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This rating methodology describes ICRA’s approach to assess the credit risk of solar and wind power producers<sup>1</sup>. It aims to help issuers, investors and other interested market participants understand ICRA’s approach to analysing risks that are likely to affect the rating outcomes of the companies in the solar and wind energy sector. This rating methodology updates and supersedes ICRA’s earlier methodology note on solar power producers, published in July 2023, and also integrates the methodology applicable to wind power producers. While this revised version incorporates a few modifications to provide more clarity on a few aspects, ICRA’s overall approach to rating entities in the sector remains materially similar.

### Overview

The all-India renewable energy capacity (excluding large hydro) that primarily includes solar and wind energy-based capacity installations has grown considerably to 172.4 GW as on March 31, 2025, from 35.8 GW as on March 31, 2015. The growth in the renewable energy sector has been driven by the strong policy support from the Government of India and various state governments, regulatory support in the form of renewable purchase obligation (RPO) norms and significant improvement in cost competitiveness of solar and wind energy.

The share of solar energy-based capacity within the renewable energy (RE) segment in India remains the highest and has increased to 61.3% as on March 31, 2025, from 10.5% as on March 31, 2015, while the share of wind capacity has decreased from 65.5% as on March 31, 2015 to 29.0% as on March 31, 2025. The share of wind-based capacity in the RE segment has declined over the past years, owing to the relatively subdued capacity addition between FY2018 and FY2022, following the shift from feed-in tariffs to competitive bid-based tariffs, greater execution challenges for wind projects and the sharp increase in solar power installations driven by more competitive tariffs, wider distribution of potential areas for setting up solar projects and a relatively shorter gestation period. Nonetheless, the growth potential for both, wind and solar remains high with the Government of India, as part of its climate change commitments is targeting to increase the renewable energy capacity to 500 GW by 2030.

The demand for solar and wind energy is driven by a confluence of factors, including policy focus on the renewable energy sector, large untapped solar and wind power potential, cost competitive tariffs and the growing demand for electricity. The tariff competitiveness for solar power projects is led by a decline in module prices over the years and improvement in module efficiencies.

<sup>1</sup> The rating methodology of solar and wind power producers have been combined as there are many similarities while assessing the risk profile of these companies.

In case of wind projects, higher plant load factor (PLF) with the use of wind turbine machines having higher hub height and rotor diameter led to competitive tariffs. Additionally, the Government is promoting solar rooftop installations and distributed solar power plants. Also, incentives are being provided for adoption of solar power agriculture pumps by farmers and installation of small-scale solar power plants by farmers /cooperatives /panchayats on their excess land.

Despite the strong growth potential, solar and wind power projects face challenges owing to delays in land acquisition, securing transmission connectivity and signing of power purchase agreements (PPAs) by the intermediate procurers because of delays in the signing of power sale agreements (PSAs) with state distribution utilities (discoms), modest credit quality of state discoms and variability in generation. Moreover, projects sometimes face tariff viability concerns owing to capital cost pressure from fluctuations in key equipment costs and from generation being lower than estimated. Additionally, the sector is exposed to regulatory challenges associated with the inconsistency in renewable purchase obligation (RPO) norms across states and against the RPO norms suggested by the Ministry of Power, Government of India as well as the challenges in integrating the growing share of wind and solar power with the grid given its intermittent nature. Further, solar and wind power producers remain exposed to the regulatory challenge of implementing forecasting and scheduling regulations.

Given the growing share of renewables in the generation mix and intermittency associated with these projects, the Government is promoting hybrid (solar plus wind) projects to compliment energy storage capacity (battery or pumped hydro) for round-the-clock (RTC) or peak-time power supply. This is visible through a number of RTC and firm and dispatchable RE (FDRE) bids issued by central nodal agencies such as Solar Energy Corporation of India Limited (SECI), NTPC Limited (NTPC), NHPC Limited (NHPC) and SJVN Limited (SJVN). Apart from the risks associated with solar and wind components, these projects would remain exposed to risks associated with storage systems like cycle losses, degradation (in case of battery storage) and high execution risks (in case of pumped hydro).

Energy Storage Systems (ESS) are becoming essential for grid stability, enabling peak shifting, storing surplus energy, and providing other ancillary grid services. This shift is evident in the rising number of renewable-plus-storage tenders floated over the last three years. According to the Central Electricity Authority's National Electricity Plan, India's storage needs will grow to 411.4 GWh by 2031–2032 from 82.37 GWh in 2026–2027, which will be met by a mix of pumped storage (PSP) and battery storage (BESS) projects.

## ICRA’s Analytical Approach for Rating Power- Solar and Wind

Solar and wind power projects are usually developed through special purpose vehicles (SPVs) with cash flow ring fencing from the sponsors. The projects typically have PPAs for a period of 25 years, which is also considered to be the useful life of the projects. The methodology articulated below is applicable for issuers with greenfield and operational projects (either single asset or portfolio of projects). The list of rating drivers covered here is not exhaustive but provides an overall perspective on the most important considerations. ICRA’s analytical approach for rating solar and wind power producers can be broadly divided into the following factors:

Industry Risk Drivers	Business Risk Drivers	Financial Risk Drivers	Other Elements of Credit Risk Assessment	Management and Parentage
<ul style="list-style-type: none"> <li>Regulatory risk</li> </ul>	<ul style="list-style-type: none"> <li>Permitting risk</li> <li>Funding risk</li> <li>Construction risk</li> <li>Operating risk</li> <li>Asset diversification</li> <li>Demand and tariff risk</li> <li>Counterparty credit risk</li> <li>Force majeure risk</li> </ul>	<ul style="list-style-type: none"> <li>Adequacy of future cash flows</li> <li>Profitability</li> <li>Leverage and coverage indicators</li> <li>Liquidity</li> </ul>	<ul style="list-style-type: none"> <li>Financial flexibility</li> <li>Tenure mismatches and risks relating to interest rates and refinancing</li> <li>Foreign currency-related risks</li> <li>Debt transaction structure</li> <li>Accounting quality</li> <li>Contingent liabilities/ Off-balance sheet exposures</li> <li>Event risks</li> </ul>	<ul style="list-style-type: none"> <li>Quality of management</li> <li>Financial policy</li> <li>Governance structure and practices</li> <li>Parentage</li> </ul>

## Industry Risk Drivers

### Regulatory risk

The regulatory risks are mainly seen for the projects with PPAs under the renewable energy certificate (REC) route, or, for projects selling power under the open access route. The inconsistency in the RPO norms approved across the states against the trajectory notified by the Ministry of Power, Government of India and less than satisfactory compliance of the RPO norms by obligated entities affect incremental capacity addition of renewable energy capacity and RECs. This in turn adversely impacts the projects based on the REC route. Further, any constraints in allowing open access and banking arrangements and increase in open access charges pose regulatory risks for solar and wind power projects, which are based on third-party sale/captive consumption/group captive sale. Also, delays in adoption of the tariffs discovered through the bidding process by the concerned central and state regulators pose regulatory risks for the solar and wind power developers and could lead to delays in project implementation. Any changes in the project cost on account of changes in taxes, duty structure or any other event as defined in the PPA post the conclusion of bidding, is covered under a change in law clause which requires regulatory approval. There have been instances of delays in securing such approvals, which could necessitate additional funding support from the sponsor in the interim.

