Crisil
Ratings

Crisil Ratings criteria for Infrastructure sectors

(Including approach for financial ratios)

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Section I.
The Infrastructure Sector: Its Unique Rating Drivers

Executive summary

The infrastructure sector comprises entities ranging from service providers in power, telecommunications (telecom), mining, and transport; to state governments and urban local bodies (ULBs). The rating drivers of these entities are different from those applicable to companies in the corporate sector. For instance, government policy influences entities in the infrastructure sector much more than others. Again, unlike the corporate sector, the infrastructure sector has supply-side constraints in many segments. Also, in a few instances, the tariff charged for services provided is not driven by market conditions but by decisions of the government or regulator. Demand- related risks are minimal in power, telecom, and urban infrastructure, whereas demand growth is a key credit driver in the manufacturing sector.

Such divergences in key rating drivers warrant a separate framework for evaluating infrastructure sector companies (refer Box 1: Categories of Crisil Ratings-rated entities) vis-à-vis their counterparts in other sectors. This section details the key rating drivers impacting the credit quality of entities in the infrastructure sector and also explains how they differ from those of companies in the manufacturing and service sectors.

Categories of Crisil Ratings-rated infrastructure sector entities

- Basic infrastructure service providers with moderate commercial viability: These include water and sewerage service boards, state transport corporations, and state government power generators, transmitters, and distributors.
- Commercial service providers: These comprise telecom service providers, aviation infrastructure providers, toll road operators, central/independent power generators and transmitters, and oil and natural gas companies.
- Special-purpose vehicles (SPVs) floated by state and local self-governments: These include municipal corporations and municipalities, and SPVs in the irrigation and roads segments with minimal commercial viability, seeking ratings that are supported by guarantees from the state governments

Scope

The broader criteria of manufacturing companies[1] apply to entities in the sector. However, this section[2] highlights some of the common features that are unique to the infrastructure sector. It also outlines how Crisil Ratings views each of these risks issues. The detailed methodology that captures the sector-specific nuances for the following sub-sectors within infrastructure are also published separately and are available on *www.crisilratings.com*

- Crisil Ratings methodology for mobile telephony services
- Crisil Ratings methodology for municipal and ULBs
- Crisil Ratings methodology for rating annuity road projects
- Crisil Ratings methodology for toll road projects

The section highlights the parameters that are relevant for assessing the credit profile of issuers within the sector. These parameters serve as illustrative guidelines. The relevance of specific parameters varies based on the issuer's unique circumstances. For instance, if the liquidity of the company is weak, industry risk or other business-related factors may

[1] The detailed criteria document is on the Crisil Ratings website under the 'Criteria and Methodology' section – Crisil Ratings criteria for manufacturing, trading and corporate services sector.
[2] For accessing the previous published document, please refer to below link:
https://www.crisilratings.com/content/dam/crisil/criteria_methodology/infrastructure/archive/the-infrastructure-sector-unique-rating-drivers-feb2024.pdf

exert minimal influence on the final rating. Likewise, business parameters that hold substantial importance for one issuer may be less pertinent for another, potentially being encompassed within the broader category of industry risk.

Business risk

These include pricing flexibility and government policy, which have a significant bearing on the viability of operations.

Pricing flexibility

In the corporate sector, prices tend to be market-driven and players enjoy greater pricing flexibility. In the infrastructure sector, however, pricing flexibility is relatively limited because the government determines much of the tariff. The power and telecom sectors are, nevertheless, better off as prices in these (partially in case of telecom) are determined by regulatory commissions, not the government.

The goods and services offered cover basic needs such as water, power, telecom and transport. Revisions in the prices of these tend to have a significant impact on large sections of the population. Price revisions, therefore, constitute a sensitive issue and come under heavy scrutiny from political parties and the media. As a result, government influences the tariff to be charged for state transport, petroleum products, aviation, and water and sewerage services. Hence, the pricing flexibility of players in these sectors is very limited, a factor Crisil Ratings views unfavourably.

In the case of power and telecom, regulatory authorities influence or determine tariff. This ensures a better balance between the interests of the service provider and the consumer. The State Electricity Regulatory Commissions (SERCs), for instance, determine tariff for the power sector after giving due consideration to the interests of the various user segments, while at the same time ensuring fair returns to licensees. Therefore, Crisil Ratings favourably views entities whose tariff structures are determined by regulators as such entities tend to have healthy financial returns and their tariff is generally independent of government intervention. In case of entities with government-influenced prices, the credit view would be driven by the extent of the influence.

In the corporate sector, prices are market-driven and determined by factors such as the demand-supply situation and import parity. Pricing flexibility is, therefore, a significant differentiator between the credit quality of an infrastructure entity and a corporate sector player.

Government policy

Government policy is a central rating driver. At times, government intervention strengthens credit profiles, while at others, it constrains them.

Traditionally, government policy has played an important role and this is centrally factored in the assessment of players' credit profiles. However, the impact of the government role may vary. There have been instances where government influence has been a positive factor driving the ratings; for example, petrol and diesel cess passed on to entities such as the National Highways Authority of India, or tax exemptions to investors on borrowing programmes of infrastructure entities.

There are also instances when government intervention has proved to be a bane. These include the following:

- Lack of clarity in telecom sector regulations in the past had resulted in increased risk perceptions for the sector as a whole.
- Water and waste-water services provided by the ULBs are usually priced uneconomically; there are many instances when tariff for the domestic segment has not been revised for over 10 years.

The government offers no fund-based or non-fund-based support to entities that are not in the infrastructure sector. Its role is largely limited to making policies for various industries. Consequently, the credit profiles of corporate sector entities are not impacted by government influence. The credit profiles of several infrastructure sector entities, however, have close linkages with government policies.

In assessing their creditworthiness, Crisil Ratings views government influence on the business and financial risk profiles of the rated entities on a holistic basis.

Demand risk

Generally, there is a favourable demand-supply situation in the infrastructure industry; in most cases, demand outstrips supply. In sectors such as water supply, airports, and urban infrastructure, the demand-supply gap is significant. Though the government encourages private investment in these sectors, a considerable portion of demand remains unmet. Demand risks are likely to remain low over the medium term, which has a positive impact on the credit profiles of the players.

In the corporate sector, demand risks play a significant role in ascertaining business risks. Industries with unfavourable demand-supply situations come under considerable stress: they face either a reduction in operating rates or decline in realisations. This, in turn, impacts the overall financial risk profile.

Crisil Ratings factors in the low demand risks in the infrastructure sector favourably in its credit risk assessment framework.

Monopoly

Monopoly alone does not improve credit profile; the ability to earn profits is critical. The government has, in the past, created several monopoly entities such as t h e Airports Authority of India (AAI), Bharat Sanchar Nigam Ltd, and State electricity boards (SEBs) that were intended to be both economically viable and socially responsible. At times, the government uses these entities to further its own social, political, or economic objectives. Hence, despite being in a monopoly business, these entities often suffer losses due to government interventions in pricing. For instance, till the late 1990s, the state governments determined the power tariff of the respective SEBs, and rational increases in tariff were not allowed; consequently, the SEBs incurred huge losses. On the other hand, some monopolies registered robust profits. For instance, the increasing congestion at airports led to a sharp deterioration in the service quality of AAI, which, nevertheless, booked large profits. The capability to effectively use the monopoly status to generate high profits is key to ensuring a favourable credit profile.

The corporate sector is largely competitive, barring a few exceptions such as the petrochemicals sector where specific entities command a large market share. Prices in the petrochemicals sector are, however, linked to import parity prices, thereby ensuring rational pricing. Therefore, a sizeable market share is generally viewed favourably in the corporate sector.

The Crisil Ratings view is contingent upon the impact of the monopoly status on the profitability of players.

Financial risk

With the exception of state governments and ULBs, the financial risk analysis framework for all entities in the infrastructure sector is similar to that of entities in the corporate sector. It has four components:

- Existing financial position
- Future financial risk profile

- Cash flow adequacy
- Financial flexibility

Given the typically higher stability of cash flows in infrastructure assets, financial ratios such as debt service coverage ratio (DSCR) and Debt to Ebitda are analysed. Additionally, similar to corporates, trends in revenue from operations, an analysis of cost and profitability, management of receivables and payables, return on capital employed, level of networth and debt analysis (ratios such as interest coverage, net cash accrual to debt, total outside liabilities to tangible networth) is carried out. The parentage, track record in raising funds, and trends in cash generated from operations are analysed to ascertain financial flexibility. To ascertain the future financial risk profile, Crisil Ratings analyses operational and financial projections, and predicts the adequacy of projected flows to meet financial obligations after adjusting for expected capital expenditure, operational expenses, and working capital requirement.

Unlike the corporate sector, where making profits is a key objective, sub-sovereign and local governments are not primarily driven by financial and economic objectives but by larger social objectives. Attaining these entails significant expenditure. However, their financials are not comparable with those of the corporates given their ability to raise funds either through borrowings or taxes. Therefore, Crisil Ratings uses a different financial risk assessment framework for ULBs and state governments (covered separately).

Management risk

Crisil Ratings follows the standard criteria used for all manufacturing companies. This is presented in detail in the Crisil Ratings publication, ‘Crisil Ratings criteria for manufacturing, trading and corporate services sector’.

Conclusion

The Crisil Ratings methodology for the infrastructure sector are unique because entities in this sector have attributes quite unlike those in the corporate sector. The dominant roles that governments play in policymaking, pricing flexibility, and management are key to determining the credit profiles of government-controlled entities. At times, governments use the entities to further their own social, political and economic objectives, which constrains the rating.

Section II.
Crisil Ratings methodology for the power sector

Executive summary

Electricity is a concurrent subject under the Constitution of India, which means the sector has oversight of both the central and state governments. Since Independence, the power sector has been dominated by integrated utilities, which operate at the state level and carry out functions of generation, transmission and distribution of power within their geographical area. Centrally owned power generating utilities contribute significantly to power distributed at the national level through sales to various integrated state power utilities. After the introduction of competitive bidding, participation by the private sector has increased considerably.

This section discusses the methodology for rating players across the value chain of the power sector, including generation, transmission, and distribution. The section also discusses the methodology for rating solar and wind power projects.

Generation and distribution

In generation and distribution, the key parameters considered for analysing business risk profile are: the policy environment and regulatory risks, market position, service area economics, operating efficiency and project implementation. Policy and regulatory risks include reform legislations, timeliness and accuracy of tariff determination, and treatment of regulatory assets. Market position covers revenue visibility through power purchase contracts, market share, customer profile, demand pattern, level of competition in the industry and project implementation risks. Analysis of service area economics and operating efficiency involves cost position and tie- ups. Assessment of project implementation focusses on risks related to funding and setting up projects and securing offtake post commissioning.

For assessment of financial risk, leverage, adequacy of future cash flows to meet financial obligations after covering operational expenses, and liquidity maintained in the form of debt service reserve account (DSRA) are the key parameters. Payment track record and management of receivables and payables are also considered. The assessment also factors in any material changes in the business environment, including the regulatory stance, changing market conditions, differential growth rates of various customer segments, tariff levels for various segments and growth orientation. Flexibility in raising funds from conventional and alternative sources to meet financial obligations and working capital / growth requirements is also evaluated.

Transmission

In transmission, the key parameters for analysing business risk profile are track record of line availability, operations and maintenance (O&M) costs, replacement of fixed assets and contingency plan, and counterparty payment delay risk.

For financial risk assessment of transmission companies, Crisil Ratings primarily analyses the adequacy of future cash flows to meet financial obligations after covering operational expenses and maintaining liquidity in the form of DSRA.

Wind and solar projects

For rating wind and solar power projects, Crisil Ratings evaluates project, management and operational risks. Specific factors such as technology risk and panel quality in solar projects are also considered. With respect to operational projects, PLF track record, counterparty payment track record, adequacy of cash flows to meet debt obligations and liquidity maintained in the form of DSRA are the key rating drivers.

For management risk assessment, Crisil Ratings follows the standard criteria used for all manufacturing companies, which includes evaluating management philosophies, strategies/policies and risk appetite. This is available in detail in the Crisil Ratings publication, ‘Crisil Ratings criteria for manufacturing, trading and corporate services sector’.

Scope

This section[3] covers the methodology for rating companies operating across the value chain of the power sector. They include

- Power generation
- Power distribution
- Power transmission

The section also covers the methodology for rating renewable power projects including:

- Solar power projects
- Wind power projects

This section also covers Crisil Ratings' methodology for financial ratios used for analysing entities in power sector, including adjustments it carries to the reported metrics in the financial statements (*refer annexure for more details on financial ratios and adjustments)*.

This section highlights the parameters that are relevant for assessing the credit profile of issuers within the sector. These parameters serve as illustrative guidelines. The relevance of specific parameters varies based on the issuer's unique circumstances. For instance, if the liquidity of the company is weak, industry risk or other business-related factors may exert minimal influence on the final rating. Likewise, business parameters that hold substantial importance for one issuer may be less pertinent for another, potentially being encompassed within the broader category of industry risk.

[3] For accessing the previous published document, please refer to below link: https://www.crisilratings.com/content/dam/crisilrating/criteria-and-methodology/criteria-for-infrastructure-sectors/archive/criteria-for-infrastructure-sectors-feb2025.pdf

Rating methodology for power generation utilities

Background

Apart from business, financial and management risks, Crisil Ratings evaluates risks specific to power generation such as industry risk and regulatory risk.

Business risk

Industry and policy environment

The domestic power generation sector had significant demand-supply deficit in the past. Capacity additions, resulting in power supply outpacing demand growth, have helped narrow the deficit in recent times. Demand has risen at a subdued pace in the past few years, owing to a slowdown in economic growth.

Traditionally, power generation has been largely by integrated utilities, state electricity boards (SEBs) and central government-owned utilities. With the advent of reforms, most SEBs have been unbundled along functional lines, with separate generation companies (gencos) at the state level. The share of the private sector in energy generation has increased rapidly over the years due to significant capacity additions. Also, there has been a shift from a single buyer to multiple buyers as gencos can now sell power to distribution companies (discoms) in their geographical area as well as to private customers.

As per the Electricity Act, 2003, tariff for generation projects is based on competitive bidding (with some exceptions), and not on a cost-plus formula as in the past. Cost of generation therefore is the key differentiator between gencos. Hence, Crisil Ratings will continue to view low-cost producers positively.

