From Green Electrons to Green Molecules

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3rd Session. Synergies in Energy: Exploring Potential for Cooperation and Investment Opportunities between Greece and the Arab Countries

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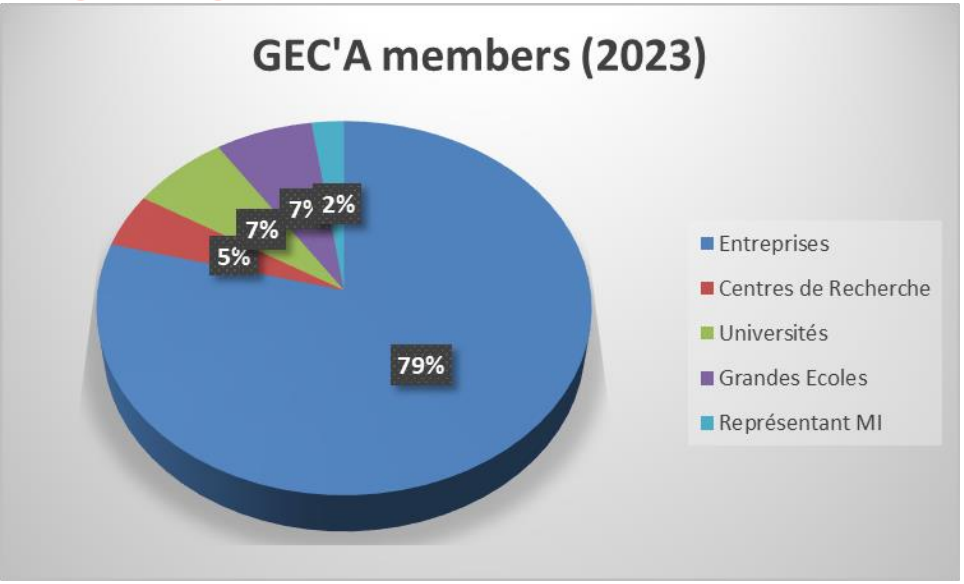
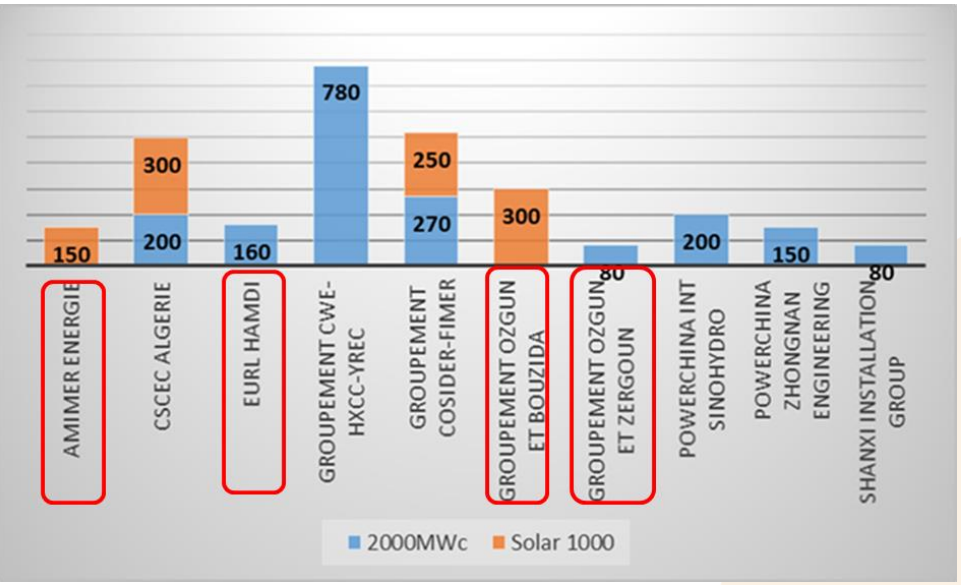
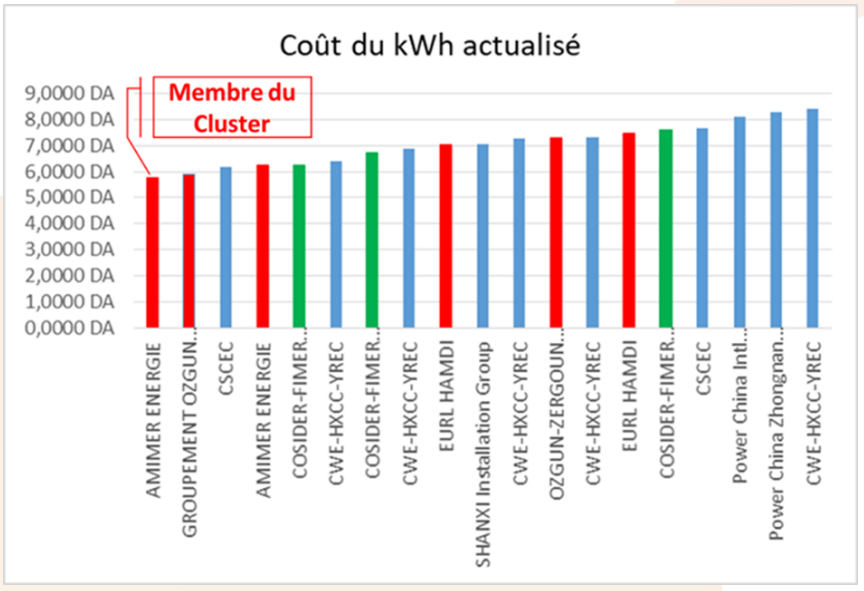
Agenda

