

BRIEFING September 2022

HEATING HOMES WITH GAS IS EXPENSIVE, HEATING WITH HYDROGEN COULD COST DOUBLE

**Switching to hydrogen could cost €240 billion.
Companies have lobbied so gas customers would pay.**

Gas companies want Europeans to heat their homes using hydrogen instead of fossil gas, a position the European Commission has said it will allow. But this could cost more than double what consumers currently pay for already expensive gas. And – if companies lobbying the EU get what they have asked for – all gas users, even those who do not want to use hydrogen, could be forced to pay €240 billion to fund hydrogen infrastructure they do not need.

With tens of millions of Europeans facing energy poverty, EU officials should be making home heating cheaper, not opting for expensive hydrogen and letting companies shift costs to consumers. As the European Parliament and Council debate draft legislation called the Gas Package, they should reject the use of hydrogen to heat homes and prevent gas companies shifting the costs for hydrogen infrastructure on to consumers.

HYDROGEN FOR HOMES

The EU needs to stop using fossil gas if it is to meet critical climate targets – the fuel is now second only to oil as Europe’s largest carbon emitter.¹ A big part of this effort will be helping everyday Europeans switch to a new source of energy. In 2020, nearly a third of household energy consumption was from gas.²

Europe’s gas transport companies think the answer is hydrogen.³ Like fossil gas, hydrogen can be burned to generate heat, and is currently used in some industries.⁴ Gas companies are promoting the idea that the fuel could do the same for Europe’s homes, replacing the gas powering boilers and stoves.

In theory, hydrogen can be a green alternative to gas. It can be produced using electricity generated from renewable sources like wind or solar. The fuel can then be sent to homes by pipe, explaining why gas transport companies like it.

Such renewables-based “green” hydrogen is a best-case scenario. At present, where hydrogen is used, it is generated largely by the very climate-wrecking gas it should be replacing.⁵ There is a good chance that much of Europe’s hydrogen would continue to be produced using fossil gas,⁶ and gas companies have been fighting to get support for gas-based hydrogen.⁷ Those touting the technology claim that, in the future, this can change and hydrogen can be produced by renewable sources.⁸

Fortunately for the fuel’s proponents, the European Commission is supporting hydrogen. In December 2021, the Commission proposed new rules on Europe’s gas and hydrogen markets (the Gas Package), that would help gas companies switch consumers – including households – to hydrogen. The Gas Package is currently being

debated by the European Parliament and Council.⁹

According to the Commission, a main aim of the Package is to “establish a market for hydrogen, create the right environment for investment, and enable the development of dedicated infrastructure.”¹⁰ At the same time, the proposal would give gas companies significant control over EU decisions about what hydrogen infrastructure should be built.¹¹

WORSE THAN GAS

But even in the unlikely event that hydrogen becomes green there is a problem: it could cost over twice as much as the already expensive gas it is supposed to replace. For Europeans struggling with high energy prices, the switch to hydrogen is unaffordable.

Switching homes to hydrogen requires an immense overhaul of Europe’s energy infrastructure – a big commitment by the EU and the consumers who will pay for it. We would need to build electrolyzers that will convert electricity into hydrogen, new pipes and pumps that push it into homes (most of those used for fossil gas do not work for hydrogen), and we need to buy boilers that run on the new fuel and meters that measure how much we are using.¹²

A new analysis, produced by the energy market consultancy Element Energy for Global Witness, outlines the costs of switching European households from gas to hydrogen. Element Energy, which has produced studies for a range of governments, companies, and non-profits,¹³ estimated how much it would cost to build and operate the infrastructure needed to get hydrogen into homes. Also included is how much it would cost to build and operate the renewable energy facilities needed to produce hydrogen in the first place. Not included were any value-added taxes (VAT) governments may add to bills.

