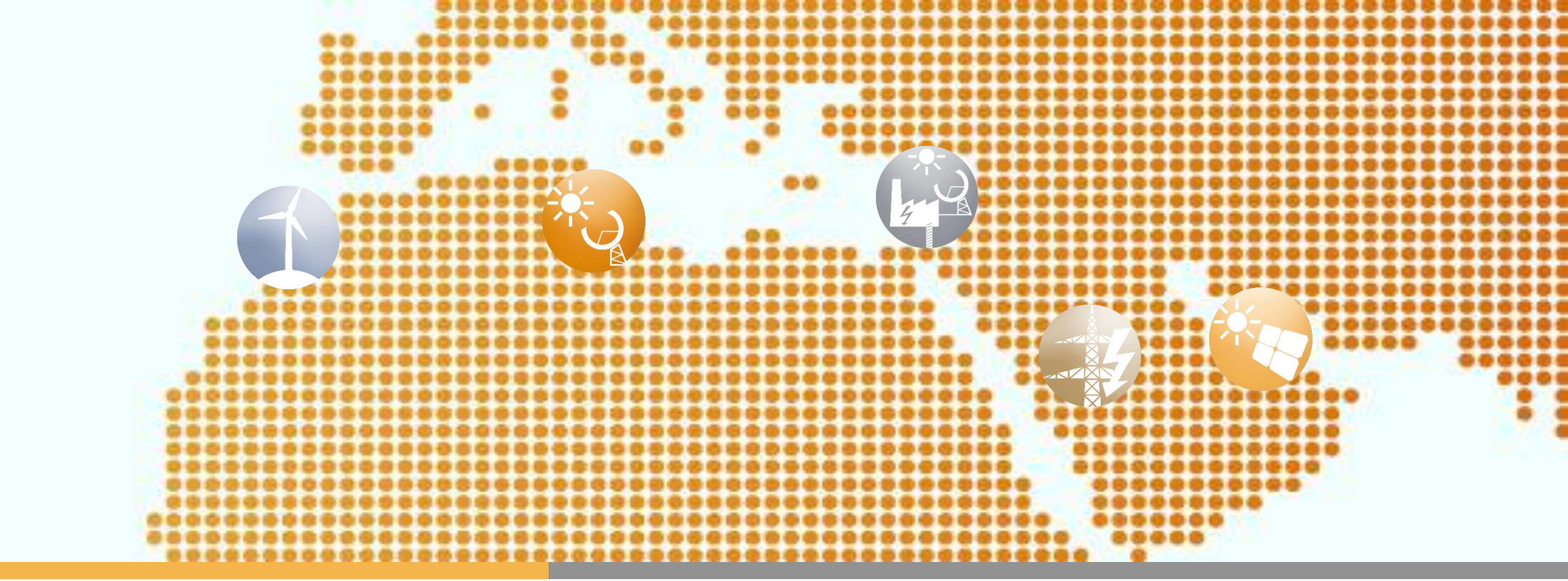


Dii Toolkit Initiative

Summary Slides for Dii Content

Dii Desert Energy

Dii Toolkit for RE Grid Integration, Project Development & Industry Localization

Fadi Maalouf

26th Feb 2019

Document History

DOCUMENT CHANGE HISTORY RECORD SHEET			
Document Title / Number	**Rev.**	**Description Of Change**	**Effective Date**
Dii Toolkit Initiative Dii-Toolkit-Initiative-Summary-Slides-Dii-Content-fm190211-R1	R1	Initial Release – For Information	11-Feb-2019
Dii Toolkit Initiative Dii-Toolkit-Initiative-Summary-Slides-Dii-Content-fm190226-R2	R2	Updated – For Information	26-Feb-2019

Category	**Name**	**Designation**	**Signature**	**Date**
Author	Fadi Maalouf	CTO - Director IPP & EPC	F2M2	26-Feb-2019

Outline

- Introduction
- Dii Content (shortlist)
  1. SunBurn Test™
  2. IPP Solar PV Project Development Roadmap, 8-Phase Bankable Approach!
  3. Project Finance Management Plan for Utility Scale Solar PV Power Plants
  4. Strategic Business Plan for IPP / EPC Renewable Energy Company
  5. Pre-Feasibility Study Solar PV LCOE Financial Model
  6. Joint Study for Integrating Renewables in GCCIA Gird
  7. Dii Toolkit Initiative - New 2019 Report: Technology and Trends for RE Industry.
  8. Coming Soon! Pre-Feasibility Study - Utility Scale Battery Energy Storage Systems (BESS) LCOS Financial Model
  9. Coming Soon! SunBurn Test™: PART 2
- Dii Contact

Introduction
Dii Objectives

Desertec Industrial Initiative (Dii)

was launched in 2009 as a 'not-for-profit' entity in Germany for exploring the potential of renewables in the desert areas of Northern Africa and the Middle East, improving market conditions and examining the synergies to be captured through connecting the European and MENA power markets.

Dii Vision

Increased competitiveness of renewables shall swiftly lead to economic growth and secure near 100% renewable based power supply without emission or waste.

Our Mission: No Emissions!

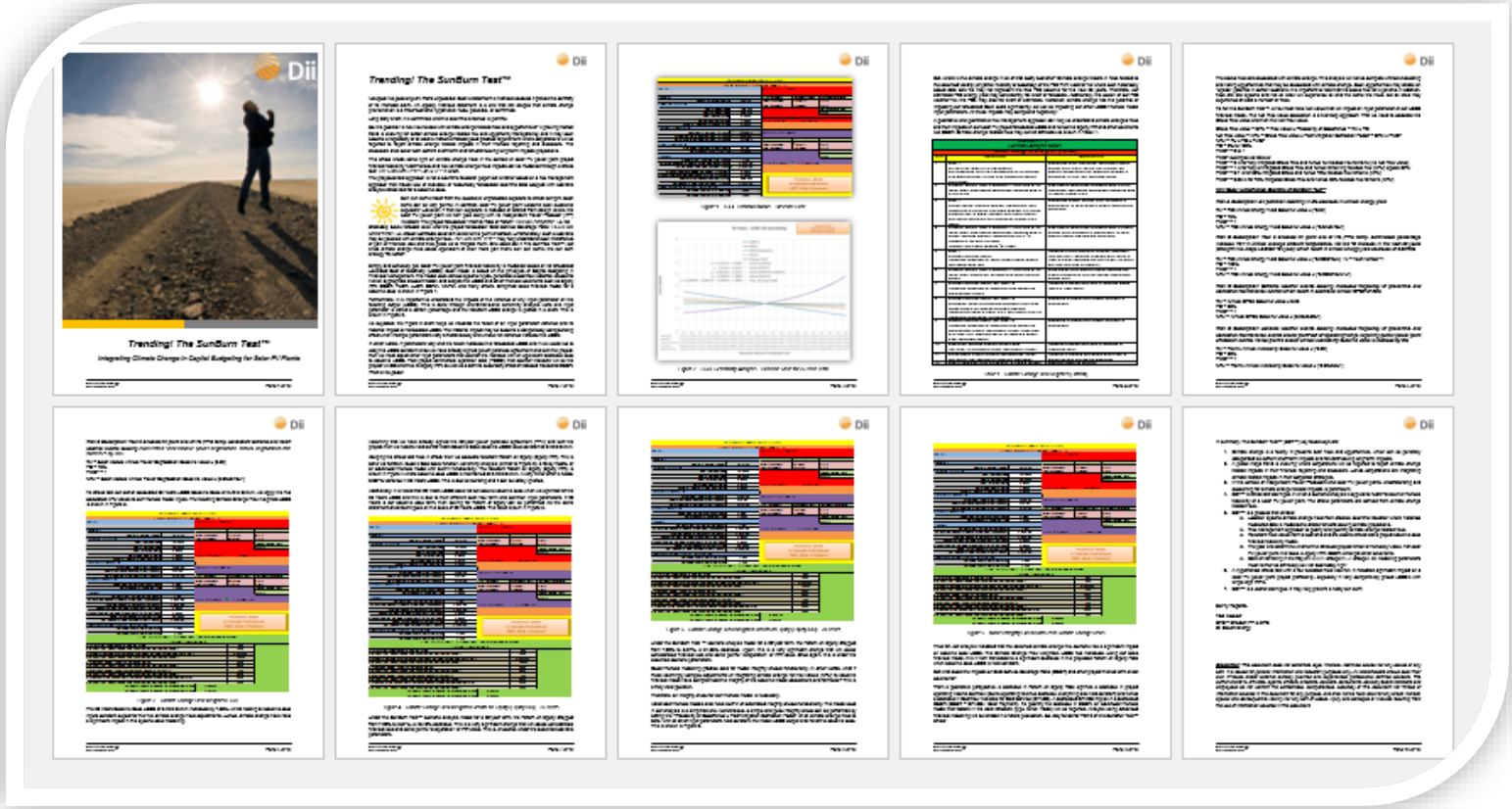
Towards a fully emission free power supply in MENA, Encourage and support the deployment of utility-scale renewable energy projects and integrating them in the expanding interconnected power systems for greater local and regional benefits.