Further, given that state-owned distribution utilities remain the key offtakers in most cases, ICRA focuses on regulatory risks in the distribution sector such as delay in the tariff determination process, inadequate tariffs in relation to the cost of supply and non-implementation of any tariff order due to litigation. Challenges like these can impact the financial position of the state distribution utilities and in turn heighten the counterparty credit risk for solar and wind power producers.

While the PPAs are contractual documents, instances of attempts to re-negotiate the PPA terms unilaterally have also been seen (like in case of Andhra Pradesh in 2019), resulting in prolonged legal and regulatory proceedings. In the interim, such events could impact the payments from the offtaker, adversely impacting the project cash flows. The occurrence of such regulatory developments remains an event risk.

## Business Risk Assessment

With reference to business risk assessment, only greenfield or expansion projects are exposed to permitting risk, funding risk and construction risk.

### Permitting risk

Permitting risk refers to a company's ability to secure all statutory clearances required for constructing and operating a solar or wind power plant as well as to comply with the applicable norms. While assessing the permitting risk, ICRA evaluates the progress on land acquisition and examines the status of various clearances in accordance with the laws of the land, for the projects under implementation. The critical approvals required for a solar or a wind power project include approval for transmission connectivity to the designated substation and long-term open access for supplying power generated to the grid (intrastate/interstate network). While the permitting risk for a greenfield solar or wind power project is relatively lower than thermal or hydro-based projects, given the exemption from environmental and forest clearance (except in case of use of forest land), the developers have faced delays in the past in securing approvals for connectivity to interstate/intrastate transmission network and completing land acquisition, leading to delays in project implementation. The permitting risk for PSP projects is anticipated to be high on account of the requirement of environmental and forest clearances, which has led to major delays for many hydro projects. In case of projects awarded in a renewable energy park, which provides a developed land plot with clearances and associated infrastructure including grid connectivity, the permitting risk is lower than that for a greenfield project at locations outside the renewable energy park.

### Funding risk

This assessment focuses on ascertaining the company's ability to tie up requisite finances, the status of the funding tie-up and the capital structure mix. Given the capital-intensive nature of the renewable energy projects and the typical debt-equity ratio of 70:30 or 75:25 adopted by the developers, such projects tend to have high financial leverage. The capital cost and the capital structure are evaluated in relation to other renewable energy projects. The reasons for variations (if any) in the capital cost with other renewable energy projects are assessed, which may be due to the higher cost of land and/or equipment configuration. The average cost of debt and the foreign exchange component in debt (if any) are also looked at. The equipment configuration<sup>2</sup> in case of solar PV projects may vary, depending upon the ratio of direct current (DC) capacity, alternating current (AC) capacity and use of trackers<sup>3</sup>, to maximise the PLF level within the permitted level as per PPA terms. While equity is arranged by the sponsor, the developer remains dependent on banks, financial institutions (FIs) and bond markets for debt funding. ICRA evaluates the extent of actual funding tie-up and the likelihood of the balance funding being available on time, so that project progress is not delayed due to lack of funding tie-up. Even though project finance is generally 'non-recourse' in nature, the strength of the sponsors is an important risk mitigation factor, as it imparts financial flexibility in terms of funding cost overruns or meeting other contingencies.

### Construction risk

Construction risks refer to challenges associated with the physical construction of a plant (including the associated evacuation network in the project scope) as well as stabilisation of design operating parameters (which includes plant availability and PLF) after commissioning. Delays in either can lead to time and cost overruns. In the past, the solar and wind power projects were typically executed under the turnkey nature of project execution<sup>4</sup>, wherein the entire responsibility, including land acquisition and development, was taken by the engineering, procurement and construction (EPC) contractor. Fixed-price, fixed-time

<sup>2</sup> DC-AC ratio: Capacity contracted as per PPA is in alternating current (AC) form to be compatible with the grid network. At module level, generation is in direct current (DC) form which is converted into AC form through an inverter. Higher DC-AC ratio by having a higher PV module capacity allows the project to generate higher solar energy; however, this ratio is required to be kept at an optimum level (which generally varies at 1.1-1.5 times), depending upon the permitted level of PLF in the PPA as well as availability of land at the project site.

<sup>3</sup> Tracker: Directs solar panels or modules toward the sun, by changing their orientation throughout the day to follow the sun's path for maximum energy capture.

<sup>4</sup> Turnkey responsibilities comprise activities related to purchase/lease of land, obtaining various statutory permissions, supply of wind turbines, installing and commissioning of the same and, subsequently, providing operations and maintenance (O&M) services.

contracts, with adequate clauses for liquidated damages (LD) are usually the mitigating factors against construction risks (essentially, the risk gets transferred to the EPC contractor). The developer may either source the plant components such as modules, wind turbine generators (WTGs), inverters or the balance of system components on its own or may enter into a supply contract with the EPC entity itself, which then sources it on behalf of the developer. Many developers have also gained expertise and undertake EPC in-house. Also, major wind independent power producers (IPPs) have themselves ventured into the EPC business, wherein the wind turbine generators are supplied and installed by the manufacturers, and the balance work is undertaken by other sub-contractors.

Solar power developers are now required to procure PV modules from domestic manufacturers listed under the Approved List of Models and Manufacturers (ALMM) notified by the Ministry of New & Renewable Energy (MNRE), Government of India. Further, it is to be noted that regulations related to the ALMM for solar PV cells, is scheduled to be implemented from June 1, 2026, which requires procurement of solar PV cells used in manufacturing modules from domestic manufacturers. This could pose a risk to solar power developers such as supply shortages, increased tariffs, and potential project delays due to limited domestic cell manufacturing capacity currently. In this context, the scale up in domestic cell manufacturing capacity and availability of cells and modules within the budgeted costs for the developers would remain important.

The construction challenges for a PSP project remains quite high in comparison to other renewable projects as these entail high execution complexities and added risks pertaining to geological surprises. However, for a battery storage project the construction risk is relatively lower than a PSP project as it requires only integrating the battery packs with the remaining project components. Further, in terms of FDRE and RTC projects, there is significant capacity oversizing as compared to the contracted capacity, although in terms of execution, the challenges remain largely same as that for implementing solar and wind projects.

While assessing the construction risks, ICRA evaluates the status of project construction vis-à-vis the scheduled commercial operation date (COD), including the ancillary services such as transmission connectivity to the designated grid substation. Further, the risk of any delays in availability of the grid substation by the central or the state transmission utility (as applicable) is evaluated. In all project ratings, ICRA carries out a sensitivity analysis to evaluate the impact of the delay in commissioning or in stabilisation of plant operations on the projected cash flows and debt servicing ability. The LD clauses, which are a part of the contract with the EPC contractor, are also evaluated to assess their adequacy with respect to the loss of profits and/or liquidated damages payable by the developer to offtakers. ICRA endeavours to assess the creditworthiness of the EPC contractor to the extent possible, and its ability to pay the LD charges to the developer in case the situation arises.

