China’s ‘spare’ solar capacity offers climate and energy access opportunity

Factories left idle could provide all the additional solar panels needed for renewables tripling goal while improving energy access across the Global South.

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About

This analysis looks at the gap between the potential output of the world's existing solar panel factories and projected global solar power deployment out to 2030. It looks at the benefits that could accrue by deploying the solar generating capacity that could be manufactured this decade, but for which there is currently set to be no market. These include improving energy access in the Global South and achieving the target of tripling renewable energy capacity agreed at the 2023 UN climate summit. With the majority of manufacturing capacity located in China, the analysis outlines how supporting this rollout would be in China's interests both economically and diplomatically, but would also be in the interests of Western countries.

Executive Summary

Using abundant ‘spare’ solar manufacturing capacity would deliver major gains on energy access and climate change

Deployment rates for solar panels across the world are lagging behind the boom in global manufacturing capacity. Recent investment in manufacturing means that over the course of this decade, factories could produce more than twice the capacity of solar panels that is projected to be deployed.

As the fastest growing source of clean energy globally (generation growing by 26% per year for the last eight years), solar power is an essential instrument in decarbonisation, and is set to dominate electricity generation. Given its low cost and rapid deployability at a range of scales from single panels upwards, solar is also logically the cornerstone of programmes to increase electrification and energy access in countries where people lack it - and there are an estimated 675 million people without even minimal access to electricity, the majority in sub-Saharan Africa. Even with such impressive growth in deployment, the boom in manufacturing means demand is running behind supply, and the world is therefore set to realise less than half of the benefits that the solar power production line could deliver this decade.

In this report, we analyse the scale of the benefits that would accrue through supporting deployment of panels produced with this ‘spare’ manufacturing capacity.

01 Solar panel rollout to 2030 is set to be less than half the potential supply

The solar panel manufacturing industry could supply an estimated 7,310 gigawatts (GW) of solar panels between 2024 and 2030. Deployment over the period is forecast to be 3,473 GW. This leaves a 'spare' solar capacity of 3,837 GW - more than half of the total that could be manufactured, installed and used.

02 Deployment of 'spare' solar would get the world on track for climate targets

Neither national targets nor projected renewable energy deployment rates are high enough to triple global capacity by 2030, the collective target governments set at the 2023 UN climate summit (COP28). National targets would deliver 7,241 GW by 2030, and projected deployment 9,513 GW, while the tripling target calls for 11,000 GW. Deploying all the 'spare' solar in addition would reach the target a year ahead of schedule and deliver 13,345 GW in 2030, exceeding the target by 21%.

03 Supporting use of 'spare' solar would bring global benefits

Accelerating solar energy rollout across the Global South would reduce the proportion of electricity that countries generate using fossil fuels – constraining greenhouse gas emissions, reducing import dependence and providing a buffer against supply shocks. It would bring jobs and investment. It would improve access to electricity, potentially for hundreds of millions of people. Just one-seventh of the 'spare' capacity could in principle meet electricity demand growth and extend basic electricity access to the entire populations of 88 Global South countries considered in this report.

Supporting use of ‘spare’ solar capacity would also benefit communities where the panels are made, safeguarding manufacturing jobs and investment. With 80-85% of the solar manufacturing industry based in China, this is the country that stands to lose the most if factories close or have to run at low capacity - and already, Chinese companies are feeling the pinch, with workers being laid off and investment withheld. Further contraction is inevitable unless demand is supported in the next few years.

Fifteen years ago the Chinese government prevented its nascent solar manufacturing industry from contracting, in the face of similarly difficult circumstances, by supporting deployment within China. Now, the most obvious opportunity for supporting deployment lies overseas, in countries with low levels of per-capita GDP and energy access, and most immediately at risk from climate change impacts. These countries are the ones with the most to gain from a fast solar rollout, but are largely missing out due to the high cost of capital for financing renewable energy build.

The existence of such abundant and cheap quantities of ‘spare’ solar capacity is also an opportunity for developed nations, which have an acknowledged responsibility to support the Global South in delivering both the Sustainable Development Goals and global climate change targets, to make up for lost time. Solar panels are going to remain cheap for the foreseeable future even if deployment ramps up, creating a unique and immediate opportunity.

The existence of so much ‘spare’ solar manufacturing capacity offers an opportunity to accelerate global decarbonisation while improving energy access in the developing world. The supply chain is clearly in good health - the issue lies in deploying what it can supply. It’s one of those rare times when there’s a win for just about everyone, and not taking advantage of it would go down as a real failure of imagination.

