AWR Lloyd overview

The Firm

AWR Lloyd is a strategy consulting and financial advisory firm that specializes in the energy, metals & mining sectors in South East Asia. Founded in 2001, the firm has worked with numerous Asian and global companies and investors to develop and implement strategy, M&A, investment structuring, and capital raising.

We pride ourselves on working closely with blue chip and mid-sized clients as a trusted advisor, from project inception to successful completion. Most of our projects are with repeat clients that look to us for short or long term support. We provide customized solutions to deliver maximum impact for our clients.

Our ultimate goal is to help our clients create shareholder value in a sustainable way. To achieve this we leverage in-depth industry analysis, best practice corporate finance skills, and extensive local networks in Asia.

New Energy Practice

Around the world, technological advances and economic drivers have transformed the global energy sector, forcing change on existing players and providing huge opportunities to well-placed new entrants.

AWR Lloyd’s New Energy Practice has developed a unique level of expertise in renewable energy, natural gas and related industries that are experiencing exceptional growth.

We help clients to conceive and execute winning strategies for this complex and dynamic environment by providing a unique fusion of three core businesses - strategy consulting, financial advisory, and market research.

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Managing Director, New Energy
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E-mail: jack@awrlloyd.com
www.awrlloyd.com
A selection of our clients

AWR Lloyd works with a range of blue-chip industry clients and mid-sized players
New Energy service offering

**Strategy consulting**
- Growth strategy
- Value creation and maximization
- New market entry
- M&A origination, screening, and due diligence
- Financing strategy
- Strategic partnerships
- Feasibility studies
- Commercial negotiations and agreements

**Financial advisory**
- M&A transaction execution and management
- Project investment identification and origination
- Asset sales and marketing
- Project finance
- Capital raising and placement

**Market research**
- Asian markets energy industry research
- Regulatory environment analysis
- Identification of opportunities and customers
- Insights and perspectives
Solar PV Investment 101 Workshop

Objectives

*Convey knowledge to provide audience with the ability to understand key economic drivers of solar photovoltaic (PV) projects*

*Develop and practice skills in evaluating and making informed decisions on solar PV project investment*

*Use this as a foundation for analyzing investments in solar companies and securities*

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Agenda

**Investing in Solar PV projects**

9:00 - 10:15 AM

- Solar PV markets overview
- Project profitability & returns
- Development curve & value creation
- Due diligence framework

**Skills session**

10:30 - 11:45 AM

- Case Study: Solar Investment Teasers
- Financial Model
- Group session

**Financing Solar PV projects**

11:45 - 12:00 PM

- Snapshot of the financing environment
- Case study
Globally solar PV has grown beyond expectations

In 2013 the world added 143 GW of renewable energy and 141 GW of conventional power. By 2030 four times as much will be added. By 202 more RE than coal

- Bloomberg New Energy Finance, IEA, both June 2015

Source: BP
Asia is catching up quickly

In 2015, China will have the most installed solar PV capacity in the world.

Meeting India’s PV targets would see the country adding as much as 14GW per year, becoming one of the world largest markets, and hitting grid parity in 2019

- Bloomberg, Mercom, AWR Lloyd

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**Asia top 5 installed capacity in 2014**

<table>
<thead>
<tr>
<th>Country</th>
<th>Solar PV Installed Capacity (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>28.2</td>
</tr>
<tr>
<td>Japan</td>
<td>23.3</td>
</tr>
<tr>
<td>India</td>
<td>2.6</td>
</tr>
<tr>
<td>Thailand</td>
<td>1.3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.2</td>
</tr>
</tbody>
</table>

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**CAGR:**

- **Japan**: 87%
- **China**: 29%

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Source: BP
Growth was initially driven by policy support

<table>
<thead>
<tr>
<th>Country</th>
<th>Installed capacity (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>&gt; 10 GW</td>
</tr>
<tr>
<td>Japan</td>
<td>&gt; 1 GW</td>
</tr>
<tr>
<td>Thailand</td>
<td>&gt; 1 GW</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>&lt; 1 GW</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.2</td>
</tr>
<tr>
<td>India</td>
<td>2.6</td>
</tr>
</tbody>
</table>

