



7th AIEE Energy Symposium
Current and Future Challenges to Energy Security
– the energy crisis, the impact on the transition roadmap –

**Feasibility study for the construction of a demonstration plant for the
production of E-fuels**

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A few questions need to be answered:

- **Is it possible to decarbonize the road transport sector quickly?**
- **Do we really decarbonize the transport sector by limiting tail pipe CO₂ emissions only?**
- **Is it possible to decarbonize aviation and maritime sectors quickly?**

- The answer is **no** with the current European legislation

- The answer is **yes** with the Low Carbon Fuels and in particular with e-fuels

- The wrong narrative of the European legislation: the electrification is the only technological solution able to decarbonize simultaneously multiple sectors of the economy

- This approach disregards completely the contributions of multiple low carbon solutions the other sectors can deploy, betrays the principle of technological neutrality, do not allow the development of carbon neutral fuels for aviation and maritime and do not have a plan B to meet the environmental target in transport sectors



Why do we need e-fuels to decarbonize transport sectors

- **The ICEs will remain an important component of the car park in the future**
- **There are around 300 million passenger cars across the 27 EU member states, of which only around 1,4% are battery electric vehicles (BEV); 98,6%, on the other hand, have a combustion engine**
- **BEV can be found almost exclusively in the economically strong states in Northern and Central Europe and the cost of BEV will remain very high for long time or perhaps will increase**
- **The assumption that the insensate European legislation will transform the BEV in a mass market product is totally wrong and will produce the following effects:**
 - **The expanding European used-car market**
 - **The growing average age of the EU fleet**
 - **The growing of CO₂ emissions in transport because the LCF deployment will be jammed and road, aviation and maritime will continue to use fossil fuels for very long time**
 - **The total loss of the European Automotive industry competitiveness vs China**
 - **By the way BEV are not zero emission vehicles**

