RatedPower
A PART OF ENVERUS

2024 Trends Report: Renewable Energy and Solar Research Report

Index

Foreword from our CEO

The past year has been a testament to the resilience and adaptability of our industry amidst an ever-changing global energy crisis. While some immediate pressures have eased, the ongoing geopolitical unrest, particularly the prolonged conflict in Ukraine and tensions in the Middle East, continue to impact energy markets and economies worldwide.

Despite these challenges, the renewable energy sector has experienced significant global growth, particularly in solar PV and electric vehicles. The IEA estimates that nearly 90%[1] of total investment in electricity generation went towards low emissions power in 2023, a trend that has been tracking for some time, and this is not only due to the push for lower emissions but also the undeniable economic case for mature clean energy technologies. The momentum behind this transition is now sufficient for global demand for coal, oil, and natural gas to decline before 2030, marking the beginning of the end of the fossil fuel era.

However, there are additional obstacles to overcome on the journey towards a cleaner energy future. Managing supply chain dependencies, especially for critical minerals like lithium, cobalt, nickel, and rare earths, remains a key challenge. Our efforts to diversify and innovate in this area will have a big say in the resilience of clean energy supply chains in the future.

Another pivotal component of this transition is the advancement and integration of battery energy storage systems (BESS). The ability to store and distribute energy when needed will make the supply more consistent, mitigating some of the strain on the grid in tandem with the escalating demand for renewable installations.

Looking ahead to the future, we asked energy industry professionals to share their thoughts on a number of topics, as a means of understanding the current state of the sector. As some recurring themes in the survey responses show, there are both clear challenges that need to be solved and exciting innovations just around the corner. We're excited to see where things go next.

Andrea Barber
VP Power & Renewables, Enverus and co-Founder, RatedPower

Executive Summary

2023 was a year where much progress was made in the renewable industry. From a legislative perspective, the European Union adopted a new Energy Directive[2], raising their 2030 renewable consumption target to 42.5% from 32%. At the same time, over $270 billion in investments were made in the US in the 18 months since the Inflation Reduction Act[3] was introduced in 2022.

The solar PV market has particularly flourished. Large utility-scale and small distributed solar PV systems were estimated to make up two-thirds of the 2023 projected increase in global renewable capacity[4]. Despite this growth, the costs have fluctuated throughout the year, with price hikes driven by various factors, including labor and inverters.

Some sources indicate that wind power could end up having a lower LCOE than solar in 2024 in certain regions for the same reasons. That said, solar PV continues to have a 29% lower levelized cost of energy (LCOE) than the cheapest fossil fuel alternative[5].

As reported by BloombergNEF, the projection of total solar module capacity installed in 2023 around the world is 413 GW[6]. This represented a

massive 58% growth from the amount installed in 2022, which itself was an almost 42% increase from the previous year.

This trajectory looks set to continue, with high targets and projections being made. A report from Aurora Energy Research[7] earlier in the year suggested that Europe was on track to install a solar power capacity of 475 GW between now and 2030. Meanwhile, at the COP28[8] conference in Dubai, world leaders agreed to triple the global renewable energy capacity by 2030 and historically agreed to commit to transition away from fossil fuels[9].

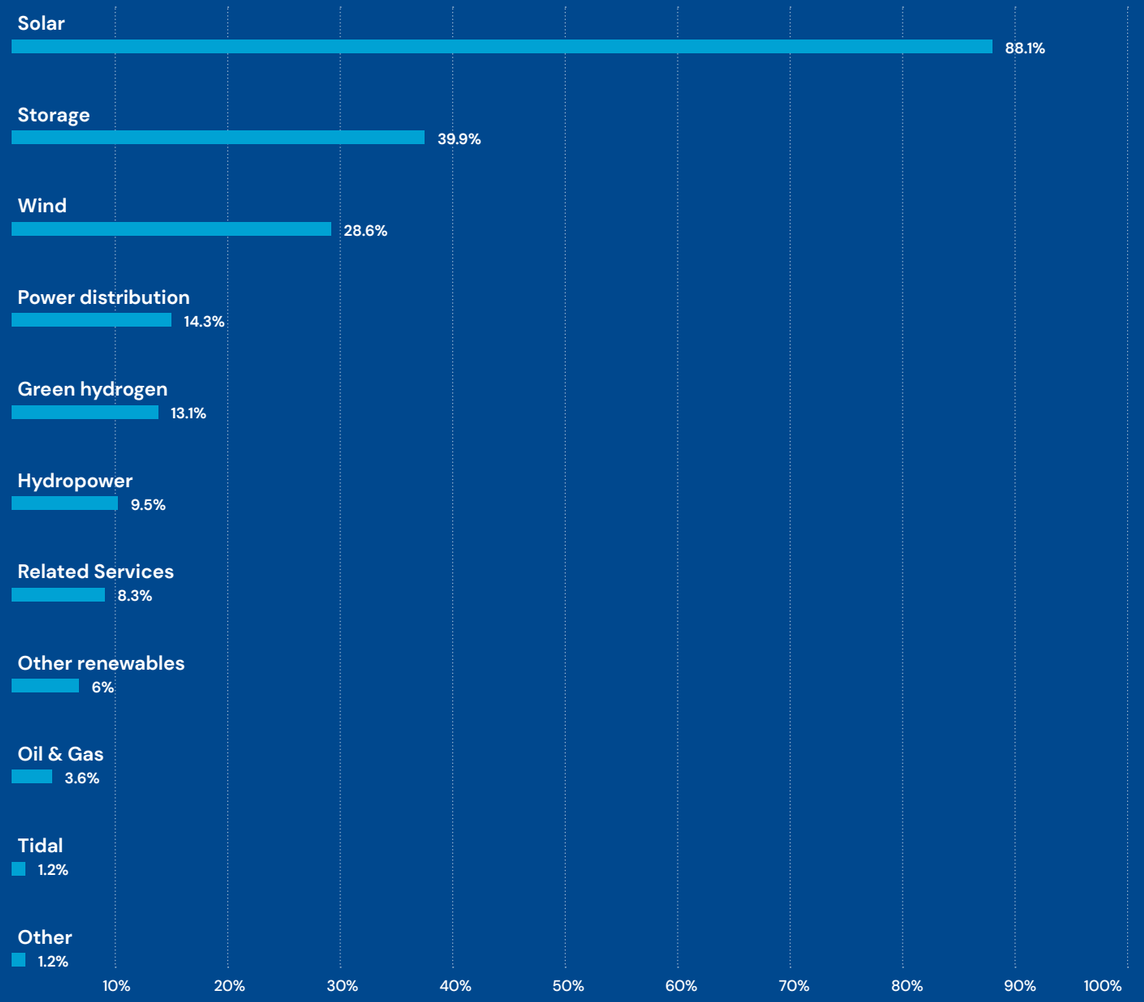
Some interesting trends were noted in RatedPower's platform this year. The dominance of bifacial modules, the growing trend of string inverters, and the geographic variation in structure preferences all highlight evolving design and engineering approaches. Overall, the world is committed to lowering its carbon emissions, and the renewables industry is right there alongside it.

About the survey

To gain insight into the renewable sector's trajectory for 2024, we surveyed energy industry professionals from 30 countries spanning six continents. They were asked about industry challenges, trends, innovations, and the impact of government legislation and incentives on the renewable landscape. They gave their take on critical technological advances in the sector and the ideal developments they would like to see in the future.

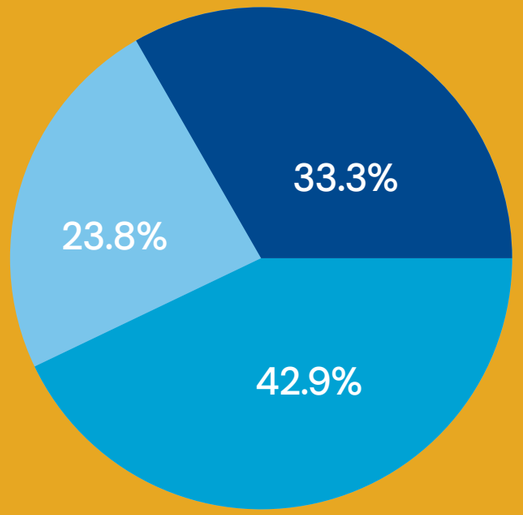
Of the experts we surveyed, over 88% said they work within the solar sector, with the storage and wind power sectors featuring prominently. Over 57% of the respondents said they have worked in the energy industry for 5 to 15+ years. Just under 60% come from organizations with less than 150 employees, and 7% from organizations with over 5,000 employees.

What is your industry sector?



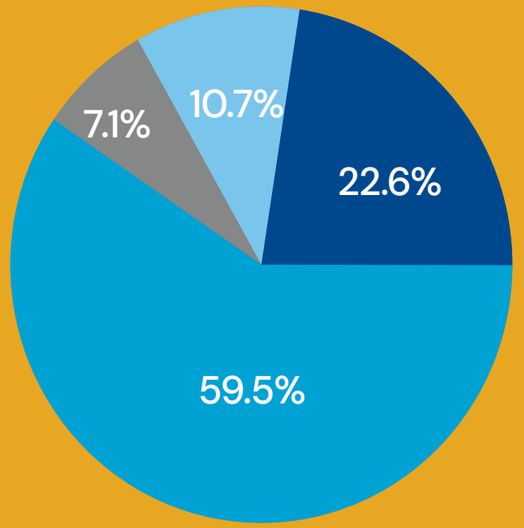
For how long have you been working in the energy industry?

- +15 years
- 5-15 years
- -5 years



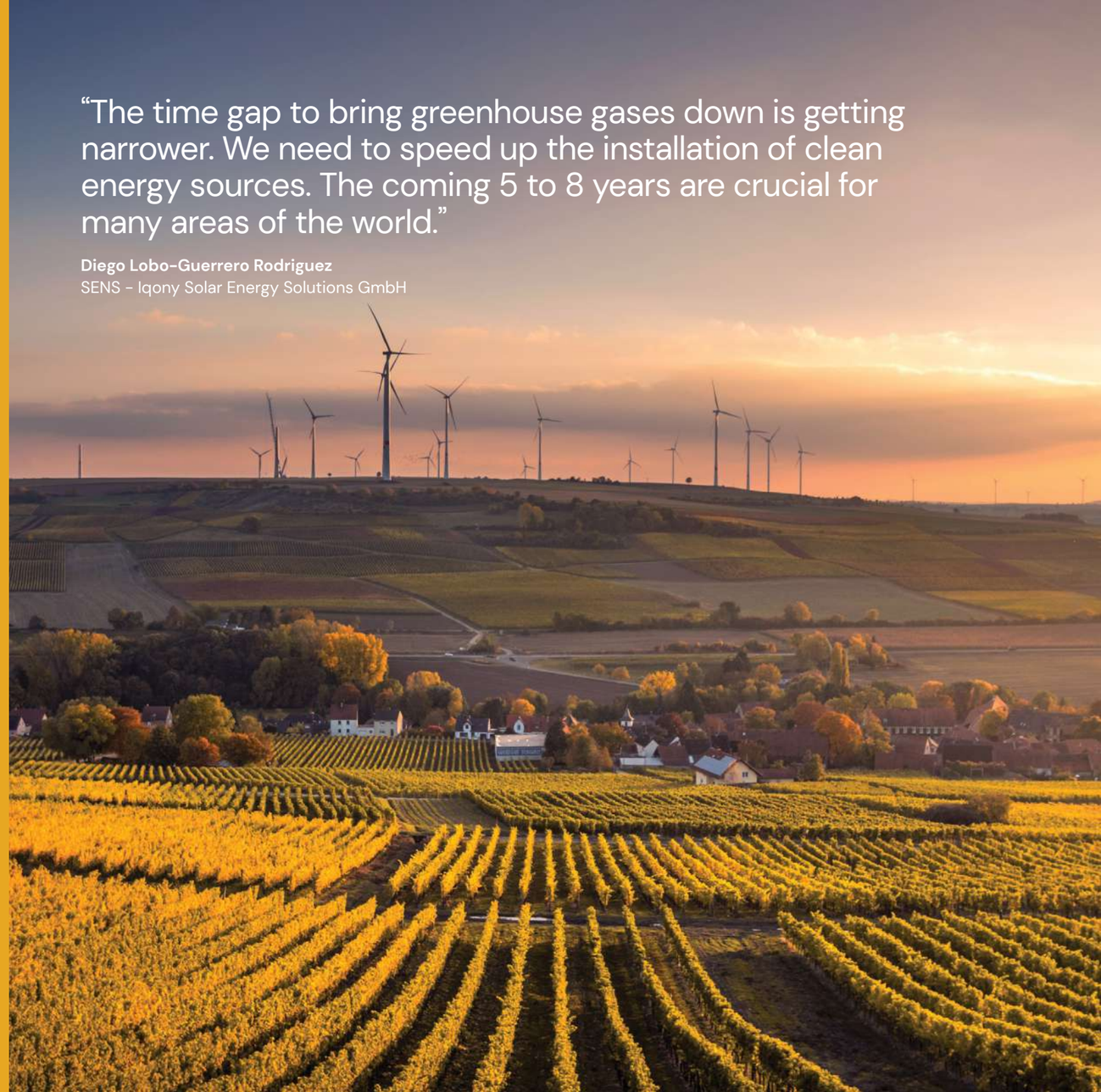
What's the size of the company you currently work for?

- Less than 150 employees
- 150-1,000 employees
- 1,000-5,000 employees
- +5,000 employees



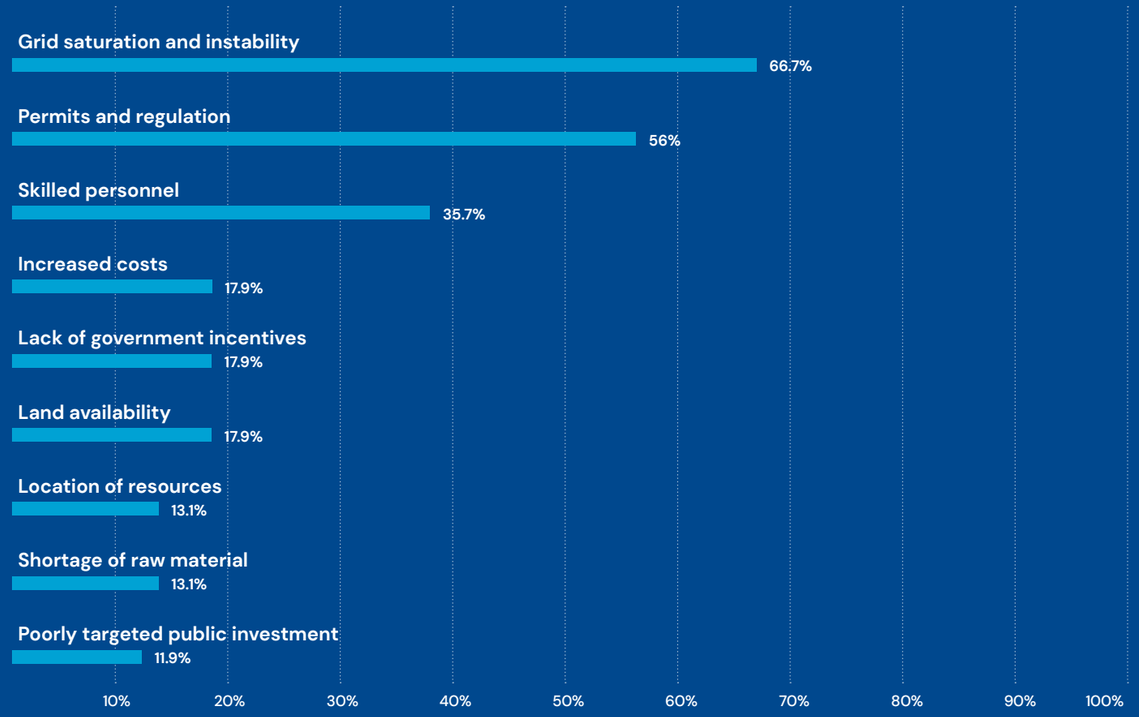
"The time gap to bring greenhouse gases down is getting narrower. We need to speed up the installation of clean energy sources. The coming 5 to 8 years are crucial for many areas of the world."

Diego Lobo-Guerrero Rodriguez
SENS - Iqony Solar Energy Solutions GmbH



Upcoming renewables challenges

What are the biggest challenges for the renewable sector for the coming year?



