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INDUSTRY INSIGHT – CLEAN HYDROGEN

How natural gas suppliers are racing to pivot to hydrogen gas blending

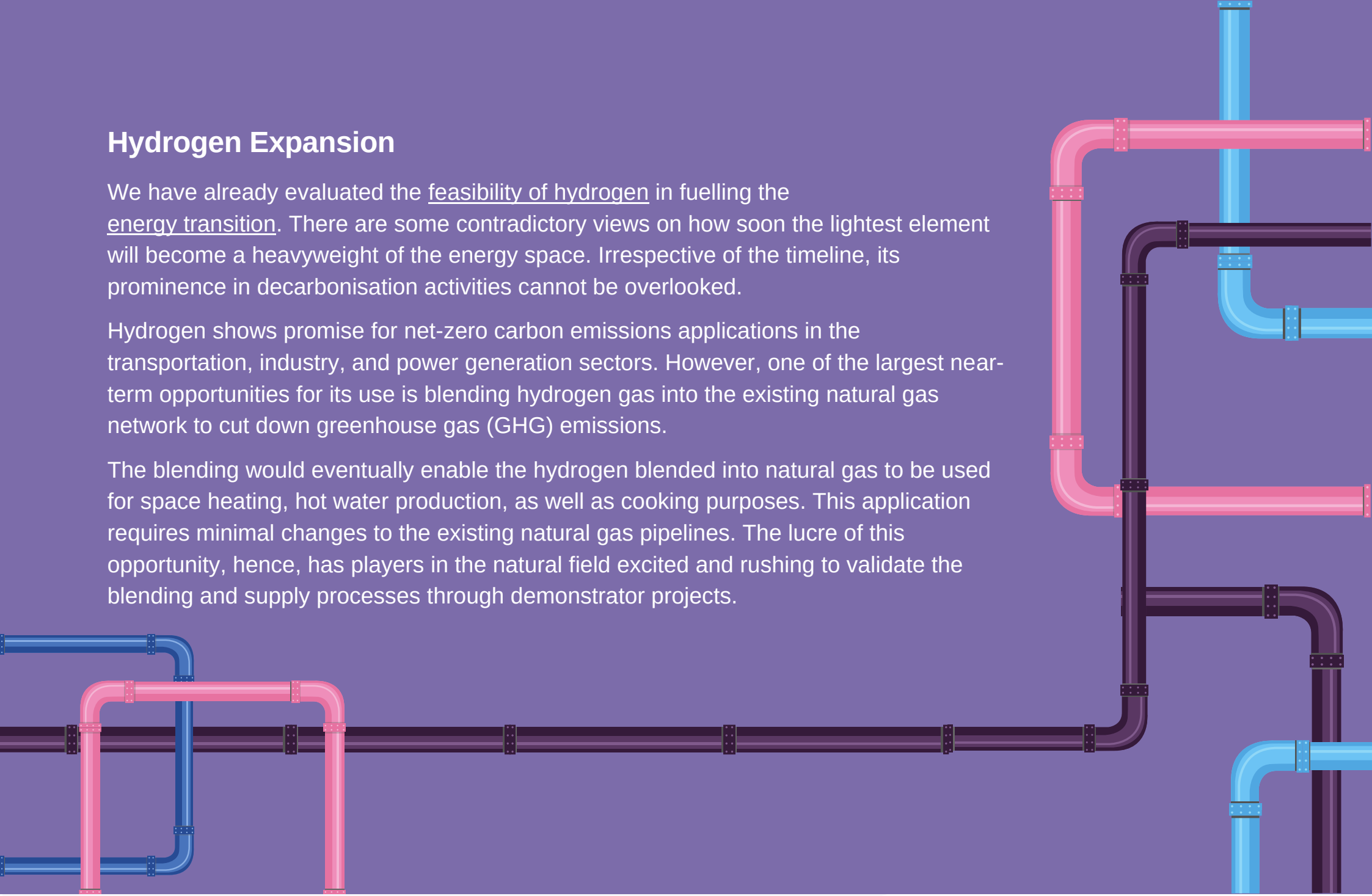
August, 06

Hydrogen Expansion

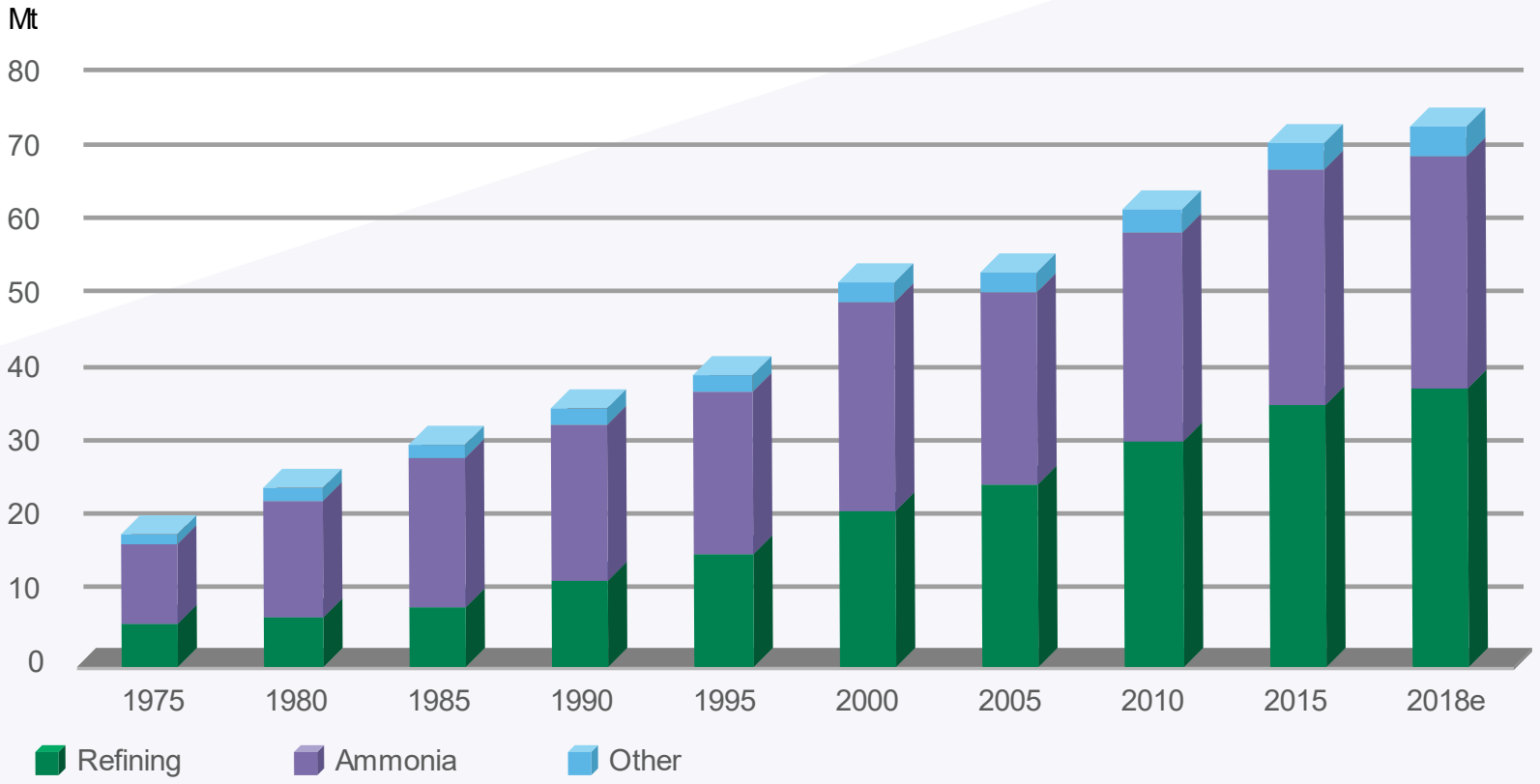
We have already evaluated the feasibility of hydrogen in fuelling the energy transition. There are some contradictory views on how soon the lightest element will become a heavyweight of the energy space. Irrespective of the timeline, its prominence in decarbonisation activities cannot be overlooked.

Hydrogen shows promise for net-zero carbon emissions applications in the transportation, industry, and power generation sectors. However, one of the largest near-term opportunities for its use is blending hydrogen gas into the existing natural gas network to cut down greenhouse gas (GHG) emissions.

The blending would eventually enable the hydrogen blended into natural gas to be used for space heating, hot water production, as well as cooking purposes. This application requires minimal changes to the existing natural gas pipelines. The lucre of this opportunity, hence, has players in the natural field excited and rushing to validate the blending and supply processes through demonstrator projects.



