Green Hydrogen in Enel

April 22nd 2021



Enel is the leader in the asset classes that are at the center of the energy transformation



enei

Leveraging on Hybridization of renewables

Green hydrogen targets for 2023 and 2030

enel

Value proposition

Competitive full decarbonization offer bundling RES electricity and green H₂ supply

Main value drivers

- ✓ Sale of hydrogen to **industrial offtakers**
- RES plant optimization
- Savings on Capex and Opex arising from synergies with RES plant
- Flexibility services





Green hydrogen capacity

Renewable hydrogen is currently expensive, but costs will decrease



Production Costs (LCOH)¹



To allow competitiveness of green hydrogen, the **cost of** electrolyzers will need to decrease by about $6x^2$

Technological Evolution Examples in 2010-2020²

	Capex Reduction	Efficiency Increase
Ê	9X	+31% capacity factor ³
Ē	9X	+49% energy density Wh/Kg

Coal Coal+CCUS RES Natural Gas Natural Gas+CCUS

Industry - Green Hydrogen is best used in hard-toabate sectors

enel





Enel hydrogen business models

revenue stream

Green hydrogen is a scarce and precious resource



Co-located RES+H2 Stand-alone Industrial user RES Industrial user RES Grid Grid **Electrolysis system** Electrolysis system Η, H_2 H_2 H_2 **PPA** Direct connection Electrolyzer Storage Electrolyzer Storage **Co-located RES+H**₂ Possibility of selecting best Đ **Transport** costs (pipeline or **Grid connection charges** Electrolyzer located at user site renewable resource trucks) may affect profitability (water and land easily available) No synergies between RES Shorter time to market with RES plant and hydrogen project Proximity of hydrogen production and Ŧ Main value project in advanced development in terms of Capex and Opex usage drivers / status and no constrains on RES Possibility of exploiting project in capacity source potential advanced status of development, **Exploiting synergies bewteen** issues shorter time to market. **RES plant + hydrogen project** Not constrains on RES capacity Ancillary services as a further source

Green Hydrogen in the Power-to-Chemical enei **Applications** ·S. **Green Hydrogen projects** Each project may have alternative implementation options at Refineries Facilities located at the same premises **Green Hydrogen** refinery Hydrogen system system at EGP plant 閒 direct **10 MW Electrolyzer for refinery** Storage Electrolyzer connection prod. consump. **H2** Æ Distance from PV site circa 30 km 600 t/v ~7k m3/y ~35 GWh/y 20 MW Electrolyzer for biorefinery prod. consump. **H2** ŦĦ Green Hydrogen refinery **Grid-connected** 1200 t/v ~13k m3/y ~70 GWh/y system 20 MW Electrolyzer for refinery 閒 Hydrogen system Æ at the refinery prod. virtual consump. Storage Electrolyzer PPA **H2** 3000 t/y ~32k m3/y ~165 GWh/y

Enel vision on hydrogen



Electrification offers the cheapest and simplest route to decarbonize large portions of total final energy uses

Green Hydrogen's best use is as a complement to electrification, and not a competitor, to decarbonize hard-to-abate sectors

Hydrogen needs to be powered by 100% renewable electricity: it is the only truly sustainable production pathway

A domestic production of renewable hydrogen can lower dependency on fossil fuel imports and strengthen security of supply

The integrated configuration Renewables+Hydrogen, using the electrolyzer as a variable load, will enhance ancillary services, making the renewable plant more flexible.