On-line Training of SAARC Professionals on Power Purchase Agreements of Renewable Energy Projects

Risk assessment and mitigation techniques for Renewable Energy Projects

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TETRA TECH

Risk assessment
and mitigation techniques for
Renewable Energy Projects

Content

- Why risk assessment?
- Risk elements, events, and mitigation
- Risk Classification
- Risk register, matrix and index
- Risk management
- Case study

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Why Risk Assessment?

- It helps in dealing with uncertainties and maintaining the project progress.
- It helps in keeping the project financing under control
- It helps in budgeting/obtaining project finances
- It helps in transfer of risks
- It helps in quick mitigation of risks
- It helps in selection of right technology
- Often absence of good risk assessment constrained the deployment of RE

Content

Renewable Energy Projects Risk Matrix: Risk Objects and Stakes

S.N.	Risk Elements	Risks Events	Risk Mitigation
1.	Investment	• Return and long tenor of return • Misalignment with project goals	• Credit assessment • Competence and knowledge of the industry • Robust project planning
2.	Construction	• On time completion • Land availability and Government clearances • Skilled staff • Technology • Force majeure	• Fixed price contract • Penalty for delays • Possession of land in advance • Completion criterion and performance tests • Good EPC • Insurance

Renewable Energy Projects Risk Matrix: Risk Objects and Stakes

S.N.	Risk Element	Risks Events	Risk Mitigation
3.	Operational	• Lower PLF • Lower plant availability • Quality of generation • Delays in interconnection • Breakdowns in power evacuation system • Supply schedule	• Performance guarantee • O&M agreement • Other options such as exchange • Sound technical analysis • Proxy generation • Volume firming
4.	Financial	• Exchange rate • Interest rate • Rate of return	• Fix rate/floating rate –market knowledge and assessment

Renewable Energy Projects Risk Matrix: Risk Objects and Stakes

S.N.	Risk Elements	Risks Events	Risk Mitigation
5.	Country and Political	• Law and order • Stability in tax rules • Import duties • Transfer restrictions	• Sovereign guarantee • Political risk insurance • Debt finance • Joint venture with local company
6.	Market	• Demand supply • Electricity tariff • Change in technology	• Long term PPA • Power market • Renewable Energy Certificate • Provision for in between investment

Renewable Energy Projects Risk Matrix: Risk Objects and Stakes

S.N.	Risk Elements	Risks Events	Risk Mitigation
7.	Envoirnmental and Social Safeguard	• Availability of source of RE • Disposal of battery and other fixed assets • Rehabilitation • Societal • Good will of neighbors	• Tie up with weather forecasting company • Provision for the cost of the battery disposal and other assets • Benefits schemes for local community • Participation in local compunity events

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Risk Classification

It is important to understand

- nature of risk?
- what is its importance to the project?
- how can it impact the implementation of the project?
- gains of the project?

To understand each risk in its all dimensions, risks are normally examined under four categories :-

1) Risk Severity,
2) Risk Category,
3) Risk Controllability and
4) Risk Impacts

1. Risk Severity

- For each project element, the severity of risk is paramount in addressing mitigation measures.
- Need to define “Risk Severity” in three categories i.e. low, medium and high.

2. Risk Category

Risks categorized into:

Strategic Risk:

- Risks that absolutely must be controlled because it is possible to do so and the control of these risks is vital to the success of the project.
- For the solar project, strategic risks are mostly asset security and resource (such as land availability) risks

Contingent Risk:

- These are risks that are destructive or would severely reduce the likelihood of project success.
- The most important example would be the solar system technology solutions to fully address the technical requirements for water pumping applications.

Non-Critical Risk:

- Not important or difficult to control, but are generally are not worth much time or effort to resolve
- Strategy refinement where addressing these risks is not necessary to project success
- These risks can be attended to when time and resources permit.

3. Risk Controllability

Controllable:

- Can be easily mitigated with the virtue of an efficient program design.
- For example, system design, operation and maintenance.
- The only challenge with these risks is their identification.

