

Thermal Power Project Rating Criteria

Sector-Specific Criteria

Scope

This criteria report outlines Fitch Ratings' approach to new and existing ratings where repayment depends on cash flow from the construction and/or ownership of thermal power projects. This report covers greenfield and existing plants, and individual or portfolio assets, typically financed with no formal guarantee of debt service from the sponsors (nonrecourse). These rating criteria are intended for global application. This report should be read in conjunction with the *Infrastructure and Project Finance Rating Criteria*.

Key Rating Drivers

We assess each key rating driver (KRD) as 'Stronger', 'Midrange' or 'Weaker'. As a general rule, Revenue Risk has the most direct influence on ratings, but the driver with the weakest assessment may attract greater analytical weighting in the analysis. *Key Rating Driver Assessment for Thermal Power* on page 2 compares the attributes we consider in assessing the risk factors as 'Stronger', 'Midrange' or 'Weaker'.

Completion Risk: Project complexity, scale and duration; contractor expertise and implementation plan; availability of replacement contractors; and contract terms, in combination with contractor default and security analysis. For further details please refer to the *Completion Risk Rating Criteria* report. Completion Risk can constrain thermal power ratings during the construction phase even if a project's post-completion operating profile is otherwise indicative of higher credit quality.

Operation Risk: Contract scope; operator experience; technology; independent engineer (IE) cost analysis and performance history; O&M reserve; maintenance reserve; emissions compliance cost exposure. The evaluation of Operation Risk serves as a basis for the level of stress applied in the financial analysis.

Supply Risk: Contractual arrangement; supplier credit quality; tenor of contract; availability of substitute fuel suppliers; abundance of fuel supply; delivery liquidated damages (LDs) or reserves; location of supplies. Supply Risk, when unmitigated, often represents a source of significant cost volatility.

Revenue Risk: Nature of revenue; indexation of revenues; portion and duration of contracted versus merchant sales; cash flow sensitivity to dispatch levels; termination provisions. The assessment of Revenue Risk concerns the fundamental basis of project cash flow, and therefore factors heavily into thermal power ratings.

Debt Structure: Payment waterfall ranking; refinance risk; covenant package; structural features; delayed draw; hedging financial risk; liquidity and reserves; security and collateral reserves.

Financial Profile: We develop cases to assess a project's financial flexibility as it encounters stresses expected to occur over the relevant analysis period. We use metrics, sensitivities and break-even financial scenarios to evaluate debt service coverage ratios (DSCRs), liquidity and overall leverage.

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This report updates and replaces the *Thermal Power Project Rating Criteria* dated 27 May 2020.

Related Criteria

[Infrastructure and Project Finance Rating Criteria \(March 2020\)](#)

[Completion Risk Rating Criteria \(December 2020\)](#)

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Framework for Thermal Power Projects

With few exceptions, rated thermal power projects employ proven technology from experienced and reputable manufacturers. Ratings on projects utilizing technologies with limited commercial operating experience will be constrained to below investment grade unless the enhanced technological risk is adequately mitigated.

Some thermal power projects have nonconventional revenues sources such as gate fees, steam sales or recyclates, which may equally be considered in the manner of off-takers and we will review in a similar way.

Even if a project meets the indicative financial metrics for investment grade, other factors may constrain it to a lower rating category. Factors such as weak sponsors, excessive technical risk, merchant exposure, sub-investment-grade counterparties or other key risk factor assessments may support a lower rating. Conversely, factors may be present that support a higher rating, such as exceptionally strong contractual protections, a benign industry environment or market dynamics that reduce potential price or cost volatility. For a discussion of how revenue counterparty ratings interact with project ratings please refer to the approach outlined in the *Infrastructure and Project Finance Rating Criteria* report.

For example, a contracted project with a DSCR profile near 1.20x under the Fitch Rating Case (FRC) could be rated in the 'BB' category if it exhibits very low cash flow volatility, or could be rated in the 'B' category if it faces considerable cost risk. Projects with DSCR profiles at or below 1.10x are constrained to the 'B' category absent structural enhancements, such as supplemental liquidity. Large thermal power projects are rarely rated initially above the 'BBB' category. When debt amortization (typically later in the term of the debt) results in DSCR coverage that significantly exceeds the thresholds indicated for the 'BBB' rating category, ratings for an exceptionally strong project could be higher. Projected high coverage ratios that result from strong merchant revenues are not likely to boost ratings.

Downward rating migration for thermal projects can result from significant technical underperformance or exposure to merchant market pricing risk, leading to a cash flow cushion persistently below earlier rating case expectations. Ratings in the 'A' category could be achievable by the exceptional project possessing mostly 'Stronger' attributes for the risk factors identified in this report, and exhibiting sufficiently high financial coverage. However, ratings are not likely to be above the 'A' category due to most projects' single asset nature and finite life.

