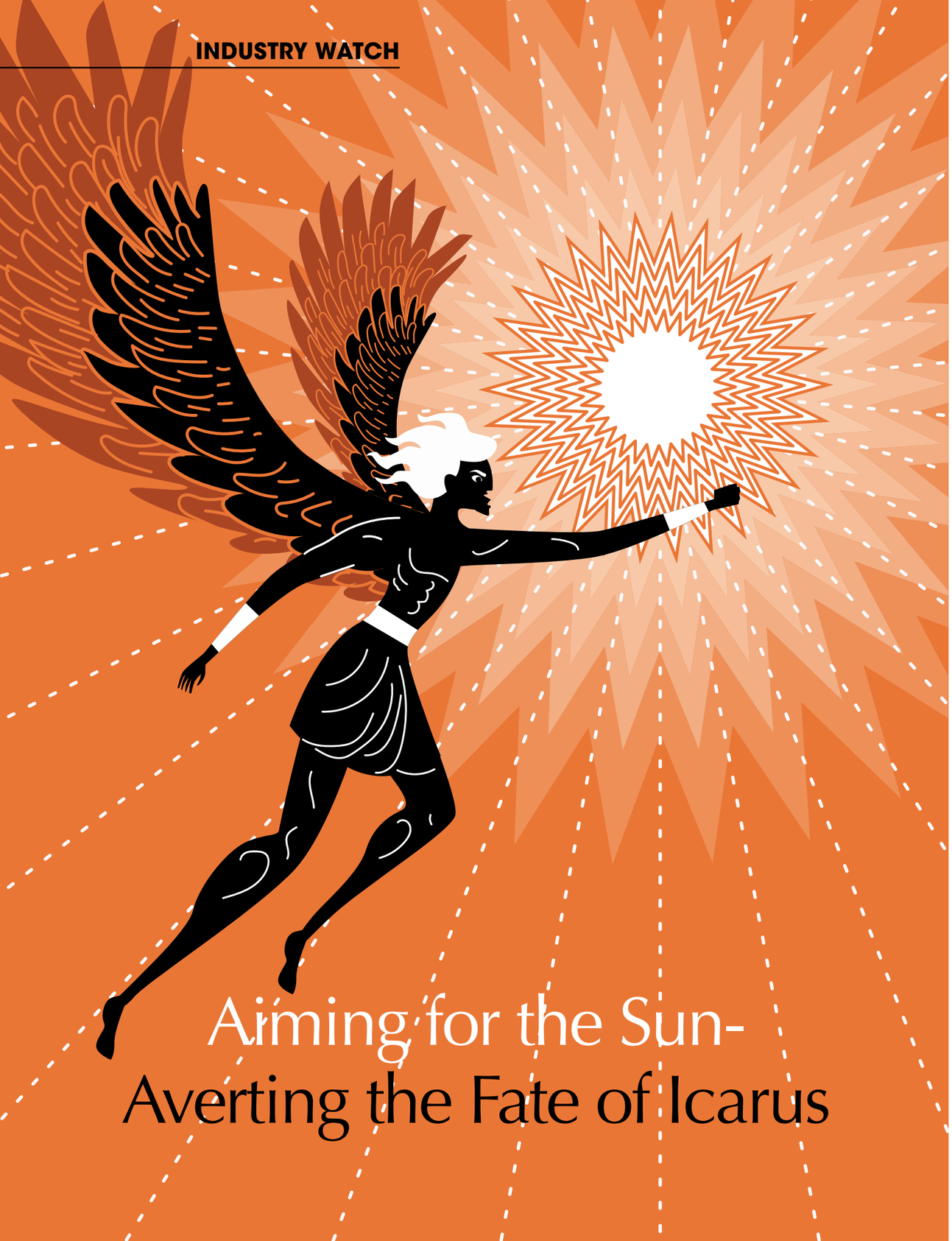

Aiming for the Sun-Averting the Fate of Icarus

De-risking solar energy projects.