Global demand for pure hydrogen, 1975-2018 (mt)



Source: Irena; BloombergNEF; IEA

$770 billion

worth of sales of clean hydrogen could meet almost 25% of the world's energy needs by 2050

Upto 20%

hydrogen to natural gas blend ratios are currently being tested with minimum impact on delivery systems and appliances

15

blue hydrogen projects by natural gas suppliers have already been announced through 2027

95%

of present hydrogen production can be attributed to natural gas and coal

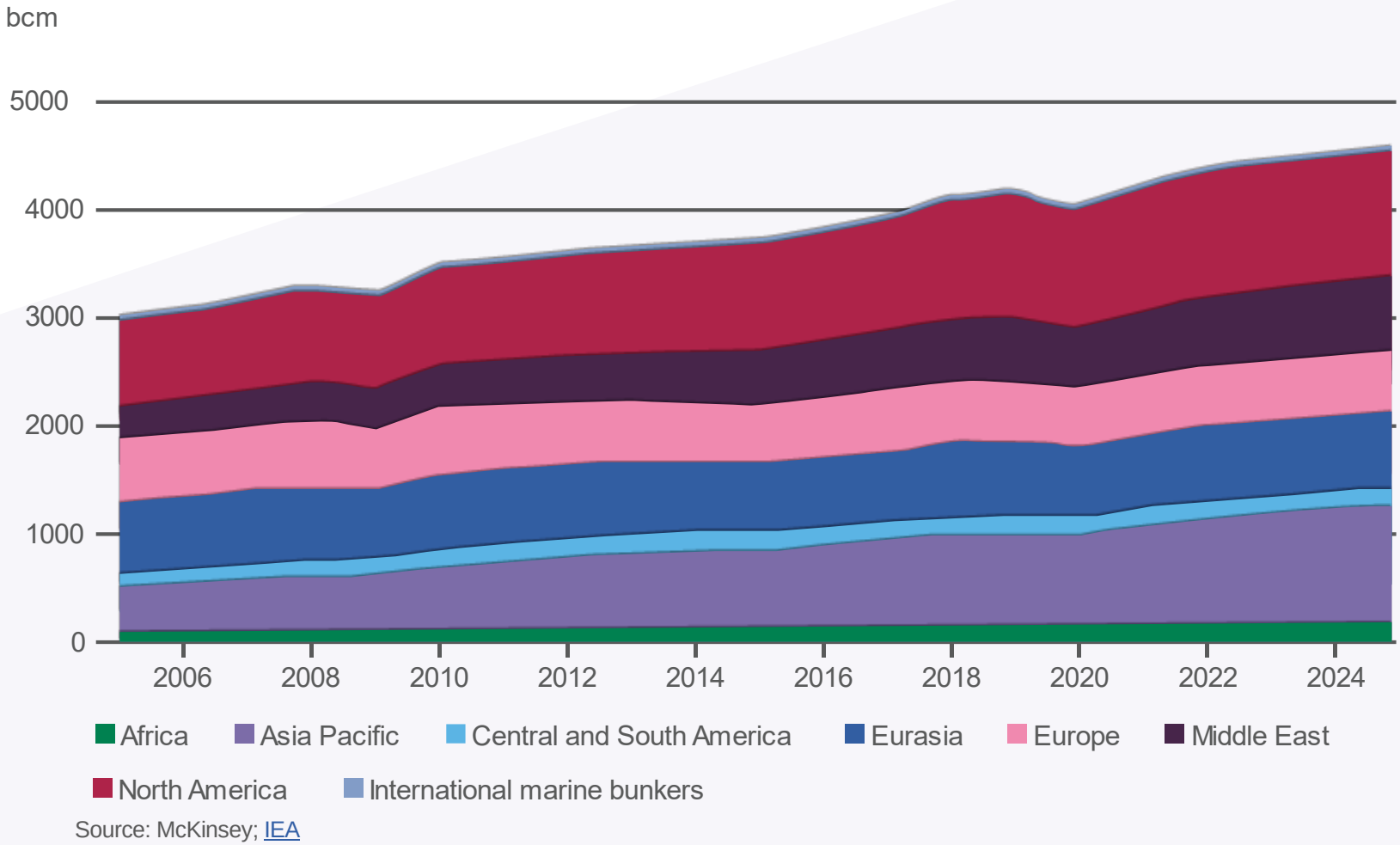
120 mt

of hydrogen was produced in 2019, meeting 4% of global total final energy and non-energy use