Key Rating Driver Assessments for Thermal Power Projects

Description	Operation risk	Supply risk	Revenue risk
	Stability of technical performance and O&M costs adequacy.	Ability to obtain fuel at an economic price to deliver power to off-taker or power market.	Revenue stability based on capacity and power prices and dispatch risk.
'Stronger'	<ul style="list-style-type: none"> Fixed-price scheduled and unscheduled maintenance. Experienced IG operator, manufacturer affiliate, and/or large pool of experienced substitute operators and low likelihood of price increase on replacement. O&M contract term (or owner extension rights) covers full life of the debt. Proven technology with long operating history or minimal incremental design changes. Detailed cost analysis from IE and/or low variability for actual operations and costs. 12 months' O&M reserve. Multiyear forward-looking maintenance reserves and active detailed maintenance plan. Contractual pass-through provisions for emissions compliance costs or not applicable. 	<ul style="list-style-type: none"> Tolling-style revenue agreement that minimizes fuel volume and price risks, or agreement to provide fuel at fixed prices. IG tolling off-taker or fuel supplier counterparty. Term aligned with that of the debt. 	<ul style="list-style-type: none"> Fixed-price capacity-based revenues, with little or no risk of performance deductions. Indexed using simple, broad-based publicly available indices. Cash flows materially independent of dispatch levels. Stronger revenue contract termination provisions.

IG – Investment Grade. DSCR – Debt Service Coverage Ratio. *Continued on next page*
Source: Fitch Ratings

Key Rating Driver Assessments for Thermal Power Projects (Cont.)

Description	Operation risk	Supply risk	Revenue risk
'Midrange'	<ul style="list-style-type: none"> Fixed-price scheduled maintenance or sub-IG contractor. Experienced operator and/or adequate substitute operators. O&M contract term shorter than debt term. Proven technology with operating history. Some limitations in cost analysis from IE and/or moderate variability for actual operations and costs. Six months' O&M reserve. Some maintenance reserve features and outlined reactive maintenance plan. Limited emissions compliance cost exposure. 	<ul style="list-style-type: none"> Fuel contract with fixed or indexed prices. Reputable, 'Midrange' fuel supplier. Term is shorter than that of the debt. Adequate substitute fuel suppliers. Abundant supply of fuel sources. Delivery LDs from creditworthy party or reserve adequate to cover PPA deductions, operating costs and debt service. 	<ul style="list-style-type: none"> Revenues subject to achievable minimum performance levels. Indexed using publicly available indices. Price exposure limited to small portion of revenues in Fitch's financial analysis. Cash flows moderately sensitive to dispatch levels. Typical revenue contract termination provisions.
'Weaker'	<ul style="list-style-type: none"> Cost plus O&M agreement. Little experience with the technology, limited in-house resources, and/or limited or unknown availability of substitute operators. Unproven, proprietary or obsolete technology. Limited or no cost analysis and/or high variability for actual operations and costs. Inadequate O&M reserve. Inadequate maintenance reserves or limited maintenance plan. Considerable emissions compliance cost exposure. 	<ul style="list-style-type: none"> Exposure to volatile and/or opaque market prices. Weak fuel supplier. Uncontracted or spot purchases. Limited substitute fuel suppliers. Variable supply of fuel sources or feedstock has multiple uses. No delivery LDs or reserve funds. Geographic supply constraints. 	<ul style="list-style-type: none"> Market-based or variable pricing. Indexed using opaque or complex indices. Price exposure represents a significant portion of revenues in Fitch's financial analysis. Cash flow very sensitive to dispatch levels. Weak revenue contract termination provisions.
Relevant indicators	<ul style="list-style-type: none"> Contract scope. Operator experience. Technology. IE cost analysis and performance history. O&M reserve. Maintenance reserve. Emissions compliance cost exposure. 	<ul style="list-style-type: none"> Contractual arrangement. Supplier credit quality. Tenor of contract. Availability of substitute fuel suppliers. Abundance of fuel supply. Delivery LDs or reserves. Location of supplies. 	<ul style="list-style-type: none"> Nature of revenue. Indexation of revenues. Portion and duration of contracted versus merchant sales. Cash flow sensitivity to dispatch levels. Termination provisions.
Rating approach	Assigned KRDs, among other things, will drive stresses applied to the rating case scenario and inform what coverage thresholds are applied to rating case financial profile. This is discussed in detail in <i>Financial Profile</i> section, starting on page 8.		
Financial profile	Debt service is the KRD that considers metrics for liquidity, debt service coverage and leverage in the context of the overall risk profile determined by review of the other KRDs. A fully contracted thermal power project with predominantly 'Midrange' characteristics could be rated in the 'BBB' category with DSCRs of 1.40x and higher in the rating case, and below investment grade with coverage ratios below 1.40x. Moreover, a project's rating may be constrained by a 'Weaker' assessment on a KRD notwithstanding coverage ratios of 1.40x and higher. This is discussed more fully under <i>Financial Profile</i> on page 8.		
Completion risk	When present, this key risk factor is assessed using the analytical framework described generally in this report and in more detail in the <i>Completion Risk Rating Criteria</i> report. The framework is used to derive the maximum possible rating during the completion phase, based on complexity, scale and duration, contractor expertise and implementation plan, availability of replacement contractor and contractual terms, in combination with contractor default and security analysis.		
Debt structure	The analysis of thermal power projects' debt features follows Fitch's approach, as outlined in the <i>Infrastructure and Project Finance Rating Criteria</i> report. Fitch considers each rated debt instrument separately, taking into account the debt's payment waterfall ranking, refinance risk, financial profile, covenant package, structural features, delayed draw, hedging financial risk, liquidity and reserves and security. In addition, collateral reserves are assessed for thermal power projects.		

