

Green Hydrogen in Morocco

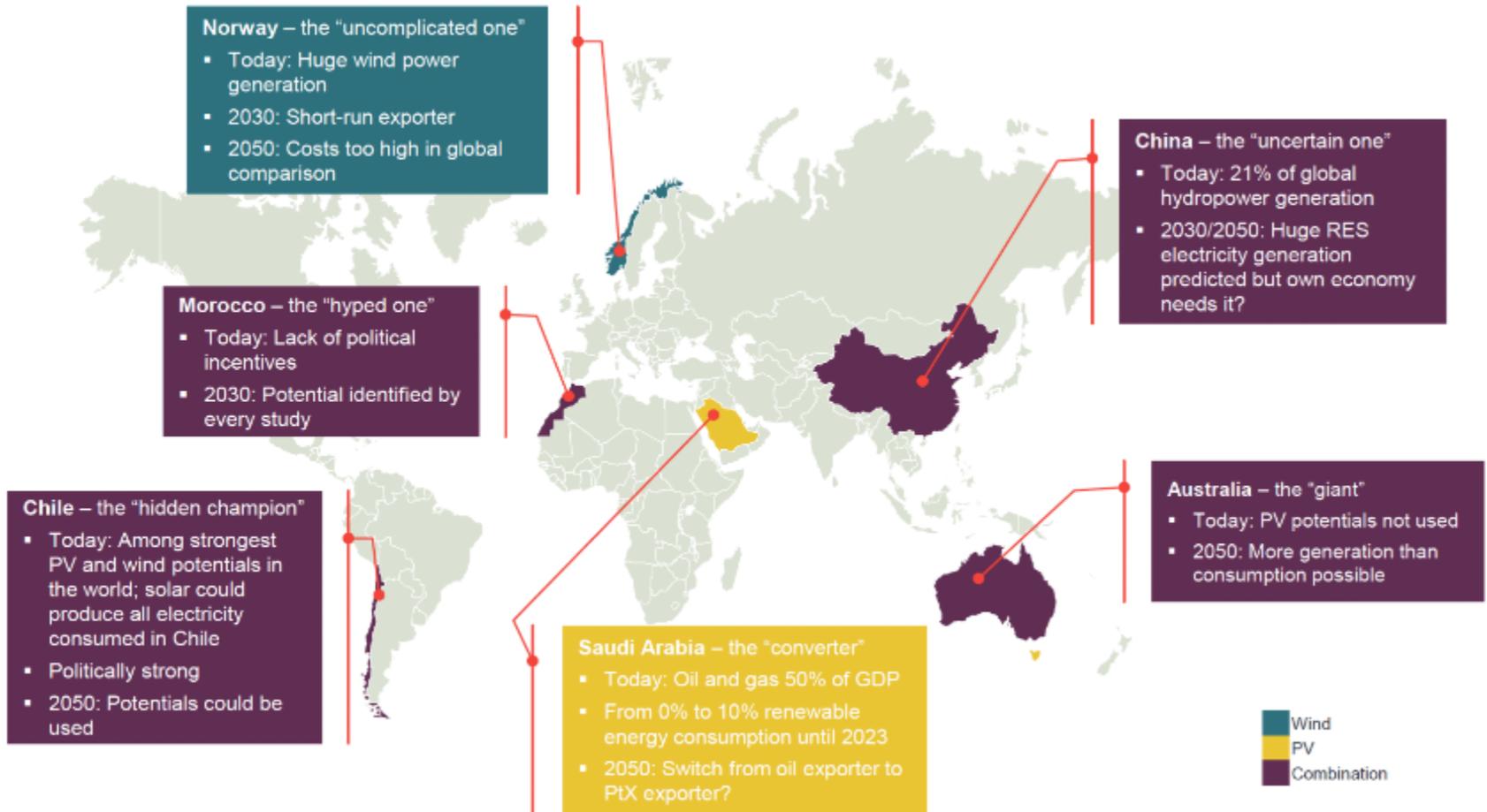
“Green hydrogen Ports - From policy to practice”