Dii Strategy

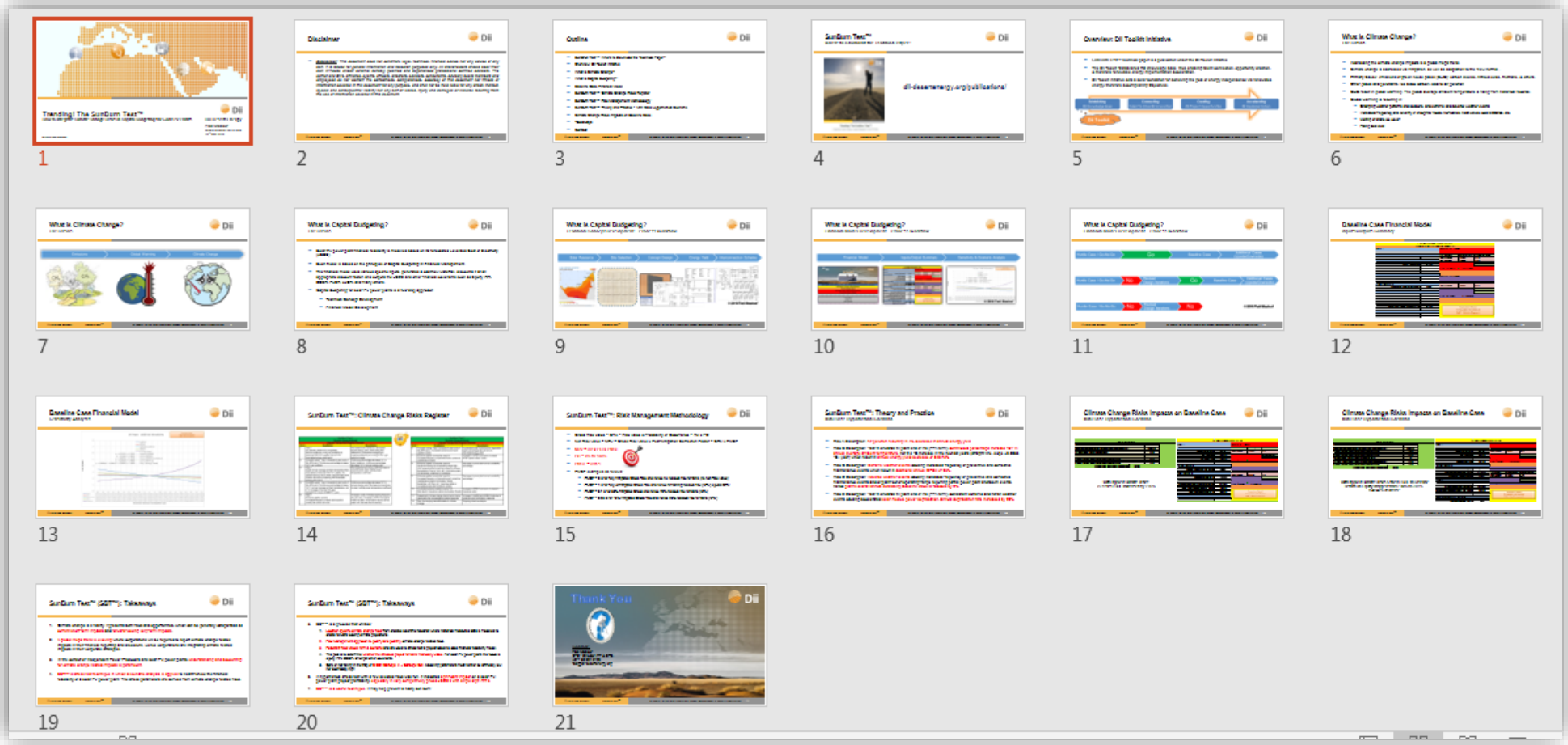
Connecting the international industry active in the MENA region with authorities and institutions. Focus on practical country specific issues of renewable energy projects and grid integration in the region and interconnections across countries leading to tangible and profitable projects and other benefits to the market.

