

# Scaling up to the challenge

**PV 2030** | While the technological advancement of solar over the coming decade will play a significant role in driving deployment, actual installations will largely be driven by two factors – manufacturing capacity and national decarbonisation targets. Jules Scully examines how much solar can be made, and deployed, by 2030.



Credit: 8minute Solar Energy.

**H**eightened decarbonisation targets combined with cost declines in deploying solar will see the technology's share in global electricity supply inch up as countries accelerate installations and some PV manufacturing moves closer to end markets.

Depending on progress towards reaching net zero emissions and the role of renewables in powering hydrogen production, projections of solar deployment in the coming decade vary considerably, although current leading solar markets are tipped to maintain their dominance.

In its flagship World Energy Outlook report published in October 2021, the International Energy Agency (IEA) presented three scenarios to show how the global energy sector could develop over the next three decades. In its net zero by 2050 pathway, installed solar PV capacity would grow from 739GW in 2020 to 4.96TW in 2030, requiring annual additions over the ten years to average at 422GW. By comparison, last year saw 141GW of solar installed globally, according to research organisation BloombergNEF (BNEF).

In the IEA's stated policies scenario, which represents a path based on the energy and climate measures governments have put in place to date, as well as specific policy initiatives that are under development, global solar additions would average at just 181GW to 2030, when total deployed capacity would be 2.55TW.

BNEF analysis, meanwhile, charts three pathways for the world to reach climate neutrality by mid-century, with its 'green' route requiring a trebling of annual solar installation rates by 2030. That scenario would see 455GW of new solar added each year, on average, to the end of this decade, when 5.3TW would be deployed.

The 'green' scenario, which would see solar supplying 17% of the world's electricity, "is the most likely" of the three, according to Jenny Chase, head of solar analysis BNEF, who says around 1TW of the 5.3TW would be for hydrogen production mainly. This route, says Chase, "relies very heavily on solar and wind and also hydrogen to decarbonise industry, because the massive challenge becomes not so much decarbonising electricity, which is relatively

easy, but decarbonising making stuff and heat, and agriculture is obviously a huge challenge as well".

In terms of 2030 solar deployment by country, the "top key markets will continue being China, the US and India, with growth also anticipated in major European markets", says Edurne Zoco, executive director of Clean Energy Technology at research firm IHS Markit.

After deploying around 48.2GW in 2020, China's installed solar capacity was more than 253GW at the end of the year, according to the IEA, which said the country had almost a third of the world's installed solar as of 2020.

A recent report from quality assurance company DNV says Greater China will reach 1TW of installed solar in 2026 and will grow its global share of PV from 35% currently to almost 50% in the next ten years.

In the US, the country has been boosted by the Biden administration, whose Department of Energy (DOE) released a blueprint in September showing that solar has the potential of powering 40% of the country's grid, but only if annual capacity additions are quadrupled.

The US added a record 15GW of solar last year, taking cumulative capacity up to 76GW, according to the DOE, which said that for the country to reach the 40% milestone, an average of 30GW of solar PV would need to be deployed between now and 2025 and then 60GW per year from 2025 to 2030, when total solar capacity would reach 550GW. With BNEF recently increasing its solar forecast for the US, Chase says the market is expected to "grow fairly strongly".

Another top market, India, is aiming to reach 280GW of installed solar by 2030, up from the current figure of around 46.3GW. The country is set to be second only to China in terms of solar deployment this decade in Asia Pacific, according to Wood Mackenzie, which expects the market to add 138GW by 2030. The market research firm said although solar tenders have

**Global installed solar capacity would reach 4.96TW in 2030 in the IEA's net zero by 2050 pathway.**

been rolled out consistently, India sees low completion rates.

Among the European countries set to outperform in the coming decade include Spain, where the current government is aiming to support at least 10GW of solar by 2025 through a new renewables auction scheme.

Fitch Solutions forecasts that Spain's solar capacity will grow from 12.3GW in 2020 to 30GW in 2030, when the asset class will account for nearly 19% of its total power generation output. The consultancy expects the country's PV sector to be boosted by government support, declining renewables costs and a sizeable project pipeline.

### The manufacturing ramp

Solar manufacturing is expected to ramp up accordingly to enable these deployment targets, overcoming supply chain issues that have plagued the industry in recent months.

Chase says that while manufacturing "is having a bit of a yikes moment right now, because supply chains are just really messed up", the sector will figure out a way to add the volumes necessary. "We can manufacture a terawatt a year of solar modules, it's not really a problem in the next decade."