**Policy environment**

Illustrative

Strongest

Sources: BP, China NEA, India MNRE, Indonesia PLN, Malaysia SEDA, Philippine DOE, Thailand EPPO, AWR Lloyd research
More recently economic competitiveness has become a key driver

- Falling panel and balance of system (BoS) costs have driven power costs down
- Cheaper capital and better structures
- Marginal new supply for power in Asia is from LNG, which drives up power costs
- Solar PV becomes increasingly competitive against LNG to power at the margin
- Increasing penetration in rooftop segment has unique drivers
  - Own use or partial export
  - Competition with retail tariffs
  - Net metering, CSR, other

The cost of delivering solar power can vary greatly

Comparative cost of major power sources in Asia

CAPEX and debt service make up the majority long term marginal cost of supply for Solar PV

<table>
<thead>
<tr>
<th>CAPEX per MW</th>
<th>Utilization</th>
<th>Fuel</th>
<th>CAPEX</th>
<th>OPEX</th>
<th>Fuel</th>
<th>Debt service</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.8 M</td>
<td></td>
<td></td>
<td>0.118</td>
<td>0.026</td>
<td></td>
<td>0.079</td>
<td>0.223</td>
</tr>
<tr>
<td>$1.4 M</td>
<td>17%</td>
<td>-</td>
<td>0.090</td>
<td>0.012</td>
<td>-</td>
<td>0.062</td>
<td>0.172</td>
</tr>
<tr>
<td>$1.0 M</td>
<td></td>
<td></td>
<td>0.065</td>
<td>0.014</td>
<td>-</td>
<td>0.044</td>
<td>0.123</td>
</tr>
</tbody>
</table>
Projects are the building blocks of any investment strategy

Primary investments in solar PV

Investing in Projects

DevCo

Take equity position directly in an asset

Requires in-depth capabilities

Making acquisitions or other transactions

DevCo

Target

Make acquisitions to expand asset base and bring expertise in-house

Easiest way to obtain new capabilities

Developing Partnerships

DevCo

Country A

Partner 1

Country B

Partner 2

Develop partnerships to get access to projects in new markets

Matching skills and capabilities

Secondary investments in solar PV

Investing in capital markets

Investor

Invest in equities and bonds of listed developers

Does not require in-depth project experience
Most solar PV projects have a similar set of components.
Project profitability & returns
IRR is the most common tool for making investment decisions

- Solar PV investments are typically assessed using Internal Rates of Return
- Generally, the higher this number, the more desirable the project
- There are two types of IRR
  - Project IRR (typically called IRR) assesses the returns to total capital
  - Equity IRR (EIRR) assesses the returns to equity holders after all other sources of capital
- Difference between IRR and EIRR is financial leverage and is driven by:
  - Spread between cost of equity and cost of debt
  - Proportion of debt
Solar PV equity IRRs have three core drivers

### Revenue
- **Price**
  - Rate (Fixed Tariff / Merchant)
  - Tariff adjustments
  - Counterparty creditworthiness
- **Critical factor**

### Costs
- **Capital Expenditure (CAPEX)**
  - Panels
  - Land
  - Inverters
  - Etc.
- **Dominant cost driver**

### Debt
- **Interest Rate**
  - Base lending rate
  - Project risk
  - Borrower risk
- **Primary financing cost driver**

- **Quantity**
  - Irradiation
  - Plant performance
  - Off-take rate
  - Operating duration
- **Critical factor**

- **Operating Expenditure (OPEX)**
  - Operations & Maintenance (O&M)
  - Security
  - Management
  - Etc.
- **Small and predictable**

**Other financing structures can also influence returns, but debt is primary**
Workshop uses a solar PV model and set of assumptions