SunBurn Test™
Technical Paper

Trending! SunBurn Test™



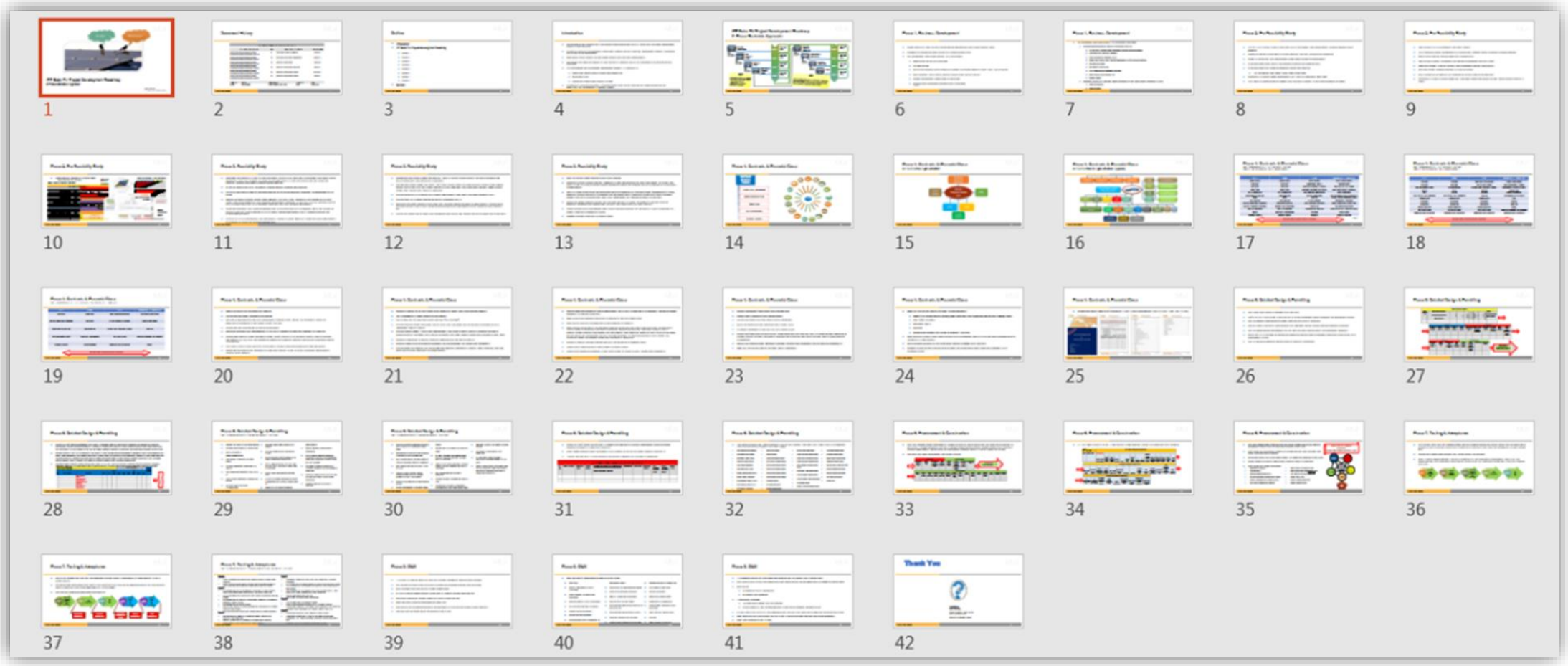
SunBurn Test™
Briefing Presentation



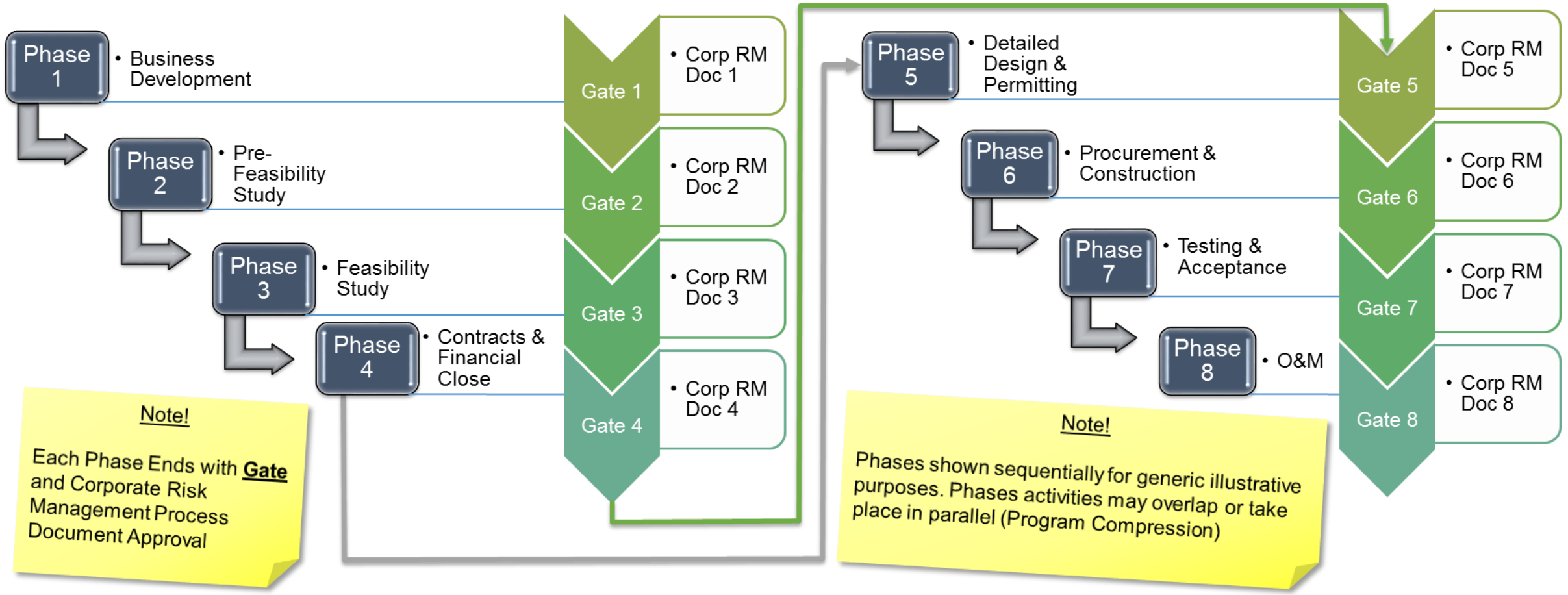
SunBurn Test™

- The objective of this document is to address climate change risk and their impacts on solar power plants. It describes the basics of climate change and the basics of capital budgeting, as well as workflow process charts for both.
- A baseline case financial model for solar PV plant is presented. Then, climate change risks related to solar PV plants is presented in a risk register form.
- Thereafter, a risk methodology is described which enables the qualitative and quantitative application of climate change risks to baseline case financial model:
  - Gross Risk Value = GRV = Risk Value x Probability of Occurrence = RV x PO
  - Net Risk Value = NRV = Gross Risk Value x Post-Mitigation Correction Factor = GRV x PMCF
  - NRV = RV x PO x PMCF
  - PO = 0% to 100%
  - PMCF = 0 to 1
- A mini hypothetical case is presented to show the risk methodology and risks impact on baseline case solar PV plant financial model.
- The studied impacts included Levelized Cost of Electricity (LCOE) and Internal Rate of Return (IRR). Finally, the key takeaways of the SunBurn Test™ technical paper are summarized