- Diversity and strong implication in RE program
- Elements that will shape the energy future of Algeria
- Renewable Energy Program
- Green Hydrogen Roadmap
- Opportunities
- Key messages

Diversity and strong implication in RE program



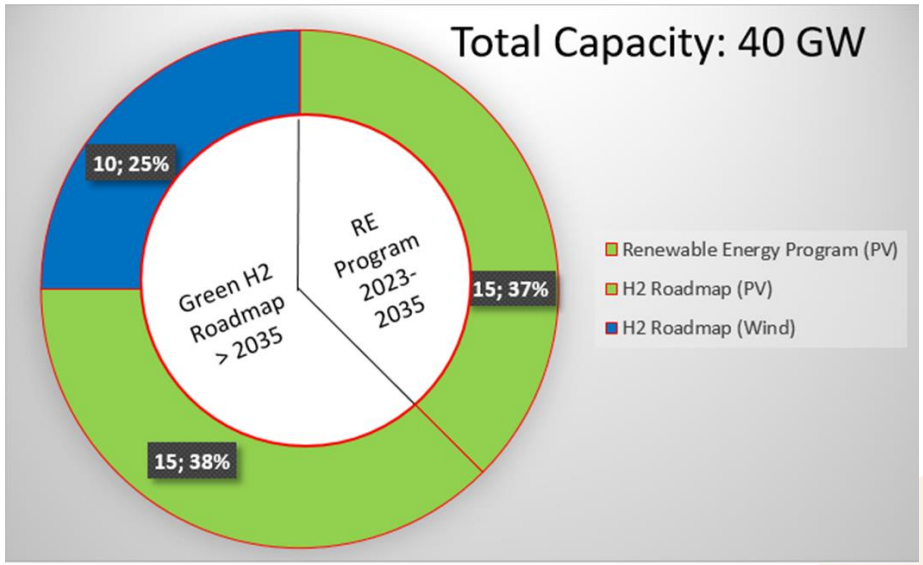


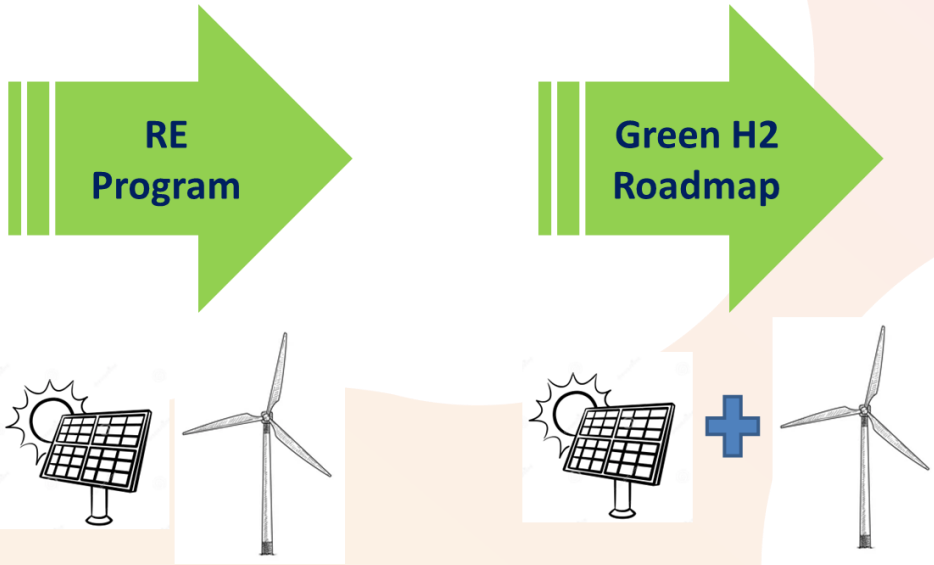


Elements that will shape the energy future of Algeria

40 GW to be implemented in 2 programs

