

9th Dii Desert Energy Leadership Summit



Dii Working Groups and activities

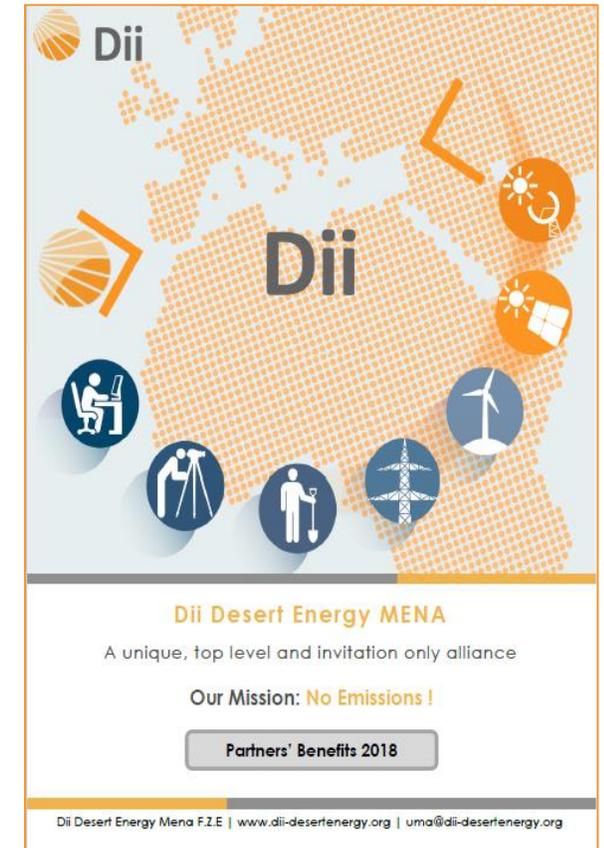
22nd of October, Dubai

Clear Positioning and Partners' Benefits

Dii's new Mission is clearly differentiating in the market



- **'Our Mission: No Emissions'** triggers the debate and actions
- Dii is still seen as a unique 'Industry Initiative', a **network among networks**/only organization in the market looking at the energy system from a holistic point of view, across technologies and entire value chain including **flexible demand, interconnections/energy transport, storage and emission free generation**
- **Pioneering work** on practical project and system matters that guides companies to tangible business. Different **working groups** accessible for Dii partners, delivering solid content
- Dii works with Industry, **Governmental agencies, Development organizations and research institutions** on relevant topics towards an emission free power system
- Unparalleled relationships in MENA, at top political and corporate decision maker level. **Top level advisory board** with industry captains, bankers, political representatives
- A comprehensive list of different **services, creating value for partners**



Overview activities 2018



- Finalised the study on **Integration of PV in GCC and potential international interconnections**, completed **upgrade of Dii toolbox** with new sections on project financing
- Start of work on **Standardization of RE Projects**, other working groups lined up to start from summit
- Presented at **numerous conferences and workshops, raised profile in market.**
More than **doubled number of Associated Partners**
- **Expanded team** with several senior colleagues on pro bono basis in different locations
- **Partnerships and host for high profile events** in Oman, Algeria, Egypt, the UAE and Germany
- **Organized** 9th Annual Conference with start planning 10th yearly event for 2019
- Working Groups: **Storage related** (storage technologies, hydrogen, solar cooling/heating), **Solar Desalination (sun2water)** and **Commercial/Industrial Solar regulatory support group all lined up**

Dii partner of choice for top events with policy makers



Dii Egypt Conference & Workshop

Dii Algeria Workshop

Planning 2019



2019 will be the 10th anniversary of Dii Desert Energy

- *10th Annual Summit*, location + partnerships to be concluded for high profile event
- Different events to be organized, e.g. celebration in Munich with Intersolar
- **Content:** Traction for new working groups and results, to be presented at 10th Dii Desert Energy Leadership Summit
- **Policy makers:** leverage “neutral platform” to make an impact in different countries
- **Events:** Build on successful events and partnerships from 2018
- **Network:** Add some select new Associated Partners in key working fields, further cooperations in different countries, e.g. with Florence School of Regulation, Fraunhofer institutes or development banks. Launch “Dii ambassador network”