### Operating risk

The operating risks for an issuer engaged in solar and wind power generation arise from the vulnerability of the plant's PLF to variability in solar irradiation and wind speed respectively, which is susceptible to weather conditions at the project location. The generation also remains susceptible to the performance of the solar PV modules, WTG machines and inverters. Moreover, the modules undergo a degradation in efficiency, which typically is seen to be about 0.5-0.7% per annum. Evaluation of original equipment manufacturers (OEM) performance warranties and equipment track record under local conditions is key to assessing operational risks in solar and wind power projects. Typically, the OEMs provide a warranty on solar modules for 90% of the rated output by the end of 10 years and 80% at the end of 25 years. Assessment of module suppliers' track record in honouring the warranty claim and availability of mitigants like third-party insurance is crucial for evaluating risk in renewable energy projects.

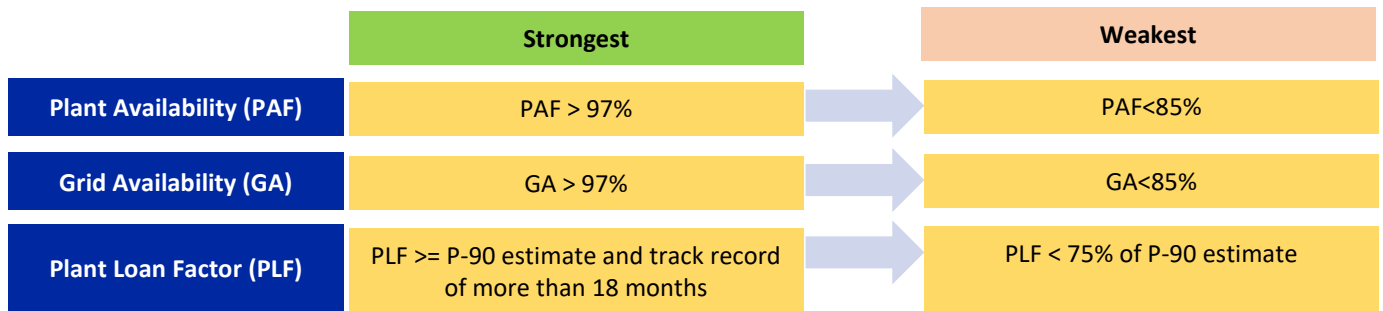
For storage projects, parameters such as cycle losses and battery degradation (for battery storage project) also remain critical. Additionally, for FDRE/ RTC projects, ability to meet the guaranteed availability and supply including during peak hours for FDRE projects remains critical, as any non-compliance may attract penalty as defined in the PPA, adversely impacting the coverage and return metrics. This is expected to be achieved by integrating solar, wind and storage projects.

For operational projects, ICRA analyses the actual performance in terms of plant availability and PLF and its variance against the P-90 generation estimate as per the energy yield resource assessment study. Projects meeting or exceeding the generation

estimates are viewed positively by ICRA. While assessing resource variability risk, ICRA considers 90% of the P-90 estimate in the first year of operations, given the stabilization period involved post commissioning and thereafter, in line with P-90 estimate as per the energy yield assessment study. For projects with an operating track record beyond three years, ICRA considers the actual PLF level as base case assumption in the projections.

The solar and wind power plant’s PLF remains vulnerable to plant availability, which could get adversely impacted, in case of inadequate maintenance by the O&M partner. In this context, ICRA endeavours to review the operations and maintenance (O&M) contract to assess the available mitigants such as LD clauses for any shortfall in plant availability below the guaranteed level. Also, ICRA examines the track record of grid availability for the project and incidence of any grid availability issues in the region. In addition, ICRA evaluates the compensation clause in the PPA for grid non-availability and factors the benefit of such clause in the financial projections suitably. In case of PPAs that do not have such clause for compensation due to grid non-availability, ICRA assesses the impact of the same on cash flows, particularly in states where such issues have prevailed in the past and are likely to remain for a longer period. Evaluation of a developer’s ability to manage operations and maintenance (O&M) independently, along with the availability of spare parts for the WTGS and inverters, is essential in case of financial constraints with the O&M contractor.

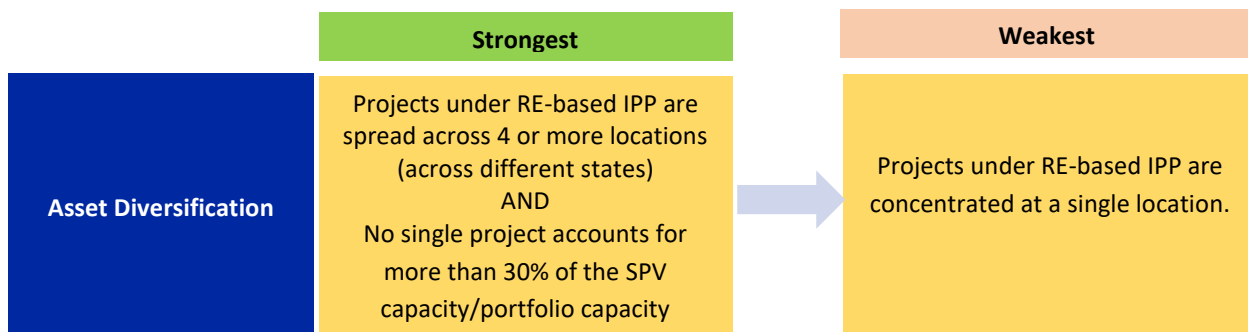
The scoring thresholds for the operating parameters of a solar and wind power project are provided below:



In addition, ICRA assesses the impact of the scheduling and forecasting mechanism approved by the regulators for solar and wind power projects, wherein higher-than-permitted deviation between the actual and the forecasted generation will attract penalties. Given the variable and intermittent nature of generation by solar and wind power projects, which is further aggravated by weather related changes, forecasting with the required accuracy remains critical and the impact of such penalties on the financial profile of the power producer is evaluated.

**Asset diversification**

Most solar and wind power SPVs have single-location projects, leading to asset concentration and exposing the project performance to weather conditions at that site. Also, there is a greater degree of risk from any force majeure events. In case of projects spread across multiple locations in different states, ICRA draws comfort from the geographical diversity of the portfolio, which acts as a mitigant against wind/radiation variability risk, to some extent.



### Demand and tariff risks

The demand risk for a solar or a wind power project is normally mitigated through the tie-up of a long-term power purchase agreement (PPA), which generally includes payment of tariff linked to the electricity units supplied by the power project. A solar or a wind power project can tie-up PPA through multiple ways, including with [a] Central intermediate procurer or state distribution utility (discom) through the competitive bidding route, [b] state discom through the feed-in tariff mechanism (prevalent till FY2017 in wind segment), [c] state discoms at the average power purchase pooled cost (APPC) rate and availing RECs, and [d] large commercial and industrial (C&I) customers under the third-party PPA or captive mode. At present, most projects are securing PPAs through the bidding route with intermediate procurers (like SECI and NTPC) or state discoms, followed by PPAs with C&I customers.

