

efuels
report
europe

1—2022

Strong tailwinds

A pilot plant for the industrial-scale production of efuels is being built in Chile

Fit for 55

How green hydrogen and efuels could change the game



‘It is important to be open to technology’

EU TRANSPORT COMMISSIONER
ADINA VĂLEAN ON THE IMPORTANCE OF
CO₂-NEUTRAL SYNTHETIC FUELS
FOR THE ENERGY REVOLUTION



‘These days, you can’t base your business model on state subsidies – and the electric car will probably need them for quite a while... And if we want to preserve the possibility of individual mobility for the public at large, we must ensure the availability of various drive technologies. Betting everything on electromobility would be truly risky.’

**Renault Development Director
Gilles Le Borgne**

in [auto-motor-und-sport.de](https://www.auto-motor-und-sport.de)
from April 21, 2022

Florian Flicke (l.)
and Gerhard Walter,
editors-in-chief:
Climate-neutral mobility – a
dream that could become
part of European reality
right away.



How climate-neutral Europe can become a reality *(but other than expected)*

HOW DO YOU
LIKE US?
—
If you want to
share praise, criticism or
suggestions
with us, please write to:
europe@uniti.de



If you're having visions, you don't need a doctor – no matter what a prominent former German Chancellor may have said on this point. However, there comes a time when a change of perspective becomes advisable to allow one's dreams to become reality. When it comes to the vision of a climate-neutral mobility in Europe, that time is now. It's a dream that could become part of European reality right away. But in order to achieve it, the right course must be set as quickly as possible – or even better: immediately. With this in mind, welcome to the first edition of efuels report europe. Going forward we want to report regularly on the potential of synthetic green fuels – and show the opportunities but also challenges associated with the future topic of efuels. Efuels will help to shape a carbon-neutral future with better resilience whilst saving an affordable individual mobility for EU citizens.

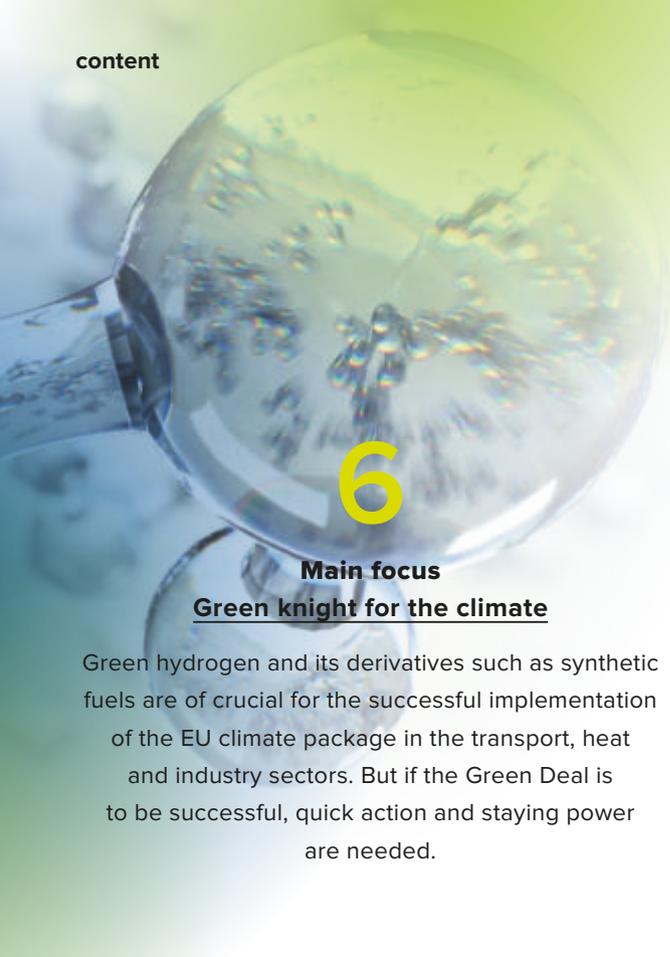
Through the research we've conducted and numerous discussions we've held with experts in the fields of business, science and politics in the run-up to this first edition of the efuels report europe, one thing has become increasingly clear to us: if climate protection in Europe is to prove a successful endeavour, green hydrogen and derivatives of it – such as synthetic fuels produced in an economical and carbon-neutral fashion from renewable energies in wind- and sun-rich regions of the world and imported in liquid form – will play a central role. If we are to walk the path of the European Green Deal and arrive in the energy revolution, we must keep an open mind about technology and people's mobility needs, as well as take a pragmatic approach to what is technically feasible. While a reasonable and im-

portant development, increased reliance on electromobility alone will not lead to the energy revolution that we want, indeed need, to implement in the transport sector by 2030. Challenges here include the charging network, which is still on the spotty side in many EU countries today. Then there are e-vehicles, which are hardly affordable for many average earners in the EU. That is why the solution for climate-neutral individual mobility cannot be an 'either/or', but must instead be a 'both ... and' response. Since they are compatible with the technology that is already on the market today, efuels can be used immediately, in both the transport sector and in the heating market – and without any technical adjustments made to the cars, trucks, aircraft, ships and condensing boilers that make up both.

However, in order to accelerate the ramp-up of efuels production, regulatory conditions in the EU, for example with regard to energy taxes, must be tweaked accordingly: Brussels failed to seize one major opportunity posed by the CO₂ fleet regulation for passenger cars, opting instead to punt to a review in 2026. But the time to act is now, if the dream of a climate-neutral Europe is to have any real hope of becoming reality, while maintaining prosperity and economic growth on the continent.

Happy reading! We hope you gain some new insight into this exciting topic!

The editors-in-chief,
Florian Flicke and Gerhard Walter



6

Main focus
Green knight for the climate

Green hydrogen and its derivatives such as synthetic fuels are of crucial for the successful implementation of the EU climate package in the transport, heat and industry sectors. But if the Green Deal is to be successful, quick action and staying power are needed.

5 Take a look

Global PtX production

International hydrogen partnerships help Europe's climate and economy

6 Main focus

Fit for 55

**Efuels as a game changer –
How the EU climate pact can actually be implemented**

8 Interview

Efuels forward duo Monika Griefahn and Ralf Diemer
Synthetic green fuels can replace petrol and diesel

13 Figures

The efuels report europe figure

1.2 million new jobs through investments in Ptl plants

14 Down to business

CO₂ fleet regulation

Opportunity for openness to technology can still be seized



8

Pragmatic, pioneering thinkers

Monika Griefahn and Ralf Diemer from the eFuel Alliance explain why Europe's energy revolution in the transport sector cannot succeed without green synthetic fuels.



22

Ready for the market ramp-up

If the existing fleet is to be made CO₂-neutral, running vehicles on efuels is indispensable. That's why Porsche, along with Siemens Energy, is involved in the production of synthetic green fuels in Chile.



18 Interview

EU Transport Commissioner Vălean
'It is important to be open to technology'

20 Down to business

A one-size-fits-all solution
Analysis on affordable, green fuelling

22 Report

A look at real-world practice
Out of the ivory tower and into industrial production: efuels made in Chile

26 News

What happens with the ban on combustion engines
News from the energy world

27 60 seconds about ...

The limits of e-mobility
Why electric drives might divide Europe

IMPRINT

PUBLISHER UNITI Bundesverband mittelständischer Mineralölunternehmen e.V., Jägerstrasse 6, 10117 Berlin, Matthias Plötzke (person responsible according to the German Press Law)
EDITORIAL ADVISORY BOARD Elmar Kühn, Dirk Arne Kuhr, Dominik Hellriegel, Alexander Vorbau **EDITOR-IN-CHIEF** Florian Flicke **EDITORIAL BOARD** Gerhard Walter
EDITORS Frank Burger, Wolfgang Kempkens, Kristina Simons, Sebastian Wolking **ART DIRECTION** Periodical.de **IMAGE EDITING** Karin Aneser **PUBLISHER AND EDITORIAL OFFICE ADDRESS** Solutions by HANDELSBLATT MEDIA GROUP GmbH, Toulouser Allee 27, 40211 Düsseldorf, Tel. +49 (0)211 5422 7700, Fax +49 (0)211 5422 7722, www.solutions-hmg.com **EDITORIAL MANAGEMENT** Jan Leiskau, Dr Christian Sellmann **PRINT** MÖLLER PRO MEDIA GmbH, 16356 Ahrensfelde **LITHOGRAPHY** TiMe GmbH
ADDRESS CHANGES UNITI office, Tel. +49 (0)30 755 414 300, Fax +49 (0)30 755 414 366, Email: info@uniti.de **ISSN 2195-4445** The content of the articles does not necessarily reflect the opinion of the publisher. All articles are protected by copyright. We reserve the right to make changes.