Zoco takes a similar view, saying that despite current near-term shortages, the solar PV industry has the capacity to expand and serve growing demand this decade, adding: "There will be opportunities for investing in new manufacturing and new technologies as well as an opportunity to bring more manufacturing closer to the end markets."

China is by far the current global leader in solar module manufacturing capacity; according to the IEA, 63% (78GW) of the 124GW of assembled PV modules shipped in 2019 were from China. Its shares of PV cells, wafers and polysilicon ingots further up the value chain are significantly larger.

While markets such as India and the US are pushing to ramp up domestic manufacturing, Chase says the current largest manufacturing hub outside China is Southeast Asia, although "a lot, but not all of the factories there are owned by Chinese companies". IEA figures show 20% of modules shipped globally in 2019 came from either Malaysia or Vietnam, representing 25GW of capacity.

As well as the planned introduction of basic customs duties on module and cell imports, India is looking to boost domestic manufacturing through a production-linked

incentive programme that will support the addition of 10GW of integrated solar PV manufacturing plants. Of the 18 bidders that recently submitted around 55GW of applications to the scheme, nine have no prior solar manufacturing experience, according to consultancy JMK Research & Analytics.

"India is trying really hard to get in on the solar manufacturing and is actually

*"We can manufacture a terawatt a year of solar modules, it's not really a problem in the next decade."*

planning to build some polysilicon and wafer plants," says Chase, adding that she remains "a little bit cynical" about new polysilicon plants being built by companies with no previous experience of doing so.

India's solar manufacturing efforts in the coming decade could be boosted by investments from conglomerate Reliance Industries, which acquired REC Group – a Norway-headquartered manufacturer of p-type, n-type and heterojunction modules – in October, when it revealed plans to use the company's technology in an integrated solar manufacturing facility it will set up in India with an initial capacity of 4GW.

Following recent announcements in the US that include First Solar planning to set up a 3.3GWdc module plant in Ohio that will produce thin film modules, the country's solar manufacturing sector could receive significant legislative support through the proposed Solar Energy Manufacturing for America Act, which would provide credits for US manufacturers at each stage of the PV manufacturing supply chain.

After the policy was announced in June, trade body the Solar Energy Industries Association called for a ten-fold increase in annual US solar manufacturing capacity to reach 50GW by 2030.

"I would say the US, Europe and India are the strongest candidates to promote domestic manufacturing," says Finlay Colville, head of research at PV Tech, who believes the next decade will see the solar industry continue to be production-led, whereby production levels, not market demand, will drive installations.

Despite fresh efforts from government to support domestic solar manufacturing, Zoco estimates that much of the current trends will continue: "The shares of manufacturing outside mainland China are

expected to remain small, with the exception of Southeast Asia, outnumbered by bigger capacities expansions announced in China."

### Sustainability and grid connectivity hurdles

From setting up new manufacturing bases to securing land and financing for mega PV projects, the solar sector has a range of challenges it will need to tackle to support the global transition towards net zero.

Confident that solar supply chains will be able to cope with increased demand, Chase says grid connectivity could pose more of a problem for the industry. "I think the issues are going to be finding sites, finding especially grid connections, because grid connections are the most valuable thing for the solar industry, and it's not always easy to get them and especially it's not easy to get them in places where you're allowed to build a solar project."

Consultancy EY warned in a report published in October that an immediate upgrade of energy transmission grids is now "critical", suggesting that a 50% increase in grid spending could be needed globally over the next decade if sustainability goals are to be met.

Zoco says the solar sector will face challenges around grid integration and balance due to the intermittency of generation. "The more renewables in the energy mix, the more tension to the grid with high and volatile loads. Increasing penetration of renewables will need to go along with investments in the grid, transmission as well as storage solutions with batteries or other technologies."

With terawatts of solar set to come online in the next decade, Zoco says the sector will also need to confront concerns surrounding the sustainability component of the supply chain as well as environmental, social and governance issues. "This is something that goes well beyond solar PV and also impacts other industries, triggering bottlenecks and disruption," she says.

Despite the upstream and downstream headwinds, the solar sector is set to accelerate deployment at rates that may largely be dependent on government decarbonisation targets rather than the industry's proven ability to manufacture the required equipment. Increased policy support for the energy transition could potentially put the PV industry on a path towards the deployments needed in net zero scenarios. ■