Richard Black
Director of Policy and Strategy, Ember

Fifteen years ago, China built its world-leading solar manufacturing industry by investing in the domestic market. Now, the real issue faced by the industry is not over-supply but under-deployment. With that in mind, the solution to support the industry resides in markets overseas, especially in the developing world. Investing in these markets will ensure that factories stay open during this difficult period while also helping developing countries with their own clean energy transitions. The diplomatic and economic stars are aligned.

Dr Muyi Yang
Senior Electricity Policy Analyst - China, Ember

Chapter 1 | Solar surplus

A supply explosion

Worldwide manufacturing capacity for solar panels tripled between 2021 and 2023, driven mainly by expansion in China. But global installation is running a long way behind production capacity, and manufacturers and investors are feeling the pinch.

Stimulated by the exponential growth of solar power in the previous decade, manufacturing companies ramped up investment in new production lines in the early 2020s. The manufacturing capacity of factories worldwide tripled from 2021 to 2023, and is set to reach 1,100 GW per year by the end of 2024. About 80-85% of manufacturing capacity is based in China, which is also the clear market leader in upstream parts of the supply chain.

However, forecasts for deployment this decade suggest that more than half of this manufacturing capacity will lie unused, with neither government targets nor project pipelines running at a commensurate scale. Solar panel prices are accordingly at a historic low of about US$ 0.10 per watt, having virtually halved during 2023.

This is already having an impact on manufacturers. In the first quarter of 2024 alone, Chinese companies cancelled or delayed an estimated US$ 8.3 billion of planned investments. Shares of major Chinese manufacturers have fallen by more than half since January 2022. Longi, one of the world's biggest solar panel producers, is laying off 5-30% of its workers, with its President Li Zhenguo saying recently that at current prices, 'Most companies are barely surviving.'

Unless installation rates ramp up quickly, market analysts believe that a contraction in manufacturing capacity is inevitable, with production lines shuttered or mothballed. But there is no obvious route to market expansion. Export volumes from China have flatlined over the last year, having tripled in the previous four. Exports to Europe, the biggest market, are currently down by a quarter year-on-year.

In China itself, deployment rose by 50% in 2023 alone, and in the first four months of 2024 was up a further 24% year-on-year. But it is encountering a range of constraints including lack of grid capacity, reducing the scope for a further acceleration.

While a shortfall in demand could partially serve to weed out older and less efficient manufacturing plants, it will obviously carry negative consequences for jobs and the economy in communities where factories are located. Chinese companies may be particularly exposed to falling market conditions given that in other countries with substantial manufacturing capacity, such as India and the United States, governments are aiming primarily for domestic use, whereas Chinese companies are targeting both domestic and global markets.

Chapter 2 | Opportunity

The scale of ‘spare’ solar

Forecasts show a surplus in solar panel manufacturing capacity from 2024 to 2030, presenting a significant opportunity to exceed the COP28 renewable energy tripling target if the spare capacity is utilised.