- 40 GW capacity to be installed (75% solar PV, 25% wind)
- 2 periods: 2023 to 2035 and 2035-2040
- Main technology to be installed: Solar PV





- Learning by doing and
- Developing manufacturing capability in solar PV and deploying a continous program during years will generate a competitive green electricity at regional level.

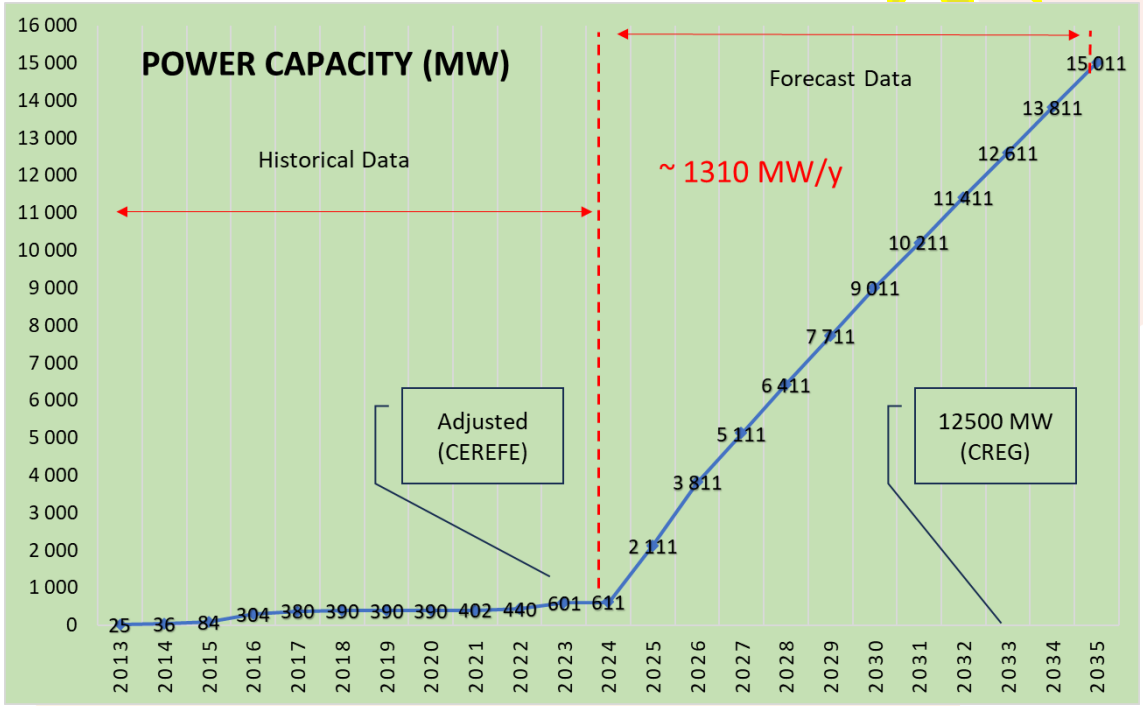
Renewable Energy Program (15 GW by 2035)