IG – Investment Grade. IE – Independent Engineer. DSCR – Debt Service Coverage Ratio. FRC – Fitch Rating Case. LDs – Liquidated Damages. PPA – Power Purchase Agreement. KRD – Key Rating Driver
Source: Fitch Ratings

Global Rating Rationale – Key Rating Driver Assessments

The table on the previous page outlines the attributes we consider consistent with the assessment ('Stronger', 'Midrange' or 'Weaker') of a typical thermal power project. The table provides qualitative guidance in the assessment of a project. Assessments are broadly comparable across the entire portfolio of Fitch's infrastructure ratings.

The attributes are not exhaustive and some are not relevant for every project. While investment-grade projects typically display attributes that are at least 'Midrange', projects normally display combinations of attributes. Our assessment considers the various attributes based on their materiality, potential effect on performance and the project's general characteristics. The weighting between individual and aggregate qualitative and quantitative factors varies between entities in a sector as well as over time. As a general guideline, when one factor is significantly weaker than others, this weakest element tends to attract a greater weight in the analysis.

The assessments table primarily reflects project qualities that are considered in the assignment of a new rating to a project under construction or with a limited operating track record. The same considerations are relevant for the ongoing monitoring of existing ratings, but attributes relating to forecasts (e.g. operating costs) may be complemented and eventually superseded by the availability of actual performance data. An initial assessment of operation risk as 'Midrange' could, for example, migrate to 'Stronger' as forecasts are confirmed by multiple years of actual operating data.

Completion Risk

When present, this key risk factor is assessed using the analytical framework outlined in the criteria report, *Completion Risk Rating Criteria*. The framework is used to derive the maximum possible rating during completion phase, based on complexity, scale and duration, contractor expertise and implementation plan, availability of replacement contractors and contract terms, as well as liquidity available to support a project in case of contractor default.

Operation Risk

Operator

As noted in the *Infrastructure and Project Finance Rating Criteria*, the factors used to assess operator risk are similar to factors for construction contractors for thermal power projects, including past experience with thermal power projects and technology, ideally in the same country or region, together with adequate resources, including relevant qualified staff.

Some of the larger thermal power equipment manufacturers and EPC contractors also own affiliated operating contractors, who generally can offer robust operating guarantees due to their familiarity with the technology, and ease the transition from start-up operations by the EPC contractor.

For unproven technology (e.g. ultra-super-critical coal-gasification projects or waste pyrolysis), operators with strong reputations and proven performance operating similar or related technologies are less risky. Weaker operators will warrant higher cost and performance stresses in our financial analysis.

Projects are stronger when operated under extended term O&M contracts with compensation based on clearly defined operating parameters, such as minimum availability and capacity levels, and maximum heat rates. Performance levels that are achievable, consistent with industry standards and include longer ramp-up periods for newer technology are credit positive.

Bonuses can incentivize operators to surpass projected performance levels. Deductions for underperformance can provide varying levels of recovery of losses for failure to meet performance requirements, but largely act as deterrence for lax operation practices. Projects that are self-operated by the sponsors or affiliates without O&M contracts are not necessarily higher risk, particularly if the sponsors have significant operating experience and use manufacturer or independent service providers for maintenance and overhauls.

The financial strength of an operator for thermal power projects is generally not a constraint on the project rating, due to the availability of replacement operators for most projects. This risk can be heightened for unproven technology requiring specialist skills for projects utilizing proprietary technology, for projects in less developed or adverse locations, for O&M contracts where the contract remuneration does not reflect market rates or other factors reducing the likelihood of ease of replacement.

Operating Costs

In developing its quantitative assumptions for operating costs, we consider operating cost volatility and the potential for unanticipated operating costs. Cost risk is lower for projects with conventional and proven technologies where substantial historical data is likely to be available against which to evaluate the reasonableness of a project's cost projections. We also consider the opinion of the IE regarding operating cost projections for projects using new and less-proven technology.

O&M contracts for maintenance services can mitigate the risk of increased capex requirements if they specify a fixed price for planned maintenance. The exposure to unanticipated operating costs is reviewed and reflected in the stresses in the cash flow analysis.

