
UGI Roadmap 2030

– a pathway to a more sustainable
future with liquified gas

We leave no one behind in the race to green

UGI
INTERNATIONAL

UGI Roadmap 2030

We have the ambition to reduce the carbon footprint of our energy products by 50 per cent from our current (2020) levels of emissions by 2030. At the same time, we are setting the foundations for a 100 per cent carbon-neutral future, by 2050 at the latest.

In a series of white papers, we outline our pathway to this more sustainable future. Through these white papers, we seek to inspire policymakers, investors, partners and customers to embark on a green journey with us, enabling thousands of homes, businesses and industries to be part of the green transition.

UGI ROADMAP 2030

- a pathway to a more sustainable future with liquified gas

For over 135 years, UGI Corporation has been supplying energy to the world. We have been an actor in the development of our society, as we know it today. Today, we offer a lower carbon alternative to oil and gas for households and businesses, as our fossil LPG emits 35% less CO₂ than coal and 12% less CO₂ than oil. Now we are ready to take the next step towards a carbon-neutral future. With our Roadmap to 2030 and beyond, we are embarking on a new chapter. A renewable chapter.

The world is facing a climate crisis. A crisis that calls for renewable solutions. That is why we are now focusing our investment efforts towards replacing our fossil fuel products with renewable alternatives. A step that will ensure that we will reduce our carbon-emissions by 50 per cent by 2030. At the same time, we are laying the foundation for a 100 per cent carbon-neutral future.

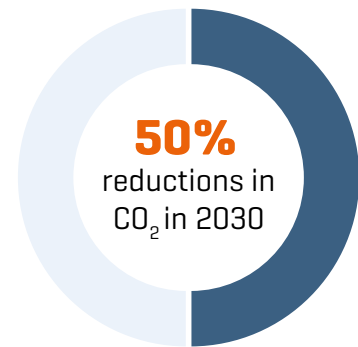
As one of the world's leading marketers of liquefied gas, not only will we take responsibility for selling and distributing our new green alternatives, we will also take responsibility for developing and producing these green alternatives.

Furthermore, we are targeting our investments in renewable alternatives that are both long-lasting and cost-effective. With an already committed investment fund of 1bn\$ we expect to deliver long lasting and cost effective renewable alternatives for our customers.

Each year we deliver approximately 2 million tonnes of Liquefied Petroleum Gas (LPG) to our customers in Europe, creating an estimated carbon footprint of 6.5 million tonnes of CO₂. Through our efforts our ambition is to reduce our external impacts by more than 3.25 million tonnes by 2030.

We are committed to driving the necessary changes to achieve our net zero goal of low carbon industrial process and heating solutions for all our customers.

Thousands of our customers are facing an increasing demand to decarbonise. They depend on us to deliver a fossil-free alternative. And we will deliver, so that they are able to meet the demands of a fossil-free future. We will leave no one behind.



Integrating production of renewable liquified gas in our organisation

We take great pride in the fact that our customers rely deeply on our ability to provide them with an alternative to LPG that is both renewable and affordable. Many have no other affordable options to decarbonise other than to replace LPG with sustainable renewable liquid gas.

We have a responsibility to our customers. If they choose a green path, we must be able to deliver a green solution. Therefore, by supporting our substantial investments in sustainable renewable liquid gas, we are also broadening our operating model. As one of the world's leading marketers of liquefied gas, not only will we take responsibility for selling and distributing our new renewable alternatives, we will also take responsibility for developing and producing these renewable alternatives. By producing sustainable renewable liquid gas, we create a more secure supply chain that we own end to end, meaning that we will constantly be able to live up to our customers' expectations.

We are also intensifying our focus on research and development. Our pathway will be an iterative process where we constantly search for new innovative and efficient ways of producing renewable liquid gases. Therefore, we are both scaling up our internal R&D competencies and expanding external partnerships.

Moving from a distribution model to a production and distribution model is a big step. We have already taken on the responsibility of producing in some parts of our business, and we are prepared to take on the full responsibility to deliver the required change.

Leaving no one behind

Today, LPG covers the heating needs of more than 20 million¹ EU citizens. Many of these in rural parts of Europe. Renewable liquid gases are an efficient way to reduce carbon emissions for many of these homes, either as a direct substitute or in a hybrid heating system. Both enable affordable renewable residential heating and improve the overall energy efficiency in Europe.

