



Dii Toolkit Initiative



Dii Desert Energy

Document History



DOCUMENT CHANGE HISTORY RECORD SHEET

| Document Title / Number | Rev. | Description Of Change | Effective Date |
|--|------|-----------------------------------|----------------|
| Dii Toolkit Initiative Dii-Toolkit-Initiative-fm170817-R1 | R1 | Initial Release – For Information | 17-Aug-2017 |
| Dii Toolkit Initiative Dii-Toolkit-Initiative-fm170923-R2 | R2 | Updated – For Information | 23-Sep-2017 |
| Dii Toolkit Initiative Dii-Toolkit-Initiative-fm180521-R3 | R3 | Updated – For Information | 21-May-2018 |
| Dii Toolkit Initiative Dii-Toolkit-Initiative-fm210119-R4 | R4 | Updated – For Information | 19-Jan-2021 |
| Dii Toolkit Initiative Dii-Toolkit-Initiative-fm210121-R5 | R5 | Updated – For Information | 21-Jan-2021 |

| Category | Name | Designation | Signature | Date |
|----------|--------------|--------------------------|-----------|-------------|
| Author | Fadi Maalouf | CTO - Director IPP & EPC | F2M2 | 21-Jan-2021 |

Outline



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Introduction

Dii Objectives

Our Mission: No Emissions!



Desertec Industrial Initiative (Dii)

Launched in 2009 as a 'not-for-profit' entity in Germany for exploring the potential of renewables in the desert areas of MENA, improving market conditions and examining the synergies to be captured through connecting the European and MENA power markets. In 10 years' time, Dii Desert Energy has grown from a rudimentary 'Desertec Vision', initially mainly concentrated on power from the deserts for Europe, (Desertec 1.0) via a focus on the conditions of renewables in the local markets (Desertec 2.0) toward a highly recognized market enabler for 'green electrons' and 'green molecules' from the deserts of MENA for MENA's own population, and for MENA to become a 'Power House' for the world markets (Desertec 3.0). Today, Dii Desert Energy are looking at the entire power system starting with various forms of Renewable Energy (RE) generation, grids, new technologies & innovations, energy storage, e-mobility, smart cities, towards the long-term objective of 'energy without emissions'.

Dii Vision

Increased competitiveness of renewables shall swiftly lead to economic growth and secure 100% energy supply without harmful emissions or waste.

Our Mission: No Emissions!

Towards a fully emission free energy supply in MENA before 2050 and making MENA a 'power house' for the global energy markets offering benefits to the region.

Dii Strategy

Connecting the international industry active in the MENA region with authorities and institutions. Focus on practical conditions for 'green electrons' and 'green molecules' along the energy value chains leading to tangible and profitable projects and other benefits for local and international stakeholders.

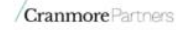
Introduction Dii Partners



Shareholders



Associated Partners



Why Toolkit?

- ▶ In the ever-evolving energy markets, the power of information and in particular know-how, innovation, & collaboration, are key success factors.

Objective: Accelerate RE Implementation

- ▶ **So What Is The Bottom Line?**

- ▶ **Use Top Down Analysis**

- ▶ **Q&A To Establish Workflow!**



Bottom Line

Why Toolkit?

➔ Q: What accelerates RE implementation?

➔ A: Creating RE project opportunities.

➔ Q: Who creates RE opportunities?

➔ A: By connecting RE talent to drive innovation.

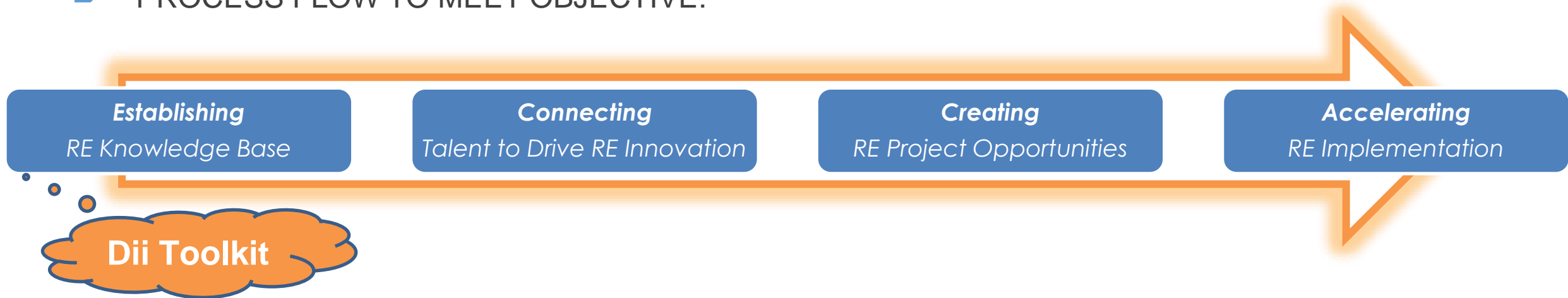
➔ Q: What is the basis RE talent?

➔ A: Establishing RE Knowledge Base. This is the bottom line! A solid foundation!



Why Toolkit?

▶ PROCESS FLOW TO MEET OBJECTIVE:



- ▶ The Dii Toolkit “Establishes RE Knowledge Base” thus enabling talent connection, opportunity creation, & therefore renewable energy implementation acceleration.
- ▶ Dii Toolkit Initiative sets a solid foundation for achieving the goal of energy independence via renewable energy, therefore accomplishing Dii Objectives.

Toolkit Description

- ▶ Dii's "Toolkit for Renewable Energy Grid Integration, Project Development & Industry Localization" is **derived from Dii's partners as well as Renewable Energy (RE) industry expert professionals' know-how, experience, & best practices.**
- ▶ The objective of the Dii's Toolkit is to provide RE industry stakeholders, both **private and public**, with access to state-of-the-art measures & techniques (tools) which enable accelerated and smooth integration of large amounts of renewable energy into existing power grids & ensure tangible and durable benefits to the region.