Plenty of land, sunny skies and abundant wind: there are 97 countries and regions around the globe, on an area of 2.4 million square kilometres of inland, coasts and inland waters, with the potential to supply not only Europe but the world with green hydrogen and CO₂-neutral synthetic fuels. This is the assessment reached by the German Fraunhofer Institute for Energy Economics and Energy System Technology (IEE) in their recently published 'PtX Potential Atlas'. The Atlas shows that PtL (power-to-liquid) fuels, which are produced with green hydrogen and CO₂ only, could play the game-changing role in advancing climate protection in Europe and around the world – while at the same time making the energy revolution a reality. In the long term, around 85,000 to 88,000 terawatt hours of energy, in the form of liquid green fuels, could be produced sustainably outside of Europe. That is enough to also supply the EU member states, in addition to Great Britain, Norway and Switzerland, with a current annual demand of 2,361 terawatt hours of CO₂-neutral liquid energy for material use in the industrial and transport sectors. The most economical production sites for green hydrogen and CO₂-neutral PtX fuels would be wind farms in Argentina and Chile as well as photovoltaic plants in Australia, Egypt, Mexico, Libya and Saudi Arabia. But Australia, Morocco and Mauritania – not to mention the USA – also make for good locations for the production of hybrid green energy from both wind and solar power. All these are viable regions for energy and hydrogen partnerships with the EU. ■

HOW EFUELS CAN ACCELERATE THE ENERGY REVOLUTION

WRITTEN BY Sebastian Wolking

There is no life without energy. Synthetic fuels can revitalise economies and transport. If efuels are produced using electricity from renewable energies, even internal combustion cars can be climate-neutral road users – and, in combination with electric cars, rapidly improve the climate footprint of today's and tomorrow's mobility sector. Achieving this goal will require swift action as well as a smart political framework and staying power.



The majority of cars on the road in Europe run on petrol and diesel.

The European Union has big plans: its Green Deal aims to transform the EU into an economy with no net emissions of greenhouse gases by 2050. By as early as 2030, related policies will reduce net emissions by 55%. The transport sector accounts for around a quarter of greenhouse gas emissions in the EU. As such, electrically powered vehicles play a central role in EU lawmakers' deliberations. In fact, sales and market shares of e-cars are growing steadily. In the first quarter of 2022, one in ten vehicles sold in the EU was an electric car. According to the European Automobile Manufacturers Association ACEA, plug-in hybrids accounted for a further 8.9% of all new registrations. Conversely, however, this also means that the majority of cars on the road in Europe will continue to run on petrol and diesel. Even after 2030, most Europeans will continue to refuel their cars with liquid fuels – purchase premiums and tax breaks for electric vehicles notwithstanding. **Even the number of e-vehicle registrations increasing more than tenfold over the next few years would put the ambitious climate protection targets still out of reach. This was pointed out by a study published by the management consulting firm Boston Consulting.**

Synthetic fuels – also called efuels – can accelerate the energy revolution. Experts even consider them an indispensable component in the fight against climate change. Not as competition for electric drives, but in addition to them. 'Efuels are necessary to achieve the EU's climate protection targets for the transport sector,' wrote the German Energy Agency (DENA) in a report five years ago. And nothing has changed in this regard to date. According to a study by the renowned economic research centre Prognos AG, 'liquid renewable fuels are indispensable for a greenhouse gas-neutral energy supply'.

Efuels would make today's car fleet more climate-friendly, let alone tomorrow's. However, critics frequently point at the lower efficiency of efuels. In fact, in an overall efficiency comparison that takes both production and utilization into account, internal combustion vehicles powered by carbon-neutral fuels have an overall energy balance comparable to that of battery-powered vehicles. This was the conclusion of a detailed study by the consulting firm Frontier Economics.

'A unique opportunity to synergise energy supply, climate protection and value creation'

It is not only daily commuters, shoppers or holi- →

←
Gamechanger:

Green hydrogen and synthetic fuels can even significantly shape and support the foreign, security and development policy of the EU.

Efuels would make today's car fleet more climate-friendly.

INTERVIEW

‘Europe must take a broader stance’

In addition to e-mobility, green synthetic fuels are the foundation for successful climate protection in Europe – of this Dr Monika Griefahn and Ralf Diemer of the eFuel Alliance are convinced. In this joint interview, they explain why an import strategy for efuels would be a particular boon for the European economy.

INTERVIEW BY Gerhard Walter



A co-founder of Greenpeace Germany and a top car lobbyist as the forward duo. How is it that you are both committed to the topic of efuels?

MONIKA GRIEFAHN Efuels are an additional solution to help stop climate change and achieve CO₂ neutrality. In addition to e-mobility, we need synthetic fuels in all mobility sectors – i.e., for aircraft, ships, lorries, construction machinery, off-road vehicles and passenger cars as well. Besides being good for the environment, this will make us less dependent on the countries currently supplying us with fossil fuels, whether that is Russia, Saudi Arabia or Qatar.

RALF DIEMER Even when I was working for the car industry, I was not a fan of ideological trenches. We have both been committed to electromobility for a long time, but we are of the opinion that, without efuels, it can't work. In the end, it all comes down to lowering CO₂ emissions and protecting the climate. I don't see why the former Greenpeace founder and a car lobbyist shouldn't find common ground in this topic. After all, the goals we are pursuing are the same.

It is clear that the eFuel Alliance is a pretty diverse group. Its current membership of more than 170 includes Siemens, Energy, Bosch, Mazda and ADAC as well as the Central Association of the German Motor Vehicle Industry (ZDK) that represents automobile dealers and workshops. What is the guiding idea that unites these different actors?

MONIKA GRIEFAHN They all want their sectors to continue to work. But that is only possible if they are open to technology, that is, if they can continue to invest their engineering prowess in good prospects. What unites our members above all is the will to find solutions to achieve climate neutrality by 2050 at the latest and to reduce CO₂ emissions with efuels. The eFuel Alliance has set goals, and everyone who joins us shares them. That is why certain car manufacturers are not members: we demand, for example, that efuels are credited in the CO₂ fleet regulation. To us, it is of particular importance that our members come from the entire value chain, from automotive suppliers to consumers. That is why I am pleased that ADAC (German Automobile Club), with its 21 million members, is involved.

With its 'Fit for 55' programme, the EU Commission wants to ensure climate-neutral mobility and an affordable, sustainable energy supply in Europe. What role could efuels play in this project?

MONIKA GRIEFAHN We urgently need a rapid transition to renewable energies. However, on their own renewable energies in Germany and Europe will not be enough to solve all our energy needs in industry, heating or transport. There are many countries in the world where sun and wind are in abundance. Take Morocco, which is able of producing more renewable electricity than it itself needs. Since electricity is difficult to transport, efuels are an ideal solution – they allow electricity to be liquefied, making it transportable. And to this end, we can use the existing infrastructure that is already in place for internal combustion engines.

RALF DIEMER In its target package, the EU Commission wants to establish a share of renewable fuels of 2.6%. We are calling for 2.6% by 2028 and 5% by 2030, and not just for shipping and aviation, but for all areas of mobility. This is the sub-quota for hydrogen and efuels. We are grateful that European Parliament-Industry Committee even voted for 5,7 per cent back in July, a very important positive signal. As far as the overarching CO₂ quota for the entire transport sector goes, the Commission proposes 13% by 2030, whereas we demand 20%. These targets would allow us to replace around 70% of Russian oil imports by 2030. The Ukraine war and the resulting energy crisis we face today show us that fixating on one option can lead to dangerous dependencies. Europe must take a broader stance and pursue other climate-friendly solutions in addition to expanding e-mobility, such as the use of CO₂-neutral efuels.

How should the legal framework look to ensure efuels can be introduced in Europe and used across the board, for example in terms of energy taxes, renewable energies or a crediting system for fleet limits?

RALF DIEMER For the time being, there is no market for efuels in the EU. Regulatory incentives for investors are lacking for a market ramp-up of synthetic fuels. Energy taxation is not yet based on CO₂ emis-



Ralf Diemer

is managing director of the eFuel Alliance e.V. at the Berlin and Brussels locations. A lawyer, Diemer headed the Brussels office for the German Association of the Automotive Industry and then the department for Economic, Trade and Climate Protection Policy in Berlin.

Dr. Monika Griefahn

is chairwoman of the board of the eFuel Alliance and a founding member of Greenpeace Germany. She served as Environment Minister in Lower Saxony from 1990 to 1998, during which time she advocated for renewable energies and the phase-out of nuclear energy.

sions. Climate-neutral efuels, however, should be taxed at lower rates than fossil fuels. Ambitious quotas in the renewable energy directives could create a market incentive, since energy suppliers would have to meet these mandatory quotas, thus ensuring demand in turn. We are convinced that road transport in particular has a role to play here. Against this backdrop, we demand that the EU Commission submit a proposal as soon as possible after the Council and the EU Parliament have agreed on how to implement the crediting of efuels toward the fleet targets of car manufacturers. Without an additional option such as this, the fleet targets for passenger cars and vans would be too one-sided and exclusively focused on

electric mobility. By this logic, electric cars always have zero grams of emissions, regardless of whether they are powered by coal-fired electricity or renewable electricity. Whereas combustion cars, even if they run on 100% efuels and are thus climate-neutral, always produce local emissions and therefore have a CO₂ footprint. We want to change this by introducing a voluntary crediting system, whereby CO₂ emission savings from renewable fuels would count towards the EU fleet targets for new vehicles. This would allow a technology mix of climate-friendly solutions to complement European electrification efforts. Such a strategy will accelerate the defossilisation of the transport sector while keeping mobility affordable for all.

Right now, energy prices in Europe are very high. What prices per litre could consumers expect if green synthetic fuels were produced in Chile or North Africa, for example, and exported to Europe?