Tuesday, April 25th, 2023



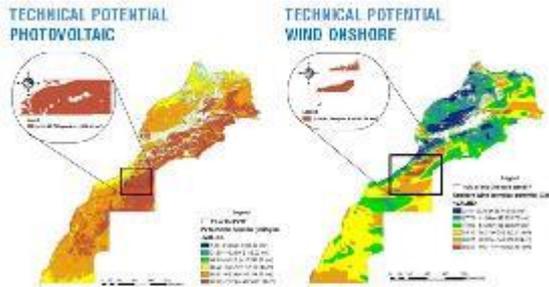
Export Potential for PtX products: Frontrunner position

Source : World Energy Council Germany, Frontier Economics 2018 Study
Fraunhofer ISI, Etude Opportunités PtX pour le Maroc, 2019



Moroccan Positive Context

HIGH REN.



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

STRONG POLITICAL SUPPORT & INTERNATIONAL PARTNERSHIP



SUCCESSFUL DEPLOY. OF REN



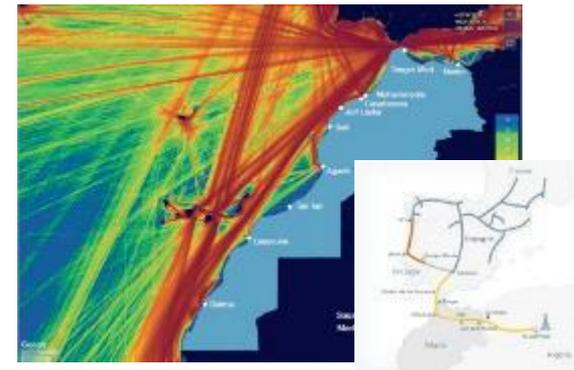
GROWING R&D INFRASTRUCTURE AND CAPACITY BUILDING



INVOLVEMENT OF THE INDUSTRY AND THE PRIVATE SECTOR



STRONG PROXIMITY + MARITIME & GAS CONNECTIVITY WITH EU



Green Hydrogen in Morocco: First Steps, Initiatives & Drivers

3 important studies conducted since 2018 on « H2 - Power to X in Morocco »



Market & Technologies



Keywords: Electrolysis, Green Hydrogen, Ammonia



Morocco Potential and Opportunities



Keywords: H2/PtX potential, Grid, Infrastructures, Impact, Exports



Morocco's PtX Roadmap 2050



Keywords: R&D, Innovation and Industrial opportunities



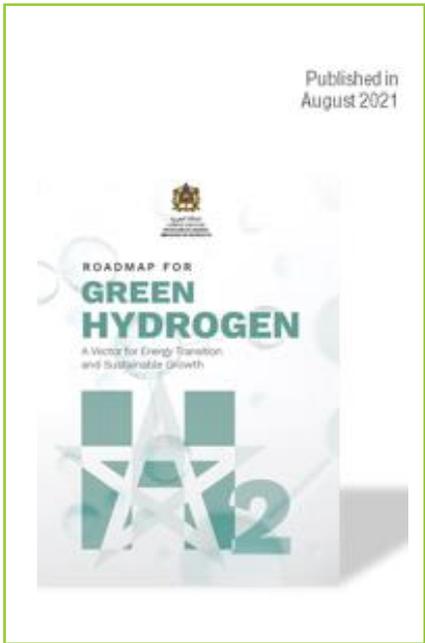
National Green H2 strategy



Creation of the National Hydrogen Commission by the Moroccan Energy Ministry in 2019