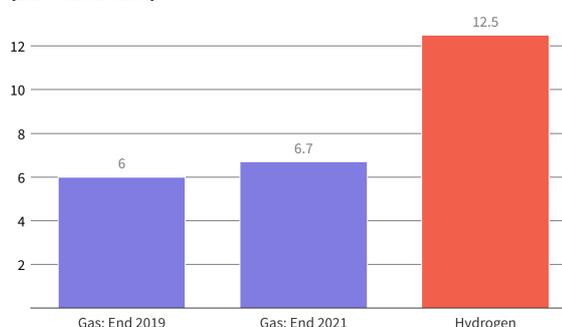
According to Element Energy, in 2050 households could spend an estimated average of 12.5 Euro Cents per unit of hydrogen energy, called a kilowatt hour (kWh). For a medium-sized house, this would represent an annual household hydrogen bill of €1,580 – which includes energy

production and network costs, but not VAT. Like a gas bill, this would come on top of a household’s electricity bill.

Compared to the gas that hydrogen would replace, this is expensive. At the end of 2019, before either the COVID pandemic or Russia’s invasion of Ukraine affected global energy prices, gas cost European households an average of 6 Euro Cents/kWh, less than half of what hydrogen would cost.¹⁴ Like hydrogen, this gas cost includes energy production and network costs, but not VAT.

The story is similar even as the energy crisis has caused household gas bills to rise. At the end of 2021 – the last period for which data is available – Europeans spent an average of 6.7 Euro Cents/kWh.¹⁵ At the time, the energy crisis had started,¹⁶ yet gas prices were still roughly half of hydrogen’s forecast prices. As gas prices have continued to rise in 2022 this gap will have shrunk. But until new EU gas price data is available it will be unclear whether costs have jumped high enough to overtake hydrogen.

Hydrogen could cost twice as much as already high fossil gas prices (Euro Cents/kWh)



Element Energy’s study presents three price scenarios for hydrogen, of which €1,580 is the central annual household estimated cost. Average bills could be as high as €2,170 per year or dip to €1,440 – still nearly double recent gas prices. Each scenario is an average across the EU, with people in some countries paying more and others paying less. Scenarios are for an average sized household, with larger homes paying more and smaller apartments paying less.

The scenarios are based upon estimated infrastructure costs and they are discounted for

long-term inflation. But the data on which they rely was produced before recent inflation spikes, which would likely increase some costs. And they assume that hydrogen will be produced using renewable energy and not fossil gas so that it does not contribute to the climate crisis.

Additional analyses of hydrogen costs have been produced. A recent study by the International Council on Clean Transport (ICCT) estimated that renewables-based hydrogen would cost even more: roughly 18 Euro Cents/kWh in 2020, dropping to around 10 Euro Cents/kWh in 2050.¹⁷ These estimates include only production costs and not the costs of building pipelines or storage. However, because ICCT assumes that prices will decrease over time, its estimates and those produced by Element Energy are broadly similar.

There are sectors of Europe's economy that will need to use hydrogen. Like households, heavy industries and large transportation sectors – shipping, long-haul air transport – will also need to stop using fossil fuels. For industries like these, renewables-based hydrogen may be the only alternative.

But it is clear that for households, switching to hydrogen would make Europeans already facing energy poverty even poorer. It is possible that as many as 80 million Europeans are now experiencing energy poverty.¹⁸ Doubling the price people pay by replacing gas with hydrogen would cause this number to increase significantly and – unless tempered by costly government interventions – would hit Europe's poorest the hardest.

A €240 BILLION BILL

Such costs are likely, of course, to cause households to reject hydrogen in favour of cheaper alternatives for replacing gas. Yet if the gas companies get what they have called for, even if households do not switch, they may still end up paying for those that do.

A large part of what makes hydrogen so expensive is the new infrastructure it requires. Element Energy have created two categories of infrastructure costs. First, there are those that

would be borne only by consumers who use hydrogen, such as electrolysers, storage facilities, and household meters. The second category contains costs that could be borne by all gas consumers, even if they do not use hydrogen, such as building pipelines to transport the fuel.

Based on Element Energy's analysis, Global Witness estimates that the cost of hydrogen infrastructure that could be borne by all gas consumers would total €240 billion over the 40 years it could be in use.¹⁹

These estimates depend upon several variables. The first is how much hydrogen infrastructure would be built. Element Energy assumes that infrastructure would be built for all gas consumers. Ready4H2, a coalition of over 90 European gas companies,²⁰ has made similar projections, estimating how much hydrogen energy would be used were all its gas users to switch.²¹

Second, these estimates assume that all gas consumers are only asked to pay for some infrastructure costs: the pipelines that transport hydrogen. If more costs (electrolysers, storage) are spread between all gas users, then this bill would become even higher.