Grid saturation and instability

Like last year's survey, grid saturation and instability is the number one challenge respondents see for the industry in 2024. 66.7% of those surveyed stated this area as an issue, up from 64% last year.

In areas of the world where green energy penetration is particularly high, local grids are at their limits. They require further reinforcement to manage the influx of variable power sources without curtailing the electricity supply.

Although curtailment rates of variable renewable energy (VRE) in the larger, more established renewable energy markets are rising overall, wind and solar rates are still relatively low, between 1.5% and 4%[10]. Most markets have been working to reduce their curtailment rates over the last decade, but the geographical disparity between generation and consumption has been an unavoidable obstacle for many regions.

Governments have implemented measures to mitigate curtailment, such as the high-voltage direct current in the UK, the Energy Imbalance Market (EIM) in California, or incentivizing batteries in Chile.

On the other hand, many areas worldwide are at risk of energy shortfalls, with reports from NERC claiming that two-thirds of North America's energy supply is vulnerable[11] throughout periods of extremely high demand.

To manage excess and shortfalls in electricity supply, there is an urgent call for increased infrastructure and storage capacity. Many countries are looking to distributed generation, more robust local grids, and smaller plants to ensure supply by implementing new legislation and reducing regulatory barriers.

As solar manufacturing continues to boom across the USA and green investments become more prevalent in Europe, and across the world, the demand for renewable energy installations will continue to increase. If not carefully planned, this growing demand will contribute to saturation and further instability.

Permitting and regulation

Over half (56%) of the respondents see permitting and regulation as a challenge for the renewable energy sector, but this is down from 64% last year. This suggests that although this issue still needs to be solved, the work is already underway.

The 2022 temporary emergency EU regulation designed to streamline renewable project permits is scheduled to come to an end in 2024; however, there are calls from several countries to extend it to avoid more bottlenecks in the future. With other regions following suit by implementing new laws and reducing bureaucratic hurdles there is hope that stalled projects could start moving.

Investors and developers require regulatory stability to confidently pour resources into new ventures. This means that creating more efficient licensing processes needs to be a priority. At the same time, there must be a balance of environmental safeguards with the need to fast-track approvals for new projects.

When permitting is a complex and lengthy process, investment is often deterred, and progress is slowed down. When regulations widely differ across regions, this adds another layer of complexity. All of this makes it harder for renewable energy providers to grow and expand their operations.

Skilled personnel

Over a third (35.7%) of survey respondents identified skilled personnel shortages as a challenge that needs to be solved. As the demand for renewables continues to grow, more and more skilled people will be required to sustain it.

This also comes at a time when most industries are struggling to find the skilled personnel they need while clean energy jobs have grown by 10%[12] in the US outgrowing the nation's overall employment. There are 3.3 million clean energy jobs, and an increasing number of these positions are carried out by contractors or outside consultancies.

Solving this problem will require an emphasis on training, education and apprenticeships tailored specifically to the needs of the renewable industry. Comprehensive programs must be developed that are aimed at attracting talent and nurturing and retaining it with continuous re- and up-skilling, engagement, and purposeful career paths.

Similar programs will need to be developed to help expand the skillset of the existing renewable workforce. Being adept in technology, management acumen, digital proficiency, and regulatory understanding will all be important moving forward.

Lack of government incentives

17.9% of those surveyed see a lack of government incentives as an issue, which is way down from 39% in 2023. This illustrates that more governments around the world are on board with renewables and creating policies that incentivize and help the industry.

Although things are heading in the right direction, more can be done. An increased focus on governmental action with less reliance on community engagement is one thing that will help. Policies offering attractive tax breaks and paving the way for public-private partnerships should be a focus. These collaborations can amplify the impact of limited government funds while harnessing private sector expertise and resources at the same time.

Throughout 2024 the Inflation Reduction Act[13] will keep driving the renewable energy landscape in the US. REPowerEU[14] and the Green Deal Industrial Plan[15] will continue to move the EU towards its 2030 renewables goals. Governments within the EU are continuing their efforts, such as the Scottish Government's New Energy Strategy and Just Transition Plan[16], the creation of the UK's Solar Taskforce[17], and the German Government's approval of just over 57 billion euros[18] in green investments in 2024 to help reach their 2045 target of becoming net-zero.

In the rest of the world, we will likely see a continued increase in mid-scale (under 5 MW) solar installations in Australia[19] as reduced regulation makes these decentralized projects more attractive to investors. We will also see the effects of Law 14,300, recently approved by ANEEL, the Brazilian Electricity Regulatory Agency[20], which will directly impact distributed micro- and mini-generation across the country. We'll likely see the effects of the Dominican Republic passing two new bills[21] (Law No. 50-07 and CNE-AD-0004-2023) reducing legislative barriers and incentivizing the use of battery energy storage systems (BESS).

Increased costs

Just under one-fifth (17.9%) of respondents see the increased costs associated with renewable energy projects as being a hurdle in 2024. This number was 63% last year, suggesting the market is maturing and becoming more resilient.

The high cost of storage technologies stands out as a key challenge, underscoring the need for more affordable solutions. Similarly, investment costs, operations and maintenance, transportation, and deployment challenges are all common concerns.

Finding ways to reduce these expenses will rely on technological advancements in areas like storage, streamlining transportation and deployment, as well as leveraging economies of scale to bring down prices. Even with rising upfront costs, renewables' long-term economic benefits cannot be ignored.

Land availability

Land availability is another concern of respondents that has dropped by more than half in the last year. While 40% of those surveyed saw it as an issue last year, that figure has come down to 17.9% this year. Many factors could have contributed to this, including both technological and regulatory changes.

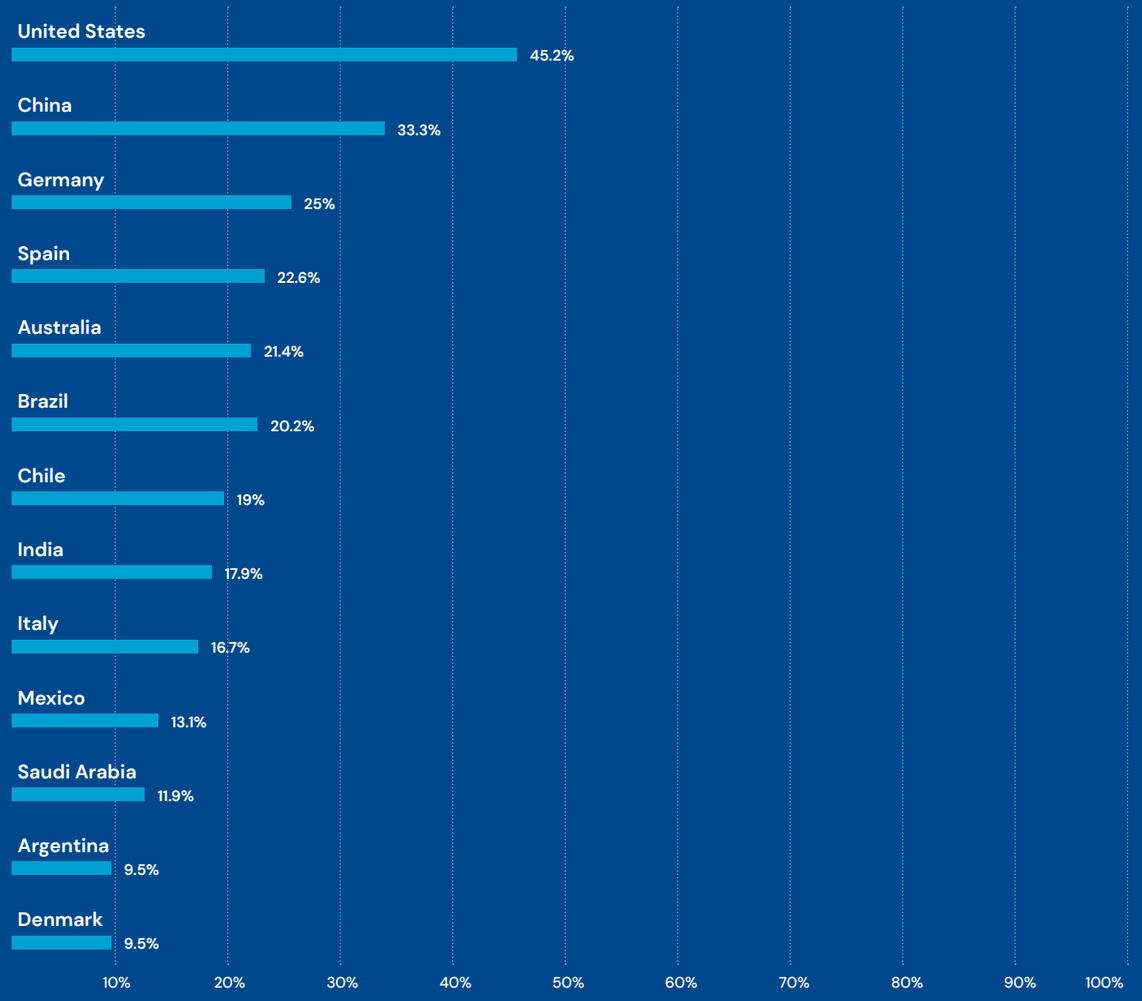
Many respondents anticipate that there will be growth in agri-PV, particularly in regions with land constraints. France[22] is one example of a region that recently passed legislation to stimulate and streamline renewables development on agricultural plots and created a more comprehensive definition of an agrivoltaic installation.

Innovations that allow for dual use of land will be significant on the path to energy independence, especially in densely populated or geographically constrained areas. Given that finding sufficient land for large-scale renewable projects in these areas will be a challenge, solutions like floating PV could also become important.

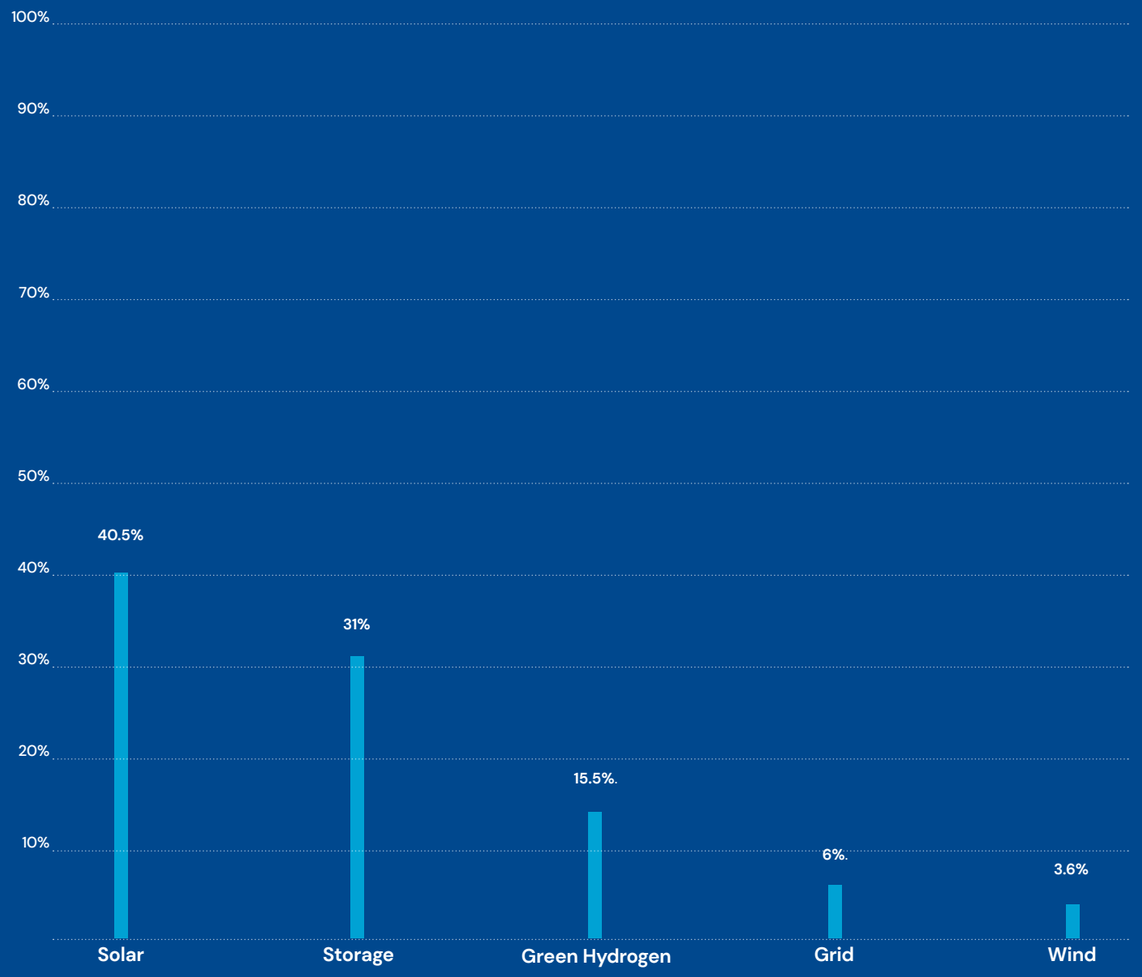
Trends according to industry professionals

How much confidence do you have in the future of renewables market?

Countries with the highest potential for 2024



Over the next five years, where do you see the biggest growth area within renewable space?



Encouragingly, the overwhelming majority of survey respondents said they have high confidence in the future of the renewables market. Over 90% of respondents rated their confidence in the industry's future as either four or five out of five.

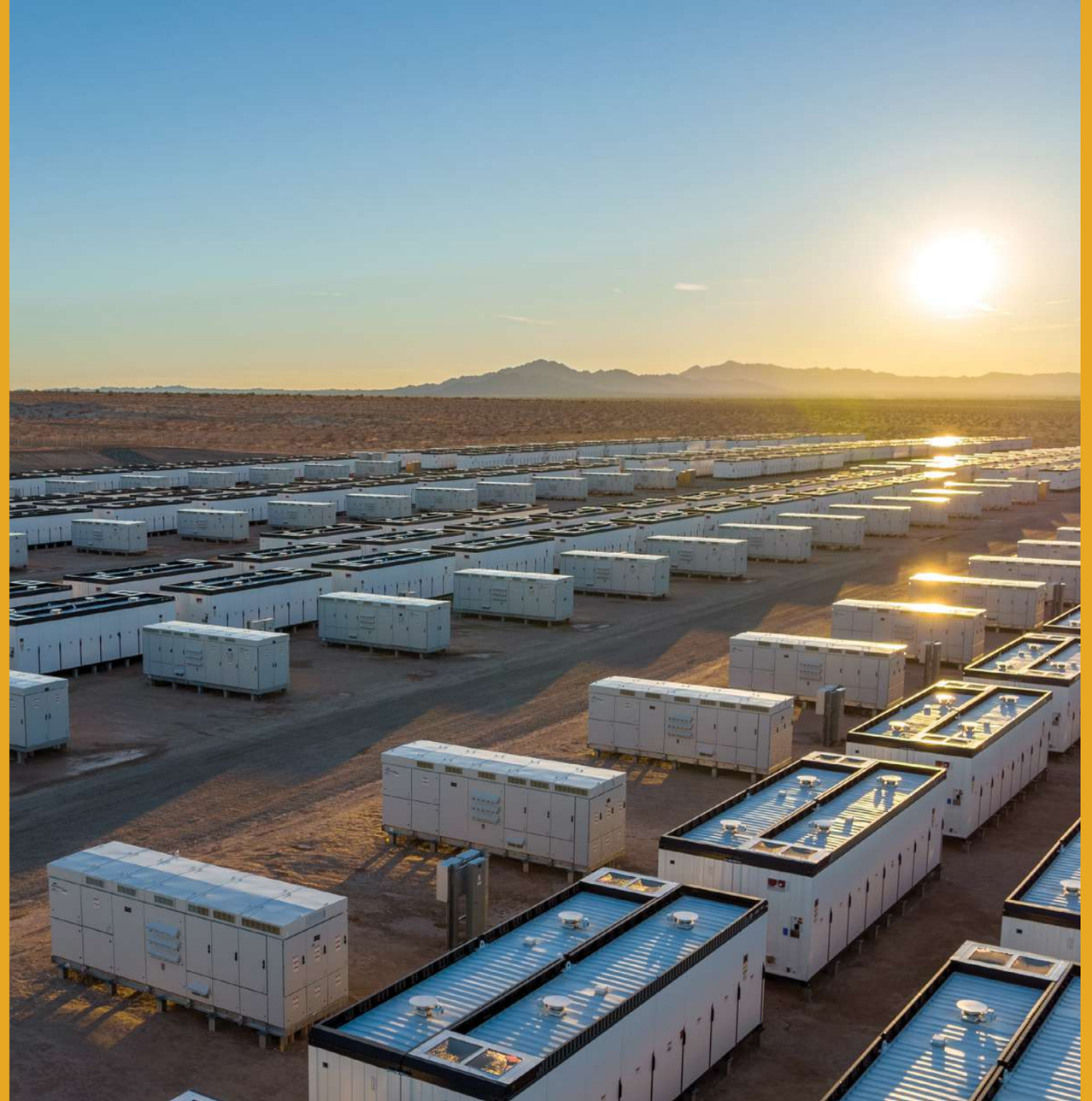
When asked to identify the countries with the most potential for growth in renewables, nearly half (45.2%) pinpointed the United States as leading the charge. China and Germany also ranked highly among our respondents, with 33.3% and 25% respectively. Other countries that made it into the top ten include Spain, Brazil, and Australia, each recognized by 19-22% of respondents, and emerging players like Chile, India, Italy, and Mexico.