Creation of the Green Hydrogen Cluster







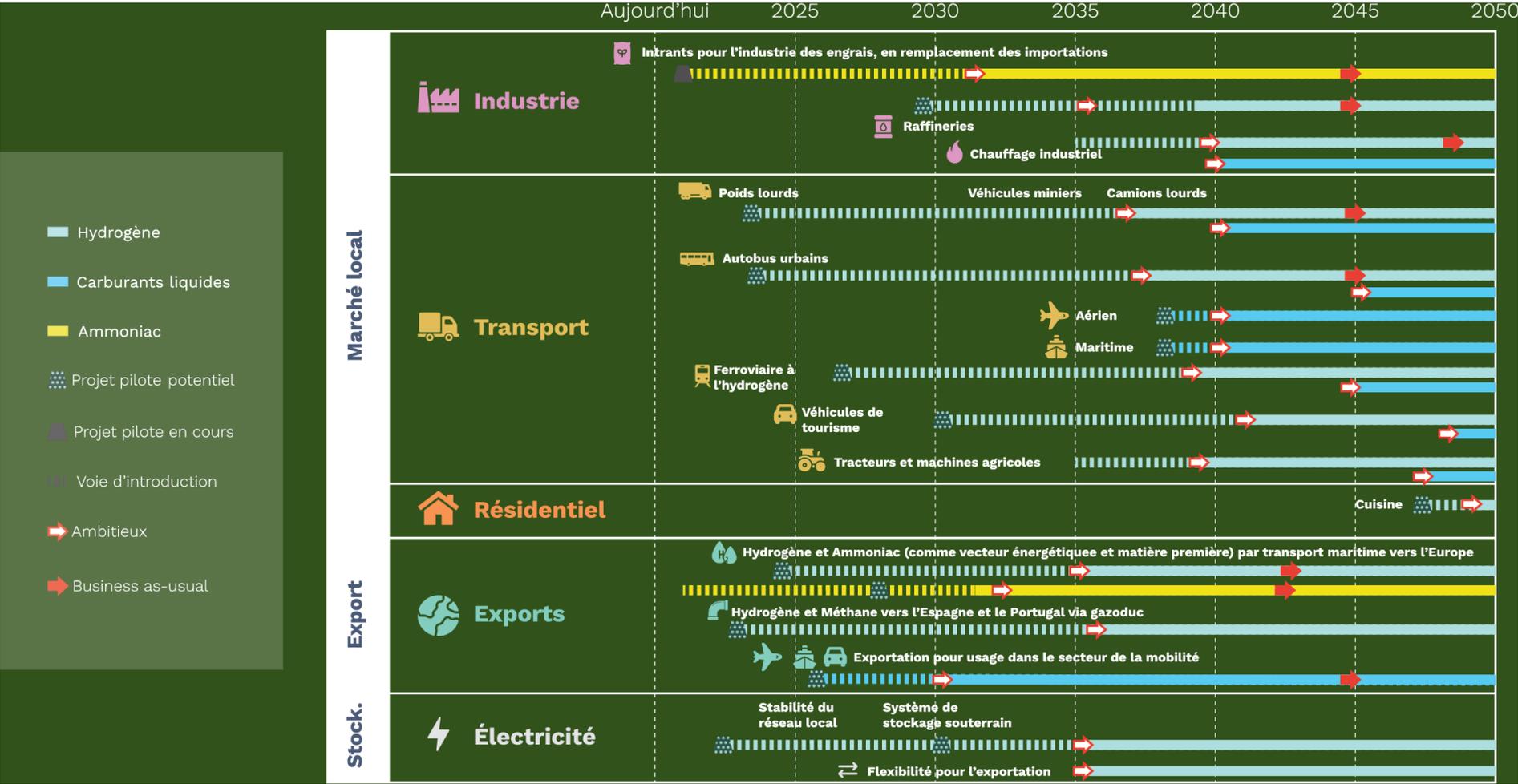
- Morocco signed an agreement with Germany in June 2020, to develop a regional market PtX
- Morocco signed an MOU with European Union to establish a Green Partnership on October 18, 2022, in Rabat





Royal instructions
The Sovereign has given his instructions for the development of a Moroccan offer covering the entire green Hydrogen value chain on November 22, 2022, in Rabat

Market Opportunities & Applications



Green Hydrogen in Morocco: Roadmap

Sustainable framework to develop the PtX industry in Morocco & Action Plan



- 1 **Facilitating costs reduction** along the PtX value chain.
- 2 **R&D: Setting-up a Moroccan and international research cluster.**
- 3 **Defining the relevant measures for local content.**
- 4 **Setting-up an industry cluster and develop related infrastructure masterplan.**
- 5 **Securing financing** to developing the PtX industry.
- 6 **Creating the conditions for exporting PtX products** from Morocco.
- 7 **Assessing in detail a storage plan** for the electricity sector.
- 8 **Developing domestic markets.**

Green Hydrogen in Morocco: Green Hydrogen Cluster



The main object of the GreenH2 Cluster is to promote the hydrogen sector in Morocco through the initiation, support and coordination of innovative collaborative projects in the field of green hydrogen in the Kingdom of Morocco and abroad, in order to encourage innovation and contributing to the emergence of a competitive hydrogen sector.