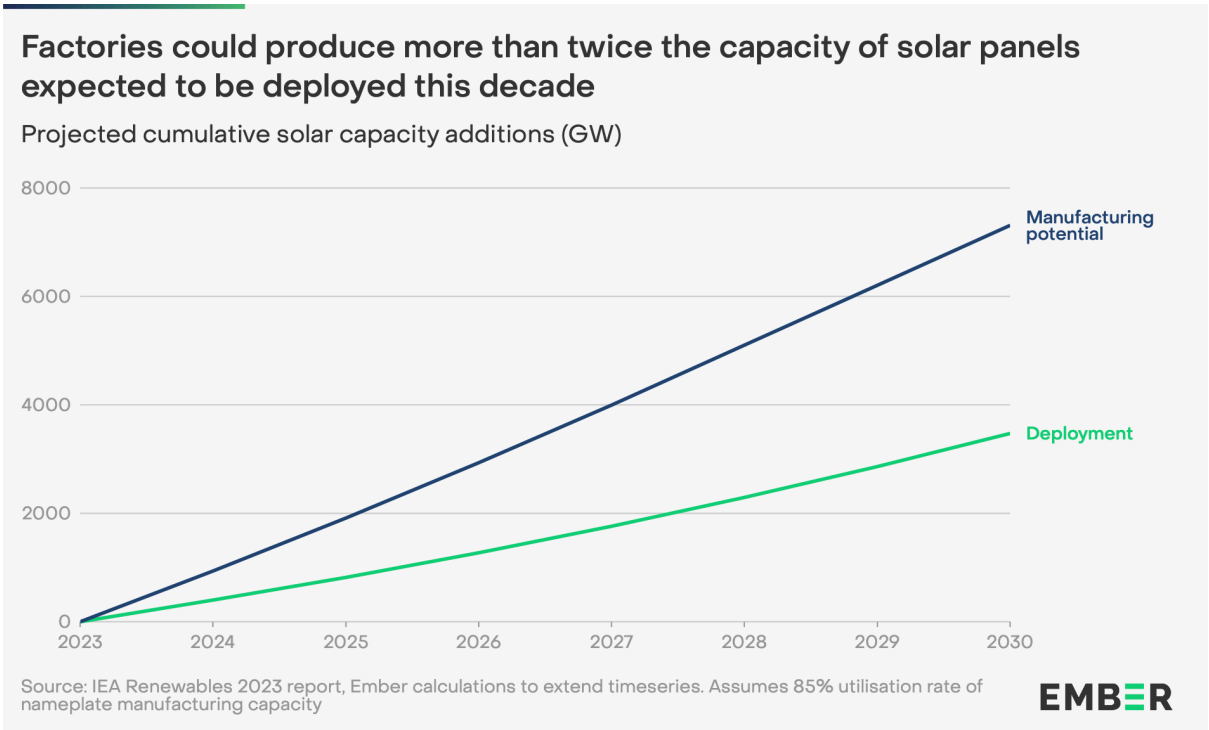
The International Energy Agency (IEA) projects that global solar manufacturing capacity will rise from 1,100 gigawatts (GW) in 2024 to 1,300 GW in 2028. It forecasts that annual deployment of solar panels will run at under half of that level, rising from 400 GW in 2024 to 532 GW in 2028.

We extend these projections out to 2030, to allow for easy comparison with the target that governments agreed at the 2023 UN climate summit of tripling renewable energy capacity from the 2022 level by 2030.

Based on the IEA’s figures, and taking into account that the utilisation rates of production lines are unlikely to exceed 85%, we calculate the cumulative manufacturing capacity over the period 2024-30 to be 7,310 GW. We calculate cumulative projected deployment over the same period at 3,473 GW. (See Appendix 2 for methodology).

The difference is 3,837 GW. This can be regarded as ‘spare’ manufacturing capacity, representing solar panels that could be produced, installed and used, but under current targets and deployment projections, will not be.

According to the IEA's estimates, the currently projected deployment of solar would raise globally installed capacity from 1,550 GW in 2023 to 5,023 GW by 2030. Deploying the 'spare' solar capacity of 3,837 GW in addition to this would raise the global installed capacity in 2030 by over 75%, to a total of 8,855 GW.