Algerian Renewable Energy Program: Sonelgaz will deploy 15000 MW

Green Electrons

Key elements:

- Deploying the entire program before 2035;
- Connecting RE power plants to the RIN Network (north of Algeria) and the PIAT Network (South of Algeria);
- Hybridization of isolated power plant will be reinforced mainly in RGS networks;
- Saving between 6 and 8 billions cubic meters of Natural Gas when the program will be fully deployed;



- **At first rounds, EPC model is previleged.**
- **Next rounds will be opened to new business models (EPC+F, IPP, CPPA)**

Renewable Energy Program (15 GW by 2035)

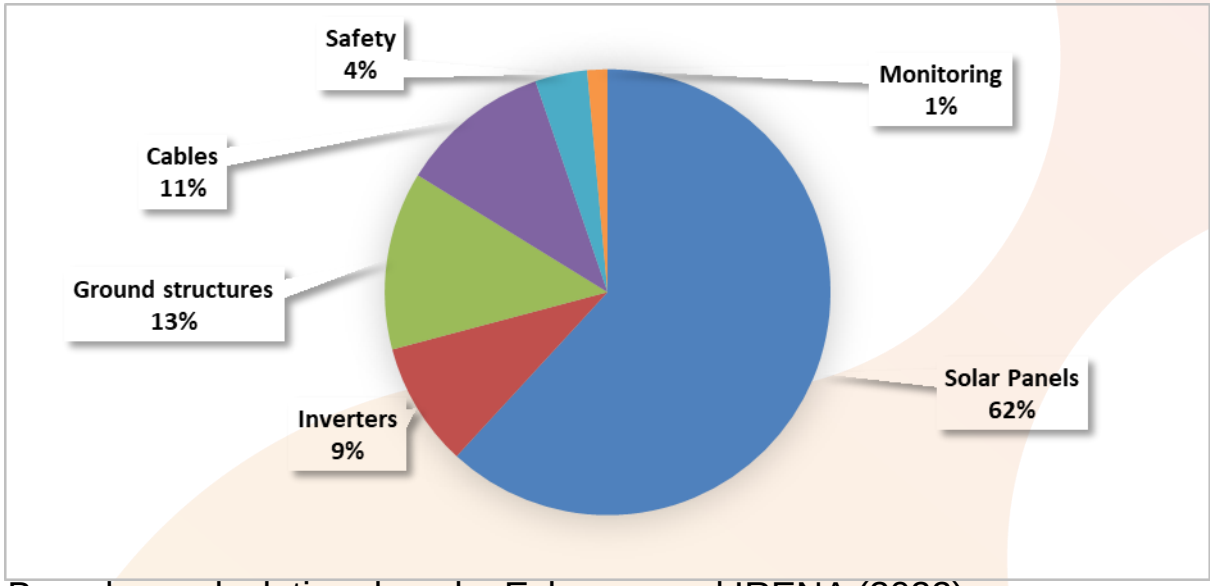
First rounds launched in 2023: 3200 MWp solar PV technology

A tender process with least price offer

- 2 rounds: 1920 MWp + 1000 MWp organized in less than 12 months by Sonelgaz (2023)
- 19 utility-scale solar PV power plant (from 50MWp to 300MWp)
- Local Content Requirement: **A minimum of 35%.** → **In Practice 54%**

Results

- The emergence of local companies (alone or in partnership) with 1210 MWc (41% of the total) of capacity gained.
- Chinese companies with 1710 MWc (59% of the total)
- The average cost of the electricity is 7.041DA (5 US cents/kWh)



Based on calculation done by Eclareon and IRENA (2022)

Updated (09/2024)