O&M Reserve

An O&M reserve helps offset potential cash flow volatility in the event of temporary excursions in O&M costs. The sizing and timing will be viewed in conjunction with the terms of the presence or lack of long-term service agreements (LTSA). If an LTSA that covers relevant operating costs of a project exists, an O&M reserve may not be necessary depending on the financial strength of the counterparty.

Maintenance Reserve Account

Financial structures, such as a forward-looking maintenance reserve accounts (MRAs), provide sufficient funding for capex, and are credit positive. As major maintenance is essential for a facility's long-term stable operations, we subtract funding for the MRA from cash flow used in the calculation of the DSCR, even when MRA funding is subordinate to debt service in the payment waterfall, and add withdrawals from the reserve to the cash flow available for debt service (CFADS).

We will evaluate thermal power projects' strategies to comply with any emissions regulations through strategies including:

- Capex for the addition of emissions-control technology or fuel switching.
- The purchase of tradable emissions credits.
- Changes to operating regimes to reduce controlled emissions (e.g. shift from intermediate load to peak load generation).
- Direct curtailment of the economic life of the project through early retirement.

We will also assess the extent to which revenue contracts contain emissions cost pass-through or other mitigating mechanisms.

We will assess the impact on cash flow and debt service coverage for the expected compliance strategy through cash flow stress testing, and incorporate the impact of definitive regulatory compliance costs as they become known.

Supply Risk

Investment-grade thermal power projects should have a stable and reliable source of fuel, preferably contracted for extended periods at fixed or indexed prices, and for volumes sufficient to avoid a mismatch with contracted generation requirements. Fuel supply agreements with fixed pricing and clear fuel provision obligations are credit positive. Conversely, exposure to spot market pricing and no fuel delivery assurance substantially increases supply risk. Coal facilities can face increased risk due to the limited duration of typical coal supply contracts, which can be mitigated through matching forward and spot coal purchases to energy sales.

Substantial competition in the coal and gas industries increases the potential for availability of replacement fuel suppliers, reducing supply risk in many locations, which is a stronger attribute compared with some other fuel sources. Multiple fuel sources and delivery options reduce risk (e.g. truck, barge, or rail transportation for coal), as does the ability to stockpile significant fuel inventory. Power projects tied to unique or specific fuel sources, such as waste coal, biomass or specific waste types, exhibit increased supply risk due to either the lack of substitute sources or inconsistency in fuel quality.

Specific geographical locations may also reduce delivery options on a seasonal basis (such as facilities reliant on barge delivery subject to freezing winter conditions), or the availability of fuel sources may be subject to geographical restrictions. Gas plants are typically connected to a single gas supply, and can mitigate supply risk through dual-fuel capability, allowing them to use fuel oil to operate when gas supplies are disrupted.

In the case of energy from waste facilities, the focus of supply risk assessment will be on the physical availability and quality of the specific waste type, whilst income received directly in relation to the waste in the form of gate fees, and the commercial arrangements with respect to these gate fees, will fall within the Revenue Risk analysis along with other revenues of the facility.

Operating Phase Technology Risk

Technology risk during the operating phase of thermal power projects focuses on operating performance and maintenance within projected cost levels.

We assess evidence of qualified staff, adequate budgets, availability of parts and consumables, and manufacturer support where required. Adequate supplies of maintenance parts in inventory reduce the risk that key components are unavailable in the event of forced outages or other critical repair requirements.

LTSA's can reduce operation risk through contractual access to a manufacturer's technical expertise as well as the ready availability of spare parts and equipment upgrades, and often provide extended warranties on the performance of critical components.

Flexibility in maintenance schedules is a credit positive, although we note thermal power facilities generally follow a relatively fixed maintenance schedule requiring planned outages that can last multiple weeks. The ability to stagger maintenance outages over several units mitigates the likelihood that a thermal project will be completely out of service, and multiple units similarly mitigate forced outage risk.

Technology risk increases significantly with new and unproven technology. For newer technology or unique combinations of proven technologies, we place more reliance on the IE's assessment of a project's ability to perform at projected levels. The IE report should address: capacity, availability, scheduled outages and overhaul cycles, repair and maintenance levels, future anticipated capital investments, spare part requirements, expected efficiency levels and environmental issues. Increased technology risk is assessed through stress testing in the financial analysis. Due to the technical complexity of even conventional thermal power facilities, projects lacking an IE's review may preclude a rating if the operational risks cannot be accurately quantified.

For existing facilities, Fitch considers historical performance and IE opinions to evaluate projected operations metrics, such as efficiency, availability and operating costs. Additionally, for all facilities, we utilize peer groups of rated projects of similar technology and design to evaluate the reasonableness of performance projections.

Revenue Risk

The interrelationship between the revenue contracts or merchant prices (discussed in this section) and the cost structure of the project (discussed in the prior section) will determine the resulting operating profit margin and the level of financial coverage obtainable for the project. In addition to reviewing revenues and cost structure individually and in detail, we view them together to identify the match of revenues and expenses that produces adequate cash margins, or the mismatch of revenues and expenses that heightens default risk.

