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Development of a hydrogen pipeline network to supply the greater Cologne area

An H₂ pipeline network can make a decisive contribution to increasing value creation in the region

Hydrogen is an indispensable component of our future energy system. An essential prerequisite for the development and expansion of the hydrogen economy is a reliable and cost-effective distribution infrastructure. A feasibility study led by HyCologne - Hydrogen Region Rheinland e.V. has investigated how this could be realised in the greater Cologne area. The study comes to the conclusion that the construction of a pipeline infrastructure to supply the region with hydrogen is technically possible and offers great opportunities for the accelerated expansion of hydrogen technologies for all parties involved.

The goal of greenhouse gas neutrality cannot be achieved with green electricity alone. In the future, large quantities of hydrogen will be needed as a material alternative to fossil fuels such as coal, oil and natural gas, especially in industry as well as in transport and logistics. For this reason, the HyCologne - Wasserstoff Region Rheinland e.V. network is pursuing the HyPipCo (Hydrogen Pipeline Cologne) project with the aim of laying the foundations for the rapid expansion of a pipeline-based infrastructure in the greater Cologne area. This is intended to ensure the long-term supply of hydrogen to the areas on the right and left of the Rhine and in the Rhenish mining area in line with demand.

To investigate whether the construction of such a pipeline infrastructure is technically feasible and economically viable, the seven energy suppliers and transport and distribution network operators GVG Rhein-Erft GmbH, Open Grid Europe GmbH, RheinEnergie AG, Rheinische NETZGesellschaft mbH, Thyssengas GmbH, Stadtwerke Brühl and Westnetz GmbH commissioned a feasibility study. This was carried out by EMCEL GmbH, ETC Energy Transition Consulting GmbH and Fraunhofer SCAI under the leadership of HyCologne - Wasserstoff Region Rheinland e.V..

Carsten Krause, project manager at HyCologne e.V. explains: "HyPipCo is an outstanding lighthouse project for us. In our opinion, hydrogen is a decisive factor for the economic development of the Rhineland region including the greater Cologne area - not only for reasons of climate protection. The current political situation shows that in the long term we must significantly reduce our economic dependence on fossil fuels - especially natural gas. The development of an H₂ pipeline network around Cologne can make a significant contribution to this. The feasibility study we have prepared shows how the construction of such a pipeline infrastructure can succeed and that the investments will pay off in the long term. "

Dr Jürgen Grönner, Managing Director of Westnetz GmbH - a member company of HyCologne e.V. - emphasises: "The results are very important for Westnetz. They show how a pipeline-based hydrogen supply can be implemented on the basis of existing infrastructures. We are convinced that hydrogen will make a significant contribution to the energy transition and that pipeline-bound transport is the most economical option for many applications. That is why we are making our grid H₂-ready and testing concepts for a conversion to hydrogen. The results of the feasibility study will also be incorporated into the so-called gas grid transformation plan. This is currently being developed by the H₂vorOrt initiative, in which Westnetz is participating. More than 50 per cent of the German gas distribution networks are covered via the committed companies."

Increasing demand for hydrogen forecast

The study was based on an analysis of the future hydrogen needs of industry in three scenarios for the period 2030 to 2050. The chemical and petrochemical companies and the transport sector were assumed to be the largest consumers in the region. For the transitional phase until green hydrogen from regional or international sources is available in sufficient quantities, the scenarios also took hydrogen into account that is produced as a by-product in the chemical and petrochemical companies. In the so-called progressive scenario, a hydrogen demand of about 345,000 tonnes per year was projected for 2050. This will probably exceed the amount of hydrogen produced regionally by a factor of ten. Therefore, in perspective, the hydrogen needed in the Cologne region will have to be obtained for the most part from other regional and supraregional sources.

Security of supply through connections to further national and international hydrogen pipelines

The feasibility study therefore also addresses other, additional connections to national and international transport and supply systems. These include the existing Air Liquide hydrogen pipeline system and the H₂ network 2050 of the Association of German Transmission System Operators (FNB Gas). In addition, the planned hydrogen production projects in the Rhenish mining area for regional supply were integrated into the planning.

Use of existing natural gas pipelines reduces costs

When planning the route, the study took into account both the current and future hydrogen producers and consumers in the region. Depending on the scenario, pipeline lengths of 270 to 300 kilometres were estimated for their connection. According to the study, investments in the range of 95 to 110 million euros are required for the construction of such a network "on a greenfield site". However, the investment volume can be significantly reduced if parts of the existing natural gas transport and distribution network are converted to hydrogen. Pilot projects of various operators already show that such a conversion is possible with comparatively manageable effort.

Great opportunities for the region

The authors of the study conclude that the development of an H₂ pipeline network offers very great opportunities for the region. Both the local chemical and petrochemical companies and numerous hydrogen projects have a high and easily predictable demand for hydrogen in the near future. A regional pipeline network also favours the planned market ramp-up of the hydrogen economy, including the planned hydrogen projects around Cologne. This contributes to an increase in value creation and to maintaining the know-how advantage in the region. The western extension of the network from Cologne via the Rhine-Erft district to the district of Düren proposed in the study can also make an important contribution to the success of the structural change of the Rhenish coalfield. For the reasons mentioned above, there is a very high political interest in the implementation of the project in the focus regions.

Andreas Feicht, CEO of RheinEnergie AG: "RheinEnergie sees the development of a hydrogen infrastructure in North Rhine-Westphalia as a great opportunity for the economic development of municipal companies. The decarbonisation of urban centres requires a transformation of the grid-based heat supply. Combinations of large-scale heat pumps and the development of a complementary hydrogen infrastructure offer a cost-efficient and pragmatic solution approach for the green transformation of the building heat supply. Existing infrastructures on site are included in the process. The approach also enables the municipalities to secure their own value creation in the area of heat and energy supply - especially to maintain the cross-connection. Both RheinEnergie and the other companies of the Stadtwerke Köln Group are currently examining, among other things through feasibility studies and pilot projects, in which of their services the use of hydrogen makes sense. This is being done in close coordination and cooperation with industry and business in the Rheinland and with other energy suppliers.

Werner Abromeit, Managing Director of GVG Rhein-Erft adds: "In the field of hydrogen-based cogeneration, energy carrier potentials for local and district heating supply are expected in the near future. Therefore, the planning and construction of a hydrogen pipeline network, also taking into account the existing gas infrastructure, is an important building block for a sustainable energy supply in the Rhenish mining area and the greater Cologne area."

Call for participation

The conditions for the construction of a hydrogen pipeline are currently very favourable. The expectation that such a pipeline project will be actively pursued is very high, because the demand for hydrogen in the region will increase significantly in the short and medium term. The expected planning and implementation phases of a pipeline project are relatively time-consuming. Also, other transport options, such as by ship, rail or road, are in direct competition with hydrogen transport via a pipeline system.

HyCologne e.V. therefore invites other stakeholders from industry and the public sector to participate in the HyPipCo project and to contribute to the rapid realisation of a hydrogen pipeline system. According to the study, the current funding landscapes of the EU, the federal government and the state of NRW currently offer good framework conditions for this.

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HyCologne networks more than 50 stakeholders from politics, industry and research. What they all have in common is the conviction that hydrogen is an indispensable energy carrier for achieving climate protection goals. Since 2007, the network has been pooling its diverse competences to massively improve the market maturity and economic viability of hydrogen technology in the Rhenish region and to realise large-scale projects. In doing so, we rely on by-product hydrogen from the chemical industry as a transfer solution until green hydrogen is economically available in sufficient quantities.

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