This big bill matters because, according to EU lobbying records, some gas companies have pushed for current gas consumers to pay it. Rather than having only those consumers (like industries) that are prepared to use hydrogen pay for its infrastructure, companies want to charge households that may not even use the fuel. In some countries, this effort has been led by the utilities that run local pipelines that currently transport gas to homes and businesses, called distribution system operators (DSOs).

In 2021, the German Gas and Water Association (DVGW) – which counts nearly 1,900 utilities as members²² – responded to a European Commission consultation on the Gas Package. In addition to asking for state subsidies to pay for hydrogen infrastructure, DVGW stated that “all current gas-end users” needed to help pay.²³ Southern Germany's Erdgas Schwaben DSO²⁴ agreed: hydrogen conversion costs could not be

borne only by existing hydrogen consumers, or “the accounting becomes next to impossible.”²⁵

Italian DSOs have taken a similar position. Also responding to the Commission’s 2021 gas consultation, Italian lobby group ANIGAS – which represents nearly 70 companies²⁶ – argued that hydrogen infrastructure should be paid for by both current users and those who might switch to the fuel “in the next [sic] future.”²⁷

Companies that run larger gas pipelines supplying DSOs, called transmission system operators (TSOs), have also lobbied for all gas consumers to pay for the switch. According to minutes from a 2021 meeting between five of Germany’s main TSOs and Commission officials, company representatives pushed for “high initial hydrogen network costs” to be covered by existing gas customers.²⁸ This year, the same point was made at a meeting attended by Belgium’s TSO Fluxys, the pan-European lobbying group Gas Infrastructure Europe, and Commission officials: the costs of hydrogen should be “mutualized” with gas costs – they should be shared between hydrogen and gas users.²⁹

To date, these lobbying efforts appear to be working. The Commission’s December 2021 Gas Package proposal states EU countries may allow companies supplying hydrogen to share infrastructure costs between their hydrogen and gas consumers. Such costs cannot, however, be shared forever, and could only be charged for “one third of the depreciation period of the infrastructure concerned.”³⁰

With Europeans facing extraordinarily high energy bills, it is remarkable that gas companies have lobbied for – and the Commission is prepared to allow – people to pay hundreds of Euros extra on their bills to build infrastructure they may not use.

GETTING EU POLICY RIGHT

The European Parliament and the Council must protect consumers and stop the gas industry’s efforts to switch them to hydrogen.

Europe does need to stop using gas, but there is a better alternative to hydrogen: energy savings and home heating sources such as heat pumps and district heating using renewable electricity. Multiple studies have shown that renewables are far cheaper for households,³¹ and they are a better way of meeting Europe’s climate goals than relying on a fuel that is currently generated using fossil gas.

Accordingly, the Parliament and Council should amend the Gas Package to ensure the following:

- > Hydrogen should be used only where it is the only viable alternative to fossil gas, for example in certain heavy industries and transportation sectors, like shipping. The fuel should only be produced using renewable electricity and companies should be barred from transporting a blend of hydrogen and natural gas.
- > Companies should be barred from requiring households to share the costs of building hydrogen infrastructure from which they do not directly benefit.
- > Energy regulators should be tasked with examining the cost-effectiveness of supplying buildings with hydrogen, including expensive construction of hydrogen infrastructure.
- > Gas DSO network planning should be more transparent and open to participation from other stakeholders, including communities, civil society groups, and local governments. DSO planning should be in line with EU and national climate and energy targets, be based on local heating and cooling plans, and identify those parts of the network that require decommissioning.
- > Market rules should ensure the rapid phase out of fossil gas use across all sectors, including households and industry by 2035.