By Manu Srivastava

Climate change is increasingly accepted as an existential threat to civilisation and 'business as usual' is considered a luxury we cannot afford any more. With burning fossil fuels accounting for almost half of the world's greenhouse gas emissions,[1] a world run on such energy sources is clearly not sustainable. At the same time, the cost of renewable energy (RE) has been dropping and it is becoming a viable alternative to fossil fuels. In fact, wind and solar energy prices have fallen as much as 73 percent in the last 10 years.[2] In the U.S., the total cost of building and operating an RE facility over its lifetime is expected to beat one running on fossil fuels by even larger margins over the coming years.[3] As per estimates, every U.S. dollar spent on RE today can generate US$3 in fuel savings by 2050.[4] It would hence come as no surprise that RE accounted for 72 percent of all new capacity installations worldwide in 2019.[5]

While both wind and solar power generation capabilities have become cheaper, the biggest price drop belongs to the solar sector, with its generating utility-scale power becoming as affordable as power from fossil fuels. This is a substantial feat for the sector, given that solar power was 7.6 times the cost of the cheapest fossil fuel-based power even as recently as in 2010. The savings for countries that adopt solar utility-scale projects is estimated to be huge, at about US$1 billion per year.[6]

We must therefore acknowledge that RE has arrived at a beautiful confluence of economic viability and environmental considerations—and this would facilitate the shift to a green future that does not require regulatory directions or government subsidy. It has the potential to lead humankind towards a more sustainable path of growth.

The fall in electricity costs from solar can be attributed to improved panel technologies, economies of scale, increasingly competitive supply chains, growing developer experience, and the rising comfort of financiers. This has been made possible by favourable policy and regulations framed by the governments, in addition to the vigour and initiative of the private sector. At the same time, project structuring has played a significant role and can further go a long way in reducing the price of clean technology. This article focuses on such successful attempts that have lowered the cost of RE, specifically solar power, in India.

Renewable energy: The cost and the risks

RE prices are lower than conventional power only in certain countries. Even in those countries, it is realised only for projects that are well-structured. Governments and project developers all over the world bear a responsibility to deliver projects where the developer risk is sufficiently mitigated. Setting up such viable projects can have multi-fold advantages. First, they attract established developers to countries that otherwise would be perceived as too risky. Second, they encourage sovereign, pension, and trust funds to invest in RE projects, since these groups of investors are more interested in assured returns than windfall profits. And third, the low risk profile would allow debt structuring at lower rates.

Some believe risk mitigation is a waste of time and effort since the RE sector is seeing an influx of large numbers of new players and prices are continuously decreasing. The bidding fields of RE projects in certain countries are increasingly witnessing the exuberance seen in casinos. Not surprising, they are also often observing accidents that usually accompany bouts of Russian roulette. Such failures deter serious long-term players from venturing into new countries and sectors.

Furthermore, most RE projects have a component of public investment, which is laid waste with the failure of the project. If the high risk-taking developers are missing, consumers will get a conservative price as lenders (who provide 70 to

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75 percent of the capital) are extremely risk-averse and will compel the deal to assume the worst case, reflecting a higher solar tariff.

Therefore, solar projects must be viable for the sustainable growth of the solar sector. Viable RE projects, ring-fenced from the uncertainties of the host country, would encourage investors to move beyond the OECD (Organisation for Economic Co-operation and Development) countries, boosting capital flow from pension, trust, and sovereign funds that are otherwise typically stuck in traditional sectors in developed countries at rather low rates of return. Capital becomes available internationally at low rates and for long periods, features that perfectly suit the RE sector with its typically long-term (20-25 years) Power Purchase Agreements (PPAs). Instead of well-meaning organisations beseeching banks and financial institutions for green commitment, debt at reasonably low rates would itself veer towards projects that are sufficiently de-risked.

Risk mitigation is even more important for the RE sector, since almost the entire investment in these projects has to be made prior to their commissioning, and the revenue expenditure is limited to operation and maintenance. Admittedly, risks can never be completely eliminated, especially for a period of 25 years, which invites uncertainty. However, it is the responsibility of the project proponent to anticipate and mitigate those risks and uncertainties. To a large extent, this could be made possible through careful project structuring and incorporating appropriate provisions in the PPA. A crucial issue is that unmitigated risks need not be left with the developer, and it is best to apportion a particular risk to the stakeholder that is best placed to address it.

Through the examples of two RE projects, this article illustrates how sound project structuring can go a long way in bringing down the cost of solar energy. The first example is the 750 MW Rewa solar plant in India, which achieved a first-year tariff-rate of INR2.97/unit (US$0.04/unit), when the accepted norm of the Government of India was to pay Viability Gap Funding[7] to achieve a tariff-rate of INR4.50/unit (US$0.06/unit). The other example is the rooftop solar project implemented in government buildings in the state of Madhya Pradesh, which achieved a rate of INR1.38/unit (US$0.019/unit) in its first year. Even if the subsidy were to be removed, its first-year tariff of INR1.38 would translate to INR2.28 (US$0.03), with three percent annual tariff escalation. This project brought rooftop solar prices on par with those for ground-mounted projects.