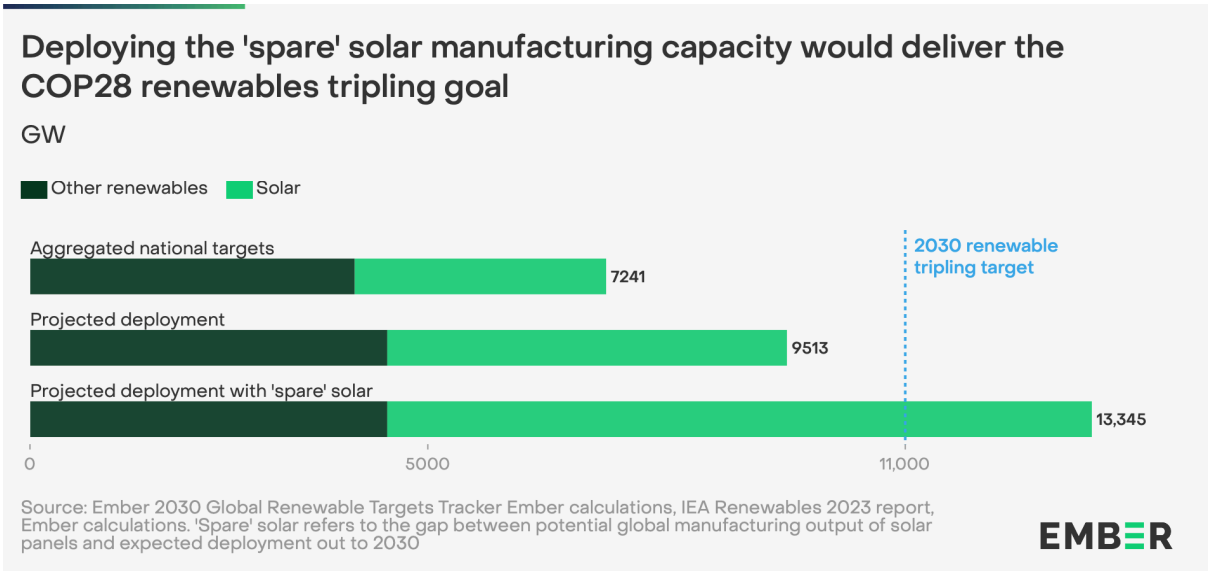


The opportunity gains significance when one compares it against the scale of installation needed across all renewables to deliver the COP28 tripling target. Meeting that would require 11,000 GW of renewable energy capacity to be in place by 2030 (against the 2022 figure of 3,630 GW).

Based on the IEA's projections, we would expect renewable energy capacity worldwide in 2030 to total 9,513 GW: in other words, the 11,000 GW tripling target will be missed.

The shortfall from governments' national targets to the tripling figure is larger still. Ember's 2030 Global Renewable Targets Tracker shows that governments are jointly targeting 7,241 GW of renewable capacity by 2030 (with solar making up 3,160 GW of that).

By contrast, if all the 'spare' solar manufacturing capacity could be delivered and installed in addition to the IEA's baseline projections, this would see the world passing the COP28 tripling target a year ahead of schedule, taking capacity in 2030 to 13,345 GW, exceeding the target by 21%.



With wind power encountering some headwinds, hydropower and bioenergy facing concerns over social and ecological impacts, and other components of 1.5C-compatible pathways such as carbon capture and storage and negative emissions seeing glacial progress, prioritising rapid deployment of ‘spare’ solar would appear to be a prudent move if governments are serious about delivering the Paris Agreement climate targets.

An unjust transition

Access to energy is already highly unequal across the globe, with less than half of people in sub-Saharan Africa having even minimal access to electricity. This is already a barrier to development - and economic factors mean the renewables revolution is leaving the poorest countries behind.

Many developing countries' energy transition plans are currently obstructed by economic factors. Apart from the low levels of per-capita GDP in Global South countries (relative to the Global North), financiers generally view investments as riskier, which raises the cost of capital for renewable energy projects three- to five-fold. The burden of debt repayments, resulting largely from the Covid-19 pandemic, also reduces the capital available in many developing countries. This means that many governments that want to speed the renewable energy transition are struggling to garner the investment needed.

Lack of access to modern energy is a barrier to poverty reduction and equitable economic development. Less than half the population of sub-Saharan Africa has access to electricity. More than 80% of Africans without electricity access live in rural areas. Here, as the IEA and others show, the greatest potential for advancement lies in standalone systems and mini-grids based around cheap renewable generation, predominantly solar.

Electricity access
'Tier One' electricity access is defined as having an electricity source that can provide very basic lighting, charge a mobile phone, or power a radio for four hours per day.

The UN's most recent assessment of progress towards Sustainable Development Goal 7, which aims to deliver 'affordable, reliable, sustainable and modern energy for all' by 2030, concludes that delivery is off track. At current rates of progress, it estimates that 660 million people around the world will still lack electricity access in 2030, the majority in sub-Saharan Africa.

In large part this is because the renewables revolution, much like the Green Revolution in agriculture half a century ago, is largely passing Africa by. While investment globally in clean energy is rising, less than 2% of it reaches Africa.

The negative impact this situation will have on prospects for social and economic development is compounded by the fact that many countries with poor energy access are also highly vulnerable to climate change impacts.

As things stand, the global transition to a clean energy system, with all the benefits it brings, is set to be deeply unjust. Countries and communities that would benefit from it most are set to miss out, and where it does take place in the developing world, it is set to be relatively more costly than in the more prosperous Global North.

Chapter 4 | Potential impact

Using ‘spare’ solar for global development

Underutilised solar manufacturing capacity offers a chance to support the global energy transition, especially in Global South countries with low levels of energy access. Deploying even a seventh of the spare 3,837 GW of solar capacity could in principle extend basic electricity access to 809 million people.

Utilisation of ‘spare’ solar manufacturing capacity could significantly advance the energy transitions of countries that need it most, increasing energy access and avoiding the need to build new fossil fuel power stations.