ENDNOTES

- ¹ Global Carbon Atlas, EU27 Carbon Emissions, available at <http://www.globalcarbonatlas.org/en/CO2-emissions>, last visited 3 August 2022.
- ² Eurostat, Energy consumption in households, available at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_consumption_in_households, last visited 30 June 2022.
- ³ Gas Infrastructure Europe, GIE Narrative on Hydrogen and Decarbonised Gas Market Package, 17 May 2022, available at https://www.gie.eu/wp-content/uploads/filr/7091/GIE_Narrative_on_Hydrogen_and_De-carbonised_Gas_Market_Package.pdf.
- ⁴ IEA, The Future of Hydrogen, June 2019, available at <https://www.iea.org/reports/the-future-of-hydrogen>.
- ⁵ IEA, The Future of Hydrogen, June 2019, available at <https://www.iea.org/reports/the-future-of-hydrogen>.
- ⁶ Climate Action Network Europe, Hydrogen Position, February 2021, available at https://caneurope.org/content/uploads/2021/02/CAN-Europe_position-on-hydrogen_February-2021.pdf. See also The International Council on Clean Transportation, Life-cycle greenhouse gas emissions of biomethane and hydrogen pathways in the European Union, Updated 14 June 2022, available at <https://theicct.org/publication/life-cycle-greenhouse-gas-emissions-of-biomethane-and-hydrogen-pathways-in-the-european-union/>.
- ⁷ Global Witness, Corporate lobbyists pushing to gut EU rules for renewable hydrogen, 11 June 2021, available at <https://www.globalwitness.org/en/press-releases/corporate-lobbyists-pushing-gut-eu-rules-renewable-hydrogen/>.
- ⁸ Hydrogen Europe, Green Hydrogen Investment and Support Report, May 2020, p. 6, available at https://profadvanwijk.com/wp-content/uploads/2020/05/Hydrogen-Europe_Green-Hydrogen-Recovery-Report_final.pdf.
- ⁹ European Parliament, Revision of the EU Gas Regulation, 23 June 2022, available at <https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revised-regulatory-framework-for-competitive-decarbonised-gas-markets-2>.
- ¹⁰ European Commission, Commission proposes new EU framework to decarbonise gas markets, promote hydrogen and reduce methane emissions, 15 December 2021, available at https://ec.europa.eu/commission/presscorner/detail/en/IP_21_682.
- ¹¹ Global Witness, EU gas market reform set to boost the fossil gas industry and fail the climate, health and the energy-poor, 15 December 2021, available at <https://www.globalwitness.org/en/press-releases/eu-gas-market-reform-set-boost-fossil-gas-industry-and-fail-climate-health-and-energy-poor/>.
- ¹² Agora, No-regret hydrogen, February 2021, sec. 4, available at https://static.agora-energiawende.de/fileadmin/Projekte/2021/2021_02_EU_H2Grid/A-EW_203_No-regret-hydrogen_WEB.pdf.
- ¹³ Element Energy, A selection of our clients, available at <http://www.element-energy.co.uk/a-selection-of-our-clients/>, last visited 3 August 2022.
- ¹⁴ Eurostat, Gas prices for household consumers - bi-annual data, available at https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_202/de-fault/table?lang=en, last visited 3 August 2022. Eurostat household gas data is available for prices including all taxes, all taxes except VAT and recoverable taxes, and no taxes. Global Witness here uses the price category that includes all taxes except VAT and recoverable taxes because it will certainly include fees issued to consumers for construction and maintenance of gas infrastructure, and thus be comparable to the hydrogen cost estimates produced by Element Energy. However, it is likely this price category also includes taxes that are not included in the estimated hydrogen cost, and thus inflates the cost of gas relative to hydrogen. For detail on Eurostat price categories, see Eurostat, Energy statistics - Gas prices for domestic and industrial consumers, sec. 3, available at https://ec.europa.eu/eurostat/cache/metadata/en/nrg_pc_202_esms.htm, last visited 3 August 2022. See also, European Union, Directive 2008/92/EC, 22 October 2008, Annex I(m), available at <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0092&from=EN>.
- ¹⁵ Eurostat, Gas prices for household consumers - bi-annual data, available at https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_202/de-fault/table?lang=en, last visited 3 August 2022.
- ¹⁶ EU Institute for Security Studies, Europe's Energy Crisis Conundrum, 28 January 2022, available at <https://www.iss.europa.eu/content/europes-energy-crisis-conundrum>.
- ¹⁷ International Council on Clean Transport, Cost of renewable hydrogen produced onsite at hydrogen refuelling stations in Europe, February 2022, p. 6, available at <https://theicct.org/wp-content/uploads/2022/02/fuels-eu-cost-renew-H-produced-onsite-H-refueling-stations-europe-feb22.pdf>. ICCT estimates a 2020 hydrogen production price of €6/kg. €1/kg equals 33.3 kWh. €6/kg divided by 33.3 kWh equals €0.180/kWh. IdealHy, Liquid Hydrogen Outline, available at https://www.idealhy.eu/index.php?page=lh2_outline#:~:text=1%20kg%20of%20hydrogen%20contains,www.h2data.de, last visited 7 July 2022.
- ¹⁸ EU Fact Check, Mostly False, "More than 30 million Europeans live in energy poverty," 16 June 2022, available at <https://eufactcheck.eu/factcheck/mostly-false-more-than-30-million-europeans-live-in-energy-poverty/>.
- ¹⁹ Calculations draws upon Element Energy estimated average annual hydrogen infrastructure conversion cost of 0.0032 €/kWh or 3,200,000 €/TWh. Element annual cost has been spread over 40 year expected infrastructure life, so total cost annual obtained by multiplying annual cost by 40. Low range cost assumes 44 percent of gas use replaced by hydrogen, totalling annual usage of 465 TWh. High range estimate assumes 100 percent of gas use replaced by hydrogen, totalling annual usage of 1,057 TWh. Low range cost gas replacement drawn from Fuel Cells and Hydrogen 2 Joint Undertaking, Hydrogen Roadmap Europe, 2019, p. 48, available at https://www.fch.europa.eu/sites/default/files/Hydrogen%20Roadmap%20Europe_Report.pdf.
- ²⁰ Ready4H2, Who we are, available at <https://www.ready4h2.com/>, last visited 27 July 2022.
- ²¹ Ready4H2, Local gas networks are getting ready to convert, slide 5, available at https://www.ready4h2.com/_files/ugd/597932_0d67d1d9fd3e467ea03d941fcb6a645.pdf, last visited 27 July 2022.