For assessing the demand risk, ICRA evaluates the status of the PPA tie-up and the provisions of the PPA such as tenure, tariff, take-or-pay obligation, PLF floor and cap, billing and payment security mechanism, compensation clauses for grid unavailability and grid curtailment, events of default and termination payments. ICRA views a long-term PPA at a fixed tariff rate favourably, given that it mitigates the risk associated with demand and pricing. Within the various revenue models, PPAs with Central nodal agencies are viewed more favourably than those with state distribution utilities and C&I customers, due to factors such as adequate payment security mechanism and benefit of tripartite agreement signed by central nodal agencies like SECI, NTPC, NHPC and SJVN with the Government of India, state governments and the RBI, for realising payments from discoms. Further, the PPAs with clauses mitigating risks associated with grid curtailments and termination payments in case of any event of buyer's default, are viewed favourably. For FDRE and peak power projects, some exposure to merchant markets is expected depending on the project's configuration and capacity oversizing, exposing them to demand and tariff risk to a certain extent.

Though solar and wind based energy generation is allowed as a 'must run' principle under the Indian Electricity Grid Code, back down restrictions have been imposed by the utilities in the past, in a few cases. ICRA assesses the tariff competitiveness of the solar and wind energy tariff in PPA in relation to the average power purchase cost for the offtaker utility. For projects having PPAs with third-party consumers or for captive consumption, ICRA assesses the regulatory environment related to eligibility criterion for group captive projects, adequacy of the banking and wheeling arrangements and open access charges. Also, for projects with C&I customers, the adequacy of the lock-in period in the PPA in relation to the debt tenure and availability of termination payments are evaluated. For projects availing the REC benefit, ICRA evaluates the REC sale trends and price movement on the power exchanges. Further, in case of projects selling power at APPC rate, delay in determination or deviation from the Central Electricity Regulatory Commission's (CERC) regulations for determining APPC, increases the business risk of the solar and wind assets. For rooftop-based solar projects, ICRA evaluates the applicable regulations with respect to net metering<sup>5</sup> policies in the respective states.

For projects wherein the PPA tenure is lower than debt tenure, such projects remain exposed to demand and tariff risk. In such a scenario, solar and wind power projects with competitive cost of generation can explore the avenues for power sale, especially in states with relatively higher tariffs for HT industrial/commercial customers, besides utility auction route. However, such projects also remain exposed to regulatory risk arising from any restrictions imposed by the utilities on open access and/or an increase in open access charges by the SERCs in the respective states.

### Counterparty credit risk

In assessing the counterparty credit risk, ICRA evaluates the financial position of the counterparty, the track record of payments and the strength of the payment security mechanism (PSM). State-owned distribution utilities, being the key obligated entities to meet RPO norms, are offtakers for solar and wind power producers in most cases. The PSM in PPAs with these utilities usually comprises revolving letter of credit (LC) for an amount equivalent to one month of billing. In addition to the PSM, ICRA examines the clauses in the PPAs in case of delays in payments by the offtaker, like the availability of right for sale of power to an alternative buyer, in case delays in making payments exceed a certain limit. In case of PPAs with multiple utilities, the

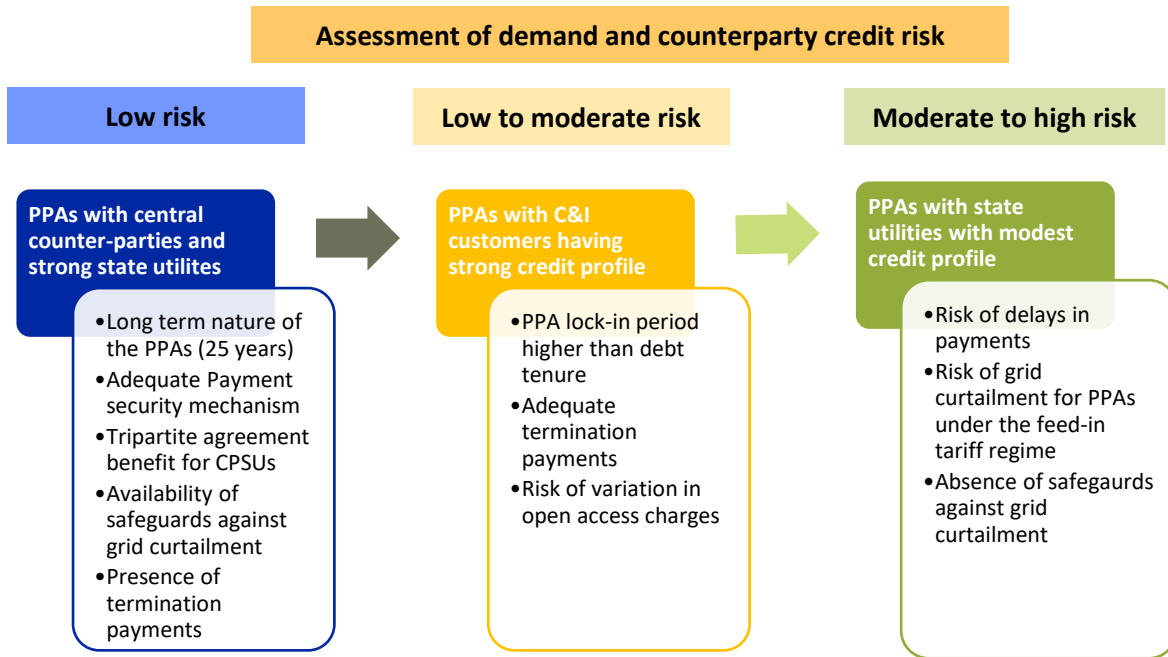
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<sup>5</sup> Net metering: Under this arrangement, the owner of a rooftop solar PV plant can sell excess power generated to the distribution utility and procure electricity from the distribution utility, as and when required, using a bi-directional meter to track this electricity exchange.

diversification in the counterparty risk is factored in the rating. Assessment of a distribution utility’s financial health involves evaluating cost coverage trends, adequacy and frequency of tariff revisions, and operating and financial efficiency metrics, alongside its linkage to the state government’s credit quality.

For projects where the PPA is signed with a central intermediary procurer such as NTPC Vidyut Vyapar Nigam Limited (NVVN), NTPC, NHPC and SECI, who in turn sign PSAs with the ultimate offtakers being state-owned distribution utilities. For such PPAs, ICRA endeavours to examine the key clauses related to PSM under the PSA as well, in addition to the PPA. Further, ICRA evaluates and suitably factors in the payment security benefits available for PPAs with central counterparties, such as a) letter of credit, b) provision for payment security fund supported by budgetary allocation from Ministry of New and Renewable Energy (MNRE) under policy framework, and c) benefits available to SECI/NTPC/NHPC, which are covered under tri-partite agreement<sup>6</sup> with the RBI, the state governments and the Government of India to ensure timely payments under power supply agreements between SECI / NTPC/ NHPC and the state discoms for supply of power. In case of PPAs with third -party C&I customers, ICRA also assesses the counterparty credit risk by evaluating the financial position of such offtakers. Over the past three years, the collections and payment discipline from the state discoms have remained satisfactory, aided by the implementation of the Late Payment Surcharge Rules (LPS) 2022.