This analysis looks at a group of countries generally positioned below the global average in terms of development, including many with limited energy access. These nations are in general vulnerable to impacts of climate change and supportive of a global clean energy transition. We define this group via membership of three blocs: the Least Developed Countries (LDCs), Alliance of Small Island States (AOSIS), and Climate Vulnerable Forum (CVF).

Collectively, this group comprises 95 countries - 45 in Africa and the Middle East, 29 in Asia and the Pacific, and 21 in Latin America and the Caribbean (full list in Appendix 1). Seven of these countries were omitted from the calculations in this report owing to absences of data, leaving 88 in the final analysis (44 in Africa and the Middle East, 23 in Asia and the Pacific, and 21 in Latin America and the Caribbean). As the population of the seven omitted countries is less than 1% of the total, their omission does not materially affect the conclusions.

Assuming that the rate of electricity demand growth seen across the 88 countries in recent years continues for the rest of this decade, we estimate the additional demand in 2030 at 676 terawatt hours (TWh). Meeting this additional demand entirely with solar would entail deploying a capacity of 454 GW before 2030 (for details on methodology, see Appendix 2). Deploying more solar capacity would reduce the proportion of electricity that each country obtains from fossil fuel generation, constraining greenhouse gas emissions, reducing import dependence and reducing exposure to fossil fuel price spikes.

Levels of electricity access vary widely across this group of countries. Twenty-five countries are at 100%, and many more close to it. But in some sub-Saharan African countries the level is much lower - 11% in Chad, 10% in Burundi and 8% in South Sudan. Across the 88 countries, the combined population without access to electricity currently numbers 519 million people. Given projected population growth, that number would be expected to rise to 809 million in 2030, in the absence of measures to increase access.

As an indicative exercise, we calculated the additional electricity demand incurred in 2030 if electricity access were to be extended to the entire population of each country. Our estimate is that this would require 843 TWh of electricity compared with 2022 – 167 TWh higher than just meeting the expected demand growth. This could be delivered by deploying an additional 112 GW of solar capacity, bringing the required deployment to 566 GW, which is just one-seventh of the 'spare' solar manufacturing output.

Improving electricity access is a complex issue, and the indicative calculation above should not be taken as implying that 'spare' solar represents a complete solution. In some of the 88 countries, particularly those where electricity is already available around the clock and levels of access already good, solar panels would need to be properly integrated with the national system, potentially entailing buildout of the grid and flexibility measures such as storage. In other settings, where levels of electricity access, hours of availability per day and per-capita consumption are much lower, minimal additional infrastructure would be needed. But in these settings, a much more substantial rise in generation would be needed to raise the amount of electricity available per person per day to levels seen in more prosperous countries, while deployment of batteries alongside solar would extend electricity availability into the evening. However, the scale of the 'spare' capacity relative to the size of the expected demand increase highlights the fact that the 'spare' solar capacity could make a significant contribution, if deployment were supported appropriately.

Chapter 5 | Renewable win

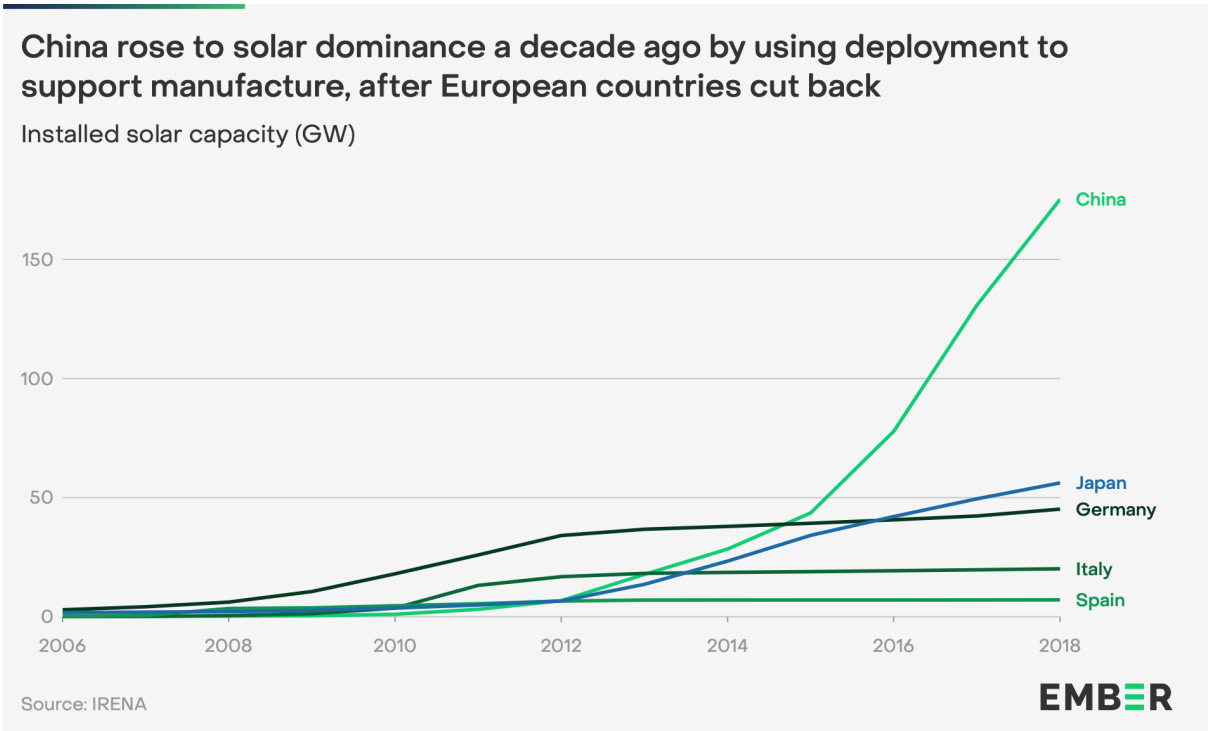
A China solution?