²² DVGW, DVGW at a glance, available at <https://www.dvgw.de/medien/dvgw/leistungen/publikationen/dvgw-at-a-glance.pdf>, last visited 30 June 2022.

²³ DVGW, Consultation Response: Gas networks – revision of EU rules on market access, 10 March 2021, available at https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12911-Gas-networks-revision-of-EU-rules-on-market-access/F1966382_en.

²⁴ Erdgas Schwaben, Natural gas in numbers <https://www.erdgas-schwaben.de/ueber-uns/unternehmen/zahlen-und-fakten>, last visited 30 June 2022.

²⁵ Erdgas Schwaben, Accompanying document to the Public Consultation questionnaire on the Hydrogen and Gas Market Decarbonisation Package, 18 June 2021, p. 3.

²⁶ ANIGAS, The Associated Companies, available at <https://www.anigas.it/le-imprese-associate/>, last visited 30 June 2022.

²⁷ ANIGAS, Hydrogen and Gas Market Decarbonisation Package Integrated Observations, 18 June 2021, p. 5.

²⁸ European Commission, Minutes from the meeting with German TSOs Bayernets, OGE, Gascade, Ontras, 29 September 2021, available at

https://www.asktheeu.org/en/request/10072/response/34173/attach/4/Minutes%20from%20the%20meeting%20with%20German%20TSOs%20final%20docx%20Redacted.pdf?cookie_passthrough=1.

²⁹ European Commission, Meeting with GIE on Security of Supply and the Hydrogen and Gas markets and decarbonisation package, 1 February 2022, available at https://www.asktheeu.org/en/request/10738/response/36791/attach/7/20220102%20TMU%20meeting%20minutes%20Kadri%20Simson%20with%20GIE.docx%20Redacted.pdf?cookie_passthrough=1.

³⁰ European Commission, Regulation on the internal markets for renewable and natural gases and for hydrogen, 15 December 2021, Art. 4, available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2021%3A804%3AFIN&qid=1640001545187>.

³¹ Jan Rosenow, Hydrogen Heating Studies, available at https://www.linkedin.com/posts/janrosenow_hydrogen-heating-studies-activity-6930099391642935296-LvOu?utm_source=linkedin_share&utm_medium=member_desktop_web, last visited 30 June 2022.