwide



European countries tend to use string inverters rather than central configurations. In Poland an average of 91.8% of projects used string inverters, in Germany the figure was 85.1%, with the UK at 75.6%, France at 70.8% and Portugal at 69.3%. This is likely related to the fact that, as we have seen, the size of plant capacities tends to be smaller in these countries, making string configurations more viable.

On the other hand, countries that design projects with higher rated power capacity such as Australia, South Africa, the US, Brazil or China, tend to favor the use of central inverters.

Preferred structure in selected geographies

String inverters

Poland
Germany
UK
France
Portugal

Central inverters

Australia
South Africa
US
Brazil
China

Overall, while central inverters have traditionally been the default structure, the trend may be changing as central inverters are larger and more costly to repair. String inverters are smaller and can be replaced easily.

Countries that designs projects with higher rated power capacity tend to favor the use of central inverters.

As equipment costs decline this trend is likely to continue. In an industry that is growing so fast, the industry could face a lack of skilled workers with the ability to fix a central inverter. This would increase costs and could have an impact on the decision on whether to choose string inverters over central inverters in the future.



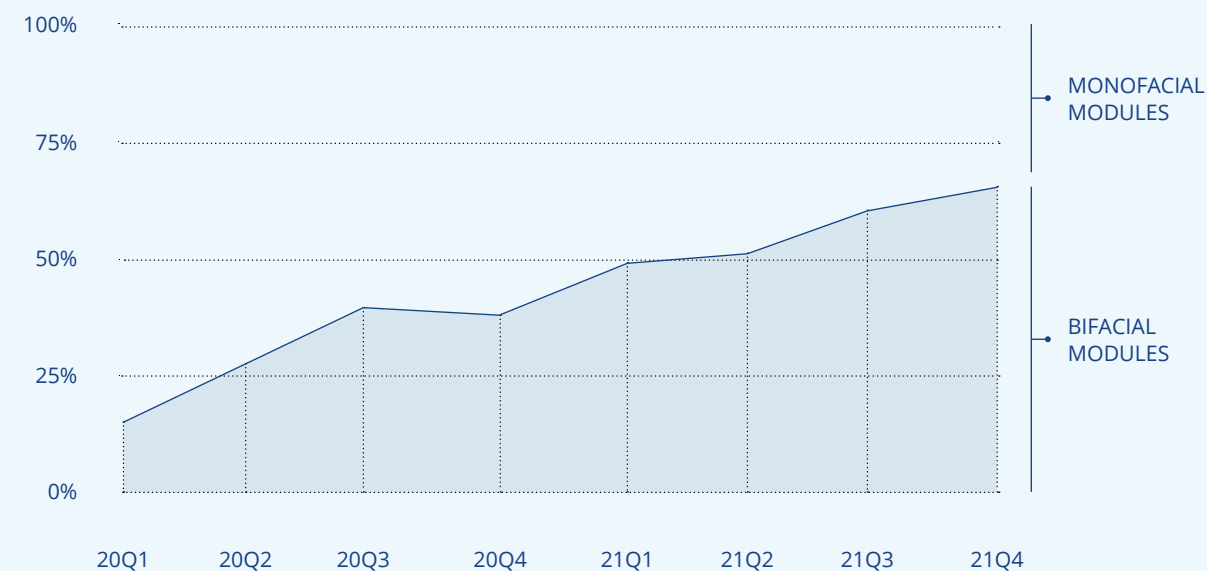
OUR DATA INSIGHTS

Module type preferences

Choosing a module that is fitting to the conditions of your site is crucial to have an efficient system. However, because of efficiency advantages, some modules are more preferred than others in general. In the past few years, bifacial modules have been increasingly popular on the global scale. There is a clear global trend towards the growing use of bifacial modules, which increase site efficiency by generating electricity from both sides of the solar panel. Bifacial modules saw a growth of 47% reaching a total of 57% of simulations, up from 30% in 2020.