Looking at the industry itself, 40.5% agreed that solar is the sector within renewables with the biggest growth potential over the next five years. Storage was closely behind at 31%, while green hydrogen (15.5%), the grid (6%), and wind (3.6%) rounded out the responses

Storage technologies (BESS)

Those who responded to the survey identified battery storage technologies and BESS as vitally important to the future of renewable energy.

They will play a key role in enhancing grid flexibility, but better performance, regulation, and reductions in price will be needed for this type of technology to meet its potential. Some respondents are concerned about the high deployment costs of storage technologies, and others noted that due to its long-term potential, the market currently underestimates its value.



"(BESS) is crucial for the success of renewable energies."

Sergio Garcia
Hipergama

"The more storage, the better; more storage means less natural gas and nuclear plants on standby to fulfill the capacity needs of the grid at high load."

Darren Bishop
Lincoln infrastructure/Convalt Energy

"BESS is a critical step towards more renewable energy integration and grid stability."

Pedro Sousa
Efacec Engenharia e Sistemas

“The lifespan of BESS still requires major improvements and does have environmental issues at the end of its life. We need to find alternatives to the scarce lithium.”

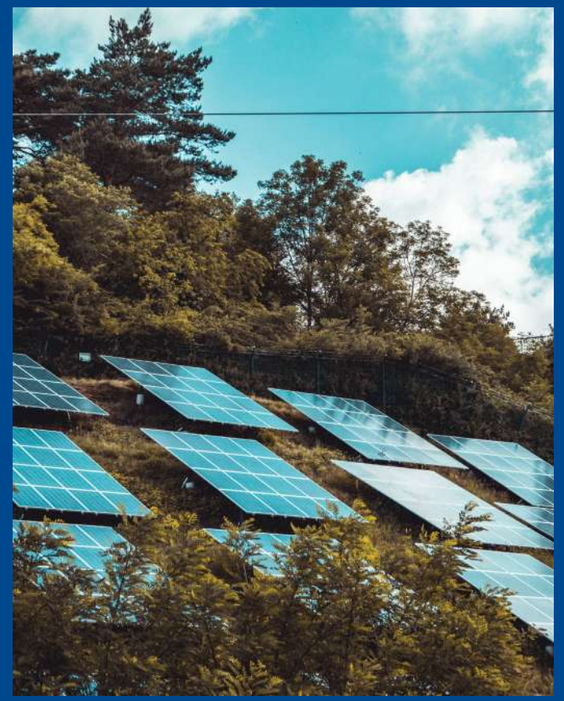
Matlhole Losaba
Keile Business Solutions (Pty) Ltd

“Storage in many forms will become mandatory in any grid-balancing strategy.”

Marco Bonvini
Solar Farm Sr

“Renewable technologies will have no choice but to hybridize with storage systems. The grid is not sufficiently ready to receive the large amount of renewables expected.”

Catalina Barrera
Review Energy

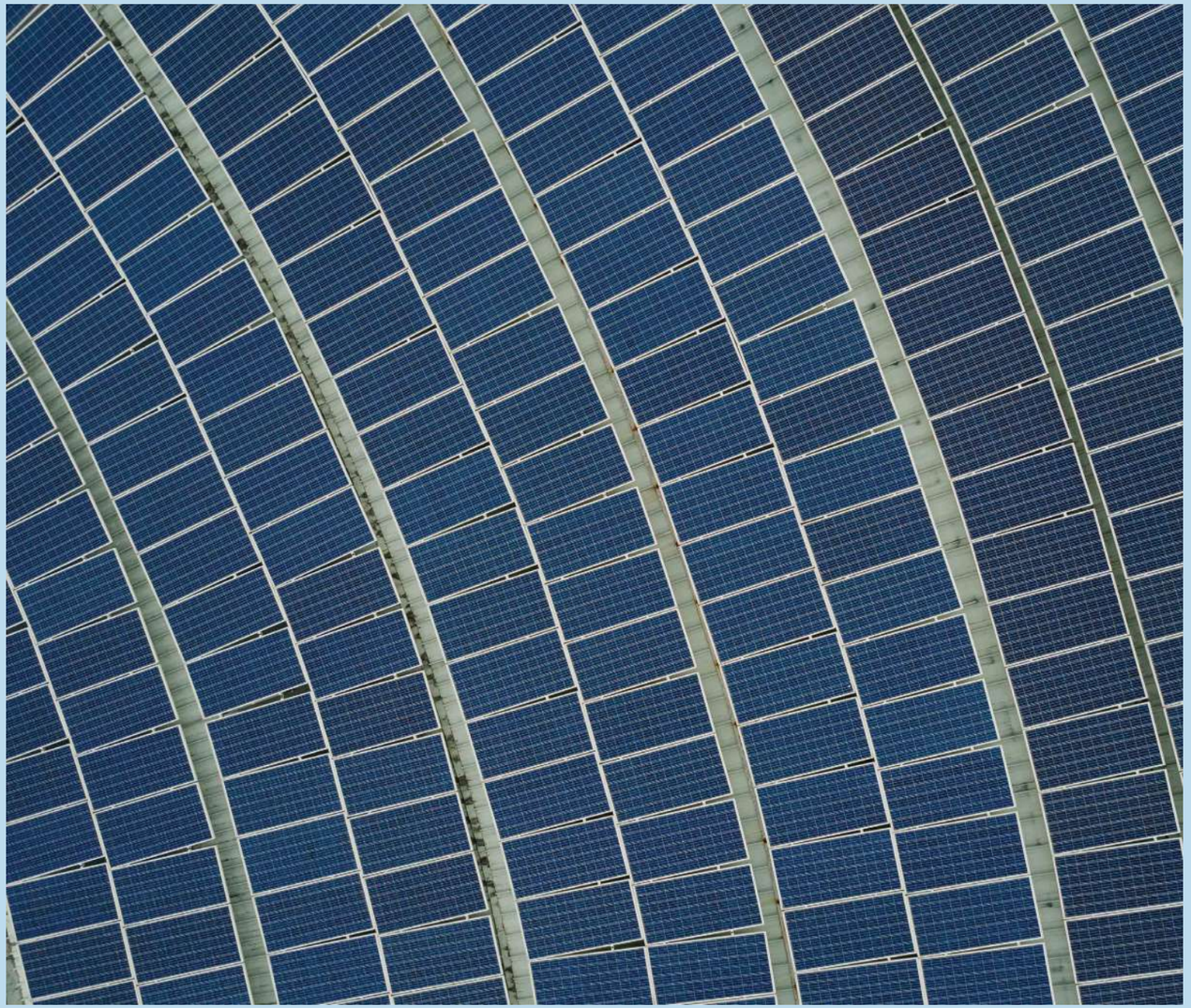


Renewable legislation

The Inflation Reduction Act (IRA) in the United States and the Renewable Energy Directive within the European Union are overall positives for the industry, acting as catalysts and incentivizing more renewable energy projects. Several respondents emphasized the importance of the IRA in positively transforming the US market.

The EU Directive is seen as setting fundamental frameworks and targets, although there are concerns about whether it is sufficient to motivate member states to reach these goals. Largely due to rising gas prices and geopolitical tensions, the EU's commitment to increasing renewables production has been reinforced, but member states must act quickly.

The sentiment from the rest of the world showed a common theme that although their governments might be enacting policies that boost the industry there is still plenty to be done to expedite project pipelines and help achieve ambitious national renewables targets.



"IRA gives the USA a big opportunity to grow. The Green Deal needs to open more to the specifics of the countries to be successful against the USA proposal."

Carolina Nester
Sonnedix

"More manufacturers will have a chance in the US. On the other hand, a slight overproduction will bring prices down elsewhere."

Diego Lobo-Guerrero Rodriguez
SENS - Iqony Solar Energy Solutions GmbH

“Policymakers need to create a more stable environment for licensing new projects, reducing the time required for licensing by digitalizing the process with the regulators.”

Pedro Sousa
Efacec Engenharia e Sistemas

Alternate renewable deployments (Agri-PV, floating solar, offshore wind)

As the industry professionals considered alternate PV deployments, there was a mixed outlook on agri-PV. While some respondents see it as having the potential for substantial growth, particularly in Europe and regions with land constraints, others view it as only a small niche compared to utility-scale PV.

While concerns were raised about the high investment costs associated with floating PV, it is seen as having significant potential, especially in coastal regions or areas with limited land availability. The floating solar PV market is expected to vary from region to region, and its success will be tied to solid regulation and infrastructure improvements. Offshore wind was also viewed optimistically with high impact in certain regions despite its perceived high costs.

"Agri-PV is part a key of our current business strategy due to (its ability to provide) additional land revenue, food security, more jobs, a built-in PPA and reduced distribution costs."

Glenn Kaka
Glenergy Ltd

"Floating PV provides more opportunities that help to use new zones and a new way of energy accumulation."

Carlos Barragan
Solar Center

"Floating PV is a very good solution, especially for South Asian countries."

Roberto Gimenez Mata
ACWA Power

"Floating PV is low impact. It will allow new installations in areas with land restrictions (e.g., densely populated areas with water bodies available)."

Filipe Souza
Kroma Energia

"Offshore wind has a huge potential impact, but technology is still not ready for most Atlantic sites, leading to higher costs and higher energy tariffs."

Pedro Sousa
Efacec Engenharia e Sistemas

"Offshore wind has high potential, especially in markets that do not have the possibility of growing their onshore operations. Now, the main challenges consist of CAPEX and OPEX costs."

Matheus Bacelar
Quinto Energy LTDA

"Agri-PV next big trend in solar anywhere."

Antonio Saponaro
Island Green Power

"Offshore wind will be one of the sectors with the greatest growth and scale."

BrunoLourenço
Energetus

"Offshore wind has enormous potential because it allows for better use of the marine surface although its costs are still high."

Felipe Sanchez
Cox Energy

Digitalization

Respondents view digitalization as a fundamental and indispensable component of the renewable energy sector, all across the project lifecycle. It will play a key role in everything from development to performance management, increasing revenue, and setting up new solutions.

Digital tools are also seen as a big part of improving the efficiency of O&M practices and asset management, enabling better site selection and overall project management. As the market becomes more complex, digital tools will have a big say in profit margins and operational stability.

"We will not be able to manage everything that will come our way without proper digitization and technological advances in data analysis. It is essential to manage resources, spare parts, and balance the stability of projects."

Glenn Kaka
Glenergy Ltd

"As the energy market gets more complex & unstable, digitalization can make the difference between huge margins or negative profitability."

Juan Romero González
RatedPower

"Digitalization has a fundamental role since it allows for better monitoring and control of processes and thus optimizing energy production."

Felipe Sanchez
Cox Energy

"Sites are becoming larger and larger, and without adequate digitalization, it'll be more difficult to design, engineer, and maintain them."

Ruben Martin
Belectric Solar Ltd

"Digitalization is the answer to the future of renewables. Without digitalization, it is impossible for a renewable asset to be competitive."

Catalina Barrera
Review Energy

"Digitalization plays a significant role given the growth of digital assets, the trend towards electrification, and virtual, decentralized power generation"

Carolina Nester
Sonnedix

Notable innovations, materials, and trends

Other notable innovations, materials, and trends that industry experts highlighted included using EVs as a storage medium. The advancements in vehicle-to-grid technology and using EV batteries for energy storage and grid support are viewed promisingly. The role of green hydrogen and its application across multiple industries was also highlighted, as was the affordability of transparent PV. The latter has the potential for dual functionality in buildings and agriculture, in addition to innovations in PV materials that help to withstand extreme weather.

The development of different types of battery technology, including H20 and sodium batteries, was regularly mentioned. The importance of digital twins in optimizing renewable operations and predictive performance modeling was raised, and the reliability of meteorological databases was identified to ensure project planning accuracy and the enhancement of energy yield simulations.

Desired new renewable advances

Industry professionals responded with a wide range of technological advances they would like to see in their respective sectors. There was a common request for energy systems to improve their capacity while becoming more cost-effective and efficient at the same time. Continuing to pursue battery technologies that do not rely on lithium or cobalt is another area, especially with a focus on more abundant and environmentally friendly materials.

Improving the infrastructure required for interconnecting renewable energy sources to the grid was something else that respondents would like to see, including addressing the current bottlenecks and enhancements in capacity. Energy yield simulation tools need to become more accurate, and biodiversity and other mapping data required to obtain developmental approval need to become more publicly available. Respondents would also like better system modeling capability for expedited project timelines and better integration.

"Bi-directional charging standards of electric vehicles. If all EVs currently rolling on the streets of the world could provide grid services while parking anywhere. This would boost the ability to manage increasingly large amounts of renewable energy: mainly solar and wind."

Diego Lobo-Guerrero Rodriguez
SENS - Iqony Solar Energy Solutions GmbH

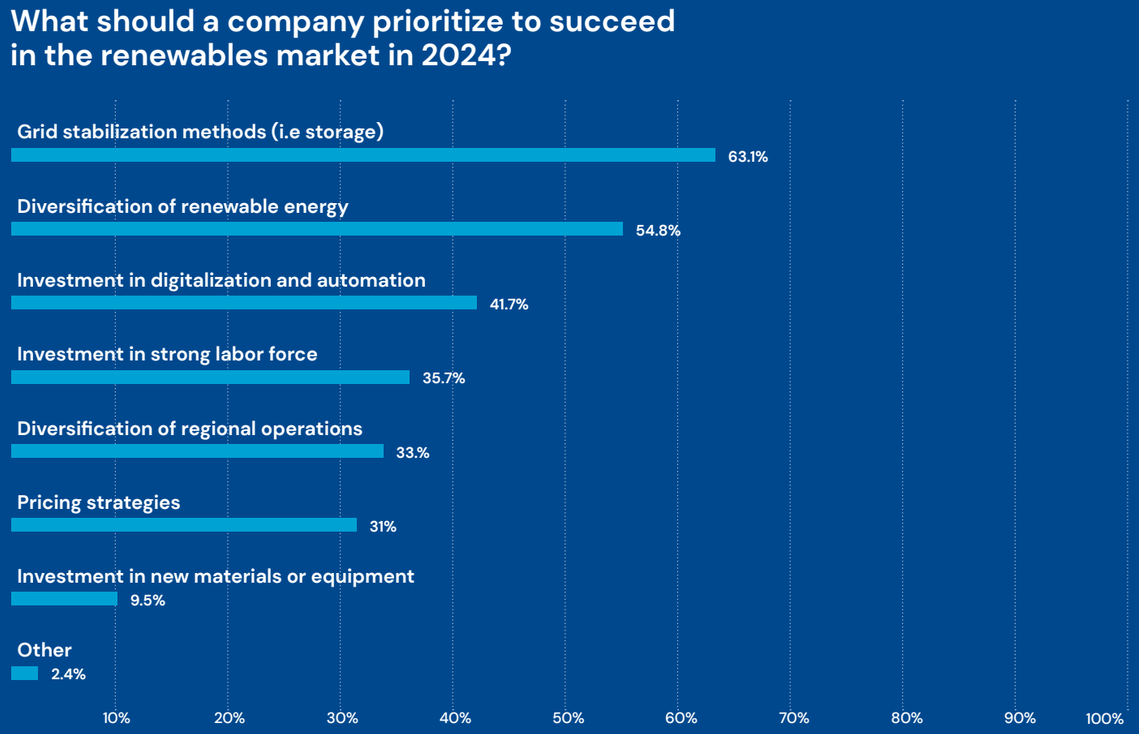
"(I would like to see) better virtual power generation options that enable residential consumers to be more self-reliant."