As China is the clear world leader in solar manufacture (as well as in deployment), China has much to gain from supporting roll-out of the 'spare' solar capacity to developing countries. It would not be the first time that the government has supported deployment in order to bolster its solar manufacturing future.

With the vast majority (80-85%) of solar manufacturing plants located in China, supporting deployment of 'spare' solar capacity in the developing world presents a significant opportunity for China to deliver national gains, in addition to helping deliver global goals on development and climate change.

One gain is economic, in that supporting deployment is a way to keep factories running and people employed until global demand naturally catches up with supply. And history offers a striking parallel.

During the 11th Five-Year Plan (2006-2010), Chinese companies expanded and modernised solar manufacturing facilities in order to compete on the world stage. However, after the 2008 financial crisis, major Western markets such as Germany cut back deployment rates and slowed imports from China, partly in an attempt to shore up domestic manufacturing. To support its industry through this economically difficult period rather than allowing factories to shut down, the Chinese government invested in building a substantial domestic market, introducing a range of support policies to stimulate deployment within China. The benefits of that response can clearly be seen today, both in the scale of China's growing annual solar deployment and in Chinese companies' dominance of the global market.



Now, with Chinese manufacturers similarly hard-pressed, the option of significantly accelerating domestic deployment is far less feasible because deployment is already happening at significant scale and pace and running up against constraints. The US is again erecting trade barriers; and India, hitherto a rapidly expanding market for Chinese exports, is planning to meet national demand with domestic manufacturing. Against this backdrop, supporting deployment across the developing world is an obvious option if the Chinese government wants to keep as much as possible of the industry running through this difficult period.

The second gain is diplomatic. Western nations have acknowledged their responsibility to support the Global South's energy transition on numerous occasions, from the 1992 UN climate convention onwards. They are also committed to supporting delivery of the Sustainable Development Goals. But they have repeatedly failed to provide the agreed collective sums of climate finance, are currently not delivering reforms to the international financial system (such as via the Bridgetown Agenda) that would speed up clean energy deployment by de-risking investment, and are not supporting implementation of SDG 7 well enough to ensure delivery.

‘Spare’ solar offers an opportunity for China to step into the breach. It is after all allied with all but one country in our analysis through common membership of the G77/China group, the 134-strong bloc which exists to ‘…provide the means for the countries of the [Global] South to articulate and promote their collective economic interests… and promote South-South cooperation for development.’ Given the severe climate impacts already affecting small island developing states and other climate-vulnerable nations, there could hardly be a more significant example of beneficial South-South cooperation than supporting the rollout of affordable solar energy in countries that need it the most.

Conclusion

‘Spare’ solar offers a win-win-win

The world needs abundant cheap solar power, for energy access, wider economic development and climate change. And it is available.

The figures in this report show the global benefits that would accrue from supporting deployment of ‘spare’ solar capacity.

This single move would ensure that governments collectively exceeded their target of tripling renewable energy capacity by 2030 by a substantial margin. Deploying just one-seventh of it in the countries that most need clean electricity would contribute to improving energy access and energy independence.