Controllable, with significant efforts:

- Can be mitigated but require either significant resources, technical expertise of effort on the project proponent's part.
- For example, land acquisition, the proponent has to put in additional efforts to assure that land rights do not pose a significant problem in the program tenure.

Uncontrollable:

- Arise due to the factors that are not under the direct control of the business.
- For example, weather (storm, tornado, etc.)

Risk controllability is defined as the chances of loss from various risk factors that can be reduced or avoided with less effort, reduced or avoided with significant efforts or cannot be controlled

4. Risk impact

Low risk - cause insignificant impacts which, in most cases, can be addressed by the project or can be resolved locally

Medium risk - cause noticeable impacts which, in most cases, can be either addressed by the project or can be resolved locally or will require some mobilization of external resources.

High risk - cause significant impact and in most cases can't be addressed locally and will require substantial cost and resource inputs to address the issues

Risk Rank Order Matrix

Risk Weights

5 Severity

1 Controllability

1 Category

4 Impact on Project

Risk Severity	High	Medium	Low	Weight
	3	2	1	5
Risk Category	Strategic	Contingent	Non-Critical	
	3	2	1	1
Controllability	Yes	Yes with Effort	No	
	1	2	3	1
Impact on Project	Un-viable	Moderately Viable	Viable	
	3	2	1	4




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4. Risk Register, Matrix, and Index

- What is risk register
- Risk matrix normally two dimensional
- Risk index without mitigation measures
- Risk index with mitigation measures

Popular measures companies take to mitigate business/ strategic, operational and construction risks with RE plants?

- Using only proven technology in construction
- Regular maintenance of plant and equipment
- Training of employees and testing of recovery plans
- Investing in R&D
- Improving analysis of market data
- Improvements to supply chain management
- Improving monitoring of industry and market trends
- Improving analysis of weather data at location ahead of investment decision
- Improving scenario planning
- Adjusting the strategic business mix on an ongoing basis
- Insurance

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Risk management

Diversification	Larger energy producers are in a better position than smaller ones to mitigate political and regulatory risk and weather-related volume risk by means of diversifying their plants in both geographical and technological terms.
Financing	Larger renewable energy developers— especially those that are part of multinational concerns—often have easier access to finance than smaller ones. They generally are also in a position to shift investments around, for example in response to macroeconomic and political changes.
Expertise	Larger firms typically can draw on deeper pools of internal expertise, including engineering, legal, risk management, public relations and lobbying expertise

Recommendations for effective risk management

Intensify efforts to reduce and mitigate risk

- Renewable energy experts say that the availability of effective risk transfer products is limited.
- Renewable power developers may do well to focus on reducing general business risk—by sharing risk with joint-venture partners, or by investing in late stage developments, for example—as well as on ways of mitigating specific risks.

Deepen industry collaboration to mitigate risk

- Measures including pooling of maintenance equipment and spare parts, as well as joint collection of relevant weather data, may go some way to mitigating the risk inherent in renewable energy projects.
- Industry partnerships may become more critical as projects become larger and more complex

Foster industry expertise and product development

- More comprehensive information and data on renewable energy technologies, coupled with industry education programmes, may enable development of expertise both within the renewable energy sector and among external stakeholders — potentially paving the way for wider availability of effective risk transfer products

Transferring Risks

- Most renewable energy companies seek to transfer at least a portion of risk onto third parties.
- Many use insurance for this purpose.
- The use of financial derivatives is also widespread.
- The inclination of renewable energy producers to transfer risk depends on the nature of the risk involved
- Many power producers use hedging instruments to transfer market risk
- When power producers transfer risk, it is not exclusively to insurers. Many say they transfer operational risk onto suppliers of hardware, such as wind turbine manufacturers.
- For example, a service agreement might guarantee the utility a minimum availability, such as 97% availability over a 15-year period. Manufacturers receive a fee per kilowatt hour(kwh) generated, in return for which they carry out maintenance and repair. This transfers operational risk and mitigates the potential for earnings volatility caused by downtime.