Strengthen the technical and technological capacities of national players to produce, use and enhance hydrogen



Develop innovation in the hydrogen sector



Supporting national industries



Support the National Hydrogen Commission in creating a regulatory and incentive framework for the development of the hydrogen industry



Encourage and develop the production of hydrogen in Morocco



Contribute to the promotion of Moroccan hydrogen on a regional and international scale



Kingdom of Morocco
Ministry of Energy, Mines and Environment



Kingdom of Morocco
Ministry of Industry, Commerce and Green and Digital Economy



Kingdom of Morocco
Ministry of National Education, Vocational Training, Higher Education and Scientific Research



Kingdom of Morocco
Ministry of Equipment, Transport



Members of the GreenH2 cluster

For more info & to Join:
<http://www.greenh2.ma/>



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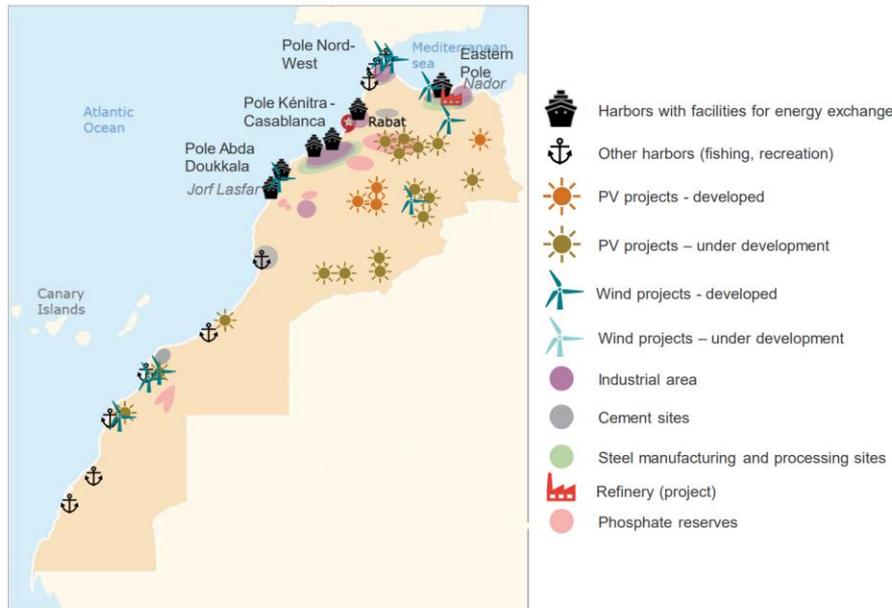
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Green Hydrogen in Morocco: Roadmap - Infrastructure

Set up an Industry Cluster & develop related infrastructure masterplan

Location of renewable energy sources, industry and ports



Source: Frontier Economics based on Masen (2020) for RES deployment, the Ministry of Industry (2020) for industry location, Ministry of Transport (2011) for harbours, Ayad, A. et al. (2019) for phosphate reserves and CemNet (n.d.) for cement sites.