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Use of bifacial modules over monofacial



Countries with larger projects are also leading in the use of bifacial modules. An average of 79.36% of project simulations in Saudi Arabia and 77.67% of simulations in Brazil used bifacial panels, compared with 34.34% in Spain or 31.76% in the UK.

Preferred structure in selected geographies

Monofacial

Spain
UK

Bifacial

Saudi Arabia
Brazil





TOP EQUIPMENT MANUFACTURERS

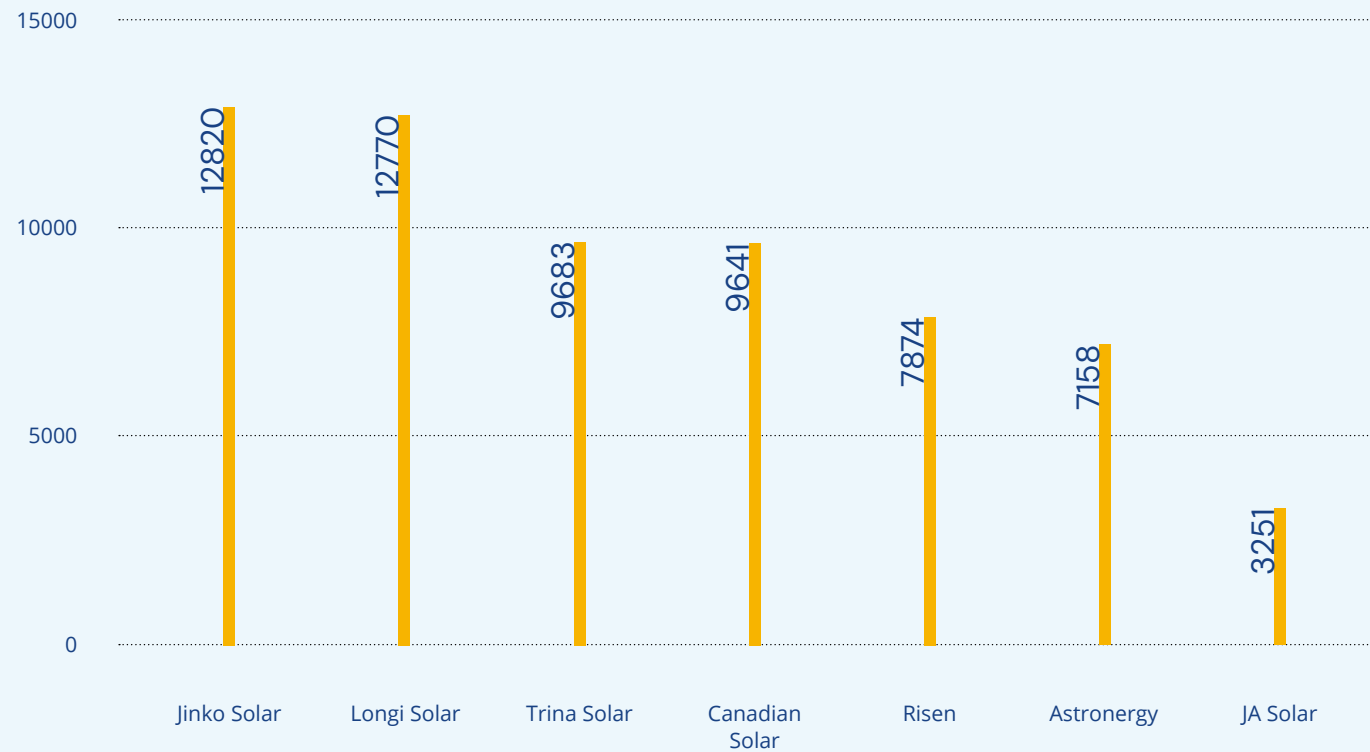
Top equipment manufacturers

Adding onto the country-specific research, we have also analyzed which modules, inverters and structures have been preferred by our clients, along with the simulation of 6.5TW of capacity and 80,000 simulations during the past two years.