CAPEX: 584kUS$ - 892kUS$/MWp

- 1x80 MWp + 1 large hybrid PV-storage (200 MW / 30 MWh) results announced in Sept 2024.
- 80 MWp: LCOE = 6,4279 DA/kWh (~4,778 cUS/kWh) . -8.7% y/y
- 200 MWp: LCOE = 10,4873 DA/kWh (~7,796 cUS$/kWh)

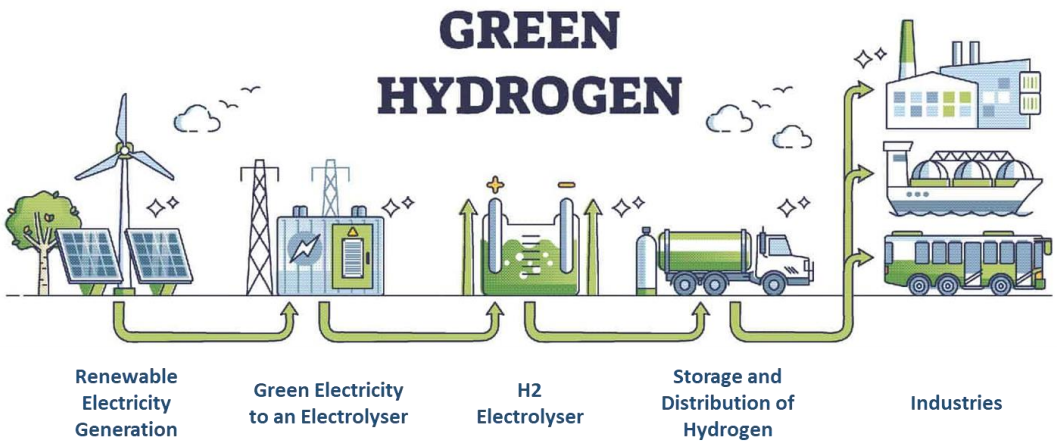
Green Hydrogen Roadmap (25 GW from 2035)

