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Risk Matrix for Power Generation

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Checklists of issues to consider when preparing or reviewing sector-specific asset recycling guidelines for power generation risk sector

- [Operating Risk](#)
- [Demand / Revenue Risks](#)
- [Financial](#)
- [Political Force Majeure \(Change in Law and Government \(In-\)Actions\)](#)
- [Force Majeure](#)
- [E&S Risks](#)
- [Climate Risks](#)

Sample risk matrix – Power Generation

Risk	Description	Public	Private	Shared	Mitigation
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OPERATING RISKS	O&M costs overrun	Risk of O&M costs being higher than forecast or budgeted.		x	Evaluation of O&M cost assumption and the adequacy of tariff component for the recovery of O&M cost is critical in ensuring the selection of private sector with credible and robust business plan; specifying the requirement of a long term O&M (e.g. LTSA) contract as part of IPP bid submission can also a mitigation strategy
	Fuel price risk	Risk of fuel price fluctuation.		x	Typically borne by tariff taker. Tariff component for fuel cost recovery will typically allow for fuel price pass-through/indexation.
	Plant efficiency	Risk of plant operation not in accordance to design standard (e.g. thermal efficiency below contracted efficiency due to operational issue).		x	Borne by the private sector operator as efficiency is under their control and responsibility of asset owner. Therefore, fuel price is a typical pass-through component.

<p>DEMAND / REVENUE RISKS</p>	<p>Demand risk</p>	<p>Output of the plant subject to dispatch order by utility.</p>	<p>x</p>		<p>For non-renewable plant, typically tariff payment will be structured into availability payment and output payment or a Take or Pay will be provided by off- taker.</p> <p>IPP will be neutral of demand risk as it will typically structure its debt servicing and capital repayment requirement based on availability payment (or Take or Pay), which is a factor under their control. Output payment will be structured on cost recovery/cost pass through basis.</p> <p>For renewable plant where resource availability is a constraint, typically will be structure on a “must take” basis by the off-taker, with further compensation from off-taker in the event of risk event caused by the off-taker (e.g. curtailment beyond cap).</p>
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FINANCIAL	Failure to achieve financial close	Inability to achieve financial close due to market uncertainty or the project capital structure is not optimal.				<p>For IPP tender, evaluation of the comprehensiveness and robustness of IPP participant debt financing plan as part of bid submission is a way to mitigate financial close risk. As part of qualification process, typically shortlisted bidder will go through a screening process of financial strength and debt raising experience in ensuring credible IPP participants are selected for bid submission.</p>
	Foreign exchange rate risk	Fluctuation of foreign exchange rate.				<p>Tariff components will allow for the allocation between foreign and local components, where foreign component is indexed to an agreed FX rate. Hence, private sector will be shielded from FX fluctuation risk if the allocation is done in accordance to the foreign-local component split of the cost component.</p>

Inflation risk

Increase of inflation rate used for estimating operating cost.

x

Same as above, tariff components will typically allow for indexation of foreign and local cost component to the relevant CPI indices. This is applicable only to tariff components meant for the recovery of cost components that are subject to inflation indexation (e.g. O&M cost, but not capital recovery and not fuel cost).

<p>Interest rate risk</p>	<p>Increase in interest rate (base interest rate).</p>		<p>x</p>		<p>Typically borne by private sector (IPP), who is responsible for arrange for debt financing for the capital investment. Mitigation strategy shall be to enter into hedge/swap to mitigate base interest rate fluctuation risk, or to even consider fixed interest rate.</p>
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<p>POLITICAL FORCE MAJEURE (CHANGE IN LAW AND GOVERNMENT (IN-)ACTIONS)</p>	<p>General change in law</p>	<p>Change in law such as taxation which impacts all businesses and industries.</p>	<p>x</p>	<p>(x)</p>	<p>Typically to be borne by the government/owner/taker, usually with a threshold to be defined (material adverse change).</p> <p>For brownfield assets (in the context of asset recycling transactions) the allocation of change in law risk can be split where the Relevant Authority/government/counterparty assumes discriminatory and certain specific changes in law.</p>
<p>FORCE MAJEURE</p>	<p>Natural disasters</p>	<p>The occurrence of natural disasters disrupting operations.</p>			<p>Insurance, to extent possible. In extended FM, parties will have the right to terminate.</p> <p>Climate adaptation plan.</p> <p>Emergency Preparedness and Response plan (EPR plan) / Disaster Risk Management plan (DRM plan).</p> <p>Incorporate Qualified Climate Risk Events</p>
	<p>Other Force Majeure</p>	<p>Other force majeure events such as war, earthquakes, etc.</p>			<p>Insurance, to extent possible; termination with compensation if settlement cannot be reached.</p>