In case of operational projects, ICRA focuses on the timeliness in cash collections from the offtakers and the extent of compliance of PSM in line with the terms of the PPA. ICRA favourably views the realisation of payments within PPA-stipulated timelines from the offtakers. For under-construction projects, ICRA analyses the track record of payments by the offtaking utility to other IPPs. If the SPV is dependent on a limited number of counterparties, the rating of the SPV is linked to the counterparties’ credit profile, unless there are mitigating factors such as strong liquidity buffer and presence of a strong parent/ promoter group, which is expected to provide support to the SPV, in case the need arises.



<sup>6</sup> NTPC/SECI is a beneficiary of the tripartite agreement (TPA) between the Government of India, state governments and the Reserve Bank of India (RBI), which ensures a payment security mechanism for supply agreements between Central PSUs such as SECI and state discoms.

## Financial Risk Drivers

### Adequacy of future cash flows

As the prime objective of the rating exercise is to assess the adequacy of the company's debt servicing capability, ICRA draws up projections on the likely financial position of a company under various scenarios, in addition to reviewing the past financials. The future cash flows are projected considering the tariff under the PPA, the PLF (based on 90% of the P-90 estimate in the base case for first year of operations and P90 estimate thereafter, for under-construction and projects with less than three years of track record; actual PLF for projects for more than three years of track record with suitable adjustments related to any one-off events), O&M cost as per the contractual terms with the O&M contractor, interest cost, debt repayment schedule, working capital and other funding requirements related to expansion (if any). These cash flows are then used to determine the company's future debt servicing capability. Further, ICRA evaluates the breakeven PLF for the project over the debt servicing period and compares it with the estimated PLF as per solar and wind resource assessment study for a greenfield project and with the actual PLF in case of an operational project, to determine the cushion available from a debt servicing perspective.

The various financial metrics assessed by ICRA could be divided into four categories—profitability, leverage, coverage, and liquidity. This document provides a summary of why ICRA considers these ratios to be important. For a more detailed description, readers may refer to the note titled, Approach for Financial Ratio Analysis, published on ICRA's website.

### Profitability

The revenue profile for a solar or a wind power project with a PPA remains sensitive to the level of energy generation, which in turn depends upon the solar irradiation/ wind speed/ weather pattern at the project location. Any adverse variation in solar irradiation/ wind pattern availability impacts the generation, which in turn impacts the company's revenues and cash accruals. However, for projects without the PPA, the revenue profile remains sensitive to the level of power offtake, in addition to generation. Given the capital intensity of the project, low operational expenses and finite life, the rating methodology focuses on return indicators (IRR) instead of profitability indicators. ICRA assesses the project IRR in relation to the company's weighted average cost of capital.

For projects based on regulated tariffs, returns remain dependent upon their ability to ensure that the actual costs and PLFs are in line with or better than the normative benchmarks. For projects based on the REC route, returns remain exposed to the market risks associated with the REC demand and pricing. ICRA evaluates the extent of cash flow mismatches for such projects, if the RECs remain unsold. For projects based on competitively bid tariff or captive projects with mutually negotiated tariff, the returns remain dependent upon the project developers' ability to ensure that the PLF level, the capital cost as well as other operating and financing costs are in line with the bid assumptions in quoted/mutually negotiated tariff.

### Leverage and coverage indicators

The solar and wind power projects are generally funded with a large proportion of external debt leading to high financial leverage. Nonetheless, availability of debt with a long maturity profile and competitive interest rate can partially offset the risk associated with a high financial leverage. In view of this, analysis of debt coverage indicators like cumulative debt service coverage ratio (DSCR) and minimum DSCR over the debt repayment tenure, hold primacy.

For projects having long-term PPAs, the financial assessment is primarily driven by debt coverage metrics like cumulative and minimum DSCR. However, for projects without long-term PPAs or renewable energy holding companies, the financial assessment is driven by a mix of leverage (total debt to operating profits) and coverage (DSCR) metrics considering the vulnerability of revenues and cash flows for such projects to volume and tariff risks. ICRA evaluates multiple scenarios to assess the DSCR over the debt repayment period with the key sensitive variables such as project cost, PLF and cost of debt. For projects adopting the REC route, additional sensitivity factors include the trends in APPC/bilateral/spot tariff rates and realisation of the REC. Further, in case of solar and wind power projects selling power to third-party consumers including under captive mode, additional sensitivity factors include the variation in open access charges and its impact on tariff realisation.

Typically, the developers infuse the required promoter contribution for a project SPV through a mix of equity and unsecured debt. As per the terms of the loan agreement, such promoter debt typically remains subordinated to the project debt from lenders while payments on the promoter debt are allowed by lenders, subject to meeting the stipulated restricted payment conditions. Also, the sub debt holders do not typically have a right to call an event of default, leading to either acceleration of the debt payment or initiation of bankruptcy proceedings. In such instances with presence of an escrow/cash flow waterfall mechanism monitored by the lenders/trustee, the leverage and coverage metrics for the project SPV are assessed on the external project debt.

The ratios typically used to analyse a company’s coverage metrics are:

Ratio	Computation
<b>Debt Service Coverage Ratio</b>	(Net Profit After Tax + Interest + Depreciation) / (Interest + Repayment + Dividend on Preference Shares)

In addition, ICRA compares the debt repayment tenure in relation to the tenure of the PPA tied up by the solar and wind power producer. If the repayment tenure is longer than the PPA tenure, the coverage metrics are evaluated for any revision in tariff following the expiry of the PPA, based on the prevailing tariff trends for similar projects in the sector.

**Assessment of profitability, leverage and coverage metrics -Solar projects**

[Indicative Metrics]

Salient Parameters	Key Ratios	Strongest	Weakest
<b>Leverage</b>	Total debt/ OPBITDA	<=1.5	>6.0
<b>Coverage</b>	Cumulative DSCR over the debt tenure	>=1.5	<1.1
	Minimum DSCR over the debt tenure	>=1.35	<1.0
<b>Profitability</b>	Internal rate of return (IRR)	>=12%	<4%

**Assessment of profitability, leverage and coverage metrics -Wind projects**

[Indicative Metrics]

Salient Parameters	Key Ratios	Strongest	Weakest
<b>Leverage</b>	Total debt/ OPBITDA	<=1.5	>6.0
<b>Coverage</b>	Cumulative DSCR over the debt tenure	>=1.6	<1.1
	Minimum DSCR over the debt tenure	>=1.45	<1.0
<b>Profitability</b>	Internal rate of return (IRR)	>=12%	<4%

**Liquidity**

Liquidity is the measure of an entity’s ability to meet its short-term cash obligations from various internal or external resources. For a solar or a wind power project, internal resources include cash flows from sale of power, debt service reserve account (DSRA) and free cash balances. External resources include undrawn lines of credit or equity capital. The short-term obligations

include operating costs, debt servicing obligations, working capital requirements and capital expenditure (if any). The higher the cushion available between the resources available (especially internal resources) and the obligations, better is the liquidity profile of an entity. ICRA also notes that the liquidity available with an entity may be for a temporary period and, hence, an entity's overall policy towards maintaining adequate liquidity in the form of DSRA, undrawn working capital lines and free cash balances is accorded due importance in the analytical approach. ICRA evaluates the transaction documents to ascertain the availability of DSRA prior to default, to ensure timely debt servicing. If DSRA is available for use only post default or is contingent on meeting certain conditions, ICRA does not consider DSRA for the liquidity assessment.