Viability of the generation sector is closely linked to development of the transmission network, which evacuates power from the plant to load centres, and development of a distribution network that can absorb additional power. Poor transmission and distribution networks in the delivery areas of gencos are viewed negatively by Crisil Ratings. The financial viability of gencos is intricately linked to the financial position of the distribution sector, which is the primary offtaker. Most distribution utilities in India are state-owned and experience significant financial losses because of their poor operational profile. Crisil Ratings considers this as a significant constraint for the ratings of gencos. Pricing and availability of fuel are also major constraining factors in the development of the generation sector.

Regulatory risk

The power sector in India comes under the purview of the central and state regulatory agencies, and functions are distributed between multiple implementing agencies. The Central Electricity Regulatory Commission (CERC), the Central Electricity Authority (CEA) and state electricity regulatory commissions (SERCs) are the chief regulators.

The Ministry of Power works in close coordination with CERC and CEA. While CERC acts more like a regulator responsible for approving tariffs of central utilities and licences, CEA is a technical advisor, focused on planning (estimating power demand and generation and transmission capacity addition). CEA also reviews the performance of the power sector every month.

CERC regulates the tariff of gencos owned or controlled by the central government as well as inter-state transmission of energy, including tariff of transmission utilities. It also grants licences for inter-state transmission and trading, and advises the central government in the formulation of the National Electricity Policy and Tariff Policy.

SERCs determine the tariffs for generation, supply, transmission and wheeling of electricity, regulate the wholesale, bulk or retail sale of power within the state, and are responsible for issuing licences for intra-state transmission, distribution and trading, and promoting co-generation and generation of electricity from renewable sources.

The Electricity Act 2003 and the National Tariff policy under the Act emphasise the implementation of competitive bidding for encouraging private sector investments in power generation, to reduce capital cost, promote efficiency in operations, and enable competitive pricing of electricity. The central and state governments have initiated various projects under the competitive bidding guidelines, typically called Case 1/ Case 2 bidding. Since January 2011, competitive bidding has become mandatory for all power generation projects.

Hence, the cost-plus tariff formulation will progressively be replaced with projects based on competitive tariff bids, which will improve the ability of gencos to manage cost under pressure. For competitive bid projects, operational efficiency resulting in competitive tariff will be critical for minimising regulatory risks arising from non-allowance of certain expenses.

Tariff for direct sale to consumers, on the other hand, does not require regulatory approval and can be based on mutually agreed upon terms. However, regulatory intervention, in terms of wheeling charges to be paid to transmission companies and charges related to 'open access' to be paid to discoms for migration of high paying industrial customers, will continue. If regulators keep such expenses very high, it will dent the competitiveness of gencos to supply power to direct customers. Low open access charges are viewed favourably by Crisil Ratings as they enhance the ability of gencos to access customers of high creditworthiness.

Market and service area

With long-term, cost-plus-based power purchase agreements, recovery of fixed costs is ensured, including return on equity. However, this is subject to the plant being run efficiently and achieving the normative parameters set for fixed cost recovery. With competitive bidding, the tariff charged will become the single most important determinant of a generator's ability to capture the market, subject to availability of an adequate transmission network for evacuation of power from the generating plant to load centres.

Power has certain unique features: for instance, it cannot be stored. However, trading, as with any other commodity, is progressively expected to increase. Here too, the generator's capability to manage a competitive tariff would play a key role. The type of technology used, track record of the EPC contractor in setting up similar plants and of the plant operator, type of fuel used, and arrangements made for long-term procurement of fuel at competitive prices are important factors analysed by Crisil Ratings. These factors have a significant impact on the ability of gencos to deliver power consistently and competitively. Fuel prices and procurement practices, in particular, are the biggest risk factors, as fuel prices generally constitute the largest cost component for power plants. Plants with long-term arrangements, such as captive coal mining, will exhibit much lower fuel related risks, than those run on liquid fuel, which may be exposed to high fuel price volatility.

Given the poor credit profiles of key offtakers (state-owned discoms), counterparty risk is another key factor that Crisil Ratings looks into. Having a portfolio of offtakers, selling only to buyers with healthy credit profiles, or special payment security mechanisms are critical for minimising counterparty risks. As power cost comprises the single most important component in the expenditure of discoms, lower the tariff, better would be the ability of discoms to recover the entire amount from customers, and repay generators.

Operating efficiency

Only an efficiently run power generation plant can ensure consistent delivery of power at low rates. The key operational parameters that shape the operational profile of a plant include:

- **The technology used:** A well-tested technology lowers the probability of unplanned breakdowns.
- **Plant availability:** High plant availability is not only dependent on the technology used, but also on processes adopted for regular maintenance and adequate fuel supply. Higher availability increases generating capability, and in a two-part tariff system, improves the actual recovery of fixed cost.
- **Plant efficiency:** Low auxiliary consumption, plant heat rates and specific primary and secondary fuel consumption norms ensure that lesser quantity of fuel is used, thus reducing variable cost.
- **Administrative efficiency:** Apart from fuel related expenses, minimisation of other expenses such as employee cost, interest and finance charges, is also necessary to keep the generation cost low. Both plant and administrative efficiency parameters should be benchmarked against those of other generators to analyse the relative efficiency.
- **Environmental issues:** The type of fuel, location of plant and technology used can dictate the cost incurred over environmental issues at the construction and operational stages. In fact, in extreme cases, non-compliance with environmental norms can put continuance of operations at risk.
- **Fuel price and availability:** Each distribution utility is mandated by the regulator to procure power based on a merit order dispatch, with the least priority set for the plant with the highest variable cost. Low fuel cost ensures high priority in the merit order system for the plant. However, in a two-part tariff system, a distribution utility would have to pay a fixed cost if the plant is available for generation; lower the actual generation, higher will be the per unit cost for the utility, thus making it non-competitive.
- **Billing and collection:** A build-up of receivables would exert pressure on the cash flow of the generator. Credit profiles of offtakers, adherence to power purchase agreement, incentives/dis-incentives, and the average generation tariff in relation to average revenue raised by the discom affect receivables for generators.

Project implementation

The size of new projects being taken up, relative to the present scale of operations, is a key indicator of the direction the company is moving in. New projects generally entail higher risks than operational projects. Gestation period for a thermal plant is 3-4 years, while that of a hydel plant is longer, due to delays caused by political and regulatory disruptions. The focus is to determine the risks faced by the company in completing the projects. Crisil Ratings studies the company’s pattern of financing approved and ongoing projects, and whether financing has been tied up. The financing mix, in terms of market debt and internal accrual /government support, is indicative of the company's financial policy. Crisil Ratings conducts sensitivities on time and cost overruns to assess ability to service debt. Projects nearing completion are viewed more favourably than greenfield projects because they entail lower construction risk. Crisil Ratings also gives due weightage to the company's track record in setting up projects. Power offtake and fuel procurement agreements are the critical documents analysed, as they represent the covenants responsible for the commercial viability of the generation plan during the operational stage.

Rating methodology for power distribution utilities

Background

Power distribution licensees service customers in a geographically demarcated area. Typically, a distribution licensee purchases power in bulk from a transmission licensee and supplies to a largely retail customer base within its service area. Traditionally, a number of power distribution licensees have been state-owned, while some urban centers do have privately owned entities.

Crisil Ratings analyses business, financial and management risks alongside specific risks pertaining to utilities such as industry risk and regulatory risk while assessing the credit profiles of power distribution entities.

Industry risk

The industry risk assessment focusses on the demand-supply scenario and the policy environment. A distribution licensee's ability to provide quality power at a competitive rate is a critical rating determinant. At an industry level, this would eventually shift the balance towards better-performing distribution licensees which generate a higher quantum of cash from operations and are better placed to meet their obligations to generation and transmission licensees.

Regulatory risk

Distribution licensees are regulated by SERCs, which ensure independent and objective criteria for tariff determination, based on adequate recovery of expense, subject to the distribution licensee achieving the requisite performance benchmark. Crisil Ratings views this process of tariff setting positively as it is free of external discretions.

Reform legislations also stipulate that each licensee file annual revenue requirements with an option to file a separate tariff petition in case a tariff revision is warranted. Although regulations provide for most costs to be passed through, along with reasonable returns on equity, SERCs may impose stricter performance standards or disallow certain cost components stemming from inefficiencies of distribution licensees. SERCs thus essentially balance customer interests with what is legitimately due to the distribution licensee.

If information used to support the distribution licensees' rationale for tariff revision is insufficient or under doubt, SERCs have been known to take a tough stance in not allowing the tariff revisions sought by the licensees. The nature and scope of tariff orders already passed by an SERC are a useful index of its regulatory stance.

Timely and accurate filing of tariff petitions by discoms is critical. Failing this, discoms would report losses as tariffs are not retrospective. Also, electricity is politically sensitive and SERCs may defer tariff hikes (at times over multiple years).

Market position and service area economics

Distribution infrastructure

Availability of widespread distribution infrastructure and retail reach of such infrastructure are key discriminators of a licensee's market position. Distribution licensees have traditionally operated in exclusive zones though legislation now permits non-exclusive licensees to operate in the same area. Although the mix of customers—residential, commercial, industrial and agricultural—within a service area and their purchasing power are key considerations, service quality and reliability offered by a distribution licensee are also important determinants of sustainability of the business relationship. While the market may be willing to offer a price premium for a more responsive and reliable licensee, the latter has to maintain this value proposition for the premium to be sustainable.

Customer segment

Growth of a lower-paying customer segment and shifts in better-paying customer segments are trends that would be appropriately factored in. A service area with a larger base of industrial customers registering good growth rates is seen as a positive, as long as such customer concentration is within acceptable limits. Existence of a depreciated distribution infrastructure within a densely populated urban service area is a key entry barrier and could work to the benefit of incumbent licensees.

Operating efficiency parameters and track record

Collection mechanisms, billing systems and other processes

Given their direct customer interface, distribution licensees have to develop necessary processes, credit guidelines, billing systems and collection mechanisms to ensure that the business is run efficiently. Operating efficiency will ultimately impact the metering, billing and collection cycle, which could affect cash flow.

Cost of power

The actual cost of power (whether generated or purchased externally) within a given tariff structure could be the most significant determinant of profitability. Therefore, ability to procure sufficient quantum of power at minimum prices is a critical rating determinant for a distribution licensee. This assumes greater significance in the open access regime where a customer can choose to buy power from different sources. A distribution licensee with a high-power procurement cost would risk losing its customers to more efficient players.

Long-term power purchase agreements (PPAs)

Crisil Ratings views long-term PPAs with an efficient generating entity as a positive. Absence of a PPA can constrain ability to ensure uninterrupted supply of power to customers, which can adversely affect business prospects.

Transmission and distribution (T&D) and commercial losses

T&D losses within the service area are either technical or commercial. Industry benchmarks are available for permissible technical losses at lower voltages. Such benchmarks are a function of voltage stability and reflect the efforts to minimise distribution transformer losses through regular maintenance. Commercial losses, on the other hand, include leakage of revenue due to non-paying customers or outright theft. Consistent efforts are required to track energy flow to ensure that all the energy input into the T&D system is being billed after accounting for system losses.

The power tariff advised by the regulator assumes specific improvement in performance indicators and ability to achieve the same is critical for profitability. Besides T&D and commercial losses, manpower productivity parameters and other administrative expenses will also need to be closely tracked and assessed in relation to regulatory forbearance on these expense levels.

Rating methodology for power transmission projects

Background

Power transmission infrastructure helps transfer electricity from generating plants to substations located close to consumers. In India, there is a disparity in access to power among regions because of bottlenecks at two levels. First, poor integration of regional grids leads to an asynchronous national grid, preventing efficient transfer of electricity from surplus to deficit regions. Second, poor last-mile connectivity spawns areas of darkness in power- surplus regions.

To overcome these limitations, the central government has been encouraging private sector participation in the transmission space by granting licenses based on competitive bidding. Typically, transmission licensees are special purpose vehicles (SPVs) set up to construct, maintain and operate transmission networks. The SPVs have definitive transmission service agreements (TSAs) with designated transmission system customers. The TSA terms are governed by the CERC, which guarantees tariff-based payment, depending on line availability.

Till their projects begin commercial operations, SPVs face significant risks related to land acquisition and clearances. Once operational, they can expect stable cash flow, backed by pre-determined tariff, assured demand and long tenure of contracts. As long as the SPVs maintain minimum availability, cash inflow is assured. Cash outflow depends on O&M cost, breakdowns due to topographical conditions, and costs incurred for replacement of transmission assets such as insulators and transmission switches. As cash flow is predictable, these SPVs can operate with low DSCR, unlike toll road and renewable projects (wind and solar), which require a higher DSCR as they face unpredictable demand and variability in PLFs, respectively.

While the quantum of cash flow is predictable, its timing is not. That's because of counterparty payment risk arising from exposure to state discoms, which may not have a uniform payment track record. Risks vary depending on whether the SPV is interstate or intrastate.