In this sense, we can conclude that the brands of choice for modules have been Jinko Solar followed really closely by Longi Solar. In third and fourth position, almost 10,000 simulations chose Trina Solar and Canadian Solar.



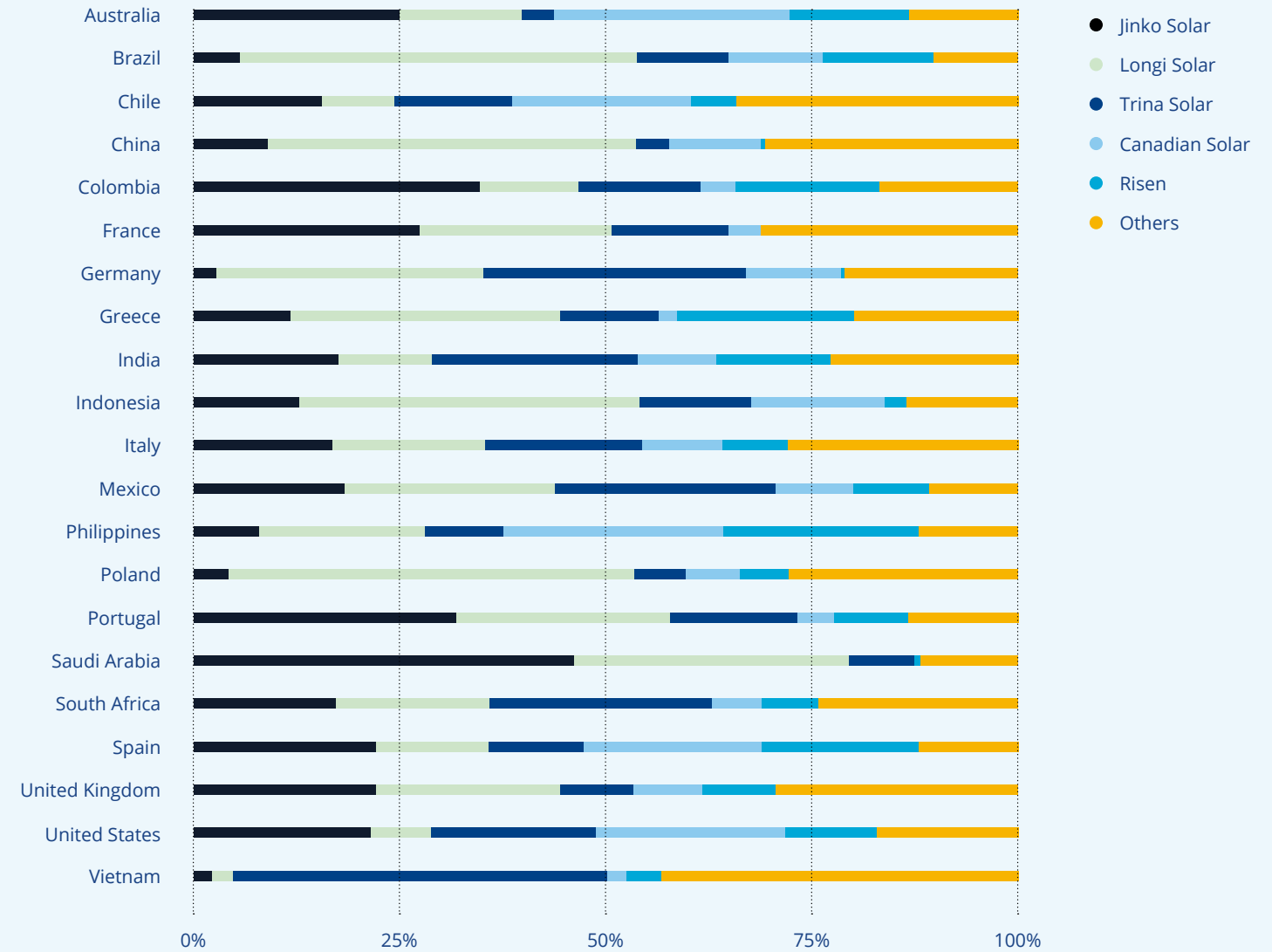
Top used module manufacturers worldwide



Nevertheless, as expected, these preferences differ by countries.