MONIKA GRIEFAHN Initially, efuels will only be blended with conventional fuels in small quantities, so that the price at the pump will only rise slightly. For the outset, we recommend a blend of 5%, which would in turn increase the price per litre by about 0.07 euros. For the future, we are predicting that renewable fuels will tend to be cheaper than fossil fuels. With the legal framework in place, we would also see large amounts of investment. The economies of scale that upscaling like this entails would cause prices to fall, and we

could expect prices comparable to those before the crisis, even at higher admixtures.

What would European lawmakers have to do to promote the expansion of industrial production of green synthetic fuels at international locations?

MONIKA GRIEFAHN It is important to understand this as positive development policy, that is, as a partnership of equals, so that countries like Chile, Morocco or Namibia also benefit themselves. The counterargument can be heard frequently: ‘They need the electricity themselves.’ While this is true, countries such as these could open up the doors to a new business sector by producing much more than they themselves need.

RALF DIEMER The easiest way to unleash investment would be for Europe to create a mechanism to help generate demand for these products. We’ve already had a number of talks, also with interested parties from the countries mentioned. They need partners and capital for the outset. A country like Namibia lacks the funds for investments of this size. But we won’t need subsidies for these products if we shape the regulatory environment accordingly, and if we support investments in countries that can’t afford it on their own.

Besides climate protection, what other benefits would the production and use of hydrogen-based products like efuels have for the European economy and European consumers?

MONIKA GRIEFAHN The use of efuels would let European consumers make a key contribution to protecting the climate. And, for the time being, it would be much easier for them to run their cars or heating systems on a climate-neutral fuel, thus helping to make the transition easier. It’s not every consumer who can afford an electric vehicle right now. Nor can we ignore raw material issues and skills shortages.

RALF DIEMER And then there is the industrial policy aspect. We are talking about technologies that already exist in the EU, in Germany especially. We have the patents for technologies to capture CO₂ from the air and industrial sources. The value chain is there. Moreover, there are up to 1.2 million potential jobs in the EU involved, well-paid jobs at that. This means that efuels are not only a climate protection programme, they also have the potential to boost the labour market. Besides that, it’s a programme to increase consumer choice, by giving consumers the option to choose from a range of different technologies. Ideally, competition will emerge, giving customers real alternatives and lowering prices. We should also bear in mind that we are competing internationally in this sector. There are plant manufacturers in China, for example, doing good work and who would also like to serve the market. ■

MORE
INFORMATION
ON THE
POTENTIAL OF
EFUELS:
[WWW.EFUEL-
ALLIANCE.DE](http://WWW.EFUEL-ALLIANCE.DE)



daymakers on the road for private reasons who stand to benefit from efuels. In fact, the entire mobility sector would undergo a green transformation. Synthetic fuel puts planes in the air, trains on the rails, ships on the water and lorries on the motorway, especially over long distances. In addition, sectors as diverse as the chemical, construction, iron and steel industries would also be major beneficiaries of a market ramp-up of green hydrogen, the chemical basis of climate-friendly fuels. In shipping, alternative fuels could replace heavy fuel oils, and in steel production, green hydrogen be substituted for coking coal.

Synthetic fuels are produced by means of a process called electrolysis. First, special production plants called electrolyzers use electricity to split water into oxygen and hydrogen. Next, the hydrogen is combined with carbon dioxide, taken, for example, from the ambient air. The process can be used to produce synthetic petrol, diesel or gas. If the electricity used for electrolysis comes from a renewable source such as solar or wind power, then the product is CO₂-free green hydrogen. If methane is used, the product is referred to as turquoise hydrogen, and if nuclear power is used, it is called red, pink or purple hydrogen. But fossil energy sources such as natural gas or coal can also be used for electrolysis. However, the so-called blue or grey hydrogen that they produce is not a win in terms of climate protection. So the ‘colour’ of hydrogen is an essential consideration; when it comes to the environment and climate, green hydrogen is the gold standard.

Hydrogen is available in nature in almost unlimited quantities – and poses a ‘unique opportunity to synergise energy supply, climate protec-

Synthetic fuel puts planes in the air, trains on the rails, ships on the water and lorries on the motorway.



Political support secures the market launch of green hydrogen.

tion and value creation'. This is how the Fraunhofer Institute for Machine Tools and Forming Technology IWU in Chemnitz describes it. 'Hydrogen plays a central role in reducing CO₂ emissions and at the same time represents a sustainable and future-proof business field.' Hydrogen would also make the rapid development of a dedicated charging network, such as is necessary for e-cars, more reliable and sustainable. Efuels can be mixed with conventional fuels and distributed via the existing filling station network – good news at last for drivers who are confronted with new impositions to no end.

But to achieve this goal, efficient electrolysis plants would have to be built and, above all, renewable energies rapidly expanded. And things are happening, both in business and research. **The German energy provider RWE, for example, is planning an electrolysis pilot plant for hydrogen production with a capacity of 14 megawatts at its Lingen site, which will be powered by green electricity.** Here in Emsland, 290 kilogrammes of hydrogen per hour will be produced from mid-2023. This would be the dawn of a new era; RWE is required to take the Emsland nuclear power plant at the site off the grid by the end of 2022. The Fraunhofer IWU in Chemnitz is currently developing a facility where new production processes and plants can be simulated, tested and compared. The researchers plan to offer their so-called 'reference factory.H2' to industrial companies in the near future. The express aim is to develop production technologies and plants for the cost-effective series production of fuel cells and electrolyzers that will substantially aid the market ramp-up from 2025. And another promising piece of news:

In 8 years the EU wants to produce 10 million tonnes of green H₂O.

28-year-old scientist Anne Lyck Smitschuysen from the Technical University of Denmark demonstrated a method only last year that increases the size of electrolysis cells from 150 to 1,000 square centimetres without breaking the cells. **It is a technological innovation that could significantly cut the cost of hydrogen production in the long run.** For her contribution, Smitschuysen received the Flemming Bilgaard Award from the Danish Ramboll Foundation last year.

'No climate solution without hydrogen'

Without political backing, however, the market ramp-up of green hydrogen has no chance of success. In competition with fossil fuels such as oil, coal and natural gas, green hydrogen currently isn't able to hold its own. 'Simply put, without hydrogen there is no climate solution,' says Daryl Wilson, executive director of the Hydrogen Council, an industry association of 130 companies: 'We know from previous experience with technologies like wind and solar that investment and policy support in the early market development phase can quickly bring down costs and enable rapid and large-scale deployment.' Provide supply, generate demand, spur investment until the idea can take hold in the market.

Options to fuel the hydrogen revolution are many. A minimum quota for efuels in all transport sectors, for example, amounting to 5% of annual consumption, would be one. According to an analysis by researchers from the Wuppertal Institute for Climate, Environment and Energy and the Institute of the German Economy, any political package to this effect would have to combine various instruments – as the EU is currently trying to do with its 'Fit for 55' package of measures. **The scientists say that reliably certifying hydrogen is a prerequisite for most other steps. This includes government support for hydrogen projects, further development of EU emissions trading, the eligibility of efuels under the EU Renewable Energy Directive (RED II), expansion and regulation of hydrogen networks as well as climate protection contracts, known as 'carbon contracts for difference'.** **'In addition to designing a balanced policy package, it is crucial to take the right steps at the right time,'** the scientists state in the analysis. In their assessment, a strategy is needed that boosts the market in the short term while setting the course for a long-term hydrogen system.

By 2030, the European Union wants to produce ten million tonnes of green hydrogen. While an ambitious target, it is not nearly enough to meet demand, and another ten million tonnes will therefore need to be imported. In the long term, the Fraunhofer Institute for Energy Economics and Energy System Technology IEE in

THE MOST IMPORTANT TERMS IN A NUTSHELL

EFUELS

Synthetic fuels produced from water and CO₂ using electricity.

POWER-TO-X (PTX)

Electricity based energy sources. The X is a placeholder and can stand for various forms of energy such as liquid, gas and heat or for applications such as ammonia, chemicals, fuel or power.

POWER-TO-LIQUID (PTL)

The conversion of electricity into liquid fuel.

GREEN HYDROGEN

Hydrogen produced by electrolysis using electricity from renewable sources, making it climate-friendly.

ELECTROLYSIS

A chemical process by which electricity is used to split water into its components, oxygen and hydrogen.

ELECTROLYSER

A technical plant for performing electrolysis.

Kassel has calculated in its 'Power-to-X Potential Atlas' that a total of around 109,000 terawatt hours of liquid green hydrogen or 85,000 to 88,000 terawatt hours of climate-neutral synthetic fuels could be produced outside Europe – more than enough to meet global, let alone European, demand. There are enough regions in the world where wind, sun and water conditions permit the climate-neutral production of hydrogen. Windy regions such as Chile and Argentina and sunny continents such as Africa and Australia are ideal for producing hydrogen. According to the Fraunhofer analysis, the USA, Egypt, Canada, Mexico, Libya, Chile and Saudi Arabia all also have great potential. Germany has already concluded hydrogen partnerships with some countries, for example Morocco. Energy could be shipped over the comparatively short distance from North Africa to Europe. Renewable energy can be stored and transported in the form of hydrogen and efuels – thus literally steering around a fundamental problem of the energy revolution.

Reducing energy dependence on Russia

All projects abroad notwithstanding, securing the local energy supply would certainly be a crucial first step, and one with many benefits: it would boost the local economy, increase acceptance and create jobs, improve the prospects of the local population and, incidentally, help mitigate the causes of migration while building sales markets for European machinery and equipment. The know-how is undoubtedly there, and European electrolyser manufacturers are among the best in the world. In Germany alone, according to a study by the Institute of the German Economy, around 500,000 mostly highly qualified jobs could be created in plant construction by 2050.