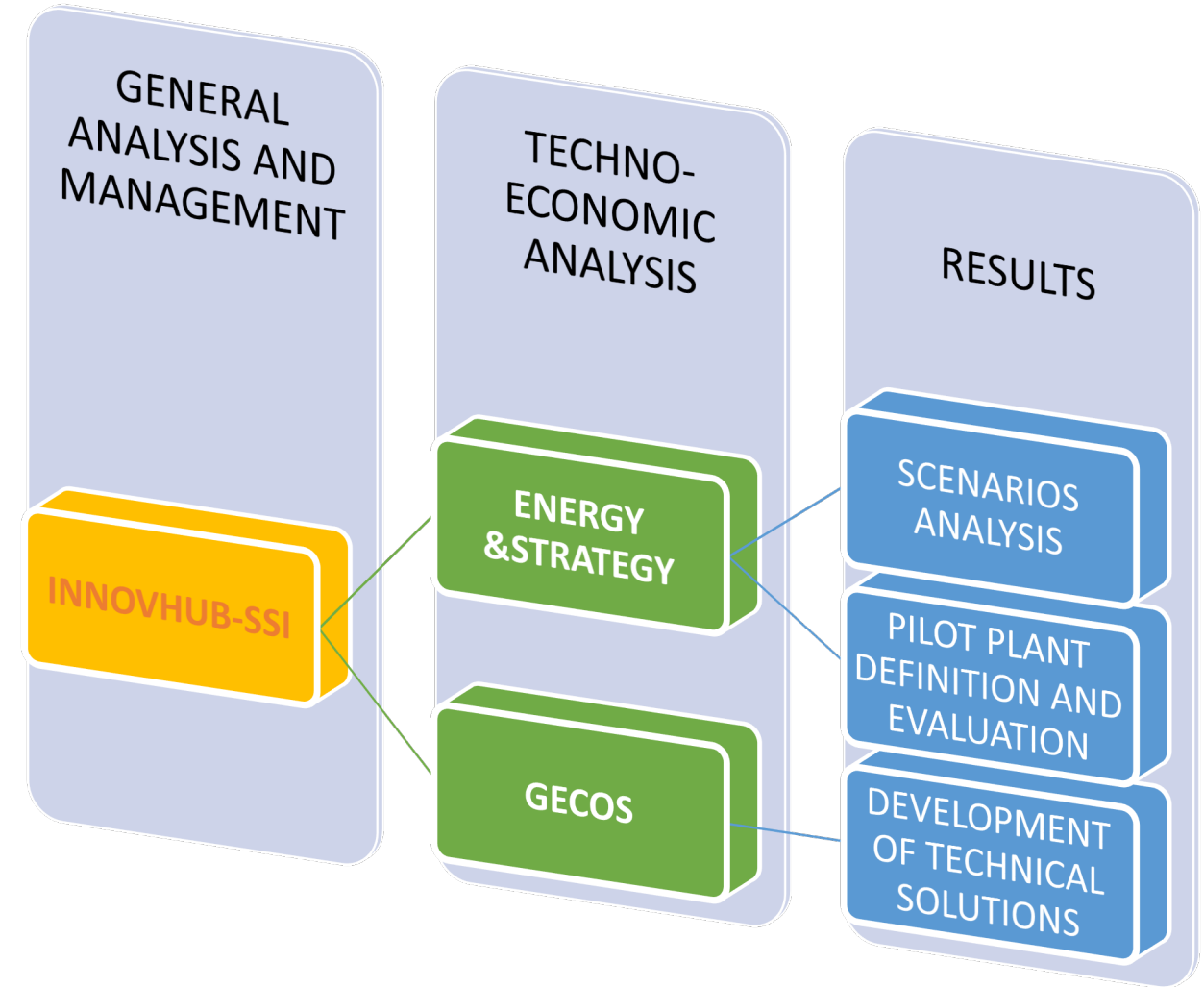


- **E-fuels immediately achieve a consistent reduction of GHG emissions in transport in all-existing fleets without any technical adaptation, without waiting the very costly and very long vehicles replacement cycles**
- **E-fuels can accumulate large quantities of non-programmable renewable electricity from wind, photovoltaic and hydroelectric, ensuring both grid stability and production flexibility**
- **E-fuels are completely compatible with traditional liquid allowing the same, identical existing logistics and distribution infrastructures without any adaptation.**
- **Over time, e-fuels volumes will shift to the aviation and maritime sectors, making the e-fuels early contributions to decarbonizing road transport a stepping stone for their availability for hard-to-abate transportation sectors.**

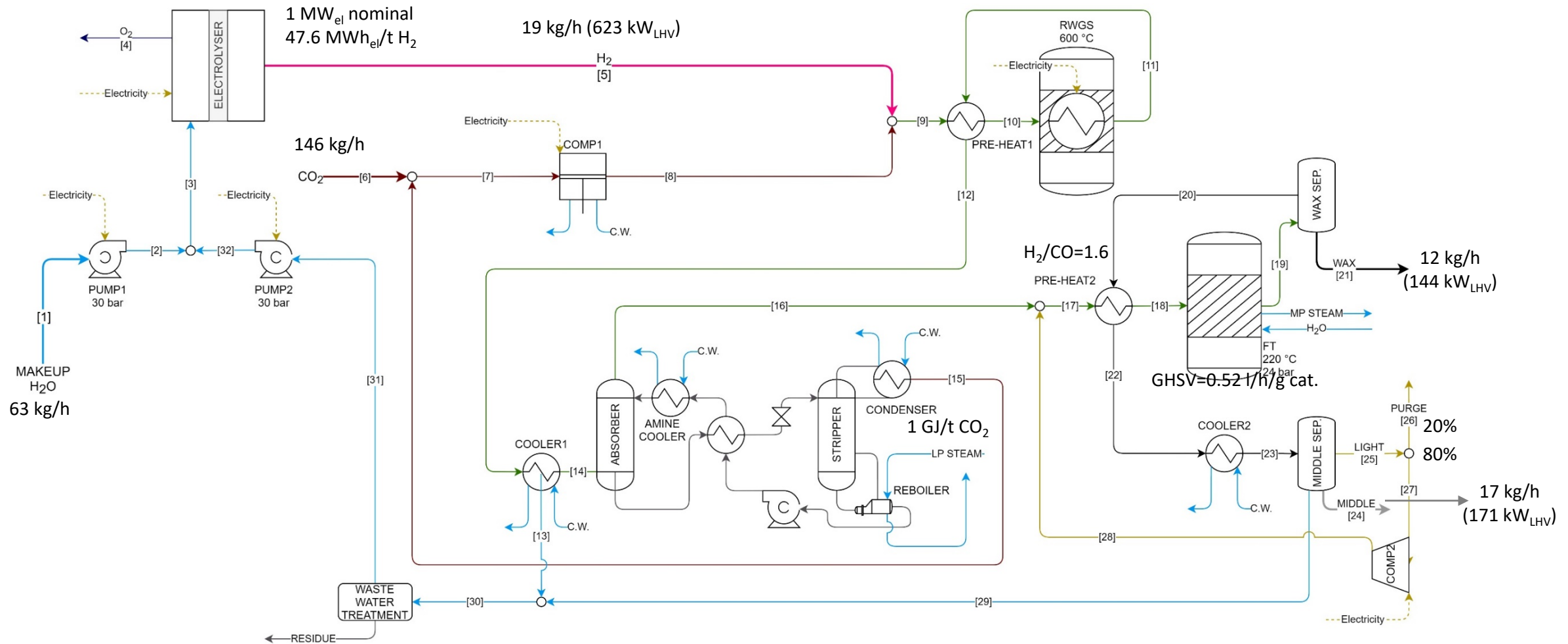


Feasibility study for an E-fuels demonstration plant

- For all the above reasons Unem has commissioned Innovhub to carry out a feasibility study for the construction of an e-fuels pilot plant
- Innovhub involved the Politecnico di Milano for the necessary technical-economic analyses
- Main objective of the study: acquire direct experience on mature technologies for a demonstration plant able to produce sufficient quantities of e-fuels (Fischer-Tropsch) to carry out performance tests on road and in laboratories
- Moreover, to evaluate the technical and economic potential for a future development in the Italian energy landscape.
- The study wanted to be generic enough to be adapted to future R&D and commercial strategies of the refining sector