Supported solar energy deployment in Global South countries would bring a range of added development benefits to those countries. Solar would create jobs in the installation and maintenance whilst reducing fossil fuel import costs; but cheaper and more plentiful electricity would also provide a boost to industry and support countries’ underlying clean development. Parts of the supply chain could be relocated in-country, as is already happening in Southeast Asia where companies are progressively moving from solar panel assembly to the manufacturing of upstream components such as solar cells and silicon wafers. Given the synergy between solar generation and battery storage, solar panel deployment on a significant scale would make countries more attractive destinations for investment in battery manufacturing, as is already happening in North Africa.

These wider benefits could, in turn, contribute to a more sustainable mode of development that would bring long-term sustainable prosperity.

What emerges overall is an opportunity for South-South-North collaboration that has the potential to markedly accelerate progress towards agreed international goals on both climate change and development:

- China has abundant ‘spare’ production capacity, and companies that may atrophy without temporary market support. It also has established diplomatic and investment links with many poorer developing countries.

- Across the developing world, governments are keen to progress the energy transition but are hindered by economic factors largely beyond their control.
- Developed countries have an acknowledged responsibility to deliver support to the developing world that improves energy access, generates jobs and income, and ensures low-carbon development. They also have abundant expertise in energy transition-related skills and knowledge to share.

Although global geopolitics might appear unpromisingly frosty, China and the US cooperation on climate change endures, as evidenced by the 2023 joint Sunnylands Statement which saw the two governments reaffirm 'their commitment to work jointly and together with other countries to address the climate crisis'. China and the EU also constantly maintain a dialogue on climate issues.

From the perspectives of clean energy access, development and climate change, the conventional representation of the current situation is flawed. **The situation is not, as it is often described, one of over-production, but of under-deployment**. The spectre of supply chain shortages is often cited as an obstacle to rolling out clean energy globally. Here, the supply chain is clearly in robust health; but governments and multilateral institutions are electing not to utilise the full extent of goods that it can produce, despite the social and economic advantages doing so would bring.

The opportunity to capitalise on the potential of solar energy will not last indefinitely. The workforce layoffs and investment delays already witnessed in solar manufacturing would be expected to deepen quickly unless governments act to support the market. The win-win-window will not be open for long.

Supporting Materials

Appendix 1: Countries covered

By bloc membership

Least Developed Countries: Afghanistan, Angola, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Laos, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, São Tomé & Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sudan, Tanzania, Timor-Leste, Togo, Tuvalu, Uganda, Yemen, Zambia (45 states)

Alliance of Small Island States: Antigua & Barbuda, Bahamas, Barbados, Belize, Cabo Verde, Comoros, Cook Islands, Cuba, Dominica, Dominican Republic, Fiji, Grenada, Guinea-Bissau, Guyana, Haiti, Jamaica, Kiribati, Maldives, Republic of the Marshall Islands, Mauritius, Federated States of Micronesia, Nauru, Niue, Palau, Papua New Guinea, St Kitts & Nevis, Saint Lucia, Saint Vincent & the Grenadines, Samoa, São Tomé & Principe, Seychelles, Singapore, Solomon Islands, Suriname, Timor-Leste, Tonga, Trinidad & Tobago, Tuvalu, Vanuatu (39 states)

Climate Vulnerable Forum: Afghanistan, Bangladesh, Barbados, Benin, Bhutan, Burkina Faso, Cambodia, Chad, Colombia, Comoros, Costa Rica, Côte d'Ivoire, Democratic Republic of Congo, Dominican Republic, Eswatini, Ethiopia, Fiji, Gambia, Ghana, Grenada, Guatemala, Guinea, Guyana, Haiti, Honduras, Kenya, Kiribati, Kyrgyzstan, Lebanon, Liberia, Madagascar, Malawi, Maldives, Mongolia, Morocco, Nepal, Nicaragua, Niger, Palau, Palestine, Papua New Guinea, Philippines, Rwanda, Saint Lucia, Samoa, Senegal, Sri Lanka, South Sudan, Sudan, Tanzania, Timor-Leste, Tunisia, Tuvalu, Uganda, Vanuatu, Viet Nam, Yemen (58 states)

By region

Africa and the Middle East: Angola, Benin, Burkina Faso, Burundi, Cabo Verde, Central African Republic, Chad, Comoros, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Eritrea, Eswatini, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lebanon, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Niger,

Palestine, Rwanda, São Tomé & Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Yemen, Zambia (45 states)