Green hydrogen and synthetic fuels can even significantly help to shape and support the European Union's foreign, security and development policy. With a broad diversification of production sites and many different hydrogen partners, Europe would combine climate protection with procurement and supply security, all the while further reducing its energy dependence on Russia. Russia itself also has great hydrogen potential, but will find it difficult to exploit it without Western customers and investments. Other countries can, and should, step into the gap. Increased cooperation also makes sense within the EU. For example, discussions between Germany and Denmark on jointly building a regional green hydrogen cluster are already quite far advanced. If Europe and the world at large are to enter the hydrogen era, international cooperation is the path. And the time has never been more opportune. ■

Around 500,000
mostly highly
qualified jobs
could be
created in plant
construction
by 2050

The hydrogen age only works through international cooperation.

1.2000 .0000

► *New jobs could be created in Europe through the production and export of plants for the generation of electricity-based synthetic fuels (power-to-X or P2X) – this is the conclusion reached by the German Economic Institute (IW) in Cologne in a report on the potential of green synthetic fuels in Europe. New skilled jobs would be created above all in European mechanical and plant engineering companies. According to the study, the export of electrolyzers to domestic and non-European wind- and sun-rich regions has the potential to generate additional added value of some 80 billion euros annually. Potential areas of application for this technology include North Africa and the Middle East, where renewable electricity can be produced with significantly higher cost effectiveness. The study also finds that P2X production could create up to 340,000 new jobs worldwide.*

However, European lawmakers must pave the way if the ramp-up in the production of electricity-based green fuels is to actually take place. Crediting climate-neutral fuels in the CO₂ fleet regulation for new passenger cars in the EU is one option. But the EU Parliament and Council failed to implement this policy in their recent decisions, opting instead to kick the decision down the line to a reassessment in 2026. ◀

WRITTEN BY Frank Burger

ELECTRIC MONOPOLY

Zero emissions: in its plans for cars to emit zero CO₂ by 2035, the EU is turning to electric motors – but synthetic fuels are a useful alternative to advance climate protection and preserve prosperity at the same time.

A GAME WITH A VARIATION

The internal combustion engine has been putting cars on the road for 162 years. The first combustion engine vehicle, the Hippomobile, was a three-wheeled cart designed in 1860 by the inventor Étienne Lenoir, who was born in the Grand Duchy of Luxembourg.

But now it seems the death knell for the internal combustion engine is beginning to ring and indeed could strike its final hour in only a few years – at least, that is, in the European Union: **the EU Commission has submitted a draft regulation to the European Parliament and the Council of Member States,**

according to which car manufacturers will only be allowed to sell zero-emissions vehicles from 2035. Instead, and for the sake of climate protection, car manufacturers will be expected to launch electric cars only. But this one-sided view would also cloud the future prospects of one technology-open alternative to e-mobility, namely, powering combustion engines with climate-neutral fuels.

Behind the Commission's initiative is the 'Fit for 55' programme, a package of adapted and new directives and regulations aimed at reducing greenhouse gas emissions in the EU

by at least 55% by 2030 (compared to 1990).

Also intended to help cut back emissions are so-called CO₂ emission performance standards for cars, which set maximum limits for average CO₂ emissions in new passenger cars and light commercial vehicles. At the moment, new cars rolling off the line are allowed to emit a maximum of 95 grammes of CO₂ per kilometre on the road, with manufacturers in violation facing fines. So far, the EU regulation stipulates a reduction of this value by 37.5% by 2030, compared to 1990. **But, apparently still seeing some room for manoeuvre, the Commission is now demanding a reduction of 55% – with greenhouse gas emissions to drop to zero only five years later.**

This is tantamount to enforcing the EU-wide purchase of electric cars, because, according to the current state of the art, only electric cars are emission-free vehicles – apart, at least, from fuel cell vehicles, a technology that is much less mature and one that plays virtually no role in the passenger car sector. Of course, with the current electricity mix itself not entirely free of fossil fuels, the solution is superficial at best.



‘Why shouldn’t we keep all options open?’

Jens Gieseke,
German Christian Democrat CDU MEP

Advocates of efuels, on the other hand, have made the case for a crediting system that could break the politically imposed monopoly of electric cars: car manufacturers who facilitate non-fossil, climate-neutral fuels coming on the market – for example by promoting their production – would have this taken into account in their vehicles’ regulatory CO₂ footprint.

This would mean car manufacturers would have to reduce the greenhouse gas emissions of their vehicles to a lesser degree, since the fuels they run on would already achieve part of the overall reduction.

Jens Gieseke is among those convinced that synthetic fuels, not electric cars alone, can help advance climate-friendly mobility. ‘Why shouldn’t we keep all options open?’ wonders CDU MEP Gieseke, who is the transport policy spokesman for the European People’s Party. According to Gieseke, the EU plans fail to fully reflect the climate footprint of electric vehicles over their entire life cycle from production to disposal.

Advantage: existing infrastructure

In the environment committee (ENVI), which voted on its position on the Commission’s draft regulation in mid-May, Gieseke moved for the promotion of efuels as an alternative to the electric motor as well as for the implementation of the crediting system described above. He also proposed take a more realistic target for 2035 from 100 to 90% so car companies could sell cars with highly efficient conventional drive systems in addition to e-vehicles.

Gieseke had found a majority for this proposal in the transport committee (TRAN), but the environment committee rejected both motions, albeit narrowly. Also rejected were initiatives of the Greens, Liberals and Social Democrats demanding an even stricter version of the draft regulation. With a close 46 to 40 vote, the committee agreed on a position that is very close to the Commission’s proposal.

The negotiations in the environment committee were led by Dutch Liberal MEP Jan Huitema, who said of the result: ‘With CO₂ standards, we create clarity for the car industry and stimulate



‘With CO₂ standards, we create clarity for the car industry and stimulate innovation and investments for car manufacturers.’

Jan Huitema,
Dutch Liberal MEP

innovation and investments for car manufacturers. In addition, purchasing and driving zero-emission cars will become cheaper for consumers. This is especially important now that the prices of diesel and petrol continue to rise.’

What is noteworthy, however, are those voices in the EU’s highest executive body that do not pin the goal of zero emissions solely on electric cars. Romanian EU Transport Commissioner Adina Valean, for example, pointed out at last year’s Handelsblatt Auto Summit that ‘having liquid fuel for the road would be absolutely great’ because ‘the infrastructure is already there’. **Existing refineries and filling stations could continue to be used as before, only now for the production and distribution of synthetic rather than petroleum-based fuels.**

Dutchman Frans Timmermans, Executive Vice President and EU Com-

mission for Climate Action, was more sceptical. 'Some in the auto industry claim that cars with internal combustion engines can also be emission-free. I think that's quite a challenge, to put it very mildly,' Timmermans said at the Auto Summit.

To the infrastructure advantage of efuels championed by Valean must be added the ease of transport even over long distances and their good storage capacity. Indeed, this is one of proponents' arguments for efuels.

The devil is in the details

One of the most important points in favour of synthetic fuels is their climate neutrality: when burnt in an engine,

synthetic fuels produce only as much CO₂ as was necessary for their initial production. But when it comes to production, the devil is in the details. Efuels are only climate-neutral if the electricity used to produce them comes from renewable sources – and in Germany, the number of available renewable sources of energy is not exactly unlimited.

In an interview with ADAC, Roland Dittmeyer, professor at the Karlsruhe Institute of Technology, said: 'In Germany, we cannot meet the demand for renewable energy for all sectors in an economical and sustainable way. We will have to import large quantities of green energy sources. The question is which ones we will import. And where in the world these sources of energy will be produced.'

Ideally, production should take place near Germany, such as 'in Norway or Sweden, where there is a lot of clean hydro power', said eFuel Alliance spokeswoman Monika Griefahn at the 2022 Clean Energy Summit in Brussels. The eFuel Alliance is an interest group with approximately 170 member companies and institutions, primarily from the fuel, energy and vehicle sectors.

The Alliance broadly welcomes the discussion on EU legislation being conducted in the context of climate protection goals. If efuels are to play a role, the eFuel Alliance believes that three premises must be fulfilled: First, the Energy Taxation Directive must be put to the test. In future, the taxation of energy should be calculated according to CO₂ footprint instead of volume, as is currently the case. This would change how fuels produced from renewable energies are evaluated compared to fossil fuels. Furthermore, the EU directive on renewable energies must be revised. 'We need much stronger incentives for investment in renewables, especially for the fuel industry,' says Tobias Block, Head of Strategy and Content at the eFuel Alliance. And finally, technology openness is needed, i.e. the focus needs to be expanded beyond mere electromobility.

Hildegard Müller, President of the powerful German Association of the Automotive Industry (VDA), even sees in the EU plans 'the opposite of technology

openness, an opposite to which the Commission and its Vice-President Timmermans have always been dedicated. Besides being questionable, the restriction of technologies to a one single type of drive within such a short period of time also fails in every way to take the interests of consumers into account.'