Glenn Kaka
Glenergy Ltd

"(I would like to see) adaptability of panel mounting structures to higher slopes without the need for earthworks."

Valentino D'amico
SCS INGEGNERIA SRL

Key success factors of a leading energy player



Grid stabilization methods (storage and BESS)

Respondents were asked to identify the areas in which companies in the renewables space should prioritize in 2024. Leading the way, 63.1% advocate prioritizing grid stabilization methods with a focus on storage. As renewable energy sources become more prevalent, using storage technologies to stabilize the grid will be critical.

Diversification of renewable energy sources

54.8% see diversification of renewable energy sources as being a key focus. They recognize that leaning on a single form of green power can leave an energy player vulnerable to fluctuations and uncertainties inherent in natural resources. Blending a mix of different renewables will not mitigate some of this risk, but it can also help ensure the stability of energy production.

Investment in digitalization and automation

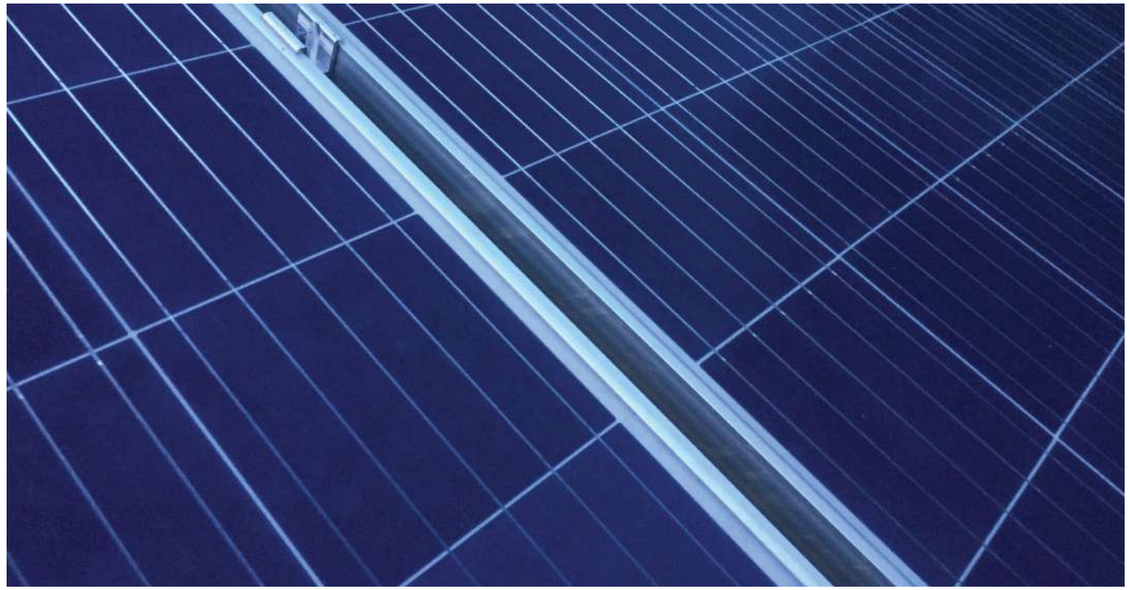
The next most common response was investment in digitalization and automation, with a little under half (41.7%) of respondents highlighting this as necessary. The role of things like automation, accurate forecasting, and real-time monitoring will become increasingly important as renewable technology matures.

Investment in a strong labor force

The importance of investing in a strong labor force in 2024 was identified by a little over a third (35.7%) of respondents. As the sector grows, there is increasing concern about the need for more skilled workers to sustain its expansion. Investing in training and development programs will be needed to solve this, both for immediate needs and the industry's long-term health.

Diversification of regional operations

The fifth most common response was noted by a third (33%) of survey respondents, and that was the need to diversify regional operations. Regional diversification is an integral part of minimizing the economic or regulatory-related risks of depending on any one region. Also, new opportunities will appear in different parts of the world as the sector grows.



Deep dive into RatedPower stats

Changing project trends

Throughout 2023, the number of simulations have considerably increased. If you combine the two months with the most simulations from 2023, that number would be higher than the total volume of simulations throughout 2022.

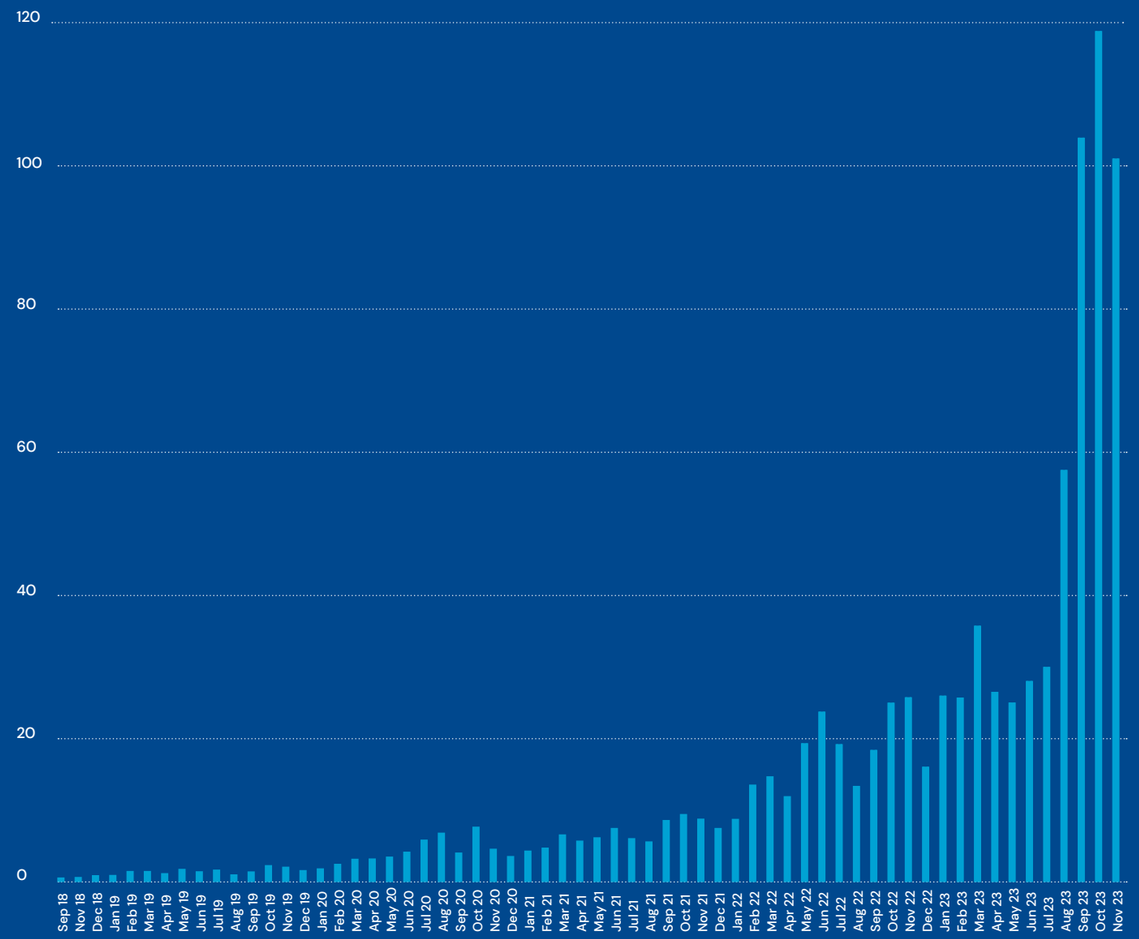
The average rated power capacity per simulation saw a slight dip, suggesting a nuanced trend toward smaller installations. Even with new policies around the world that streamline the construction process for mid-scale installations, plenty of larger plants are still being designed in RatedPower. Brazil and South Africa stand out as having high-rated power averages.

+400
Customers

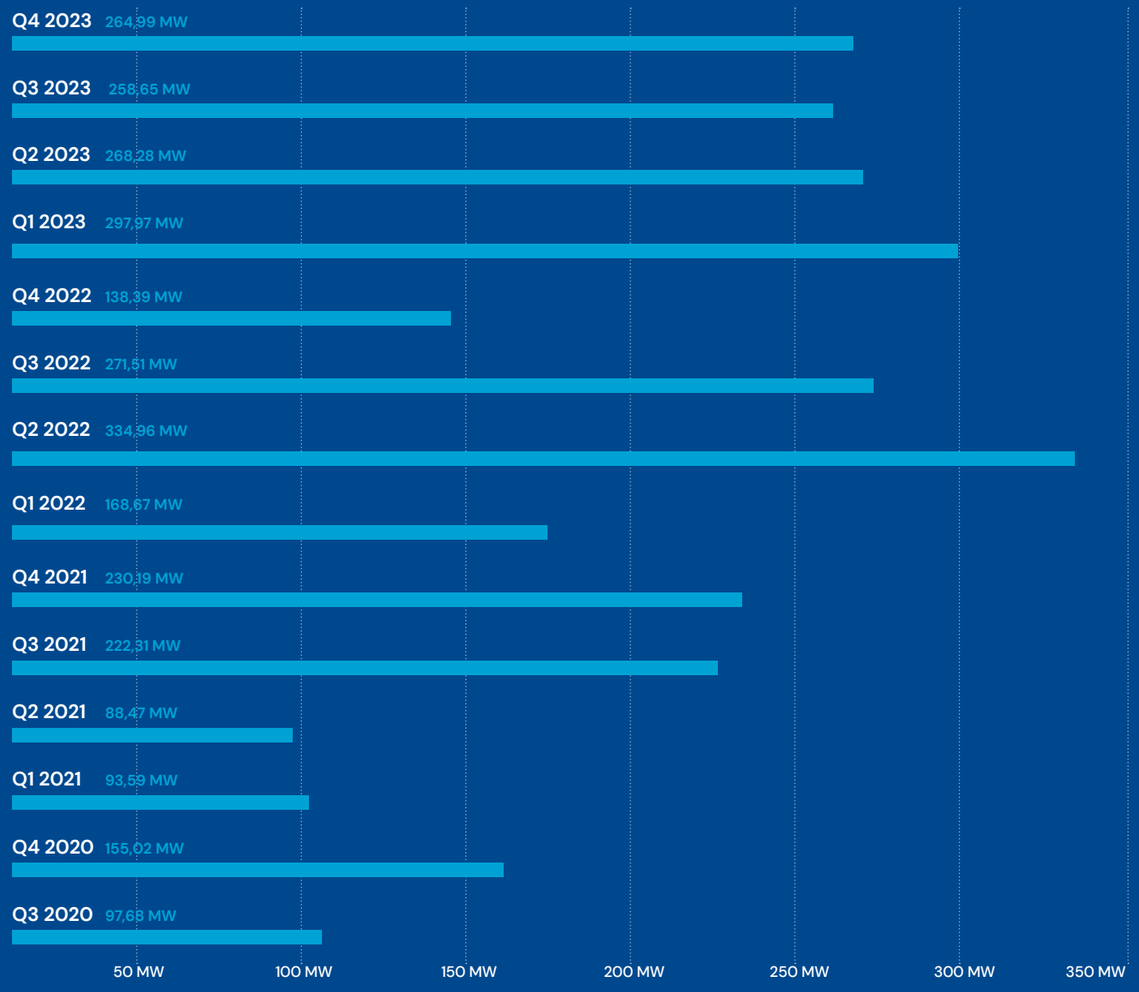
+2,600
Users

+55
TW simulated

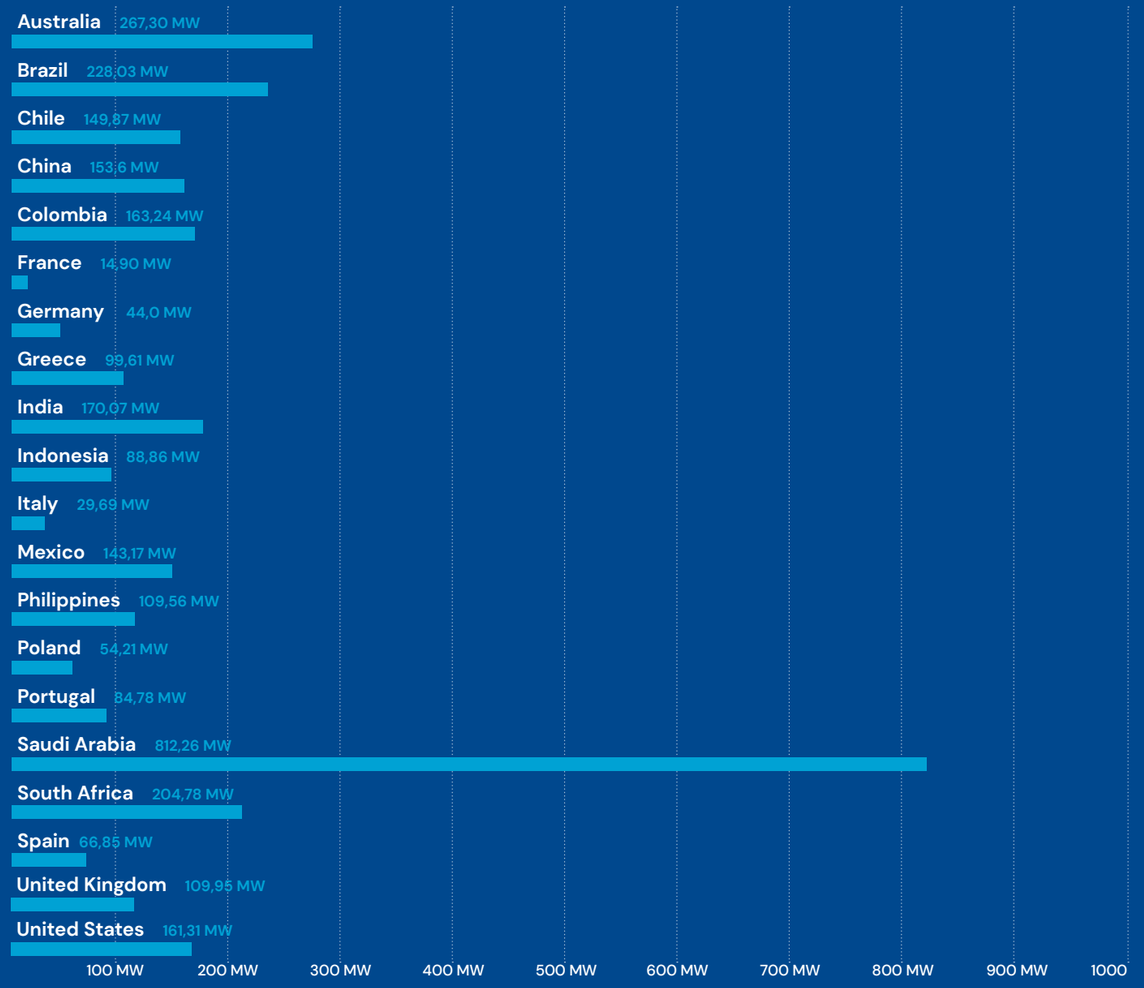
Number of simulations (indexed)