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



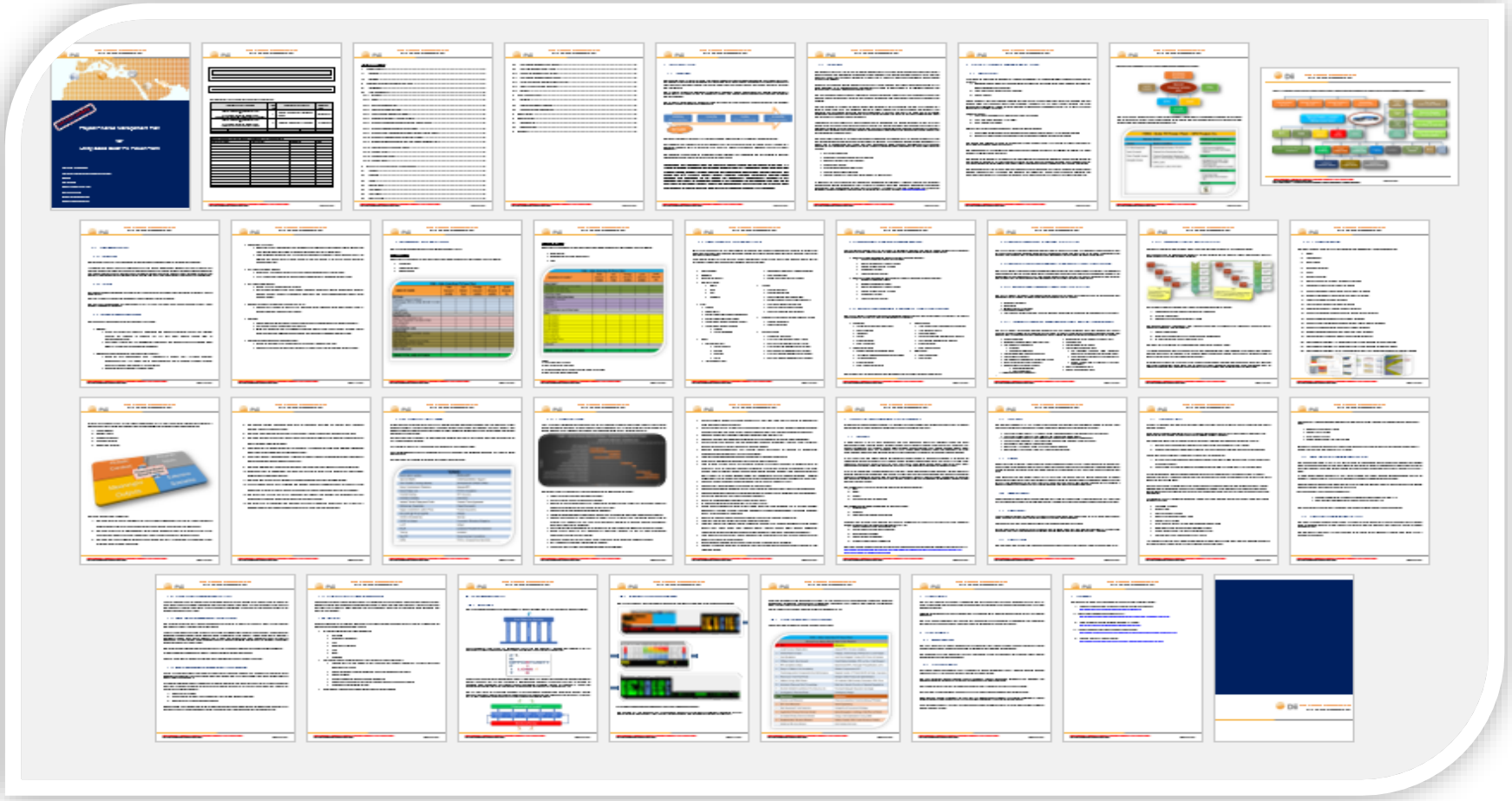
IPP Solar PV Project Development Roadmap
8-Phase Bankable Approach!



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

- The purpose of this presentation is to provide a concise overview IPP utility scale solar PV project development process, cradle to grave.
- 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.
- All key critical components are highlighted and discussed via a holistic 8-Phase Approach.
- Each phase is well detailed with a step-by-step process workflow.
- Where applicable, reference standards are listed.
- Charts, graphs and all-inclusive templates are included.
- A companion fundamental sub-document is also included
  - Project Finance Management Plan for Utility Scale Solar PV Power Plant

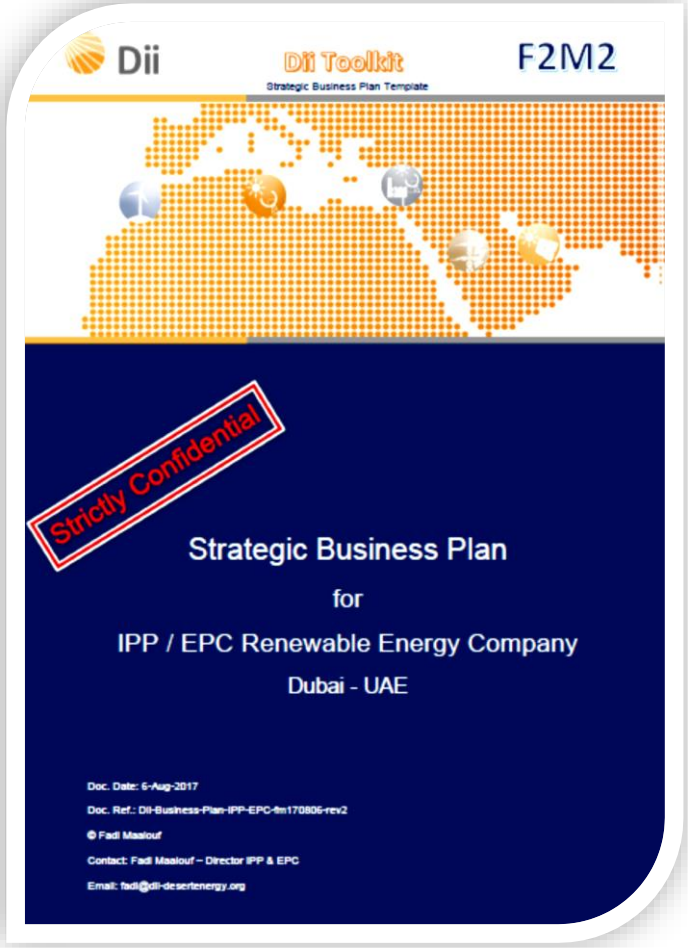
Project Finance Management Plan for Utility Scale Solar PV Power Plant

