IPP Solar PV Project Development Roadmap
Bankable Approach!

Dii Toolkit for RE Grid Integration, Project Development & Industry Localization
## Document Change History Record Sheet

<table>
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<th>Rev.</th>
<th>Description Of Change</th>
<th>Effective Date</th>
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<td>PV-Project-Development-Roadmap-fm1700417-R1</td>
<td>R1</td>
<td>Initial Release – Draft For Information</td>
<td>17-Apr-2017</td>
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<td>F2M2</td>
<td>Fadi Maalouf</td>
<td>Director – IPP &amp; EPC</td>
<td>F2M2</td>
<td>18-Jun-2017</td>
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</table>
Outline

- Introduction

- IPP Solar PV Project Development Roadmap
  - 8-Phase Bankable Approach

- Contact
Introduction

The Purpose Of This Presentation Is To Provide A Concise Overview IPP Utility Scale Solar PV Project Development Process, Cradle To Grave.

As Much As Possible, The Roadmap Is Described In Generic Nature, Since The Development Process Is Unique To The Jurisdiction Of Development.

Nonetheless, Major Elements Of The Process Remain Valid For Most Developments.

The Presentation Does Not Address All The Fine Details. However, Key Critical Components Are Highlighted And Discussed.

In a Cross-Border Multi-Stakeholder Development Process, It Is Important to:

- Understand Scope of Work & Compliance Necessities
- Meticulously Plan
- Execute With Monitoring & Control In Place


1 This PPT is the short version. Layout is dense as slides were compacted!
IPP Solar PV Project Development Roadmap
8–Phase Bankable Approach

Phase 1 • Business Development

Phase 2 • Pre-Feasibility Study

Phase 3 • Feasibility Study

Phase 4 • Contracts & Financial Close

Gate 1 • Corp RM Doc 1

Gate 2 • Corp RM Doc 2

Gate 3 • Corp RM Doc 3

Gate 4 • Corp RM Doc 4

Gate 5 • Detailed Design & Permitting

Gate 6 • Procurement & Construction

Gate 7 • Testing & Acceptance

Gate 8 • O&M

Note!
Each Phase Ends with Gate and Corporate Risk Management Process Document Approval

Note!
Phases shown sequentially for generic illustrative purposes. Phases activities may overlap or take place in parallel (Program Compression)

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Phase 1: Business Development

- Project Opportunity Identification & Pre-Screening (Documented Sales Funnel Process, CRM)
- Alignment with Corporate Vision, Mission, & Strategic Business Plan
- Risk Management Compliance Gateway: Initial Assessment
  - Geographical Market Risk Clearance
  - Site Identification, Direct Proposal or PPP or Receipt of RFQ / RFP / ITB
  - Concept Development, Rough Order of Magnitude
  - Corporate Risk Thresholds & Approval Matrix Clearance
  - Go-NoGo Techno-Commercial Review & Assessment Form
    - e.g. site particulars, project structure, regulatory framework & risks, grid access & infrastructure, off-taker due diligence, initial finance plan / benchmark term sheet, competitiveness
  - Go-NoGo & Bid-Win BD Committee Approval for Next Phase: 2
    - Required Resources
    - Required Budget
Phase 2: Pre-Feasibility Study

- Site Visit (Initial Survey) to Identify Key Constraints & Challenges, Land Lease/Access, Including Boundary Areas Concerns
- Conceptual Design & Assessment of Various Technical Solutions, Including grid Connection
- Project Estimated Cost Plan (Development/Capex/Opex/Finance)
- Estimated Energy Yield, PVsyst, P50 Based on Credible Solar Resource Data
- Estimated Energy Tariff based on Incentives/FIT/N.Meter/PPA/Lease/ESCO
- Pre-Feasibility Financial Model Development & Est. IRR, w/ Benchmark Term Sheet
- Initial Sensitivity/Scenario Analysis Model (1D & 2D Tables, +/- up to 30% parameter variances)
- Identification of Initial Environmental and Social Impacts
- Initial Licensing & Permitting Roadmap & Estimated Cost, Success Factors including Estimated Timelines
- Overall Market Review Including Regulatory Changes/Risks
- Identification of Project Stakeholders and Respective Agreement/Contracts Types
- Selection of Project Structure (SPV/etc.) and Shareholders Options (PPP/PE/etc.)
- High Level Project Schedule/Program, with Key Milestones
- Risks & Opportunities Register, with Proposed Mitigation & Realization Measures
- Pre-Feasibility Study & Financial Model BD Committee Approval for Next Phase: 3