Prolonged force majeure	If above prolongs for 6 to 12 months, may cause economic problems to the affected party (esp. if insurance does not exist).			x	Either party should be able to terminate the contract and trigger an early termination.
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<p>E&S Risks and Climate Risk</p>	<p>E&S risks management</p>	<p>Power gen plant development and operation create many E&S impacts and risks, which if not appropriately managed, can result in impact on the social and natural environment.</p> <p>Impact of discharged water temperature on fish populations.</p> <p>High chlorine content in the air.</p> <p>Marine biofouling and/or microplastics affecting cooling systems.</p> <p>Noise pollution affecting plant employees and nearby communities.</p>	<p>x</p>	<p>The party in charge for construction and Operation and Maintenance (O&M) should have undertaken E&S Studies prepared management plans to mitigate any adverse impacts and risks and consistent with applicable laws.</p> <p>Convert to Closed-cycle cooling system or implementing Cooling ponds or reservoirs.</p> <p>Install noise control equipment (acoustic enclosure, baffles, exhaust silencers, absorptive panels, d silencers, etc).</p> <p>Cogeneration or Combined Heat & Power (CHP) facilities</p> <p>Install flue gas desulfurization equipment.</p> <p>Install electric bag filters.</p>	<p>The parties to review compliance of the E&S aspect of the Concession Agreement, during construction and O&M.</p>
		<p>Risk of noncompliance on the E&S aspect of the concession agreement.</p>		<p>x</p>	

Integrate climate resilience in maintenance regimes and materials and equipment design specifications.

Improve emergency repair procedures.

Temporary shutdowns during heat waves.

Increase efficiency of cooling systems. Redesign cooling facilities (water recovery from condenser and heat exchangers, reduction of evaporative losses, secondary or wastewater usage, construction of dry cooling towers).

Install a demineralized

**Based on "WB (2016) - [Emerging Trends in Mainstreaming Climate Resilience in Large Scale, Multi-sector Infrastructure PPPs](#)" and based on "ADB (2013) - [Guidelines for Climate Proofing Investment in the Energy Sector](#)"*

Key variables to monitor on climate risks and its impacts, for power generation assets:

- Temperature of cooling water before and after use (in °C)
- Cooling water availability (in m3)
- Maximum temperature and deviation vs. average monthly max temperature (in °C)
- Flooding (power gen area affected)
- Sea level rise (in meters)
- Intense precipitation events (in millimeters)
- Drought events (area affected)
- Wind speed (in km/hour)
- Storm surge (# events and intensity)
- Turbine efficiency (in %)
- Solar panel efficiency (in %)
- Moisture content in coal (in %)
- Airport unavailability (hours per year)
- GHG emissions (tons CO2 e.g., per year)

Related Content

- [Guidelines for Implementing Asset Recycling Transactions \(Download PDF version\)](#)

Additional Resources

- [Risk Matrix for Power Generation](#)
- [Power and Renewable Energy PPPs](#)

This section has not been prepared with any specific transaction in mind and are meant to serve only as general guidance. It is therefore critical that the content will be reviewed and adapted for specific transactions.

This is a new section of the website and is currently in draft form. For feedback on the content of this section or to suggest additional links or materials, please [contact the PPP Resource Center](#) using the feedback form.