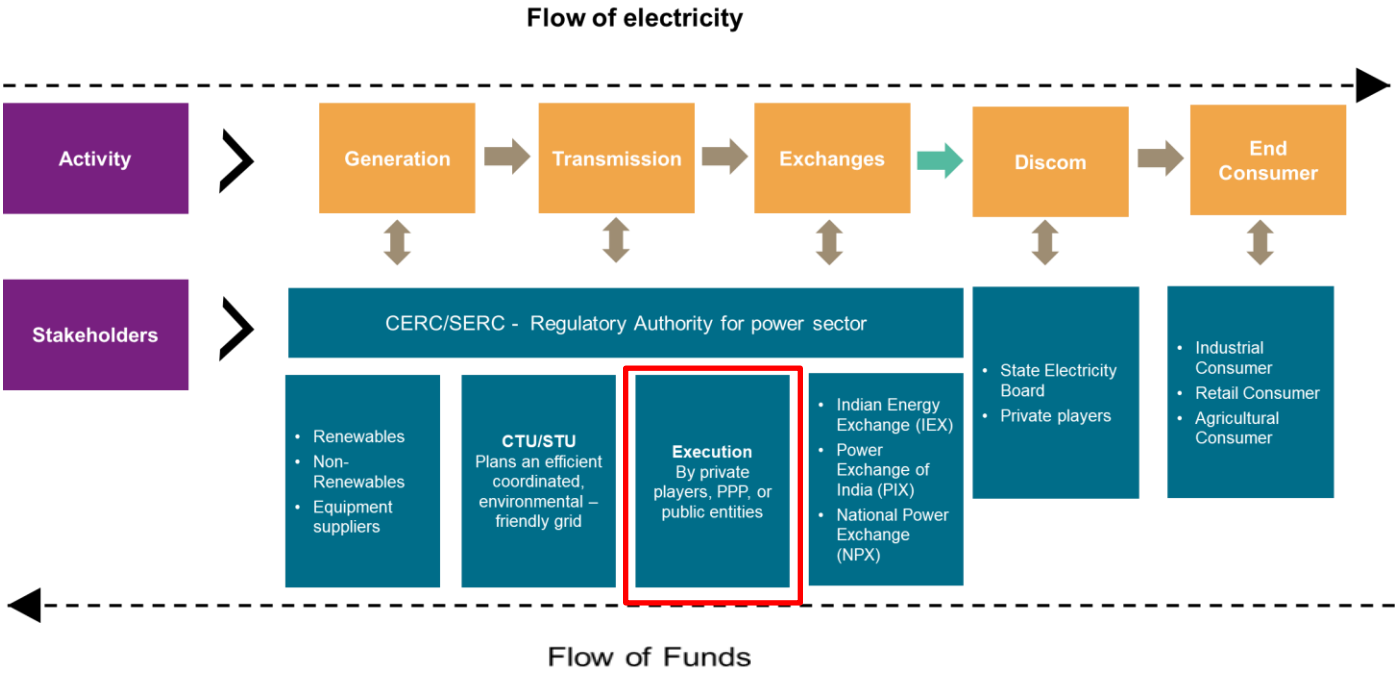
In interstate transmission projects, the counterparty risk is largely mitigated through the point of connection (PoC) mechanism, under which, transmission charges are pooled and distributed among licensees in proportion to their annual transmission charges. Involvement of a central transmission utility (CTU) in billing, collection and disbursement of transmission charges among licensees further reduces risk. Currently, Central Transmission Utility, which is a 100% subsidiary of Power Grid Corporation of India (PGCIL) plays the role of CTU.

In intrastate SPVs, state transmission utilities (STUs) are responsible for development of the transmission system. Here, discoms make the payment to the STU, which pays the SPV. In the absence of a pooling mechanism, the SPV faces higher risk of delay in payment by the counterparty due to exposure to a single STU which is dependent on the state discom for cash flow. Crisil Ratings evaluates the counterparty payment delay risk depending on the presence or absence of a pooling mechanism.

Crisil Ratings believes transmission projects can mitigate counterparty payment risks by maintaining adequate DSCR and liquidity buffer. For SPVs with similar counterparty payment risk profiles, those with more liquidity buffer will be rated higher.

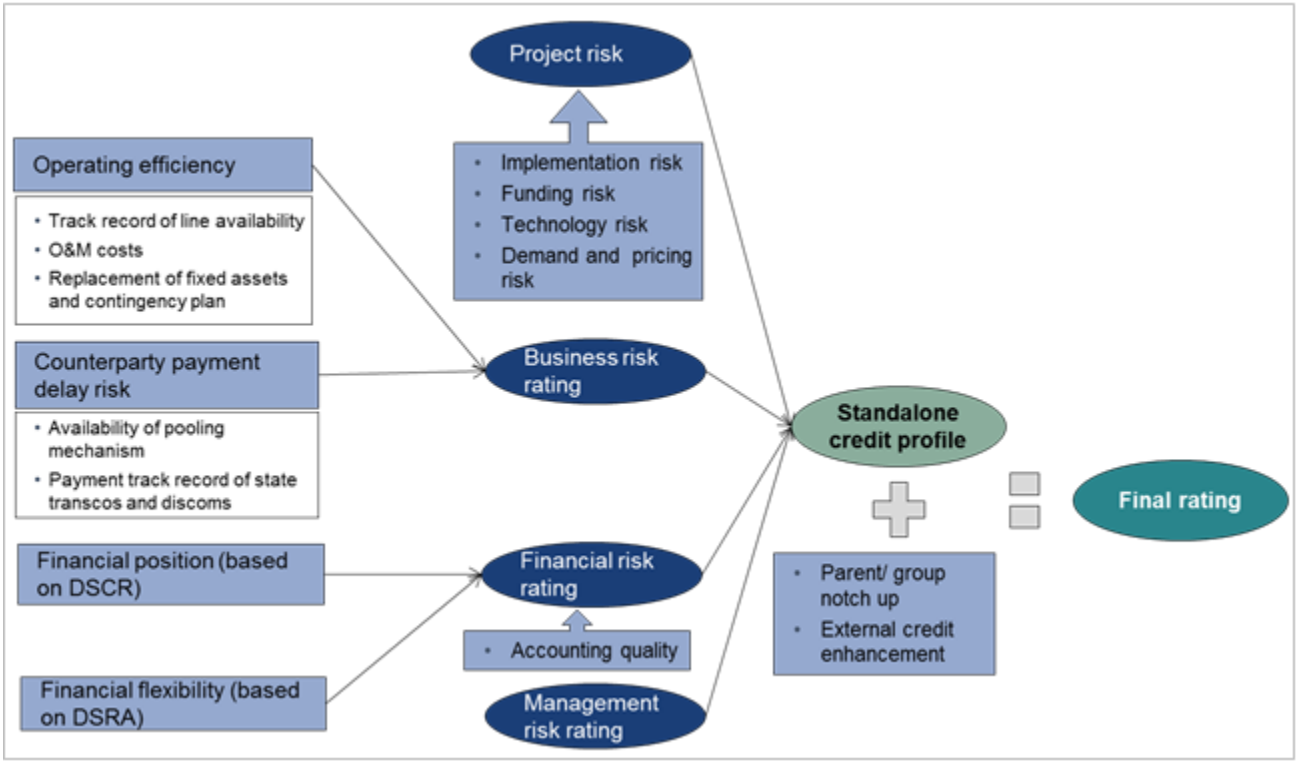
This section focuses on risks faced by power transmission projects and the methodology followed by Crisil Ratings for assessing their credit quality. The methodology is applicable to SPVs executing a single project. In the electricity ecosystem (Chart 1), the position of transmission licensees (SPVs) for which the methodology is applicable is highlighted in red.

Chart 1: Electricity ecosystem



Methodology

Chart 2: Framework for rating power transmission projects



1. Project risk

For transmission projects under implementation and yet to become operational, the rating factors project risk (see Table 1).

Table 1: Factors for assessing project risk

Key project risks	Explanation
Implementation risk	Issues related to land acquisition and environmental clearances, and delays in awarding contracts may hamper timely implementation. Terrain complexity enhances risk. While segments passing through plain terrain are easy to execute, those near hills, forests or rivers are more complex.
Funding risk	Availability of funding—both debt and equity—is critical for timely completion of the project.
Technology risk	Technology associated with transmission networks is proven and involves standard electrical equipment, reducing risk of disruptions and need for maintenance.
Demand and pricing risk	Power transmission is a natural monopoly, as duplication of transmission lines is highly unlikely. Hence, demand risk is negligible. Pricing risk is negligible as tariff is based on competitive bidding and approved by the CERC. These contracts are of long duration (typically 25-35 years). Long-term transmission customers (LTTCs) pay SPVs in proportion to the allocated capacity.

Crisil Ratings also factors in the track record of sponsors with regard to timely project completion and the post-implementation debt-servicing ability and liquidity of projects. However, as power projects span long distances, cost overruns and delays are common. Hence, ratings may be lower during the project implementation stage.

Post construction, transmission assets do face some teething issues in maintaining line availability above the normative levels and receiving payments from counterparties on time. It is only when operations have stabilised that the operational metrics may be tested for base-case assumptions. This stabilisation phase can be as long as 18 months depending on the counterparty payment behavior. SPVs with PoC mechanism take less time to stabilise.

Operating efficiency

Given the long-term nature of TSAs, transmission SPVs face limited demand risk. Tariff is determined through competitive bidding and is unlikely to change once approved by the CERC, ensuring healthy revenue visibility. However, cash inflow and outflow could vary depending on performance risk resulting from variations in line availability and O&M cost, and natural factors.

In its analysis of operating efficiency of transmission projects, Crisil Ratings considers factors that may impact cash flow, including the SPV's ability to maintain line availability higher than that specified in the TSA. As transmission assets are long-lasting, most of the expenses tend to be related to O&M. Crisil Ratings evaluates the SPV's ability to cover expected expenses and plan for unexpected circumstances (such as breakdown due to topographical conditions) so as to sustain debt-servicing ability.

- **Performance risk:** Decline in line availability below the upper threshold (say 98%) reduces transmission charges. There is an additional penalty if line availability drops below the lower threshold (say 95%). Incentives are offered if line availability is maintained above the upper threshold, which result in higher cash inflow. Analysis by Crisil Ratings indicates that most operational transmission assets have a strong track record of maintaining line availability of 99% and higher. Decline in line availability tends to be temporary and is soon restored. However, as cash flow depends on overall line availability, Crisil Ratings considers the track record of transmission projects in maintaining higher-than-normative line availability as a key input in its credit risk assessment.
- **O&M expenses:** Though O&M expenses do not constitute a substantial portion of cash outflow, periodic maintenance is crucial to avoid issues related to tripping of transmission lines, which impacts overall line availability. With

increasing uncertainty in the climatic patterns across the globe, insurance expenses can also rise over time. Crisil Ratings evaluates the nature of the O&M contract, adequacy of insurance coverage and adequacy of electrical components and technically qualified manpower for upkeep of transmission networks. Projects which are likely to absorb escalation in O&M expenses without any adverse impact on their debt-servicing ability will have a higher rating.

- **Geographical risks and contingency plan:** Transmission assets have a long life of 30-35 years, which usually exceeds the loan tenure. While breakdowns are rare, assets in geographies prone to extreme weather conditions are more susceptible to this risk. For example, abnormal wind conditions or cyclones may damage transmission towers, or frequent lightning may cause line tripping and lead to wear-and-tear of insulators and other hardware fittings. Hence, geographical and topographical conditions are critical parameters factored into risk assessment. Moreover, the management's contingency plan to restore line availability fast becomes critical. Hence, measures such as the availability of back-up transformers, provisions for replacement of insulators and other hardware fittings, and adequate insurance cover, are critically evaluated.

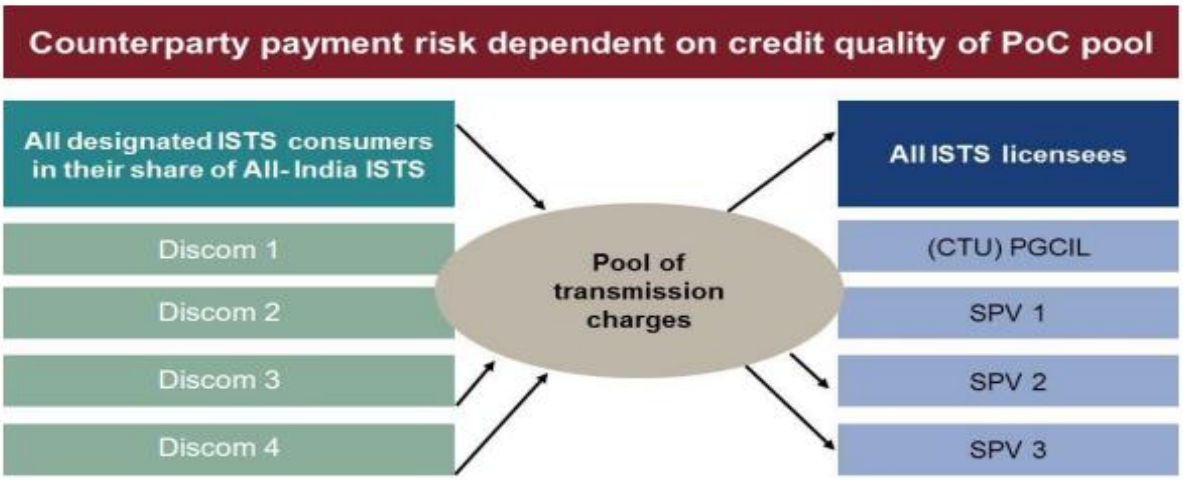
2. Counterparty risk

This risk arises in case of delay or non-payment of dues to SPVs. Non-payment of dues is not a major risk as discoms have limited alternatives in terms of transmission infrastructure, and because transmission, unlike generation, constitutes a small proportion of their payables. However, there is uncertainty whether discoms will pay on the due date. More-than-anticipated delay in payments can impair the ability of transmission SPVs to service debt on time. The timeliness of payment depends on the financial health of discoms and the type of collection mechanism adopted by SPVs (PoC or non-PoC).

PoC mechanism: Interstate transmission projects

Under the PoC mechanism, which is typical in interstate projects, an inter-state transmission system (ISTS) licensee does not have direct exposure to a single discom. Rather, multiple ISTS licensees pool collections as per their respective tariffs. The CTU (100% subsidiary of PGCIL) is the collection agency responsible for billing, collecting and distributing transmission charges. Each ISTS licensee will inform the CTU of the amount due on its lines, while the designated customer will issue a statement on the extent of power drawn. The details are submitted to the national load dispatch centre, which fixes the rate per megawatt (MW) for that quarter, based on which the CTU issues bills for the quarter. On receipt of payment from customers, it is disbursed to each licensee based on the disbursement ratio for that quarter.

Any shortfall on account of delay in payment by a discom is borne collectively by the ISTS licensees in proportion to their share in the pool. For example, in the figure below, ISTS licensees, including PGCIL, collectively owe Rs 100 (Rs 25 each). Let us assume a scenario where the CTU collects Rs 90 within the due date. In this scenario, each licensee will receive Rs 22.5, that is a shortfall of Rs 2.5 for each licensee. In contrast, if the delay in payment of Rs 10 was on account of Discom 3 delaying its dues to SPV 2, in the absence of the pooling mechanism, SPV 2 would have borne the entire impact of Rs 10 instead of the four SPVs bearing the impact of Rs 2.5 each.



Hence, the PoC mechanism leads to more collection efficiency for ISTS licensees than what the individual entities would have in the absence of such a mechanism. Additionally, stringent regulations related to non-payment of transmission charges have led to significant improvement in collection efficiency, as indicated by the strong track record of CTU/PGCIL, which had stable collection of around 98%+ over the past few years.

Hence, counterparty payment risks are lower for interstate projects that collect payments through a pooling mechanism. The monthly collection efficiencies, which are linked to the payment patterns of the DISCOMs, may be volatile for these assets. But typically, it normalises to 98-99%+ over a longer time horizon.