A large proportion of businesses that use fossil energy sources have process and heat requirements that cannot be electrified. This is a significant barrier to the green transition, and thus a challenge to realising the EU's climate reduction goals. LPG and sustainable renewable liquid gas are an effective way for these companies to reduce carbon emissions, as it is possible to gradually increase the share of renewable liquefied gas without expensive retro-fitting or new installations.

Today LPG covers the industrial and heating needs of more than

20 million

EU citizens &

700,000

businesses

– predominantly in areas where there is no gas network.

At UGII, we serve these off-grid private households and industries, and we know these homes and businesses can be some of the most difficult to decarbonise. Our customers typically live and work without access to the gas network. They use LPG to heat their homes, cook their food, and operate their businesses, either for heat or industrial processes. They rely on us to provide a cost-effective alternative to LPG.

As renewable liquid gases re-use a significant portion of the existing traditional LPG distribution and storage supply chain, there is a relatively

limited investment required, meaning that renewable liquid gases will be affordable as well as readily available.

It is our long-term goal to offer our customers a carbon-neutral alternative to the LPG they use today. At the same time, we – both today and in the future – can contribute with a renewable alternative to companies that today are fuelled by higher carbon solutions.

¹ https://www.liquidgaseurope.eu/images/BioLPG2050_pathway_study.pdf (page 6).



Our green building blocks

To achieve our 2030 and beyond goals, we have created an innovative roadmap built from novel technology building blocks.

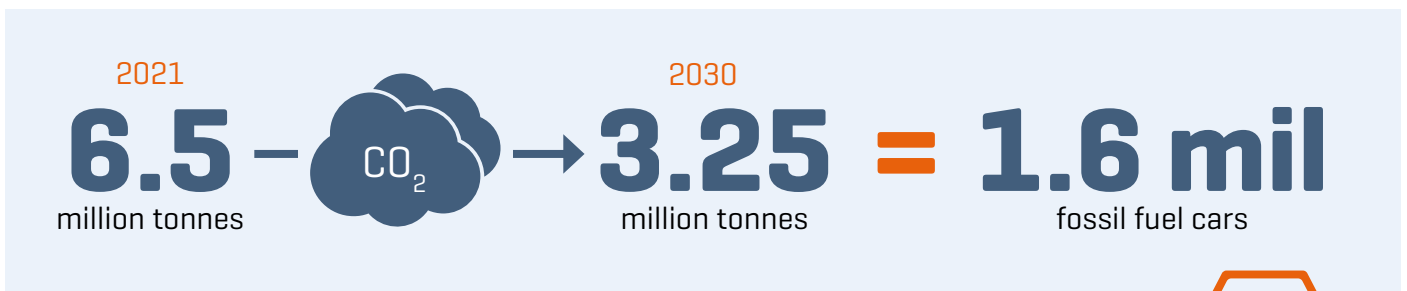
Traditional fossil LPG is explored like natural gas but is also a co-product from the production of petrol and diesel. In order to meet our green ambitions for the future, we are loosening our fossil ties from the past and building new partnerships with companies central to the green revolution. Our Roadmap 2030 is built on the energy sources of the future.

Today, our primary renewable alternative to LPG is bioLPG, which is a co-product of biodiesel produced using the

Hydrogenation of Vegetable Oils [HVO] from food waste processes.

However, analysis shows that by 2030, the global production of bioLPG will only achieve 2.6 million tonnes. The demand for LPG in Europe alone will be 19 million tonnes. Although bioLPG is an important starting point on our pathway to a more sustainable future supply is limited, and additional pathways to transition are required.

Our roadmap is built on a mix of additional renewable technologies, which ensure that we can live up to our goal of reducing our carbon emissions by 50% by 2030. Our roadmap is aligned with RED II criterias meaning that there will be no 1st generation feedstock in our renewable products, allowing double counting.



By 2030, UGI will emit 50 per cent less CO2

With our Roadmap 2030 we are able to reduce the carbon footprint of our products by 50 per cent in 2030 compared to today. This means that we will emit approximately 3.25 million tonnes less CO2 by 2030. This significant reduction corresponds to the emissions of 1.6 million fossil-fuel cars.