We would like to make a remark here to not take the global most used brands information as a global trend as this total is drawn from all simulations carried out in RatedPower software, and, as an example, Spain alone represents 8% of the total value. Total values by country are therefore more representative.

Top used module manufacturers by geography



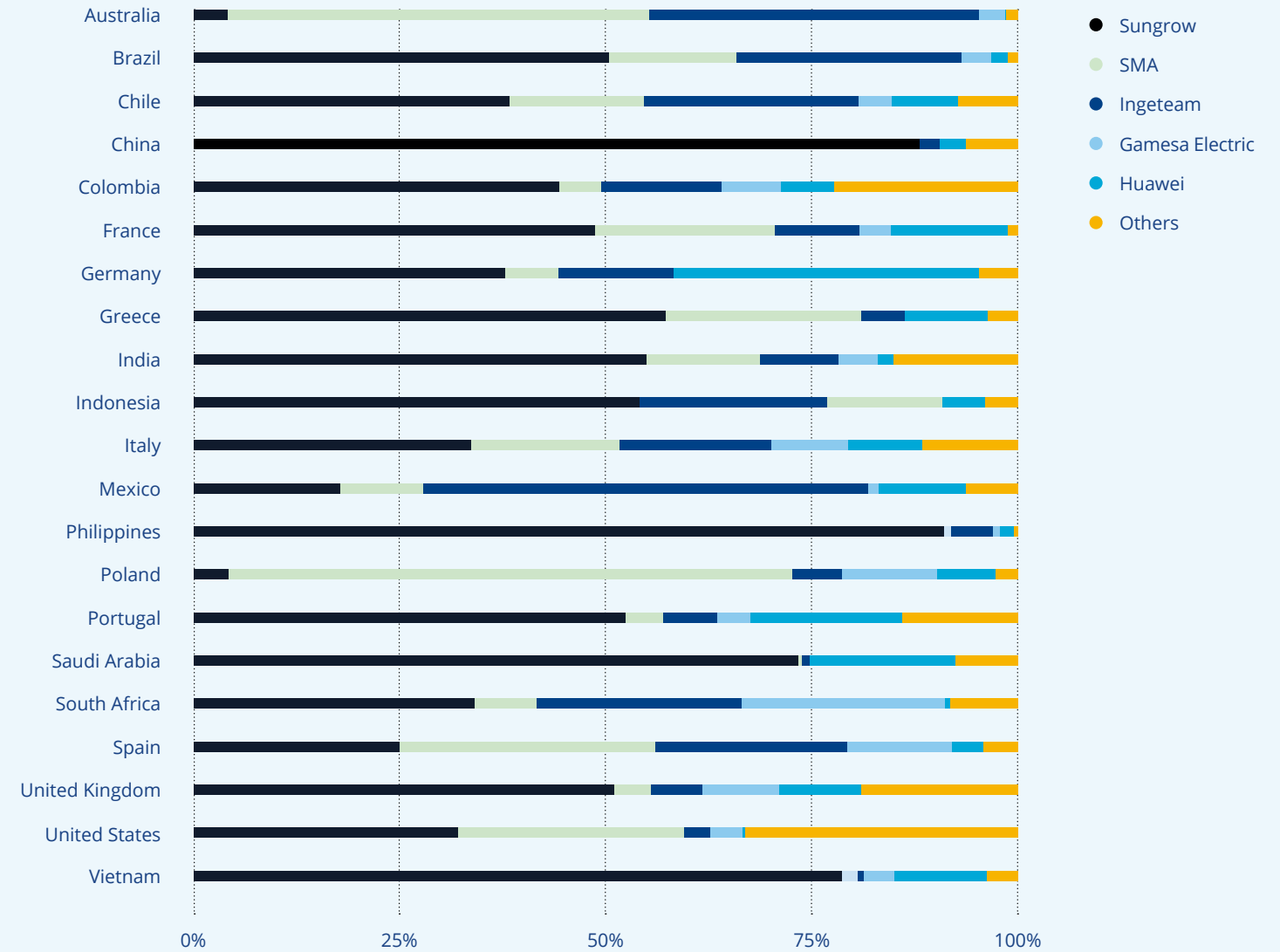
Top used inverter manufacturers worldwide