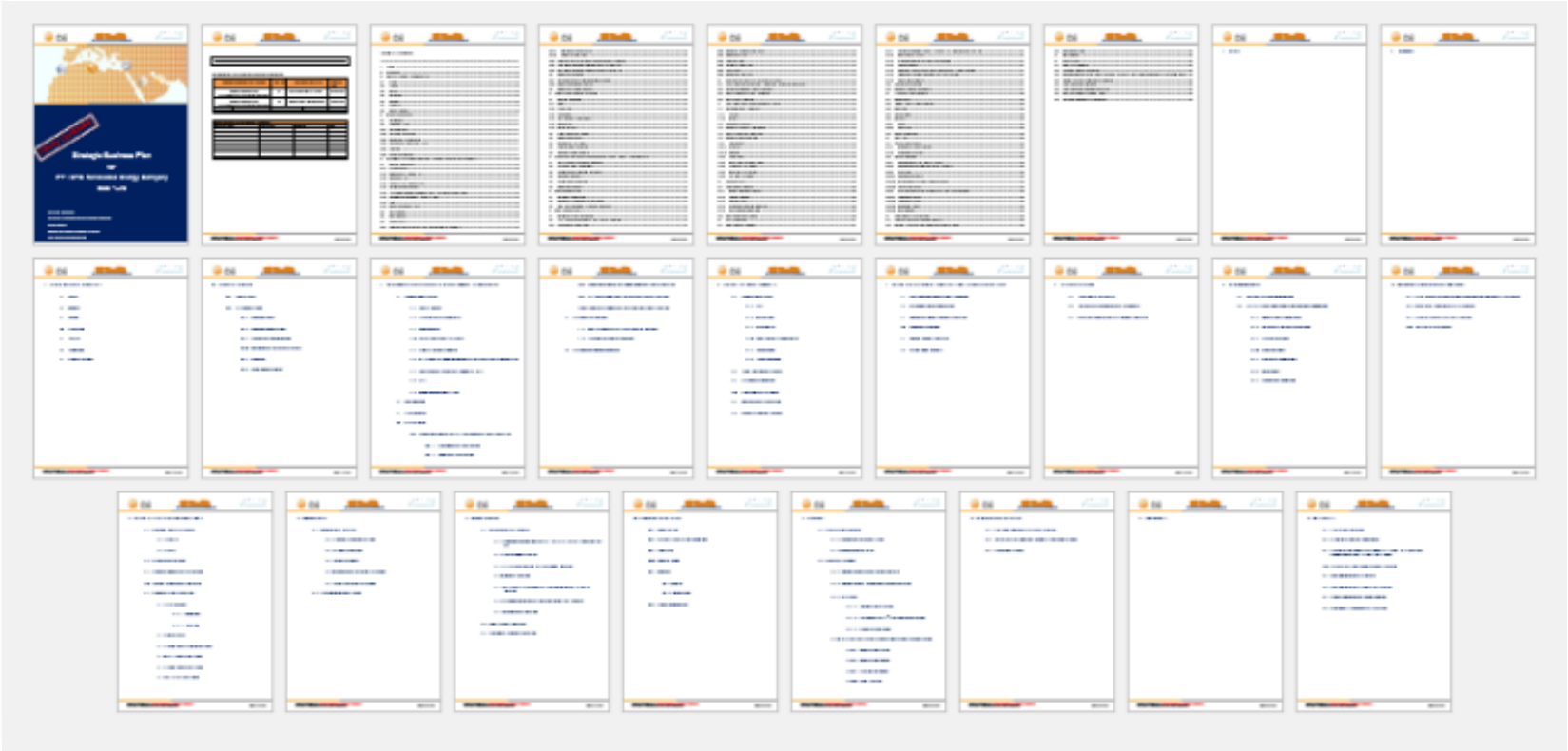


Project Finance Management Plan for Utility Scale Solar PV Power Plant

- The objective of the plan is to demonstrate the project finance approach based on top-notch best practices.
- It describes the:
  - Background
  - Scope
  - Roles and responsibilities of the project stakeholders
  - Sources and uses of funds
  - Debt financing sources and terms and conditions
  - Repayment schedule and interest margins
  - Quarterly cashflow statements
  - Debt service coverage ratios
  - Levelized cost of electricity
  - Financial modelling
  - Financial close
  - Important guideline and bankability benchmarks for the proposed project finance term sheet
  - Risk management
  - Compliance and governance

Strategic Business Plan
for IPP / EPC Renewable Energy Company

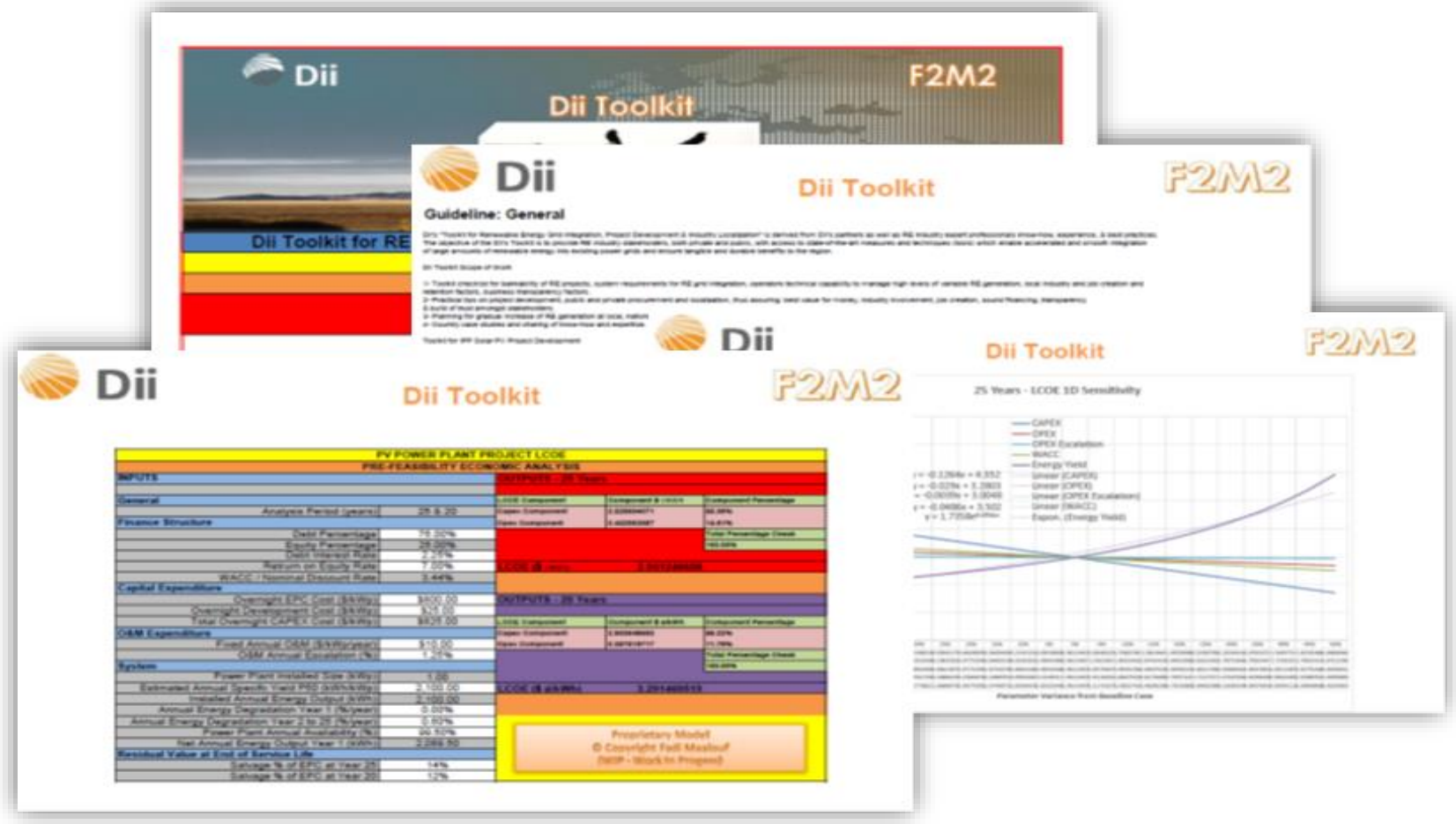




Strategic Business Plan for IPP / EPC Renewable Energy Company

- The objective of this document is to ensure that the IPP/EPC business is run professionally, sustainably and profitably.
- It provides “How To” methodology for expert business planning and a detailed template that covers the business’s:
  - Mission
  - Vision
  - Strategies
  - Current situation
  - Market segmentation
  - Profile of target markets
  - Sales plans
  - Risk management
  - Operations
  - Financial projections
  - Realization and execution.