GREEN BUILDING BLOCKS

Based on thorough analysis, we have selected three building blocks. As other technologies mature, we will add more building blocks to the roadmap. Thus, our roadmap is flexible.

All the technologies in our roadmap are known technologies. They have existed for decades. However, they need to be scaled and industrialised. Based on thorough analysis, we currently have three building blocks to generate the renewable liquid gas of our future – Alcohol to Hydrocarbon, Renewable Dimethyl Ether (rDME) and Power-to-X. These are the technologies we believe have the greatest potential to deliver before 2030.

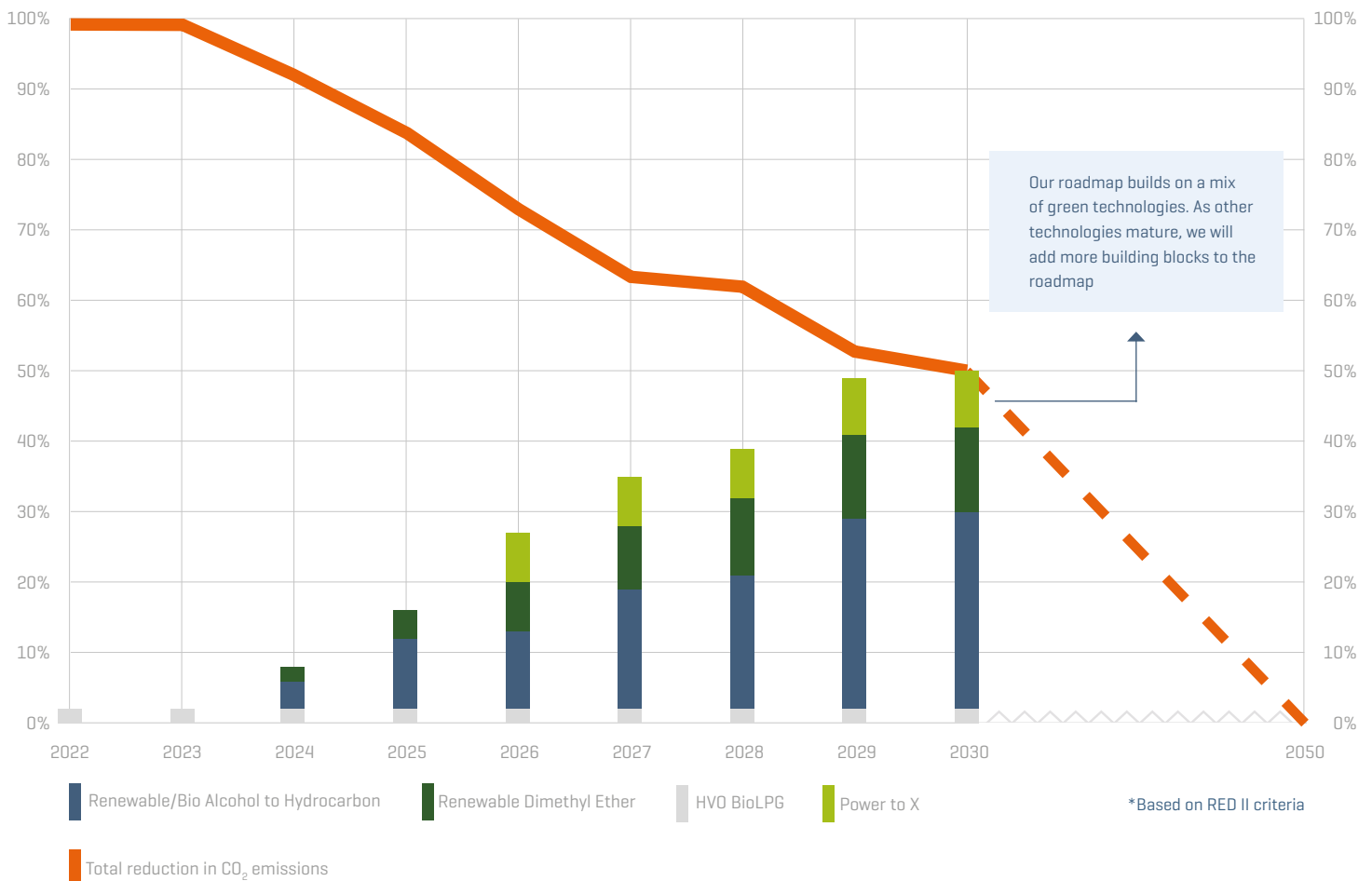
However, we will remain flexible and versatile. As other technologies mature, we will add more building blocks to the roadmap. And if a technology matures faster than expected, we will not hesitate in adding the building block, making our roadmap robust and flexible.

