Danish Energy Agency

Technology Brief

New chapters on Hydrogen transport by pipeline and road in the Technology Catalogue (July 2025)

The Danish Energy Agency has published an updated Technology Catalogue chapter for transport of hydrogen in July 2025, due to the renewed interest in transporting this fuel across Europe.

In comparison to the old chapter that described the transport of gasses and liquids (hydrogen, ammonia, dimethyl ether and liquid organic carriers) in pipelines, trucks and ships, the new chapters focus exclusively on the pipeline and road transportation of hydrogen.

The new version of the pipeline transport includes more and updated considerations about pressure levels and pipeline diameters, including the interdependencies between them. There are now three datasheets split between three significant pressure levels: 40, 90 and 140 barg with six pipeline diameters each, linked to typical capacities.

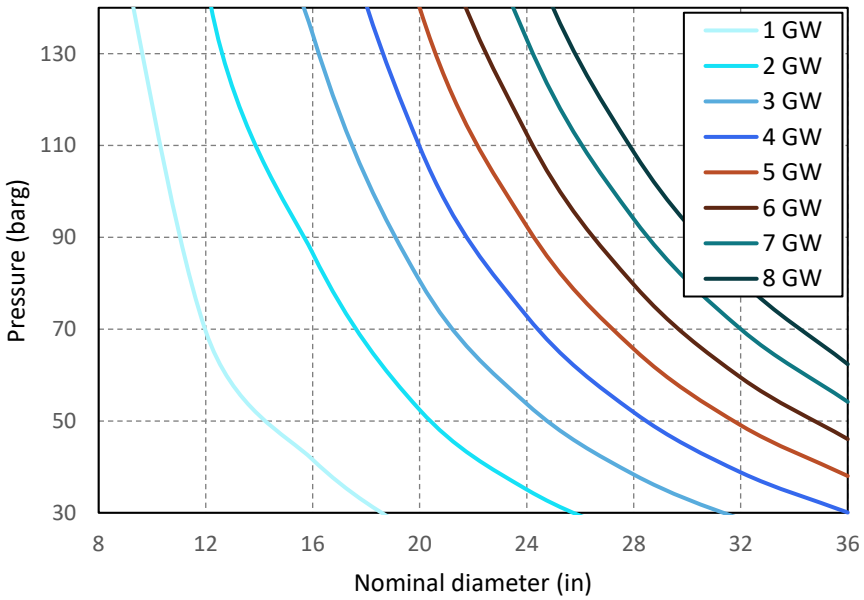

Figure 1: Energy transport capacity (LHV) for different nominal pipe sizes within the operating pressure range at 20 m/s velocity.

The chapter has clearer cost breakdown between pipelines, compressors and other infrastructure components. The same applies to the development of infrastructure costs which involves a new methodology for determining the component costs.

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Carsten Niebuhrs Gade 43
1577 København V

T: +45 3392 6700
E: ens@ens.dk

www.ens.dk

In addition, the chapter now also includes considerations regarding line packing opportunity and by-pass and reverse operation.

The chapter on transport by road describes in more detail both liquid hydrogen and compressed hydrogen transportation in containerized or cylindrical trailers. Not least, the chapters are more structured, simplified and better described, so a larger pool of readers can make use of them.

Major changes in updated Technology Catalogue

Based on the latest publicly available data and newest projects, the updated hydrogen transport chapter gives an up-to-date perspective on technical and economic assumptions behind the expected future development of the technology, based on the current macroeconomic climate.

Pipeline transport

All sections in the new chapter are now described in more detail due to the exclusive focus on hydrogen transport. The most important characteristics described in the new chapter refer to, among others:

- **Pressure drops**: hydrogen pipelines do not essentially loose energy, but can experience pressure drops. For example, 2 compressor stations would be needed for a 1.500 km long 36” pipeline.
- **Description of transmission and distribution systems**, including how to design hydrogen pipeline systems based on velocity limits, pipe diameter and energy storage and transport potential under varying pressure.
- **Design considerations in relation to other infrastructure** and how pipelines should be routed and separated from buildings, roads or electrical infrastructure
- **Line packing opportunity**, or the storage potential in pipelines by adjusting pressure, has a limited effect due to hydrogen’s low density.
- **Refurbishment of existing pipelines**, especially in Germany and The Netherlands, where in general the cost of repurposing is 75% cheaper than new pipelines, but at the cost of lower operating capacities.

Besides a renewed description of the pipeline materials, the chapter goes in depth with describing the other elements of a pipeline infrastructure including:

- Compressors
- Line valve (LV) systems
- Pigging launcher and receiver (PLR) stations
- Injection and extraction station
- Pressure regulation station
- Fiscal metering station

Prediction of performance and costs

The new chapter on pipeline transport uses an engineering-based methodology to develop costs calibrated against actual project estimates. The development of the catalogue prices thus includes both equipment and installation costs benchmarked hydrogen projects in Denmark and Germany.

In general, the equipment and installation costs for the pipelines do not present major changes compared to the old chapter, but have been adjusted for inflation and material costs and now include PLR and LV stations, which also explains the sharpened cost data.