Blue hydrogen

made from natural gas using steam methane reforming (SMR) and CCUS among other processes is pegged to remain cheaper to produce than green hydrogen, at least until 2030

Global natural gas demand by region, 2005-2025 (bcm)



Source: McKinsey; IEA

0.9%

estimated growth of gas from 2020 to 2035, the strongest among fossil fuels

Beyond 2030

gas is the only fossil fuel expected to grow

4%

drop in gas demand in 2020 due to the Covid-19

Europe, Eurasia and North America

expected to recover most of their 2020 consumption losses in 2021

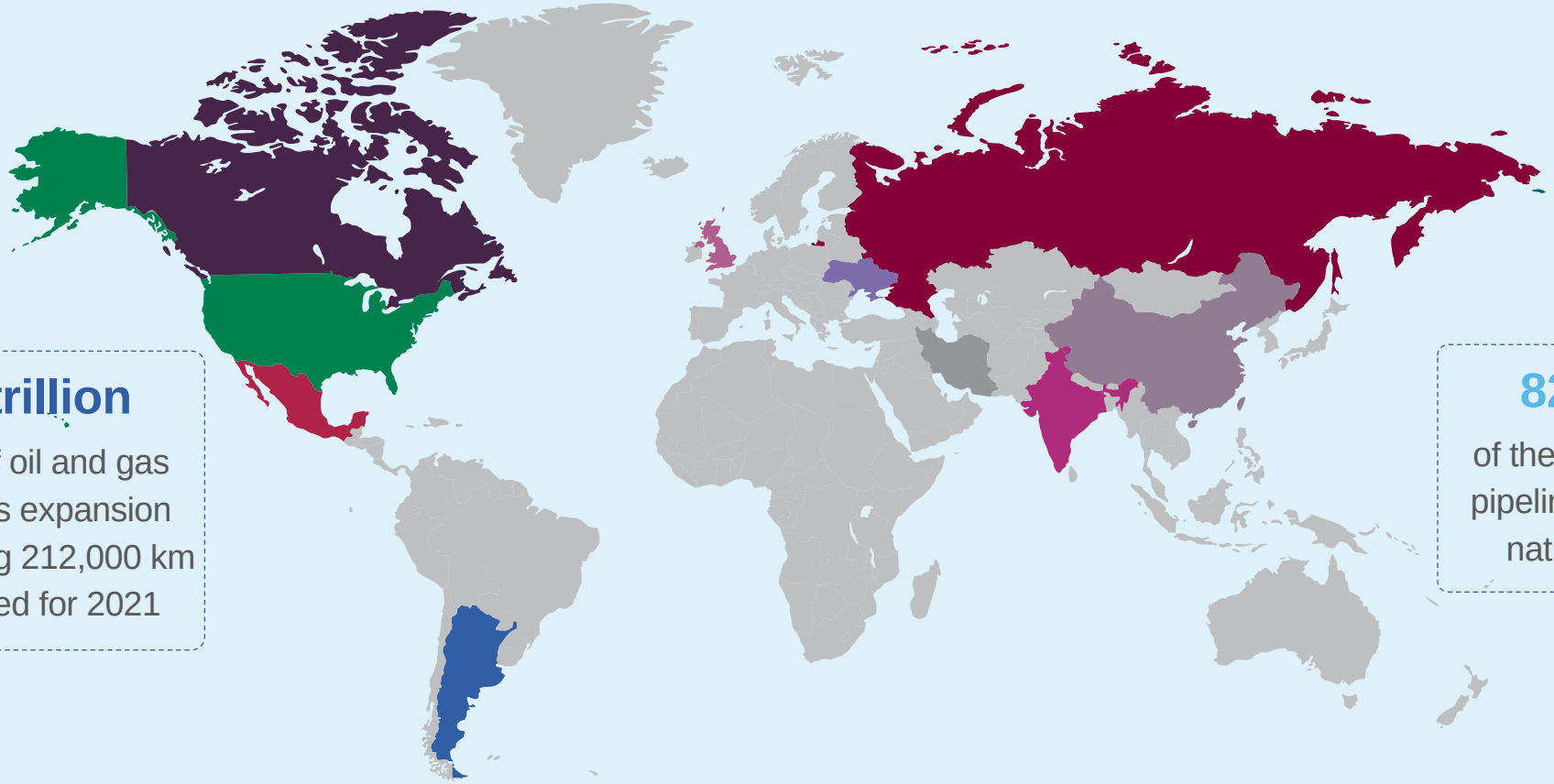
China and India

will drive the gas demand and consumption in the coming years

28%

of global gas supply in 2019 came from North America

Top gas pipeline networks by country



$1 trillion

worth of oil and gas pipelines expansion measuring 212,000 km proposed for 2021

82.7%

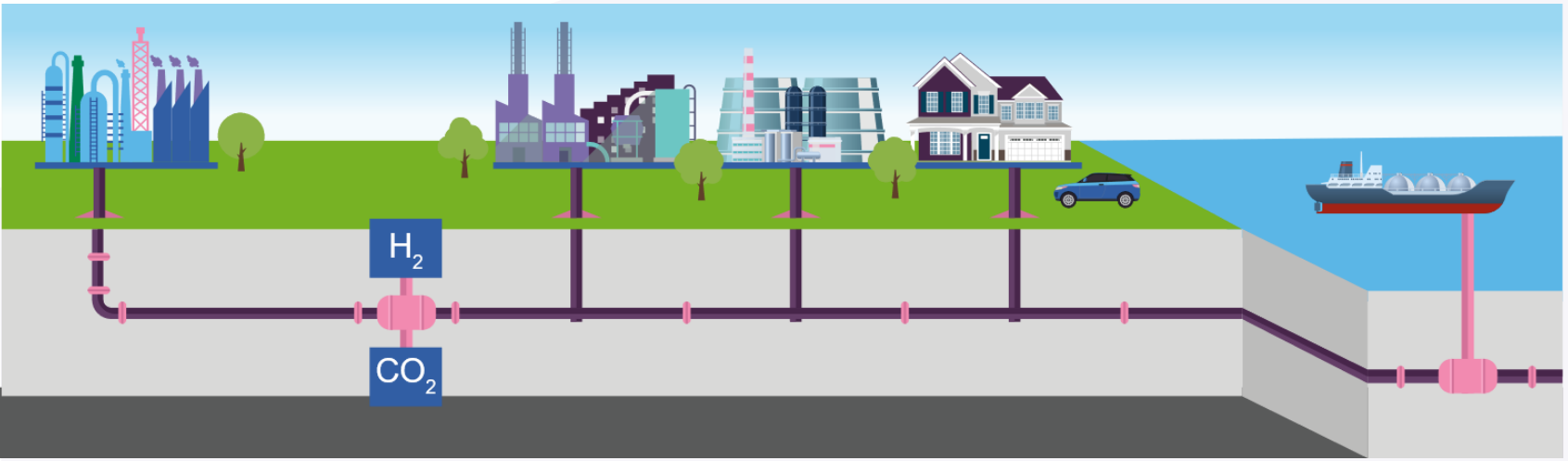
of the proposed pipelines are for natural gas

United States	2,225,032
Russia	259,913
Canada	100,000
China	86,921
Ukraine	45,597
Argentina	39,850
United Kingdom	39,778
Iran	38,906
Mexico	37,008
India	35,676

Source: Evalueserve Insights; World Atlas; World Energy Monitor

Hydrogen gas blending into natural gas supply systems

Advantages



Emissions cut: Even a 5% blend of hydrogen in natural gas is estimated to cut its GHG emissions by 2%, depending upon the production method. This is the main purpose, that a hydrogen blend makes sense to natural gas suppliers

Cuts upfront capital needs: Eliminating the need for dedicated hydrogen gas transmission and distribution infrastructure development, capital expenditure aligned with this can be mitigated or at least delayed for a long time. It would also remove hurdles such as opposition faced while installing new pipeline networks

Demand creation, cost reduction: While the needs for clean hydrogen will grow over time, blending hydrogen in natural gas instantly creates demand for hydrogen gas, as it serves an existing purpose with existing equipment. Growing demand and resultant supply increase would significantly reduce the cost of hydrogen and its supply technology, which is currently 1.5 to 5 times more expensive than its natural gas counterpart