Further, ICRA evaluates the debt amortisation structure in relation to the seasonality in cash flows, as 60-70% of wind energy generation is during the peak wind season of about 4-5 months in a year. For a solar and wind power SPV, surplus cash flows after meeting the financial covenants stipulated by the lenders, and after maintaining liquidity reserves as per the cash flow waterfall mechanism are assumed to be paid out to the sponsor and/or used for debt prepayment under the cash sweep mechanism of the loan agreement.

## Other Elements of Credit Risk Assessment

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### Financial flexibility

An entity's financial flexibility (or the lack thereof) is reflected in its ability to access the capital or the money markets at short notice, attract diverse and marquee investors and enjoy the confidence of banks, financial institutions and intermediaries. A strong financial flexibility allows an entity to raise fresh borrowings or refinance existing ones in quick time and whenever required. For a solar or a wind power project, financial flexibility could arise from factors such as the tail period<sup>7</sup> available in the PPA and/or strong parentage or linkages with a strong group.

In case of entities with a bullet debt repayment structure, ICRA examines the refinancing ability of such projects by assessing the expected cash flows from the balance tenure of the project life. Herein, ICRA considers ratios such as project life coverage ratio (PLCR) for assessing refinancing capability.

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<sup>7</sup> Residual PPA tenure after completion of scheduled debt repayment

Ratio	Computation
<b>Project Life Coverage Ratio</b>	(Net present value of the projected cash flows from the project over the balance life discounted at the cost of debt) / (Outstanding debt)

**Tenure mismatches and risks relating to interest rates and refinancing**

Given the capital-intensive nature of the operations for solar and wind power projects, ICRA views a longer debt maturity profile and ballooning repayment structure positively. Dependence on short-term borrowings to fund long-term investments can expose a company to significant refinancing risks, especially during periods of tight systemic liquidity. One source of mitigation could be the existence of adequate buffers of liquid assets/ committed bank lines to meet short-term obligations. Another source of mitigation could be the entity’s strong financial flexibility to be able to garner fresh funds at a short notice or a potent ability to refinance. ICRA also evaluates the impact of movement in interest rates on the debt coverage indicators of the issuer.

**Foreign currency-related risks**

The foreign currency risk can arise from unhedged foreign currency liabilities pertaining to funding the capital expenditure and/or working capital. The focus here is on assessing the hedging policy of the issuer concerned in the context of the company’s entire cash flows being denominated in domestic currency. Firm hedging, if not for the entire tenure of debt, then at least for the near-term foreign exchange repayment commitments, is viewed positively.

**Debt transaction structure**

ICRA reviews the debt transaction structure to evaluate features available to provide additional protection to the lenders/bondholders through presence of the escrow mechanism and the ring fencing of cash flows. This would include the cash flow waterfall mechanism, creation of reserve funds for debt servicing and stipulation on minimum coverage ratios that must be met before payment to subordinate debtholders (mainly sponsor debt) or declaration of dividends. This apart, availability of completion guarantees by sponsors, guarantee for debt servicing by other external entities, provision for inverter replacement reserve, restriction on the ability of the project company to take on additional debt and/or capital expansion without the approval of the lenders/bondholders and implementation of cash sweep/ cash trap mechanism to use surplus cash flows for debt prepayment by the lenders are viewed positively by ICRA.

	Positive	Neutral	Negative
<b>Structured Features</b>	1) Trustee (in case of NCDs)/Lender (in case of bank loans) administered cash flow waterfall with well-defined payment priorities 2) Dividend lock-up/ restricted payment triggers based on covenant testing 3) Immediate replenishment of debt service reserves (if dipped into) from subsequent operating cashflows 4) Using cash surplus for cash sweep mechanism 5) Provision to build inverter replacement reserve from project cash flows over the first 10 years of operations for solar projects; this is applicable in case of absence of comprehensive AMC for inverters including their replacement	1) Trustee (in case of NCDs)/ Lender (in case of bank loans) administered cash flow waterfall with well-defined payment priorities 2) Dividend lock-up/ restricted payment triggers based on covenant testing 3) Immediate replenishment of debt service reserves (if dipped into) from subsequent operating cashflows	1) Lack of presence or lack of adherence to the specified cash flow waterfall 2) Weak/ no dividend lock-up triggers 3) Debt service reserves with no replenishment

	Positive	Neutral	Negative
<b>Amortisation Structures</b>	1) Fully amortising with uniform amortisation/ step down repayment structure with more than 50% of debt amortisation in first half of the tenure 2) No debt acceleration triggers	1) Fully amortising debt with back ended /step-up repayment structure 2) Bunching up of repayments not over 10% of the debt quantum in the amortising structure in any particular year	1) Highly concentrated maturities with large bullet repayments 2) Cross default or debt acceleration triggers
<b>Covenant Packages</b>	1) Restrictions on additional indebtedness (including financial assistance) or liens, acquisition and sale of assets; limitations on mergers and consolidations; limitations on investments (permitted investments) 2) Limits on change of control/ownership, especially if the sponsors are important to the project 3) Frequent and regular reports of creditors' technical advisers and compliance with contractual and financial obligations 4) Lender's step-in rights and remedies to terminate key contracts (including O&M contract) in case of non-performance of the contractors thereby jeopardising the asset performance	1) Restrictions on additional indebtedness (including financial assistance) or liens, acquisition and sale of assets; limitations on mergers and consolidations; limitations on investments (permitted investments) 2) Frequent and regular reports of creditors' technical advisers to sanction base case validity and compliance with contractual and financial obligations	1) No restriction on additional indebtedness (including financial assistance) or liens or on investments

**Accounting quality**

ICRA reviews the accounting policies, notes to accounts and auditors' comments that are part of the annual report of the rated entity. Any deviation from the accounting standards is noted and the financial statements of the entity are adjusted, to the extent possible, to reflect the impact of such deviations. In case of solar and wind power projects adopting the REC sale route, the accounting policy related to unsold RECs is evaluated and suitable adjustments are made in the financial statements, to the extent possible.

**Contingent liabilities/ off-balance sheet exposures**

For this, the likelihood of devolvement of contingent liabilities/off-balance sheet exposures and the financial implications of the same are evaluated.

**Force majeure risk**

Like any infrastructure project, solar and wind power projects are also vulnerable to force majeure events. While this risk relates to the expected loss in the event of a default rather than the probability of default, the presence of force majeure clauses in the PPAs limits the company's liability arising from non-performance or underperformance. ICRA examines if, and the extent to which, the force majeure risks are mitigated through insurance contracts or by specific provisions in the PPA that cover such eventualities. The strength of these mitigating factors influences the overall financial flexibility of a company.