Overview Dii Working groups

1. **Grid integration/expansion: Fadi Maalouf, Dii** Completed Q2 2018
 2. **Standardization of Power Purchase Agreements: David Short, Dii** In progress
 3. **Battery Storage: Roland Kaepfner, ThyssenKrupp**
 4. **Hydrogen: Frank Wouters, Dii**
 5. **Solar Heating & Cooling: Paul van Son, Dii**
 6. **Solar desalination: Thomas Altmann, ACWA Power**
 7. **Industrial and Commercial Projects: Regulatory Support Group: Jeremy Crane, Yellow Door Energy** Kick-off, objectives being elaborated
- Kick off meetings around 9th Dii Desert Energy Leadership Summit**

Standardized Financing Initiative for Medium Scale Renewable Energy Transactions



Objectives

- Introduce a set of documents supporting medium scale renewable energy transactions in the MENAT region
- Simplify the process as much as possible
- Provide general guidelines designed to assist developers and lenders in understanding the credit process and financing and to thus reduce transaction costs at this scale
- Overall, accelerate the deployment of renewable energy projects, assisting Associated Partners and the market in general

Dii Proposed Approach

Dii plays an active part in the TWI programme

- Global Solar Energy Standardisation Initiative implemented by the Terrawatt Initiative together with IRENA
- Dii joined TWI as a member of the review committee in July 2018 in order to participate in the review and implementation of the finance agreements
- TWI working towards a release date by October for the review process
- Following the review process, Dii to become an “Associate” member which will enable Dii to represent its members at TWI

Role our with different banks planned

Marketing approach

- Initial discussions with key players in the sector suggest a standardised approach at the small & medium scale level is beneficial and working with the Terrawatt Initiative will help gain more traction from the likes of international banks and government departments
- Dii will follow up this initiative with DFI's, ECA's, local as well as international banks, particularly those with limited experience in financing renewable energy transactions

Dii Proposed Implementation

Credit Proposal

Prepare a credit **application** with general guidelines:

- **Country Overview** - political and economic situation, electrical demand & generation, governmental framework, strategies, policies and regulations
- **The transaction** – rationale, location, technology
- **Proposed financing structure** – funding requirements, project economics
- **Sponsors** – trading history, experience in sector and region
- **Risk factors and mitigants** – political & economic, technology, stress testing

Dii Proposed Implementation

Transaction Documents

Applying standard contractual documentation/guidelines:

- Power purchase agreement
- Supply agreements
- Finance facility agreement
- Direct agreements
- O&M agreement

Summary

- Objective is to introduce guidelines and documents for financing medium scale renewable energy transactions across the MENAT region and in so doing, simplify the process as much as possible and reduce transaction costs at this scale
- Given that there are initiatives already established providing a suite of documents, prepared and under review by a committee of large public and private sector key experts within the industry, it would make sense to include these as part of our Toolkit
- The added benefit of replicating already established practices is that as we reach out to the markets, they will be familiar with these key experts and are more likely to embrace our approach to this standardisation initiative
- The details of this initiative will be included in the Dii Toolkit, giving our stakeholders access for their reference and implementation

Dii Desert Energy Leadership Summit



Dii Energy Storage and Conversion Working Groups

Roland Kaepfner, thyssenkrupp

22nd of October, Dubai

Energy storage and conversion technologies unfold the full potential of renewable energy



Objectives of the future energy system

- **Green!** ecologic and sustainable energy system
- **Cross-Sectoral!** connection with industrial, heat, and transportation value chains
- **Economic!** from both a microeconomic and a macroeconomic perspective

Impact on value chain

Emission reduction

Market for emission free power, gases, liquids & solids

Energy Storage

From seconds to seasons, both on- and off-grid

Energy Conversion

From green electrons to green, transportable chemicals and fuels

Improved matching of availability and demand of green energy

timing and location

Storage and conversion technologies are market ready and will add value to various stakeholders



Industry
lower cost of energy
deliver green products

Consumer
safety of supply
greater well-being

Society
economic growth
creation of jobs

Utilities and TSO
greater flexibility
(CAPEX & Revenues)

Supplier Industry
new products
new markets



Three storage and flexibility related working groups will develop a vision for future value chains