Risk transfer mechanisms: Tools of the trade

- Captives Insurance companies financing parent company's risks.
- Catastrophe bonds: Risk-linked securities transferring risks to investors.
- Derivatives: Contracts specifying payment in the event of certain changes, such as in weather measurements (rain, wind) or energy prices.
- Insurance: Contract providing third-party coverage in case of loss.
- Self-insurance: Setting aside specified amounts against future loss.

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Case Example - Risk Assessment and Mitigation for Solar and Grid Energy Hybrid Systems for Irrigation Pumps in Rural Uttar Pradesh

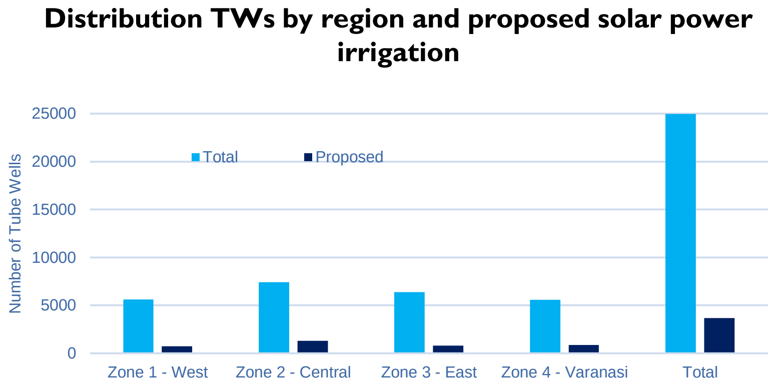
Introduction

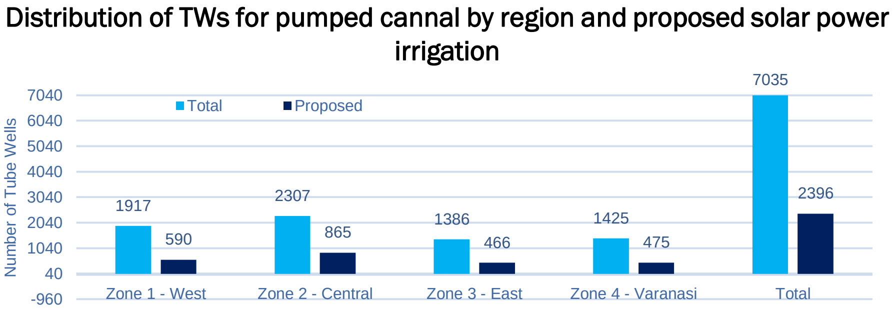
The purpose of the study was to assess the risks in the project and suggest risk mitigation measures. The broad objectives were:

- Analyze the Project Benefits
- Analyze the risk involved with the project

Benefits of Solar Powered Irrigation

- Optimal use of infrastructure leading to increase in irrigation potential up to 2.0 lacs hectare.
- Reliable power supply from decentralized solar power generation.
- Timely and assured irrigation resulting to increase productivity and food security.
- An additional generation of about 140 MW power in the state which is suffering from demand and supply gap.
- Saving in transmission and distribution losses of the electric utility.
- Reduced dependency on the grid supply.





Survey Assessment Methodology

Literature Review

Key document studied were:

- UP Irrigation Project report (6067 TWs and 57 MLCs under hybrid model)
- UPSEB's Tariff Orders
- UPERC Regulations for (Rooftop Solar PV Grid Interactive Systems Gross /Net Metering)
- Regulations, 2015, (RSPV Regulations, 2015). Canal Solar Roof Top Project in Gujarat

Detailed Field Survey

Field Surveys include site visits to:

- Tube wells sites
- Pumped canals sites
- Solar pilot tube wells sites

Stakeholder Consultations

The discussions centered on the following aspects:

- Experience with existing solar irrigation pilots
- Development of solar irrigation policy
- Sourcing of funding for the process
- Procurement process for solar systems
- Solar/RE unit with UP Irrigation for project roll-out
- Training and capacity development of UP Irrigation personnel on solar system operation and maintenance
- Performance monitoring of solar systems installed.