We assess the degree to which thermal power projects are sufficiently interconnected with a transmission system for electricity exports. Any reliance on nonfirm transmission capacity or exposure to potential noncompensated transmission curtailment is a credit negative and may constrain the project rating if it is not feasible to estimate the revenue impact with any precision.

Gross Revenue/Off-Take

The revenue stream stability of a project is critical to its credit quality. The degree to which thermal power projects are exposed to revenue risk varies from tolling contracts (largely insulated from market risk and fuel cost risk) to merchant projects (significantly exposed). We categorize the Revenue Risk as price (electricity, fuel and emissions allowances) and volume (as affected by dispatch or buyer's requirements).

Contracted Projects

Power purchase agreements (PPAs) and other forms of revenue contracts with fixed capacity payments are typically structured to cover debt service and a return of and on investment. Energy payments are usually designed to cover the cost of operation largely through a pass-through of fuel costs and O&M costs, adjusted for the dispatch requirements of the contract. Projects occasionally earn revenues from ancillary services, such as spinning reserves and frequency control. We usually consider ancillary services revenues as merchant revenues, unless contracted with a counterparty whose rating is consistent with the project rating.

Revenue contracts will also be analyzed to discern their provisions or lack thereof for future environmental costs. PPAs containing pass-through provisions for regulatory-driven environmental compliance costs such as emissions-related costs reduce credit risk. We will also focus on the interrelationship between the revenue contracts and cost-related arrangements to ensure any mismatches of indices or similar factors are properly mitigated.

Counterparty Credit Quality

In fully contracted transactions, the credit quality of the revenue counterparty typically caps the project's rating. This means that, in the case of counterparties with a weak financial profile, the debt instrument's rating may be driven primarily by the counterparty's credit quality irrespective of otherwise 'Midrange' or 'Stronger' key rating drivers' assessments and financial metrics in line with guidance for higher rating levels.

Absent a counterparty rating, Fitch may assume that the respective portion of revenues is exposed to merchant price risks, as described in the *Merchant Exposure* section below. There may also be situations where Fitch's assessment of the credit quality of the payment obligation is not constrained by the payment counterparty's credit quality. Examples include transactions whose products or services are essential and/or provided at prices where a large number of off-takers are inclined to replace any existing counterparties that default or otherwise leave the transaction, or where the payment risk ultimately lies with a broader sector or a group of end users. Such circumstances are described in more detail in the *Counterparty Risk* section of the *Infrastructure and Project Finance Rating Criteria*.

Merchant Exposure

We evaluate exposure to merchant market power prices and/or volume based on the ratio of merchant to total revenues that the project is forecast to receive under the Fitch rating case over the debt's remaining life. In assessing the revenue risk of a project, no distinction is made in the calculation between projects that derive a portion of their revenues from merchant sales throughout the life of the debt and projects that are exposed to merchant prices and/or volume during only some of the debt's life.

When a project is exposed to price and/or volume risk, Fitch will stress power prices and volumes and in determining its assumptions will rely on a combination of the opinions of independent market experts, its in-house views and expectations, market-quoted forward prices, and historical price and volume trends (if the quality and evidence are considered to have predictive value).

As discussed in the *Break-Even Stresses and Individual Stresses* section, a central consideration in Fitch's analysis of merchant price risk is the assessment of the market price decrease that a project can sustain while still meeting debt obligations at a particular rating level (i.e. power price break-even level). This analysis is performed by reference to historical prices in the relevant market and informed by Fitch's internal view and discussions with market consultants on future market dynamics and fundamentals.

Ratings may be constrained to sub-investment-grade in the case of limited meaningful historical data for a specific power market or, in Fitch's view, particularly high future uncertainty in market dynamics.

Additional factors to be considered include the project's position on the dispatch curve, the nature of the project's function as a peaking, midmerit (load following) or base load facility, and the marginal fuel in the region.

Merchant peaking and midmerit assets are unlikely to achieve an investment-grade rating.

Price Indexation

The price payable by the revenue counterparty under PPAs and regulatory incentive frameworks may be fixed for the life of the contract, increased periodically by a fixed percentage or indexed based on a variety of indexation formulas. The predictability of price evolution is likely to be lower in the latter case and is dependent on the complexity and transparency of the indexation formula.

As indicated in the *Infrastructure and Project Finance Rating Criteria*, inflation, foreign-exchange and other assumptions are modeled in line with Fitch's expectations. Assumptions will be based on historical values and the agency's judgement where a formal in-house view is not available. Fitch is likely to apply stresses to the sponsor's forecast in the case of opaque indexation formulas.

Debt Structure

The analysis of thermal power projects' debt features follows our approach, as outlined in the *Infrastructure and Project Finance Rating Criteria* report. We consider each rated debt instrument separately, taking into account the debt's payment waterfall ranking, refinance risk, financial profile, covenant package, structural features, delayed draw, hedging of financial risk, liquidity and reserves and security.

