AppLHy!

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I. Short Project description:

- content: Transport and Application of Liquid Hydrogen (LH_2) – efficient liquefaction, hybrid energy transport, synergy of power engineering and LH_2
- duration, budget, partners: 04/2021-03/2025 (plus 2x extensions), ≈16 M€
- framework: part of the German National Hydrogen Strategy (BMBF), Lead project TransHyDE

II. Research focus/core competencies related to project:

- **Efficient production and handling of LH_2:** liquefaction, containment, transport
- **Materials and safety:** regulations, instructions, (cryogenic) material testing
- **Power engineering & LH_2**: research & development on synergetic integration of LH2 into efficient and powerful devices (electric power grid components, inverters, transformers,...) and vehicles (eTrucks, eTrains, eShips, eAircrafts)
- **Hybrid energy pipeline:** simultaneous transport of LH2 (chemical energy) & DC electric power (electrical energy)
- **Most favourable connecting link of LH2 and power technology:** High-Temperature Superconductors (HTS)

III. Relevant infrastructures related to the project:

- **Liquefaction facility, cryogenic labs for materials, components & power devices, hybrid energy pipeline**

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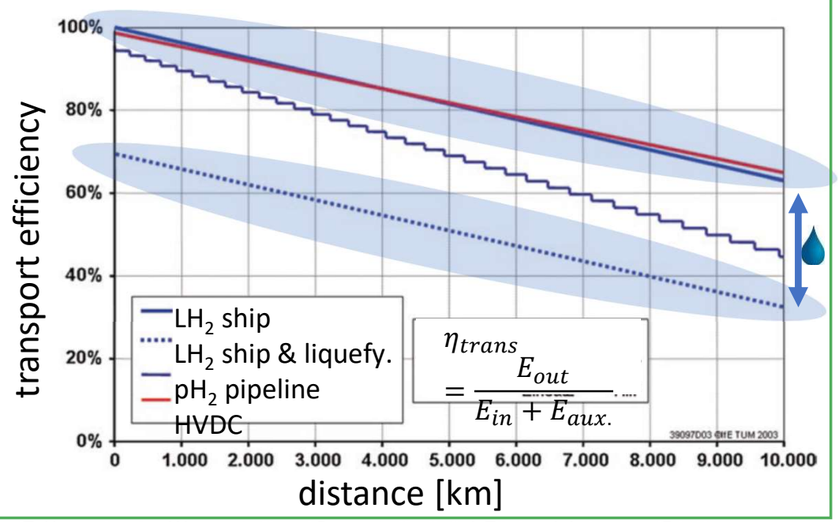
Energy transport efficiency aspects



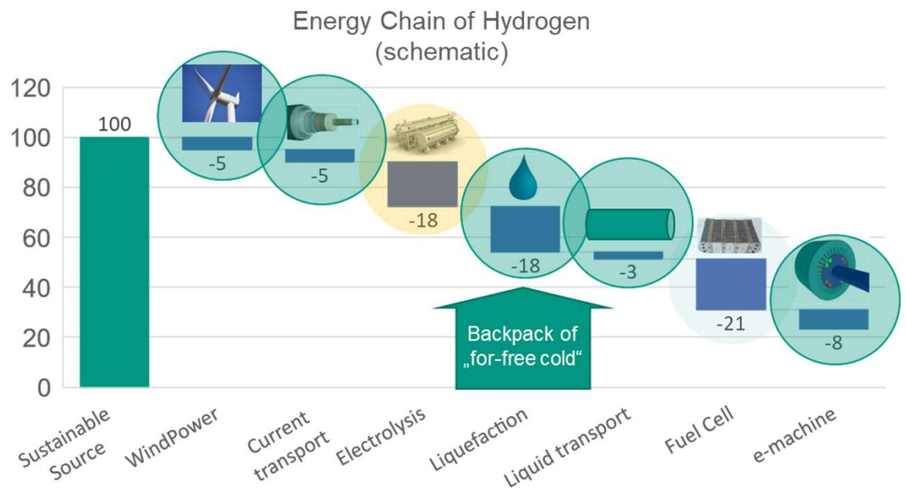
(T. Hamacher in „Wasserstoff und Brennstoffzelle“, J. Töpler, J. Lehmann (Eds.))

Storage	Minimum cost [$/kg H_2]	Maximum cost [$/kg H_2]
NH_3	4.4	3.5
LH_2	3.8	2.0 (3.2)
LOHC	4.4	3.5

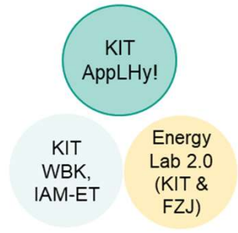
[Report of Hydrogen Council, McKinsey “Hydrogen Insights”, Feb.2021, Exhibit 16]

Combine the two most efficient energy transport lines!

(L)H_2 energy chain efficiency – e.g. sustainable wind to mechanical power



- There is substantial loss along the energy chain
- Research is conducted in selected parts:
  - transportation
  - power engineering



1) Decrease energy efforts along chain
2) Use for-free backpack of cold!
3) Design new, record-efficient power devices (e.g. motors & generators)

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IV. Current partners from science and industry

TU Dresden, IFW Dresden, HTW Dresden,
KIT ITEP, KIT ITES, KIT ETI, KIT IAM-WK,
Linde, SciDre, THEVA, VESC,
Amprion*, Daimler Truck AG*,
potential others

V. Outlook for future development:

- joining the hybrid energy pipeline with the KIT EnergyLab & a public double-fuel station
- demonstration of vehicles (LH_2) on the closed campus north of KIT
- creating model regions for hybrid energy transport
- aligning a “green H_2 supply” (Chile) and a “green H_2 import need” (Europe)
- connecting LH_2-imports to the ports and systems of Germany
  (see implementation projects w/i TransHyDE, e.g. Helgoland, Mukran,...)
- strategically working in improvements of the energy chain of $(L)H_2$ and in power engineering