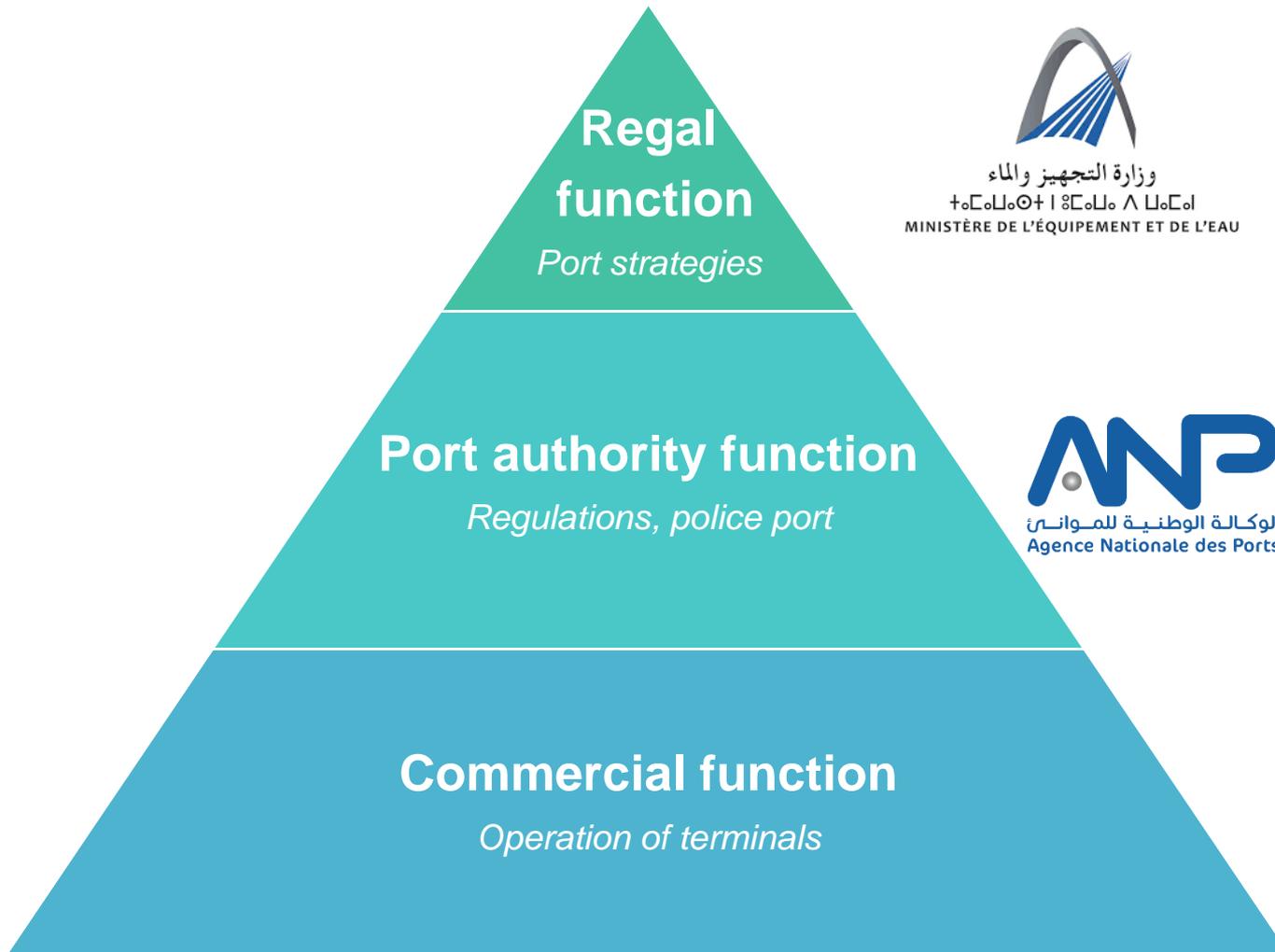
- The locational array of the PtX industry strongly determines infrastructure requirements and associated costs.
- Developing the industry in clusters may enable synergies in the use of infrastructure and lead to cost savings.
- Four options appear possible for Morocco:

| Cluster | Drivers of cost differences | | | | | |
|-------------------------------|-----------------------------|-----------------|------------------|----------------------|-----------------|--|
| | RES-E generation | RES-E transport | Carbon procureme | Pt Hydrogen pipeline | Harbor adaption | |
| South-South | | | | | | |
| South-North (via H2) | | | | | | |
| South-North (via electricity) | | | | | | |
| North-North | | | | | | |

Recommended actions (short term)

- Conducting technical and cost studies to choose the cluster (or clusters) and its **related infrastructure**.
- Including PtX in “**Special Economic Zones**” (SEZ), define its legal framework and market design
- **Assessing grid needs** and lead the dialogue on PtX grid access terms