Battery Storage
(Roland Kaepfner / Marc Yacoub)

make storage add value to the entire power system

Integrated Solar Cooling
(Paul van Son)

make cooling the perfect partner of PV

Hydrogen Value Chains
(Frank Wouters)

make green molecules from green electrons

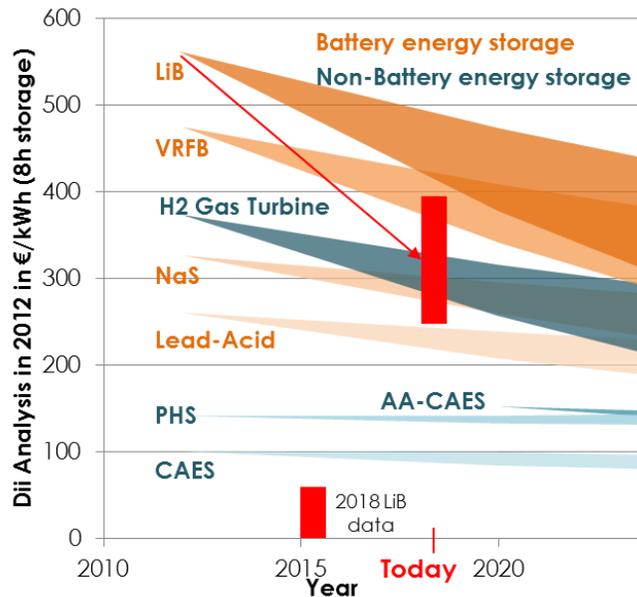
Value chains - Technology costs - System view - Synergies - Business cases
Market potential - Projects implementation - New business opportunities - Market scale-up

Battery Storage

Stabilizing the power grid and balance power supply with batteries



Current Situation



- Cost decrease due to scaled production and technology improvements
- Business cases with growth potential are becoming economic
- First large scale projects deployed

Market Outlook

- High market potential
- Current trends of wind and PV will trigger further market growth
- Further cost decline expected, less regulation for positive business cases required
- Dependent on trends of decarbonization and sustainability

Dii Targets 2019

- Provide a white paper on:
- value add of storage for different stakeholders
 - challenges and hurdles
 - global success stories

LiB: Lithium-ion battery, VRFB: Vanadium redox flow battery, NaS: Sodium sulfur battery, PHS: Pumped hydro storage, (AA)-CAES: (Advanced adiabatic) compressed air energy storage

Integrated Solar Cooling and Cold Storage

The Perfect Partner for PV Power

Present Market

- Cooling demand is often the biggest load component in hot areas (e.g. up to 70% of total power demand in Dubai)
- Cooling demand is putting unnecessary stress on the power grid
- Economy of scale through district cooling, however, optimisation of cooling (and heating) storage along the energy value chain is still very rare
- The cooling market is fragmented and business opportunities often intransparent

Opportunities

- Cooling demand is expected to triple in the MENA region by 2030
- Cooling energy supply, demand and storage offers high unused synergy potential, e.g. in connection with power system supply and demand patterns in particular based on decentralised and centralised PV (with its LCOE < 2 ct/kWh)
- Optimisation of cooling, heat and related storage would serve various purposes, such as offsetting imbalances in the power system

Targets 2019/20

- Assess present practices and experiences
- Gather lessons learnt (MENA)
- Assess market potential for technologies and benefits for system users
- Outline of innovative solutions in the area of cooling and cold storage including its integration in the power system and related energy systems. For example 2 study cases Dubai and Bahrain

Hydrogen Value Chains

Develop local projects, scale market & unleash market potential for global transport chains

Current Situation

- Market is gaining momentum, first positive business cases appear on the horizon
- Early adopters are positioning the market
- Growth of a hydrogen industry along the whole value chain is needed to fulfill climate targets

Outlook

- Market potential is very high (GW scale for individual countries)
- Green Hydrogen is versatile commodity:
 - Store power
 - Decarbonize heat, transport and chemicals
- Countries with cheap renewable energy will be exporters of hydrogen or tail products
- Global transport chains emerge on basis of locally grown markets

Targets 2019

- Understand value chains (markets, costs, business cases)
- Development of local projects
- Support development of global transport value chains

Oct. 2017
Bids for 300 MW solar plant in Saudi Arabia between 1,8 and 3,4 \$ct/kWh

Sep. 2018
Tata Steel and Dow invest in green chemicals

Sep. 2018:
thyssenkrupp inaugurates Carbon2Chem

Japan:
Deployment of hydrogen applications for the Olympic games 2020. Supply chain from Australia by 2025.