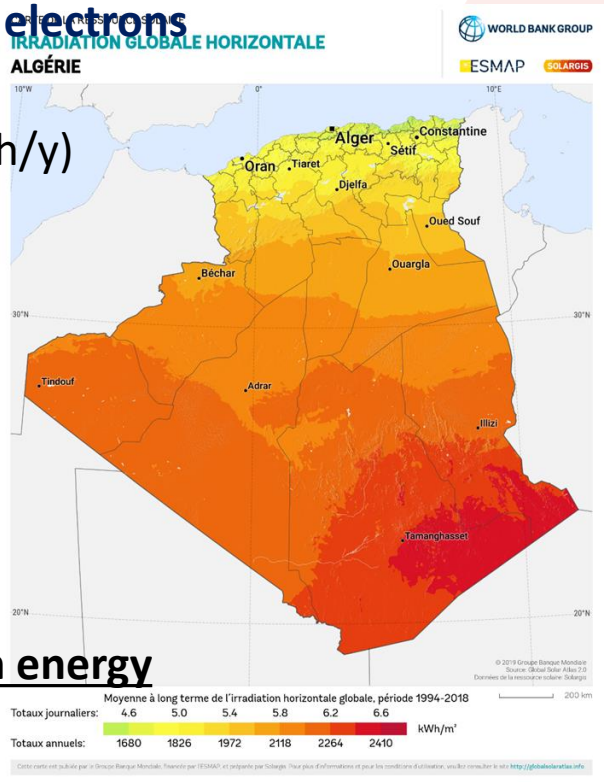
ALGERIA GREEN ENERGY CLUSTER

Huge Potential and competitive cost of green electrons

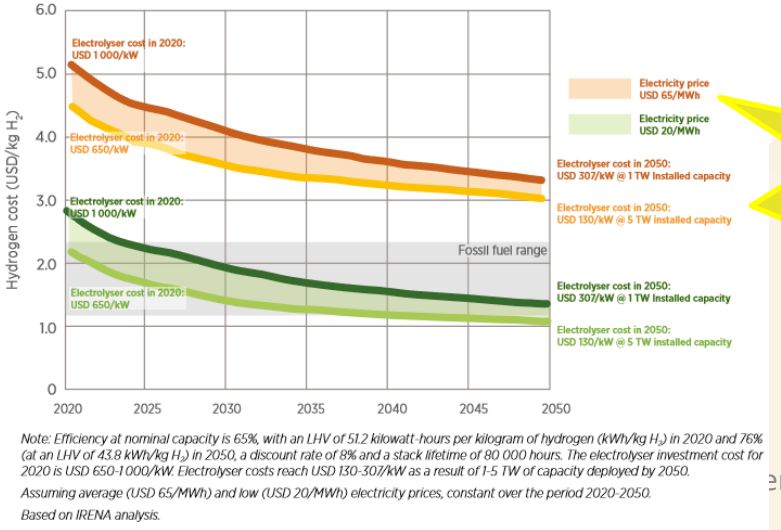
1) **Huge solar radiation in Algeria**. Around 169.000 TWh/y

2) **Wind onshore ressources.** One of the best in Africa (24.900 TWh/y)





3) **The cost of Green H2 (US$/kg) is impacted by the cost of green energy**

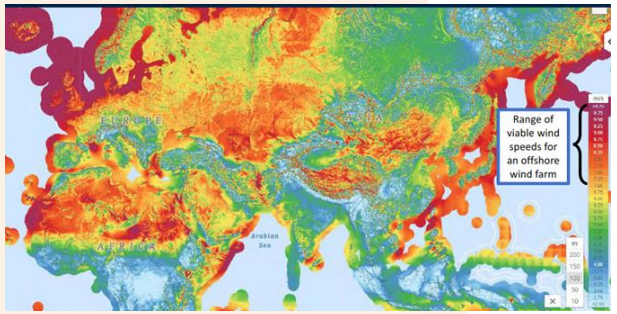


Note: Efficiency at nominal capacity is 65%, with an LHV of 51.2 kilowatt-hours per kilogram of hydrogen (kWh/kg H_2) in 2020 and 76% (at an LHV of 43.8 kWh/kg H_2) in 2050, a discount rate of 8% and a stack lifetime of 80 000 hours. The electrolyser investment cost for 2020 is USD 650-1 000/kW. Electrolyser costs reach USD 130-307/kW as a result of 1-5 TW of capacity deployed by 2050.

Assuming average (USD 65/MWh) and low (USD 20/MWh) electricity prices, constant over the period 2020-2050.

Based on IRENA analysis.