Although the scale of these two projects differs, they illustrate that sincere attempts at robust project preparation, risk mitigation, and appropriate risk distribution among stakeholders could make solar energy far more affordable, thus facilitating the shift from fossil fuel-based energy to green and clean solutions. More widely, the projects highlight the structuring features that lead to successful public-private partnerships (PPPs).

Risk reduction through robust project preparation

CLARITY ON LAND/SITE

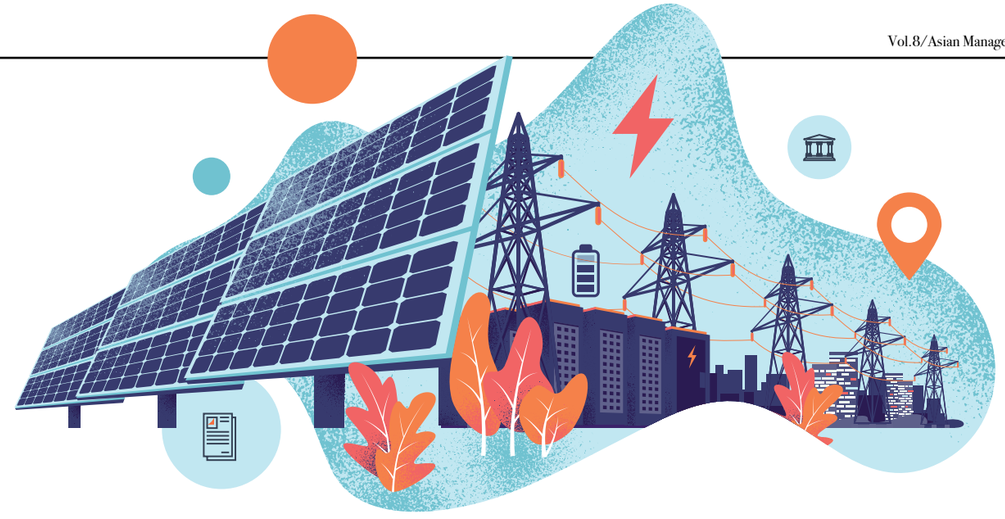
One of the initial challenges typically faced by ground-mounted solar projects is the unavailability of land. The same problem manifests itself as unavailability of rooftop sites for solar rooftop projects. In many countries, large parcels of land belong to the sovereign, hence the sovereign is usually better-placed to arrange the large areas of land needed for RE projects. Therefore, the responsibility of arranging the site should be taken up by a public organisation.

In the Rewa project, when the project was put to developers for bidding, 97 percent of land had already been procured by the project proponent, Rewa Ultra Mega Solar Limited (RUMSL), an entity jointly owned by Governments of India and the state of Madhya Pradesh. Similarly, for the rooftop solar project, only those projects where the rooftops had been made available were put up for bidding.

ADDRESSING INFORMATION ASYMMETRY REGARDING AVAILABILITY OF LAND/SITE

In both projects, data rooms were developed, where bidders could see the extent of land/sites that were made progressively available closer to their bidding dates. This was crucial for the rooftop project since developers in such projects usually have the added responsibility of marketing the Renewable Energy Service Company (RESCO) concept to consumers and negotiating the availability of the sites with them post-tender.

The data room in the rooftop solar project had detailed information about the buildings, such as their Google Map coordinates, indicative Solar PV array layouts superimposed on Google images, and monthly electricity bill figures. For example, if a project group in the rooftop tender consisted of 291 college buildings, its data room would have 291 folders, each containing the abovementioned information for one building. It would have been impossible for bidders to visit the 291 college buildings located over a state that runs around 1,000 km from east to west and



700 km from north to south. However, by accessing the data room, bidders could 'see' each of the 291 buildings and their pre-engineering solar project design with the click of a button.

Risk reduction through contractual provisions

PAYMENT SECURITY MECHANISM

The single biggest risk or uncertainty for a developer is receiving the tariff payment, and on time. Almost all the investment is made upfront, and the developer expects to recover it through tariff payments over 25 years. Hence, payment security is a key concern for developers. This is especially crucial when the customer is a utility provider, since utilities, especially in developing countries, are often loss-making and have poor financial ratings.