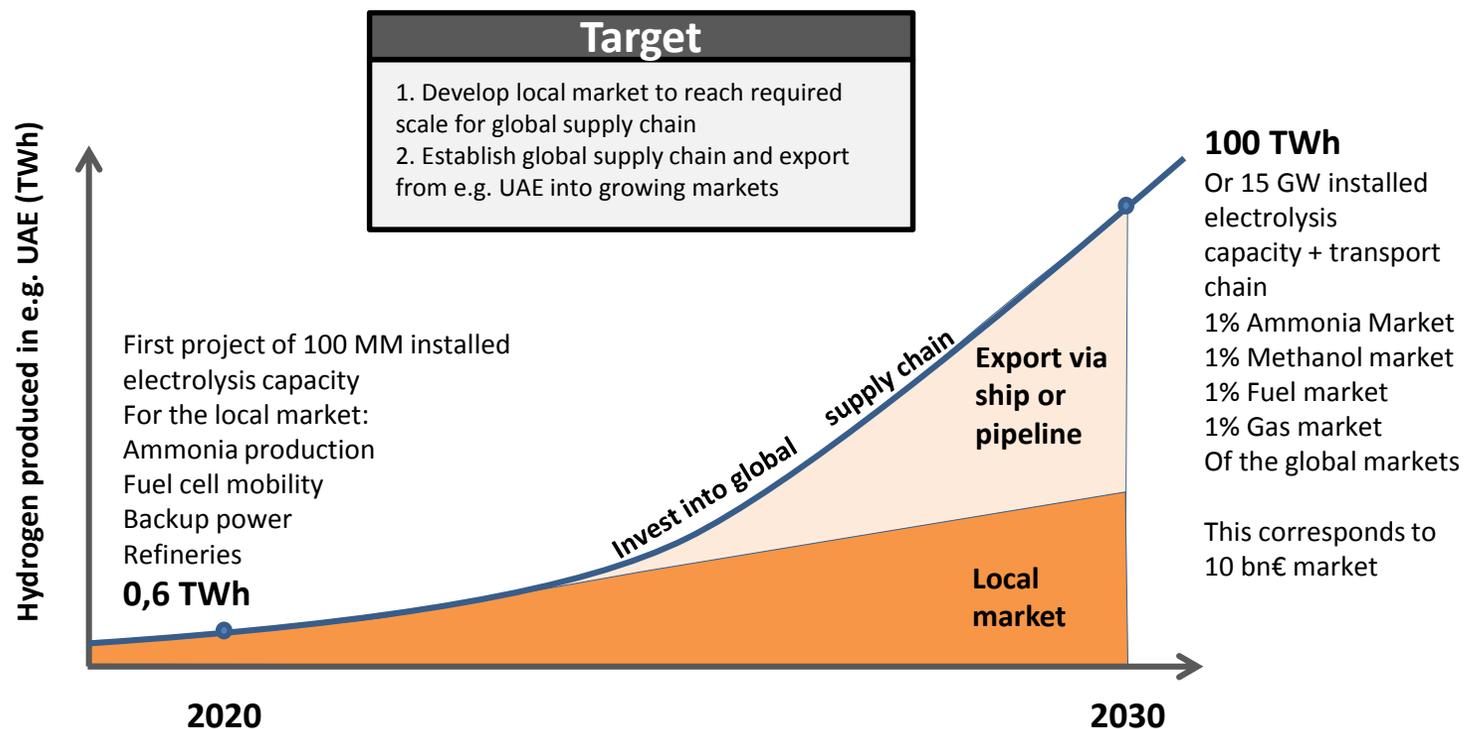
Cost development:
H2 from electrolysis is expected to become cost competitive to SMR+CCS.

May 2018:
Alstom set to make hydrogen fleet in the UK

Oct. 2018:
Gasunie, Tennet and Thyssengas announce 100MW electrolyser

Hydrogen: Initiating and Scaling Up

1. Global hydrogen supply chain



2. Hydrogen Master Plan Dubai South