In fact, German market research and polling company forsa found in a representative 2021 survey that the majority of German motorists would prefer an internal combustion engine running on efuels to an electric car. Faced with the choice between a diesel and petrol engine car fuelled with CO₂-neutral efuels or an electric car, 60% of respondents chose the former; only 27% opted for the electric car. A majority of respondents also voted against a ban on combustion cars and the promotion of electric cars. More to the point, the forsa survey from the summer of 2021 found that two thirds of people living in Germany (66%) find the one-sided promotion of electric mobility in Germany and Europe practised by politicians for many years wrong. Instead, respondents demanded that all technical solutions aiming at climate targets receive equal backing.

No banning of petrol and diesel

In a representative follow-up survey in the summer of 2022, a large majority of 89% supported this position. An equally clear majority (58%) think it wrong that no new petrol and diesel cars will be allowed to be registered in the EU from 2035. In addition, almost two-thirds of respondents (63%) were opposed to the banning of petrol and diesel cars in the medium or long term. Another 54% were concerned they would not be able to afford electromobility if electricity prices rose; 53% fear the loss of jobs in the automotive industry if combustion vehicles are banned. What's more, 74% expect that manufacturing electric cars will create a dependency on Chinese imports of raw materials.

The VDA is aware that electromobility will nevertheless be decisive in achieving climate targets and steering the development of the automotive industry: 'The energy revolution is a huge challenge that manufacturers and suppliers are



'Having liquid fuel for the road would be absolutely great' because 'the infrastructure is already there.'

Adina Vălean,
Romanian EU Transport Commissioner

GLOSSAR



‘Some in the auto industry claim that cars with internal combustion engines can also be emission-free. I think that’s quite a challenge, to put it very mildly.’

Frans Timmermans
Executive Vice President and EU Commission
for Climate Action

committed to tackling. The automotive industry is already full steam ahead on the road to climate-neutral mobility. In Germany alone, companies are investing around 150 billion euros in the energy revolution by 2025. Now it’s up to the EU to pave the way so that the revolution can succeed,’ says Müller.

In the debate about the pros and cons of the possible ban on internal combustion engines, one argument has emerged that crops up whenever society faces a far-reaching technological change – that of jobs. The European Association of Automotive Suppliers (CLEPA) estimates that the switch to electric cars will cost half a million jobs in the EU, mainly among suppliers. While the production of electric drives and batteries is estimated to create 230,000 new jobs, this would still mean a total loss of 275,000 jobs by 2040.

The EU Council of Environment Ministers had taken a position on the jobs situation at the end of June, a move which was, as in the EU Parliament, preceded by an intensive debate on the great importance of balancing climate protection and affordable, individual mobility for EU citizens. But unlike in the Parliament, the Council in its decision called on the EU Commission to work out a way to allow new passenger cars with combustion engines to be registered even after 2035 – if they run on climate-neutral fuels.

Whether supporters or opponents of the planned CO₂ ban will gain the upper hand in the EU remains to be seen. But as soon as September the Council, the Parliament and the Commission will meet for so-called trilogue negotiations to try to agree on a wording for the regulation. In the search for a compromise, the high art of diplomacy remains much in demand – and as does the vision of a path that leaves enough room both for technological openness and climate protection, where the goals of economy and ecology are equally reflected. . . ■

EFUELS:

Synthetic fuels produced using electricity. The electricity is needed for electrolysis, which splits water into hydrogen and oxygen. The hydrogen is mixed with carbon dioxide by means of synthesis, a process that produces hydrocarbons with structures similar to petrol, diesel or paraffin that are suitable for internal combustion engines. Burning efuels emits only as much CO₂ as was fed in during production.

RENEWABLE ENERGY DIRECTIVE (RED II):

An EU directive that aims to raise the share of renewable energies in the electricity, heat and transport sectors to at least 32% in gross final consumption by 2030.

CO₂ EMISSION PERFORMANCE STANDARDS:

Indicates how much CO₂ a manufacturer’s entire annual fleet of new cars and new light commercial vehicles is allowed to emit per kilometre on average.



‘Now it’s up to the EU to pave the way so that the revolution can succeed.’

Hildegard Müller,
President of the German Association of
the Automotive Industry (VDA)

INTERVIEW BY Gerhard Walter

Efuels enable the CO₂-neutral operation of vehicles with combustion engines – and are a mainstay for sustainable and intelligent mobility in Europe. This is the assessment of EU Transport Commissioner Adina Ioana Vălean. In an interview, the mathematician announces an alliance for the use of low-carbon fuels in air and sea transport.

Mrs Vălean, at the Handelsblatt Auto Summit in November 2021, you spoke in favour of openness to technology in road traffic and showed your openness to efuels. In your opinion, what are the arguments in favour of using synthetic fuels in existing vehicles and in new vehicles? _____ I did indeed say that it is important to continue to be open to technology – and look to all the developments on the market that could offer solutions for the future. And at that time I mentioned efuels and hydrogen as viable means, along with electricity, for bringing emissions down in the transport sector.

Efuels certainly have a place in our overall decarbonisation journey, and their advantage is that they can be used as a drop-in fuel for the vehicles already on the market today. It is also true that for their production they need huge quantities of green electricity, and I look with interest towards industrial initiatives that are based in places around the world where it is possible to harvest large amounts of wind or solar power. That will open new possibilities and increase the volumes of clean energy without impacting on the electricity produced in Europe.



‘Solutions for the future’

Adina Ioana Vălean

has been European Commissioner for Transport since 2019. The mathematician previously served as a Member of the European Parliament from 2007 until 2019, where she chaired of the European Parliament Committee on Industry, Research and Energy in 2019. Adina Vălean is considered one of the most experienced Romanian EU politicians. From July 2014 to January 2017, she was Vice President of the European Parliament.

But, as we all know, at this time quantities are limited and production is still expensive, so efuels are primarily of interest for transport modes lacking mature zero-emission alternatives – such as aviation and maritime. That does not mean these fuels cannot be used for other modes.

Our RefuelEU Aviation and FuelEU Maritime proposals support this approach and create the conditions for increasing the production of such fuels. **I would like to say that we have finalised the process of establishing a new alliance, the Renewable and Low-Carbon Fuel Alliance, and a successful kick-off meeting took place in July.** It will be a collaboration between stakeholders from the entire value chain to scale up and boost the production, storage, distribution, and use of renewable and low-carbon fuels for the aviation and maritime sectors, in line with RED II and its revisions.

? If you look at the Commission's current regulatory proposals, you will

read the following reports: the EU is making combustion engines more expensive with very strict Euro 7 requirements and will be banning them as of 2035 because the goal is a 100% CO₂ reduction. Openness to technology or bans: how do these two approaches work side by side? In the light of the recent positions on CO₂ performance standards for cars by Parliament and Council, how do you assess the next steps, and will the COM come forward with a proposal on the registering of cars with efuels after 2035?

— **We do not 'ban' technologies. We set emission requirements that steer market action. The emissions reductions that we need to help keep climate change within acceptable limits is established through scientific assessment.** In this context, being technologically neutral might mean also promoting technologies that help put transport on the path towards these objectives, in a way that is proportionate to the impact of their contribution. The market will then determine which technologies should take the lead.

Our proposal to revise the CO₂ standards for new cars and vans requires a 100% reduction of CO₂ emissions from new vehicles by 2035.

As for the Euro 7 proposal under preparation, let's not forget that, even if all newly registered vehicles are zero-emission in 2035, the majority of cars in circulation will still run on an internal combustion engine. These engines will be

used for another 20 years – so they need to be as clean as possible. This is why a robust and evolving pollutant emissions standard is still needed, for cars, buses and lorries. Ultimately, our objective is to have nearly all cars and vans zero-emission by 2050, as our Sustainable and Smart Mobility Strategy makes clear.

? Around 70% of all charging stations in the EU are located in three countries: Germany, France and the Netherlands. There is no e-charging infrastructure in many EU member states in Southern and Eastern Europe, and there is no prospect of purchasing power there to buy new e-cars. Isn't there a risk of a split in the EU with an enforced exit from combustion engines: e-mobility for Europeans in a few rich countries while the rest have to walk?

— **Indeed, there is a disparity between western and eastern parts of Europe at this stage, but we can't say that there is no electric charging infrastructure in Eastern and Southern Europe, or that there is no prospect of purchasing power for electric cars there.** For example, in my country, Romania, sales of battery-electric cars more than doubled between 2019 and 2021, reaching a 5.2% market share. Just two years ago, in 2019, the market share in Germany was 1.7%; it is now 13%. So Romania is only a couple of years behind Germany, and the market share is rising fast. Continuing with this example, with its national recovery and resilience plan, Romania has committed to put in place 15,000 recharging stations over the next five years.

Of course, our common market is the mainstay of the European project, and in order for it to work, we need to ensure seamless mobility across all internal EU borders. This is why we proposed the Alternative Fuel Infrastructure Regulation (AFIR) as part of our Fit for 55 package. It sets requirements and provisions for member states to develop a dense, widespread network of recharging and refuelling infrastructure throughout the EU. **This regulation will set minimum requirements that ensure drivers of zero- or low-emission vehicles can travel across the EU and recharge or refuel their vehicle as easily as they would refill a diesel or petrol one.**

'Efuels certainly have a place in our overall decarbonisation journey, and their advantage is that they can be used as a drop-in fuel for the vehicles already on the market today.'