Intrastate transmission projects: Exposure to a single transmission utility

In intrastate transmission projects, the counterparty is an STU, which depends on state discoms for cash flow. Hence, there is no diversification benefit and bargaining power available to PoC pools. In such a scenario, Crisil Ratings evaluates the track record of payments by the STU to SPVs, and whether it is at significant variance with payments by discoms to transmission utilities. Crisil Ratings also assesses state discoms based on their payment track record and ranks them under different payment risk categories.

Crisil Ratings believes maintenance of adequate liquidity by SPVs, in the form of DSRA and other cash equivalent, is critical to mitigate counterparty payment risk. The greater the delay in payment by counterparties, the more liquidity the transmission licensee will need to maintain to lessen counterparty payment risks.

3. Financial risk

A DSCR-based cash flow approach is used to evaluate the financial strength of SPVs. This methodology takes into account line availability, operating expenses, asset replacement charges, and interest and principal obligations during the tenure of the debt. Crisil Ratings also analyses liquidity maintained by SPVs in the form of DSRA to withstand any counterparty payment delay.

Transmission projects can operate with thin DSCR because of the predictability of their cash flow. This is in contrast to toll road and renewable (wind and solar) power projects. Toll projects have uncertain cash flow due to demand and price risk, as traffic volume is unpredictable and toll rates are subject to revision. For renewable power projects, seasonal PLFs lead to uncertain output. Hence, these projects need higher DSCR.

Conclusion

For rating transmission projects, Crisil Ratings focuses on adequacy and stability of cash flow for servicing debt, and liquidity required to mitigate counterparty payment risks.

Crisil Ratings also evaluates qualitative factors to arrive at the standalone rating of transmission SPVs and may factor in parent/group support or external credit enhancements through guarantees (partial or full). Methodologies for factoring in parent/group support and for evaluating partial guarantee instruments are covered under other criteria available on Crisil Ratings' website.

Rating methodology for solar power projects

Background

Solar power is emerging as a major segment in the renewable energy space because of the push from the government and the rapid decline in capital cost. Solar power projects depend on solar radiation, also called insolation, to generate electricity, and face lower fuel availability risk than conventional sources of power.

Solar power projects face risks such as variation in radiation levels, new technology, solar panel quality, and counterparty payment risk. While vulnerable to climatic changes, the inter-annual variability in solar radiation, unlike wind speed, is relatively low. There are significant technology risks involved in solar power projects because, barring some exceptions such as crystalline silicon, the technology is new, evolving rapidly, and often owned by companies with moderate-to-weak credit quality.

Counterparty payment risk pertains to the risk of delays in payment by state power discoms. Crisil Ratings believes solar power projects can mitigate this risk by maintaining adequate DSCR and liquidity buffer.

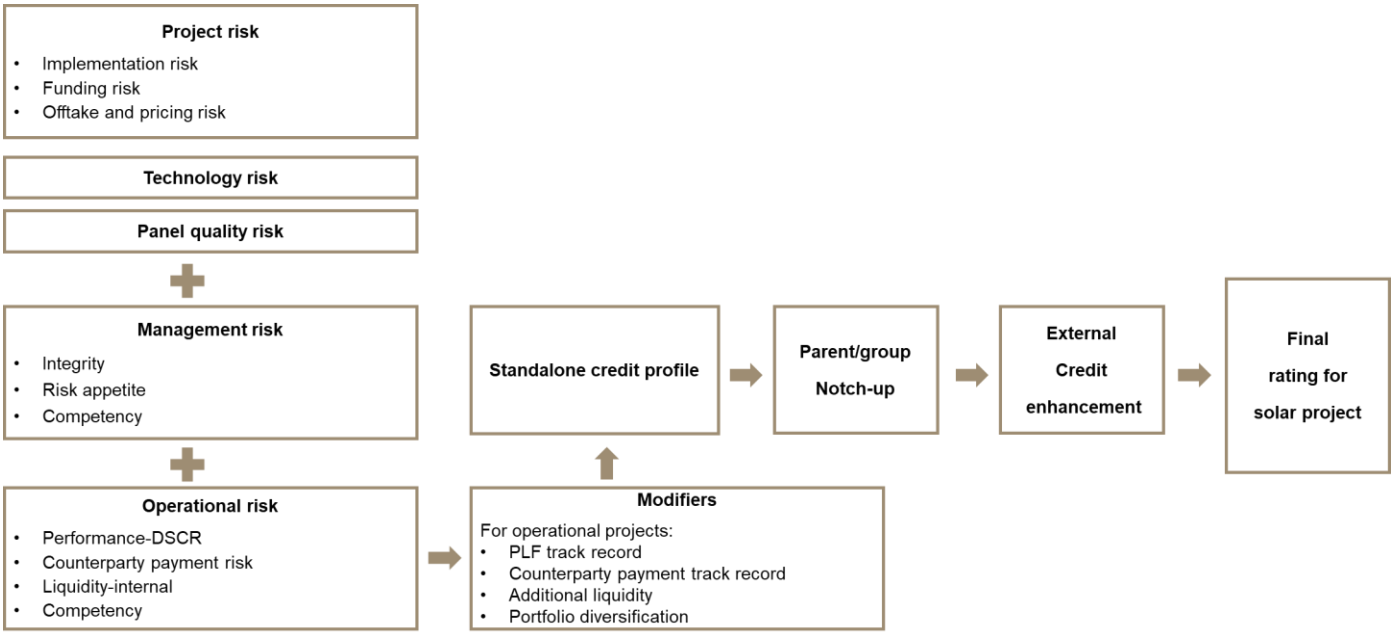
In its analysis of solar power projects, Crisil Ratings takes into account all the risks that impact their credit quality and the risk-mitigating initiatives adopted by the sponsors. The analysis also factors in the risk related to renewal of PPA and considers the benefits of portfolio diversity.

This section covers the risks that solar power projects face, and the rating methodology Crisil Ratings follows for assessing their credit quality.

Methodology

The Crisil Ratings framework for assessing a solar power project is indicated in Chart 1. This methodology is similar to any other project finance assessment.

Chart 1: Framework for rating solar projects



Project risk

For solar power projects under implementation and yet to enter the operational phase, project risk (see Table 1) plays a key role in arriving at the standalone credit rating.

Table 1: Factors to assess project risk

Key project risks	Explanation
Implementation risk	Solar power projects face fewer implementation risks. However, issues related to land availability and power evacuation because of delays in commissioning of transmission lines could be a major hindrance to timely completion of projects.
Funding risk	Availability of funding, both debt and equity, is critical for timely completion of the project.
Offtake and pricing risk	PPA with a distribution company or captive power consumers reduces the market risk once the solar power project is commissioned.

Solar power projects are relatively less challenging to set up than thermal power plants and have an established track record of timely completion. That said, they face risks related to land availability and evacuation infrastructure which play a key role in determining debt servicing ability. Nevertheless, these risks are usually lower for projects set up in solar parks and this is factored in the credit rating.

Solar power projects face stabilisation risks after construction is complete. It is only when the operations have stabilised that the operational metrics may be tested for base-case assumptions. The stabilisation phase may vary from one to two years.

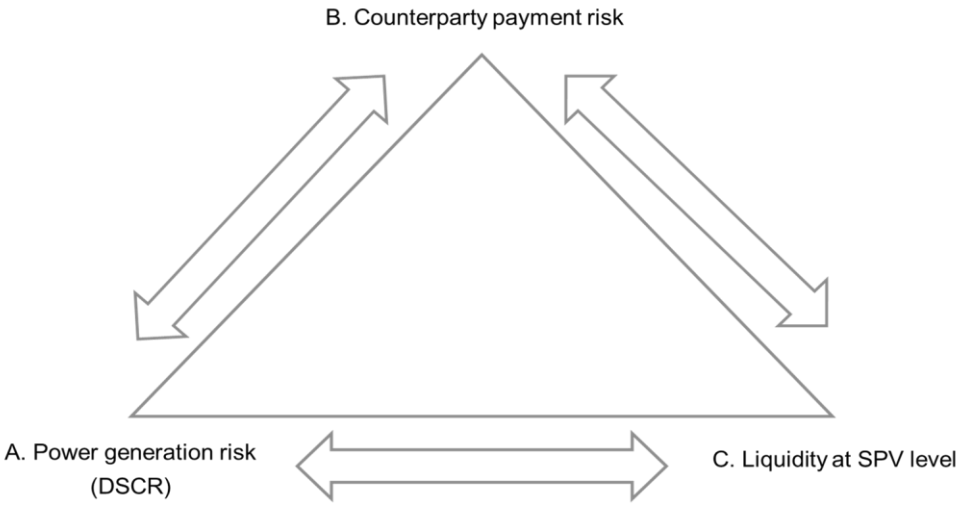
Management risk

Crisil Ratings evaluates the management in three broad categories: integrity, risk appetite and competency. For details, please refer to the Crisil Ratings article, 'Crisil Ratings criteria for manufacturing, trading and corporate service sector', available on www.crisilratings.com.

Operational risk

Operational solar power projects primarily face generation and counterparty payment risks, which can be mitigated through adequate liquidity and DSCR.

Chart 2: Framework for capturing operational risk



a. Power generation risk:

A solar power project SPV will depend on cash flow generated by the asset for servicing debt. The cash flow will depend on electricity generated, which is vulnerable to inter- or intra-annual variability in solar radiation.

Inter-annual variation: Solar radiation may vary from year to year, though not as significantly as wind speed (variations are less than half of that in wind speed). Crisil Ratings believes the inter-annual variation risk can be largely mitigated by projecting power generation at a PLF of P90 in the base case to arrive at the appropriate DSCR and rating.

Annual seasonality: Solar radiation is seasonal, peaking in summer and declining in monsoon. However, the seasonality, at least in Indian conditions, is typically less than half of that for wind. The lean season for solar power typically is of 3-4 months compared with 6-7 months for wind. (See section, 'How does seasonality risk differ between solar and wind projects?'). Crisil Ratings believes solar power SPVs may mitigate the impact of variability in power generation by maintaining liquidity buffer or by retaining surplus cash generated during the peak season to cover the deficit in the lean season.

b. Technology risk:

Technology risk is an important credit rating factor for solar PV projects because the technology is still evolving. Different technologies have varying track record of efficiency and degradation. *(See box, 'What is degradation in solar panels?')*

Crystalline silicon technology has a long and established track record in capturing solar radiation. It has been operational for some time and deployed in several utility-scale projects globally. Thin-film technologies (CIGS, CdTe, and amorphous) do not have such a proven track record. The quality of thin-films and the production process varies among manufacturers. Hence, for thin-film technologies, the reputation of the vendor and the credibility of the technology and manufacturing process will play a critical role in determining technology risk. Unproven technologies with moderate reputation and limited track record face more risks such as steep degradation and dramatic equipment failure. These risks are factored in while arriving at the credit rating.

c. Panel quality risk:

The quality of solar panels varies among manufacturers. Even for the same manufacturer, the quality may vary significantly across specifications. For instance, a reputed solar manufacturer may have 30 products across 20 price points. Solar project developers will try to optimise between quality, price, and panel-supplier reputation because of pricing pressure spawned by competitive bidding.

Crisil Ratings analyses the factors given below to assess equipment quality risk. Management interaction and reports by third-party consultants (part of the project report) will play a key role in the assessment of these factors. The project rating may be constrained because of concerns regarding panel quality. But this could be offset if satisfactory empirical evidence proves that the panel quality is not detrimental to performance.

What is degradation in solar panels?

Solar panels convert solar radiation into electrical energy. The ability to do so declines steadily and irreversibly over time. The degradation may be in a cell or parts of a module or both. The ability to accurately predict power delivery over time is vital to assess the credit risk profile of a project. The thumb rule in the industry is 0.75% system degradation per annum. That translates into 10% degradation over 10 years and 20% over 25 years. Anything higher is considered a risk to cash generating ability and, by extension, to debt servicing ability. Degradation depends on many factors such as technology, panel quality and maintenance.

How does seasonality risk differ between solar and wind projects?

The table below highlights energy generated by typical solar and wind projects operating in India. In wind projects, nearly 60% of the energy is generated in just four months, while in solar projects, the generation is more spread out—close to 55% in six months. Hence, for a solar power project, liquidity required to mitigate the seasonality risk is much lower.

Months	Solar	Wind
Jan	7%	6%
Feb	8%	5%
Mar	9%	5%
Apr	9%	17%
May	9%	15%
Jun	9%	12%
Jul	8%	12%
Aug	8%	5%
Sep	9%	4%
Oct	8%	5%
Nov	7%	8%
Dec	7%	5%
	100%	100%

- **Reputation of the module supplier:** The reputation of the module supplier depends on track record, bankability, scale of orders executed, order backlog and technological capability. The landscape of solar panel suppliers is constantly changing with new companies setting up shop and several exiting due to weak credit risk profile. Financial distress at the time of supplying panels to a rated solar power project may result in the supplier compromising on quality, leading to low quality of the project. In addition, it is the manufacturer's credit quality that backs the warranties on panels.
- **Design quality:** Design quality is driven by the type and combination of materials used to build the module. Because of pricing pressure, panel makers may buy cheaper cells and assemble them into panels. The quality of other components such as glass, back-sheet, module junction box, and cable connectors could also be compromised. International standards governed by IEC indicate a minimum threshold to predict reliability.
- **Manufacturing quality:** Manufacturing quality is driven by the process followed. This can vary from factory to factory, especially in a scenario when many panel manufacturers outsource production of modules. Hence, it is important for a

project developer to look closely at the materials and control quality during production by keeping a tab on the process, from raw material supply to the finished module.

- **EPC quality:** Although construction complexity for solar projects is much lower than that for thermal projects, the quality of construction may vary significantly from one EPC player to another. Hence, the reputation, track record, industry expertise, and bankability of the EPC contractor are critical when assessing the quality of a project.
- **Warranty and insurance:** Manufacturers of solar panels extend warranties of 20 years or more. This provides business certainty and assures project developers performance up to 90% for 10 years and 80% for another 15 years. If panels degrade more and affect project cash flow, the manufacturer will fulfil the warranty by supplying additional panels that will enable achievement of the performance originally warrantied. However, if a manufacturer has shut shop, the warranty is of limited use. To overcome the credit risk in warranty, suppliers back their warranties with third-party insurance. It is critical to understand the nature of such insurance and the extent to which they compensate any material failure in performance warrantied by the panel manufacturer. Modules from other equipment suppliers can be made compatible after minor engineering modifications, which, however, may come at a cost. Like panel suppliers, EPC players also provide performance guarantee for two years and workmanship guarantee for five years.

d. Counterparty risk:

Solar power projects usually have PPAs with discoms or captive consumers. While PPAs tend to reduce the demand risk, operational solar power projects continue to face counterparty payment risk. Even if the SPV generates adequate power and supplies to a buyer, any delay in payment by the buyer can significantly impact the SPV's credit quality. Payment risk varies from buyer to buyer.