Asia-Pacific: Afghanistan, Bangladesh, Bhutan, Cambodia, Cook Islands, Fiji, Kiribati, Kyrgyzstan, Laos, Maldives, Republic of the Marshall Islands, Federated States of Micronesia, Mongolia, Myanmar, Nauru, Nepal, Niue, Palau, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Timor-Leste, Tonga, Tuvalu, Vanuatu, Viet Nam (29 states)

Latin America & the Caribbean: Antigua & Barbuda, Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Saint Kitts & Nevis, Saint Lucia, Saint Vincent & the Grenadines, Suriname, Trinidad & Tobago (21 states)

Countries excluded due to absent data

Cook Islands, Republic of the Marshall Islands, Federated States of Micronesia, Niue, Palau, Palestine, Tuvalu (7 states)

Appendix 2: Methodology

Chapter 2

Projections of solar panel manufacturing capacity and deployment 2024-2028 were sourced from the International Energy Agency's Renewables 2023 report. The IEA projects that global solar manufacturing capacity will rise from 1,100 gigawatts (GW) in 2024 to 1,300 GW in 2028. Taking 1,200 GW as an average annual production figure for the period 2024-2028 gives a cumulative nameplate output of 6,000 GW. At an 85% utilisation rate, this gives a total feasible output of 5,100 GW.

We conservatively extend the manufacturing capacity time series to 2030 by assuming that the 2028 figure of 1,300 GW per year does not increase from 2028 to 2030. This gives a cumulative manufacturing output 2024-2030 (assuming an 85% utilisation rate) of 7,310 GW.

The IEA forecasts that annual deployment of solar panels will rise from 400 GW in 2024 to 532 GW in 2028, a cumulative capacity addition over the period 2024-28 of 2,292 GW.

We extend this estimate to 2030 by projecting that the average annual percentage capacity addition for the period 2024-2028 (7%) continues for 2029 and 2030. This gives the cumulative solar capacity added 2024-2030 as 3,473 GW.

We extend the IEA's baseline projection for overall renewable capacity forward to 2030 by assuming that the average annual growth rate forecast for the period 2024-28 (14%) continues for two more years.

Chapter 4

Data on annual electricity demand, and renewable and solar generation for the countries in this report were sourced from Ember's electricity data. Installed capacity figures were sourced from the International Renewable Energy Agency (IRENA). The year 2022 was taken as the most recent year for which there is comprehensive data available on all parameters for the countries analysed. Data on access to electricity was taken from the World Bank Data Portal; figures for 2022 are not available, therefore 2021 figures were used.

Due to issues with data availability, Ember does not collect or publish data on four of the 95 countries - Republic of the Marshall Islands, Federated States of Micronesia, Palau and Tuvalu. The World Bank does not publish energy access figures for a further three - the Cook Islands, Niue and Palestine. With a combined population of 5.4 million, these seven states account for less than 0.5% of the population across the 95 countries, and were excluded from all calculations.

For each country, electricity demand was forecast for 2030 by assuming that the average annual rate of demand growth during 2013-2022 continues for the period 2023-2030. Using average growth figures for this recent decade, rather than for the last one or two years, reduces the impact of exceptional circumstances caused by the Covid pandemic, the Russian invasion of Ukraine, or more localised factors. The amount of additional solar generating capacity needed to meet all the growth in demand was then calculated based on IRENA's global average capacity factor of 17%.

The number of people across the 88 countries without access to electricity now was calculated using the World Bank energy access figures and population data in the Ember database. Population forecasts to 2030 were obtained by assuming that the average annual rate of population growth during 2012-2021 continues for the period 2022-2030. The proportion of the population expected to have electricity access in 2030 was calculated by assuming that the average annual rate of energy access growth during 2012-2021 continues for the period 2022-2030. These two figures were used to calculate the number of people in these countries expected to be without electricity access in 2030, and this was used to calculate the additional demand necessary to extend access to the entire population. The additional solar capacity needed to bring access to the 100% level in all countries was then calculated using the same 17% capacity factor.

This approach does not address wider inequalities in electricity access nor barriers to it, but provides a rough indication of the capacity needed to extend the current level of per-person energy access seen in each country, for those who have it, across the entire population.

Acknowledgements

Contributors

Sam Hawkins, Libby Copsey, Nicolas Fulghum, Shiyao Zhang, Rini Sucahyo, Chelsea Bruce-Lockhart

Cover image

Workers installing hybrid grid tied electrical installation of solar panels, inverters and backup batteries in South Africa.

Credit: Suretha Rous / Alamy Stock Photo