Collateral Reserve

In addition to the generic debt structure items set out in the *Debt Structure* section of the *Infrastructure and Project Finance Rating Criteria* report, for thermal power projects we also assess the cash flow impact of the potential collateral requirement surrounding an energy hedge agreement or merchant plant sale, which could face significant mark-to-market liquidity calls to back trading positions. An excessive collateral requirement could be a constraint on the rating.

We also consider the presence and adequacy of O&M reserve and MRA under the Operation Risk to evaluate the project's resilience to cost volatility.

Financial Profile

We evaluate a project's financial performance by assessing projected cash flows in a variety of potential scenarios. The scenarios outlined below reflect our indicative financial analysis scenarios. We will apply more or less stress to key performance variables to adequately reflect the distinct characteristics of each project with respect to technology, project location, operational history, and construction contractor and operator. Based on the IE's opinion and peer comparisons of other Fitch-rated projects, we will adjust stress scenarios accordingly.

In evaluating projected financial performance, Fitch considers the overall profile of the DSCR. This profile consists of: the average of DSCRs over the life of the project; the degree that the minimum DSCR deviates from the average; and the magnitude and frequency with which DSCRs persist below the average. The DSCRs reflect the levels of cash flow cushion available (on top of the transaction's internal liquidity available through reserve accounts) to mitigate other possible reductions in cash available for debt service.

Base Case

When analyzing a thermal power project, we create a scenario reflecting the expected long-term sustainable performance based on its experience with the industry and with similar projects (the Fitch base case). The Fitch base case is also used as a common starting point for stress analysis, and it constitutes the base line for surveillance over the debt's life.

As a starting point, we will make certain adjustments to the sponsor's projections where appropriate including to the project's technical and operational parameters. The process for setting these quantitative assumptions relies on our experience; actual performance, where available; and the opinion expressed by the IE, which is particularly relevant in the case of newer or less proven technologies. The adjustments aim at bringing parameters such as availability, capacity, heat rate and operating costs in line with expectations for the specific technology in similar environments and conditions.

For projects exposed to price risk, we set our base case price forecast at a level we consider sustainable on average over the long term. This may be derived from our price decks for commodities, such as crude oil and natural gas, or from the analysis of empirical market data — for example, regional power prices. Due consideration will also be given to the market adviser's projections, such as power price forecasts, and fuel supply and pricing studies.

Rating Case

The rating case includes some reasonable downside assumptions and does not reflect extreme stresses, which would be addressed through separate sensitivities (see below). The rating case evaluates the resilience of the projected cash flow to a combination of stresses that together simulate a scenario of material underperformance, which is conceivable but not expected to persist during the life of the thermal power project financing. We emphasize the minimum level of the cash flow cushion where it is substantially or persistently below the average, when it occurs in key stress points in the life cycle of the debt (e.g. refinance dates), or in the later years of the transaction where uncertainty is higher.

We develop a rating case using a combination of performance and financial stresses or individual stresses based on our experience, peer comparison and third-party consultants' opinions. We place greater weight on the IE's opinion when newer technology lacking demonstrated performance results is employed. Stress levels can be more moderate for existing projects that demonstrate sustained operational stability. The range of adjustments is guided by our assessment of the operation risk KRD. The table below summarizes typical rating case stress levels for primary performance variables. Availability stress is expected to test the resilience of the project to increased outages and/or reduced generation. The level of the stress is subject to a variety of factors, including the operational profile of the project.

In case of exposure to price risk, the FRC will also incorporate adjustments to our base case market price assumptions. We set its rating case price forecast based on our market price expectations, with due consideration given to the market adviser's projections, available historical data or the projections of another third-party consultant, as relevant.

Indicative Rating Cases – Thermal Projects

	Fitch Rating Case
Heat rate	BC plus 0%–5%
Availability	BC minus 0%–10%
O&M costs	
‘Stronger’ operation risk assessment	BC plus 0%–5% ^a
‘Midrange’ operation risk assessment	BC plus 5%–15% ^a
‘Weaker’ operation risk assessment	BC plus 15%–20%

^a Ranges include the lower bound number, but not the one at upper bound
Source: Fitch Ratings.

Individual and Break-Even Financial Stresses

We seek to identify each project’s performance drivers and examine the sensitivity of cash flows to changes in these risk factors, generally against the Fitch base case. We investigate through the application of stresses whether the transaction is particularly exposed to a combination of events (e.g. harsh temporary deterioration in availability together with a spike in maintenance costs) or to a specific risk (e.g. power prices, fuel costs, O&M costs). Such single-factor stress cases may also highlight that a particular risk factor, because of its nature and the dependency of the transaction performance on it, acts as a constraint on the ratings.