**Revenue drivers**

<table>
<thead>
<tr>
<th>Description</th>
<th>Investor</th>
<th>Developer</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed in Tariff (in local currency)</td>
<td>5.66</td>
<td>1.73</td>
<td>3.16</td>
</tr>
<tr>
<td>Feed in Tariff (in USD)</td>
<td>0.17</td>
<td>0.51</td>
<td>0.32</td>
</tr>
<tr>
<td>Tariff Duration</td>
<td>25 yr</td>
<td>25 yr</td>
<td>25 yr</td>
</tr>
<tr>
<td>Average annual horizontal irradiation</td>
<td>1,700 kwh/m²</td>
<td>1,700 kwh/m²</td>
<td>1,700 kwh/m²</td>
</tr>
<tr>
<td>Annual energy produced</td>
<td>1,586,687 kwh (ac)</td>
<td>1,587 Mwh (ac)</td>
<td>1,587 Mwh (ac)</td>
</tr>
<tr>
<td>Utilization</td>
<td>1,308 hr p.a.</td>
<td>1,308 hr p.a.</td>
<td>1,308 hr p.a.</td>
</tr>
<tr>
<td>Utilization ratio</td>
<td>15% p.a.</td>
<td>15% p.a.</td>
<td>15% p.a.</td>
</tr>
</tbody>
</table>

**Cost drivers**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (ac)</td>
<td>1.0 Mw</td>
</tr>
<tr>
<td>Performance loss</td>
<td></td>
</tr>
<tr>
<td>Inverter</td>
<td>6–15% 5%</td>
</tr>
<tr>
<td>Mismatch</td>
<td>4–15% 4%</td>
</tr>
<tr>
<td>Temperature</td>
<td>3–15% 3%</td>
</tr>
<tr>
<td>DC cable</td>
<td>1–3% 1%</td>
</tr>
<tr>
<td>AC cable</td>
<td>0–3% 1%</td>
</tr>
<tr>
<td>Weak irradiation</td>
<td>3–7% 3%</td>
</tr>
<tr>
<td>Dust, snow, etc.</td>
<td>2–5% 2%</td>
</tr>
<tr>
<td>Combined loss (geometric)</td>
<td>18%</td>
</tr>
<tr>
<td>Installed capacity required (dc)</td>
<td>1.2 Mw</td>
</tr>
<tr>
<td>Solar panel output (dc)</td>
<td>330 W</td>
</tr>
<tr>
<td>Average panel size</td>
<td>2.2 m²</td>
</tr>
<tr>
<td>Total solar panel area</td>
<td>8,083 m²</td>
</tr>
<tr>
<td>Average solar panel yield</td>
<td>12–15% 14%</td>
</tr>
<tr>
<td>Panel degradation rate</td>
<td>0.3–0.4% 0.4% p.a.</td>
</tr>
</tbody>
</table>

**Finance drivers**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leverage</td>
<td>75%</td>
</tr>
<tr>
<td>Tenor</td>
<td>12 yr</td>
</tr>
<tr>
<td>Interest</td>
<td>6.00%</td>
</tr>
<tr>
<td>Debt service</td>
<td>(0.17) $M</td>
</tr>
<tr>
<td>Investor stake</td>
<td>51%</td>
</tr>
<tr>
<td>Developer fee (in local currency)</td>
<td>2.00 M/Mw</td>
</tr>
<tr>
<td>Developer fee (in USD)</td>
<td>0.06 $M/Mw</td>
</tr>
<tr>
<td>Total payment</td>
<td>0.07 $M</td>
</tr>
<tr>
<td>Capital cost per Mw ac (in local currency)</td>
<td>53.8 $/M</td>
</tr>
<tr>
<td>Capital cost per Mw ac (in USD)</td>
<td>1.61 $/M</td>
</tr>
<tr>
<td>Total capital cost in Mw ac</td>
<td>2 $M</td>
</tr>
<tr>
<td>Land available to purchase</td>
<td>0 Ha</td>
</tr>
<tr>
<td>Land cost per Ha (in local currency)</td>
<td>0.00 $/Ha</td>
</tr>
<tr>
<td>Land cost per Ha (in USD)</td>
<td>0.00 $/M</td>
</tr>
<tr>
<td>Total land cost</td>
<td>0.00 $M</td>
</tr>
<tr>
<td>Any other one-time costs (in local currency)</td>
<td>0.00 $M</td>
</tr>
<tr>
<td>Any other one-time costs (in USD)</td>
<td>0.00 $M</td>
</tr>
<tr>
<td>All in capital costs</td>
<td>1.95 $M</td>
</tr>
<tr>
<td>Operating expenses (OPEX)</td>
<td>2.00% of CAPEX p.a.</td>
</tr>
</tbody>
</table>
Business model is moving beyond fixed price tariffs