e-FT pilot plant scheme



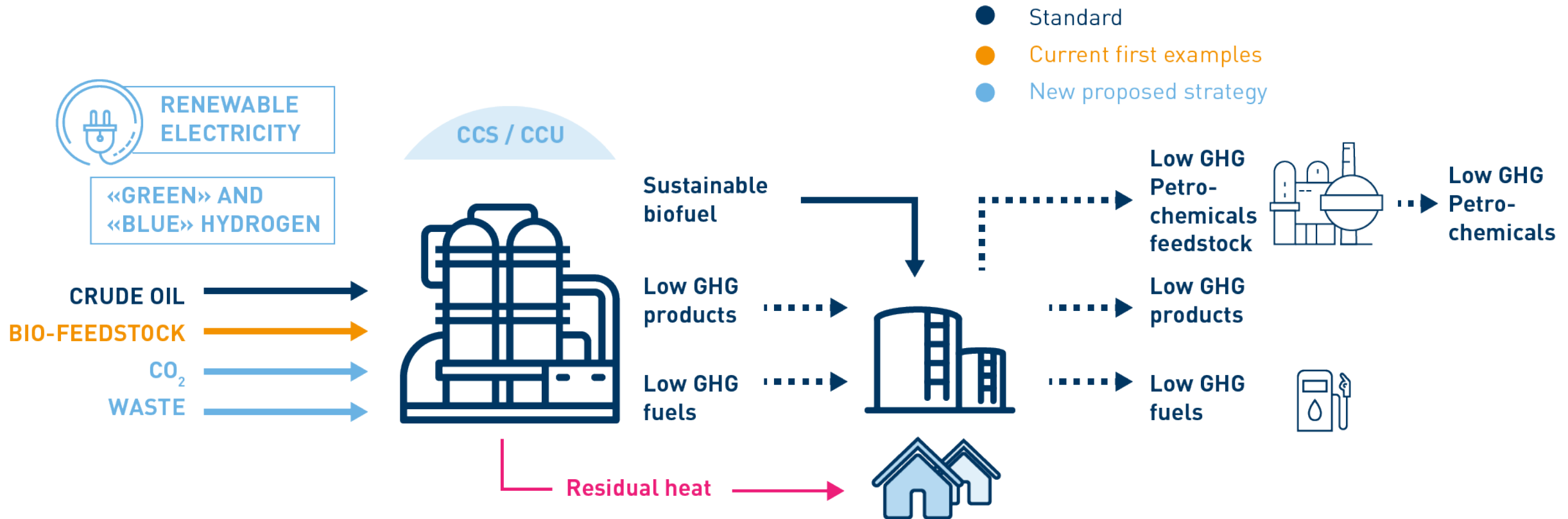
- **Electrolysis technology adopted: conventional low temperature water electrolysis**
- **The CO₂ compressed at 30 bar is mixed with the H₂ produced by electrolysis, then the overall flow is preheated to be fed to the RWGS reactor. The syngas thus obtained is sent to the CO₂ separation system, with MDEA-based amines.**
- **The output flow from the MDEA system absorber is mixed with a recirculation of light products to produce the feed of the FT synthesis reactor**
- **The FT synthesis reactor, externally cooled with boiling water, consists of 220 tubes with a diameter of 1" and a length of 7 m, with a cobalt catalyst, operating at about 220°C and 24 bar. The output of synthesis reactor is sent to the separation and purification section.**
- **The size of the plant is able to produce 8 barrels/day of syncrude**



- **For the future of refining industry, we foresee an important role into the integrated energy system that will help ensure safe and affordable energy for all consumers**
- **We already started the transformation of our mineral oil refineries towards a progressive decarbonisation of process and products**
- **The refining system will evolve towards production methods where oil, as a raw material, will be gradually replaced by other feedstocks such as biomass, renewables, waste, captured CO₂ from CCS/CCU technologies and clean H₂**
- **Refineries will be able to operate in industrial clusters by providing a range of low-carbon energy and products (for transport, for petrochemicals, heat for civil uses, etc.), clean and low carbon hydrogen and by implementing common CCS and CCU schemes within these clusters**



The refinery as an ENERGY HUB within an INDUSTRIAL CLUSTER



- **To achieve all the above advantages and to encourage and enable investments, it's essential to correct the current EU Regulation on CO2 emissions limits for cars and van**
- **The Tank-to-Wheel approach adopted by EU legislator betrays the technological neutrality avoiding any differentiation between the fossil CO2 and renewable CO2 tailpipe emissions. Moreover, does not take into account the CO2 emissions emitted upstream both for the production of fuels and for the production of electricity**
- **Car manufacturers are currently forced to deploy only the BEV technology in order to avoid the high penalties laid down into the Regulation for failing to meet their fleet targets**
- **Engines powered by decarbonized liquid fuels reduce CO2 by almost 100% but the current CO2 Regulation does not recognize these positive effects. It is therefore essential to consider GHG emissions released along the entire fuel supply chain and to link the legislation on fuels with that on cars**





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