Continuity of natural gas business: Introducing hydrogen gas blends as a decarbonisation initiative will also ensure longevity of the natural gas supply chains in their current form

Can use existing natural gas pipelines: There are a few thousand km of dedicated hydrogen pipelines as opposed to millions of km of pipelines for natural gas supply. Blends upto 20% hydrogen can safely be transported through most existing pipelines

Challenges

Embrittlement: Hydrogen gas exposure and higher pressure is known to embrittle older steel pipelines, but not newer steel and polyethylene pipelines. However, this would need to be addressed to ensure total safety in gas transmission

End-use limitations: The hydrogen blend ratio will be entirely dependent on end-use applications. General domestic use gas devices are being tested to tolerate a 15 to 20% blend, while more specific industrial processes could handle a maximum of 5% hydrogen blend

Lower energy density: Hydrogen has about one-third the energy density of natural gas, meaning the energy content of blended gas would be lower. As the hydrogen blend rises, the gas would need to be compressed for energy density parity

Pipeline volume capacity: Growing hydrogen blends with lower energy per volume would require higher volumes of gas to be moved. This would spell eventual added transmission and storage capacity needs.

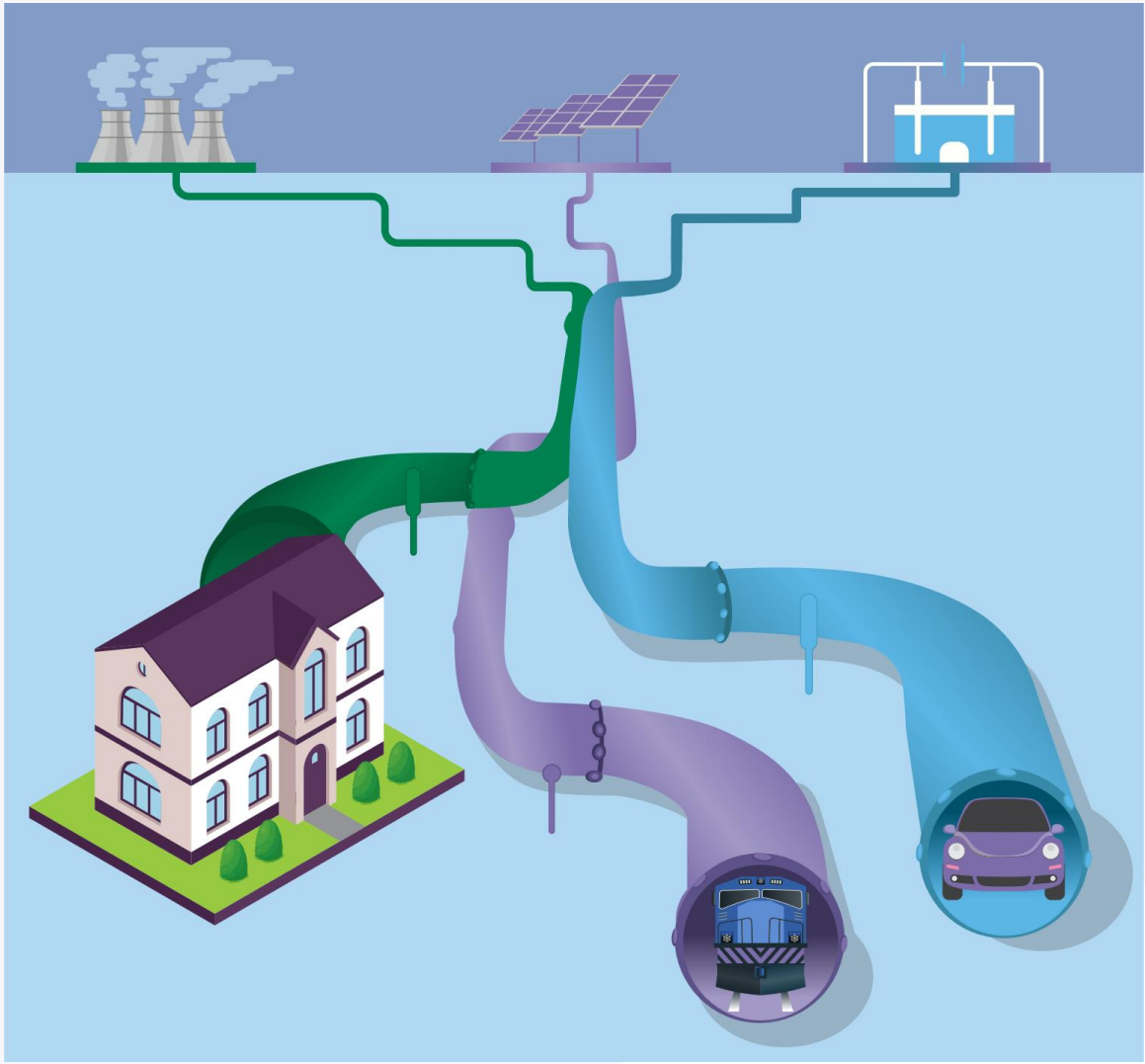
Leakage: Gas leakage through pipeline welds is a known issue for natural gas transmission. Hydrogen being the lightest element would need even more secure pipelines to limit the transmission losses