Average rated power per plant by quarter



Average rated power per plant by geography (selected regions) 2023



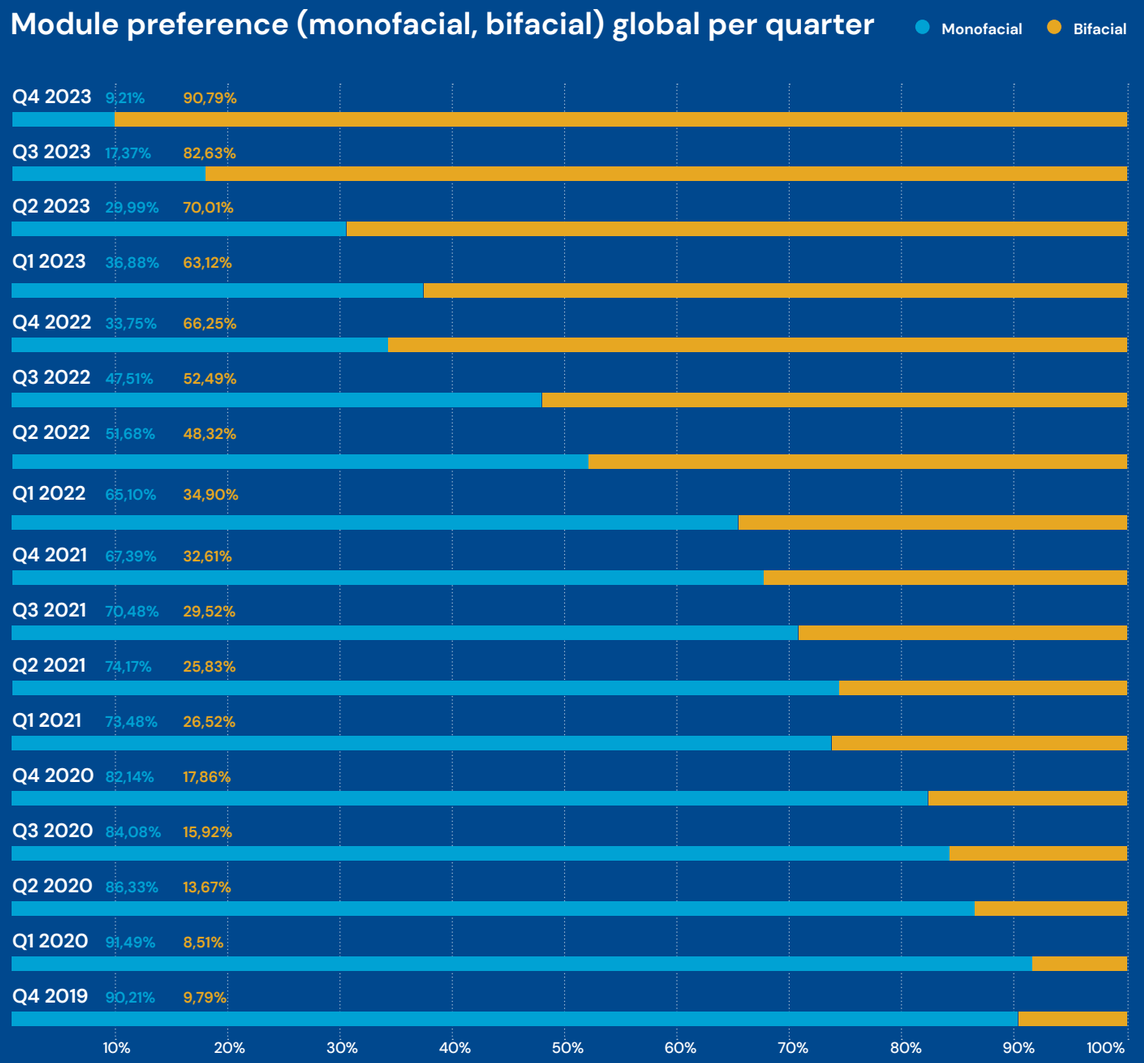
Module preferences

There has been a significant increase in the use of bifacial modules versus monofacial in 2023, a trend that has been tracking for the last few years. Their adoption soared above 90% in Q4 of 2023.

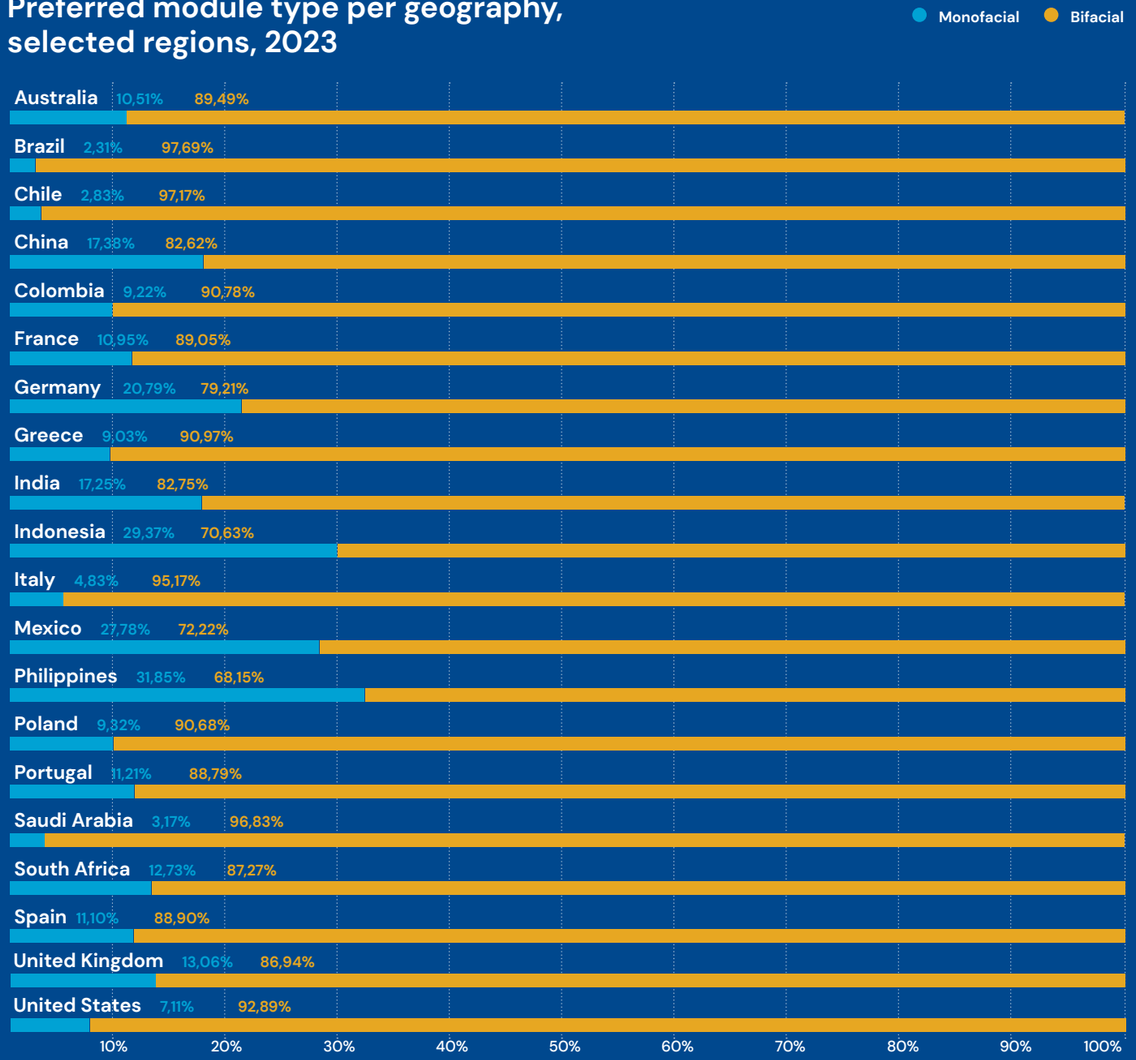
Bifacial simulations typically showcase an increase in rated power of about 25-30% on average. The average output for simulations using bifacial modules exceeded 100 MW compared to monofacial modules, which are slightly lower than 80 MW. Despite this trend of dominance, monofacial modules still make up between 17-31% of simulations in countries like the Philippines, Mexico, Indonesia, China, and Germany.

According to the RatedPower platform, Trina Solar was the leader among module manufacturers, with Jinkosolar in second. JA Solar claimed the third spot, while Risen Energy Co and CSI Solar rounded out the top five.

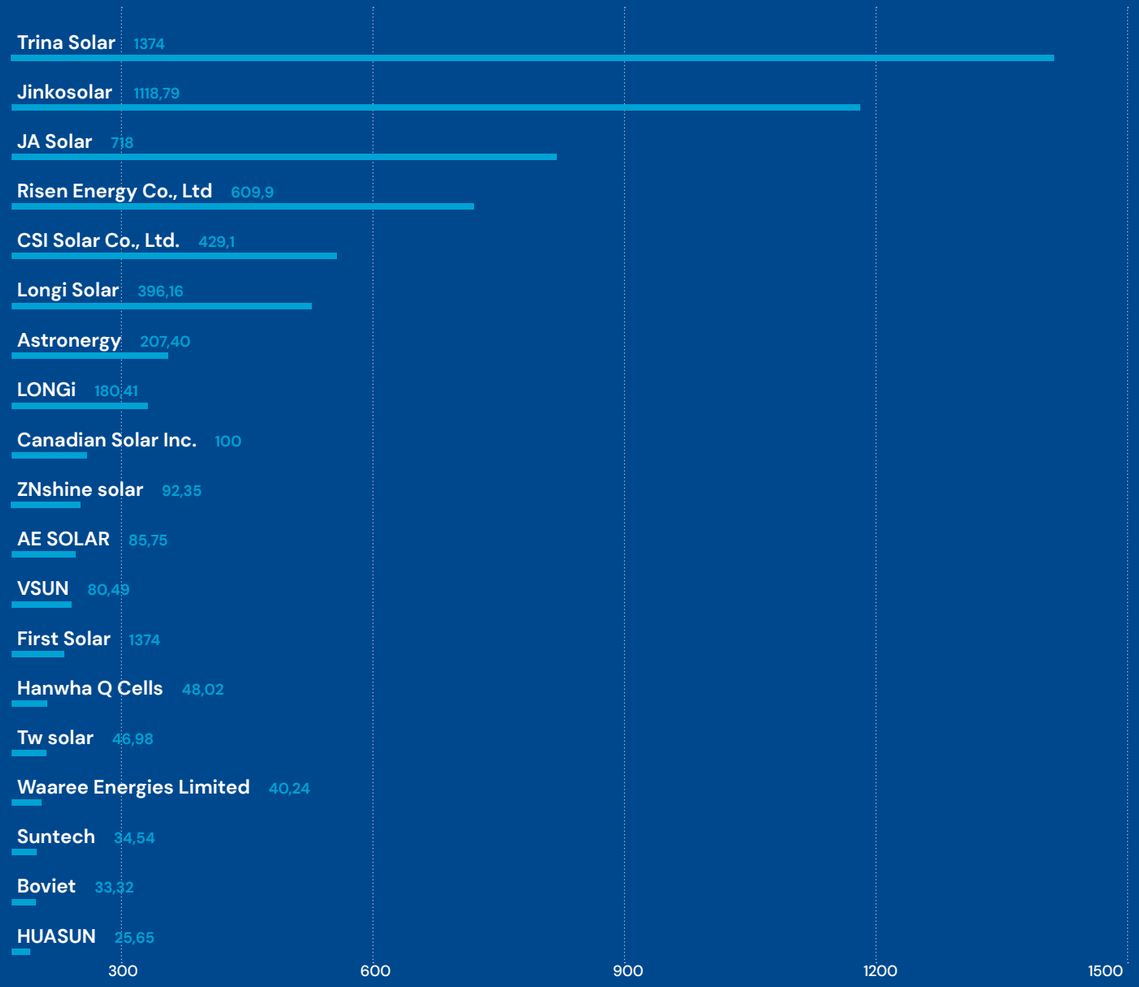
Based on the average PV plant rated power per module manufacturer in megawatt terms, Mingyang Solar stood out as the clear leader, with an impressive 349 MW of rated power on average. Yingli Solar was second, and Mundra Solar Energy was third, hovering slightly above 259 MW. SEG Solar Inc & Hanwha Q Cells rounded out the top five, both of which had between 222 and 206 MW rated power on average.



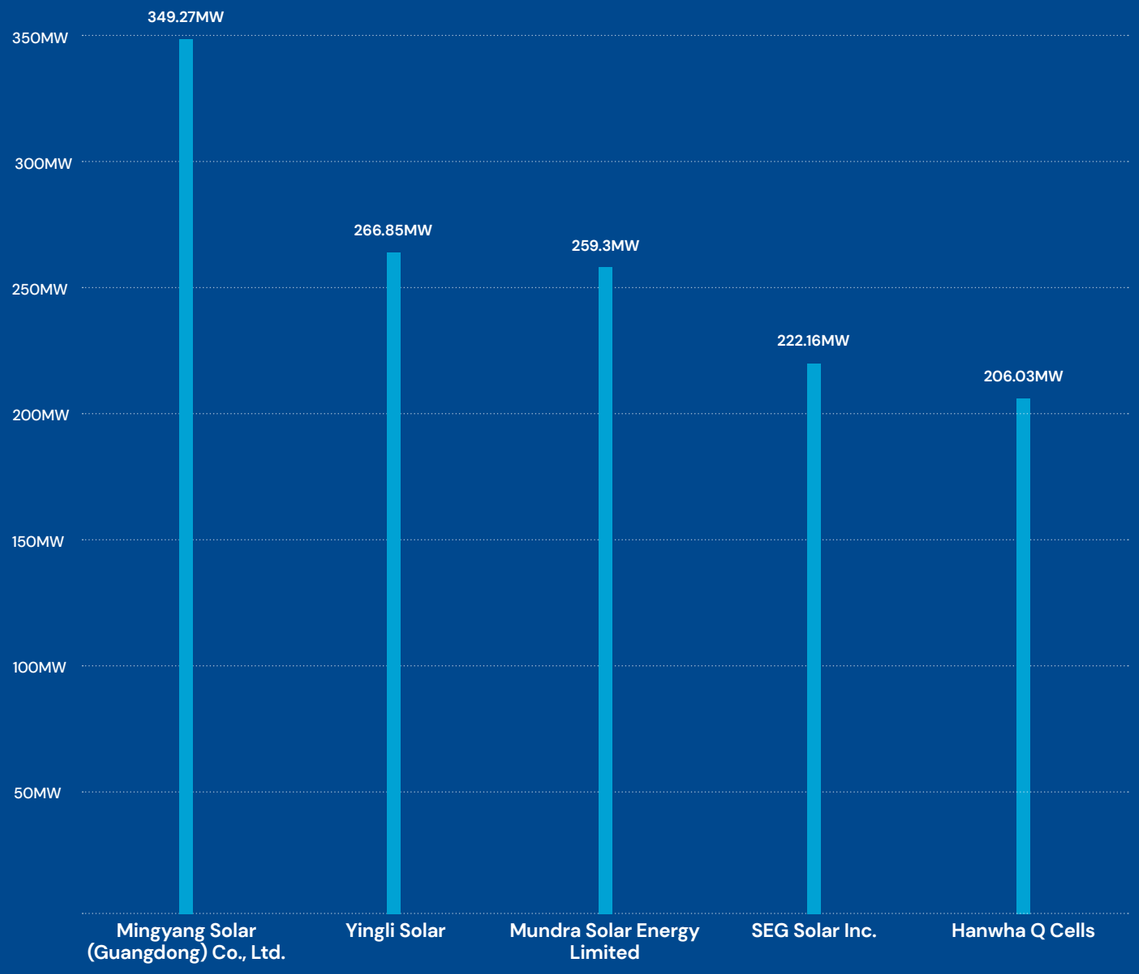
Preferred module type per geography, selected regions, 2023



Top module manufacturers used in simulations (indexed), 2023



Average PV plant rated power per module manufacturer



Inverter preferences

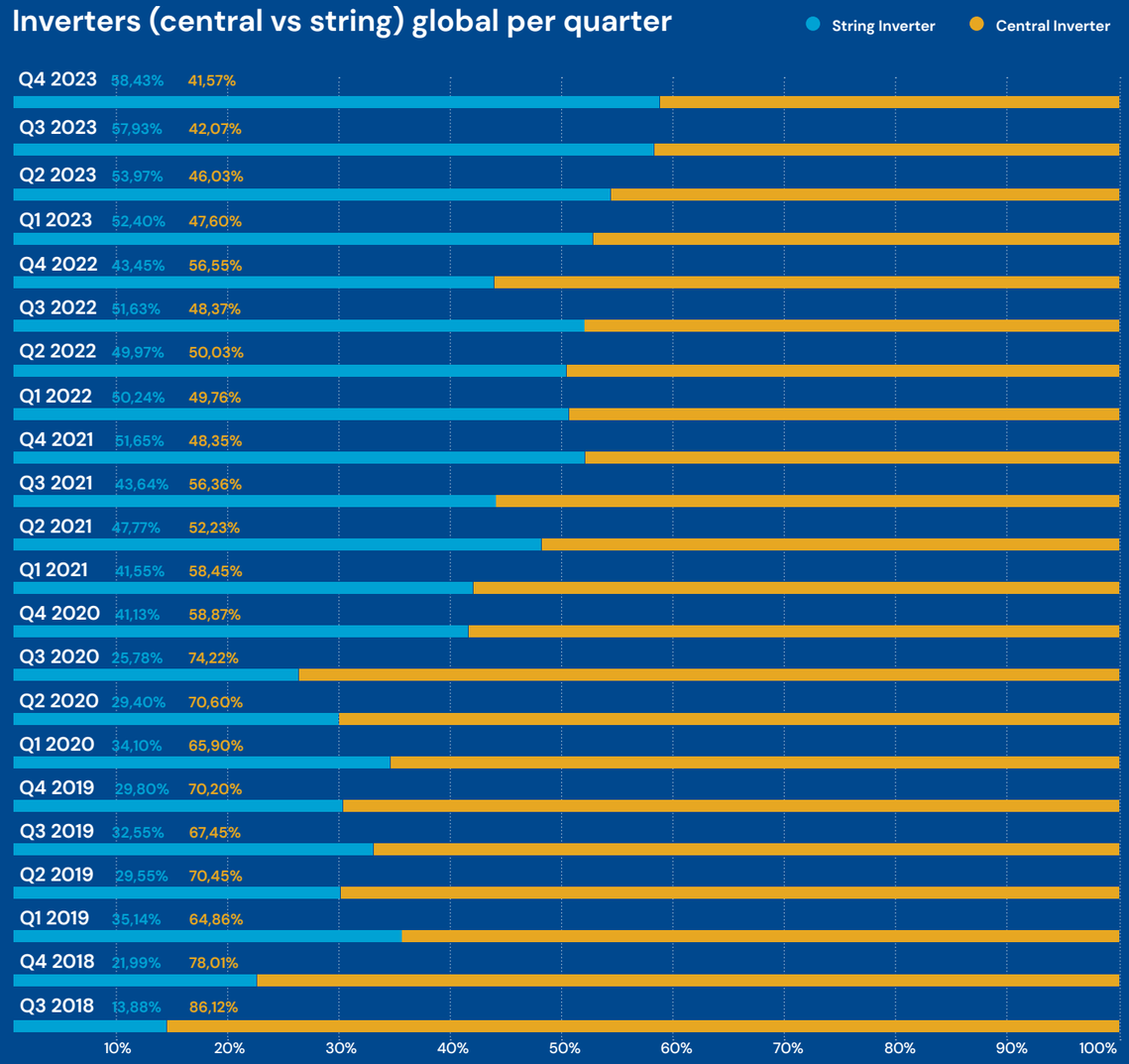
The RatedPower platform saw an upward trend towards string inverters over their central counterparts, a tendency that has been growing over the last few years. String inverters are often used in smaller PV plants. When you combine this with the slight reduction in average rated power per simulation, this trend confirms that more small plant designs are being simulated.