**Relevant drivers**

- **Feed in Tariff (in local currency):** 5.66 / kWh
- **Feed in Tariff (in USD):** 0.17 $ / kWh
- **Tariff Duration:** 25 yr

**Price**

- Purchase price (tariff) is generally quoted on a per kilowatt-hour basis
- Tariff levels are ultimately set based on cost (which is impacted by a wide range of factors including insolation and project development costs) and thus can vary significantly
- Traditionally, governments have offered a wide range of tariff structures: stepped, escalating, location-based, size-based, etc.
- Solar PV is moving towards market based approaches such as bi-lateral contracts, merchant power plants, and auction structures

**Key considerations**

- Changes to tariff regime can represent a risk
- Power purchaser’s creditworthiness can be a key factor in expected project profitability
- Any non-payments or delays in payment will decrease returns

**Solar PV tariff range in key Asian markets**

*Source: Enerdata, PLN, METI, SEDA, Philstar, EPPO, AWR Lloyd research*
Maximizing volume is essential

Quantity

- Higher irradiation levels for a given system size or PPA means more electricity is produced per unit of capacity and investment
- Plant uptime and efficiency drive the quantity of electricity produced
- Off take rate is the average quantity of electricity sold per day
- Duration of project operations is a direct factor in determining quantity over project lifecycle

Key considerations

- Insolation is not uniform throughout the country and can vary depending on the time of the year
- Intermittent power production can stress local grids
- Interconnection reliability is a crucial element of success
- Grid curtailment / unavailability can leave supply stranded during generation times

Resource measurements in key Asian markets

<table>
<thead>
<tr>
<th>Resource</th>
<th>IRR</th>
<th>Equity IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% increase</td>
<td>+1.7%</td>
<td>+2.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horizontal irradiation (kWh/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
</tr>
<tr>
<td>India</td>
</tr>
<tr>
<td>Indonesia</td>
</tr>
<tr>
<td>Japan</td>
</tr>
<tr>
<td>Malaysia</td>
</tr>
<tr>
<td>Philippines</td>
</tr>
<tr>
<td>Thailand</td>
</tr>
</tbody>
</table>

Source: SolarGIS, AWR Lloyd research
CAPEX is the dominant cost element

### Cost drivers

<table>
<thead>
<tr>
<th>Cost Description</th>
<th>Base Case</th>
<th>+10% CAPEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital cost per MW dc (in local currency)</td>
<td>$54.4 M/MW</td>
<td></td>
</tr>
<tr>
<td>Capital cost per MW dc (in USD)</td>
<td>$1.65 M/MW</td>
<td></td>
</tr>
<tr>
<td>Total capital cost in MW dc</td>
<td>$2 M</td>
<td></td>
</tr>
<tr>
<td>Land available to purchase</td>
<td>0 Ha</td>
<td></td>
</tr>
<tr>
<td>Land cost per Ha (in local currency)</td>
<td>0.00 M/Ha</td>
<td></td>
</tr>
<tr>
<td>Land cost per Ha (in USD)</td>
<td>0.00 $M/ Ha</td>
<td></td>
</tr>
<tr>
<td>Total land cost</td>
<td>0.00 $M</td>
<td></td>
</tr>
<tr>
<td>Any other one-time costs (in local currency)</td>
<td>0.00 M</td>
<td></td>
</tr>
<tr>
<td>Any other one-time costs (in USD)</td>
<td>0.00 $M</td>
<td></td>
</tr>
<tr>
<td>All in capital costs</td>
<td>2.00 $M</td>
<td></td>
</tr>
<tr>
<td>Operating expenses (OPEX)</td>
<td>2.00% of CAPEX p.a.</td>
<td></td>
</tr>
</tbody>
</table>

### Costs

- Capital costs (CAPEX) have a greater impact on profitability than operating costs (OPEX) primarily due to greater magnitude. In addition, the expenses occur pre-operations – thus involving greater risk.
- Installed capacity is commonly quoted in kilowatts (kW), megawatts (MW), or Gigawatts (GW).
- Operating costs (OPEX) play a lesser role in impacting profitability.
- OPEX is often forecast as a % of capital costs or on a per kilowatt basis.