Dii Toolkit scope of work includes:

- ▶ **Tools & checklist** for bankability of RE projects, system requirements for RE grid integration, operators' technical capability to manage high levels of variable RE generation, local industry & job creation & retention factors, business transparency factors.
- ▶ **Practical tips** on project development, public and private procurement and localization, thus assuring: best value for money, industry involvement, job creation, sound financing, transparency & build of trust amongst stakeholders.
- ▶ **Planning for gradual increase of RE generation** at local, national, regional and international scale.
- ▶ **Country case studies** & sharing of know-how & expertise.
- ▶ The Toolkit database will be **available at Dii's website platform**, exclusively for Dii's partners & network members.

Toolkit Approach

- ▶ Dii Toolkit Approach to Creating Value and Knowledge Base
- ▶ WHAT TO DO vs. HOW TO DO



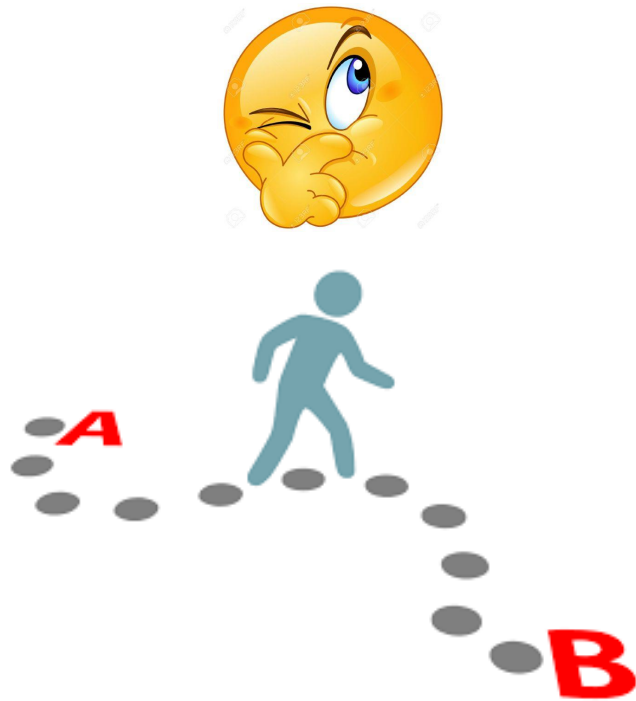
WHAT TO DO ?



HOW TO DO ?

Toolkit Approach

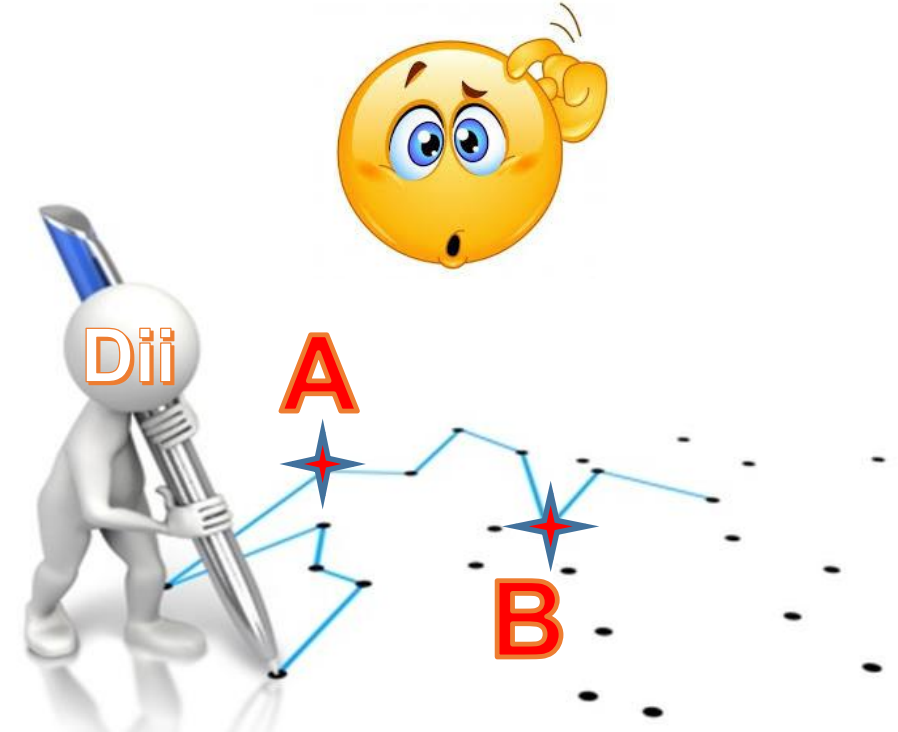
WHAT TO ?



Limited



HOW TO ?