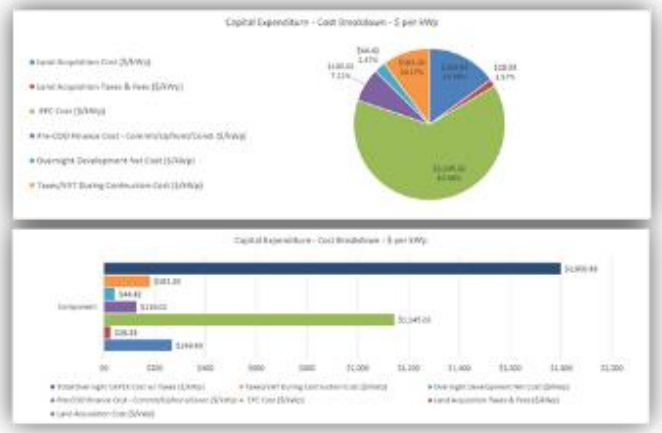
Pre-Feasibility Study
Solar PV LCOE Financial Model



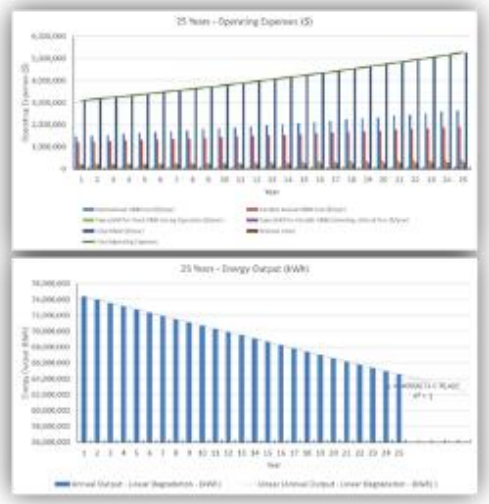
Pre-Feasibility Study
Solar PV LCOE Financial Model

- This document provides a toolkit for the Roadmap Phase 2 “Pre-Feasibility Study”.
- The tool is a financial model for calculating the levelized cost of electricity.
- The objective of such financial model is to assess whether the project can be developed to be bankable, and most importantly whether LCOE (PPA price) is competitive with off-taker other sources of energy production, as well as providing the developer with reasonable return on investment or IRR.

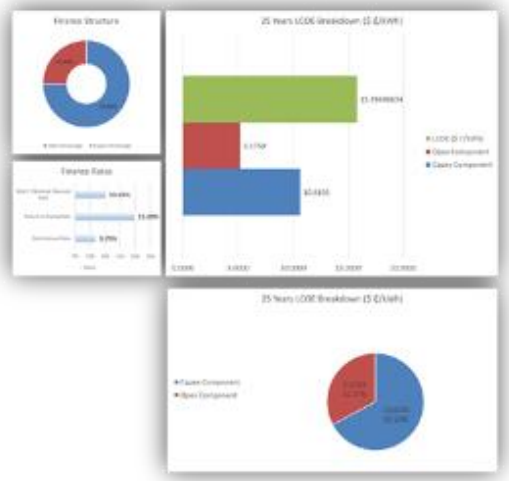
CAPEX



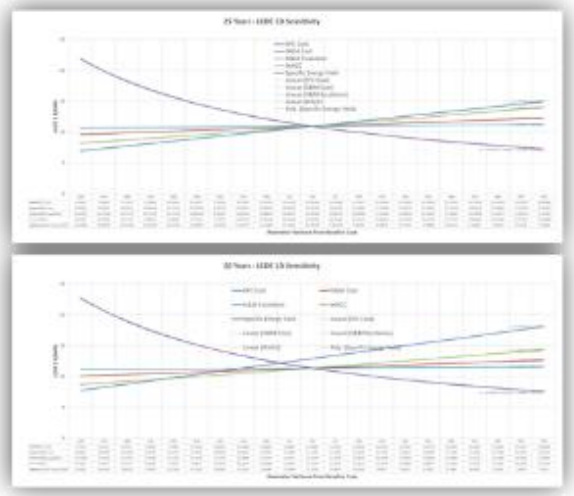
OPEX & Energy



LCOE Breakdown



Sensitivity

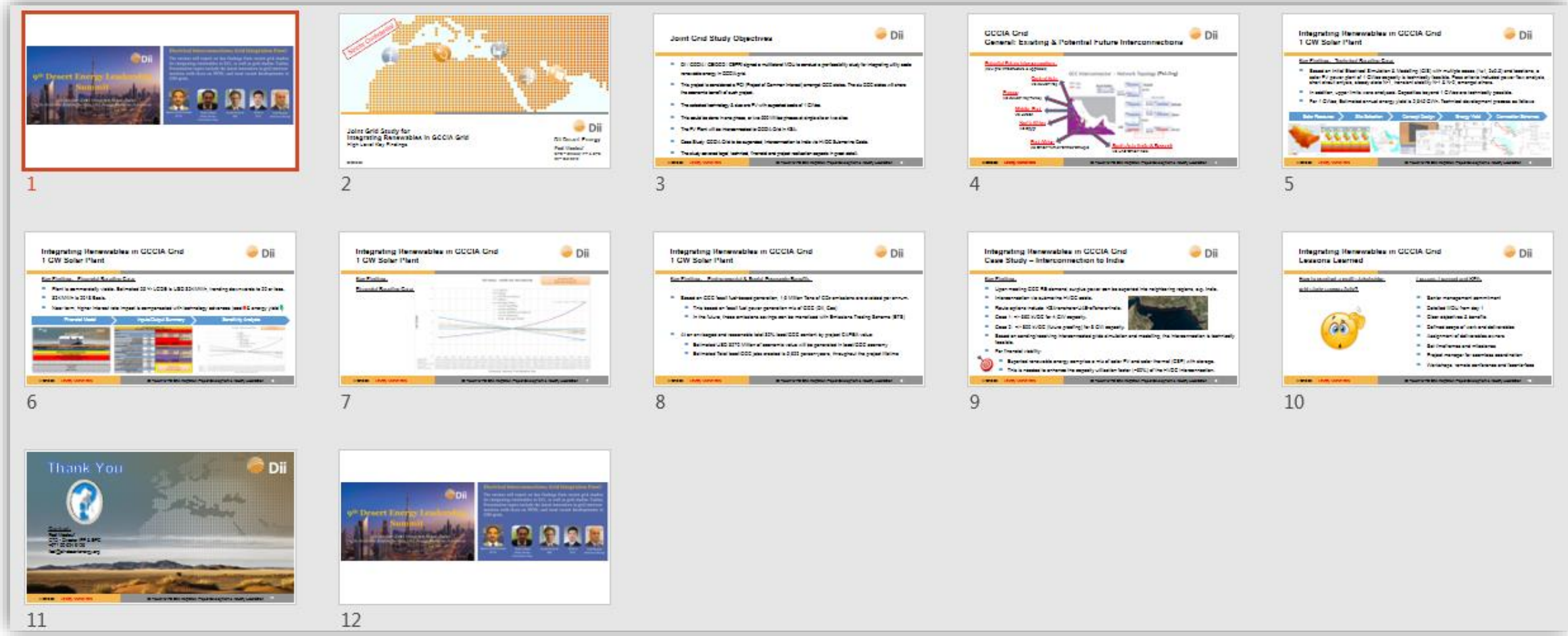


Pre-Feasibility Study
Solar PV LCOE Financial Model

- Pre-Feasibility Financial Model Features
  - Cover and disclaimer sheets that describe the objective.
  - Guideline that describes toolkit, overall project development roadmap tool, and its component tool Pre-Feasibility Financial Model.
  - Summary Sheet and Summary Chart Sheet for Financial Model Input & Output Parameters
  - Analysis Period (project lifecycle): The model addresses both 25 and 20 years cases. This allows stakeholders to utilize the tool for various geographic markets which standardize their IPP solar PV project programs at 25 or 20 years lifecycle.
  - Summary Sheet for 25 & 20 Years LCOE One Dimensional (1D Input Parameter) Sensitivity/Scenario Analysis Optimization.
  - Tables for 25 Years LCOE Two Dimensional (2D) Sensitivity/Scenario Analysis
  - Charts for 25 Years LCOE Two Dimensional (2D) Sensitivity/Scenario Analysis
  - Tables for 20 Years LCOE Two Dimensional (2D) Sensitivity/Scenario Analysis
  - Charts for 20 Years LCOE Two Dimensional (2D) Sensitivity/Scenario Analysis
- NOTE:

All Sensitivity/Scenario Analyses resultant values are indicative only and shall be used to optimize the baseline case (& not as baseline case). Analyses provide visualization that assist in optimization process. This is due to the fact that input parameters have direct and indirect dependencies due to economies of scale, specific project use case, and many other factors. A variance in an input parameter does not auto-correct other input parameter(s) value relating to economies of scale, specific project use case or other factors. The provided input parameter variance ranges shall be used as a guide for identifying such input parameter influence and weightage on output. Extreme due diligence shall be exercised in identifying parameters dependencies and correcting for the same in baseline case inputs.