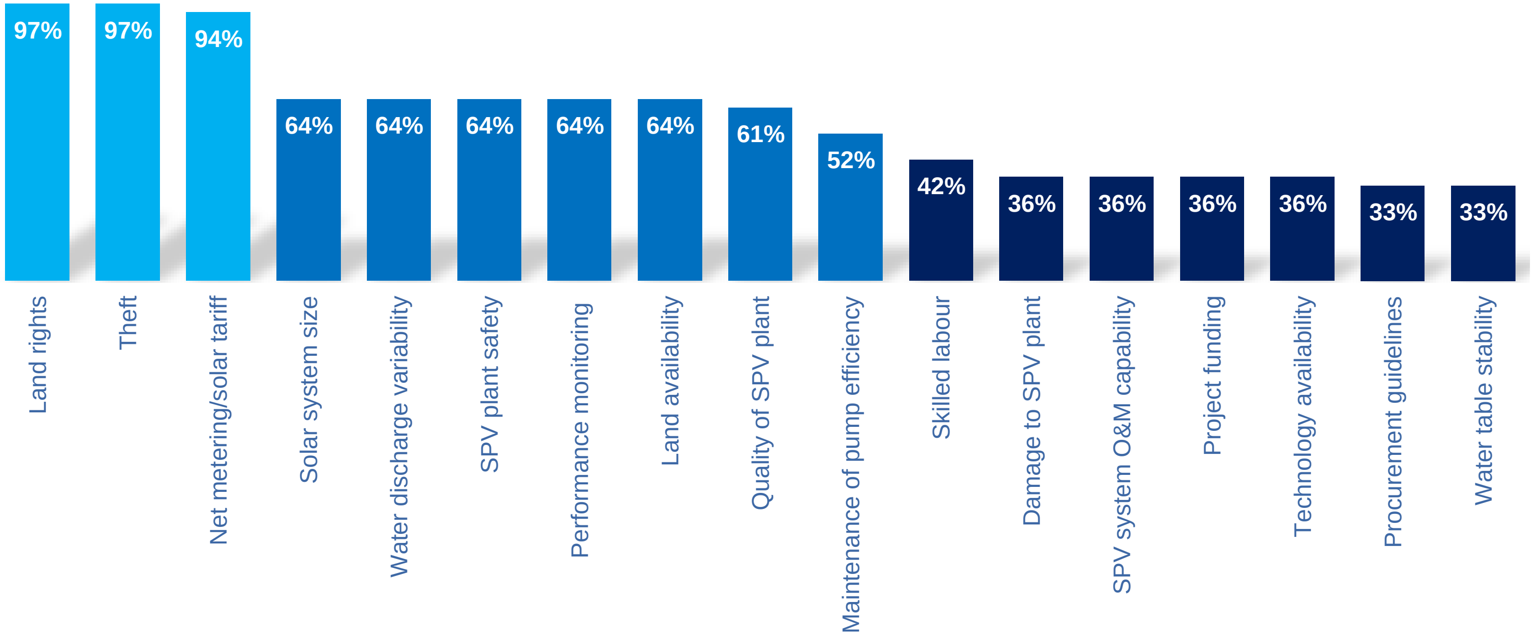
International Experience

Allocated Risks (Without Risk Mitigation)

Risk Elements	Allocated Risk	Maximum Risk	Risk Factor
Risk 1: Resource Risk			
Land availability	14.00	33	0.42
Land rights	32.00	33	0.97
Water table stability	11.00	33	0.33
Risk 2: Asset Security Risk			
Theft	32.00	33	0.97
Damage to SPV plant	12.00	33	0.36
Risk 3: Technology Risk			
Solar system size	21.00	33	0.64
Quality of SPV plant	21.00	33	0.64
Water discharge variability	17.00	33	0.52
Technology availability	11.00	33	0.33
Risk 4: O&M Risk			
SPV system O&M capability	12.00	33	0.36
Maintenance of pump efficiency	21.00	33	0.64
Risk 5: Policy and Regulation Risk			
Project funding	12.00	33	0.36
Net metering/solar tariff	31.00	33	0.94
Risk 6: Procurement Risk			
Procurement guidelines	12.00	33	0.36
Performance monitoring	20.00	33	0.61
Risk 7: Skills Risk			
Skilled labour	21.00	33	0.64
Risk 8: Safety Risk.			
SPV plant safety	21.00	33	0.64
Overall Project Risk	**321**	**561**	**0.57**