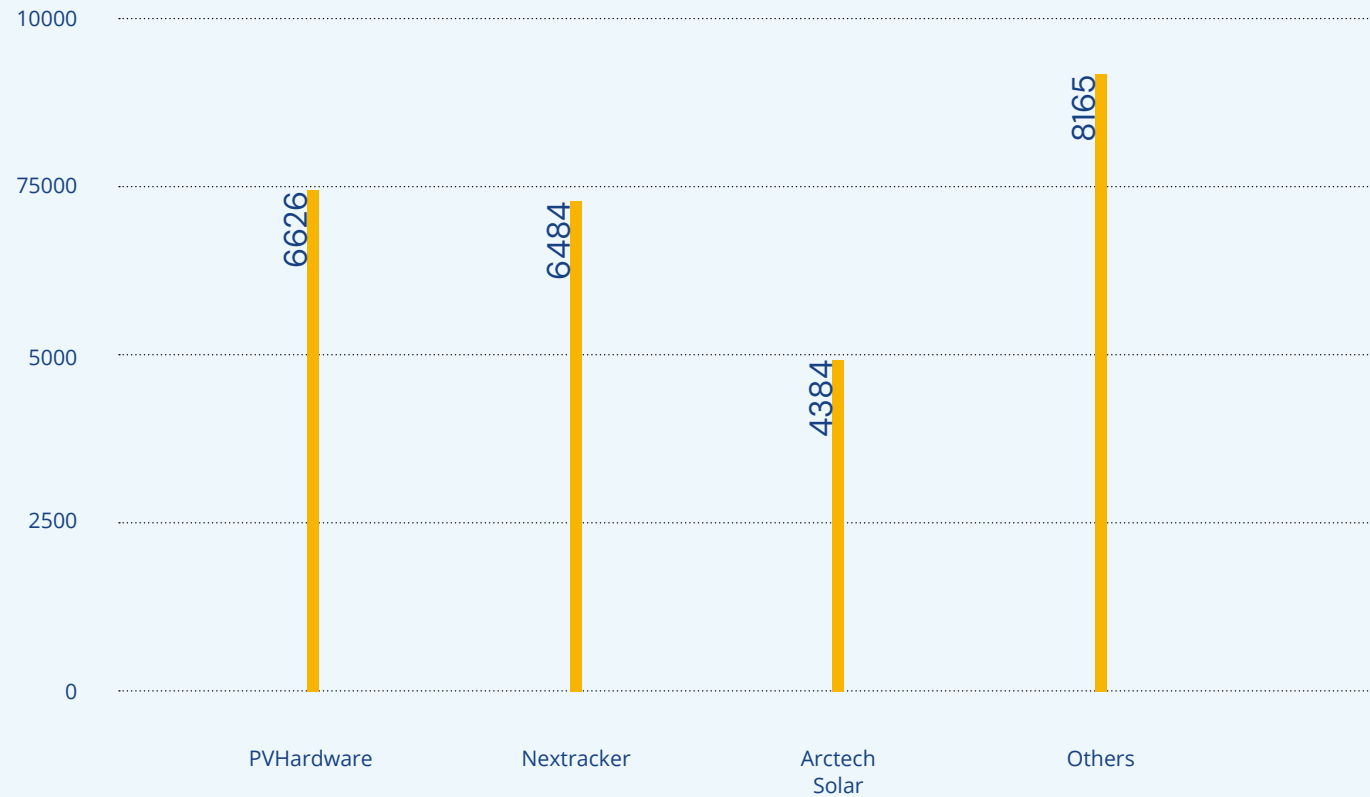
In terms of inverters, Sungrow will be the clear top choice of industry experts followed by SMA and Ingeteam.