ONE SIZE FITS ALL – HOW TO MAKE TRANSPORT CARBON-NEUTRAL IN EUROPE

Efuels can be used in all existing fleets of combustion-powered transport vehicles and special-purpose vehicles as well as in new vehicles. No technical adaptations are necessary. The required infrastructure already exists.

This makes efuels truly a ‘one size fits all’ solution.

| TRANSPORT AND SPECIAL-PURPOSE VEHICLES | | DRIVE POWER | | | |
|---|--|------------------------|--------------|-----------------------------------|--------------|
| | | Use of efuels possible | | Use of battery-electric possible* | |
| | | Existing fleet | New vehicles | Existing fleet | New vehicles |
|  | Scooters and motorbikes | ✓ | ✓ | ✗ | ✓ |
|  | Passenger cars | ✓ | ✓ | ✗ | ✓ |
|  | Public transport buses | ✓ | ✓ | ✗ | ✓ |
|  | Coaches | ✓ | ✓ | ✗ | ✗ |
|  | Delivery vehicles (up to 7.5 t) | ✓ | ✓ | ✗ | ✓ |
|  | Lorries (up to 40 t) | ✓ | ✓ | ✗ | ○ |
|  | Construction machinery | ✓ | ✓ | ✗ | ✗ |
|  | Agricultural and forestry machinery | ✓ | ✓ | ✗ | ✗ |
|  | Ambulances, fire brigade, emergency vehicles | ✓ | ✓ | ✗ | ✗ |
|  | Waste disposal and street cleaning vehicles | ✓ | ✓ | ✗ | ✗ |
|  | Military vehicles | ✓ | ✓ | ✗ | ✗ |
|  | Helicopters | ✓ | ✓ | ✗ | ✗ |
|  | Transport and cargo aircraft | ✓ | ✓ | ✗ | ✗ |
|  | Cargo and container ships | ✓ | ✓ | ✗ | ✗ |
|  | Cruise ships and ferries | ✓ | ✓ | ✗ | ✗ |

* and technically and economically feasible

** Charging facilities at depots

WRITTEN BY Gerhard Walter

Tractors, combines, emergency vehicles, excavators, tanks, fuel tankers and traditional lorries – all of them are powered by combustion engines. It’s no surprise, because in order to be mobile, vehicles such as these rely on location-independent and readily available energy. So far, battery-electric drive systems have played only a minimal role, if any, in Tractors and Co.

| PUBLIC INFRASTRUCTURE | | | | | |
|--|----|-------|--|-----|-------|
| Refuelling infrastructure Blanket and sufficient availability | | | Charging infrastructure Blanket and sufficient availability | | |
| Germany | EU | World | Germany | EU | World |
| ✓ | ✓ | ✓ | ○ | ○ | ○ |
| ✓ | ✓ | ✓ | ○ | ○ | ✗ |
| ✓ | ✓ | ✓ | ✗** | ✗** | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ○ | ○ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |

- ✓ yes
- ✗ no
- partly

Vehicles for transport and special purposes have a broad and varied range of potential applications. This is especially true where mobility and transportation is a high-energy undertaking; planes and trucks, for example, demand fuels with a high energy density. Energy density is the amount of energy stored per unit mass (e.g. watt-hour per kilogram). The chemical properties of diesel or petrol lend them a much higher energy density than a comparable lithium-ion battery. Conversely, this means that battery-electric vehicles would have to lug around a heavy, high-volume battery to yield the same amount of energy that a vehicle powered by liquid fuel gets from a comparatively low-volume tank with a low filling weight. Since the majority of newly registered vehicles in Europe currently runs on internal combustion engines, green synthetic liquid fuels – known as efuels – are a true one-size-fits-all solution. Efuels are carbon-neutral, and they can be used without making any technical adaptations to all existing fleets of internal-combustion transport and special-purpose vehicles, as well as in new vehicles. New cars with internal combustion engines are just embarking on a lifetime of 15 to 20 years. Bearing this in mind, it is crucial from the point of view of climate protection that European drivers tank up their vehicles with carbon-neutral fuels in the coming years.

Graphics: UNITE

WRITTEN BY Kristina Simons

STRONG TAILWIND FOR EFUELS

A pilot plant for the industrial-scale production of green synthetic fuels is being built in the windy south of Chile: by 2026, the capacity of 'Haru Oni' is slated to reach 550 million litres of efuels per year. The project was initiated by German sports car manufacturer Porsche.



P

atagonia, in the extreme south of Chile. There are strong winds almost all year round here. So strong, in fact, that a wind turbine generator (WTG) can run at full load and generate green electricity about 270 days out of the year. That is more than twice as much as in Germany, where at coastal or other particularly windy locations, wind turbines produced green power under optimal conditions on only about 133 days last year. As such, it is something of an inevitability that a pilot plant for the production of CO₂-neutral efuels is currently being built north of Punta Arenas

on the Strait of Magellan, where it can take advantage of these unique wind conditions. The project is named 'Haru Oni', which means 'strong wind' in the language of Chile's indigenous people. According to the operators, it will be the world's first commercial integrated plant for the production of climate-neutral fuels. The project was initiated by German car manufacturer and sports car specialist Porsche. The company headquartered in Stuttgart-Zuffenhausen will also be the main consumer in the first phase of the project, fuelling its own vehicles with the synthetic fuel produced

at Haru Oni. Siemens Energy is also involved and has already built a wind turbine that will supply the pilot plant with 3.4 megawatts (MW) of power. This electricity is used to split water into hydrogen (H₂) and oxygen by means of electrolysis. The green hydrogen, along with CO₂ filtered from the air using Global Thermostat's Direct Air Capture (DAC) technology, is then turned into synthetic methanol. This, in turn, is then converted into efuels. In the Haru Oni project, all these process steps take place in one plant, making operation particularly efficient.





Promising technology:
If existing vehicles are to be operated in a climate-neutral manner, synthetic green fuels are indispensable.



‘Our icon, the 911, is particularly suitable for use with efuels.’

Michael Steiner,
Member of the Executive Board for
Research and Development at Porsche

550 million litres by 2026

Ground was broken for the pilot plant in Patagonia in September of 2021. The plant is expected to produce around 130,000 litres of efuels by as early as late 2022. For the time being, Porsche intends to use these fuels in motor sport lighthouse projects. But in the future, they may also be used for the first fueling of its own combustion engine vehicles at the factory and ‘Porsche Experience Centers’ worldwide. For now though, the sustainable fuel from Haru Oni is headed for Europe. It will be freighted by ship, making the plant’s location directly on the Strait of Magellan a favourable one indeed. With emission-free delivery still out of reach, hopes are pinned on green methanol for shipping to make transport itself climate-friendly at some point.

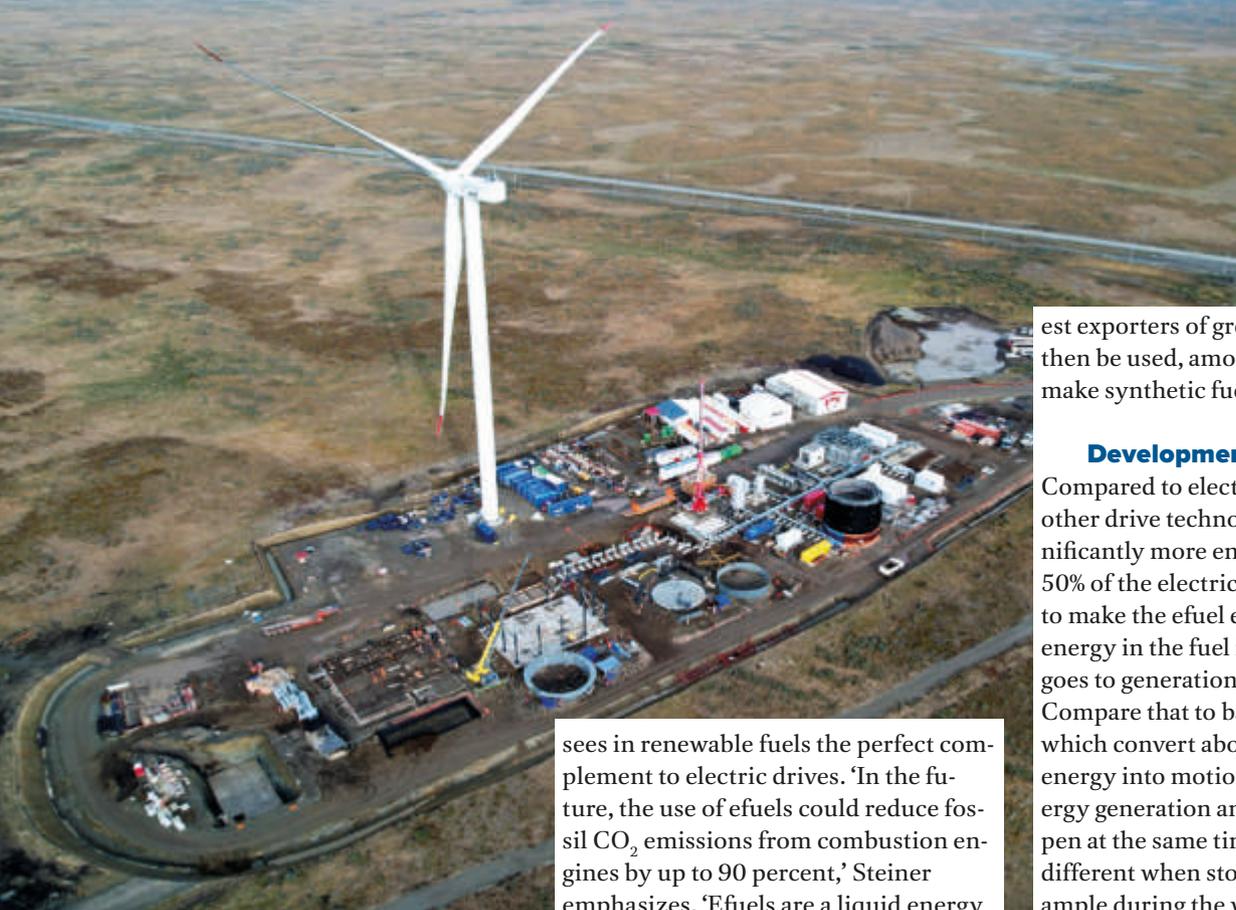
After the pilot phase, the plant’s capacity is to be expanded in two stages: to around 55 million litres of efuels in 2024 and to around 550 million litres by 2026. To achieve this, the wind farm’s output will initially be expanded to around 280 megawatts (MW). Ultimately, when the plant reaches the planned industrial scale, wind turbines with a total capacity of 2.5 gigawatts (GW) will be located here. Siemens Energy has already begun preparatory work for the next major commercial phase of the project. Which countries