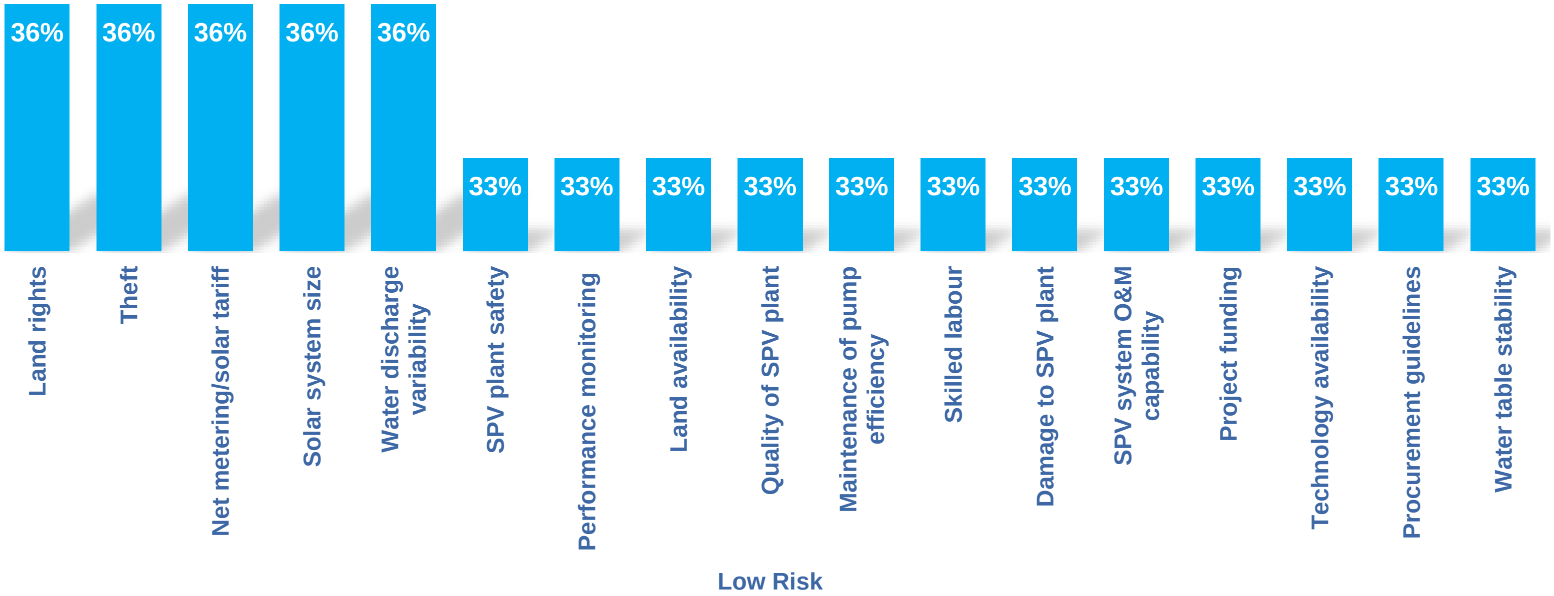
Risk Index for Solar Powered Tube Well Project
(Without Risk Mitigation)