According to RatedPower's platform, the top global manufacturer of inverters in 2023 was Sungrow, clearly ahead of the second-choice, Huawei Technology. Sungrow and Huawei were chosen at least three times more than inverters from other manufacturers, with SMA, Power Electronics, and Gamesa in spots three to five.

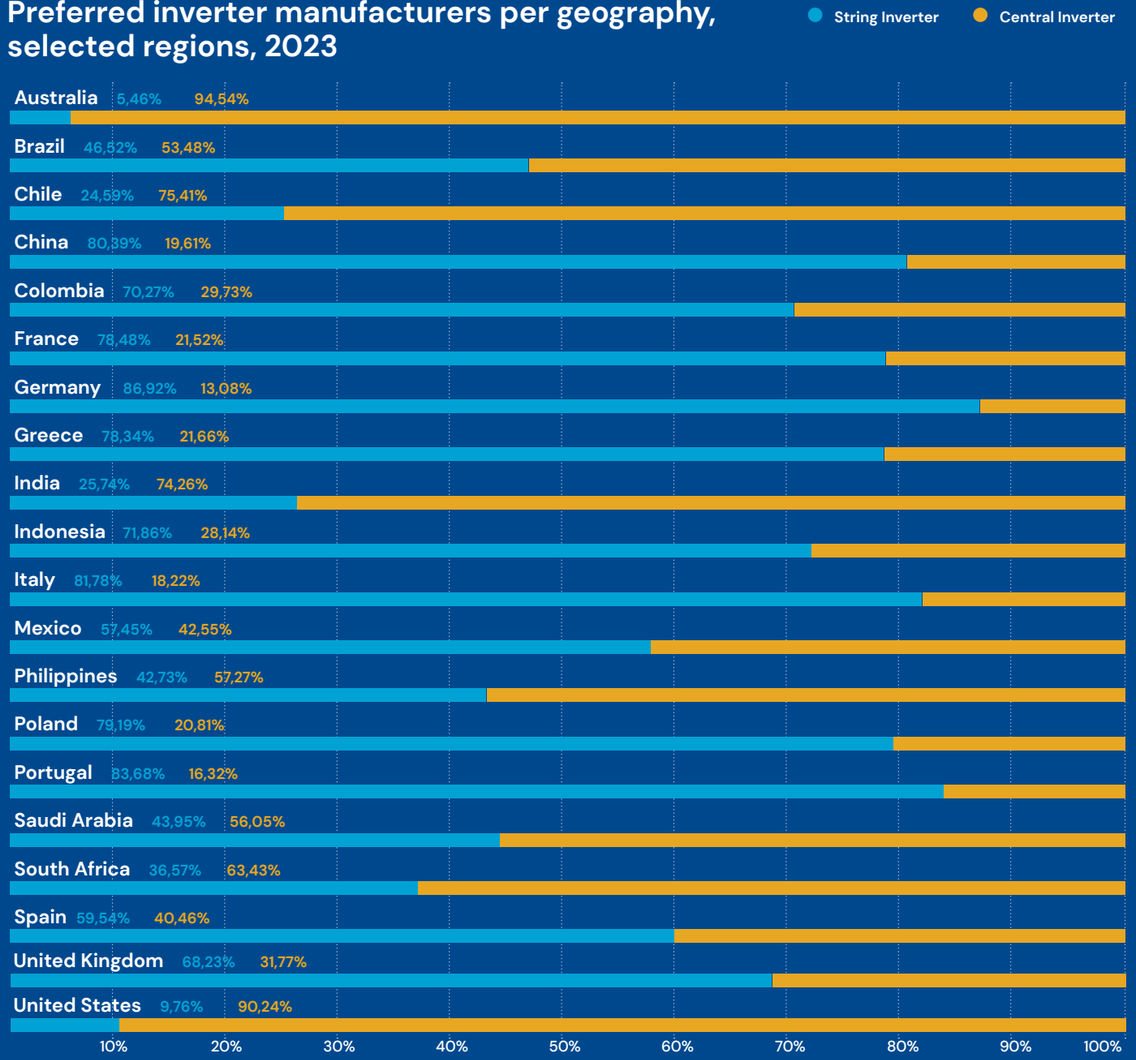
In countries like Australia, India, Chile, and the US, the expansive land availability results in larger-scale projects, leading these countries to favor central inverters. Also notable was that PV plant designs with central inverters typically have 2.5 greater rated power than those employing string inverters.

The top two inverter manufacturers chosen for simulations with the highest average plant rated power, in megawatt terms, were TBEA Xi'an Electric and Siemens, which exceeded the 200 MW mark. TMEIC and Sineng Electric Co Ltd were the only other two to surpass the 150 MW mark, while Power Electronics came in fifth place, just narrowly ahead of some other manufacturers.

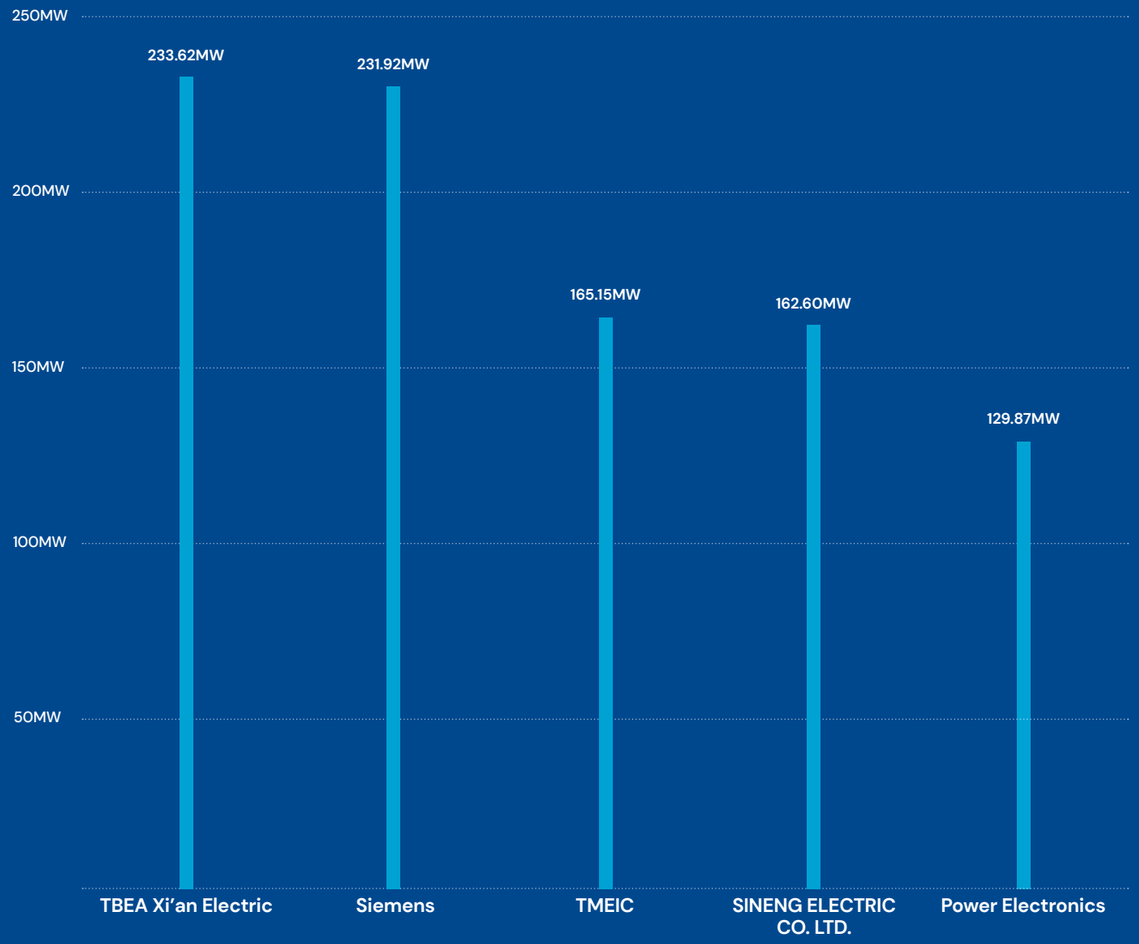
Throughout all of RatedPower's data, there is a growing trend in the use of string inverters. The only exception to this is in those designs where the peak power is larger than 100 MW.



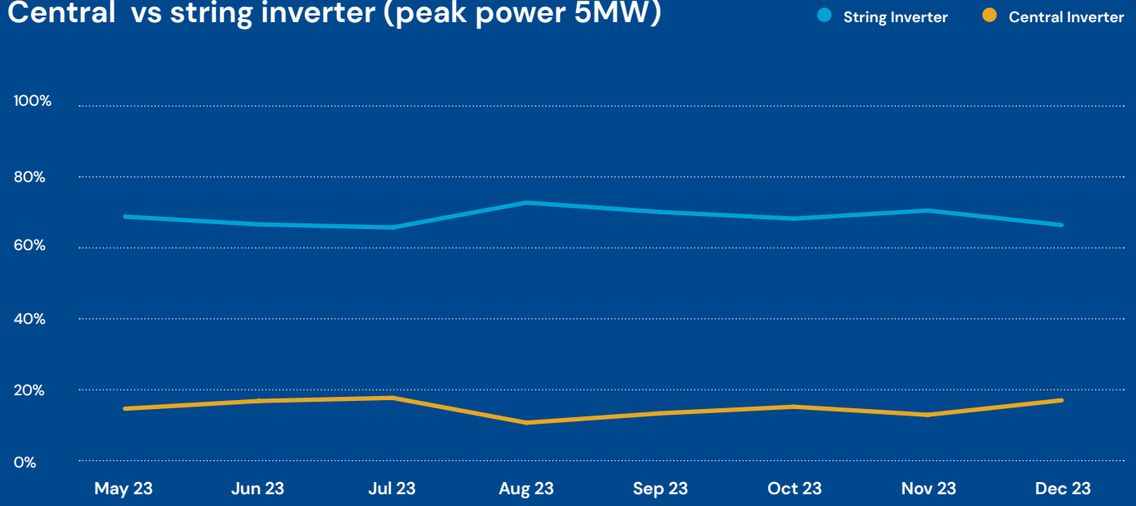
Preferred inverter manufacturers per geography, selected regions, 2023



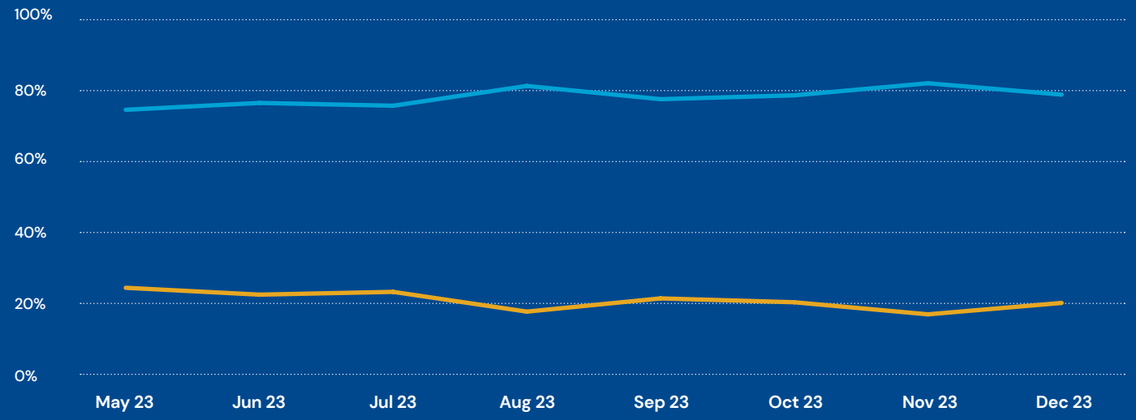
Average PV plant rated power per inverter manufacturer



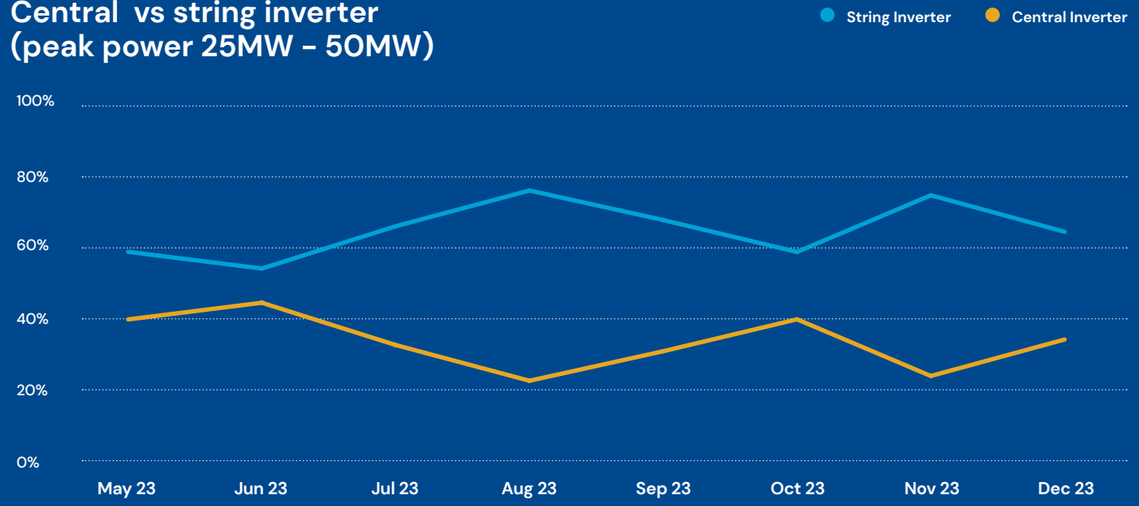
Central vs string inverter (peak power 5MW)