the sustainable fuel will then be delivered to will be decided later. After all, in addition to HIF Global, Porsche and Siemens, there are other international partners involved in the Haru Oni project, including Chilean gas supplier Empresas Gasco, Chilean petroleum company ENAP, Italian energy company Enel and U.S. oil company ExxonMobil.

Efuels and electric drives in tandem

Haru Oni is owned by HIF Global (Highly Innovative Fuels), a holding company of international project developers of efuels production plants. Earlier this year, Porsche invested \$75 million in HIF Global, acquiring a long-term 12.5% stake. The sports car manufacturer aims to be net CO₂-neutral by 2030, by which time more than 80% of all its new vehicles will run on an all-electric powertrain, others as hybrids. The exception remains the sports car, which is considered the epitome of the Porsche brand: ‘Our icon, the 911, is particularly suitable for use with efuels,’ says Porsche AG Member of the Executive Board for Research and Development Michael Steiner. It will, for the time being, remain a pure combustion engine. Then there’s the existing fleet: with a majority of all Porsches ever built with combustion engines still on the road today, the car manufacturer





↑
Ideal location:
The Haru Oni plant is located in one of the regions with the cheapest wind power in the world.



‘If produced on an industrial scale, the cost could drop below two dollars a litre.’

Peter Gräve,
Spokesman at Porsche

sees in renewable fuels the perfect complement to electric drives. ‘In the future, the use of efuels could reduce fossil CO₂ emissions from combustion engines by up to 90 percent,’ Steiner emphasizes. ‘Efuels are a liquid energy source. They enable renewable energy to be stored and transported in regions with high energy demand,’ adds Porsche spokesman Peter Gräve. ‘However, it only makes sense to produce them in regions where renewable energy is available in large quantities.’ With the special wind conditions there, Patagonia, says Gräve, is ideal. ‘Haru Oni will show that the innovative technology for the production of efuels works in an overall chain – from renewable electricity to the finished raw fuel.’

It is against this backdrop that Porsche sees itself as a pioneer. After all, no efuels plants on the scale of Haru Oni exist as yet. The reason for this, argues the interest group eFuel Alliance, is that the necessary political framework is lacking: for example, CO₂-based taxation of fuels or crediting efuels as a climate-neutral fuel for use in road transport. But this might be changing. In Germany, the Federal Ministry of Economics and Climate Protection (BMWK) is funding the Haru Oni project with 8.23 million euros as part of its National Hydrogen Strategy. And Chile has set itself ambitious hydrogen targets, too, with a national strategy to expand its electrolyser capacity to five GW by 2025 and to 25 GW by 2030. By 2050, the South American country plans to be one of the world’s three larg-

est exporters of green H₂ – which can then be used, among other things, to make synthetic fuels.

Development work needed

Compared to electric drives (and all other drive technologies), efuels are significantly more energy-intensive: only 50% of the electrical energy necessary to make the efuel ends up available as energy in the fuel itself; the other half goes to generation from wind and sun. Compare that to battery-powered cars, which convert about 80% of the initial energy into motion – but only when energy generation and consumption happen at the same time. The balance looks different when storage is needed, for example during the winter. A combustion engine running on synthetic fuels therefore consumes significantly more electricity than an electric car. The good news is that researchers are already working on efuels with significantly better efficiency. For example, by cleverly combining four different technologies, a power-to-liquid (PtL) pilot plant at the Karlsruhe Institute of Technology (KIT) enables the production of efuels with efficiencies of around 60%.

Still, efuels production is also a comparatively expensive undertaking. At the moment, Porsche calculates that it costs around ten dollars to produce one litre. ‘If produced on an industrial scale, the cost could drop below two dollars a litre,’ says Gräve. ‘However, when it comes to the at-the-pump price, taxation is a major factor.’ HIF Global is convinced that the production of synthetic fuels will eventually pay off financially as well as environmentally: ‘We see efuels as a very efficient decarbonisation solution and expect them to be competitive in the medium term,’ says HIF Head of Communications María Jesús Sievers Pozo. ‘Since they are chemically identical to fossil fuels, no changes need to be made to engines or infrastructure to use them.’ Synthetic fuels could make classics like the Porsche 911 part of the solution to lower emissions. ■

REAL-WORLD APPLICATIONS

EFUELS PROJECTS IN EUROPE



Norway

In Norway, European industrial consortium Norsk e-Fuel is planning to produce renewable aviation fuels on a large scale. The first PtL plant is scheduled to go on stream in Mosjøen in Northern Norway in 2024. It will initially produce 12.5 million litres of efuels from renewable energies per year, with output ramping up to 25 million litres from 2026. By 2029, further development of the concept will eventually enable Norsk e-Fuel to produce 100 million litres of green fuels annually. This plan would cut current flight emissions from the five most frequently served air routes in Norway roughly by half.

The joint venture includes Germany's Sunfire, whose patented high-temperature co-electrolysis process enables the highly efficient conversion of renewable electricity, water and CO₂ into fuels, and Switzerland's Climeworks, a pioneer in direct air capture of CO₂. The two other partners are Paul Wurth, a Luxembourg-based technology supplier and Valinor, a Norwegian clean tech investment company.



Germany

Shell Germany has announced that, to produce sustainable aviation fuels, it is building a commercial bio power-to-liquid (PtL) plant with an initial capacity of around 100,000 metric tons per year in the Wesseling section of the Rhineland refinery. The production of synthetic kerosene and raw gasoline (naphtha) is expected to reduce CO₂ emissions by at least 80% compared to conventional products. Shell plans to use wood waste products as biomass in addition to green power for generation. Construction work on the PtL plant could begin in 2023, with the plant going on stream in late 2025. In addition, Shell aims to ramp up the capacity of its PEM hydrogen electrolysis plant in the Wesseling section tenfold from 2022, from ten megawatts at present to 100 megawatts.

The start-up Ineratec is building an industrial PtL plant at Industriepark Höchst in Frankfurt am Main. Starting in 2023, it will produce up to 3,500 metric tons (4.6 million litres) of efuels annually for cars, trucks and aircraft. To achieve this end, Ineratec will use renewable electricity and recycle up to 10,000 tons of CO₂ from a biogas plant. In early 2022, Ineratec acquired further growth capital of 20 million euros for construction of its large-scale plant. Another PtL plant from the start-up with an output of one megawatt has already been in operation in Werlte in Northern Germany since October 2021. The operator, Atmosfair, plans to produce 350 tons of efuels here annually, most of which will be delivered as e-kerosene to Lufthansa Cargo.



France

Hy2gen AG of Wiesbaden is building a plant for the industrial production of CO₂-neutral sustainable aviation fuels (SAFs) in Meyreuil in the South of France under the project name HYNOVERA. The planned capacity of 60,000 litres per day will be produced from biomass synthesis gas and green hydrogen. Hy2gen has invested 460 million euros in the project, which is joined by partner GazelEnergie (formerly Uniper France). The project's stated goal is 'a global ecosystem for the production of green hydrogen and other biofuels.' To this end, in addition to SAFs, Meyreuil will also produce fuels such as e-methanol and green ammonia for shipping from 100% renewable energies.



Spain

Spanish oil company Repsol is using waste materials to produce a sustainable aviation fuel at its Petronor industrial complex in Bilbao, promoting a circular economy. In August 2021, the company reported the production of the first 5,300 tons of biojet fuel. Repsol is also planning a plant in the eastern Spanish city of Cartagena that will produce 250,000 metric tons of biodiesel, biojet fuel, bionaphtha and biopropane from waste annually. The oil company has already been producing sustainable aviation fuels from biomass at its Puertollano and Tarragona refineries since 2020 and 2021, respectively. Repsol aims to produce 1.3 million tons of sustainable biofuels in 2025 and upwards of 2 million tons in 2030.

