

# Hydrogen A renewable energy perspective



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- Inter-governmental agency established in 2011
- Headquarters in Abu Dhabi, UAE
- IRENA Innovation and Technology Centre Bonn, Germany
- Permanent Observer to the United Nations New York





Mandate: Assist countries to accelerate renewable energy deployment

## Hydrogen in the energy transition



# *"Hydrogen and electricity, as energy carriers, are complementary in a world dominated by renewable energy"*

Hydrogen:
A Renewable Energy
Perspective (2019)



 Hydrogen from Renewable
Power: Technology Outlook for the Energy Transition (2018)





- Renewable-sourced hydrogen (green hydrogen) a key low-carbon solution
- Green-hydrogen production ramping up fast in size and volume
- New opportunity to accelerate renewable power deployment
- New hydrogen commodity trade opportunities

## **Context: the Global Energy Transformation**



- ✓ Paris Agreement: Average global temperature to "well below 2 degrees"
- No economically-viable options to decarbonize one third of energy-related emissions (mostly from the energy-intensive industry sectors and freight transport).
- Hydrogen could be the "missing link": supply renewable energy to sectors for which electrification is otherwise difficult, such as transport, industry and processes that require high-grade heat





Annual energy-related CO2 emissions, 2010-2050 (Gt/yr)

Source of hydrogen – today and 2050 A shift to clean hydrogen with a key role for green hydrogen



#### Today:

About 14 EJ hydrogen produced mainly from fossil source - green and blue hydrogen production is negligible

### 2050:

Two-thirds of hydrogen produced could come from green hydrogen

Demonstration projects with electrolysis – with increasingly large sizes (> 50 MW)



#### Hydrogen and electricity, as energy carriers, are complementary in a world dominated by renewable energy

- ✓ Decarbonising Transport:
  - ✓ FCEVs: performances of conventional vehicles
  - ✓ FCEVs are complementary to BEVs in decarbonising road transport
  - ✓ FC/E-fuels for rail, aviation, maritime sector (deep decarbonization)
- ✓ Decarbonising Industry:
  - ✓ Replace fossil-fuel produced hydrogen
  - ✓ Replace fossil-fuel based feedstocks
  - ✓ New commodities e.g. iron pellets (DRI)



Decarbonization



Deep Decarbonization

✓ Decarbonising the gas grid:

- ✓ Take advantage of low electricity prices
- ✓ Provide seasonal storage for solar and wind
- ✓ Provide grid services from electrolysers
- Distributed stationary fuel-cell for heat and power generation



## Solar & Wind: LCOE/auction price evolution overview -Continued rapid cost reduction in the coming years





Source: IRENA

## Hydrogen production costs Scale is needed for electrolysers development





- ✓ Past Projects
  - ✓ kW to few MW scale
- ✓ Under development and planned projects
  - + 100 MW scale and there are ambitious projects targeting even a GW scale in the short and medium term

### Rapid upscaling of electrolysers for hydrogen production is key for green hydrogen

## Hydrogen production costs

## Presently accelerating investments in eletrolyzers worldwide





#### Hydrogen from renewables has a great potential but electrolyser costs need to further decrease

Key assumptions Electrolyser Load factor: 4200 hours (48%), conversion efficiency 65% (today), 75% (2050)

## Hydrogen production costs Competitiveness in 3-5 years with low-cost solar and wind



#### ✓ Hydrogen from RE competitiveness:

- ✓ Hydrogen from low-cost wind and solar PV projects is expected to achieve competitiveness with fossil fuels within the next five years (SMR with CCS at 8 USD per million BTUs)
- ✓ In the case of average-cost solar and wind projects, this would be achieved in 2030-2040
- ✓ Costs of Hydrogen from fossil fuels with CCS is expected to increase due to CO2 prices



Note: Remaining CO<sub>2</sub> emissions are from fossil fuel hydrogen production with CCS. Electrolyser costs: 770 USD/kW (2020), 540 USD/kW (2030), 435 USD/kW (2040) and 370 USD/kW (2050). CO<sub>2</sub> prices: USD 50 per tonne (2030), USD 100 per tonne (2040) and USD 200 per tonne (2050).

### Hydrogen from renewables is close to competitiveness in regions with best solar and wind



- Acknowledge the strategic role of hydrogen in the energy transition
- Enable and mandate clean and efficient hydrogen production and use
- Focus more on hydrogen supply infrastructure and viable transition pathways
- Develop new hydrogen markets



## Thank you!



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#### HYDROGEN: A RENEWABLE ENERGY PERSPECTIVE

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