The payment risk is not the same as the counterparty's credit quality. Often, state discoms with weak credit risk profiles continue to make payments to power generation companies, albeit with delays. That's because discoms may get support from the respective state government. Some discoms have a better payment track record for their purchases of renewable power.

Crisil Ratings has assessed state discoms based on their payment behaviour over the past few years along with other factors (see Table 2) and classified them into various payment risk categories.

Table 2: Approach to assess the payment risk category

Risk factor	Aspects analysed
Business profile	• Track record of recent increases in tariff • Aggregate technical and commercial losses • Profit gap (in rupees per unit on subsidy booked basis)
Financial profile	• Networth • Debt • Losses
State government's ability to support	• Release of subsidy • State government rating
Payment track record	• Payment track record in the past few years

e. Liquidity at the SPV level

Crisil Ratings believes maintaining adequate liquidity at the SPV level is critical to mitigate counterparty payment risk and seasonality. The more the delay from counterparties, the higher will be the liquidity that the SPV needs to maintain to mitigate counterparty payment risk. Also, seasonal deficit in a typical project is about two months of debt obligation.

Crisil Ratings factors in variation in solar radiation and payment risk appropriately. The rating depends on the DSCR and liquidity maintained by the SPV. The liquidity requirement varies with counterparty risk and the extent of seasonality. Given the sector's inherent risks and the economic considerations where the developer may want to generate reasonable returns on investment, project DSCR and liquidity are unlikely to be substantially high.

Modifiers

There are other project-specific modifiers that may also impact the SPV's credit quality.

- **PLF track record:** Crisil Ratings considers a P90 PLF for projects to arrive at the DSCR. Thus, it is expected that the average annual PLF will be greater than the P90 PLF in 9 out of 10 years. However, if the project has a PLF track record that is much weaker—for instance, if output has been at a sub-P90 level for 2-3 years—it could indicate either faster degradation or less-than-expected solar radiation. This will constrain the cash generating ability, and thereby, the rating of the solar power project. On the other hand, if the PLF in the first few years is materially higher than the P90 level—for instance, between P50 and P75—it is still consistent with the expected power curve. If a new study indicates that the new P90 PLF is higher than the one assumed earlier, Crisil Ratings will use the new P90 PLF in its assessment.

Why use P90 PLF levels to calculate DSCR?

Please refer to the Annexure to understand why P90 PLF levels are used to calculate DSCR

- **Payment track record:** Crisil Ratings has categorised counterparty payment risk based on which a base-case assumption of likely payment delay is made. However, if the observed payment pattern for specific solar projects is materially different from the base case assumption for a substantial period of time, this will be taken into account while arriving at the rating.
- **Liquidity at the parent level:** The liquidity requirement for mitigating the seasonality and payment risks should be available at a project level. However, if the SPV's parent has a policy of maintaining liquidity buffer on its balance sheet for addressing cash flow mismatches of the SPVs it has sponsored, Crisil Ratings takes this into account when rating the SPV.
- **Portfolio diversification:** Crisil Ratings views portfolio diversification through geographical and counterparty diversification positively. Solar farms spread across locations and supplying to different counterparties tend to reduce the impact of risks related to resource variation and counterparty payment. Crisil Ratings notches up the rating of an SPV if it has greater stability in cash flow on account of portfolio diversification.
- **PPA tenure and renewal risk:** If the PPA tenure is less than the debt tenure, the SPV will face pricing risk. The lesser the tenure of the PPA compared with the debt tenure, the greater will be the risk.
- Also, if the PPA is priced close to or lower than the prevailing market rate, renewal risk is low. On the other hand, if the current tariff considerably exceeds the prevailing market rate, the project will face renewal risk once the PPA expires. Also, the liability structure could be such that the entire principal is not amortised over the tenure of the debt, leading to a large bullet payment at the end of the tenure. This exposes the project to refinancing risk. Crisil Ratings will assess these aspects and adequately factor in the risk when arriving at the rating of the solar power project.

- The above methodology, which includes assessment of project risk, management risk and operational risk along with other modifiers impacting the credit quality of the solar power project, is used to arrive at the standalone rating of the SPV. Crisil Ratings may also consider parent/group support or any other external credit enhancement mechanism to arrive at the final rating on debt instruments of the SPV

Crisil Ratings methodology for multiple SPVs belonging to the same group

Many a times promoter groups operate multiple renewable assets housed in separate SPVs. Crisil Ratings uses the homogenous group methodology to consolidate these SPVs to arrive at the individual SPV rating if cash flow is fungible among them and the management has articulated its intent to support them.

Conclusion

The Crisil Ratings methodology for rating solar power projects involves extensive analysis of all the pertinent risk factors. The analysis focuses on the adequacy and stability of cash flow for debt servicing, and considers the risk mitigation initiatives the SPV has set in place for factors that impact cash flow adequacy and stability. In addition, Crisil Ratings may factor in parent/group support or external credit enhancement in the form of guarantees (partial or full) when assigning credit ratings. The methodologies for parent/group support and for evaluating partial guarantee instruments are covered under other criteria on the Crisil Ratings' website.

Rating methodology for wind power projects

Background

Wind power projects depend on wind speed for generating electricity, and therefore, have lower fuel availability risks than other conventional sources of power generation. Moreover, wind power technology has established itself in the renewable energy space, given its track record of more than three decades in operations and predictability regarding performance and lifecycle maintenance.

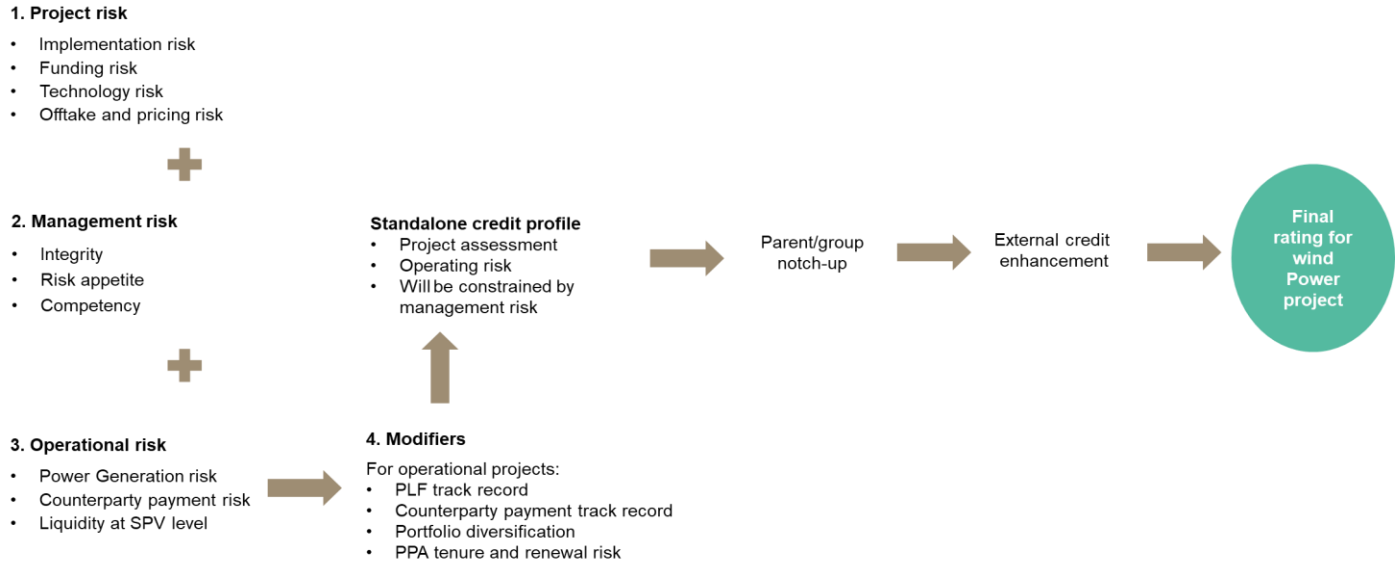
However, wind power projects face some risks, the key ones being wind variability and counterparty payment risks. As wind power primarily depends on wind speeds, it is exposed to the vagaries of nature. Wind speeds may vary from year to year and even within a year. The counterparty payment risks pertain to delays in payments by the state power discoms. Crisil Ratings, however, believes that wind power projects can mitigate these risks by maintaining adequate DSCR and liquidity buffer. In its analysis of wind power projects, Crisil Ratings considers all the risks that impact their credit quality and the risk-mitigating initiatives adopted by their sponsors. The analysis also factor in the benefits of portfolio diversity and risks relating to renewal of PPA.

This section explains the methodology of Crisil Ratings for assessing the credit profiles of wind power producers and discusses the risks faced by wind power projects.

Methodology

The Crisil Ratings framework for assessing the rating of a wind power project is indicated in Chart 1. This methodology is similar to any other project finance assessment.

Chart 1: Framework for rating wind projects



1. Project risk

For wind power projects that are under implementation and yet to enter the operational phase, the rating takes into account project risks (*see Table 1*):

Table 1: Factors for assessing project risk

Key project risks	Explanation
Implementation risk	Design and construction risks in wind power projects are negligible. Wind power projects have a proven track record of timely execution across several installations. However, land availability and power evacuation issues due to delays in commissioning transmission lines could pose a major challenge for timely completion.
Funding risk	Availability of funding—both debt and equity—is critical for timely completion of the project.
Technology risk	Technology used for onshore windfarms such as the turbine and gear boxes is proven.
Offtake and pricing risk	PPAs with discoms or captive power consumers reduce market risk once the wind project is commissioned.

Wind power projects are relatively less challenging to implement than thermal power plants and have a track record of timely completion. Crisil Ratings factors in the sponsor track record of timely completion of projects and the project's post-implementation debt-servicing ability and liquidity while assigning the rating. The rating factors in stabilisation risks on completion of construction.

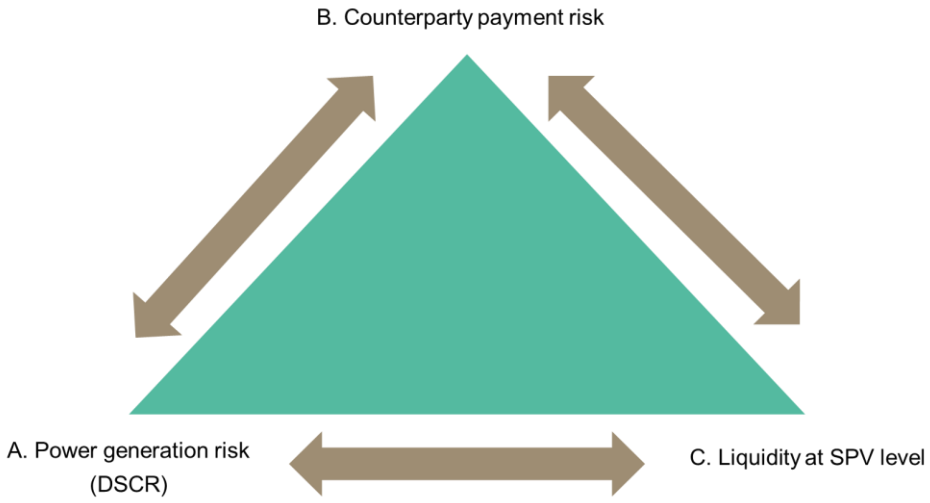
Management risk

Crisil Ratings evaluates the management in three categories: integrity, risk appetite and competency. *For details, refer to 'Crisil Ratings criteria for manufacturing, trading and corporate service sector' available on www.crisilratings.com.*

2. Operational risk

Operational wind projects primarily face risks pertaining to power generation and counterparty payment. The risks may be mitigated by maintaining adequate liquidity and a sufficient DSCR.

Chart 2: Framework for capturing operational risk



a) Power generation risk

Wind power SPVs depend largely on cash flow generated by the asset for debt servicing. The project cash flow will, in turn, depend on the power generated by the wind farm, and therefore, on the wind speed. The wind speed may vary from year to year and within a year.

- Inter-annual variations: The inter-annual wind speed and therefore the power generated follow a normal distribution pattern. Inter-annual variation risk may be largely mitigated by projecting power generation at a PLF of P90 in the base case to arrive at the appropriate DSCR and rating *(refer to annexure, 'Why use P90 PLF to calculate DSCR?')*
- Annual seasonality: Typically, the peak wind season is of 3-5 months while the lean season is for the rest of the year. Around two-thirds of the annual production is in the peak season. Thus, in the lean season, the project PLF and revenue generation will be much lower than the annual average. SPVs may, however, mitigate the impact of variability in power generated by maintaining liquidity buffers or retaining surplus cash generated during the peak season for making up for the deficit in the lean season.

b) Counterparty risk

Wind power projects also face risks relating to delayed payments from customers. They usually have PPAs with discoms or captive power consumers. However, while the PPAs tend to reduce demand risks for operational wind power projects, the projects continue to face counterparty payment risks. Even if the SPV generates and supplies adequate power, its credit quality may be hit by delay in payments by the buyer. Payment risks vary from buyer to buyer.

The payment risk is, however, not the same as the counterparty's credit quality. Often, state discoms with weak credit risk profiles continue to make payments to the power generation companies, albeit with delays. This is because the state discoms get support from the state government. Some state discoms also maintain better payment track records on their renewable power purchases than on thermal power.

The primary risk for operational wind mills is delay in payments by the discoms. Crisil Ratings assesses the state discoms based on their payment behaviour in recent years and other factors (see Table 2) and classifies them in various payment risk categories.

Table 2: Approach to assess payment risk category of discoms

Risk factor	Aspects analysed
Business profile	• Track record of recent tariff hikes • Aggregate technical and commercial losses • Profit gap (in rupees per unit on subsidy booked basis)
Financial profile	• Networth • Debt • Losses
State government ability to support	• Release of subsidy • State government rating
Payment track record	• Payment track record over last few years

c) Liquidity at the SPV level

Adequate liquidity at the SPV level is crucial to mitigate counterparty payment risks and seasonality in wind speeds. The greater the delay from counterparties, the higher will be the liquidity the SPV needs to maintain to mitigate counterparty

payment risks. Also, annual seasonality deficit in a typical project is 4-5 months of debt servicing (refer 'Assessing annual seasonality.')