SAVING JOBS, PRESERVING KNOWLEDGE, AND PROTECTING THE CLIMATE

Employees in the automotive sector in the EU

13.8 million; of which

3.5 million in production

4.5 million suppliers

5.1 million in logistics

Share of the automotive industry in the GDP of the EU-27 (2022):
7% of 17.9 trillion euros, amounting to 1.253 trillion euros
Source: European Commission, CIA World Factbook, our own calculations

If, as the European Council and Parliament has now decided, only electric cars will be allowed in the EU from 2035, this step could have wide-reaching consequences for the European automotive and supplier industry – not least that up to 500,000 jobs could be lost in a very short time. At least, that is the fear of CLEPA, the European Association of Automotive Suppliers. CLEPA's Secretary General Sigrid de Vries has a low opinion of a unilateral commitment to electromobility – especially since the negative effects of e-mobility on climate change are immense: for example, the production of batteries in Europe is a high-energy enterprise, and the energy required comes, more often than not, from fossil sources. Sigrid de Vries has implored policymakers to set a regulatory framework 'that is open to all available solutions, such as the use of hybrid technologies, green hydrogen, and renewable sustainable fuels.' An internal combustion engine ban would mean that Europe would risk losing its know-how advantage in engine technology, which could prove particularly fatal in the EU's economic wrangling with China. After all, the Red Giant's leaders are also focusing their strategy on highly efficient engines that can be powered by green synthetic fuels and hydrogen.

An exclusively electric-car strategy in the EU would have fatal effects on the labour market as early as the period between 2030 and 2035. Seventy per cent of the negative consequences would be felt by then, according to a study by New York-based consulting firm PwC Strategy&. The study explores the consequences that an e-car share by 2030 of 50, 80 and 100%, respectively, would have. Additionally, the study warns that the opportunities for electric vehicles also depend on the establishment of a 'deep EU battery supply chain, the timing and likelihood of which is still uncertain.' Western European countries would have the greatest chance of becoming strongholds in the production of electric vehicle power trains, while employment in Central and Eastern European countries would remain heavily dependent on the internal combustion engine. This would lead to the loss of a disproportionately large number of jobs in, for example, Slovakia, Romania, the Czech Republic and Hungary, where between 12.9 and 15.4% of all jobs are linked to traditional car manufacturing. Germany risks losing 'only' 11.8% of jobs, according to the PwC study.

THE EU'S E-STRATEGY: EASTERN EUROPE IN PARTICULAR AT HIGH RISK



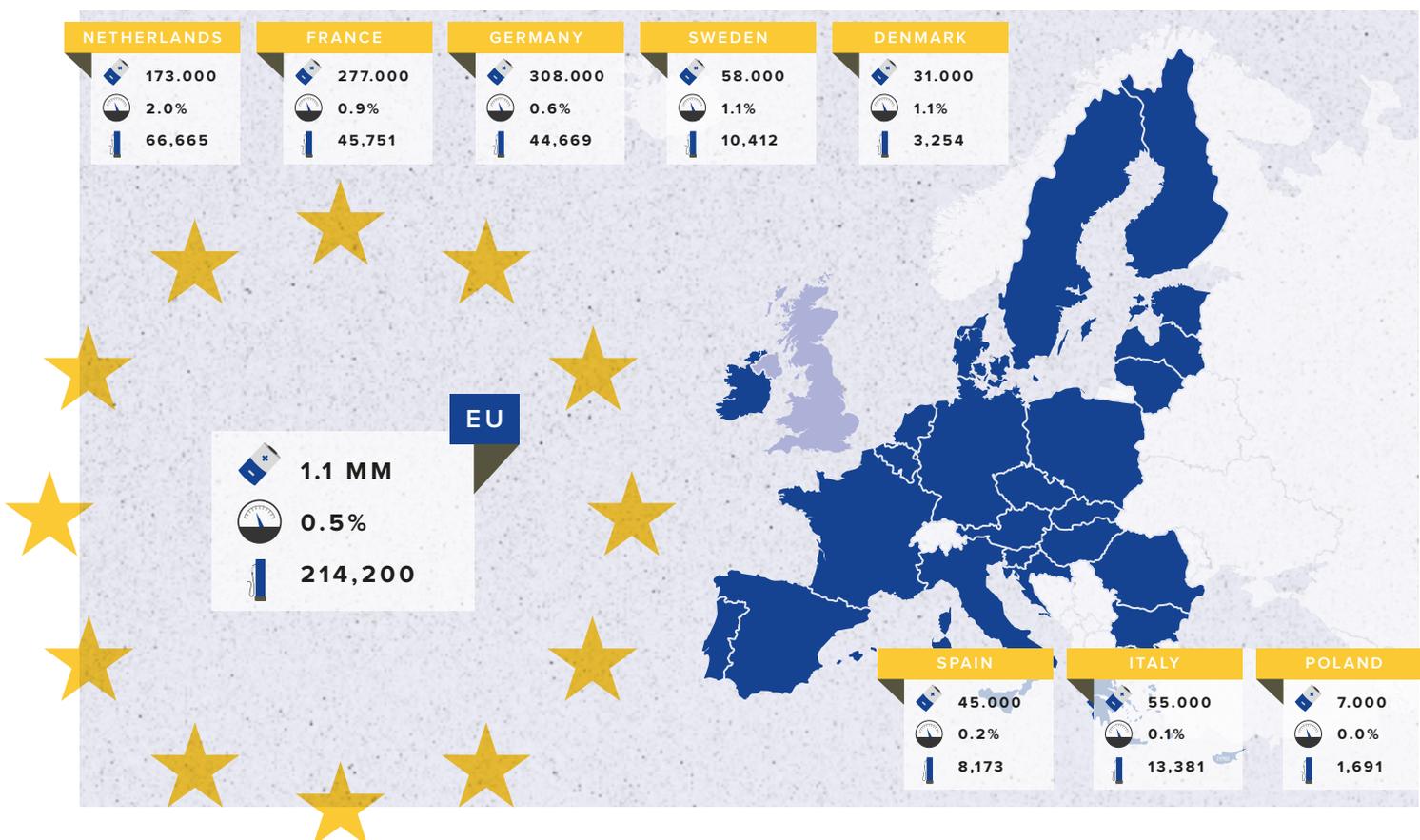
Photos: Westend61/Getty Images, Suriyapong Thongsawang/Getty Images

INCREASED RISK OF FIRE ON CONTAINER SHIPS TRANSPORTING E-MOBILES

The number of total losses of large vessels last year was a record low of 54. In 2015, the figure was 105, according to the latest shipping study by insurer Allianz. But Allianz is still not satisfied – especially since the number of fires on board is steadily increasing. There have been 70 reported fires on container ships in the past five years alone, which can be chalked up at least in part to the misdeclaration of containers holding hazardous goods. According to Anastasios Leonburg, an engineer with a nautical captain's license, this affects about five per cent of containers shipped. The fires are often chemicals that are difficult to extinguish. But, increasingly, electric cars are also to blame. Often caused by short circuits, the fires can be disastrous, with highly flammable lithium-ion batteries quickly catching fire or even exploding. 'With today's capabilities, these fires are very difficult to extinguish,' explains Leonburg. Shipowners have begun responding. Ships operated by major shipping company Maersk are no longer allowed to carry hazardous goods, including e-cars, below deck.



→ e-mobility



How e-mobility is dividing Europe

S E C

0 —

The figures speak for themselves: there are currently around 249 million passenger cars in the EU, of which only some 0.5% are battery-electric. 99.5% of cars across the EU's 27 member states still run on an internal combustion engine. Only in the affluent EU countries of the Netherlands, Sweden and Denmark does the figure lie above the one per cent mark. The proportion of battery-powered vehicles on the road in the economically weaker countries of Southern and Eastern Europe tends toward zero, including populous countries such as Spain, Italy and Poland. Moreover, the infrastructure necessary for e-mobility is only available in sufficient numbers and density in a few wealthy EU countries. For example, a good 70% of the publicly accessible charging stations within the EU can be found in the Netherlands, France and Germany alone. Simply by using carbon-neutral efuels, all the roughly 248 million cars with internal combustion engines in the European Union could be on the road with zero emissions, without needing any technical adjustments or conversions. What's more: green synthetic fuels could let drivers in economically weaker EU states retain the convenience of affordable, individual car mobility and make a substantial contribution to climate protection at the same time. In addition, efuels could help relieve the burden on the public purse in EU member states, by making it unnecessary to construct a costly charging infrastructure. —

20 —

40 —

60 —

eFuel Alliance

eFuels: a way out of the European climate dilemma

78% of all drivers want to refuel with CO₂-neutral eFuels.* eFuels can be used in a climate-neutral way around the world, both today and in the future. Synthetic fuels can help reduce import dependency on Russia and bring us closer to our ambitious climate targets, providing a way out of the European energy dilemma.



Advantages of eFuels:

- Many potential applications in the mobility as well as the industry sector
- Ready for immediate use in all existing vehicles with combustion engines – combustion vehicles can be operated CO₂-neutrally in the long term
- Existing gas station infrastructure can be used
- Withdrawal from combustion engines would not be mandatory
- End of dependence on fossil fuels, including those sourced from Russia
- Potential for cost-effective production in places with an abundance of sun and wind

The eFuel Alliance is an interest group with 180 companies that promotes the industrial production of synthetic fuels from renewable energy sources. The goal of the initiative is a recognition of eFuels as an essential component of a European, technologically open climate protection policy.

www.efuel-alliance.eu

* forsa survey in Germany from June 2022