### IRR and Equity IRR

<table>
<thead>
<tr>
<th>CAPEX IRR</th>
<th>Equity IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% increase</td>
<td>-1.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPEX IRR</th>
<th>Equity IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% increase</td>
<td>-0.3%</td>
</tr>
</tbody>
</table>

**IRR is highly sensitive to changes in CAPEX...**

![Graph showing IRR sensitivity to CAPEX changes]

**... and less sensitive to changes in OPEX**

![Graph showing IRR sensitivity to OPEX changes]
CAPEX is more than just panels

CAPEX components (% of total CAPEX)

- Panels (~36%)
- Racking (~13%)
- Inverter (~16%)
- Land (9-15%)
- Wiring (~10%)
- Interconnection 0-10%
- EPC Service (8-10%)
- System design (1-2%)
- Permits (1-2%)

Source: UBS, IRENA
Debt terms are a major driver of returns

Two main dimensions of debt are interest rate and tenor

<table>
<thead>
<tr>
<th>Finance drivers</th>
<th>75%</th>
<th>12 yr</th>
<th>6.00%</th>
<th>(0.18) $M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leverage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt service</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Debt service costs can be almost as important as CAPEX
- Interest rate is the cost of debt. Drivers include:
  - Base lending rate - influenced by country’s 10 year bond rate
  - Project risk – bank’s perceived quality of project
  - Borrower risk – bank’s assessment of project owner’s credibility
- Obtaining favorable debt terms for solar PV projects has gotten a lot easier
- As markets matured, there has been global commoditization of debt terms

Impact of debt cost and tenor on Equity IRR

Spread between the term deposit savings rate and the commercial lending rate

Source: Central banks of countries highlighted.
### Solar PV debt can span a range of terms and structures

<table>
<thead>
<tr>
<th>Illustrative</th>
<th>Project finance</th>
<th>Green bonds</th>
<th>Term loan</th>
<th>Revolver</th>
<th>Vendor Finance</th>
<th>Subordinated Notes</th>
<th>Mezzanine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>Lowest</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Funding level</td>
<td>Project</td>
<td>Parent</td>
<td>Parent, Project</td>
<td>Parent</td>
<td>Parent, Project</td>
<td>Parent, Project</td>
<td>Parent, Project</td>
</tr>
<tr>
<td>Investors</td>
<td>Banks</td>
<td>Public</td>
<td>Banks</td>
<td>Banks</td>
<td>Vendor</td>
<td>Banks or Funds</td>
<td>Banks, Mezz. Funds</td>
</tr>
<tr>
<td>Interest rate fixed or floating?</td>
<td>Either</td>
<td>Fixed</td>
<td>Floating</td>
<td>Floating</td>
<td>Floating</td>
<td>Either</td>
<td>Fixed</td>
</tr>
<tr>
<td>Interest paid in cash</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, but Payment-in-Kind possible</td>
</tr>
<tr>
<td>Tenor (yr.)</td>
<td>Long (12-15 yr.)</td>
<td>Medium-Long (7-10 yr.)</td>
<td>Medium-Long (7-10 yr.)</td>
<td>Short-Medium (3-5 yr.)</td>
<td>Short-Medium (3-5 yr.)</td>
<td>Medium-Long (7-10 yr.)</td>
<td>Short-Medium (3-5 yr.)</td>
</tr>
<tr>
<td>Repayment term</td>
<td>Amortized</td>
<td>Bullet payment at end</td>
<td>Amortized, or Semi-amortized with Bullet payment at end</td>
<td>n/a</td>
<td>Amortized</td>
<td>Amortized, or Semi-amortized with Bullet payment at end</td>
<td>Bullet payment at end</td>
</tr>
<tr>
<td>Secured by</td>
<td>Project</td>
<td>Parent operations</td>
<td>Parent operations</td>
<td>Parent operations</td>
<td>Parent and/or Project</td>
<td>Parent operations</td>
<td>Parent operations</td>
</tr>
<tr>
<td>Covenants</td>
<td>Financial ratio maintenance</td>
<td>Variable</td>
<td>Financial ratio maintenance</td>
<td>Variable</td>
<td>Financial ratio maintenance</td>
<td>Variable</td>
<td>Variable</td>
</tr>
</tbody>
</table>

*Source: Adapted from Wall Street Oasis for applicability to Solar PV*
Development curve & value creation
Different investors require different minimum EIRR based on their risk tolerance.