Break-Even Stresses

Break-even stress levels, which result in DSCRs of 1.0x and typically exhaustion of available liquidity, are often utilized as a basis of comparison to other projects. We compare the stress levels required to reach break-even coverage across similarly rated projects in our portfolio under base case conditions to highlight outliers and evaluate the reasonableness of the break-even levels for one or more of the following risk factors, depending on the project. Availability and O&M are two of the most common break-even scenarios run for thermal projects:

- **Availability/Capacity Factors:** We consider the impact of reduced availability and capacity factors on the project cash flows, using expectations based on historical performance and the IE’s opinion.
- **O&M:** We consider the impact on the project’s cash flows of a sustained increase in O&M expenses and a change in the timing of such costs. We will adjust the cost level depending on how it compares with its peers. For new technology, we expect the IE to opine on the ability of the project to achieve the projected cost profile.

Individual Stresses

We may also run individual stress cases as appropriate to determine the level of exposure and sensitivity of the project’s cash flow to the volatility of fuel prices and fuel supply, increased heat rate, the impact of potential regulatory emissions requirements, and other individual risk factors and events. The relevance of specific individual and/or combined-stress scenarios depends on the project’s characteristics and features.

Merchant Prices

When a project is exposed to price risk, or when there is material termination risk on a highly priced PPA because of a weak off-taker, we will consider what level of market price decreases the project can sustain beyond those suggested by the rating case stress.

The magnitude and duration of rating case adjustments and other downside scenario adjustments is identified by reference to empirical precedents, peer analysis, forecasts and our expectations for the future.

Metrics guidance is to be considered in the context of the degree of merchant exposure at any point in time in our analysis. Guidance for a project under the FRC, which derives a portion of ongoing revenues from merchant sales (a partially contracted project) is to be calculated by linear interpolation between metrics for fully contracted and fully merchant projects depending on the degree of exposure (e.g. the rating of a project with a fully contracted period followed by a merchant one will reflect fully contracted metrics guidance for the initial period and fully merchant metrics guidance afterwards).

For a project exposed to merchant risk, for example, we evaluate the debt's performance under actual, historically experienced, depressed market conditions in comparable markets and for similar projects. An investment-grade rating requires a project to demonstrate at least break-even coverage without reliance on reserves in a scenario using the inflation-adjusted historical annual average low price for its output and/or historically low margins constrained by higher fuel costs. 'A' ratings are associated with projects that at least break-even without relying on the contribution of merchant revenues.

Debt instruments rated in the 'BB' and 'B' categories are expected to demonstrate a break-even price that is exceeded by 80% and 60%, respectively, of annual observations based on a sufficiently long price history in the relevant market. We may place more emphasis on recent extended periods of low prices, which may indicate persistent structural changes in the market.

Ratings may be constrained to sub-investment grade in the event of limited meaningful historical data for a specific power market. Our internal view and discussions with third-party consultants will inform the period of historical pricing deemed most relevant to a project's pro forma financials on a case-by-case basis. Also, we may set more demanding break-even tests, for example by requiring an investment-grade project to break even at a price lower than the minimum historical annual average price, depending on our view of future market dynamics and fundamentals.

Break-even analysis on merchant prices is performed by testing for the price at which the DSCR is at 1.0x for any debt service period of the debt's life, excluding drawings on reserves that are not specifically structured to mitigate merchant risk exposure and under base case scenario assumptions otherwise.

Metrics

Our metrics quantitatively summarize our views on certain risks by their impact on a project's cash flows. Importantly, the quantitative financial metrics are considered in combination with qualitative risk assessments in determining a project's credit rating. Some qualitative risks cannot be reflected in cash flow projections (for instance, termination risk), but can also be key drivers of the eventual rating.

The financial metrics in the table on the next page apply to the rating case and are intended as a guide for category rating thresholds in the thermal power sector. As stated above, they are only one part of our analysis. Indicative coverage thresholds are subject to the assessments determined for the KRDs. We may apply higher or lower thresholds where this is appropriate given the specific circumstances of a transaction. An example would be where we consider cash flows to be contracted but may apply merchant-level thresholds because of the particular payment history of the counterparty. Investment-grade ratings are typically associated with transactions displaying predominantly 'Stronger' or 'Midrange' attributes, as described in this report.

In addition to superior financial metrics, 'A' category rated debt instruments would display mostly 'Stronger' attributes with respect to the KRDs. To qualify for the specified rating level for projects with no merchant exposure, the lower end of the coverage guidance will apply only to projects with a 'Stronger' assessment for the revenue risk KRD. Revenues for such projects rely almost exclusively on contracted capacity payments, with cash flows independent of dispatch levels.