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### Phase 2: Pre-Feasibility Study

**Sample Template: Pre-Feasibility Financial Model**
(www.slideshare.net/solaruae)

**Model Inputs & Outputs Summary**

<table>
<thead>
<tr>
<th>PV POWER PLANT PROJECT LCOE</th>
<th>PRE-FEASIBILITY ECONOMIC ANALYSIS - 25 YEARS</th>
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<tr>
<td><strong>INPUTS</strong></td>
<td><strong>OUTPUTS</strong></td>
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<tr>
<td><strong>General</strong></td>
<td><strong>LCOE Component</strong></td>
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<td>Analysis Period (years)</td>
<td><strong>Component $/kWh</strong></td>
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<td>Debt Percentage</td>
<td><strong>Component Percentage</strong></td>
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<td>Equity Percentage</td>
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<td>Debt Interest Rate</td>
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<td>WACC / Nominal Discount Rate</td>
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<td><strong>Finance Structure</strong></td>
<td><strong>Total Overhead CAPEX Cost ($)</strong></td>
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<tr>
<td><strong>Capital Expenditure</strong></td>
<td><strong>O&amp;M Expenditure</strong></td>
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<tr>
<td>Overnight EPC Cost ($)</td>
<td><strong>Fixed Annual O&amp;M ($/kWp/year)</strong></td>
</tr>
<tr>
<td>Overnight Development Cost ($)</td>
<td><strong>O&amp;M Annual Escalation (%)</strong></td>
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<tr>
<td>Total Overhead CAPEX Cost ($)</td>
<td><strong>1.25%</strong></td>
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<tr>
<td><strong>System</strong></td>
<td><strong>Power Plant Installed Size (kWp)</strong></td>
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<td>Estimated Annual Specific Yield (kWh/kWp)</td>
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<tr>
<td>Installed Energy Output (kWh)</td>
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<td>Annual Energy Degradation Year 1 (%/year)</td>
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<tr>
<td>Annual Energy Degradation Year 2 to 25 (%/year)</td>
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<td>Power Plant Annual Availability (%)</td>
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<td>Net Annual Energy Output Year 1 (kWh)</td>
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<td>Residual Value at End of Service Life</td>
<td><strong>12%</strong></td>
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<tr>
<td>Salvage % of EPC at Year 25</td>
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**Sensitivity Analysis 1D & 2D Tables**

**Output Parameters Charts**

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8
Phase 3: Feasibility Study

- Developed the Prefeasibility Study into a Detailed Report. Assign suitably qualified and experienced study team, create responsibility matrix for the team, to include the assigned feasibility study deliverables and their associated timeline/program. Hold weekly progress review meetings.

- Utilize site-specific data for all parameters, including design, financing, and execution.

- Establish a detailed risk register and keep updating with mitigation measures throughout the development of this phase.

- Develop the design including surveys (topo, geotech), site plans, SLDs, schematics, grid connection, grid impact study where necessary, solar resource measurement (preferred 1 yr on site, & 10/20 yr bankable satellite data) & energy yield (P90), initial equipment selections, cost plan, and O&M requirements.

- Create detailed permitting & licensing roadmap and initiate discussions with stakeholders and all AHJ (Authorities Having Jurisdiction) to obtain consents or initials NOCs. Produce requirements matrix, schedule/program, and estimate accurate costs.

- Establish initial ESIA and relevant EHS requirements. Include TIS where necessary. Include applicable requirements of financing institutions (e.g., Equator Principles, etc.).

- Produce detailed financial model and scenario/sensitivity analysis which cover all variables thresholds and obtain commitment from respective stakeholders.

- The detailed financial model shall cover: IRR, LCOE, CAPEX, OPEX, D/E gearing ratio, CFADS, DSRA, MRA, DSCR, LLCR, PLCR, EBL, WC, SBWC, PPA/Tariffs, ECA, incentives if any, senior debt sources/model & rates (Fixed, Libor + Margin, Mini Perm, Int. Swap) etc.