The Rewa solar project supplies 24 percent and 76 percent of its output to the Delhi Metro and utilities of Madhya Pradesh respectively. While the financial rating of Delhi Metro was unimpeachable, two out of three utilities of Madhya Pradesh had the lowest 'C' rating,[8] which indicated 'very low operational and financial performance capability'. The project addressed this risk by providing a unique three-tier Payment Security Mechanism (PSM). The first tier was a Letter of Credit from the utility, the second was a Payment Security Fund (PSF), and the third was a guarantee from the Madhya Pradesh state government against utility payments. Thus, the state government put up its own balance sheet to shore up the financial ratings of the utilities. With this innovative three-tier PSM, the project could successfully mitigate the enormous uncertainty regarding payment from the poorly-rated utilities.

TERMINATION COMPENSATION

As the PPA duration is usually 25 years, clarity regarding consequences of early contract termination provides much-needed comfort to developers and their financiers. In both projects, a termination compensation clause was included. The compensation offered is higher in the event of the procurer defaulting, as compared to the developer defaulting. As the third tier of the PSM, the state government guarantee also covered termination compensation, apart from delayed payments.

DEVELOPER COMMITMENTS COMMENCING WITH AVAILABILITY OF LAND/SITE

In a large number of projects, providing the land/site is the responsibility of the government or a public authority. Often, there is a delay in doing so, and the developer has to seek time extensions with its attendant challenges. The PPAs in both projects addressed this issue by stating that 'day zero' of the project would not start from the signing of PPA, but the day when the land/site was provided to the developer.

Appropriate distribution of risk among stakeholders

CHANGES IN LAW

Changes in law and regulations is a risk that the developer is typically ill-equipped to handle. The developer is not in a position to influence either the Government or the regulators. It is also not in a position to anticipate the changes, especially over a long 25-year PPA period. It is hence necessary that the developer be insulated from this risk, which should be borne by the utility/consumer through clearly stated 'change in law' provisions.

TAXATION

Changes in law often pertain to taxation. It would make things less discretionary if the correlation between any change in taxation and impact on tariff is provided upfront in the PPA. In the rooftop project, it was stated in the Request for Proposal (RfP) and PPA documents that the relative change in taxation on the capital and operational cost would impact the discovered tariff to the extent of 80 percent and 10 percent respectively. Even the benchmark costs for material components and yearly operation cost were provided in the documents. This meant that any change in taxation would lead to a corresponding change in the tariff that could be calculated through a formula given in the PPA, without having to file a petition before the regulator.

For instance, it was widely expected that there would be an imposition of safeguard duty of 25 percent on solar cells soon after the close of bidding of the rooftop project, which proved to be so. It was clarified prior to the bidding that based on the provisions in the documents, 25 percent of safeguard duty on solar cells would increase the discovered tariff by 5.2 percent. This gave enormous comfort to the bidders, as it ensured that any subsequent change in taxation would be added transparently to the discovered tariff.

INSULATE RELATIONSHIP FROM THE GRID

The relationship between the developer and the consumer, and the payments due to the developer from the consumer over the PPA period, should not depend on the decisions of the utility or the transmission company. For the rooftop solar projects situated within the premises of the consumer, the generator-consumer relationship has to be behind the metre. In other words, the generator needs to be paid based on the solar energy generated, irrespective of the regulations or the utility's policy regarding excess energy, banking, etc. Thus, the PPA should provide for payment based on readings from the generation meter. The decision of the regulator or the utility regarding solar power generated that is not immediately consumed might change during the period of PPA and this risk has to be borne by the consumer.

An interesting lesson from the Rewa solar project brought home the point that the risk should be borne by the stakeholder best placed to handle it. Delhi Metro, located 875 kilometres away from Rewa, was a consumer of Delhi utilities when discussions for the project started. The plan was to deliver power to Delhi through the national grid. Delhi Metro was keen on the delivery point being within the city. It seemed an innocuous request, given that the policy of the Government of India provided that inter-state transmission of RE would be free and the cost would be socialised. However, the relevant notification had not been issued until the bidding commenced. Hence, it would not have been appropriate to leave the risk of the inter-state transmission charges and losses from Rewa to Delhi with the developer, and Delhi Metro was persuaded that the delivery point would be Rewa and not Delhi.

After the PPAs had been signed and the project activities were about to begin, the Government of India issued the awaited notification, providing for free inter-state transmission of renewable energy, but applicable only to utilities. As Delhi Metro was not a utility, it could not take advantage of the free inter-state transmission. Given that the charges for transmission from Rewa to Delhi would have been almost 40 percent of the cost of power, had the delivery point been kept at Delhi as Delhi Metro had requested, the additional cost would have fallen on the developers who would have been unable to bear the additional charge and would have defaulted.