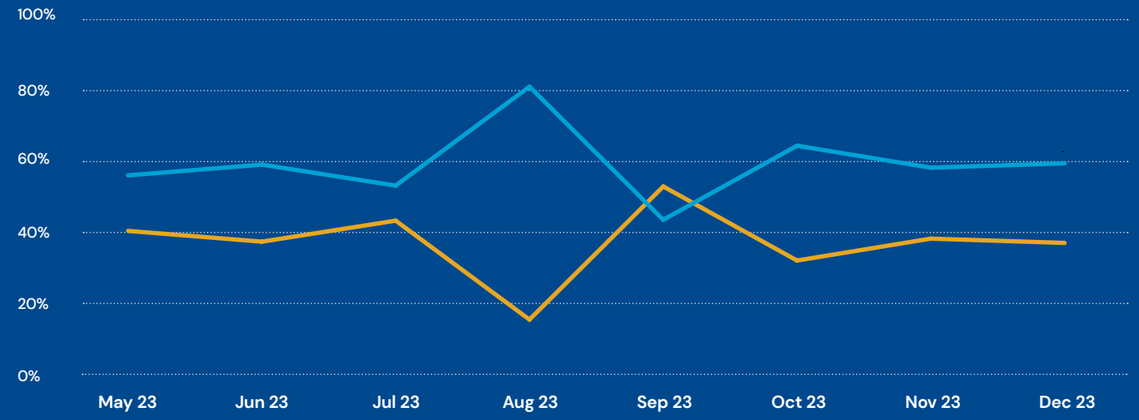
Central vs string inverter (peak power 5MW - 25MW)



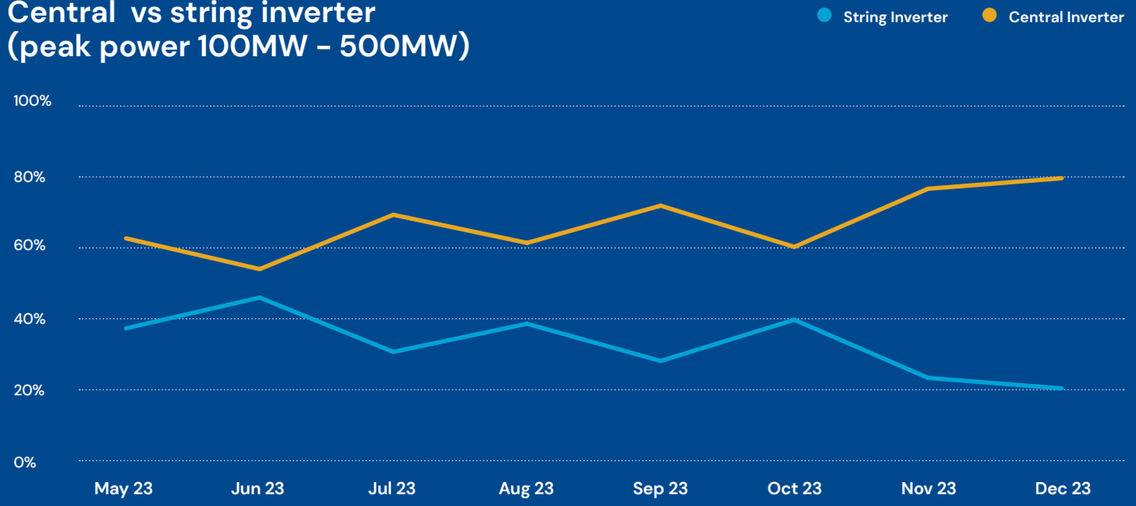
Central vs string inverter (peak power 25MW - 50MW)



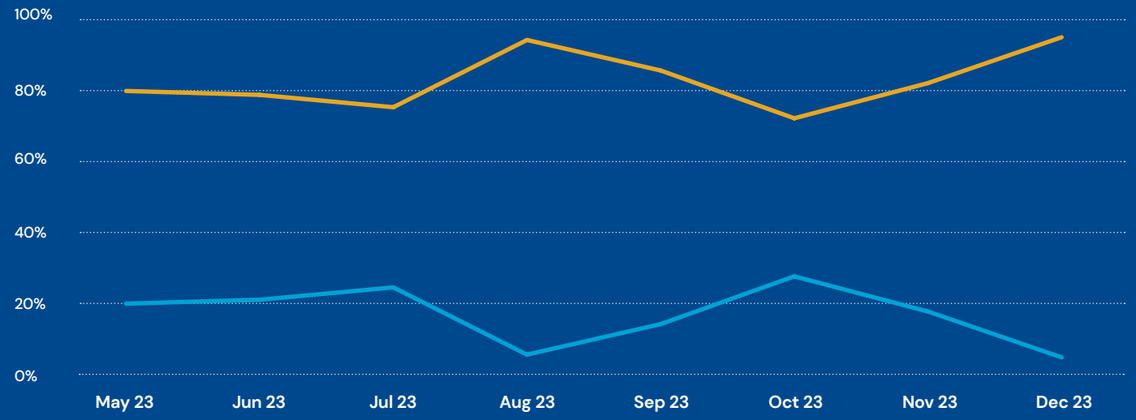
Central vs string inverter (peak power 50MW - 100MW)



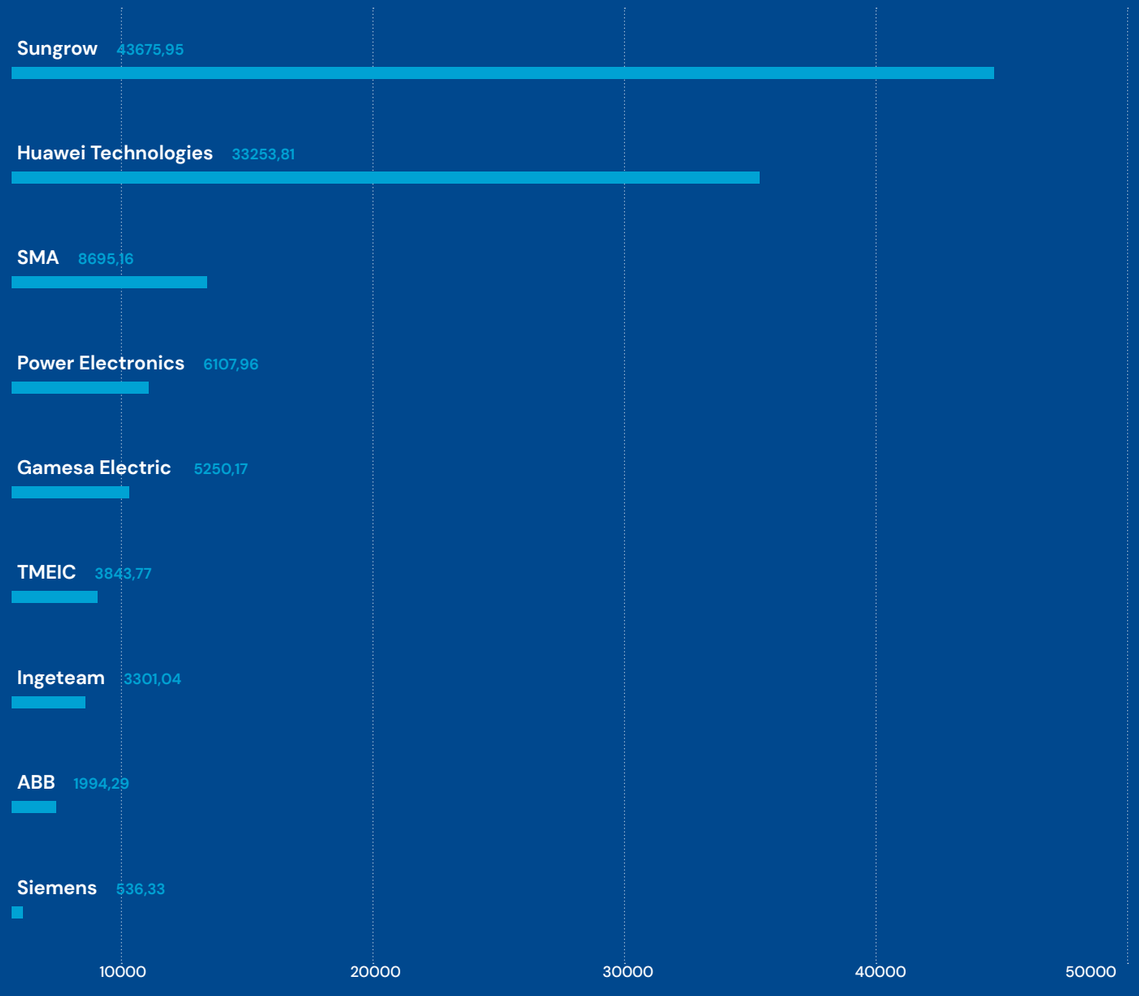
Central vs string inverter (peak power 100MW - 500MW)



Central vs string inverter (peak power 500MW+)



Top inverter manufacturers used in simulations (indexed), 2023

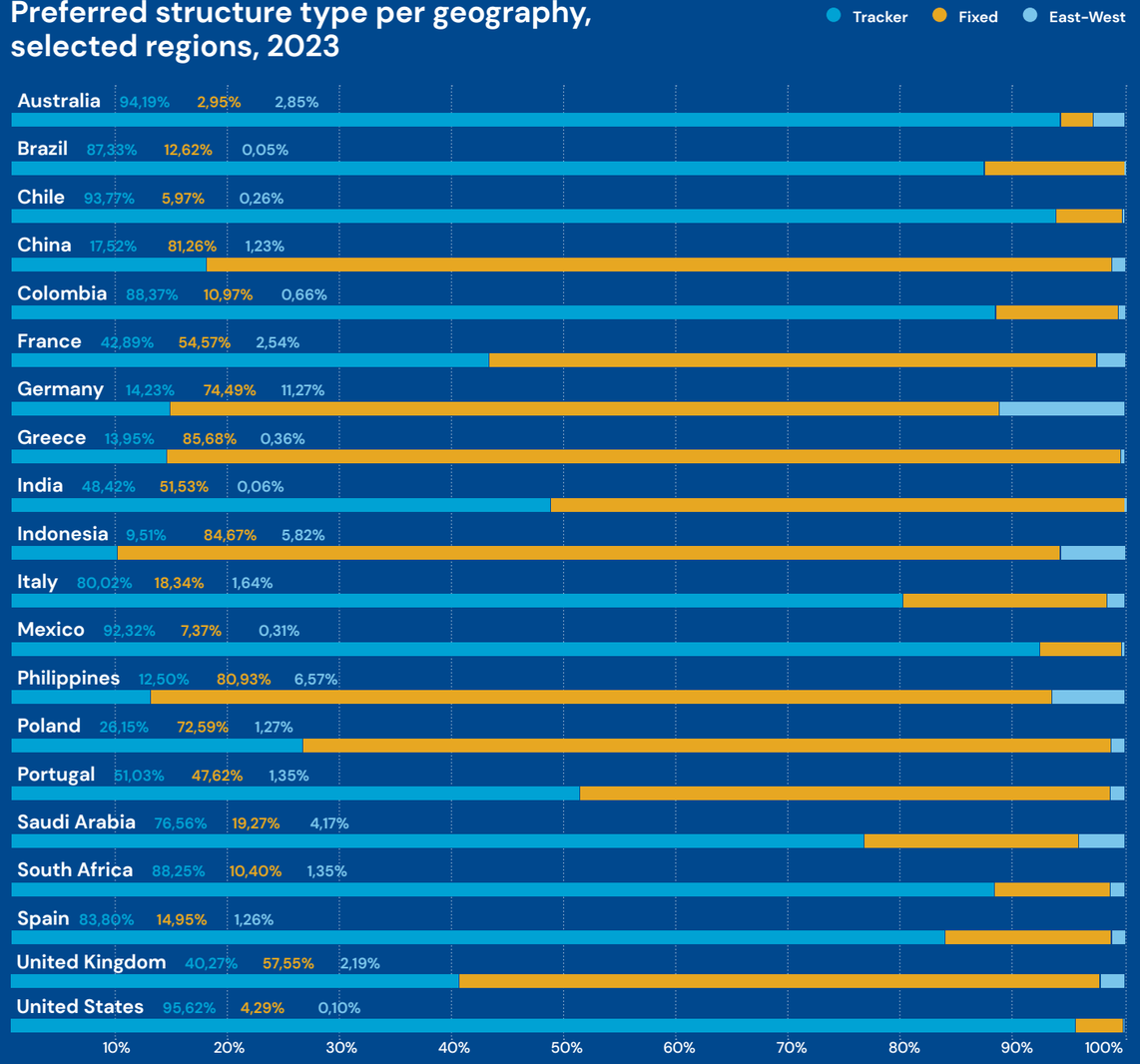


Structure preferences

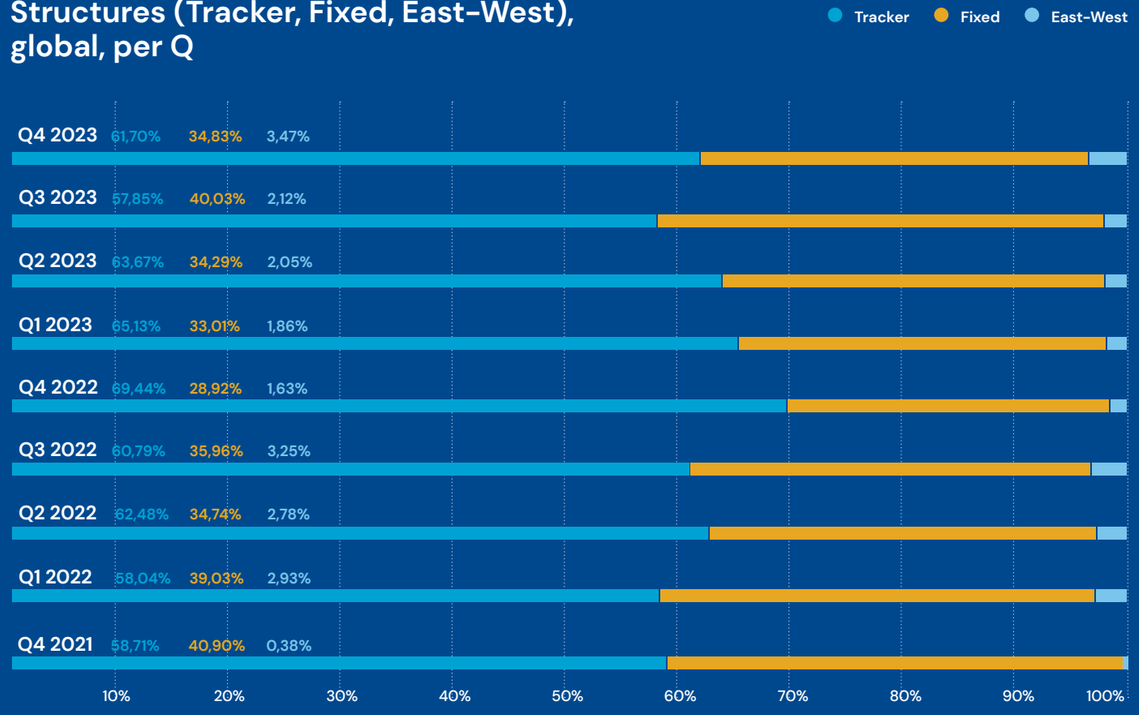
Platform data revealed a relatively even share between fixed and tracker structures, leaning more toward the latter. This trend has been consistent throughout the last few years. Throughout 2023, RatedPower saw Nextracker as the most used structure manufacturer, with Soltec in second place. Following these two were TrinaTracker, Array Technologies and Archtech Solar, who were all relatively close to one another.

Geographically speaking, structural choices vary significantly. In countries like China and Germany, fixed structures were more prevalent, while nations like Australia, Brazil, Chile, Mexico, and the US demonstrate a clear preference for tracker structures. The data shows that designs for plants with a larger average PV plant rated power tend to favor tracker structures.