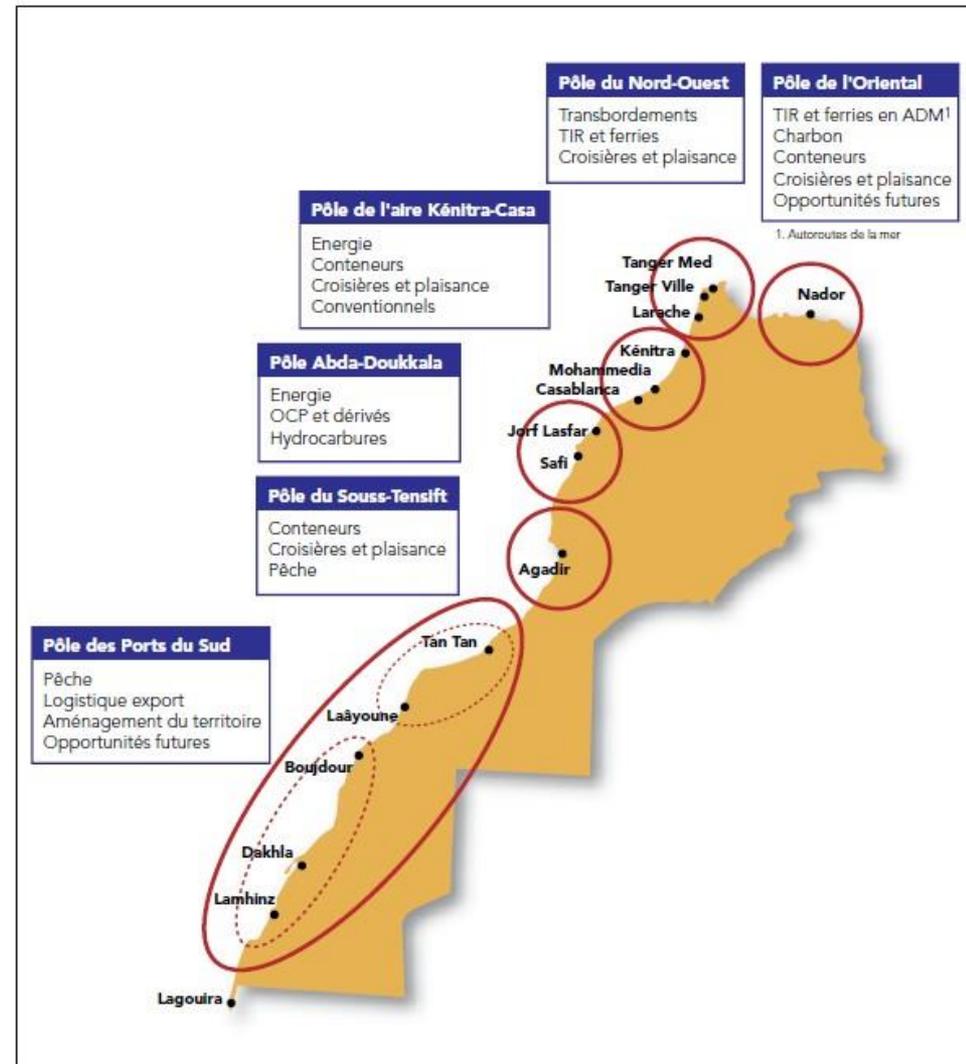
Ports in Morocco: Organizational chart



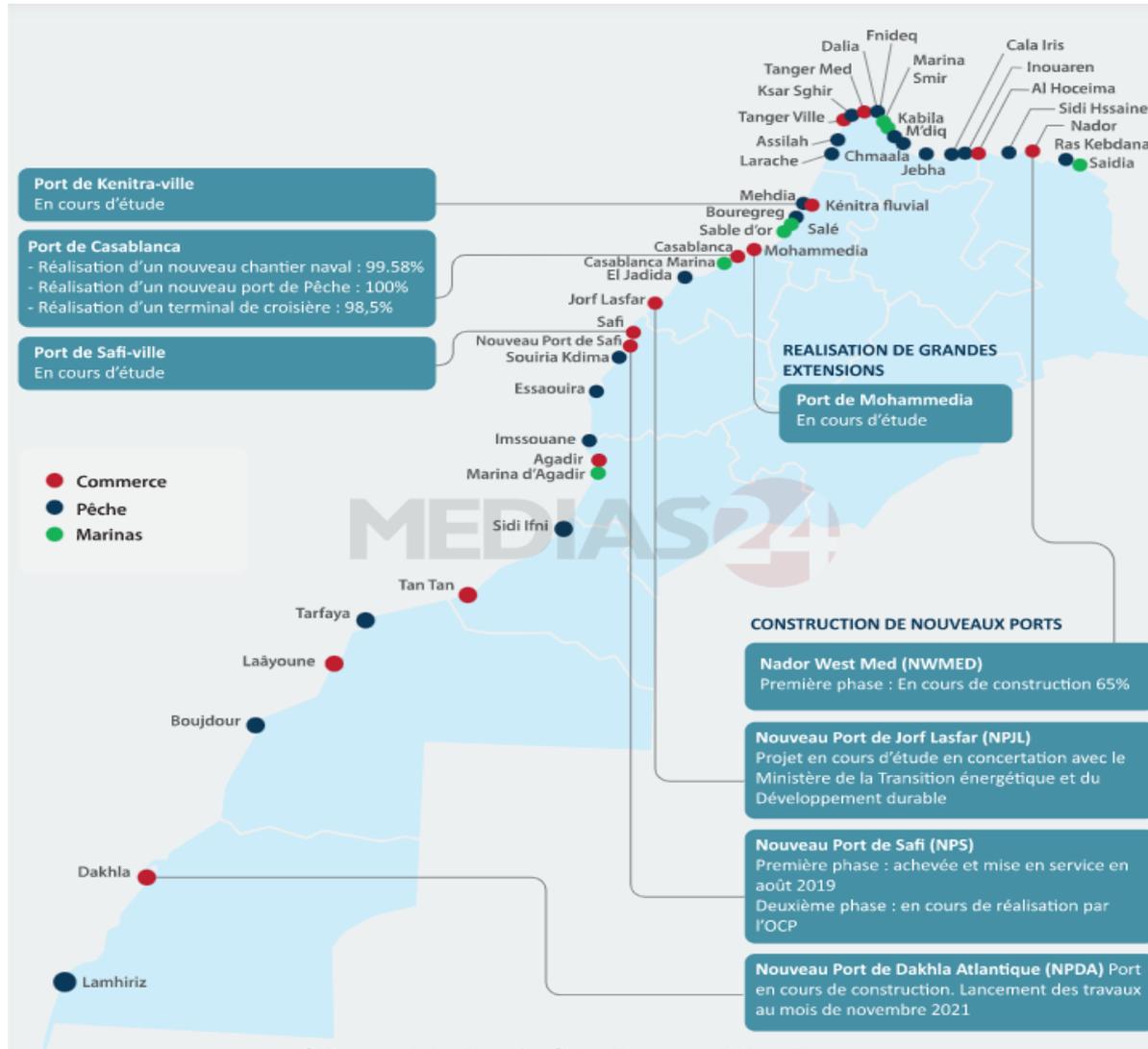
Ports in Morocco Hub strategy

Today, several key factors promise strong growth in port demand:

- The national and sectoral policies that are being implemented, intended to contribute to the economic and social development of the country.
- Valuing the proximity of Europe which offers potential for business development nearshoring: industrial relocations and/or local logistics.
- The development of the Hub concept (containers, bulk) and a larger opening of the Moroccan economy internationally (towards the American continent, the Maghreb and the basin Mediterranean...) could offer many national or external opportunities, requiring heavy investments and reservation space for port development.



Ports in Morocco Existing infrastructure



Green Hydrogen In Morocco: Key Drivers

- Morocco has a **strong potential** to produce **competitive Clean Hydrogen & Molecules**
- Morocco is preparing a **positive ground** for **doing business** in « **Power-To-X** »
 - Preliminary Studies
 - National Commission on Green Hydrogen (mainly public sector)
 - Country's Roadmap published
 - Green Hydrogen Cluster (mainly private sector)
 - Further indepth studies to be launched, with priority on:
 - Markets Perspectives,
 - Regulation Aspects,
 - Infrastructure Masterplan
- Key Drivers:
 - **Exports**
 - Domestic **Economy Decarbonization**
 - **Co-Localization** of **PtX Industry** and **Innovation**
- Ongoing R&D-Innovation, Demonstration and Capacity Building Activities → Green H2A Platform
- Involvement in international collaboration schemes and frameworks on Hydrogen

**Thank you for your
attention!!**

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