Indicative Coverage Ratios Guidance – Fully Amortizing Debt

Fitch Rating Case (x)	Revenue risk KRD	'A-' DSCR profile	'BBB-' DSCR profile	'BB-' DSCR profile ^a	'B-' DSCR profile
No Merchant Exposure	'Stronger'	1.5	1.3	1.15	1
	'Midrange'/'Weaker'	1.6	1.4	1.2	1
Full Merchant Exposure	'Weaker'	n.a.	1.80 and higher	1.4	1

^a Coverage thresholds for ratings at or below the 'B' category are guided by Fitch's ratings definitions for those categories, and also the assessments assigned for all the qualitative key rating drivers (KRDs). We note for partially merchant projects coverage thresholds are calculated using coverage guidance for projects in Full Merchant Exposure 'Weaker' and No Merchant Exposure 'Midrange'/'Weaker' revenue KRD categories. DSCR – Debt service coverage ratio.

n.a. – not applicable

Source: Fitch Ratings.

We consider that thermal power plants are exposed to an operating environment of such complexity that it is not possible to capture adequately the full range of scenarios by way of quantifiable sensitivities. Therefore, in addition to applying the specifically quantified rating case stresses, Fitch considers that a transaction needs to retain the relevant coverage cushion shown in the table under the rating case assumptions.

We recognize financial structures without full debt amortization do not lend themselves completely to DSCR metrics. We will therefore consider other financial metrics, such as project life coverage ratio (PLCR) and debt to CFADS, for financing structures with balloon or bullet scenarios. An example of these are Term Loan B (TLB) structures in the US, often used for financing US power projects exposed to merchant price risk, incorporate minimum and target amortization, cash sweep mechanisms, medium-term tenors and other features that serve to enhance repayment flexibility and reduce the unamortized principal amount to be refinanced at maturity. TLB outstanding debt at maturity is often refinanced with another TLB financing maturing within the useful life of the facility, which Fitch evaluates in its financial analysis. Definitions of these metrics are set out in the *Infrastructure and Project Finance Rating Criteria*.

Alternatively, we may create a fully amortizing scenario for the outstanding debt over a reasonable length of time in accordance with the parameters of the base and rating cases to generate comparable financial metrics for use in our rating decision. We will also consider the post-maturity risk profile for comparison with other market transactions depending on the age and type of asset for refinancing scenarios.

Interest rate risk will be covered through stress analysis, as described in the *Infrastructure and Project Finance Rating Criteria*.

Models

Fitch may use the following models in the analysis of thermal sector credits: GIG AST Model, Corporate Monitoring & Forecasting Model (Comfort Model) and third-party models. The *Models* section in the *Infrastructure and Project Finance Rating Criteria* provides a description of these models.

Rating Assumption Sensitivity

We may positively or negatively adjust ratings for thermal projects based on actual project experience. Below is a non-exhaustive list of the primary sensitivities that can influence thermal power project ratings.

Operating Performance: Changes in expected technical performance, often reflected in availability or heat rates, can affect a project's ability to earn projected revenues and potentially lead to contractual penalties.

O&M Costs: Routine O&M and major maintenance costs that deviate from projections may indicate greater than expected cost volatility or a failure to properly estimate or fully capture all relevant cost items.

Price Risk: Projects exposed to volatile commodities markets, whether wholesale electricity rates or fuel pricing, can experience unanticipated and wide variations in cash flow that could persist beyond the short term.

Counterparty Credit Quality: Movement in the ratings of key counterparties, such as a power purchaser or a fuel supplier, can influence or constrain thermal power project ratings.

Disclosure

We expect to disclose the following items in our rating reports and/or Rating Action Commentaries (RACs):

- KRDs and their assessments;
- Financial metrics;
- Peer analysis;
- Main analytical assumptions;
- Rating assumption sensitivity;
- Any variations from criteria.

Variations from Criteria

Our criteria are designed to be used in conjunction with experienced analytical judgment exercised through a committee process. The combination of transparent criteria, analytical judgment applied on a transaction-by-transaction or issuer-by-issuer basis, and full disclosure via rating commentary strengthens our rating process while assisting market participants in understanding the analysis behind our ratings.

A rating committee may adjust the application of these criteria to reflect the risks of a specific transaction or entity. Such adjustments are called variations. All variations will be disclosed in the respective RACs, including their impact on the rating where appropriate.

A variation can be approved by a ratings committee where the risk, feature, or other factor relevant to the assignment of a rating and the methodology applied to it are both included within the scope of the criteria, but where the analysis described in the criteria requires modification to address factors specific to the particular transaction or entity.

Limitations

Ratings, including Rating Watches and Outlooks, assigned by Fitch are subject to the limitations specified in Fitch's Ratings Definitions, available at www.fitchratings.com/site/definitions.

Data Sources

Key rating assumptions used in this report are based on the analysis of data received from issuers, arrangers, engineers, consultants and other third parties, and public information in addition to our analytical judgement. We rely on these sources for the assignment of new ratings. In monitoring existing ratings, we also rely on updated operational and financial reports in addition to or in lieu of updated third-party reports. See the *Infrastructure and Project Finance Rating Criteria* for a discussion of the relevant information used in our analysis and rating decisions.

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