Green Molecules

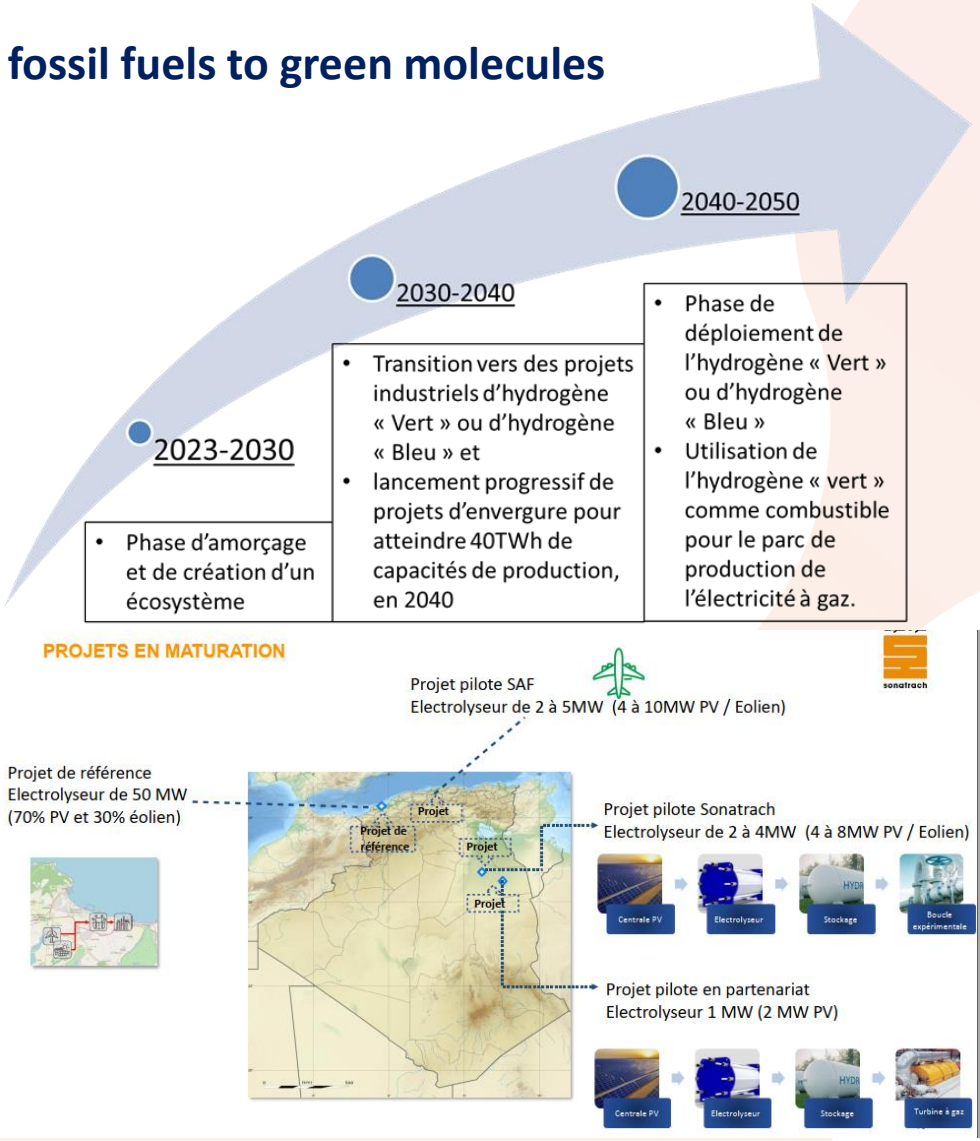


Green Hydrogen Roadmap (25 GW from 2035)