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Phase 3: Feasibility Study

- Finalize and Obtain Initial Consent for All Access Requirements (land, roads, LUP, ROW, community, etc.)
- Finalize Level 2 or 3 Project Program and Obtain Stakeholders Buy In.
- Determine the Project Company (SPV) Legal, Tax, Insurance, Accounting/Reporting Requirements, including setup and operation costs. Details must include offshore/onshore setup requirements/plan w/ respective banks accounts, etc.
- Finalize the finance plan with equity and shareholders contribution, debt sources and obtains committed pricing levels.
- Keep the Financial Model Updated as details gets secured. Procure an External Financial Advisor, if necessary, to lead the discussion with shortlisted funding institutions, term sheets, as well as further optimized financial engineering. Update the Financing Plan with Financing Institutions Offers & Commitments.
- Identify all Types of Warranties and Guarantees Which are Necessary for Bankable Project (non-recourse, or limited Recourse). Validate and Obtain Stakeholders Buy and Commitments. These may include EPCs, Major Equipment Vendors, ECA, MLIA, MIGA Offtaker, Local State / Government, etc. Incorporate These in to Contracts.
- Procure the Owners Technical Advisor (OE) and Legal Advisors, to support the process of Contracts Drafting, Tendering, Implementation & Acceptance (ITB, MFS, EPC, O&M, PPA, LLA, SHA, SPV, etc.)
- Execute Corporate Risk Management Docs & Obtain Corporate Approval For the Feasibility Study to Conclude that Project is Feasible & Economically Viable.
Phase 4: Contracts & Financial Close

Contracts Success Factors

- Expertise & Know-How
- Good Communication
- Negotiation
- Risk Management
- Competitiveness

- SPV
- SHA
- Land Lease
- Grid Connect
- PPA
- ECA
- MIGA
- Gov. Credit Support
- EBL
- Insurance
- Hedging
- Sr Debt Lender(s)
- O&M
- EPC
- OE/IE
- Fin. Advisor
- Legal Advisor

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# Phase 4: Contracts & Financial Close

Key Consideration For SPV Contracts (Shortlist)
Head of Terms Waterfall, Term Details Matter!

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<tr>
<th>EPC</th>
<th>O&amp;M</th>
<th>PPA</th>
<th>Lender(s) Sr. Debt Fin.</th>
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<td>Scope Of Work</td>
<td>Scope Of Work</td>
<td>Term &amp; Phases</td>
<td>MLA &amp; Senior Lenders</td>
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<td>Price Basis</td>
<td>Price Basis</td>
<td>Development Security</td>
<td>Approved Banks</td>
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<td>Warranties</td>
<td>Warranties</td>
<td>Conditions Precedent to Closing</td>
<td>Term Facilities, Incl. Standby</td>
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<tr>
<td>LNTP &amp; NTP</td>
<td>LNTP &amp; NTP</td>
<td>Documents Delivered After Closing</td>
<td>Equity Contributions &amp; Retention</td>
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<tr>
<td>Soil &amp; Ground Risk</td>
<td>Soil &amp; Ground Risk</td>
<td>Min. Functional Specifications</td>
<td>Equity Bridge Loan</td>
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<tr>
<td>Guaranteed PR, Pdc, Pac</td>
<td>Guaranteed PR</td>
<td>Testing &amp; Acceptance</td>
<td>Facilities Ranking, Facilities Availability</td>
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<td>Bonds</td>
<td>Bonds</td>
<td>Metering</td>
<td>Interest, Periods, Repayment Profile</td>
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<td>Risk Allocation</td>
<td>Risk Allocation</td>
<td>Billing &amp; Payment</td>
<td>Refinancing, If applicable</td>
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<tr>
<td>Testing, Acceptance &amp; Handover</td>
<td>Performance Appraisal</td>
<td>Sale &amp; Purchase Obligations</td>
<td>Margin, Commitment, Upfront Fees</td>
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<td>Contract &amp; Payments Milestones</td>
<td>Payment Plan &amp; Milestones</td>
<td>Localization</td>
<td>Min DSCR @ P50 @ P90</td>
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<td>Order Of Precedence</td>
<td>Order Of Precedence</td>
<td>Interconnection Conditions</td>
<td>DSCR for Div. Pay / DSCR For Default</td>
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<td>Interfaces</td>
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**Continued**
### Phase 4: Contracts & Financial Close