Lack of regulation: Hydrogen blending standards will need to be declared very soon. There are none. This will ensure there is oversight on the blending processes and safety norms

Current applications by gas majors

The magnitude of the advantages presented by blending hydrogen gas into existing natural gas supply systems is not lost on either major natgas players nor on governments with large pipeline networks. Here are some of the projects being used to demonstrate the capabilities and applications of the blended gas.

U.S.-based Sempra Energy's utilities, SoCalGas and SDG&E are conducting their first demonstration project in California to decarbonise the natural gas grid in the region. The project begins with a 1% hydrogen blend in an isolated section of its network which has primarily polyethylene-based pipelines and could eventually increase the blend to 20%.



- Enbridge Gas Inc. and Cummins Inc., through a Calgary-based subsidiary, plan to experiment with a hydrogen blend upto 2% supplied to about 3,600 customers based in Markham, Ontario. Much of the hydrogen produced will come from a facility powered by excess electricity from the grid.

- The Divina (Decarbonisation of the Glass Industry: Hydrogen and New Equipment) Project which is being coordinated by a working group of Snam, RINA and Bormioli among others aims to cut GHG emissions in glass melting, which contributes about 50% of the total energy consumption in the entire glass production process. The scale of this project becomes apparent due to its location in Italy, the second largest producer of glass objects in Europe.

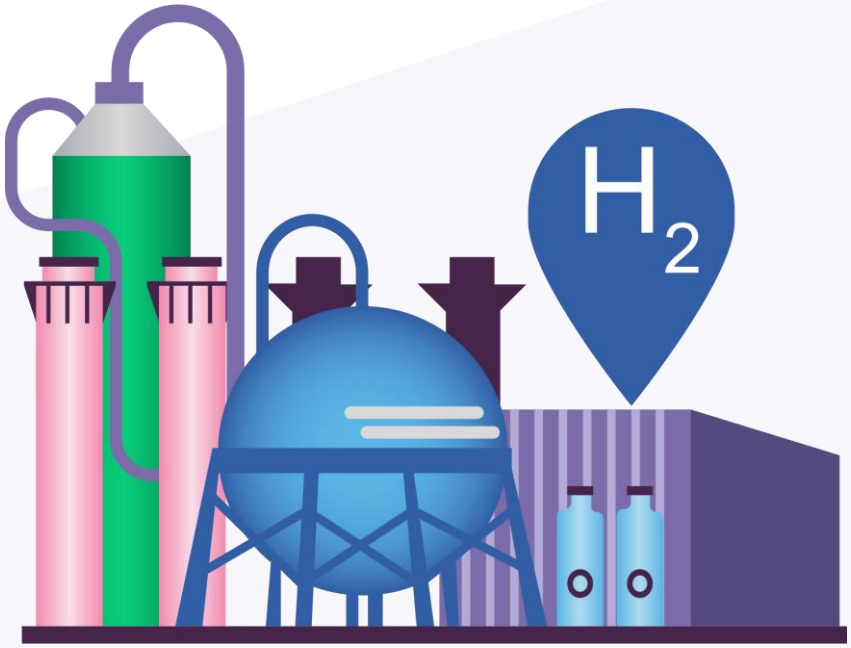
- Snam has also recently doubled the volume of hydrogen blended in its natural gas transmission network in Contursi Terme (Salerno) to 10%. It estimates that through this higher blend, it could introduce close to 7 billion cubic meters (bcm) of hydrogen into its gas network, resulting in a CO2 emission reduction of 5 million tons (mt).