**Event risks**

ICRA recognises the possibility of events such as mergers and acquisitions, asset sales and litigations, which could have a material impact on the credit profile of an entity. Incorporating the impact of such discrete events in the credit rating, from the beginning, is often difficult. Depending on whether and when such events occur, the rating opinion could be substantially different. To take rating decisions in such cases, ICRA applies its analytical judgement based on the rated entity's track record,

the credibility of the management and the experience of having seen similar situations play out in other entities. However, given the nature of such events, it is possible that the rating may undergo a material change later, upon the occurrence of the event.

### Parentage

Despite the non-recourse nature of the debt availed by the issuers in solar and wind power sector, the financial strength of the parent/sponsor is a credit factor, given that apart from contributing the equity capital and/or subordinated debt, a stronger sponsor has greater wherewithal to meet any funding shortfalls faced by the SPV, while ensuring timely financial closure of the project. Further, during the pre-COD stage, most of the projects take recourse of the sponsor for cost overrun support.

If the parent's or promoter group credit profile is relatively stronger than the rated entity, ICRA assesses the ability and the likelihood of the parent extending extraordinary support to the entity. Support here means financial support from the parent, expected to be available to the entity in the form of loans, equity, extended credit period, advances, etc., in times of credit or liquidity stress on the entity. Support here does not mean operational support. It may be noted that promoters in their individual capacity, or private equity firms/other financial investors are generally not treated as parents for assessing the likelihood of extraordinary financial support coming in.

While the weak financial health of the sponsor constrains its ability to support the project SPVs in a time of need, the presence of a financially strong sponsor need not necessarily mean assured support to fund SPVs in case of any funding shortfall. In the absence of explicit support (guarantees), the sponsors' willingness to support the operational projects is determined by the long-term project attractiveness, which is a function of the strength of the project cash flows and duration of the tail period. Also, ICRA considers the past track record of the sponsor in extending timely support to any of its other SPVs and gauges the intent of the sponsor to extend extraordinary support to the rated SPV, based on interactions with the sponsor.

## Management Quality Assessment

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In addition to the industry, business and financial risk analysis, all credit ratings incorporate an assessment of the quality of the rated entity's management, the financial policies and the governance practices.

### Quality of management and financial policies

As a part of its process, ICRA undertakes discussions with the rated entity's management to understand its views on past performance as well as its plans and strategies, besides the outlook on the industry. Some of the points assessed are:

- Experience of the promoter/management in the line of business concerned
- Commitment of the promoter/management to the rated entity
- Risk appetite of the promoter/management and risk mitigation plans
- Policies on leveraging, managing interest rates and currency risks
- Management's past success in introducing new projects and managing changes in the external environment
- Management's plans on new projects, acquisitions, expansion, etc.

Periodic interactions with the management help in ascertaining the shifts, if any, in the issuer's financial policies.

## Assessment of Environmental, Social and Governance (ESG) Risks

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The assessment of ESG risks by ICRA involves a broad range of considerations that pertain to the sustainability of an entity with focus on aspects that can have a material impact on its credit quality. While the E&S risks tend to be both sector-related as well as entity-specific and could be driven by external factors such as regulations or demographic changes, the governance (G) risks are largely entity driven. The impact of the E&S risks on an entity's credit profile tends to be asymmetric. If the ESG risks

are material but unmitigated, these generally translate into pulling down the rating, but generally the ratings are not pushed up even when the ESG context is favourable.

### Environmental and social risks

As this methodology highlights, while undertaking credit assessment of entities, ICRA seeks to incorporate all relevant credit considerations into its rating decisions, while taking a forward-looking view on the risks and the mitigating elements. The relevant credit considerations include (sometimes overtly, sometimes covertly) the E&S factors that could affect the rated entity/transaction. While ICRA's analytical approach does not explicitly disaggregate these risks to assess their impact on the rating, these risks are often assessed broadly. Further, it is not always feasible to fully or precisely disaggregate the sub-components of E&S risks in credit analysis as these considerations often tend to overlap.

That said, the materiality of the E&S risks and the time horizon over which they are expected to crystallise differs widely across sectors and entities. In some cases, while the E&S risks could be material, but their effect on the credit profile may be muted because of other fundamental strengths of the entity. In other cases, the adverse impact of the E&S risks is expected to play out in the distant future and, hence, these considerations do not necessarily weigh on the rating today—with the expectation that when these risks manifest in the distant future, the rated entity would possibly have adapted itself by realigning its business model by then.

While evaluating the E&S risks, ICRA's objective is only to assess the direct and indirect risks that an entity faces and how it already is or is intending to mitigate the impact of such risks on its credit profile. As an example, ICRA only assesses whether an entity is exposed to physical climate risks or carbon transition risks such as those arising from changes in regulations or other E&S risks and seeks to understand the various mitigation and adaptation approaches that the entity is implementing to mollify these risks.

Solar and wind power producers contribute to the reduction in green-house gas (GHG) emissions by being an alternative to power generation from fossil fuel-based sources. The policy, demographic and societal trends in favour of clean energy support the business profile of solar and wind power producers. At the same time, solar and wind power producers are exposed to the risk of natural disasters and extreme weather conditions, which could damage their equipment—PV modules or WTGs or transmission lines. Nonetheless, the issuers avail insurance against such risks, including against loss of profits due to business interruption. The solar and wind power producers would also remain exposed to the variation in weather patterns, which could adversely impact their generation performance.

Given the large capacity targets set by the Government for the renewable energy sector, there is a large requirement of land for setting up such projects. There have been challenges in completing land acquisition, and social risks manifest when there are disagreements on compensation between the developers and the landowners. Further, there are competing claims that renewable power projects adversely impact the ecosystem, such as the possible impact of transmission lines of these projects on the extinction of the Great Indian Bustard (GIB) in Gujarat and Rajasthan. Additionally, in case of solar and battery power projects, the developers must also plan for the disposal/recycling of the modules and battery after decommissioning at the end of the project life. Thus, solar and wind power producers remain exposed to E&S risks arising from such considerations.

### Governance practices

Corporate governance remains a complex and an evolving subject. From a risk perspective, the same tends to hold as high an importance as an entity's business strategy. A sound corporate governance structure attempts to make clear the distinction of power and responsibilities between the board of directors and the management. The constitution of an entity's board and the board of directors' participation in strategy formulation, besides the entity's adherence to legal and statutory compliance requirements are factored in during credit assessments. ICRA seeks to gain a qualitative understanding of an entity's commitment to following transparent and credible practices by the way its financial statements are reported, their level of disclosures, consistency in communication and the openness about sharing information during the credit rating exercise. Besides, the corporate group structure (whether simple or complex), the rated entity's related party transactions and instances of supporting Group entities at the expense of debt holders are assessed.

## Summing Up

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ICRA's credit ratings are a symbolic representation of its opinion on the relative credit risk associated with the instrument being rated. This opinion is arrived at following a detailed evaluation of the company's business and financial risks, likely cash flows over the life of the instrument being rated and the adequacy of such cash flows vis-à-vis its debt servicing obligations.