**Key Consideration For SPV Contracts (Shortlist)**

**Head of Terms Waterfall, Term Details Matter!**

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<td>Offtaker Credit Guarantee / Support</td>
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<td>Insurance</td>
<td>PCOD &amp; Completion</td>
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<td>CTA</td>
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<td>Default</td>
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<td>Arbitration &amp; Place</td>
<td>Arbitration &amp; Place</td>
<td>Conditions Precedent For Drawdown</td>
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<td>Governing Law &amp; Jurisdiction</td>
<td>Governing Law &amp; Jurisdiction</td>
<td>Governing Law &amp; Jurisdiction</td>
<td>Governing Law &amp; Jurisdiction</td>
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</table>
Phase 4: Contracts & Financial Close

- Finalize Detailed Project Implementation Program.
- Continue to Keep Accurate Track of All Development Expenses (direct, indirect, incl. man-hours).
- These are Reportable & Chargeable to SPV (subject to Audit & by LTA).
- Prepare Detailed Sub-Program for Contracting Approach.
- Determine Cross-Contracts Dependencies, Critical Path, & Respective Conditions Precedent for Execution.
- Prepare Docs Register & Docs Packages & Submit to AHJ to Obtain Initial Preliminary Permits, such as Planning, LUP, Access, TIS, LLA, ESIA, Grid Connection, Generation & Operator Licenses, Construction. Allow Ample Time for the Processes.
- Final Permits such as Final Construction will be Obtained in the Next Phase upon completion of Detailed Design.
- Amend Design Based on AHJ Comments or Conditional Approval, as well as Other Stakeholders Requirements (Development Banks or Other Financing Institutions).
Phase 4: Contracts & Financial Close

- Prepare & Execute ITB for EPC & O&M. Rank, Negotiate & Select Shortlisted Preferred Bidder(s).
- ITB is Preceded by Stringent Prequalification Process.
- EPC & O&M shall be fixed Price Turnkey Contracts “Fully Wrapped”.
- The Model shall be Audited by Approved 3rd Party Independent Specialist.
- Prepare & Execute OE/IE Contract. Prepare & Coordinate with LTA and LLA.
Phase 4: Contracts & Financial Close

- Prepare & Negotiate Grid Connection Agreement and PPA Agreement.
- Finalize Project Risk Register. Risk are Categorized (Technical, Commercial, Financial, Legal, Execution), Qualified, Quantified, Mitigated, Weighted, & Assigned Owners.
- Negotiate Markups/Comments/Deviations, & Complete All Contracts Negotiations.
- Make Sure All Contracts are Acceptable to and Signed Off by Financing Institution(s).
- Head of Term & Other Details like Equipment Selection (3-5 options shortlisted) & Warranties must be Bankable & inline w/ Financing Institutions Acceptable Thresholds & Guidelines (Reputed Manufacturer, Long Term Financial Stability Forecast, Proven Excellent Track Record, Certified Products, Local Regulatory Compliant (AVL), Class A & No Vague Warranty Terms incl. Performance, 3rd Part Insurance Coverage, Eff./Tech Performance Inline w/ Highest Tier, Suitable for Project Environmental Conditions, Serviceability, MTBF, etc.)
- Prepare & Execute Insurance Program Contracts (Limited Notice to Proceed – LNTP)
- Execute EPC & O&M Contracts (LNTP subject to Financial Close).
Phase 4: Contracts & Financial Close

- Execute Grid Connection Agreement and PPA (LNTP subject to Financial Close).
- Prepare Shareholders’ POAs & RBDs (notarized/legalized) & Execute SHA & Incorporate SPV as a Legal Entity.
- All Projects Agreements & Contracts shall be in Name of SPV.
- Ensure SPV’s operations are setup as well: Office Lease and Fitout Contracts, HR, IT & Cloud Services, Accounting & Finance, Banking, Business Insurances PI/D&O/PPL/WC/EAR/CAR, Healthcare Insurance, QMS & PMO Processes & Procedures.
- Negotiate & Finalize Lenders’ & Fin. Services Contracts (Senior Debt, Equity Bridge Loan, Hedging, Swaps, Guarantees, Upfront / Closing Fees, Annual Fees, etc.). Execute Contracts & Term Sheets.
- Upon Achieving Financial Close, Update Corporate Risk Management Docs with Finalized and/or Amended Terms of the Feasibility Study Approval.
- Obtain Corporate Approval For the Issuing NTPs (Notice to Proceed) for All Contracts.
Phase 5: Detailed Design & Permitting