It is our ambition that

25%

by energy content of the total product delivered to our customers will be **renewable liquid gases, including bioLPG, leading to 50% emission reduction**

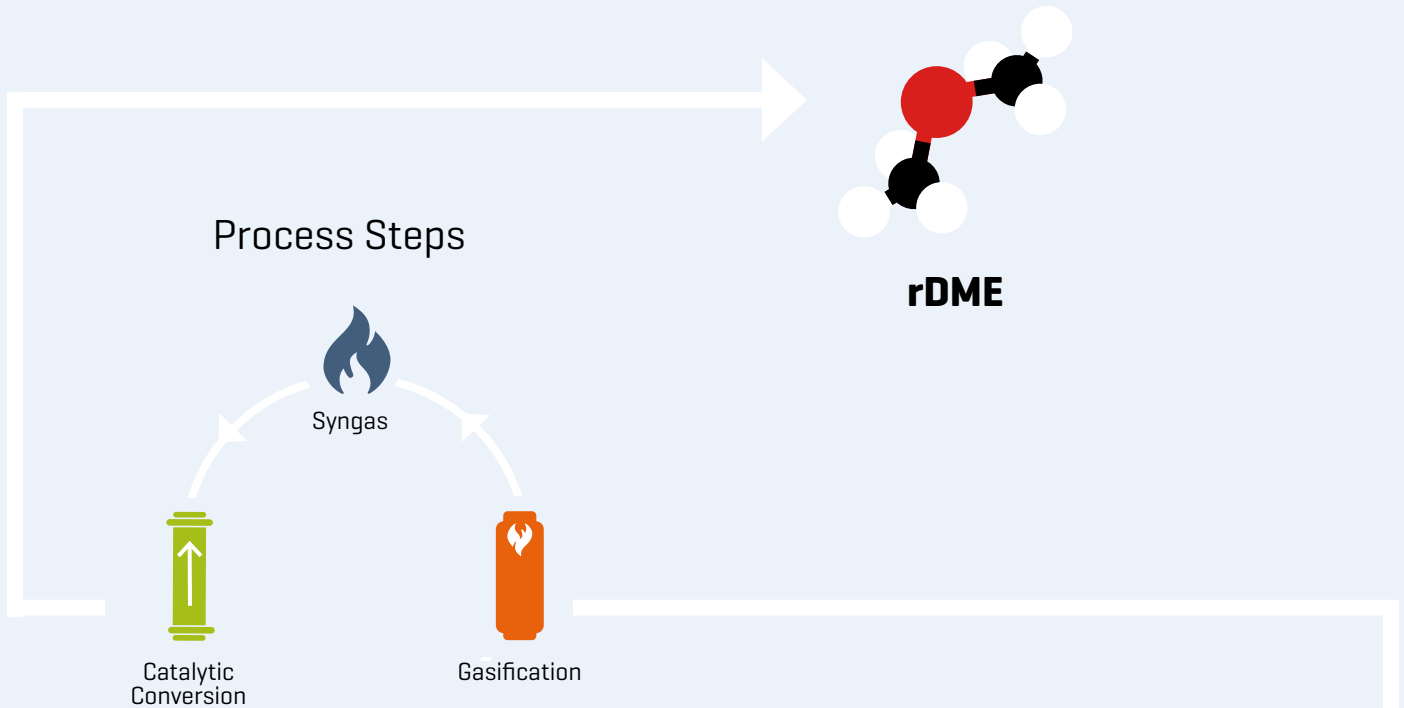
Reduction in CO₂ Emissions*



Share decarbonisation (percentage)