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Top used inverter manufacturers by geography



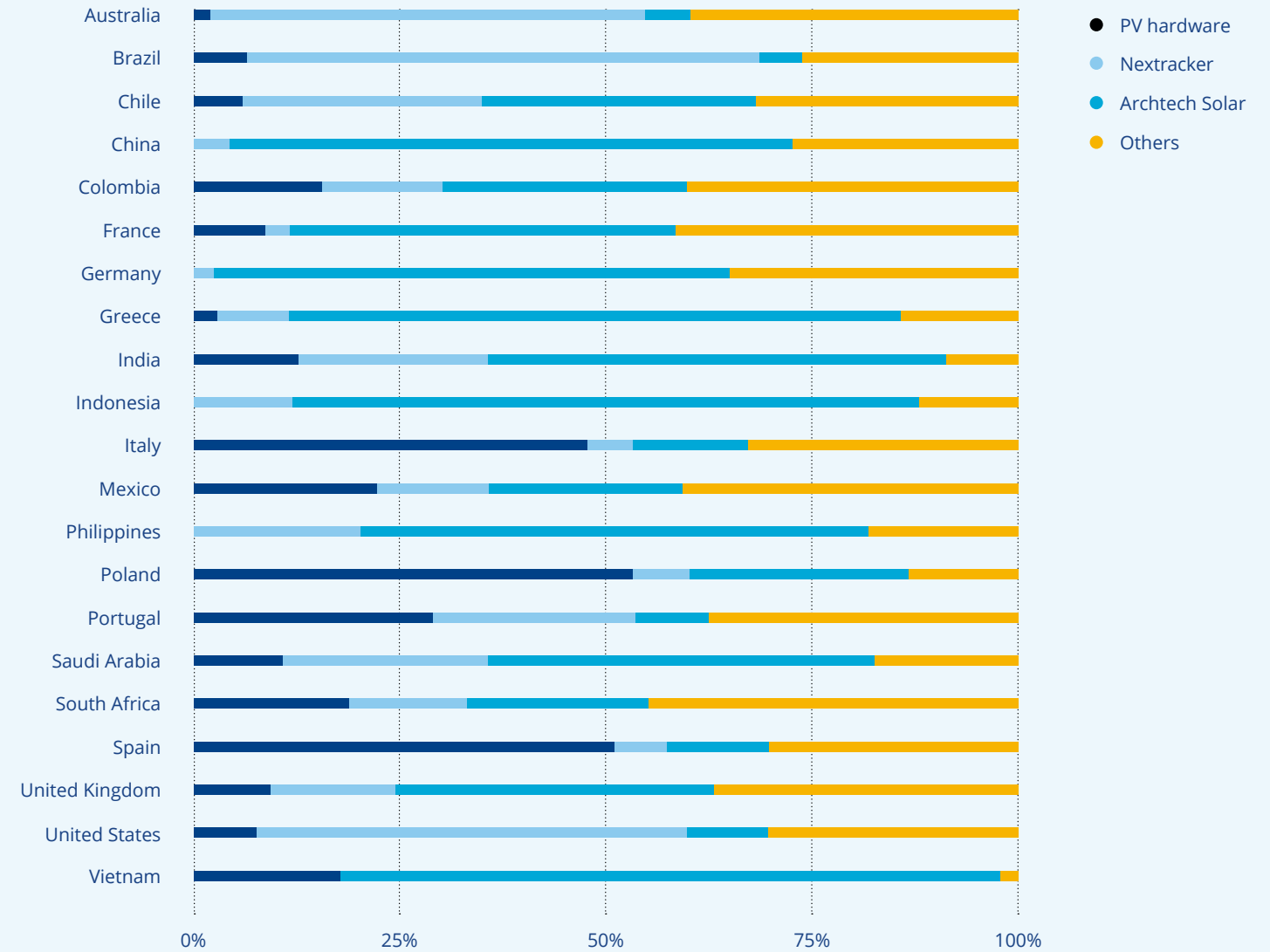
Top used structures manufacturers worldwide