- SPV Issues NTPs (Notice to Proceed) for All Contracts.
- SPV’s Vital KPI is Maintaining a Solid Contract & Claims Management Team Throughout the Development Phases.
- EPC to Produce a Comprehensive Project Execution Plan (PEP) & Sub-Plans.
- The First Focus is Org Chart (Back Office & Site), Document Control System, Baseline Program & Cashflow.
- EPC to Produce Design Management Plan incl. WBS for DPPS (Design Permitting Procurement Schedule).
- DPPS Shall List all DD Docs w/ Respective Production Timeline linked to Packages Submission to AHJ as well as to Procurement Initiation.
- EPC to Incorporate Adequate Review Cycles for Relevant Stakeholders.
Phase 5: Detailed Design & Permitting

<table>
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<tr>
<th>Work Package Description</th>
<th>Permit Description</th>
<th>Group</th>
<th>Area</th>
<th>Package Manager</th>
<th>EX/ Designer</th>
<th>Permit Coordinator</th>
<th>QM</th>
<th>Ext Designer</th>
<th>Authority Having Jurisdiction</th>
<th>Planned</th>
<th>Actual / Forecast</th>
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</table>

### DESIGN
- 30% (Stage C/D) Design Complete
- 60% (Stage E) Design Complete
- 90% (Stage F1) Design Complete
- IFC (Stage F2) Design Complete
- Package Design Available
- Scope Review / Prepare BoQ (weeks)
- Package Design available for Permitting & OE/IE/LTA Submission
- Prepare Permit Package (weeks)
- Issue Design for Permit Package to OE/IE/LTA
- Cycle 1 (weeks) OE/IE/LTA
- Permit Package Incorp. Comments & Re-Submit & Receive Approval

### PERMITTING
- Prepare Tender Package (weeks)
- HOLD For Permit Approval YES/NO DESIGN STAGE
- Issue Tender
- Tender Period (weeks)

### PROCUREMENT
- Submit Design Permit Package to AJJ
- Cycle 1 (Weeks) AHJ
- Permit Package Incorp. Comments Re-Submit to AHJ
- AHJ Permit Approval & Issuance
- Prepare Tender Package (weeks)
- Issue Permit for Permit Package to OE/IE/LTA
- Cycle 1 (weeks) OE/IE/LTA
- Permit Package Incorp. Comments & Re-Submit & Receive Approval

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Phase 5: Detailed Design & Permitting

- Ensure that EPC’s Design Management Plan (DMP) Its Document Register (Deliverables Schedule) are Updated with Previous Development Phases Approved Comments / Changes & is Regulatory Compliant. Expert Understanding of Local Code Compliance incl. Sustainability is an Extremely Critical KPI for Project Success & Bankability. DMP Must be Submitted for Approval by OE/IE/LTA


- Thorough Understanding of Design Deliverables SOW is a vital KPI. EPC Shall Deliver a Complete Design Production Schedule (Document Register), w/ Proper Monitoring & Tracking Controls. A Typical Design Deliverables Document Register as Follows:

<table>
<thead>
<tr>
<th>DISCIPLINE: XXXXXXXXX</th>
<th>DESIGN PHASE: XXXXXXX</th>
<th>Planned Issue Date</th>
<th>Current % of Completion</th>
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<tbody>
<tr>
<td>S/N</td>
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<td>Schedules:</td>
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<td>Calculation:</td>
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<td>Studies/Reports:</td>
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<tr>
<td>Specifications:</td>
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Continues……
Phase 5: Detailed Design & Permitting
Key Considerations for Bankable Design (Shortlist)

- Competitive LCOE vs. Optimized Design
- Balance CAPEX/OPEX vs. Value Eng’g
- Quality Assured vs. Scope/Schedule/Cost
- CAD Format is Compliant w/ Local Codes
- Site Solar Resource is Measured 1 Yr (hourly)
- Solar Resource Checked vs Satellite 20 Yr
- Satellite Solar Resource is Credible DB, P50/90
- PV Field Layout Optimized (tilt/orientation)
- PV Field Layout Meets O&M & FLS Reqmnt
- PV Field Shading Loss (row/nearby) <1.5%
- PV Soiling Loss Calc’d Based on Site Cond. & Adopted Cleaning Plan
- PV Eff, Deg<0.6% TR., LID, PID, +Tol, FT, ELT, IECs, ISO 2859-1, BOM, CDF, All Validated
- PVsyst Uses Validated met/pan/ond Files
- All Auxiliary Power Consumption Calc’d & Accounted For in PVsyst Energy Yield Est
- Comply w/ IEC 62548 PV Design
- Requirements
- Topo & Geotech Studies Results Adhered To
- Civil/Structural Design & Materials Suitable for Site Soil & Environmental Conditions (Corrosion, Seismic, Wind, etc), PE Stamped
- Drainage & Flooding Prevention is Included, Based on Site Environmental Conditions
- Electrical Studies PSS/E (GIS, LF, VD, SC, HR, CR, TRNS) & Eqpt Rated Accordingly
- HAZOP Study per IEC 61882, if Required