A low-risk investor is prepared to pay a higher price per MW capacity – *when a project is appropriately de-risked*.

Project developers will seek to get rewarded for their work through a premium sometimes called a developer fee – which can be paid as cash or other methods.
Solar PV has a clear development curve
Value rises as solar PV projects achieve certain milestones

**Development progress**

- Favorable regulatory framework present
- Resource and interconnection considered
- PPA application & permitting process started
- Land identified and assessed
- EPC and equipment assessed
- Discussions with debt providers initiated
- PPA and permits obtained
- Land acquired
- Financial close
- EPC engaged
- Construction within budget
- Project insurance obtained
- COD according to schedule
- Power production and sales meet expectations
Due diligence framework
We use a project due diligence framework with four categories:

- Project
- Management
- Financing
- Regulation
Importance of each category varies by project stage
Preparation stage work is concerned with initial set-up activities …

Key elements of a good preparation stage project

- Solar irradiation assessment – completed
- Pricing e.g. FiT (Feed in Tariff) – confirmed as viable
- PPA application and other regulatory processes/permits\(^{(1)}\) - in progress or completed (varies by country)
- Interconnection plan – developed; and connection confirmed
- Viable land – identified and secured
- EPC and equipment assessment – substantially progressed
- Relationship with government agencies - developed
- Discussions with financial institutions – possibly initiated
- “Sweat equity” – substantially created

What a project investor would bring to the table

- Capital
- Credibility
- Technical capabilities
- Relationships

Note: (1) e.g. construction, operation, Environmental Impact Assessment (EIA) and grid connection
… and DD focuses on project, management, and regulation

### Preparation stage due diligence

<table>
<thead>
<tr>
<th>Importance</th>
<th>Project</th>
<th>Management</th>
<th>Finance</th>
<th>Regulation</th>
</tr>
</thead>
</table>
| **High**   | • Key assessments – solar irradiation, environmental impact  
             • Interconnection plan  
             • Land ownership and structure  
             • Development timeline  
             • Scale of civil work needed | • Past experience  
             • Capabilities consistent with their role  
             • Relationships |                                | • FiT (Feed in Tariff) rate and terms  
             • Application verification  
             • License and permits  
             • Permitting milestones |
| **Medium** |                                |                                            |                                | • Financial model  
             • Any financial agreements |
| **Low**    |                                |                                            |                                |                                |
Implementation stage activities focus on project construction ...

Key elements of a good implementation stage project

- All prerequisites – finalized (mostly early in stage)
  - PPA - obtained
  - Project studies - completed
  - Land - acquired
  - Corporate structures - established
  - Local approvals - obtained
  - EPC and O&M\(^{(1)}\) contracts - negotiated and finalized
  - Project insurance – negotiated and finalized
  - Project debt – negotiated and finalized

- Construction and other implementation - proceeding to plan
- Less open to partnerships; higher developer fee

What a project investor would bring to the table

- Capital
- Credibility
- Technical capabilities
- Exposure to public markets

Note: \((1)\) including minimum availability guarantee
... and all areas of DD are important

**Implementation stage due diligence**

<table>
<thead>
<tr>
<th>Importance</th>
<th>Project</th>
<th>Management</th>
<th>Finance</th>
<th>Regulation</th>
</tr>
</thead>
</table>
| High       | • Equipment cost  
             • Equipment quality  
             • Land cost  
             • EPC service expertise  
             • Development timeline  
             • Ownership structure | • Project team capabilities | • Finance terms and conditions  
             • Shareholder’s Agreements  
             • Developer fee cost  
             • Budget overrun | • FiT (Feed in Tariff) rate and terms (or other pricing structure)  
             • Application verification  
             • License and permits  
             • Permitting milestones  
             • Ability to delay COD |
| Medium     | • Insurance provider | | | |
| Low        | | | | |
Operations stage is all about electricity sales …

Key elements of a good operations stage project
- Power generation – operating at design specifications
- Operating risks – identified, analyzed, and mitigation in place
- All licenses, permits, and titles are in the project company name
- Corporate structures – operating effectively / transparently
- Experienced O&M (operation and maintenance) contractor
- Project insurance - paid on time

