AGENDA

Risks for PV Solar Project Development
Risks for the PV Solar Parks
Loss Lessons for PV Solar Industry
Summary
Risks for PV Solar Project Development

- **Construction risk** - Risk of property damage or liability stemming from errors during the building of new projects.

- **Company risk** - Risk affecting the viability of the project developer, for example, risks related to key personnel, financial solidity and technical ability to execute on plans.

- **Environmental risk** - Risk of environmental damage caused by the solar park including any liability following such damage.

- **Financial risk** - Risk of insufficient access to investment and operating capital.

- **Market risk** - Risk of a cost increases for key input factors such as labor or modules, or rate decreases for electricity generated.
• **Operational risk** - Risk of unscheduled plant closure due to the lack of resources, equipment damages or component failures.

• **Technology risk** - Risk of components generating less electricity over time than expected.

• **Political and regulatory risk** - Risk of a change in policy that may affect the profitability of the project, for example changes in levels of tax credit or incentive programs. Also, this includes changes in policy as related to permitting and interconnection.

• **Climate and weather risk** - Risk of changes in electricity generation due to lack of sunshine or snow covering solar panels for long periods of time.

• **Sabotage, terrorism and theft risk** - Risk that all or parts of the solar park will be subject to sabotage, terrorism or theft and thus generate less electricity than planned.
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PV Solar - Supplier Risks

Liabilities of Component Suppliers
• Product Liability (Third Party, Safety)
• Workmanship warranties
• Performance warranties

Liabilities of Developer/EPC
• Damages occurring during construction
• Liquidated damages (e.g. delay in startup)
• Workmanship warranties
• Yield warranties

Liabilities of Operations & Maintenance provider
• Liquidated damages related to availability or yield (e.g. shadowing due to uncontrolled vegetation growth or soiling)

General Business Risks
• Market change
• Margin pressure
• Political change
• Growth financing
• Debt overload
PV Solar - Park Risks 1

Lightning strikes
- Lack or improper lightning protection leading to destruction of components
- Undetected malfunctions (bypass-diodes)

Grid overvoltage
- Lack or improper surge protection leading to component failures

Wind loads
- Mounting structures tear off
- Module pull off or bending

Damage caused by snow loads
- Module breakage
- Frame deformation
- Loss of roof cladding

Damage caused by hail
- Module breakage/cracks

Strong rain
- Landslide
- Stream channels

Fire
- PV systems affected by building fire
- PV systems causing fire

Theft or vandalism
- Loss of infrastructure, e.g. modules, copper
- Damaged fences

Animal impact
- Glass breakage or contamination by birds
- Rodent bites in cable insulation

Grounding and Mounting
- Roof damage due to installation work
- Overloading the roof structure
- Water ingress beneath PV systems
PV Solar - Parks Risks 2

Solar Array Design
- Uncertain estimation of environmental factors (e.g. climate, ammonia, salt, sand, dust)
- Weak supplier qualification
- Weak components qualification
- Stress - strength alignment (fit for purpose)
- Layout errors, e.g. cabling, grounding, electrical dimensioning
- Uncertainty in irradiance estimation
- Using wrong assumptions for yield prognosis
- Weak O&M planning, e.g. maintenance intervals, spare part requirements
- Weak EPC qualification

Installation
- Weak material inspection
- Acceptance of improper deliveries
- Undetected installation errors passing through acceptance audit
- Installation faults that cannot be corrected, get insufficiently compensated, and leading to follow-up problems during the lifetime
- Time or cost over-run

Operations
- Downtimes higher than expected
- Inappropriate maintenance intervals
- Spare part demand higher than planned
- Default of warranty providers
- High maintenance effort due to bad setup
- Need for re-powering
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If it can happen, it will happen

In a short time, we have already seen a variety of different types of claims

**Weather**
- Wind Storms/Hail - Fence ripped out of the ground and smashed panels: $300,000
- Hail causing hairline fractures in the panels, potential for total loss
- Lightning – struck a transformer, total loss: $400,000
- Rain – During construction, heavy rains transferred disturbed soil from property and washed sediment into residential wells, on-going claim, will be in the millions

**Human Error**
- Transformer improperly installed, went up in flames: $250,000
- Roof top panels ripped off due to improper design/installation of racking: $500,000
- Substandard roof top transformer was installed, total loss to transformer and damage to roof of building. Loss is in excess of a $1,000,000.

**Theft**
- Everything from security cameras to copper wiring to electrical components
Business Interruption
The real cost of claims

Business Interruption
Transformers and Inverters are key components to any solar farm. Important to focus on minimizing any downtime; how accessible are replacement parts?

Common loss example: Transformer fire
Value of transformer: $500,000
Average BI for a 10MW solar farm in Ontario is about $5M- $7M annually, approximately $500,000 per month in lost income
Transformer fire = $500,000 + 6 – 8 months of downtime = $3.5M - $4.5M claim

Contingent Business Interruption
Not as common, but still an exposure to consider
Strong Wind Storm knocked out a non-owned substation of a 10MW solar farm, over 2 months to reconnect to the grid, CBI claim has been submitted
What does the future hold?

The future is sunny
- Advancement in technologies
- Costs are coming down
- Improved efficiencies, hail resistant panels, etc.
- Longer life expectancies

Challenges Ahead
Rapid Expansion leads to the following:
- Improper planning & design
- Competition for capital leads to cost reductions; purchase of substandard equipment
- Hiring inexperienced contactors
- Not budgeting for proper service and maintenance, reliance on manufacturer warranties

Key Takeaway
Regular service and maintenance by the OEM is critical to the success of any solar farm
OPEN DISCUSSION LOSS LESSONS

JACQUES O’BRIEN

SENIOR RISK ENGINEERING SPECIALIST
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5 Primary Risk Stages

Site Risks
- Ground, weather, access and resource
- How does resource vary monthly and annually? What is the confidence level?

Completion Risks
- Issues that could affect construction milestones, particularly energisation

Technology Risk
- Is the technology proven? Is it suitable for the site?

Operating Risks
- Issues that could affect project revenue over the project life
- Are there contractual or physical mitigants?

Financial Risk
- Assess the volatility of cashflow
- Are mitigants in place?
Principals of Effective Risk Management

Risk Analysis - is the process of defining and analyzing the dangers to individuals, businesses and government agencies posed by potential natural and human-caused adverse events.

Risk Control - is the method by which an organization evaluates potential losses and takes action to reduce or eliminate such threats.

Risk Transfer - is a risk management and control strategy that involves the contractual shifting of a pure risk from one party to another. One example is the purchase of an insurance policy, by which a specified risk of loss is passed from the policyholder to the insurer.
Questions?

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