As this note highlights, for solar and wind power projects, project risks assume importance during the implementation phase, while post-COD, it is the operating performance which determines the adequacy of cash flow generation vis-à-vis the debt servicing commitments that primarily influence the rating. As cash flows for a solar and wind power project remain sensitive to the level of electricity generation and tariff tied-up under the PPA along with the timeliness of collections from the counterparty, various scenarios are drawn up to assess the impact of key variables on the debt-servicing metrics. ICRA's rating approach also involves an assessment of the entity's management quality and governance practices. In addition to these considerations, an entity's credit rating may also be influenced by its ownership, the nature of linkages with its parent or Group entities, degree of financial flexibility, the corporate legal structure, track record of operations and that of debt servicing, and vulnerability (if any) to discrete event risks. Further, ICRA draws comfort from strong coverage ratios and the presence from structural features like adequately funded DSRA and restrictive covenants on additional debt and adequate dividend lock-up/restricted payment triggers.

ANNEXURE

Summary of rating factors and an example to illustrate the key building blocks of a credit rating

		Strong		Comfortable		Adequate		Moderate		Weak							
Industry Risk	Industry Position																
	Execution and Funding Risk																
Business Risk	Availability of LT PPA and Cost competitiveness of Tariff																
	Counterparty Credit Risk																
	Generation Risk																
	Asset Diversification																
Financial Risk	Coverage																
		Enhance				Support/ Neutral				Hinder							
Do these factors enhance or hinder the credit profile?	Diversification																
	Liquidity and Financial Flexibility																
	Currency Risk																
	Financial Policy																
	Management, Governance & Reporting																
		Very High				High				Moderate				Low			
Parent Support	Likelihood of Parent Support																
	Rating of Parent	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B/ C category		
	Final Rating	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B/ C category		

The above graphic is only for illustration purpose and does not represent a rating output from a formulaic model. The ratings assigned by ICRA are determined by Rating Committees based on both quantitative and qualitative considerations.

## Glossary

Key Terms	Definition
<b>Average Pooled Purchase Cost (APPC)</b>	The weighted average pooled price at which the distribution utility has purchased the electricity including cost of self-generation, if any, in the previous year from all the energy suppliers (long term and short term), excluding those based on renewable energy
<b>Cost Coverage Ratio for a discom</b>	Annual Revenue Realisation (ARR) / Average Cost of Supply (ACS) ARR = Cash Collection inclusive of subsidy receipts/Units Sold ACS = Total expenditure/Units Sold
<b>IPP</b>	An IPP is a non-state utility, which owns and operates a power generation project for sale of power to discoms
<b>Plant Availability Factor (PAF)</b>	PAF for a generating station means the average daily declared capacity of the power plant as a percentage of the installed capacity less auxiliary consumption
<b>Preferential or Feed-in Tariff</b>	Tariff determined by the SERC for sale of electricity generation from a renewable energy project to the state distribution utility
<b>P90 PLF</b>	The P90 estimate of generation is the generation which a solar plant is 90% likely to produce over an average year
<b>Renewable Purchase Obligation</b>	Obligation of an entity (distribution utility, open access consumers and captive power consumers) to purchase a proportion of their electricity consumption from renewable sources of energy as per the notified regulations by respective SERCs
<b>Renewable Energy Certificates</b>	RECs have been designed to address the mismatch between the availability of renewable energy sources and the requirement of obligated entities to meet their RPO, given that renewable energy sources are concentrated in a few states; one REC is equivalent to 1 MWh of electricity; renewable energy-generating companies shall be eligible for issuing and trading RECs, subject to conditions notified by CERC; the obligated entities can purchase RECs on the energy exchange towards meeting their RPO target

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### About ICRA Limited:

ICRA Limited was set up in 1991 by leading financial/investment institutions, commercial banks and financial services companies as an independent and professional investment Information and Credit Rating Agency.

Today, ICRA and its subsidiaries together form the ICRA Group of Companies (Group ICRA). ICRA is a Public Limited Company, with its shares listed on the Bombay Stock Exchange and the National Stock Exchange. The international Credit Rating Agency Moody's Investors Service is ICRA's largest shareholder.

For more information, visit [www.icra.in](http://www.icra.in) and [www.icresearch.in](http://www.icresearch.in)

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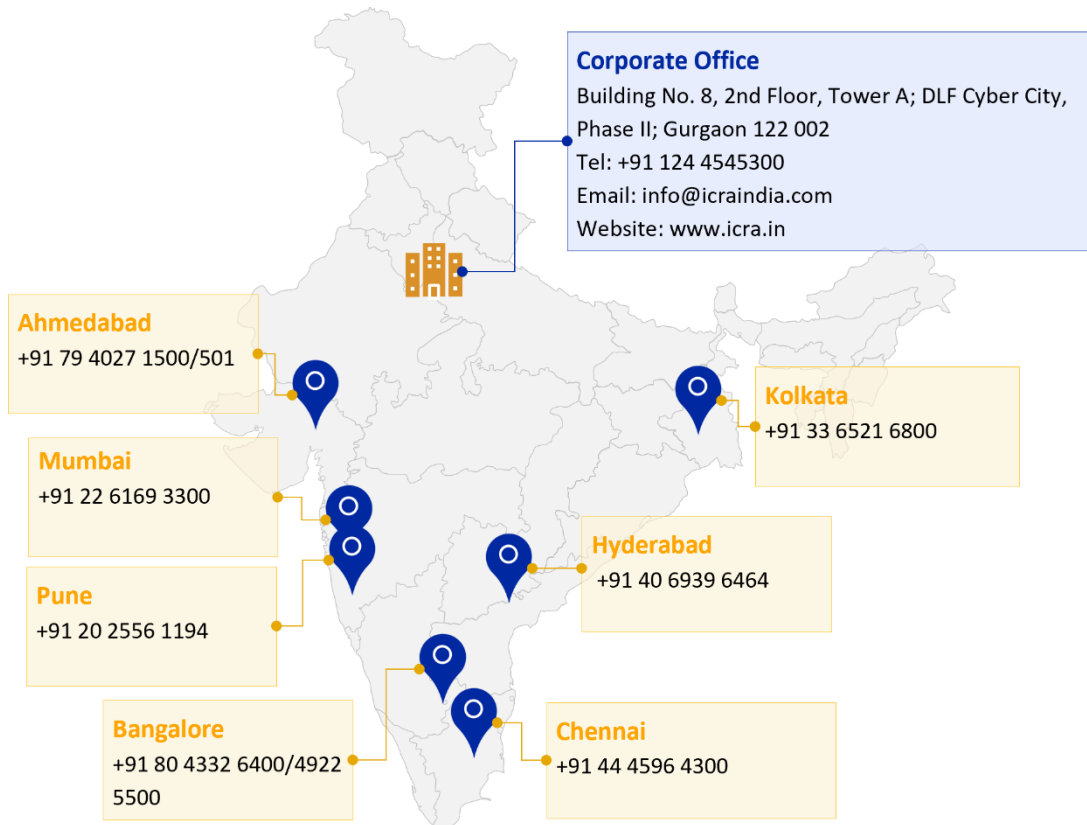


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