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Phase 5: Detailed Design & Permitting
Key Considerations for Bankable Design (Shortlist)

- Electrical Protection Measures Correct & are In Line w/ Int'l Standards & Local Code
- Grounding/Earthing/Lightning Protection is Correct for the Site Conditions
- PV String Voltage vs. Min/Max Temp vs. Inverter Thresholds Voc/Vp is Adequate
- Total Cables Loss DC, AC Calc < 1.5% & 1.0 %
- Inverter Sizing is Correct (MPPT Window, Power Ratio, PF Range, A.Temp, Eff, etc.), IECs Comp.
- XFMR & S/G Selection/Sizing/Protection Correct
- Cables Management & Trenches Code Compl.
- MV/HV Net & S/S Comply w/ Trans/Dist Code
- All Eqpt Interfaces I&C/Comm/Alarms are Incl. & Correct, Detailed Interface Matrix is Validated
- Security Sys. CCTV, Acc Con, Intrusion, Fence, Lighting , Adequate for Risks & Insurance
- Tariff Grade Metering System is Compliant
- SCADA System is Included per Industry Stds.
- SCADA Grid Interface is Thoroughly Engineered for Local Code Compliance
- Weather Station(s) Instruments Classes Correct.
- Equipment IP Validated for Site Conditions
- All Equipment Selection Meets Restricted / Approved Vendor List (by AHJ)
- Overall Design and All Equipment Meet Set Min Func/Perf Specs (MFS/MPS), Warranties, Long Term Servicing & Spare Parts Availability.
Phase 5: Detailed Design & Permitting

- Ensure that EPC’s Permitting Plan and Its Schedule are Updated with Previous Development Phases Approved Comments/Changes & is Regulatory Compliant.
- Expert Understanding of Permitting Process is an Extremely Critical KPI for Project Success & Bankability.
- A Permitting Flow Chart is a Also Mandatory Deliverable to Demonstrate Interfaces & Sequencing.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of Permit</th>
<th>Authority (AHJ)</th>
<th>Permit Owner</th>
<th>Information Required for Application</th>
<th>Predecessor</th>
<th>Successor</th>
<th>Durations (Weeks)</th>
<th>Start Planned</th>
<th>Finish Planned</th>
<th>Permit Status</th>
</tr>
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<tbody>
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</table>
Phase 5: Detailed Design & Permitting

Execute the Permitting Plan. The Permits are in 3 Groups: NOC/Planning, Pre-Construction, Construction & Commissioning. The typical permits are (obtained during project phases):

- SPV Incorporation Licenses
- SPV Generation License
- Equipment Import Permit
- Land/Plot Affection Plan
- Land Lease Agreement
- Land Use Permit (UPC)
- Various Appointment Letters
- Various NOCs from AHJs
- Environmental Permit (ESIA)
- Traffic Control Permit (TIS)
- EHS Permit (SSEHSP)
- Mobilization Permit
- Grading Permit
- Excavation/Shoring Permit
- PV Structural Design Permit
- Building ARC Design Permit
- Building STR Design Permit
- Building MEP Design Permit
- Building/Construction Permit
- LV Design Permit
- LV Shop Dwg Permit
- MV/HV Design Permit
- MV/HV Shop Dwg Permit
- Substation ARC Design Permit
- Substation STR Design Permit
- Substation MEP Design Permit
- Grid/SCADA Interface Design Permit
- U/G Cable / OHL Route Permit
- Fire/Life/Safety Design Permit
- Fire/Life/Safety Shop Dwg Permit
- ICT Design Permit
- Security Systems Design Permit
- Infra/Road Design Permit
- Drainage Design Permit
- Water Conn. Design Permit
- Sewerage Design Permit
- Various AHJs Inspections App.
- Building Completion Permit
- HV/MV Energization Permit
- LV Energization Permit
- Others, etc.
Phase 6: Procurement & Construction

- EPC Shall Produce Project Procurement & Subcontracting Plan (PPSP) Which Must be Submitted for Approval by OE/IE/LTA, It Includes Responsibilities Matrix, Vendor/Subcon Prequal Process, Vendor/Subcon EHS & QA/QC & Closeout Requirements. Design Permitting Procurement Schedule (DPPS) is also an Integral Part of PPP.