What a project investor would bring to the table
- Capital
- Credibility
- Technical capabilities
- Ability to arrange superior finance
- Exposure to public markets
... and DD focuses primarily on the project and regulation

**Operations stage due diligence**

<table>
<thead>
<tr>
<th>Importance</th>
<th>Project</th>
<th>Management</th>
<th>Finance</th>
<th>Regulation</th>
</tr>
</thead>
</table>
| **High**   | ● Performs as claimed  
             ● Operating risks over project lifetime | ● Commitments or obligations | ● Long-term regulatory environment consistent with security required  
             ● Ability to purchase projects | |
| **Medium** | | ● Finance terms and restrictions  
             ● What is taken out and what remains  
             ● Control and consolidation | | |
| **Low**    | | | ● Competitive and efficient O&M services | |
Skills session
### Financial model

**Objectives and use**
- The focus will be on drivers of profitability:
  - Revenue
  - Costs
  - Debt
- While going through the teasers you are encouraged to view them as marketing documents from a project company that is trying to convince you to invest.
- You should test their assumptions and run your own evaluations.
- Input locations are highlighted in yellow.

#### Revenue drivers
<table>
<thead>
<tr>
<th>Description</th>
<th>Investor</th>
<th>Developer</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed in Tariff (in local currency)</td>
<td>5.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed in Tariff (in USD)</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tariff Duration</td>
<td>25 yr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Cost drivers
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (ac)</td>
<td>1.0 MW</td>
</tr>
<tr>
<td>Performance loss</td>
<td></td>
</tr>
<tr>
<td>Inverter</td>
<td>6-15%</td>
</tr>
<tr>
<td>Mismatch</td>
<td>4-15%</td>
</tr>
<tr>
<td>Temperature</td>
<td>3-15%</td>
</tr>
<tr>
<td>DC cable</td>
<td>1-3%</td>
</tr>
<tr>
<td>AC cable</td>
<td>0-3%</td>
</tr>
<tr>
<td>Weak irradiation</td>
<td>3-7%</td>
</tr>
<tr>
<td>Dust, snow, etc.</td>
<td>2-5%</td>
</tr>
<tr>
<td>Combined loss (geometric)</td>
<td>18%</td>
</tr>
<tr>
<td>Installed capacity required (ac)</td>
<td>1.2 MW</td>
</tr>
<tr>
<td>Solar panel output (ac)</td>
<td>330 W</td>
</tr>
<tr>
<td>Average panel size</td>
<td>2.2 m²</td>
</tr>
<tr>
<td>Total solar panel area</td>
<td>8.66 m²</td>
</tr>
<tr>
<td>Average solar panel yield</td>
<td>12-15%</td>
</tr>
<tr>
<td>Panel degradation rate</td>
<td>0.3-0.4%</td>
</tr>
</tbody>
</table>

#### Cost drivers
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital cost per MW dc (in local currency)</td>
<td>53.0 M/MW</td>
</tr>
<tr>
<td>Capital cost per MW dc (in USD)</td>
<td>1.61 $/MW</td>
</tr>
<tr>
<td>Total capital cost in MW dc</td>
<td>2 $M</td>
</tr>
<tr>
<td>Land available to purchase</td>
<td>0 Ha</td>
</tr>
<tr>
<td>Land cost per Ha (in local currency)</td>
<td>0.00 M/Ha</td>
</tr>
<tr>
<td>Land cost per Ha (in USD)</td>
<td>0.00 $/Ha</td>
</tr>
<tr>
<td>Total land cost</td>
<td>0.00 $M</td>
</tr>
<tr>
<td>Any other one-time costs (in local currency)</td>
<td>0.00 $M</td>
</tr>
<tr>
<td>Any other one-time costs (in USD)</td>
<td>0.00 $M</td>
</tr>
<tr>
<td>All in capital costs</td>
<td>1.95 $M</td>
</tr>
<tr>
<td>Operating expenses (CAPEX)</td>
<td>2.00% of CAPEX p.a.</td>
</tr>
</tbody>
</table>

#### Financial results
<table>
<thead>
<tr>
<th>Description</th>
<th>Investor</th>
<th>Developer</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leverage</td>
<td>75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenor</td>
<td>12 yr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td>6.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt service</td>
<td>0.17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investor stake</td>
<td>51%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer fee (in local currency)</td>
<td>2.00 M/MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer fee (in USD)</td>
<td>0.06 $/MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total payment</td>
<td>0.07 $M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Solar PV investment analysis and due diligence exercise

Report to investment committee must contain

1. Investment decision
   - Would you invest in the project at current terms?
   - If not, would you invest at a better price? If so, how much?