Project Overall Risk Index – 57%



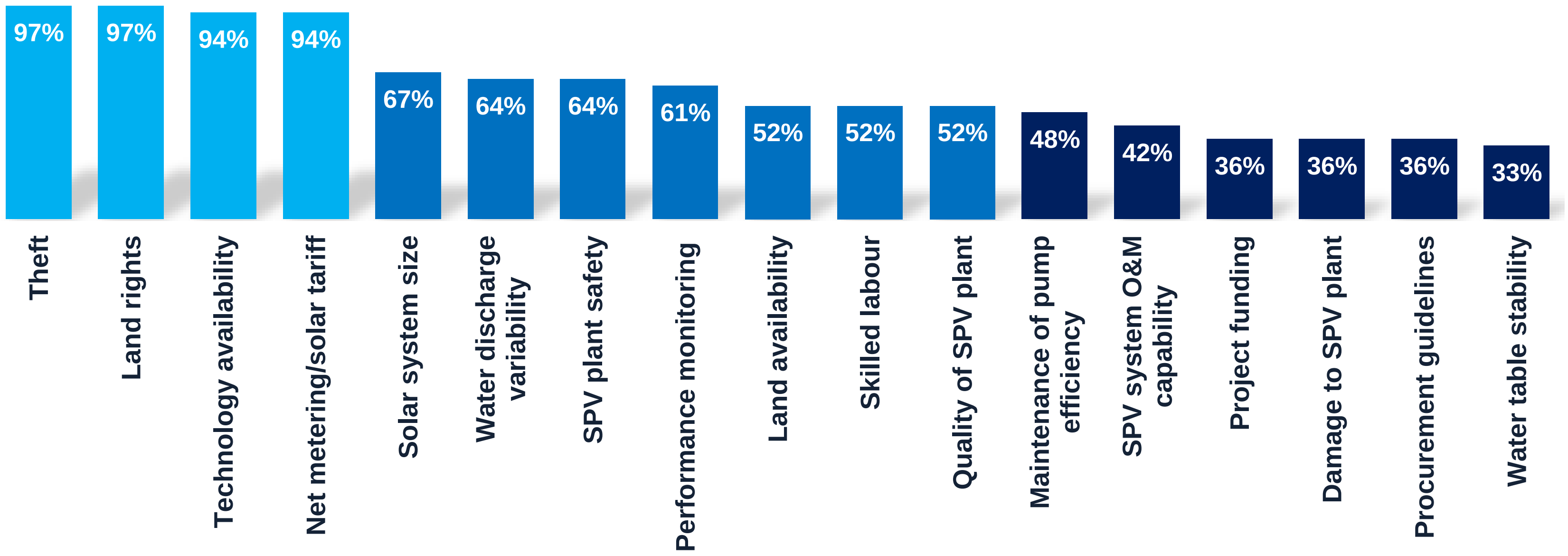
Risk Index for Solar Powered Tube Well Project
(With Risk Mitigation)