RENEWABLE DIMETHYL ETHER

Sustainable Low-Carbon Liquid Fuel



Renewable Dimethyl Ether

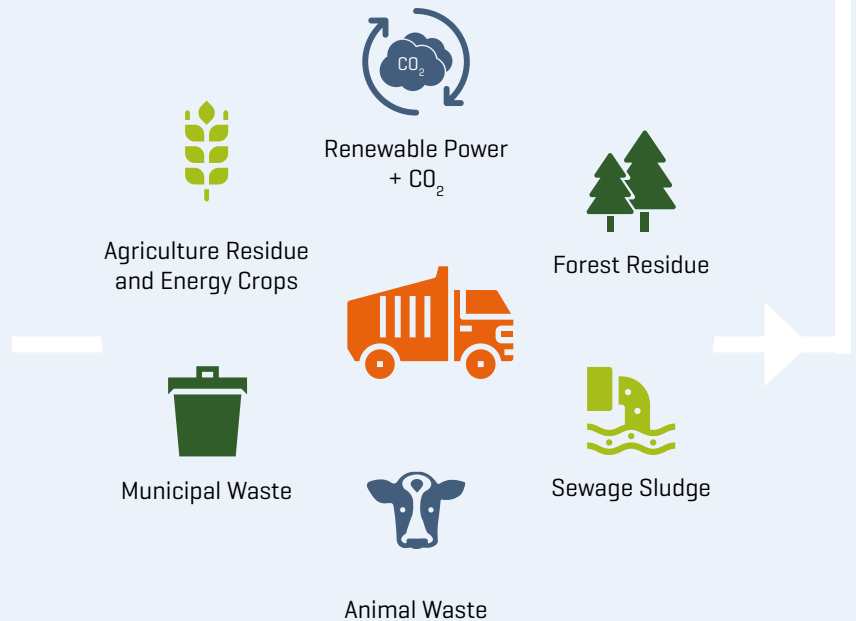
Among the more mature greening pathways, renewable dimethyl ether [rDME] produced from organic matter is a sustainable renewable liquid gas with up to 85% lower greenhouse gas emissions than fossil alternatives.

rDME can be produced from sustainable feedstocks such as waste and residues, using gasification and catalytic synthesis.

Being a safe, cost-effective and clean-burning fuel, rDME is a viable and sustainable addition to the energy mix. rDME is chemically similar to LPG, and in both pure and blended form, rDME can help the decarbonisation by becoming a sustainable alternative for off-grid energy uses including heating, cooking and transport.

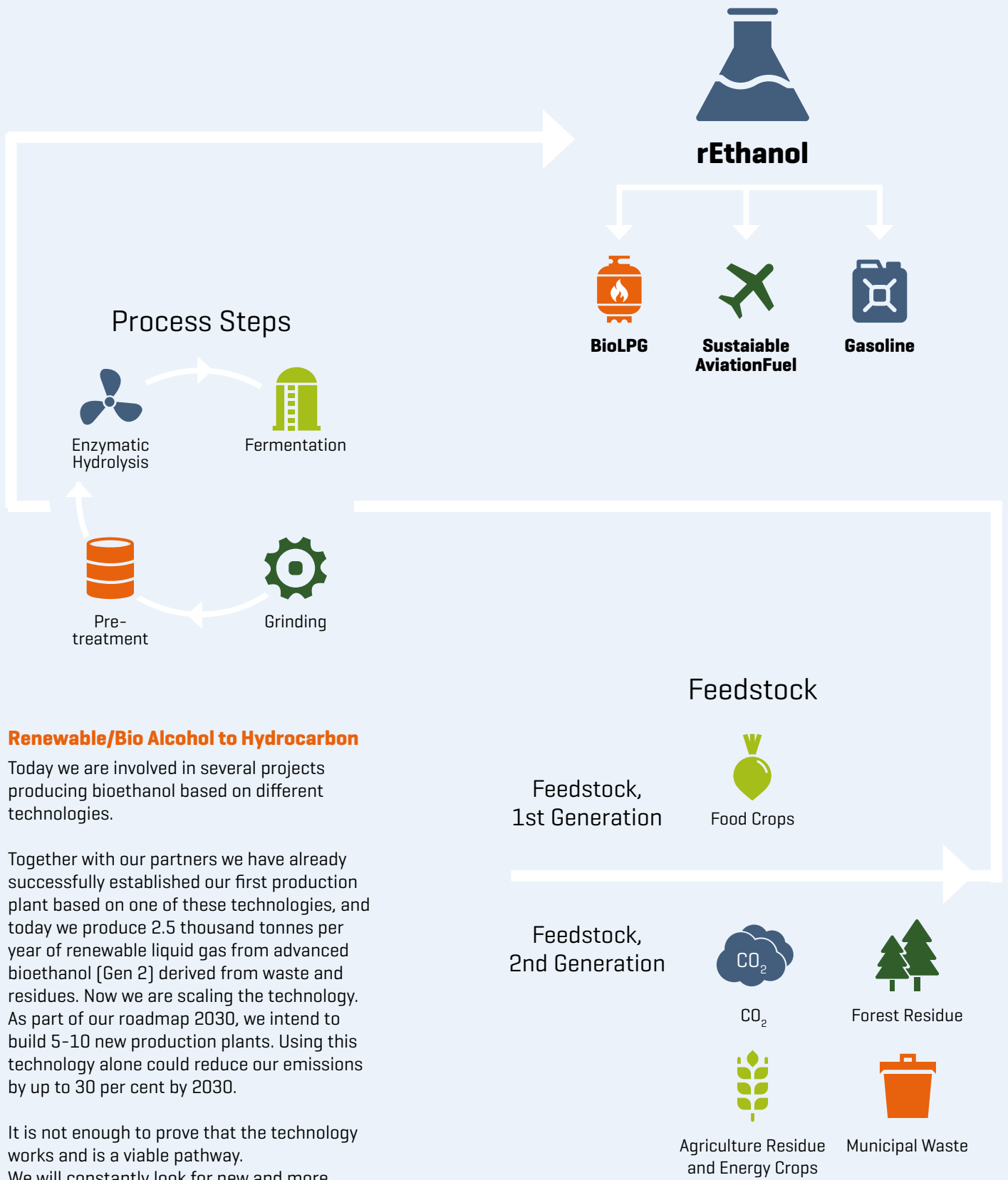
Together with industry partners, we have the required know-how and we are investing in the development of 5-7 production plants within the next 5 years, targeting a total production capacity that could reduce our emissions by up to 15 per cent by 2030.