Crisil Ratings factors in the wind variability and payment risks appropriately. The rating will vary based on the DSCR and liquidity buffer maintained by the SPV. The liquidity requirement varies with the counterparty risk and the extent of seasonality in the project. Given the inherent risks in the sector and the economic considerations where the developer may want to generate reasonable returns on the investment, the project DSCR and liquidity are unlikely to be substantially high.

Assessing annual seasonality

The following table gives the pattern of PLF generated by a wind power project of 1 MW in a typical year. The project cost is assumed to be Rs 6 crore, funded in a debt-to-equity ratio of 3:1. We have assumed a P90 annual PLF of 20%, the tariff at Rs 5 per unit along with debt tenure of 12 years at an interest rate of 11% per annum serviced through an equated monthly installment (EMI) for the sample calculation.

The power generated in the peak season (months 1 to 4) is about 70% and that in the lean season (months 5 to 12) is about 30% of the annual output. It is assumed that the surplus generated in the peak months is not retained in the SPV. Thus, for an equated monthly payment, in the lean months there is a cash flow deficit against the maturing debt. The deficit in a typical wind power project is about four months of debt obligation. In the example given below, the cumulative deficit in the lean months is Rs 22.38 lakh and the maturing debt is Rs 5.6 lakh each month. Thus, the deficit is around 4 months of maturing debt (Rs 22.38/Rs 5.6).

	Month	PLF	Units generated (kWh lakh)	Cash flow for debt servicing (Rs lakh)	Total debt servicing(P+I) (Rs lakh)	Monthly surplus/ shortfall (Rs lakh)	Cumulative shortfall (Rs lakh)
Peak season	1	37%	2.69	14.05	5.6	8.40	-
	2	48%	3.50	18.54	5.6	12.90	-
	3	50%	3.65	19.35	5.6	13.70	-
	4	34%	2.48	12.92	5.6	7.28	-
Lean season	5	15%	1.10	5.29	5.6	-0.35	-0.35
	6	14%	1.02	4.89	5.6	-0.75	-1.10
	7	12%	0.88	4.09	5.6	-1.55	-2.65
	8	8%	0.58	2.48	5.6	-3.16	-5.81
	9	7%	0.51	2.08	5.6	-3.56	-9.37
	10	6%	0.44	1.68	5.6	-3.96	-13.33
	11	5%	0.38	1.36	5.6	-4.28	-17.62
	12	4%	0.29	0.88	5.6	-4.76	-22.38
		20%	17.5	87.6	68		

This deficit is covered only if liquidity in terms of cash and/or surplus cash flow is retained from the peak season. Operational wind power projects should, therefore, have a base case cash liquidity equivalent to at least four months of maturing debt to fund the deficit during the lean months. However, some projects may have deficits that exceed four months of maturing debt.

3. Modifiers

Other project-specific modifiers may also impact the SPV's credit quality.

- **PLF track record:** Crisil Ratings considers a P90 PLF in determining a project's DSCR. The average annual PLF may, therefore, be expected to exceed the P90 PLF in 9 years out of 10. However, if the project's PLF track record is much weaker—for instance, if its output has been at a sub-P90 level for two to three years—this could indicate that the power curve has possibly shifted and will constrain the rating of the wind power project. On the other hand, if the PLF in the first few years materially exceeds the P90 levels, and ranges, say, between P50 and P75, this is still consistent with the expected power curve. If a new study indicates that the power curve has shifted and the new P90 PLF is higher than the one assumed earlier, Crisil Ratings will use the new P90 PLF in its assessment.
- **Payment track record:** Crisil Ratings has categorised the payment risk of the counterparty, based on which, a base case assumption of likely payment delay is assumed. However, if the observed payment pattern for the specific wind asset differs materially from the base case assumption for a substantial period of time, this will be taken into account while arriving at the rating.
- **Liquidity of the parent:** The liquidity required to mitigate the annual seasonality deficit and payment risk is to be maintained by the project. However, if the parent has a policy of maintaining liquidity buffer on its balance sheet for addressing any cash flow mismatches of the SPVs it has sponsored, Crisil Ratings also takes this liquidity buffer into account while assessing the rating of the SPV.
- **Portfolio diversification:** Portfolio diversification, through geographical and counterparty diversification, helps reduce risk. For wind farms spread across different locations, the farther the locations are from each other, the lesser will be the correlation between their wind speed patterns. Hence, geographical diversification tends to reduce the inter-annual variability (as indicated by standard deviation) of the wind speed. Diversification with regard to counterparties tends to reduce payment risks. Crisil Ratings notches up the rating of the SPV if it has greater stability in cash flows on account of portfolio diversification.
- **PPA tenure and renewal risk:** If the PPA tenure is lower than the tenure of the debt, the SPV will be exposed to pricing risk. The lower the tenure of the PPA compared with the debt tenure, the greater will be the risk.
- If the PPA is priced close to or lower than the prevailing market rate, the renewal risk is low. On the other hand, if the current tariff considerably exceeds the prevailing market rate, the project will be exposed to renewal risk once the PPA expires. Therefore, the higher the current tariff from the market rate, the greater the project's risk exposure.
- The liability structure could be such that the entire principal is not amortised over the tenure of the debt, leading to a large bullet payment at the end of the tenure. This exposes the project to refinancing risk. Crisil Ratings will assess these aspects and risks in rating wind power projects.

This methodology of assessing project risk, management risk and operational risk, along with other modifiers impacting the credit quality of the wind power project, is used to arrive at the standalone rating of the SPV. Crisil Ratings may also consider parent/group support or any other external credit enhancement mechanisms to arrive at the final rating of the debt instruments of the SPV.

Ratings methodology for multiple SPVs belonging to the same group

Many a times promoter groups operate multiple renewable assets housed in separate SPVs. Crisil Ratings uses the homogenous group methodology to consolidate these SPVs to arrive at their individual rating if they have fungible cash flow and the management has articulated its intent to support the SPVs.

Conclusion

For rating wind power projects, Crisil Ratings analyses all the relevant risk factors. The analysis focuses on the adequacy and stability of cash flows for debt servicing. The rating methodology also takes into account the risk mitigation initiatives the SPV has set in place for factors that impact cash flow adequacy and stability. Crisil Ratings may also factor in parent/group support or external credit enhancements in the form of guarantees (partial or full) while assigning ratings to the debt instruments. The methodologies for parent/group support and for evaluating partial guarantee instruments are covered under other criteria on Crisil Ratings' website.

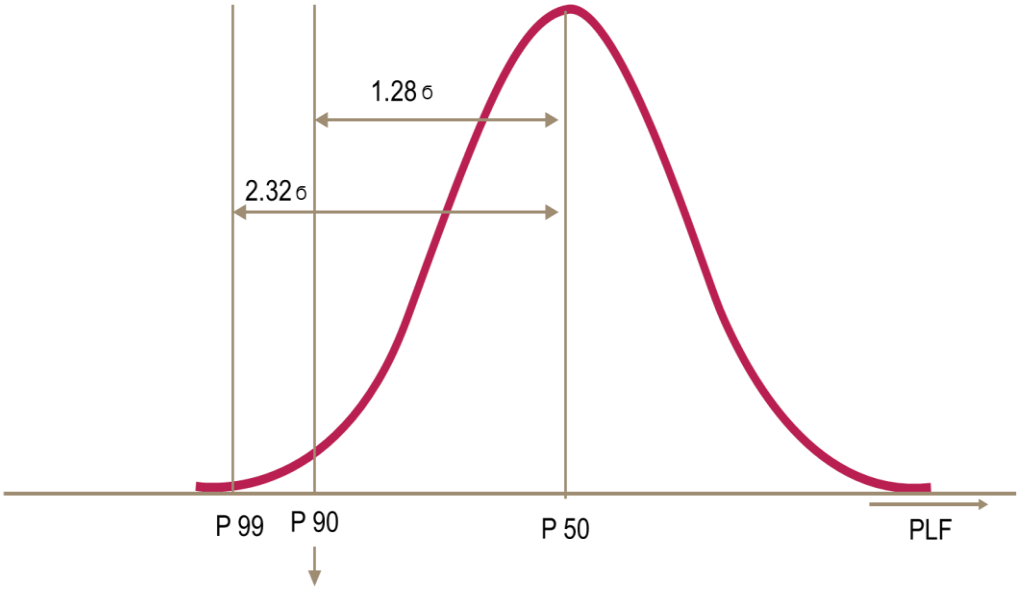
Annexure

Why use P90 PLF levels to calculate DSCR?

The output of solar projects depends on solar radiation, which is an exogenous factor and is variable. The resultant uncertainty is offset by assigning probability to different PLF levels. Based on meteorological and ground-level data, solar radiation at a given site may be assessed, which may be combined with the panel's power output curve to arrive at the expected average annual PLF, which may be termed as P50.

For wind mills, output is driven by wind speed, which is unpredictable. This uncertainty is countered by assigning probability to each PLF level. Based on historical wind speed data, the average wind speeds at a given site may be assessed. These may be combined with the turbine's power curve to arrive at the expected average annual PLF, which may be termed as P50.

As can be seen from the following chart, there is equal probability that the PLF in a given year may be higher or lower than P50. On the other hand, P90 is the PLF level that a wind turbine is 90% likely to exceed in a given year.



P90 has 90% area under the curve to the right Indicating that PLF is higher than this value 90% Of the time

In the early years of a solar panel or wind mill's operations, there may be estimation errors or sharp deviation in actual energy output compared with estimates through studies. In solar, these may crop up because of errors in solar radiation assessment, which is a combination of meteorological satellite data and ground-level data. Furthermore, quality of air due to pollution and suspended air particles can alter solar radiation reaching the panel.

In wind, these may crop up because of errors in calculation of wind speed at incorrect mast heights, sample bias during the study, or faulty estimation of power curves. Furthermore, changing weather patterns due to global warming, and climatic phenomena, such as El Nino, adversely impact wind speeds. Thus, the risk of inter-year wind variability is inherent for wind power projects.

In solar, the standard deviation for PLF estimation is typically 2-3% with a P50 value of 20%. Hence, the variation in PLF in a solar project may not be very high compared with say a wind project where the variation is 4-6%. However, to factor

in estimation error and resource variability risk, Crisil Ratings uses the P90 level of annual PLF when calculating DSCR in both solar and wind power projects. Also, internationally, both solar and wind power estimates are made using P90 PLF.

Financial ratios applicable for power utilities

Power utilities have some unique elements which differentiate them from general manufacturing and services entities. Power utilities generally have well defined contractual cash flows from counterparties through the life cycle of the asset. Given that the cash flows are contractually defined, the business profile of power utilities are more stable and support higher leverage than general manufacturing and services entities.

The financial risk assessment of power utilities involves assessing cash flow adequacy to service debt, capital structure to sustain cash flow volatility and adequacy of liquidity buffer to meet delays in contracted receivables from counterparty. Ratios such as Debt service coverage ratio (DSCR), Debt-to-EBITDA and months of available liquidity buffer in the form of debt service reserve account (DSRA) are used to assess the financial risk profile of power utilities.

Debt service coverage ratio

The adequacy of cashflows in servicing the debt obligations is assessed based on the DSCR over the tenure of the instrument. DSCR indicates the extent to which cashflows of the entity cover the debt servicing obligations which includes both principal repayment and interest expense for the period. DSCR indicates the ability to withstand corridors of stress due to fluctuation in cash flows. Higher the DSCR the better the ability to withstand uncertainty of cashflows.

The rating of an operational power project is primarily driven by the DSCR over the loan life of the project. The DSCR based rating can be based on minimum DSCR, average DSCR or a combination of both depending on variability of cashflows.

The DSCR is calculated using the cash accruals-based approach. Also, average DSCRs for determining rating is calculated based on project cash flows only i.e., without considering parent support or DSRA.

DSCR = (Profit after tax + Depreciation + Interest) / (Interest + Repayment)

Assessment of refinancing risk in power projects:

Power projects can raise debt with lower tenures of ~3-5 years with significant refinance of principal on maturity. Raising bonds with lower tenors initially, and then refinancing the same, enables the project to utilize almost the entire asset life (eg. 25 years for a solar power project) for debt repayment compared with the typical term loan tenure of 10-15 years. However, lower tenures with bullet payments at the end of the tenure expose the issuer to refinancing risk. Crisil Ratings assesses this risk by evaluating the ability of the project cash flows to support the debt over the life of the asset as well as its ability to support the debt expected to be refinanced. Appropriate tail period assumptions are taken into consideration.

Crisil Ratings may also assess Project Life Coverage Ratio (PLCR) of power sector entities where relevant, to ascertain their refinancing risk. PLCR is derived based on dividing present value[4] of cash flows available for debt servicing (CFADS) over the life of the asset by outstanding debt.

[4] Cash flow available for debt servicing discounted at the cost of debt

Debt to EBITDA

Crisil Ratings shall assess the Debt-to-EBITDA ratio for certain power sector entities that fund multiple projects from their own balance sheet and take up regular expansionary capex. Debt to EBITDA indicates the entity's ability to pay-off incurred debt. Lower the Debt to EBITDA better shall be the indicative financial profile of the entity assessed.

Depending on management's philosophy of maintaining cash portfolio in its books, under certain circumstances, Crisil Ratings may adjust the debt against unencumbered cash held by the company to arrive at net debt. This adjustment is done as the company can use the excess cash available to repay the outstanding debt or reduce short-term borrowings. In such cases the ratio shall be calculated in terms of net debt.

Debt-to-EBITDA = Adjusted Total debt / EBITDA

Debt service reserve account:

Liquidity is maintained in power projects to mitigate risks pertaining to timing mismatch in cashflows, counterparty delays, and cashflow variability. Liquidity requirement is lower for projects where structuring ensures that there is adequate time gap between the inflows and outflow. Liquidity requirement is directly proportional to the counterparty delays and cash flow variability.

Power projects maintain requisite liquidity buffer in the form of DSRA to ensure timely debt servicing. Over and above this, power projects generally maintain liquidity as a combination of cash and unutilised fund based working capital limits. At times bank guarantee (BG) is used to replace cash DSRA. For such BGs to be construed as providing liquidity support, they need to have recourse to parent. Crisil Ratings ascertains if parent maintains sufficient liquidity to cover the BG, to provide any liquidity benefit of BG to the project.