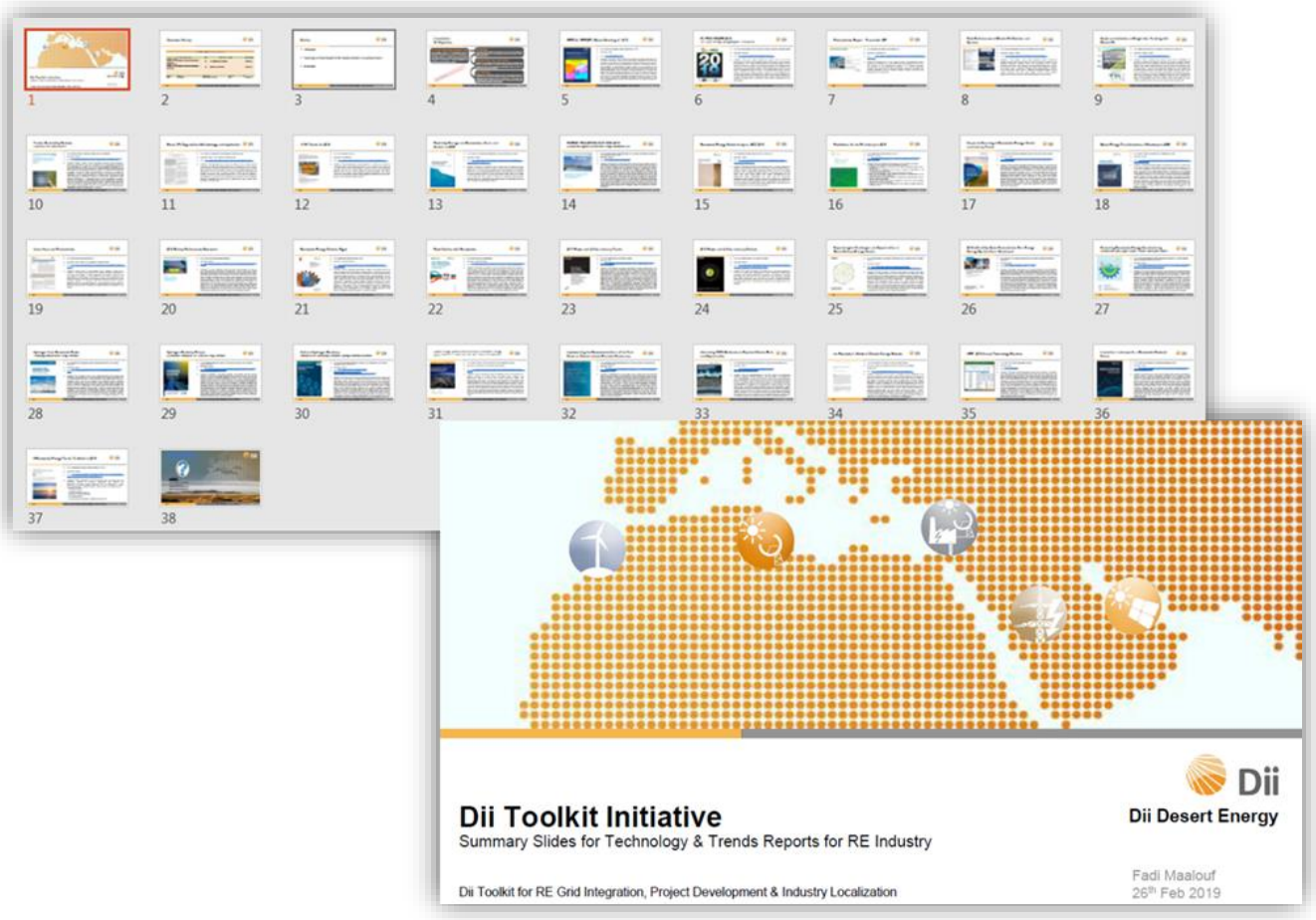
Joint Study for Integrating Renewables in GCCIA Gird



Joint Study for Integrating Renewables in GCCIA Gird

- The joint study was conducted by four stakeholders: GCCIA, Dii, CERPI and GEIDCO.
- Dii's CTO was the study overall project manager as well as the author of several sections of the study.
- The study was concluded in July 2018 and it took around 10 months to finalize.
- Several interim workshops were conducted. The study addressed on the benefits of implementing such a project which is considered a multilateral project of common interest (PCI).
- The analyzed benefits included: environmental, social, economic, and energy security benefits.
- The study determined the technical, financial and legal approach for implementation.
- This included: site selection, concept design, Levelized Cost of Electricity (LCOE) and sensitivity, basic and detailed legal structure, tendering and procurement approach, project realization timeline, and project finance management plan.
- The study analyzed the impact assessment of integrating renewables in GCCIA grid and it used several schemes for detailed examination.
- The study also covered the export of renewable energy to nearby regional grids.
- A study case of interconnecting GCCIA grid to Indian Grid was evaluated and the case included explorations of several interconnection schemes.
- Finally, the study assessed the next steps and future studies including expansion of GCCIA grid, future planned development of GCC power market framework and integrating energy storage in GCCIA grid. The study included detailed appendices for each section.

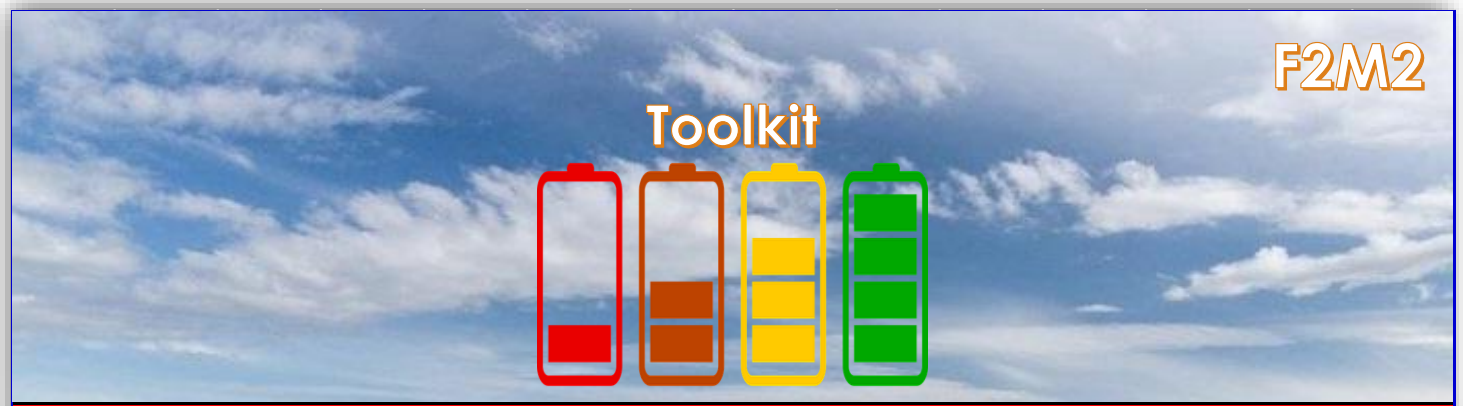
Dii Toolkit Initiative - New 2019 Report: Technology and Trends for RE Industry



- The report covers 33 recent and significant industry reports with a wide range of topics:
  - PV
  - Bifacial PV
  - Batteries
  - Trackers
  - Storage
  - Markets
  - Trends
  - Technology
  - Costing & Benchmarking
  - Climate Change
  - Economics
  - Financial Disclosure
  - Energy Transition
  - Hydrogen.