- The Australia Renewable Energy Agency (ARENA) is betting big on hydrogen solutions. Among its recent funding rounds recipients are ATCO which will receive $28.7 million to produce hydrogen for gas blending in Western Australia, while AGIG will receive upto $32.1 million for a gas blending project in Victoria.

- The U.S. Department of Energy’s Hydrogen and Fuel Cell Technologies Office (HFTO) has launched the HyBlend Project in November 2020 to address the technical barriers of blending hydrogen gas in natural gas pipelines, including compatibility of pipelines, lifecycle and techno-economic analyses. HyBlend has partnered with six national laboratories as well as 20 industry and academia participants for the two-year project, which will be led by National Renewable Energy Laboratory (NREL).

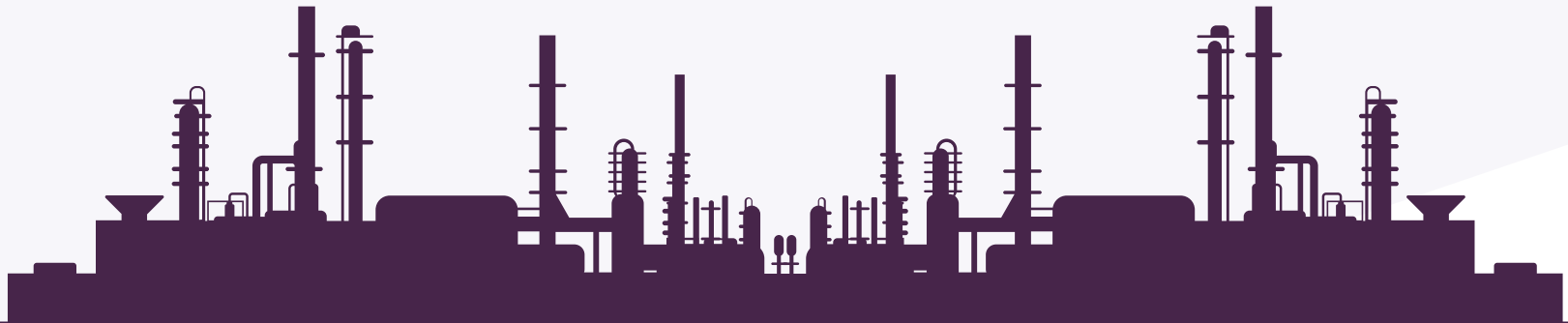
- HyDeploy is the U.K. government’s project to inject green hydrogen into a has gas network, to be utilised for home and business use. The project at Keele University has already begun testing a 20% maximum hydrogen blend, the highest in Europe, feeding it to 100 homes and 30 faculty buildings. The project is led by Cadent in partnership with Northern Gas Networks and other participants.

Conclusion



The question of hydrogen's feasibility and prominence within the energy mix is not one of if, but only when. When an energy source is pegged to meet a quarter of the global energy demand within coming decades, everyone sits up and takes notice. And, so have some majors of the natural gas space. It would be no secret that the hydrogen gas blending into existing natural gas supply systems would serve their interests in terms of costs as well as scope for decarbonisation within their current value chains.

Blue hydrogen in particular is in need of a massive scale-up and now. For, it is a near to mid-term solution for the world's hydrogen needs until green hydrogen reaches the economies of scale where it becomes cost competitive and hence accessible. In such a scenario, oil and gas players practically have the keys to the energy kingdom in their hands if they can pivot quickly enough to make the most of the opportunity and prolong their operability within changing emission scenarios. One estimate is that blue hydrogen projects that do not come online by 2030 risk becoming non-competitive, as other options might be available by then.



A major push for faster adoption of hydrogen solutions could come from policy. While major gigawatt-scale projects are being announced and net-zero goals are being set, the incentivising of such projects through subsidies and tenders remains a big unknown. This policy should also focus on passing the benefits to end-users apart from the suppliers. In the case of natural gas, hydrogen blends upto 20% seem feasible without much change. But once that blend threshold is crossed, the users will need to upgrade their devices to be compatible and safe as well.

In such a case, it will be as much up to governments to provide a buffer for users towards the eventual upgrade as it will be up to natural gas suppliers to ensure that a small chunk of their hydrogen-blended profits goes into retaining their customer.

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