Project Overall Risk Index – 34%



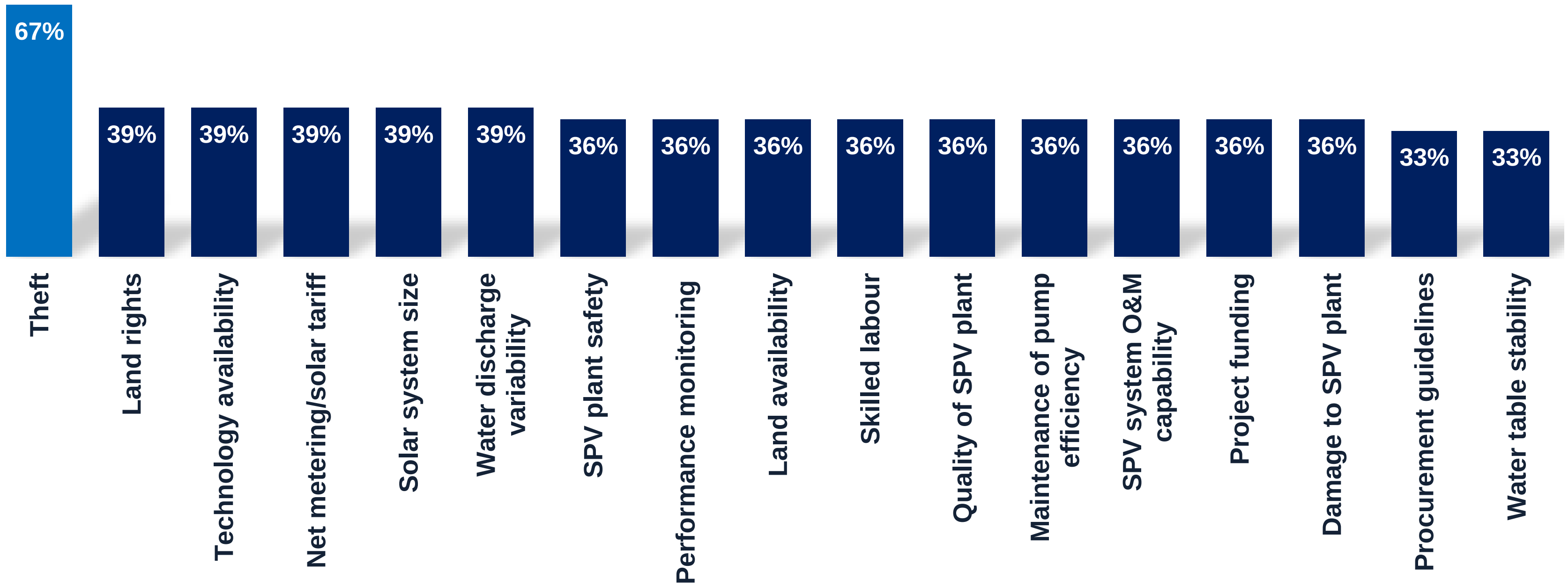
Risk Index for Solar Powered Minor Lift Canals
(Without Risk Mitigation)

Project Overall Risk Index – 60%



Risk Index for Solar Powered Minor Lift Canals
(With Risk Mitigation)

Project Overall Risk Index – 39%



Recommendations

Installation of Remotely read meters with net metering facility

- UP irrigation department should immediately approach Chairman UP Power Corporation and UPERC for installation of remotely read meters at all TWs and switch to metered tariff from fixed tariff. It is estimated that department will save about 50% in electricity bill. The TWs which are covered under this project shall be supplied meters with net metering provisions.

High Wire fencing

- Six to eight feet high wire fencing of the solar panel should be made must in the project to avoid the risk of security. This has been adopted in some of the pilot tube wells visited during the survey.

Land Acquisition on Consent Basis

- Discussions with the farmers in whose land currently TW is existing should be started for giving more land on consent basis. UP Government may consider acquisition of such land by paying the adequate compensation to the farmer. Part of the surplus generation from solar plant may be made available to the farmer who provided the land for solar panel for his domestic/farm use.

Recommendations

Settlement of Excess Power

- A petition should be filed before UPERC for allowing settlement of excess power supplied to grid from the project at feed in tariff rather than current tariff of INR 0.5/kWh

Utilization of Surplus Power

- Options (such as micro-grid/distributed generation, pump storage etc.) for utilizing of solar power when grid supply is not available and water is not required for irrigation should be evaluated and included in the project to increase the gains of the project and avoid wastage of electricity generated from solar.

MoU with MNRE and IREDA

- An MOU should be signed at the earliest with MNRE and IREDA for year marking the grant and debt for the project.

Recommendations

Solar Unit within the UP Irrigation Department

- A special cell in the department should be created for this project. This cell should be made responsible for pursuing all the above suggestions at the appropriate level. More so solar is the future and it is likely in coming times even canal will get covered with solar panels.

Supplier Service Agreement

- A service level agreement should be signed with the supplier for replacing the panel and attending other faults in a time bound manner, pending enquiry of cause.

Equipment Guaranty and Warranty

- Equipment should be purchased with life time guarantee of solar panels and five year guarantee of the rest of the equipment's. There should be 5 year O&M contract should be in built. The departmental staff will take time to learn and to become self-sufficient in O&M.

Capacity Building

- Capacity building of the staff should be must for all suppliers. The farmer on whose land solar panels will be installed should be included in the capacity building programs.

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Thank you