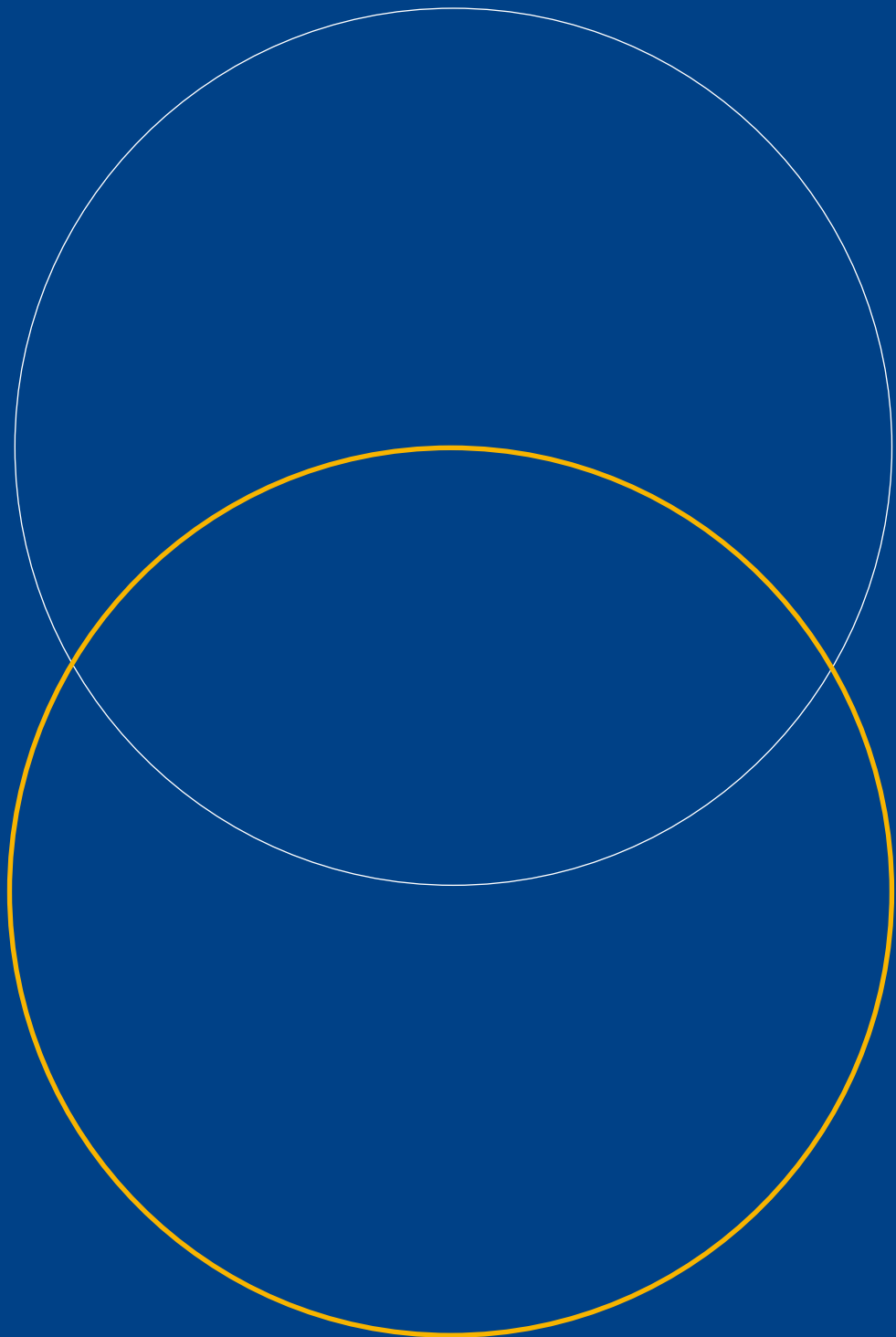


In terms of structures we would highlight the use of PVHardware followed really closely by Nextracker and in third position Arctech Solar.

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Top used structures manufacturers by geography





Conclusion

The year ahead will be an exciting period for the renewable energy industry. The transition to clean energy is gathering pace, with governments taking the opportunity of the economic recovery from the COVID-19 pandemic to implement policies to help meet their carbon emissions reduction goals. Ambitious policies and accelerating renewable deployments in China, the US, Europe and Australia are inspiring confidence in industry leaders that they will continue to lead in the growth of global solar and wind capacity.

Our survey of industry experts shows that the industry faces challenges such as bottlenecks in permitting, grid saturation and supply chain disruptions. But there is also potential for continued strong growth in new renewable installations, with solar leading the way.

“
We need to find the best scale to implement renewable energy projects as close to the final users as possible. Very big projects near little or medium villages cause a great visual and ecological impact and make them unpopular. We need to listen to the people and help them go ahead with the transition to a “not only big scale” green energy projects.”

IT MANAGER, SOLAR DEVELOPMENT (SPAIN)

Respondents are confident that the solar sector will surpass 2021’s record 127GW of capacity additions to reach the 200GW mark in 2022. The COVID-19 pandemic has had a limited impact on companies’ investment plans, as most remain committed to playing a role in the energy transition. Consumers are keen to support companies that demonstrate sustainable practices and more companies are securing renewable power supply to limit their exposure to rising energy costs while reducing their carbon footprint.

“