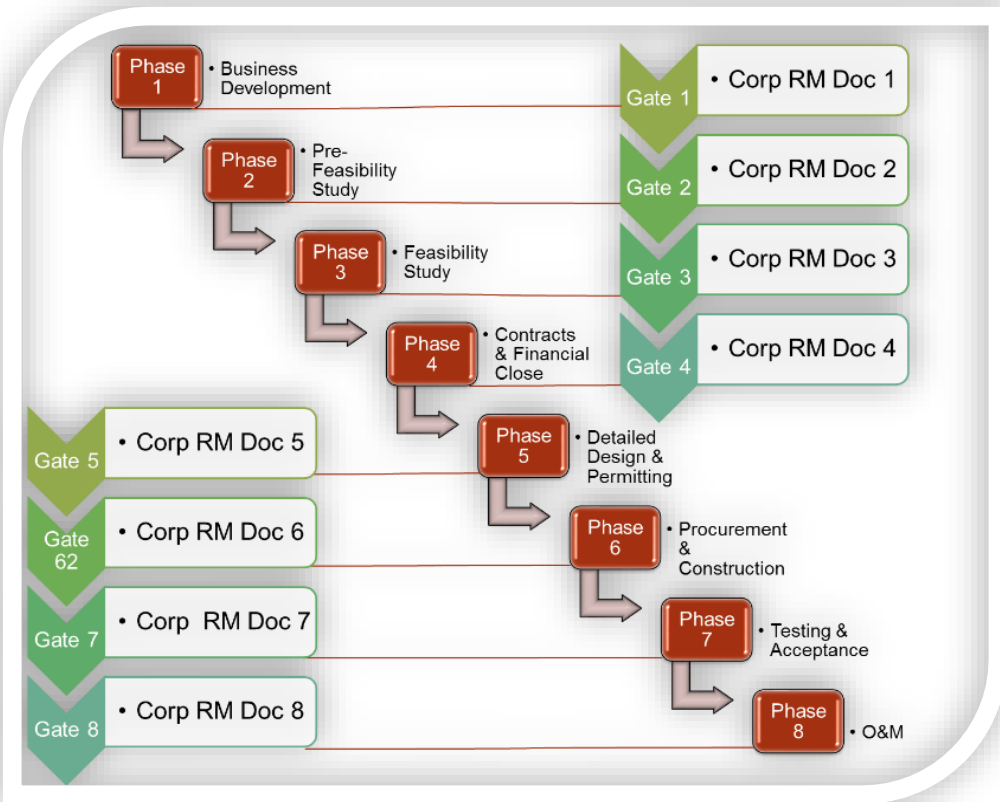


Comprehensive View

Recent Toolkit Publications How To?



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



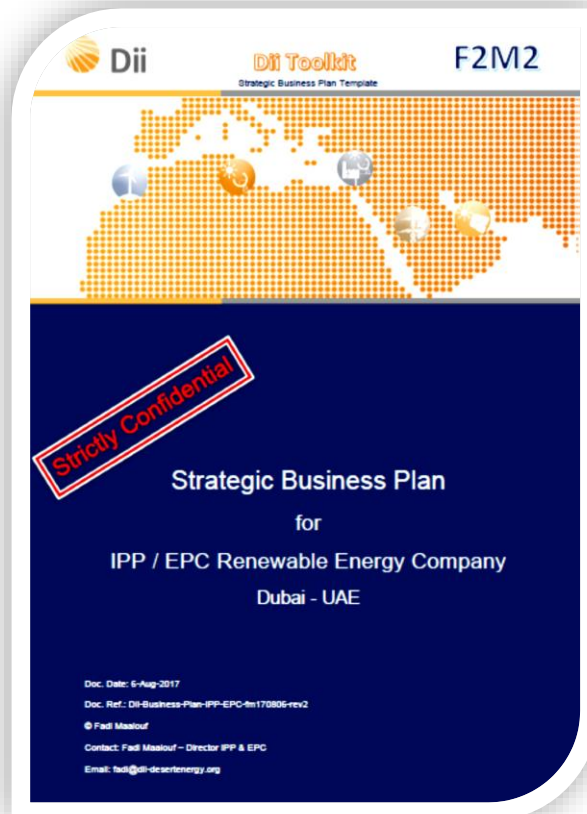
Pre-Feasibility Study LCOE Financial Model



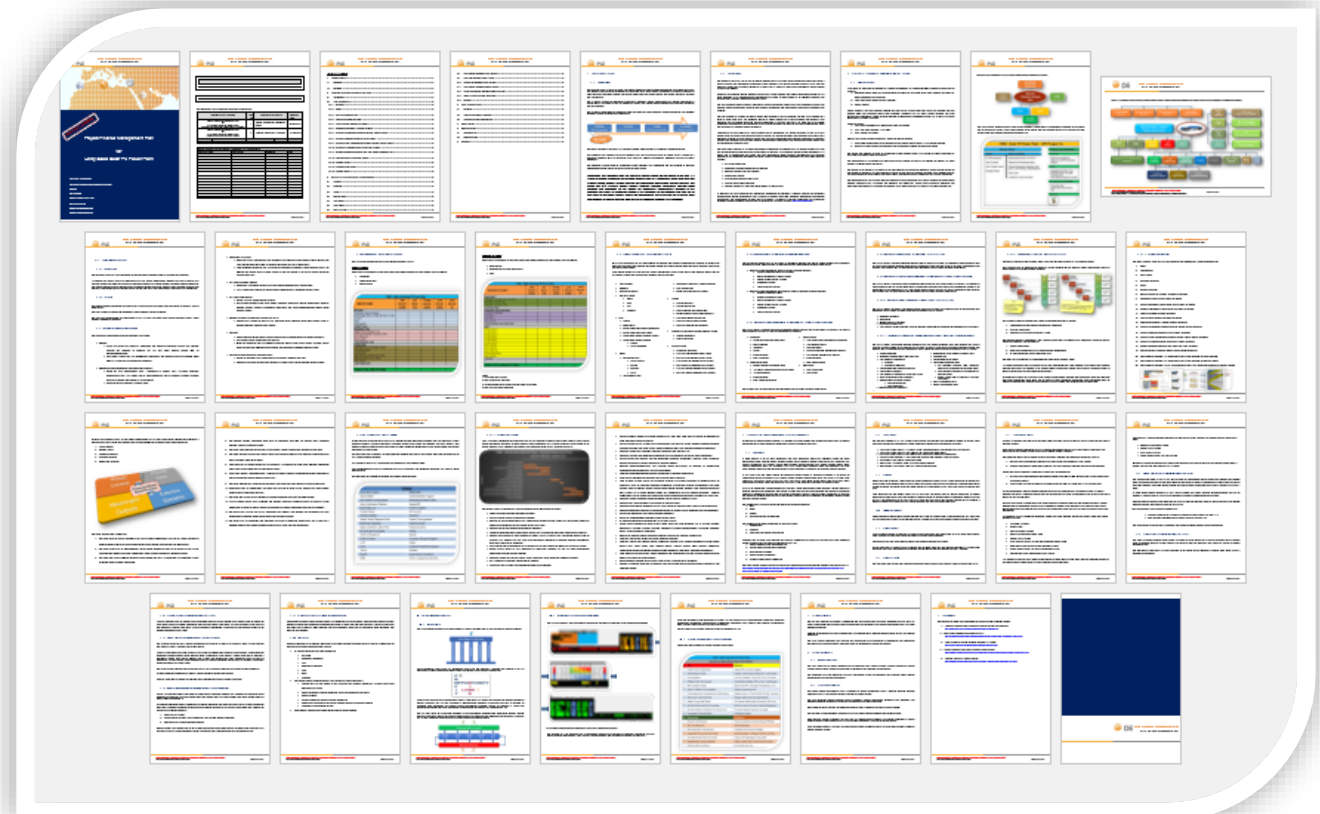
Recent Toolkit Publications How To?