Feedstock



RENEWABLE/BIO ALCOHOL TO HYDROCARBON

Sustainable Renewable Liquid Gas



Renewable/Bio Alcohol to Hydrocarbon

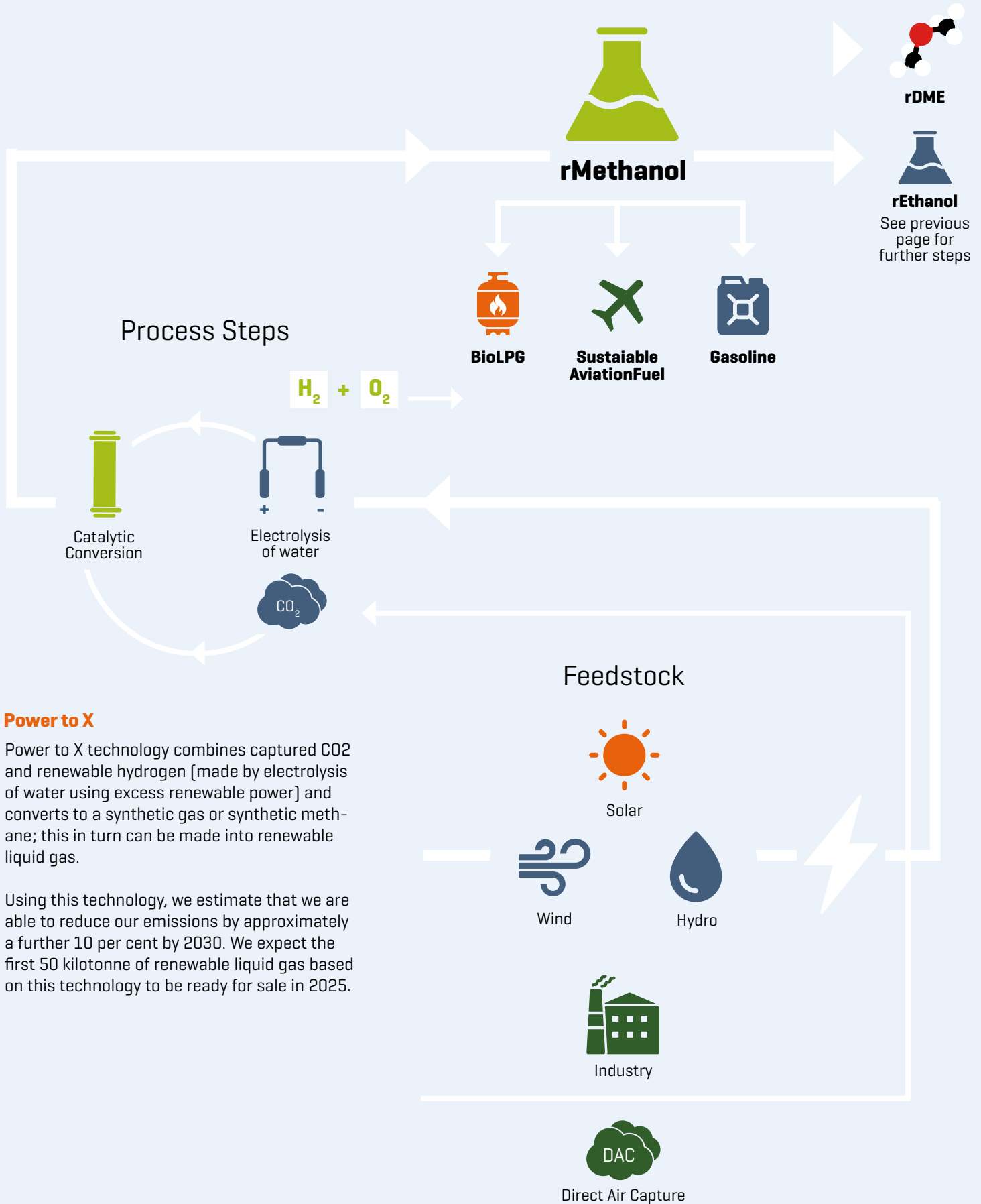
Today we are involved in several projects producing bioethanol based on different technologies.