The industry mustn’t forget to focus on life-cycle sustainability of materials and humanitarian supply chain concerns.”

Eduardo Arteaga — BUSINESS DEVELOPMENT ENGINEER AT INFRATEC (NEW ZEALAND)

New technologies and digitalization will help to advance the viability of solar as a primary form of electricity generation. Innovations in the deployment of solar panels such as floating panels and agrivoltaics are making the technology viable in parts of the world such as developing countries where land is scarce and climate change is having an impact on agriculture and water availability.

Digital tools such as Internet of Things (IoT) devices, data analytics, virtual reality and artificial intelligence are changing the way that solar installations are managed. Automation and advanced modeling tools help reduce the time it takes to plan each installation by enabling developers to optimize site layout and engineering. They also help operational managers to maximise a project's return on investment. Almost all industry professionals believe that technology solutions will help them achieve their objectives in the future.

“

The first stage must be efficient energy usage, followed by renewable energy. The focus nowadays has been on how to produce more renewable energy but not how to reduce energy consumption.”

Luis Pacheco Ibarra — **ENGINEERING COORDINATOR EN ATLAS RENEWABLE ENERGY (CHILE)**

Along with digitalization, the industry also needs to invest in battery storage and energy efficiency to supplement renewable generation, experts say. This will expand the viability of intermittent solar and wind in a growing number of applications. The development of green hydrogen could ramp up demand for solar generation to supply the power needed for the production process. Experts believe that while the technology is in its early stages, it could play an important role in decarbonization over the long term.

Despite the challenges the industry faces, it's clear that the solar sector has a bright future ahead.



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