Strategic Business Plan for IPP / EPC Renewable Energy Company



Project Finance Management Plan for Utility Scale Solar PV Power Plant



Recent Toolkit Publications How To?



Trending! SunBurn Test™ Integrating Climate Change in Capital Budgeting for PV Plants



Trending! The SunBurn Test™
Integrating Climate Change in Capital Budgeting for Solar PV Plants

The thumbnails display various content from the publication, including:

- Textual sections with headings like "Trending! The SunBurn Test™" and "Integrating Climate Change in Capital Budgeting for Solar PV Plants".
- Tables with multiple columns and rows, some with color-coded headers.
- Line graphs and charts showing data trends.
- Summary lists and bullet points.

Recent Toolkit Publications How To?



Battery Energy Storage System Levelized Cost of Storage (LCOS) Financial Model Toolkit

F2M2

Toolkit

Toolkit for Renewable Energy Project Development

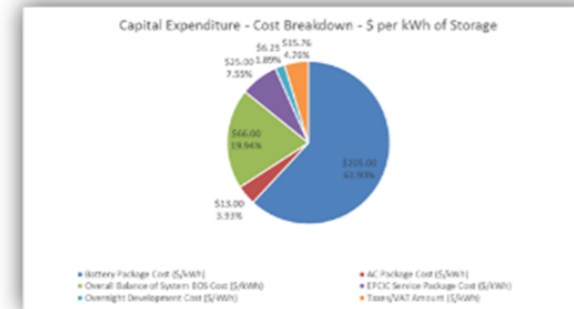
Battery Energy Storage System Project

Pre-Feasibility Study

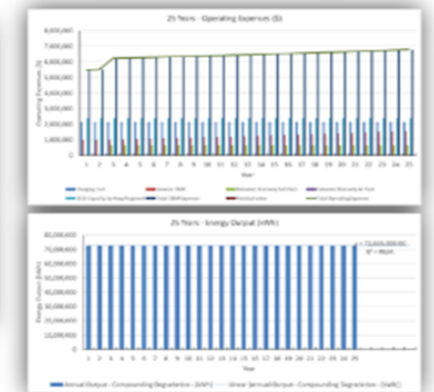
Levelized Cost of Storage Financial Model
25 and 20 Years Analysis

© 2019 Fadi Maalouf
 Version: 19
 Date: 28/02/2019

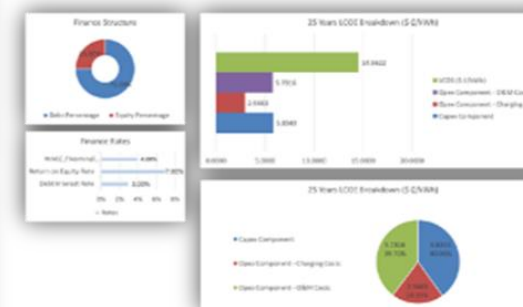
CAPEX



OPEX & Energy



LCOS Breakdown



Sensitivity



Recent Toolkit Publications How To?



Technology and Trends for RE Industry 2019

The image displays a grid of 38 numbered summary slides from a report. The slides are arranged in a grid that is 5 rows high and 8 columns wide, with the final row containing only 2 slides. Each slide is a small thumbnail showing various charts, graphs, and text. Below the grid, a larger version of slide 38 is overlaid. This slide features a world map composed of orange dots, with several circular icons representing different renewable energy technologies: a wind turbine, a solar panel, a hydroelectric dam, a geothermal geyser, and a battery. The slide includes the following text:

Dii Toolkit Initiative
Summary Slides for Technology & Trends Reports for RE Industry