- The PPSP Shall cover Procurement from Cradle to Grave:

<table>
<thead>
<tr>
<th>PERMITTING</th>
<th>PROCUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submit Design Permit Package to AJJ</td>
<td>HOLD For Permit Approval YES/NO *************** DESIGN STAGE</td>
</tr>
<tr>
<td>Cycle 1 (Weeks) AHJ</td>
<td>Prepare Tender Package (weeks)</td>
</tr>
<tr>
<td>Permit Package Incorp. Comments Re-Submit to AHJ</td>
<td>AHJ Permit Approval &amp; Issuance</td>
</tr>
<tr>
<td></td>
<td>Prepare Tender Package (weeks)</td>
</tr>
<tr>
<td></td>
<td>Tender Period (weeks)</td>
</tr>
<tr>
<td></td>
<td>Issue Tender To PQ Vendors &amp; Subcons</td>
</tr>
<tr>
<td></td>
<td>Tender Period (weeks)</td>
</tr>
</tbody>
</table>

PROCUREMENT

- Tender Return Technical Eval (weeks)
- Technical Eval Completed (weeks)
- Commercial Eval Completed (weeks)
- Final Negotiation (weeks)
- Submit Recomm. to Award (RTA)
- RTA Approval (weeks)
- RTA Approved
- Finalize Subcon (weeks)
- Award Subcon
- Material Submittal (weeks)
- MS Approval
- Lead Period (weeks)
- Commence on Site

Procurement Phase Continues.....
Phase 6: Procurement & Construction

PPP Includes Logistics Tracker Schedule Which Integrates the 5-Level Commissioning Requirements:

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Log Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBS ID</td>
<td>Package Name</td>
</tr>
</tbody>
</table>

Dii Toolkit for RE Grid Integration, Project Development & Industry Localization
Phase 6: Procurement & Construction

- EPC Shall Produce Project Execution Plan (PEP) Which Includes Construction Execution Management (CEMP) & Shall be Submitted for Approval by OE/IE/LTA.
- EPC’s CEMP Shall be Validated to Comply with Finance Contracts, PPA, Insurance, Land Lease, & Applicable AHJs Standards.
- During Construction, EPC to Continuously Report to & Undertake Inspections by OE/IE/LTA.
- Various Elements of CEMP will Require AHJs Approvals (Permits & Inspections).
- EPC’s CEMP shall Include the Following:
  - Responsibilities Matrix
  - Interface Matrix
  - Updated Program Level 4 or 5
  - Detailed Lookahead Subprogram 4/8 Weeks
  - Project Communication & Reporting Plan
  - Risk Plan w/ Updated Risk Register
  - Mobilization & Site Logistics Plan
  - Construction Waste Management Plan
  - Site Specific EHS Plan, Safety First
  - Project Quality Plan
  - Project Commissioning Plan
  - Project Close Out Plan
Phase 7: Testing & Acceptance

- Early on Post NTP, EPC Shall Produce Project Testing & Commissioning Plan (PTCP) Which Shall be Submitted for Approval by OE/IE/LTA/AHJ. Ensure Plan is Compliant w/ Contracts (EPC, PPA, Grid Connection, Sr. Debt Finance, etc.).

- The Testing & Acceptance Approach Shall Follow 5-Level Std Approach.