Section III.
Crisil Ratings methodology for annuity and HAM road projects

Executive summary

The Government of India invites private participation in the road construction segment by awarding projects under different models such as cash contracts (engineering, procurement and construction [EPC]), toll, annuity, and hybrid annuity. The fundamental differences in these models are the method of compensation and the obligations during the construction and operational phases. This section outlines Crisil Ratings' methodology for rating annuity and hybrid annuity model (HAM) road projects.

In annuity road projects, a special purpose vehicle (SPV) constructs the road and receives fixed payments from the National Highways Authority of India (NHAI) or state government authorities throughout the concession period, with an obligation to maintain the quality of the road. Unlike toll road projects, demand risk here is mitigated by a steady stream of assured payments.

HAM is a variant which combines the features of annuity and EPC projects. In HAM projects, the concessionaire receives inflation-adjusted payments during the project implementation phase to fund a certain percentage of the project cost. During the operational phase, these projects receive annuity payments and maintenance compensation, which are adjusted for interest rate and inflation, respectively.

Both annuity and HAM projects face construction and funding risks in the project phase. Construction risk depends on the availability of right of way (ROW) and environment and forest clearances. Funding risk mainly involves the ease of tying up financing. These risks are mitigated in HAM projects by certain features such as presence of 80% ROW before the work begins and funding support from the concessioning authority during the construction phase.

During the operational phase, annuity road projects are insulated from fluctuations in revenue as cash flow to the concessionaire is fixed and semi-annual as per the concession agreement. So, the major residual risk pertains to the costs — operations and maintenance (O&M), and major maintenance and repair (MMR) — to maintain the road. Crisil Ratings' analysis of annuity road projects considers the adequacy of these costs and potential increases therein due to inflation.

Operational HAM projects, in addition to the annuities, have inflows comprising interest on the residual annuities and inflation-linked maintenance compensation. Such a project resembles a financial asset with almost a pass through cash flow structure, if bid appropriately. The major residual risk, therefore, is the extent of adverse co- movements in the interest rate and inflation. Crisil Ratings' analysis of HAM projects centrally factors in structural cushion in terms of leverage along with any liquidity buffer to manage these residual risks. The revised model concession agreement pegs the interest rate for annuity with MCLR (Marginal Cost of Funds based Lending Rate) – which typically is the index used for interest on term loans, thereby further reducing the residual risks.

Crisil Ratings' analysis also looks at the counterparty risks and adequacy of the liquidity cushion to counter any delay in payment of annuity by the counterparty.

Scope

The scope of the methodology[5] applies to projects that receive annuity payments from counterparties such as NHAI and state governments.

[5] For accessing the previous published document, please refer to below link: https://www.crisilratings.com/content/dam/crisil/criteria_methodology/infrastructure/archive/crisil-ratings-criteria-for-rating-annuity-and-ham-road-projects-oct2023.pdf

This section also covers Crisil Ratings' methodology for financial ratios used for assessing annuity and HAM projects, including adjustments it carries to the reported metrics in the financial statements.

Rating annuity and HAM roads

An annuity or HAM road project has two main stages:

- Construction (project) stage
- Operational stage

The methodology for rating in each of these stages is explained below.

Rating construction (project) stage annuity and HAM road projects

For annuity and HAM road projects that are under implementation, the rating factors in construction/project stage risks. Key risks are listed below.

Table 1: Key risks in annuity and NHAI HAM road projects in the construction stage

Risks	Annuity roads	HAM roads
Implementation	Road projects span several kilometers. Hence, factors such as land acquisition, environmental clearances and delay in contracts may hamper timely implementation. Most clearances and permits are to be sought on an ongoing basis. Terrain complexity such as hills, forests and proximity to rivers makes execution more complicated.	HAM projects fare better in implementation risk front due to the presence of certain specific features. Firstly, 80% ROW is available before the work begins. Also, in the event of delays in handing over required ROW by NHAI within the stipulated time, there is an option to descope or delink. In such instances, the PCOD is given for the completed stretch and annuity payments are received. This feature minimises the risk of delay in project completion which in road projects arises primarily due to land acquisition issues
Funding	Availability of funding, both debt and equity, is critical for timely project completion.	The concessioning authority's support for 40% of the construction cost in HAM projects reduces this risk to some extent.
Technology	The technology for construction of roads is well established.	

Crisil Ratings also factors in the track record of the sponsor with regard to timely completion of projects, post-implementation debt-servicing ability, and liquidity, when rating annuity and HAM projects in the construction stage.

Rating operational annuity and HAM road projects

Major risk factors in operational annuity and HAM road projects are highlighted below:

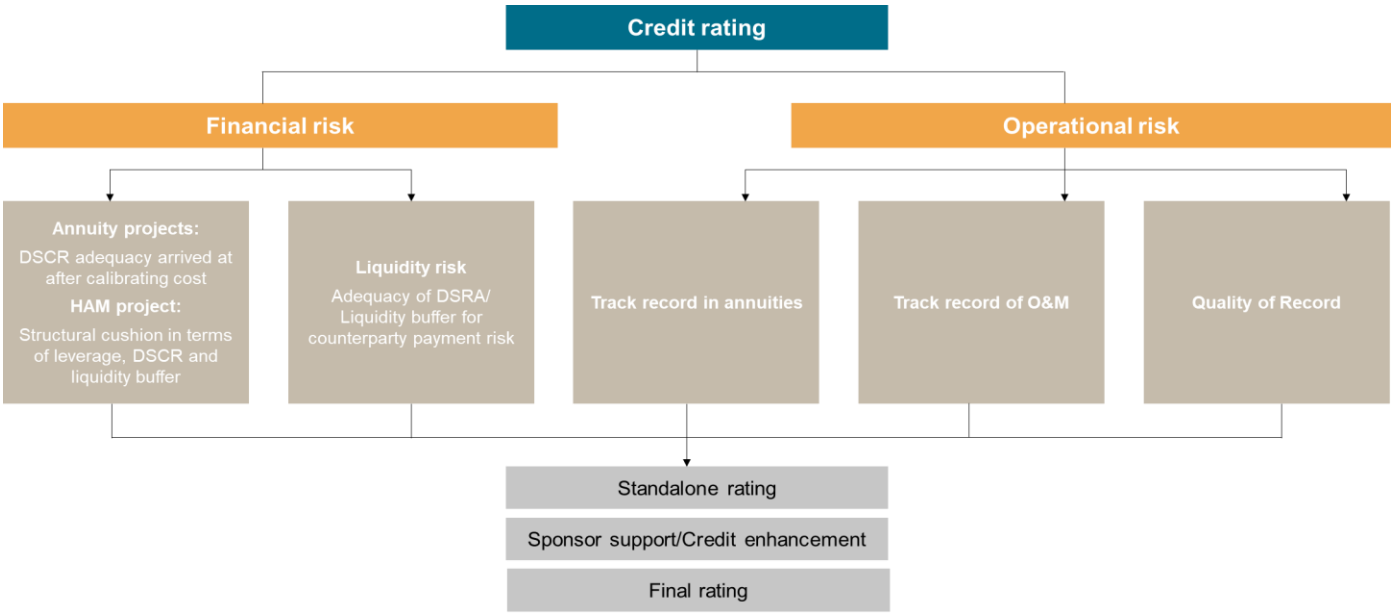
Table 2: Key risks in operational annuity and HAM road projects

Risks	Annuity roads	HAM roads
Demand	No demand risk (fixed semi-annual payments from NHAI or the state government without linkage to traffic on the road)	No demand risk (annuity payments from NHAI or the state government along with interest on residual annuities, and inflation-linked maintenance charges without linkage to traffic on the road)
Price	No price risk	
Cost	Risk due to inadequacy of maintenance estimates of the road to account for actual maintenance cost	Risk due to aggressive bidding leading to inadequate maintenance compensation compared to actual cost

Risks	Annuity roads	HAM roads
Inflation and interest rate risk	Fixed inflow leads to inflation risk on maintenance cost front and interest rate risk on debt servicing front.	Both interest rate and inflation risks are minimised as the inflow is linked to benchmark interest and inflation rates. However, residual risks remain due to possible adverse co-movement of these rates vis-à-vis cost indices.
Counterparty	Risk due to delay in payment of annuities that could lead to liquidity mismatches, thereby affecting ability to service debt on time.	

Methodology to assess operational annuity and HAM projects

Overview of Crisil Ratings' methodology for assessment of operational annuity and HAM road projects



Financial risk

Crisil Ratings' analysis of the financial risk profiles of operational annuity and HAM projects involves analysis of the cash inflow against maintenance and debt servicing requirements, and presence and adequacy of liquidity buffers.

In annuity projects, with inflow being stable and known, the financial risk profile is highly sensitive to the adequacy of the provisions for maintenance expenses. Crisil Ratings looks at debt service coverage ratios (DSCRs) of annuity projects after sensitizing inflation on maintenance cost, to understand their ability to meet financial obligations.

In HAM projects, annuity is received adjusted for interest rate (in the form of interest on residual annuities). Also compensation for maintenance is adjusted for inflation. Such adjustments help mitigate risks arising due to inflation or interest rate movements. However, residual risks remain, arising from adverse co-movements in the indices (if the indices are different), and receipt of inadequate compensation against outflow could lead to cash flow mismatches. Crisil Ratings, therefore, centrally looks at leverage and liquidity in HAM projects, to maintain a healthy credit risk profile.

Key changes introduced to the HAM roads model concession agreements:

The concession agreements of HAM road projects have undergone two key amendments over the past couple of years–

- Interest on annuity balance linked to MCLR (November 2020)
- Maintenance compensation to be paid as fixed percentage of bid project cost (May 2022)

Interest on annuity balance linked to MCLR:

Initially, interest on residual annuities for HAM roads was linked to the bank rate. These HAM roads received 'bank rate plus 3%' as interest on the annuity. However, the interest cost on debt availed was generally linked to MCLR. The use of different indices – bank rate for inflow and MCLR for outflow of interest – resulted in basis risk as the indices may not move exactly in tandem.

NHAI in November 2020 amended the model concession agreement, whereby the interest payouts were linked to MCLR. Projects awarded post November 2020 are to receive 'MCLR plus 1.25%' as interest on residual annuities semi-annually. This change is expected to nullify the nominal basis risk in HAM projects awarded post November 2020.

Maintenance compensation to be paid as fixed percentage of bid project cost:

The bid evaluation as per the initial concession agreement was a factor of both bid project cost (BPC) and NPV of maintenance bid. NHAI in May 2022 amended the model concession agreement whereby it prescribed that the bid evaluation be solely based on BPC and that maintenance compensation be paid as a fixed percentage of BPC for the projects awarded post May 2022. The said changes to the maintenance norms are expected to reduce the risk of under-bidding the maintenance payouts to a large extent.

Leverage:

In case of HAM projects, leverage is measured in terms of Debt to annuity balance. HAM road projects are designed similar to a financial asset wherein the inflows and outflows are largely matched, and the asset is subject to residual risk in the form of adverse co-movement of the inflow-outflow indices. Leverage is used as key determinant of the credit profile to address the inherent nature of HAM model.

Crisil Ratings evaluates the Debt to Annuity balance of the project as it indicates the presence of equity content in a project that can act as cushion against adverse inflation and interest rate movements. The credit profile of a HAM project is sensitive to the bidding strategy employed, as both the extent of absolute maintenance compensation and the corresponding offset on account of inflation depends on the maintenance bid quoted by the developer. Hence, Crisil Ratings may suitably adjust the debt to annuity ratio depending on the maintenance component in the bidding.

With respect to the revision in the MCA in 2022, the maintenance compensation is defined in the MCA itself, thereby doing away with any need for developer to quote separate maintenance bid.

Leverage = Debt / Annuity balance[6]

DSCR:

DSCR is a key indicator of the ability to service debt and is critical for assessing credit quality of annuity and HAM projects. The financial risk profile of annuity projects is primarily driven by the DSCR over the loan life of the project. For

[6] Sum of the balance amount of annuity to be received from the concessioning authority over the remaining concession period as on date of calculating the ratio

HAM projects, besides the leverage assessment, DSCR assessment is carried out to assess the adequacy of cash flows to service debt.

The DSCR profile can be driven by minimum DSCR, average DSCR or a combination of both depending on variability of cashflows. The calculation shall solely be based on project cash flows, without considering parent support or debt service reserve account (DSRA).

DSCR = (Profit after tax + Depreciation + Interest) / (Interest + Repayment)

At times, the debt tenor is shorter when compared to the life of the asset and relies on refinance to meet the repayment obligation. In such situations, Crisil Ratings may factor in the refinancing risk while arriving at the rating.

Calibrating maintenance cost and calculating DSCR in operational annuity and HAM projects

Crisil Ratings' framework primarily focuses on the following key aspects while calibrating the costs to arrive at cash flow for computation of DSCR:

- Adequacy of MMR and O&M costs
- Ability to withstand fluctuations in inflation rate
- Ability to withstand fluctuations in interest rate

These aspects are covered in detail below.

a) Adequacy of MMR and O&M costs

Crisil Ratings evaluates various factors to assess the quality of the road in order to determine the adequacy of MMR and O&M costs. State road projects, which see lesser traffic than national highways, usually entail lower MMR and O&M costs as the wear and tear of roads is lower. Crisil Ratings also factors that high-quality roads may be able to reduce the frequency of MMR or use emerging technologies to carry out MMR at a later stage. Other project specific factors that may affect the MMR and O&M costs, such as presence of freight intensive zones, difficult terrain, and the developer's track record in maintaining operational road stretches, are also factored in.

b) Ability to withstand fluctuations in inflation

Once Crisil Ratings evaluates provisions for maintenance cost, adequacy of inflow to support these costs despite inflation spikes is gauged. This assessment is important as timely maintenance of the road stretch is critical. Non- maintenance could lead to delay in receipt of annuities or in the worst case, suspension of payments from the concessioning authority till the quality of road is restored to the stipulated condition.

Assessment of the SPV's ability to carry out maintenance without seeking support from the sponsor is important. This helps in delinking the credit risk profile of the SPV from that of the sponsor.