Dii
Dii Desert Energy

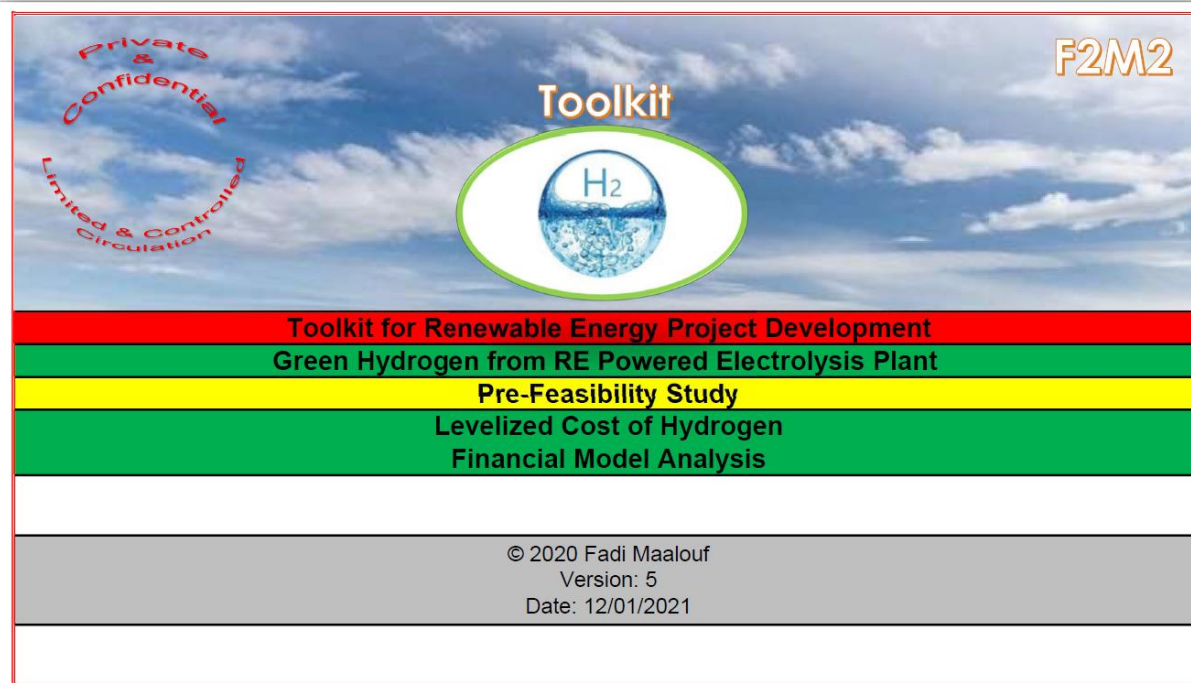
Fadi Maalouf
26th Feb 2019

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

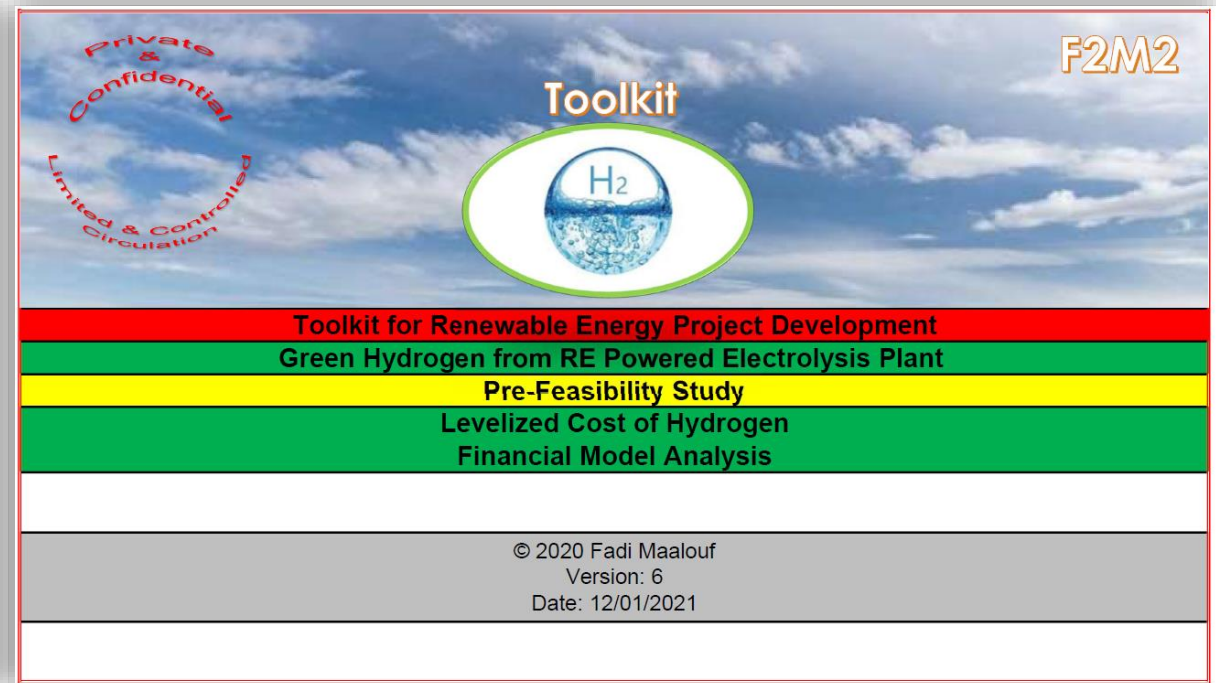
Recent Toolkit Publications How To?

LCOH Financial Model Toolkit V5 Green Hydrogen Production

LCOH Financial Model Toolkit V6 Green Hydrogen Production & Delivery Infra Pathways

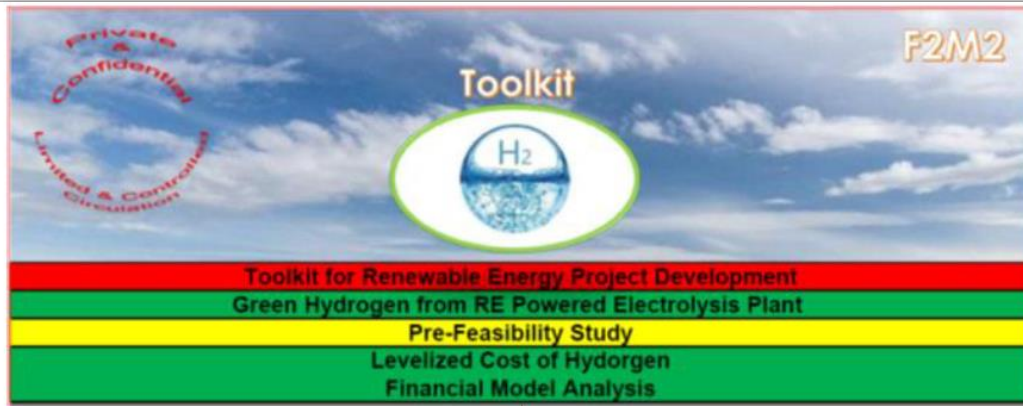


The cover features a blue sky background with a central image of a hydrogen molecule (H₂) in a blue sphere. A red circular stamp in the top left corner reads "Private & Confidential Limited & Controlled Circulation". The word "Toolkit" is written in orange above the H₂ sphere, and "F2M2" is in the top right corner. The bottom section contains a red bar with "Toolkit for Renewable Energy Project Development", a green bar with "Green Hydrogen from RE Powered Electrolysis Plant", a yellow bar with "Pre-Feasibility Study", and another green bar with "Levelized Cost of Hydrogen" and "Financial Model Analysis". The footer includes "© 2020 Fadi Maalouf", "Version: 5", and "Date: 12/01/2021".