Together with our partners we have already successfully established our first production plant based on one of these technologies, and today we produce 2.5 thousand tonnes per year of renewable liquid gas from advanced bioethanol [Gen 2] derived from waste and residues. Now we are scaling the technology. As part of our roadmap 2030, we intend to build 5-10 new production plants. Using this technology alone could reduce our emissions by up to 30 per cent by 2030.

It is not enough to prove that the technology works and is a viable pathway. We will constantly look for new and more cost-effective bioethanol technologies that will produce renewable liquid gas in even higher quantities.

POWER TO X

Sustainable Renewable Liquid Gas



Power to X

Power to X technology combines captured CO₂ and renewable hydrogen (made by electrolysis of water using excess renewable power) and converts to a synthetic gas or synthetic methane; this in turn can be made into renewable liquid gas.

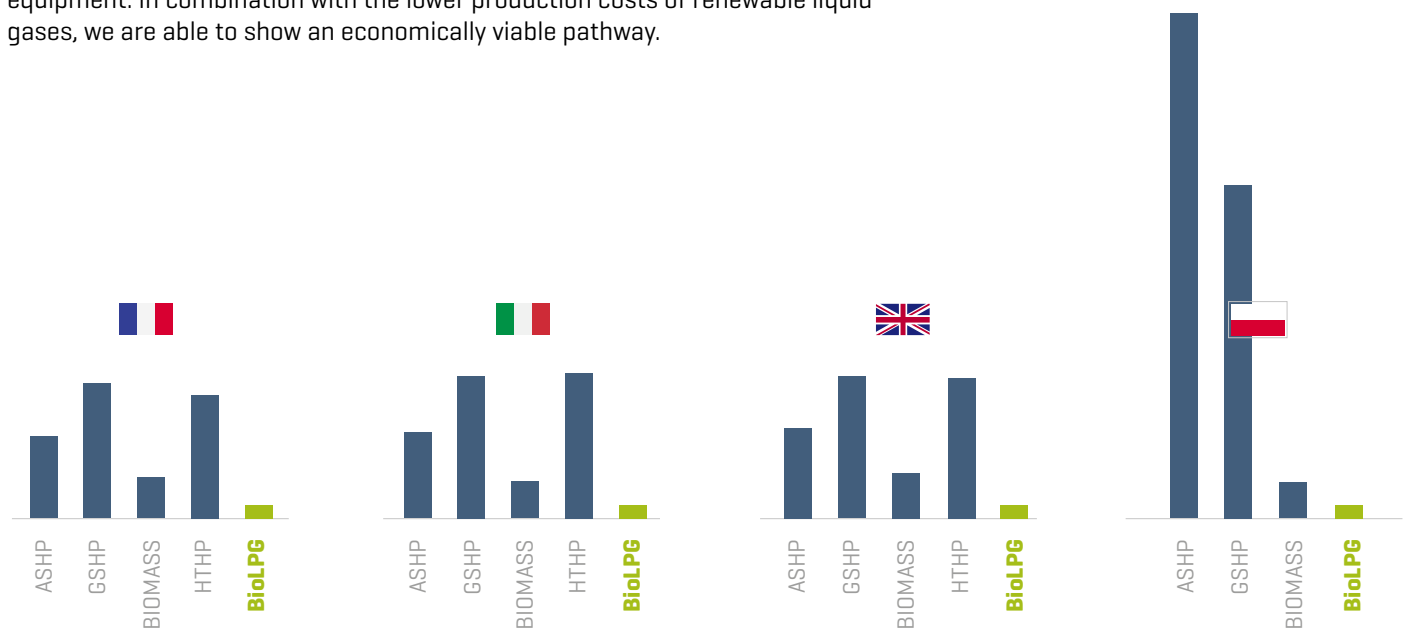
Using this technology, we estimate that we are able to reduce our emissions by approximately a further 10 per cent by 2030. We expect the first 50 kilotonne of renewable liquid gas based on this technology to be ready for sale in 2025.