Coming Soon!

Pre-Feasibility Study - Utility Scale Battery Energy Storage Systems (BESS)
LCOS Financial Model



Toolkit for Renewable Energy Project Development

Battery Energy Storage System Project

Pre-Feasibility Study

Levelized Cost of Storage Financial Model
25 and 20 Years Analysis

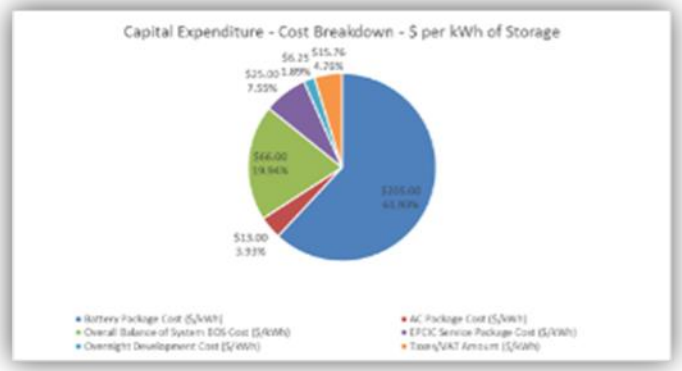
Version: 19
Date: 28/02/2019

Coming Soon!

Pre-Feasibility Study - Utility Scale Battery Energy Storage Systems (BESS)
LCOS Financial Model

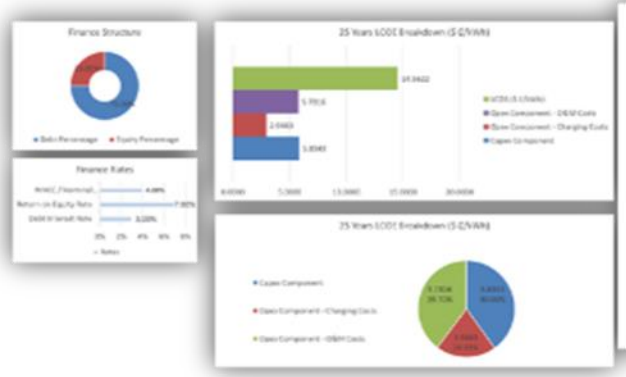
- This document provides a toolkit for the Roadmap Phase 2 “Pre-Feasibility Study”.
- The tool is a financial model for calculating the levelized cost of storage (LCOS) for Front of Meter Utility Scale BESS.
- The objective of such financial model is to assess whether the project can be developed to be bankable, and most importantly whether LCOS (PPA price or Revenue Stream) is competitive with off-taker other sources of energy production and “use case”, as well as providing the developer with reasonable return on investment or IRR.

CAPEX



OPEX & Energy

LCOS Breakdown



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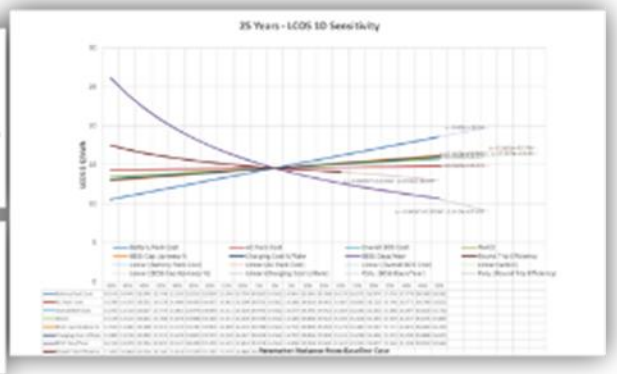
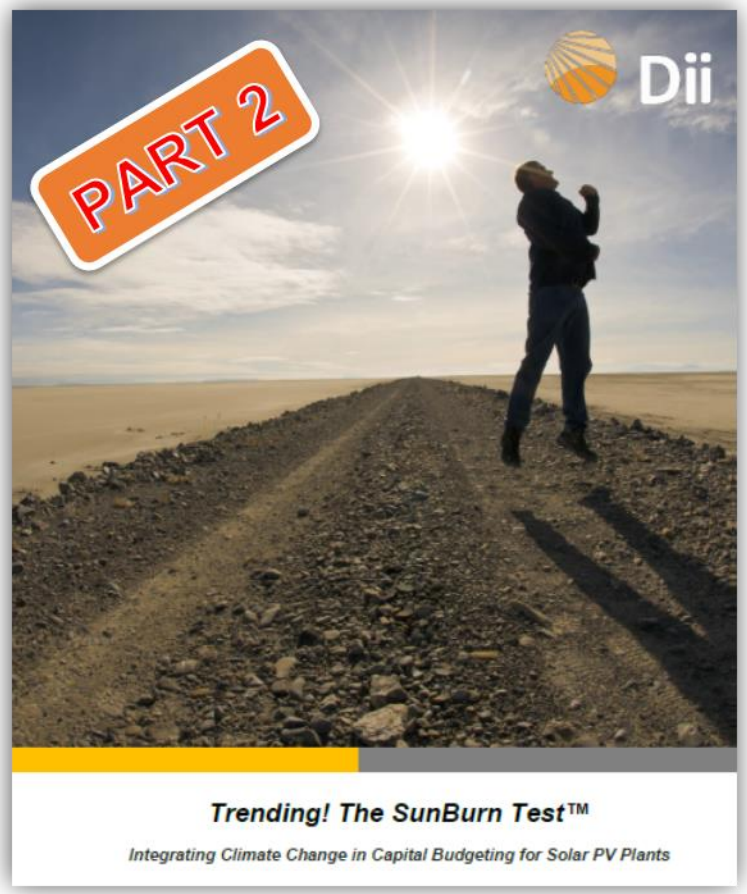


Coming Soon!
SunBurn Test™: PART 2



- Part 1 addressed climate change risks and their impacts on solar power plants. It described the basics of climate change and the basics of capital budgeting, as well as workflow process charts for both.
- In Part 2, the impact analysis will be expanded into more details.
- In Part 1, the analysis was based on a costing model, LCOE.
- In Part 2, the analysis will be based on a detailed integrated costing and revenue model, LCOE/DSCR/LLCR/PLCR/NPV/IRR
- The objective of such the expanded analysis model is to assess whether the project can still remain feasible when subjected to climate change risks.
- The feasibility is examined from the perspective of both:
  - Project Owners: NPV/IRR
  - Project Financiers: DSCR/LLCR/PLCR

Thank You

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