The cover features a blue sky background with a central image of a hydrogen molecule (H₂) in a blue sphere. A red circular stamp in the top left corner reads "Private & Confidential Limited & Controlled Circulation". The word "Toolkit" is written in orange above the H₂ sphere, and "F2M2" is in the top right corner. The bottom section contains a red bar with "Toolkit for Renewable Energy Project Development", a green bar with "Green Hydrogen from RE Powered Electrolysis Plant", a yellow bar with "Pre-Feasibility Study", and another green bar with "Levelized Cost of Hydrogen" and "Financial Model Analysis". The footer includes "© 2020 Fadi Maalouf", "Version: 6", and "Date: 12/01/2021".

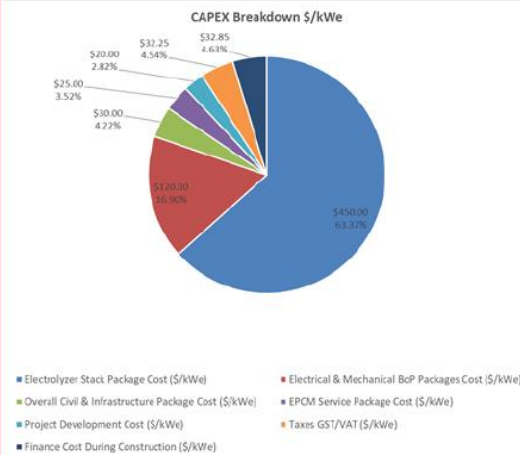
Recent Toolkit Publications How To?



GREEN HYDROGEN Innovative Financial Model Toolkit for Analyzing Levelized Costs (LCOH)

Inputs Form

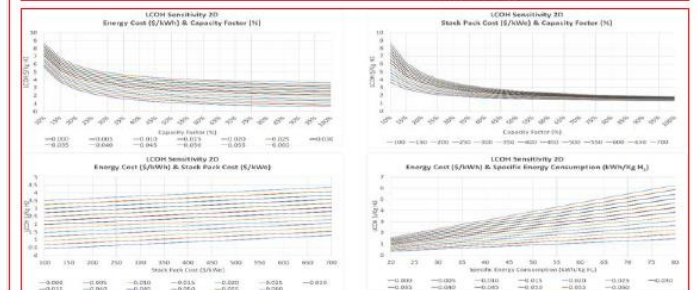
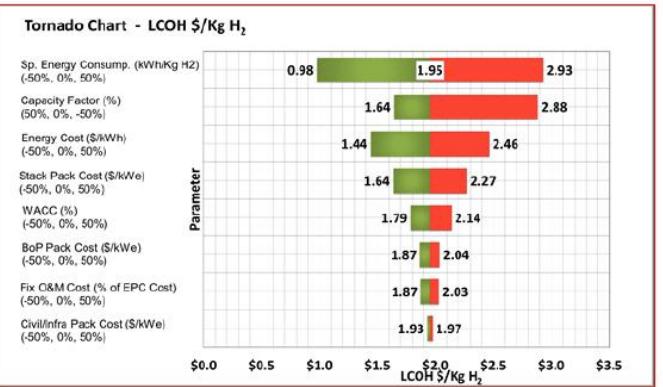
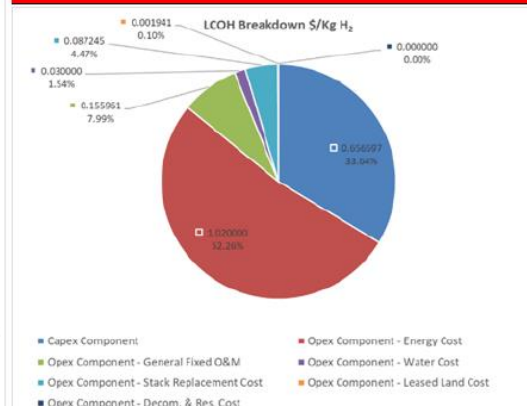
| Parameter | Value | Unit |
|---|-------|--------|
| Capacity (MW) | 100 | MW |
| Capacity Factor (%) | 50 | % |
| WACC (%) | 10 | % |
| Energy Cost (\$/MWh) | 1.95 | \$/MWh |
| Stack Pack Cost (\$/kWe) | 2.27 | \$/kWe |
| BoP Pack Cost (\$/kWe) | 2.04 | \$/kWe |
| Fix O&M Cost (% of EPC Cost) | 0.00 | % |
| Civil/Infra Pack Cost (\$/kWe) | 1.97 | \$/kWe |
| Opex Component - Energy Cost | 0.52 | \$/kWh |
| Opex Component - General Fixed O&M | 0.08 | \$/kWh |
| Opex Component - Water Cost | 0.03 | \$/kWh |
| Opex Component - Stack Replacement Cost | 0.00 | \$/kWh |
| Opex Component - Leased Land Cost | 0.00 | \$/kWh |
| Opex Component - Decom. & Res. Cost | 0.00 | \$/kWh |