- Level 1 (Factory Acceptance Test / 3rd Party Inspection) & 2 are Integrated w/ Procurement. Level 3 & 4 (Site Acceptance Test) are Integrated w/ Construction. 90 Days Prior IST (Integrated Systems Test), EPC Shall Produce Final Plan.
Phase 7: Testing & Acceptance

- Prior to IST, Closeout Activities Shall be Completed (Training, As-Built, Snag/Punch List, O&M Manuals, S. Parts, Project Dossier)
- The Guaranteed Performance Ratio PRg & Plant Annual Availability Ag shall be Repeated During 2 Yrs EPC Warranty (DLP) at End of Yr1 & Yr2 (EPC undertakes First 2 Yrs of O&M).
- EPC Contract Completion Acceptance Milestones are:
# Phase 7: Testing & Acceptance

Key Considerations for 5-Level Testing & Acceptance (Shortlist)

## General
- EPC to Produce Detailed Testing, Commissioning, & Acceptance Program
- EPC to Ensure Compliance of Giving Timely Advance Notices to OE/IE/LTA/AHJ for Witnessing Inspections & Tests (all levels)

## Level 1
- Witnessed FAT/TPI for PV Modules Flash Test, EL Test, BOM & CDF, Batch Acceptance Sampling per ISO 2859-1 Level S-4
- TPI for PV Mounting Structure Mill Certificates & Protection Coating Gauge
- Witnessed FAT for Inverters, Transformers, Reactors, Switchgears, Gen-sets, UPSs, Chillers
- Witnessed FAT for MV/HV Cables
- Routine Test Report for Type Approved Certified Materials & Check Validity of Certificates
- TPI Calibration Certificates (e.g. Energy Meters & Meteo Sensors)

## Level 2
- Detailed Material Receipt & Inspection Report (MRIR) for All Materials, No Exceptions
- Regular Inspections for Laydown & Storage Areas, Validate Compliance w/ Eqpt Manufacturers’ Requirements

## Level 3
- Implement Inspection & Test Plan (ITP), covering all Systems Packages
- All Site Testing Instruments/Meters w/ Valid Calibration Certificates
- ITP to Comply w/ IEC 60364-6, LV Electrical Installations – Part 6: Verification
- HV/MV Equipment Tests per IEC
- Pac & Pdc Installed Capacity Validation

## Level 4
- Start up Tests per IEC 62446 & 60346
- SAT w/ Pre-Approved Protocols for All Systems (Inverter, Transformer, Reactors, Switchgear, UPS, Gen-sets, Grid Emulation, SCADA & Grid Interfaces, FLS, HVAC, Security, Met Stn)

## Level 5
- 100% Plant Availability (Ag) / Reliability Run, 3 Days
- Integrated Systems Test in Line w/ IPP Code (e.g Voltage / Frequency / PF / Reactive Power Thresholds Compliance Tests, etc.)
- PRg Test IEC 61724, Weather Corrected, 10 Days
Phase 8: O&M

- Prior to PCOD, SPV Shall be Fully Staffed & Operational.
- At Start of Level 4 Commissioning, Limited NTP is Issued for Turnkey O&M Contract.
- It Is Crucial to Integrate O&M Early On Prior to Project Commercial Operation Date (PCOD). This Ensures Training & Familiarization of Systems During Commissioning & Testing Phase.
- Provisional Completion (PCOD) Triggers Full NTP for O&M Contract.
- O&M Contractor Prepares Comprehensive O&M Plan for the Approval of OE/IE/LTA. It Covers:
  - Org Chart
  - Roles & Responsibilities & Interfaces
  - O&M Concept & Operations Approach
  - Working Hours & Shifts Approach
  - Preventive Maintenance
  - Corrective Maintenance
  - Maint. Tasks Freq. & Response Times
  - Spare Parts & Consumables Mgmt
  - Tools & Machinery Approach
  - Warranties & Claims Mgmt
  - PV Cleaning Method Statement
  - Performance Monitoring, Analysis, & Optimization
  - Performance Guarantees & Tests
  - Communications & Reporting
  - Site Specific EHS Plan
  - QA/QC Approach
  - Processes & Procedures
  - Procurement/Subcons/SLAs Approach
  - Regulatory Compliance
  - Training

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Phase 8: O&M

- It is common practice that EPC undertakes O&M during 2 yrs Defect Liability Period (DLP).

- Prior to DLP expiry & EPC final completion, EPC’s O&M contract can be negotiated & extended for another term.

- Term can be:
  - Extended for 3-5 yrs, renewable.
  - Or competitively tendered.

- If new O&M is awarded,
  - Extreme due diligence shall be executed.
  - Ensure smooth & well planned technical & contractual handover between parties.

- At plant end of life (20/25 yrs), SPV decommissions the plant (N.B. recycling).

- SPV restores the site, as per its obligation under PPA and land lease agreement.

- Then, SPV liquidates as per its SHA.
Contact:
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Director IPP & EPC
www.dii-desertenergy.org