Boosters, or compressors have not been specifically included in the pipeline costs, but reported separately, as these are often project specific, and should only be needed depending on the length of the pipeline and if there is a need to increase or decrease pressure. In the datasheets, the energy usage is stated for going from 40 to 90 barg and going from 40 to 140 barg, which would be a relevant scenario for compressing the hydrogen after electrolysis at the inlet to the pipeline.

Investment costs for large hydrogen infrastructure projects are often come with significant indirect costs that take a large part of the total investment costs. Figure 2 illustrates the type of costs and their size in relation to the investment costs.

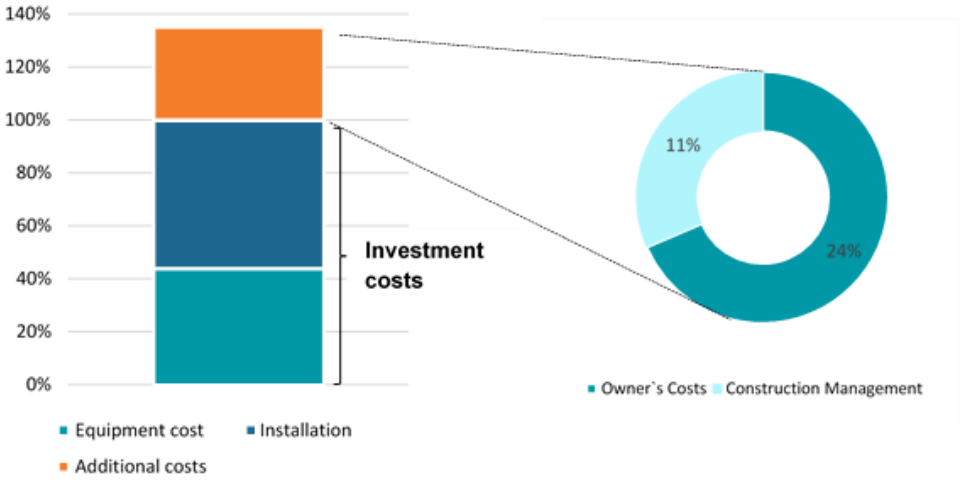

Figure 2: Typical distribution of key additional project costs components for hydrogen pipeline as share of total investment costs

Operational expenditures are often dependent on the operational and maintenance philosophy, where the fixed OPEX are generally low, while the variable OPEX are only relevant if compressors are used.

Road transport

An alternative to pipeline transport or an extension of it is the transportation of liquid or compressed hydrogen in truck trailers. Besides the more known transport in tank trucks, the chapter now also describes containerized solutions for 40 ft. tanks that can carry up to 1.600 kg CH_2 or up to 2.700 kg LH_2.

Transport of hydrogen by road has advantages, such as reaching out to locations where pipelines do not exist with relatively high flexibility, they are fast to deploy and are easier to permit than pipelines, but they are limited by high OPEX costs, short lifetime and limited scalability among others. For this reason, transport by road only makes sense for short distances (<200-300 km) and low payloads (<2 t).

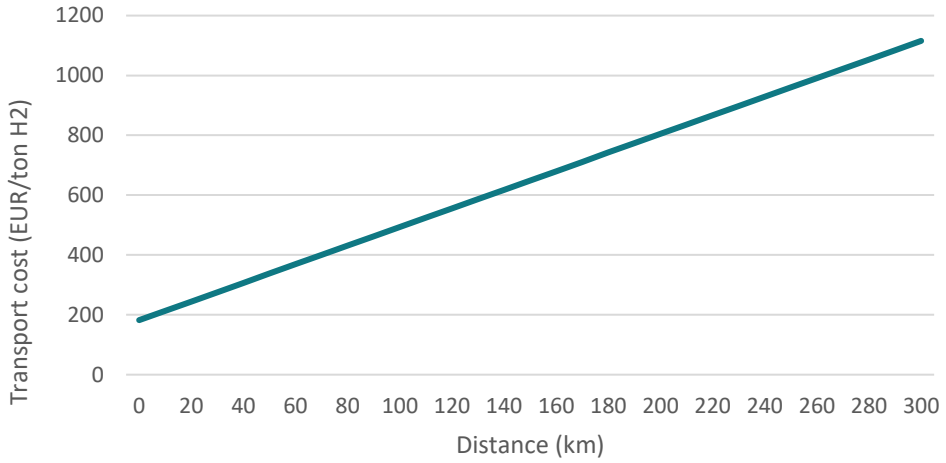

Figure 3: Modelled total hydrogen transport cost by truck (fixed + variable) as a function of distance

Perspectives for Denmark

Hydrogen infrastructure is a new chapter in the Danish energy transition, and although the technology is well-established, there remains some uncertainty around performance, permitting procedures, safety requirements, and cost. There can also be supply chain constraints, that can hamper the development of the infrastructure, although this is not the concern of this technology catalogue. The same goes for hydrogen transport by road, where the cost and performance at scale remain uncertain. The technology is already in use across Denmark and Europe, particularly for refuelling stations and industrial gas customers, but questions remain about competitiveness for high-volume and long-distance delivery.