H2 Algerian Roadmap : from fossil fuels to green molecules

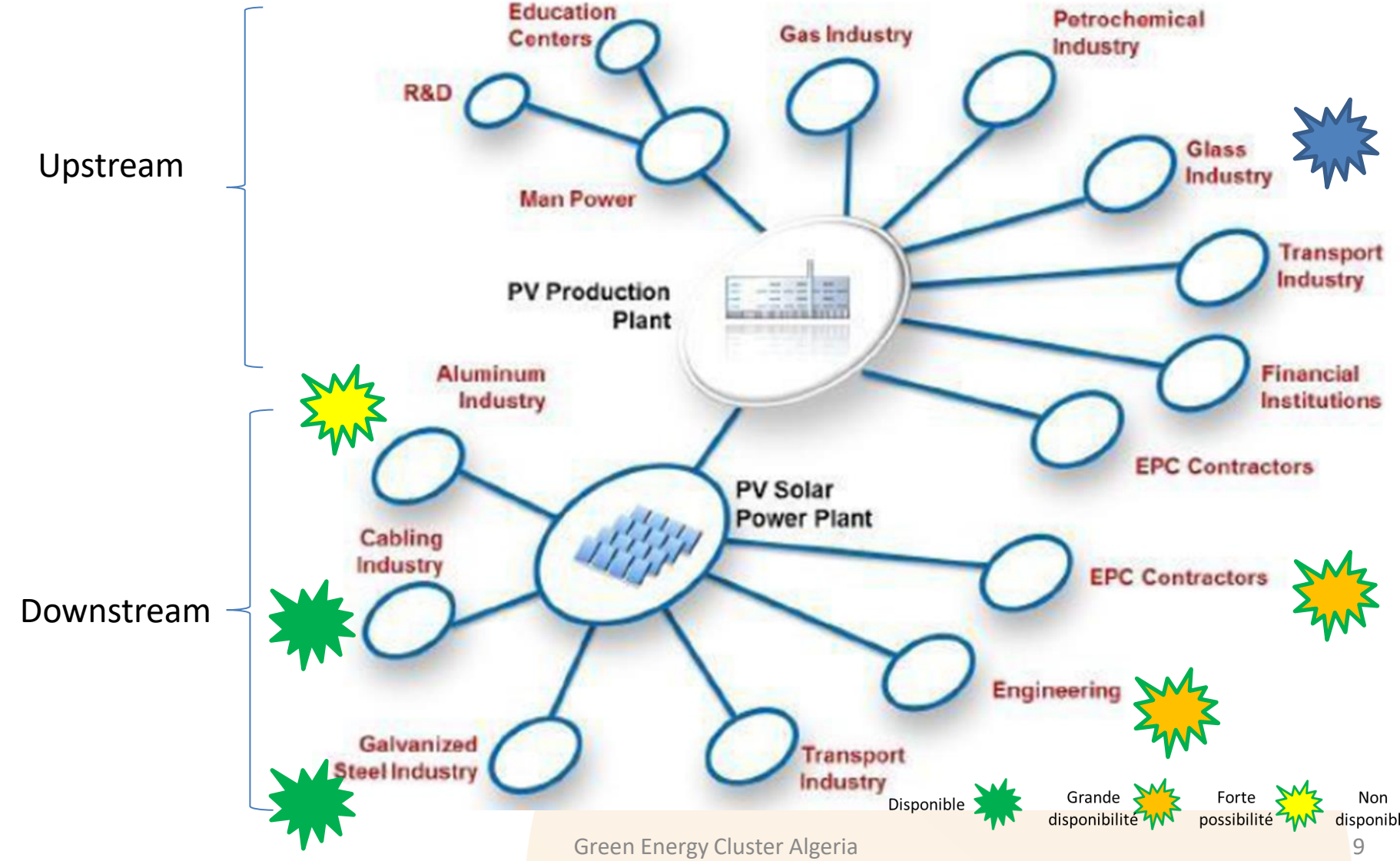
The Algerian roadmap for the development of a hydrogen sector in Algeria. Main actions:

- Establishment of a regulatory framework governing all activities related to the production, storage,
- transport and use of hydrogen;**Development of human ressources**;
- Implementation of measures to ensure **industrial integration** (services, studies and procurement & inputs and equipment, etc.);
- Implementation of **financing mechanisms** and appropriate incentive measures;
- Development of **international cooperation**, **technology transfer** and **technical assistance**;
- Deployment of the Hydrogen sector;



Source: Sonatrach, Vers une économie de l'hydrogène vert - CIC - 24 Juin 2024

Opportunities in Algeria



Key messages

1) Algeria's commitment to the Paris Agreement aimed at decarbonizing the national economy
   - ❑ Algeria's commitments up to 7% (own effort) and 22% (with the support of the international community)
   - ❑ Renewable Energy Program (15000 MW by 2035), Energy Efficiency (-10% of energy consumption by 2030) and Green Hydrogen Roadmap for different users (local economy and export) from 2035 will ensure energy transition of the country and the development of green economy.

2) Offering a competitive green electricity at regional level
   - ❑ Saving natural gas to supply EU economy
   - ❑ Facilitating FDI to Algeria mainly for RE100+ companies
   - ❑ Transforming green electricity (electrons) to green hydrogen (molecules) in Algeria serving local and regional markets

3) Revitalization of the national economy
   - ❑ A new regulatory investment framework including RE investment (national/international)
   - ❑ A review of regulation related to electricity and gas transportation (on-going)
   - ❑ A PPP law is in an advanced stage
   - ❑ A sustained effort to move towards economic diversification & export
   - ❑ Perceptible results in export diversification
   - ❑ Priority to the local content regime

4) Green Energy Cluster Algeria, an energy transition player
   - ❑ Building strong relationships
   - ❑ Acting in favor of partnership