Nevertheless, since the delivery point had been decided as Rewa and the risk of charges for inter-state transmission from Rewa to Delhi was left with Delhi Metro, they took it upon themselves to request the Government of India for a change in policy. While the decision is still pending, transmission charges have not been imposed on Delhi Metro over the last two years that the project has been running. Even if such charges were to be imposed, they would be levied on Delhi Metro and the cost of delivering power from Rewa would still be lower than the rate of Delhi utilities. More importantly, the project has insulated itself from the risk of changing government policy.

Avoiding the fate of Icarus

Solar energy has shifted from the 'vicious cycle' of high cost that limits its application and consequent attention to a 'virtuous cycle'. In this context, the two examples of Rewa and Madhya Pradesh's solar rooftop projects demonstrate that risk mitigation through robust project preparation, careful project structuring, and appropriate distribution of risk among stakeholders can lead to successful solar projects.

Apart from the path-breaking low rates achieved, both the projects attracted enthusiastic participation from the developers. RUMSL, the proponent of Rewa solar project, was a new kid on the block. Established in July 2015, it has ventured into territories reserved for established federal companies. Despite this, as many as 20 reputable solar developers, including six international companies, participated in the

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bidding for the Rewa project. The tender was oversubscribed by 10 times. Similarly, Madhya Pradesh's RESCO tender attracted 40 international and domestic bidders, and was oversubscribed by 630 percent.

Following the Rewa project bid in February 2017, the Government of India issued Standard Bidding Guidelines for ground-mounted solar projects in August 2017.[9] These guidelines incorporated many notable features of the Rewa project, ensuring that the principles of risk reduction become standard practice for all ground-mounted solar projects in India, leading to a continued decrease in solar prices (which have, as of April 2021, reached INR 2/unit, or about US$0.026/unit). The Rewa project also received the World Bank Group President's Award for innovation and excellence for its transaction structure.

The Madhya Pradesh rooftop solar project, with an investment of US$26 million, led to government savings of US$323 million over its project life in net present value (NPV) terms. Its RESCO documents have been circulated by the Government of India to all states. The project is also being replicated by the World Bank in some Indian states and by the International Solar Alliance (ISA) in ISA member countries.

Solar energy is now the cheapest source of energy in many countries, without the crutches of regulatory directions or subsidies. This revolution has to be carried all around the world, to achieve the U.N. Sustainable Development Goals (SDGs) of energy access, economic development, and concern for the climate. There is a broad global coalition in favour of RE, and the establishment of organisations like the Indian Solar Alliance shows global commitment towards this cause. The time is ripe to think hard and act quickly to make a dent on the wall of fumes that humans have created.

We need continuous innovation to deliver solar power at lower costs. Solar project innovation is important and powerful because it can provide solutions that are more persistent than democratically-achieved compromises. At this moment in history, the calling is to set up viable projects where risks are mitigated and long-term returns assured. The risk mitigation needs robust project preparation and careful project structuring. Risks that cannot be mitigated need to be left not necessarily with developers, but rather with the stakeholder best placed to handle them. If we take such steps, we can fly high, without the solar sector meeting the fate of Icarus whose wings tragically melted when he came too close to the sun.

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is a member of the Indian Administrative Service (IAS). He was the Chairperson of RUMSL, from the beginning to the commissioning of the Rewa project

Endnotes

1. Our World in Data, "Global CO2 Emissions from Fossil Fuels and Land Use Change".
2. IRENA, "Renewable Power Generation Costs in 2019", International Renewable Energy Agency, Abu Dhabi, 2020.
3. Silvio Marcacci, "Renewable Energy Prices Hit Record Lows: How can Utilities Benefit from Unstoppable Solar and Wind?" Forbes, January 21, 2020.
4. OECD, "Climate Change Mitigation: We must do more", April 2021.
5. IRENA, "Renewable Power Generation Costs in 2019", International Renewable Energy Agency, Abu Dhabi, 2020.
6. Ibid.
7. In India, Viability Gap Funding (VGF) refers to government support offered to public-private partnerships (PPP) projects that are assessed to be economically justified but not financially viable.
8. Powerline, "Ranking Discoms: MOP's Latest Report Shows Performance Improvement, Gujarat Utilities Continue to Lead", October 2019.
9. Ministry of New and Renewable Energy, Government of India, "Guidelines for Tariff-Based Competitive Bidding Process for Procurement of Power from Grid Connected Solar PV Power Projects", August 3, 2017.