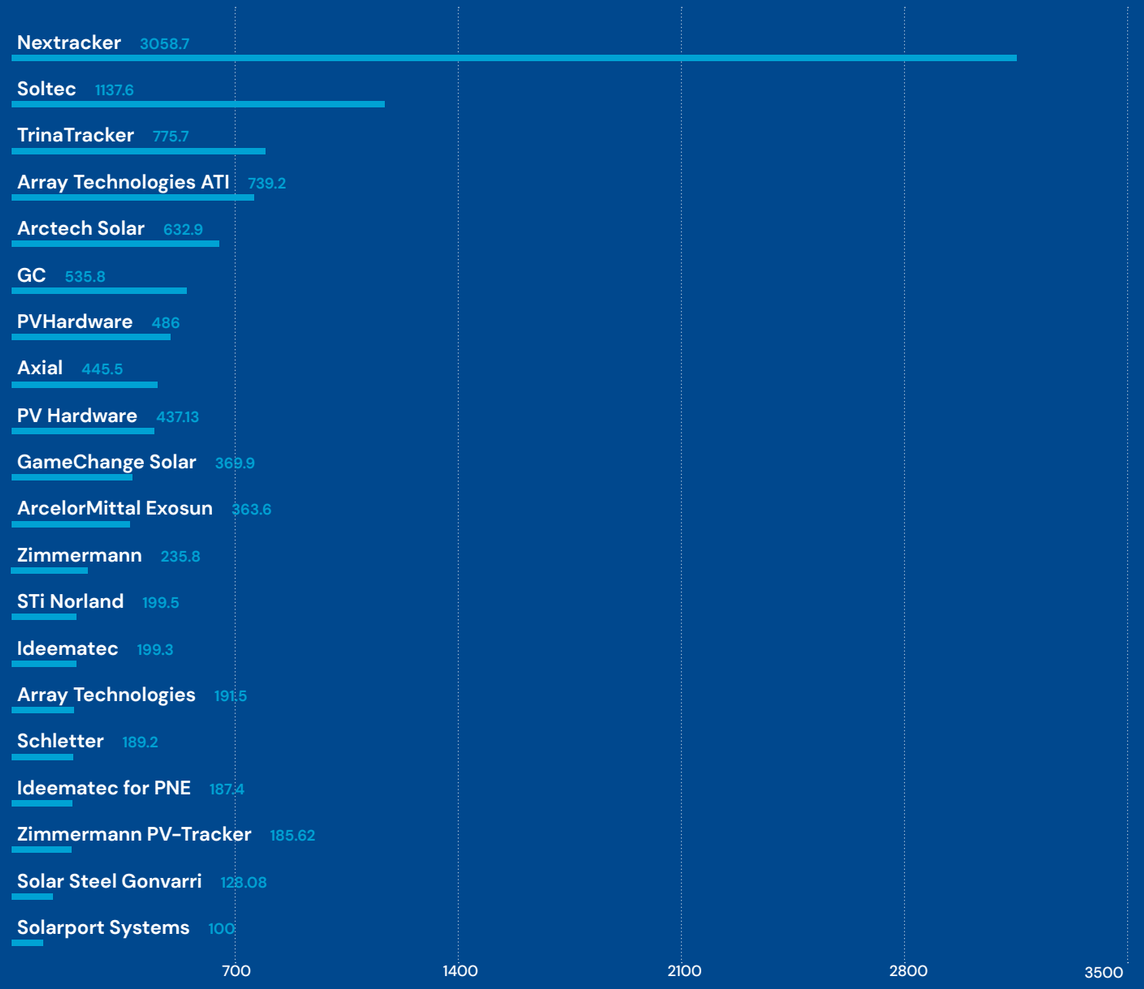
Preferred structure type per geography, selected regions, 2023



Structures (Tracker, Fixed, East-West), global, per Q



Top structure manufacturers used in simulations (indexed), 2023



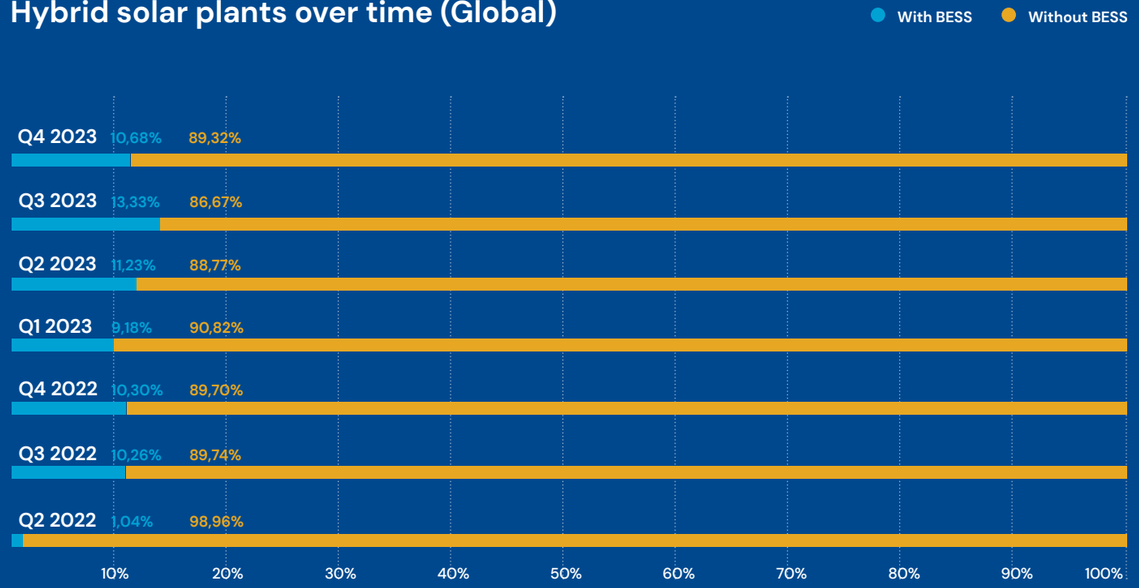
BESS

Platform data captured since 2022 shows that hybrid plants have made up around 10–13% of simulations on the RatedPower platform. Countries such as Indonesia, Chile, Mexico, and the UK have comparatively more hybrid simulations than other countries, between 31% and 59%.

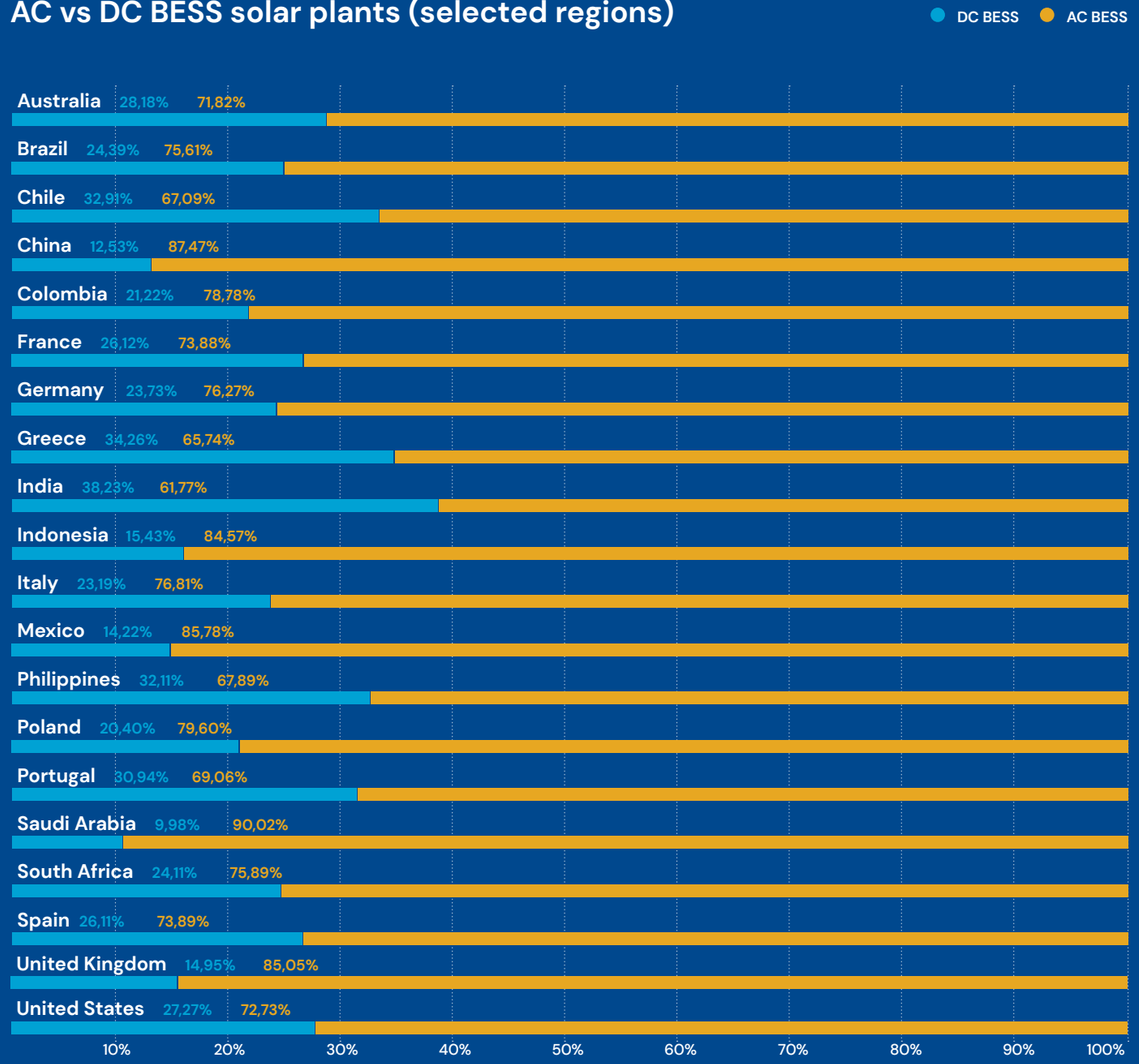
BESS is a recent addition to the report and stems from the new feature that allows users to choose between DC and AC BESS in their designs on RatedPower's platform. As such, we have limited data to analyze for 2023.

In the first quarter comparing AC vs DC BESS, we saw that AC BESS has taken up 61.9% of hybrid simulations, a trend that translates across most regions. As we gather more data, we look forward to seeing how this develops over time and where the preference lies between AC and DC BESS in future reports.

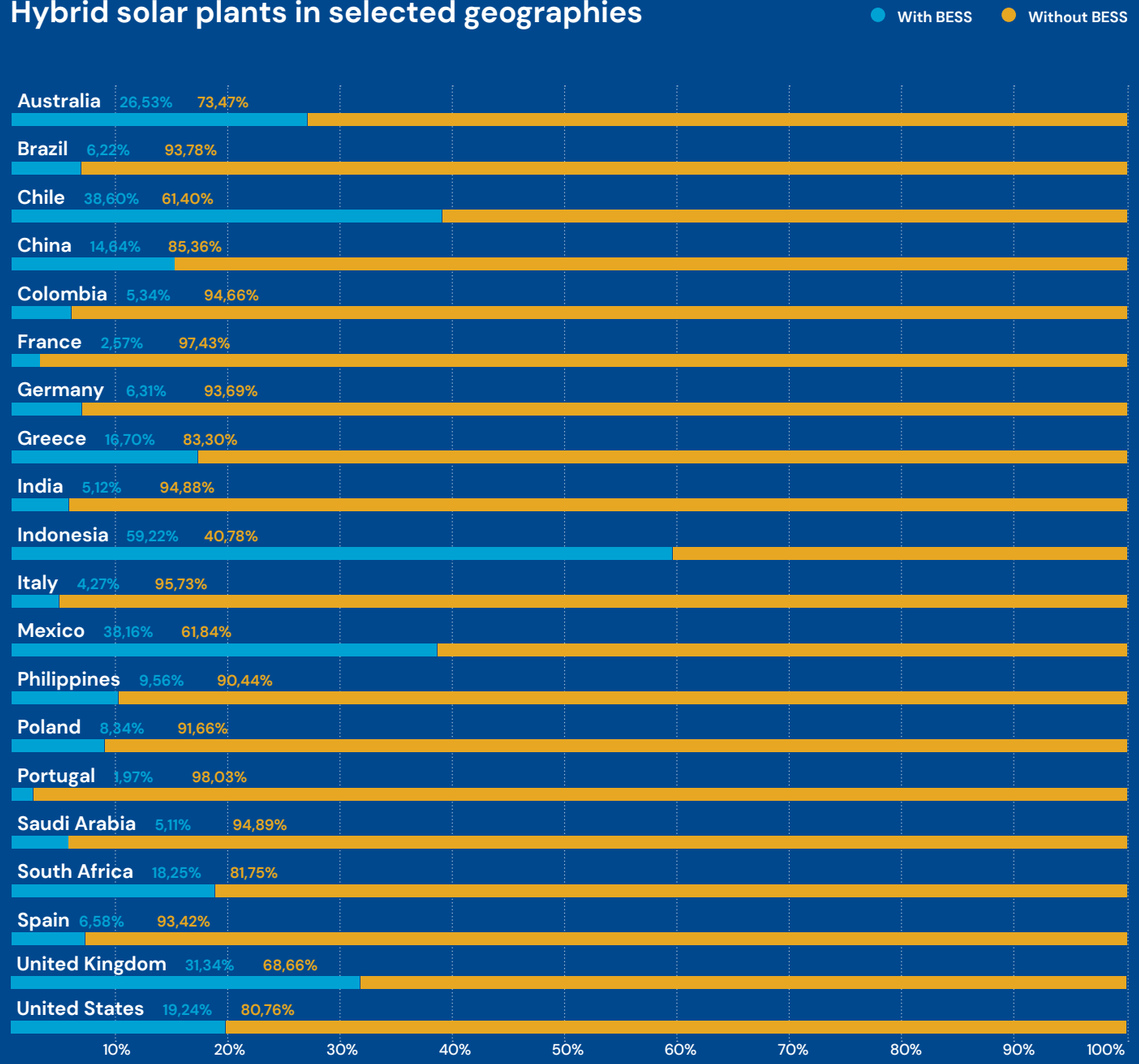
Hybrid solar plants over time (Global)



AC vs DC BESS solar plants (selected regions)



Hybrid solar plants in selected geographies



Conclusion

The renewable energy industry stands at a pivotal junction. There are challenges both in the industry and around the world, technological advancements underway, and a rising tide of optimism among industry professionals.

The survey results indicate a significant shift in industry perception. While concerns about grid saturation and instability remain essential, there's a noticeable decline in apprehensions about permitting, regulation, and government incentives. This suggests a maturing market, increasingly supported by strong governmental policies and a more streamlined regulatory environment.

Technological innovation continues to be at the forefront of the industry's evolution. The growth of new storage technologies, including BESS, will be a critical player when it comes to both meeting the escalating demand for renewable installations and making the grid more resilient and flexible. Major government policies like those out of the United States and the European Union have emerged as catalysts, opening the door for more investment and opportunity.

The solar sector, identified as the area with the greatest potential for expansion in our survey, looks set to have a big 2024. The shift towards smaller plant designs, the increasing adoption of bifacial modules, and preferences for specific types of inverters and structures all point to a growing and evolving solar market.

Confidence in the renewable sector's future is strong, buoyed by the significant growth potential in key markets like the United States, China, and Germany. Diversifying renewable sources and regional operations, coupled with a focus on digitalization and a skilled workforce, are identified as the key elements industry players should focus on as we head into a new year.

Wrap up

The global renewable energy sector in 2024 is one of challenge, advancement, and opportunity. The year has seen growth in renewables in many parts of the world, driven by environmental concerns and geopolitical dynamics.

The war in Ukraine continues to persist, as does inflation and the threat of a potential recession on the horizon. Meanwhile, new geopolitical conflicts are opening up in different regions of the world. In addition, although the pandemic feels like a thing of the past, there are some lingering effects, namely around supply chain disruptions.

All of these challenges are affecting the renewable industry in different ways, but they are not slowing it down. New installations and investment continue to rise while favorable legislation continues to pass. The European Union's recently updated renewable energy targets for 2030 are a good example of this.

Even though there are uncertainties to contend with, overall sentiment in the industry is positive. The demand for critical minerals will continue to grow in response to the growing demand for renewables and the diversification in battery technology. This means that global trade and diplomacy will continue to be important when coupled with the geopolitical tensions in the world.

The potential for technological advancement in 2024 is exciting to think about. As well as battery and storage technology, promising areas like green hydrogen and different types of PV are set to give the industry more choices. Artificial intelligence burst onto the world in 2023, and as it begins to mature, it will be interesting to see all the ways it can be used in the renewables space.

Regardless of what challenges are thrown our way, the path toward the clean energy transition is one that we still stay on. The commitment of Enverus remains steadfast. We will continue to solve problems and minimize risk, helping to create a more seamless experience for energy organizations, from start to finish.

Bernadette Johnson
GM Power & Renewables, Enverus

References

1 IEA
2 European Commission
3 The White House
4 IEA
5 pv magazine USA
6 pv magazine
7 Aurora
8 COP28
9 Bloomberg
10 IEA
11 NERC
12 Deloitte
13 The White House
14 RatedPower
15 European Commission
16 RatedPower
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