2. Investment criteria
   - What are the key characteristics of this project?
   - What do you like? What don't you like?
   - What risks have you identified?

3. Sensitivities
   - What happens if costs are higher than expected?
   - What if debt terms were more/less favorable?

4. Counter-proposal
   - What terms would you go back to the project owner with?

Cost drivers

<table>
<thead>
<tr>
<th>Per MW</th>
<th>Capital cost (M)</th>
<th>Land cost / m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>RMB 7.5 – 8.5</td>
<td>24 - 38</td>
</tr>
<tr>
<td>Japan</td>
<td>JPY 275 – 400</td>
<td>2,300 - 3,700</td>
</tr>
<tr>
<td>Thailand</td>
<td>THB 45 – 55</td>
<td>160 - 250</td>
</tr>
</tbody>
</table>

- 1 MW of solar requires 20,000 m² or 2 Ha.
- Transmission line costs are one time costs

Debt terms range

<table>
<thead>
<tr>
<th></th>
<th>Interest rate</th>
<th>Tenor</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>5.0 – 7.0%</td>
<td>12 – 15 yr</td>
</tr>
<tr>
<td>Japan</td>
<td>3.5 – 5.5%</td>
<td>15 – 17 yr</td>
</tr>
<tr>
<td>Thailand</td>
<td>5.5 – 7.0%</td>
<td>12 – 15 yr</td>
</tr>
</tbody>
</table>

Universal / Reminders

- OPEX: 2% of CAPEX
- Assume that inverters do not need to be replaced
- 75% debt financed
- Inflation: 2%
- Developer fee payments can take place in different forms

Note: Figures are illustrative and intended to be used in this exercise only
Financing solar PV projects
Roles, expectations and exposure vary across the development curve

- **Developers**
  - Risk appetite: High
  - Expect revaluation

- **Project debt**
  - Risk appetite: Low
  - Expect returns

- **Mezzanine Finance**
  - Risk appetite: Medium
  - Expect revaluation

- **Investors**
  - Risk appetite: High
  - Expect revaluation

- **YieldCos**
  - Risk appetite: Low
  - Expect yields
Pulling it all together – a United Photovoltaic case study

1. Convertible Bond Holders
   - China Merchant Group
   - Invesco
   - Zongli Talesun
   - Value Partners
   - Morgan Stanley
   - Others
   - Interest: 5%
   - Maturity: 2016+

2. Framework Agreement (separately)
   - Zhongli Talesun
   - GDSolar
   - NARI
   - Inner Mongolia New Energy Investment of State Grid
   - GCL
   - Goodian Solar
   - 48th Research Institute of China Electric Technology

3. China Merchant Group
   - New Energy Group
   - China Merchants

4. China Development Bank
   - Provided an $1.6B long term loan facility
   - $1.6B financial lease strategic cooperation agreement
   - Used $0.1B from CDB 150MW; 14 year term

5. China Financial Leasing Co. (Sinolease)
   - Provided $0.1B from CDB 150MW; 14 year term

6. Framework Agreement
   - Photovoltaic Green Ecosystem Organization (PGO)

Issues:
- Issue convertible debt
- Issue new equity
- Bank Partnerships
- Asset leasing agreement
- Project level equity
- Framework agreements

Project:
- 572MW Operational
- Deliver 1,000MW by 2015+
- Deliver 2,000MW by 2017
- Deliver 5,000MW by 2018
- Invest/acquire 500MW by 2015

Leverage relationship to recruit long-term loans

Huabei gets 8% fixed return on for 3 yr, then can request UPV to purchase 50% stake with new shares priced at HK$1.6/share or cash.

Acquire projects at 9% project IRR; project developer pledge deposits to guarantee production of 7 to 10 yr, if production falls short, UPV deducts deposits