OUTPUTS - 20 Years

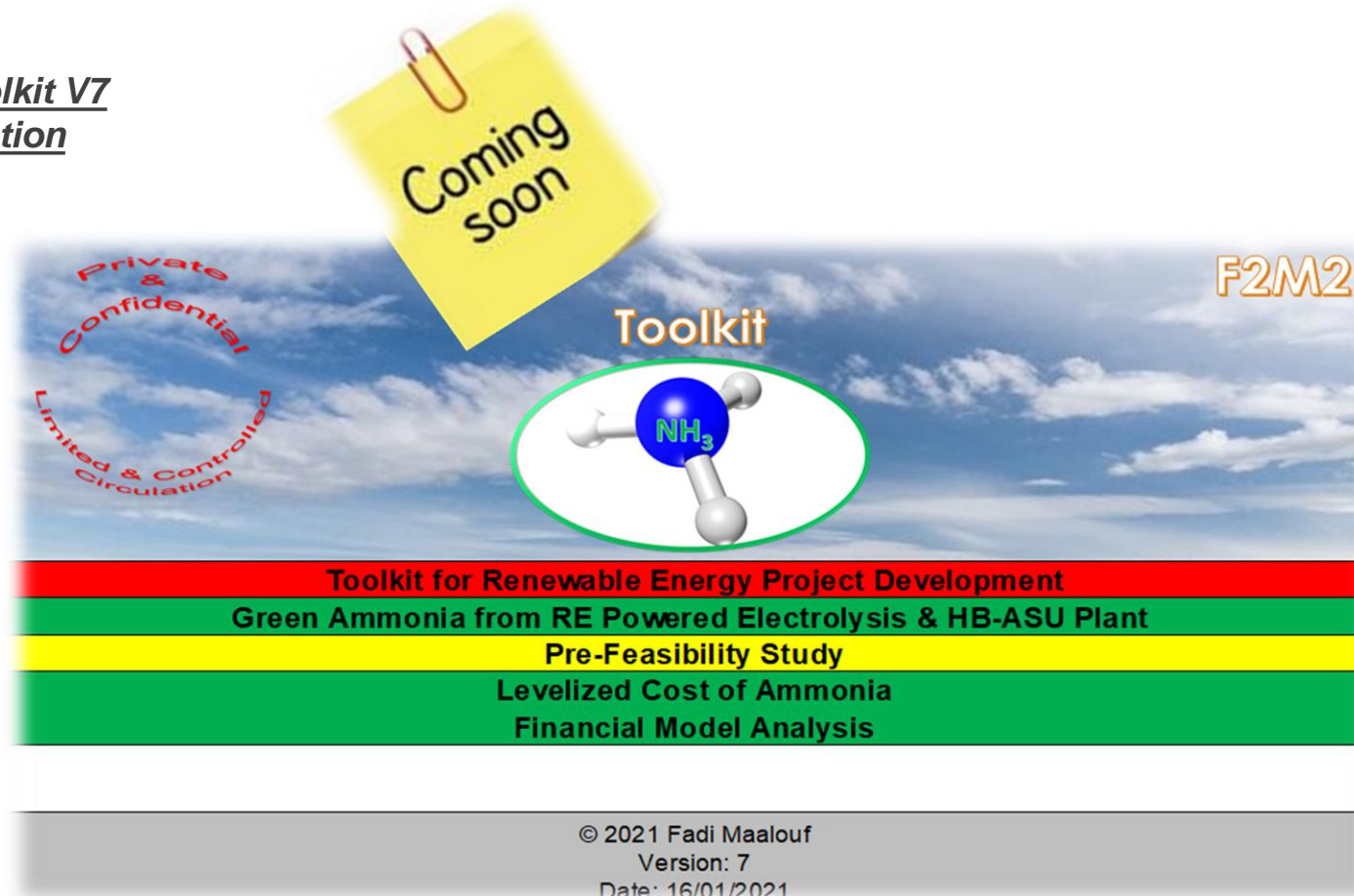
| LCOH Component | Component \$/Kg H ₂ | Component Percentage |
|---|--------------------------------|----------------------|
| Capex Component | 6.656597 | 33.64% |
| Opex Component - Energy Cost | 1.020000 | 52.26% |
| Opex Component - General Fixed O&M | 6.155561 | 7.99% |
| Opex Component - Water Cost | 6.030000 | 1.54% |
| Opex Component - Stack Replacement Cost | 6.087245 | 4.47% |
| Opex Component - Leased Land Cost | 6.001541 | 0.10% |
| Opex Component - Decom. & Res. Cost | 6.000000 | 0.00% |
| Total Percentage Check | | 100.00% |

LCOH (\$/Kg H₂) \$1.951743
LCOH (AED/Kg H₂) 7.172656



Recent Toolkit Publications How To?

