

KINGDOM OF MOROCCO Ministry of Energy, Mines and Environment



# POWER-TO-X IN DOWNER OF MEDICE AND A CONTRACT OF MEDICE AND A CONTRACT

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# WHAT ARE POWERFUELS ?

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# What is Power-to-X ?

Renewables

#### POWERFUELS

- are synthetic gaseous or liquid fuels based on (green) electricity
- can deliver energy or basic materials for many use cases
- are an alternative to fossil fuels to avoid CO<sub>2</sub> emissions





## **Basic Scheme of Power-to-X Economy**



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# Power-to-X at the heart of a circular economy





#### Green Hydrogen and Green Ammonia Value Chain





#### Costs of generating renewable electricity as fundamental driver of synthetic fuel costs

**Renewable Energy Recent Biding Prices** 





# WHY NOROCCO?

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# **Renewable Energies Potential in EU-MENA**

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# **Exceptional REN Technical Potential**



	Photovoltaic (PV)	Wind Onshore	Wind Offshore
Technical Potential (TWh)	49 000	11 500	2 250
Technical Potential (GW)	20 000	6 000	500
5% of the Tech. Pot. (GW)	1 000	300	25



# **Morocco Local Context**

#### **HIGH REN. POTENTIAL**



#### SUCCESSFUL DEPLOY. OF REN.



#### **STRONG POLITICAL SUPPORT &** INTERNATIONAL PARTNERSHIP



#### **INVOLVMENT OF THE INDUSTRY AND** THE PRIVATE SECTOR

**GROWING R&D INFRASTRUCTURE AND CAPACITY BUILDING** 



#### **STRONG PROXIMITY + MARITIME & GAS CONNECTIVITY WITH EU**





# Power-To-X in Morocco: Studies and Roadmap

2 Preliminary Studies conducted in 2018 on  $\ll$  Power-To-X in Morocco  $\gg$ 





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**MOROCCO'S PTX** 

**2050 ROADMAP** 



**MARKET &** 

TECHNOLOGIES

**Key-Words** Electrolysis, Green Hydrogen & Ammonia

With

Fraunhofer

**Key-Words** Key-Words: PtX Potential, Grid, Infrastructure, Impact, Exports

**OPPORTUNITIES &** 

POTENTIAL FOR MOROCCO

**Creation of a National Commission for Powerto-X** by the Moroccan Energy Minister on Feb. 11th, 2019

3rd more in-depth study is launched assess R&D. to Innovation and Industrial opportunities for Morocco. of the **Evaluation** socioeconomic impact of the PtX Focus the economy, on environmental impact of the PtX industry, Elaborate a sectorial Roadmap for PtX in Morocco 2050

\*

**MOROCCO-GERMANY ALLIANCE** Morocco's ambassador to Germany, Zohour ALAOUI, signed an agreement with German Federal Minister for Economic Cooperation and Development, Gerd MÜLLER, in a landmark agreement that is set to transform the country's renewable energy sector.

COMMISSION



## From Small Scale to Industrial Scalle R&D

#### TRL 1 - 3

Test ranges: 1W - 1kW 1g - 1kg Short Term

#### TRL 4 - 7

Test ranges: ~1MW ~1 tpd Short Term

#### TRL 8 - 9

Test ranges: ~10MW - +100MW ~100 tpd - +1000 tpd Mid to Long Term





## Export Potential for PtX Products: Morocco Joins a Restricted Club



- Morocco Identified and Short-listed among 6 Countries as a "Front Runner" Potential for the "Power-To-X" Sector
- Main advantages:
  - Renewable Potential (Combined: wind and solar),
  - Leadership in Energy transition and
  - Geographic proximity to Europe
- Morocco will be able to capture up to 4-8% of the global 'Power to X' market

≈ 100 - 400 Md€ 💽

ed



## PtX Market Domestic and Export Opportunities

**Domestic demand for PtX as a raw material for industry** and **Exports** are the sectors where the industry could start to develop.





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Distance in such

# RESEARCH & INNOVATION

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MAL SHARE

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# **R&D Infrastructures Network**

With almost \$50M already dedicated for R&D in Morocco, IRESEN is also setting the most important network of platforms in the field of Research and Innovation in Africa





The aim of this platform is to stimulate the use of green raw materials in

n part

Creening and so support our country in achieving its goal of reducing greenhouseR&D & INNOVATION42%TECHNNOLOGICALg R&TRAINING &SUPPORTSUPPORTCAPACITY BUILDING





## DEVELOPMENT OF A NEW TECHNOLOGICAL ECOSYSTEM BASED ON GREEN MOLECULES









# CARBON

#### RENEWABLE ENERGY HYBRIDIZATION

Increase the load factor of renewable electricity to run the electrolyzes

#### HYDROGEN PRODUCTION, TRANSPORT & STORAGE

Comparing at different scales PEM, Alkaline and SOEC High Temperature Electrolysis

#### GREEN CHEMISTRY

Focus on green molecules: ammonia, methanol and synthetic fuels

#### CARBON CAPTURE STORAGE AND UTILIZATION

Investigate the various CO<sub>2</sub> capture techniques and their applicability to the national context

#### MOBILITY ON HYDROGEN

Foster green mobility solutions based on powerfuels for public transport and heavyduty vehicles (mining...)





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« Water Splitting» Platform	(Oxy-) Combustion Platform: Mobility & Electricity Production (Hydrogen, Ammonia, eFuels, etc.)		Hydrogen Refueling Station
<b>Green Ammonia</b> Platform	<b>Green Methanol</b> Platform	<b>PtL Platform:</b> Carbon Capture / Fischer Tropsh / Refining	MAIN BUILDING
Multi-Technology Electrolyses Platform (Alcalin, PEM, SOEC, etc.)			& Offices
		RAL MARSAN	

# **Laboratories**

entrale Thermique Jorf Lasfar





# New model of Energy partnerships





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#### SAVE THE DATE **1-3 DECEMBER 2020** MARRAKECH - MOROCCO

The World Power-to-X Summit 2020



www.worldptxsummit.com

The World Power-to-X Summit 2020 is a must-attend event to witness the start of a new clean energy era. A cross road for policy-makers, industry leaders, research experts and global innovators to discuss PtX opportunities and challenges.

**GUEST COUNTRY GERMANY** 

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**THANK YOU** for your kind attention

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