In HAM road projects, benchmark inflation-linked inflows offset the cost-side inflation to a great extent. However, there still remains a possibility basis risk, and hence, sensitivity analysis is carried out to account for the extent of adverse co-movements possible in the inflation indices.

c) Ability to withstand fluctuations in interest rates

For traditional annuity projects, Crisil Ratings analyses the adequacy of the cash flow to withstand any fluctuation in interest outgo over the concession period.

HAM road projects receive interest on annuity, linked to the bank rate, for projects awarded before 2021. The SPVs generally borrow debt linked to the MCLR of a bank. While interest received on annuity offsets interest rate risks, the two indices—bank rate and MCLR (or the index with which the borrowings are linked) —need not exactly move in tandem. This leads to residual risk, wherein the inflow may not exactly offset the outflow. Crisil Ratings carries out sensitivity analysis on the interest rate movements to account for the residual risk arising from the movements of these indices.

If the SPV has raised debt at a fixed interest rate, Crisil Ratings' analysis of the cash flow factors in the fixed obligations against fluctuating inflow.

For projects where the interest calculation – both on the inflow and outflow side – is pegged to the same index (e.g. MCLR), this risk does not arise.

Liquidity assessment: Creation of adequate DSRA/ liquidity buffer

In an operational annuity or HAM project, as the concessioning authority is generally a government or a government-controlled entity, the risk of incomplete payments is low and solvency is rarely an issue. However, there could be delays in annuity payments, which could adversely affect the borrower's ability to service debt on time. Hence, presence and adequacy of liquidity cushion is looked into. Besides, time gap between the repayment date and date of annuity receipt is also taken into account, which indicates ability to withstand delays in receipt of annuity.

Crisil Ratings also considers the strength of the counterparty in deciding adequacy of liquidity. Having a larger quantum of DSRA in case of counterparty with higher payment risk would be critical whereas relatively lower DSRA levels would suffice for a project having counterparty with low risk.

For HAM projects in particular, a liquidity buffer may be required to take care of cash flow mismatches arising from differential movement in indices.

Crisil Ratings also evaluates whether liquidity/DSRA is maintained in the form of cash or bank guarantee or if there is a counter guarantee from the sponsor.

Operational risk

Track record of receipt of annuities

Typically, SPVs have to obtain certifications from various authorities to achieve the project commercial operations date (PCOD). Delays resulting from these procedural aspects can push back annuity payments by the concessioning authority. Even after receipt of PCOD, it is important to look at the track record of timely receipt of annuities to establish the stability of the process. Hence, a track record of timely receipt of annuities becomes a critical factor in evaluating operational annuity and HAM road projects.

Track record of maintenance

Crisil Ratings looks at whether the required maintenance (both O&M and MMR) expenses have been incurred. Any shortfall in this can lead to additional wear and tear, thereby affecting road quality. This may lead to a breach of the terms of the concession agreement, leading to non-receipt of annuity. A sustained track record of maintenance is, therefore, critical.

Sponsor track record in managing operational road stretches

Crisil Ratings looks at the history of the sponsor in managing operational stretches. A consistent track record indicates ability to maintain the road as per the agreed requirements. This also highlights the sponsor's ability and willingness to absorb any unforeseen expenses/losses and keep the project operational. Furthermore, Crisil Ratings looks at the

creditworthiness of the sponsor managing the operational road projects. Weak credit risk profile of the sponsor may form a critical factor in evaluating the credit risk profiles of operational road projects, especially in higher rating categories.

Management risk

Crisil Ratings' evaluation involves assessment of the management in three broad categories: integrity, risk appetite and competency. For details please refer to Crisil Ratings' article titled 'Crisil Ratings criteria for manufacturing, trading and corporate services sector' available on www.crisilratings.com. However, Crisil Ratings also notes that compared to a typical manufacturing company, management intervention will be limited for passive infrastructure projects such as annuity and HAM.

Credit enhancement

Credit enhancement in the form of guarantee or other tools may be factored appropriately in the rating.

Sponsor support

Sponsor support refers to financial support from a creditworthy sponsor to account for any delay in annuity or liquidity crunch. Crisil Ratings analyses the possibility of sponsor support based on the stated intent and track record of supporting projects, credit profile of the sponsor, whether it is economically beneficial for the sponsor to support the SPV and to what extent, and the status of other projects of the sponsor.

Conclusion

Crisil Ratings' methodology for rating annuity and HAM projects involves extensive analysis of all the risk factors pertaining to these projects. The analysis focuses on the assessment of leverage and adequacy of cash flow for debt servicing after factoring in the required maintenance costs. The rating methodology also takes into account the liquidity cushion maintained to mitigate the risks arising from cash flow mismatches and delayed annuity payments. In addition, Crisil Ratings may factor in parent/group support or external credit enhancements in the form of guarantees (partial or full) while assigning ratings to the debt instruments

Section IV.
Crisil Ratings methodology for Toll road projects

Executive summary

Crisil Ratings' framework[7] for analysing the credit quality of toll road projects encompasses the following risk factors:

- Project operating risk
- Project construction risk
- Financial risk
- Management risk

Projects in the operational phase face revenue risk. Revenue depends on traffic volume and the toll rate per unit of traffic. Forecasting traffic volume for an under-construction or newly operational road involves analysis of traffic studies including study on origin-destination traffic on existing comparable routes, and likelihood of users switching to the new road based on time and cost saved. For an operational road, historical variations in traffic are key. Linking of increase in toll rate to inflation typically mitigates the risk associated with increasing maintenance cost, and hence, is considered a positive.

Under-construction projects have their own set of challenges in terms of the risk of cost or time overruns. As the road usually does not generate toll revenue in this phase, the role of the sponsor in making good any shortfall is key.

The financial risk of a road project is driven by the projected debt service coverage ratio (DSCR), which indicates the extent of cushion available for debt servicing through the project life and helps ascertain if the structuring of debt is appropriate given the expected traffic variation and increase in toll. Most importantly, it helps establish the extent to which revenue may fall without affecting debt servicing. Roads with high DSCR usually enjoy higher ratings, all other things remaining constant. Liquidity buffers in toll roads cushion debt servicing during temporary disruptions in traffic or tolling.

The assessment of management risk is largely in line with 'Crisil Ratings criteria for manufacturing, trading and corporate services sector, and focuses on integrity, risk appetite, and competence.

TOT (toll-operate-transfer) assessment is also done on the same basis as that of the operational toll road.

Scope

The scope of the methodology applies to projects that charge toll from the users of the road stretch over the concession period. This section also covers Crisil Ratings' methodology for financial ratios used for analysing these projects.

Project operating risk

The analysis takes into consideration critical factors such as projected traffic volume, toll revisions, cost savings for users, inbuilt flexibility in the concession agreement, and operational risks, to determine the overall commercial viability of the project. For projects not yet operational, construction risk is critical.

Traffic volume forecast

The expected mix and volume of traffic on a proposed toll road is assessed by referring to origin-destination surveys conducted by reputed consultants and project advisors. The survey should adequately factor in the effect of seasonal variations. Principal considerations are an analysis of the traffic mix (based on the type of vehicle), origin, destination, purpose, and frequency of traffic.

[7] For accessing the previous published document, please refer to below link:
https://www.crisilratings.com/content/dam/crisil/criteria_methodology/infrastructure/archive/crisil-ratings-criteria-for-toll-road-projects-june2023.pdf

A balanced mix of vehicles improves the commercial viability of the facility. A toll road used exclusively by freight vehicles (such as single-axle trucks) may put pressure on operations and maintenance (O&M) cost. Furthermore, freight traffic is sensitive to seasonal variations (such as increased flow in post-harvest agricultural operations), and traffic volume may diminish in times of industrial recession. Traffic volume is linked to the level of economic activity in the area. Factors such as the type of goods in transit, local and regional demand for these goods, and frequency of movement, are directly related to the stability and growth of industrial and economic activity in the vicinity of the toll road. The strength of the economic base of the principal origins and destinations of the toll road is reflected in the traffic volume forecast.

Creation of new roads does not mean existing road facilities cease to exist. Existing facilities could pose serious competition for limited-access toll roads. The scope of improvement in existing facilities due to the creation of a toll road can add to the uncertainty in forecasting traffic volume for the proposed project. In addition, Crisil Ratings analyses the forecasts with reference to the network of feeder roads and distributaries which will channel traffic into the proposed toll road. Excessive dependence on a few feeder roads can adversely influence the movement of traffic on the toll road. In many instances, the traffic volume was highly overestimated, resulting in significant financial pressure on the operating entity subsequently. Crisil Ratings conducts a sensitivity analysis on traffic volume while evaluating toll road projects.

For toll roads in the operational phase, the historical patterns of traffic on the same stretch form critical inputs into projecting future growth.

Toll rate revisions

Pegging of revisions in toll charges to price index movements helps improve the overall project risk profile, as this tends to offset comparable increases in the price of inputs required for carrying out maintenance, operating, and administrative activities. Some concession agreements specify the precise amount and timing of toll revisions.

Estimating willingness of users to pay

Willingness of users to pay for services is a critical assumption in assessing commercial viability. The demand forecast for the proposed toll road will materialise into a revenue stream only if the benefits accruing to users are in excess of the cost (toll charge). These benefits take the form of savings in:

- Vehicle operating cost (VOC),
- Transit time
- Distance covered

Typically toll roads offer high speed, superior surface quality, and high safety features which results in users benefiting in terms of significantly lower VOC (less fuel consumption and wear-and-tear). Revenue risk is considerably lower for toll roads that offer such benefits on a sustainable basis.

Flexibility in concession agreement

Concession periods can be fixed or variable. In the latter case, the build-operate-transfer operator has the option to extend the concession period if the anticipated revenue stream does not materialise. This reduces the pressure of setting a high toll charge in the initial phase of operations, as compared to a fixed concession period model. This reduces the overall project risk compared with fixed-duration concession agreements.

Project construction risk

Delays in project construction can seriously impair revenue generation and debt servicing. The factors considered by Crisil Ratings in assessing project construction risks are:

- The profile of stakeholders and the financial structure of the special purpose vehicle (SPV) undertaking the construction
- Capability of the promoters in undertaking large multi-phased projects
- Financial strength of the sponsor and its ability to raise resources for the project
- Receipt of requisite approvals with respect to right of way (RoW), that is, land acquisition and associated rehabilitation and resettlement issues
- The reputation and track record, and financial position of the engineering, procurement, and construction (EPC) contractor
- Legal considerations in project construction documents
- Scheduling of construction
- Covenants for timely construction

The complexity of these factors will increase if the road passes through several states. The extent to which the government is involved in land acquisition and related activities will have a strong bearing on the risks associated with the project. In addition, lack of clarity in the legal arrangements between the financiers, equipment suppliers, and contractors can constrain timely completion.

On the other hand, enhancement projects like conversion of 4 lane to 6 lane stretches, have relatively low project construction risk compared to greenfield stretches as the ROW issues are likely to be lower and as the developer can toll the existing 4 lane stretch which reduces funding burden.

Penalties for late and bonuses for early completion, and their quantum in relation to the debt to be serviced over the period, form a part of Crisil Ratings analysis. Any situation wherein the penalty payable by the project contractor is less than the liability towards the proposed debt holders is viewed unfavourably by Crisil Ratings.

Financial risk

Projected financial performance and DSCR

Crisil Ratings assesses the projected financial performance from the perspective of the project meeting its maintenance cost and debt obligation. Specific attention is given to assumptions (such as growth in traffic volume, flexibility of toll revisions and cost for maintenance and operations) underlying the cash flow projections. In addition, alternative scenarios are created to assess the sensitivity of the project to adverse developments in the operating environment.

Based on the sensitivity of cash flow to the above factors, Crisil Ratings assesses the ability of the project to meet its debt obligation (principal + interest). DSCR is a key indicator of the ability to service debt and is critical for assessing credit quality. The financial risk profile is primarily driven by the DSCR over the loan life of the project. It can be driven by minimum DSCR, average DSCR or a combination of both depending on variability of cashflows. The calculation shall solely be based on project cash flows, without considering parent support or debt service reserve account (DSRA).

DSCR = (Profit after tax + Depreciation + Interest) / (Interest + Repayment)

At times, the debt tenor is shorter when compared to the life of the asset and relies on refinance to meet the repayment obligation. In such situations, Crisil Ratings factors in the refinancing risk while arriving at the rating.

Financial flexibility

Financial flexibility is assessed with reference to dependence on a specific source of funds and ability of the promoters to generate additional resources. The possibility of seeking support from government agencies involved in the project is also considered. In the initial stage, the project may warrant some support from the promoters to service debt. Crisil Ratings also examines the construction schedule and its implications on financial flexibility- taking on a large number of projects to construct usually saps funds and may impact the ability to support ongoing projects. Further, maintenance of a liquidity buffer usually acts as a cushion against temporary disruptions and falls in toll revenue.

Debt service reserve account (DSRA):

Liquidity is maintained to mitigate risks pertaining to cashflow variability. Liquidity requirement is lower where structuring ensures that there is adequate time gap between the inflows and outflow. Liquidity requirement is directly proportional to the cash flow variability.

Projects maintain requisite liquidity buffer in the form of DSRA to ensure timely debt servicing. At times bank guarantee (BG) is used to replace cash DSRA. For such BGs to be construed as providing liquidity support, they need to have recourse to parent. Crisil Ratings ascertains if parent maintains sufficient liquidity to cover the BG, to provide any liquidity benefit of BG to the infrastructure project.

Provisions for credit enhancement

Credit enhancement provisions, such as securitisation of toll revenue and guarantees extended by members of the SPV, are examined for assessing the financial risk. The extent of credit enhancement by the promoters, both through specific covenants in the underlying agreement and financial support for servicing debt, are critical aspects of Crisil Ratings risk assessment for toll road projects.

Management risk analysis

Crisil Ratings follows the standard criteria used for all manufacturing companies. This is presented in detail in the Crisil Ratings publication, ‘Crisil Ratings criteria for manufacturing, trading and corporate services sector’.

Conclusion

Crisil Ratings methodology for rating toll roads covers the risks associated with both under-construction and operational toll road projects. For under-construction projects, the focus is on the receipt of necessary approvals and right of way and ensuring there are no time or cost overruns. The ability and track record of the sponsor to take care of such events is critically evaluated. In operational projects, the cushion of cash flow for debt servicing, which centrally depends on the revenue risk, is analysed. The traffic volume projections form a critical input. Inflation affects costs and toll increase (if linked), which form the inputs for calculating the DSCR. Liquidity buffers usually provide some respite in times of muted toll collection. An assessment of the management rounds off the analysis.

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