LCOA Financial Model Toolkit V7
Green Ammonia Production



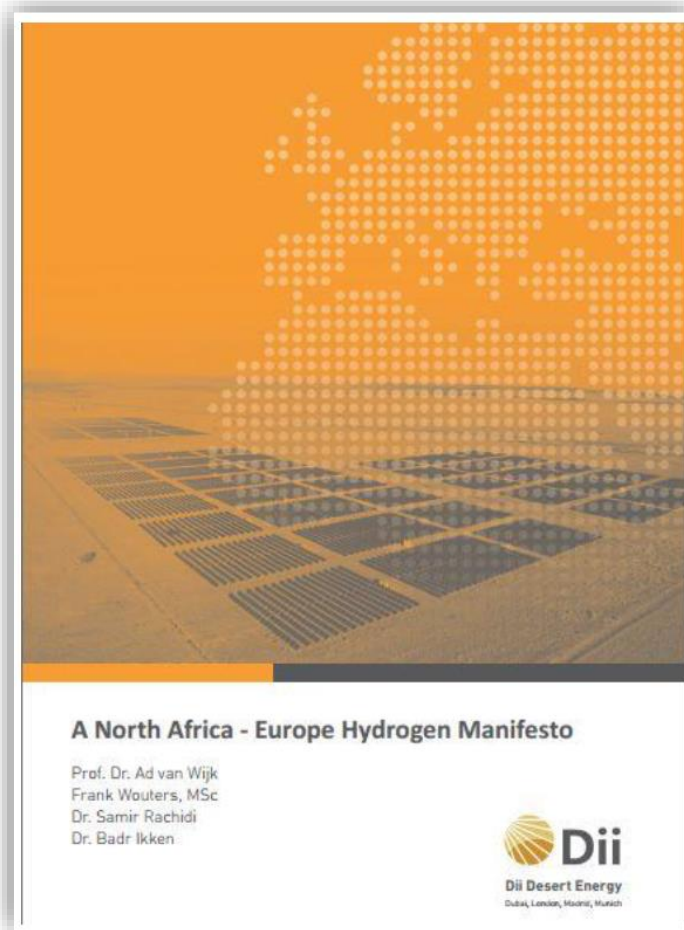
The image shows the cover of a toolkit. At the top left, a yellow sticky note with a paperclip says "Coming soon". In the center, the word "Toolkit" is written in orange above a 3D ball-and-stick model of an ammonia molecule (NH₃). To the left of the model is a red circular stamp that reads "Private & Confidential" and "Limited & Controlled Circulation". To the right of the model is the text "F2M2". Below the central image are four horizontal bars: a red bar with "Toolkit for Renewable Energy Project Development", a green bar with "Green Ammonia from RE Powered Electrolysis & HB-ASU Plant", a yellow bar with "Pre-Feasibility Study", and a green bar with "Levelized Cost of Ammonia Financial Model Analysis". At the bottom, a grey bar contains the text: "© 2021 Fadi Maalouf", "Version: 7", and "Date: 16/01/2021".

Recent Studies

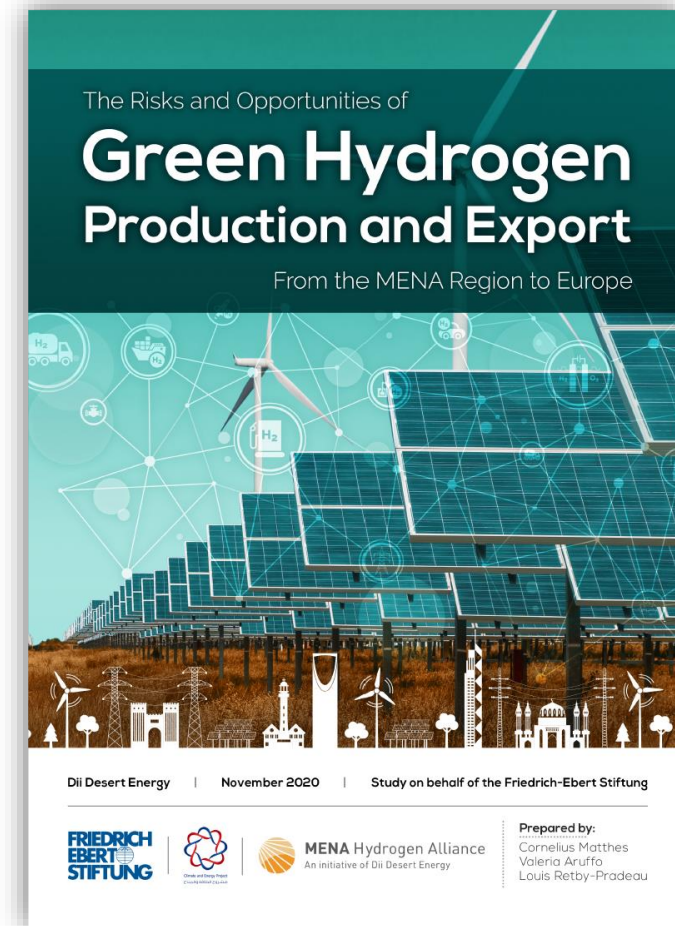
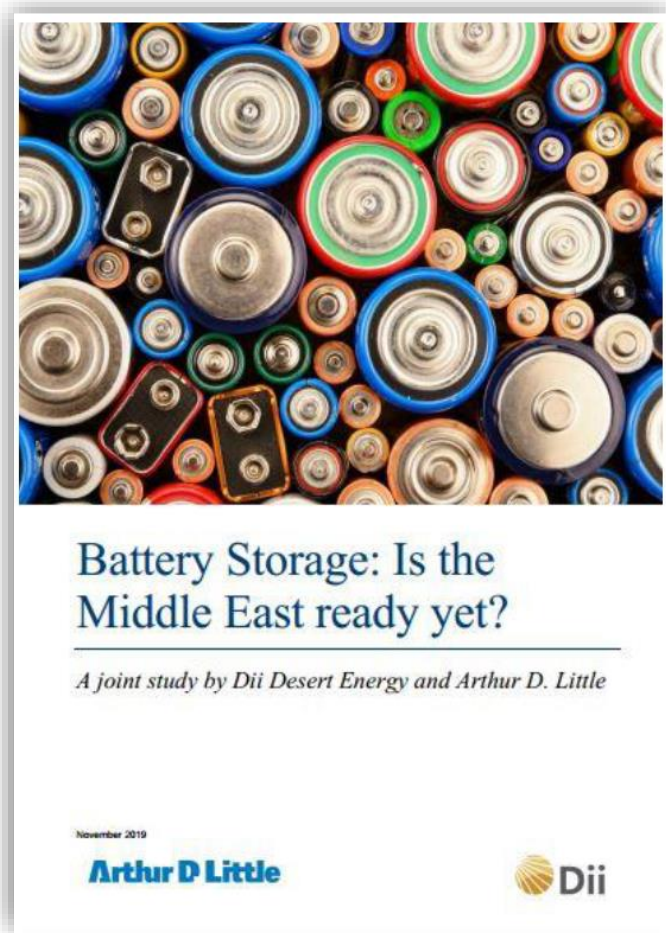


Joint Study for Integrating Renewables in GCCIA Grid

Recent Studies



Recent Studies



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Thank You



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