AVAILABLE AND AFFORDABLE

Decarbonisation with renewable liquid gas is one of the most cost-efficient ways to decarbonise both households and businesses.

Our Roadmap 2030 will be delivered through a mix of technologies. The technologies are available and mostly already proven in the market. Now we invest to scale and optimise, making our pathway to a more sustainable future affordable. Affordable for our customers and affordable within policy ambitions.

Direct replacement of fossil fuels with liquid gas is one of the most cost-efficient ways to decarbonise both households and businesses. It is a drop-in solution identical in its use to conventional LPG. Therefore, it does not require new equipment. In combination with the lower production costs of renewable liquid gases, we are able to show an economically viable pathway.



Abatement cost comparison for 90 to 109 sqm house built between 1946 and 1980. CO2 abatement cost (EUR/t; TCO) 10 years; without boiler replacement and subsidies

CO2-abatement cost for bioLPG is far below alternatives

We have analysed four decarbonisation alternatives to bioLPG. Three kinds of heat pumps, and biomass boilers. Our analysis shows that overall, the CO2 abatement cost of bioLPG is by far the lowest, almost 30% of biomass on average, and well below heat pump solutions.

| | |
|----------------|--|
| BioLPG | Boiler consuming bioLPG |
| ASHP | Air source heat pumps absorbing heat from the outside air |
| GSHP | Ground sourced heat pumps using buried pipes to extract heat |
| Biomass | Boiler consuming wood pellets |
| HTHP | Taking heat from air and transferring it to a water-based system |



Decarbonisation with renewable liquid gas is one of the most cost-efficient ways to decarbonise both households and businesses.

The regulatory framework must support the green transition

Our Roadmap 2030 is an ambitious and realistic pathway to a more sustainable future for liquified gas. Within 10 years our ambition is to reduce our carbon emissions by 50 per cent, and beyond 2030 we will replace all fossil LPG with renewable alternatives.

However, if we are to succeed in making thousands of homes and businesses more climate friendly, it is crucial that the regulation supports the transition from conventional LPG to renewable liquid gases.

In doing so, we recommend policymakers and industry stakeholders to investigate answers to the following questions:

- 1.** Is it more cost-effective to use the existing LPG infra structure in the decarbonisation of thousands of homes and businesses rather than invest heavily in well published alternatives [such as Heat Pump technology]? As the supply of renewable liquid gases increases, it is likely that existing gas boilers across Europe could be a cost-effective way to decarbonisation simply by replacing conventional LPG with renewable liquid gases.
- 2.** Do we have the right incentives to decarbonise industrial processes and the heating of homes and businesses? We should carefully consider whether we have a balanced approach to decarbonisation across sectors. Harvesting low-hanging fruits in the decarbonisation of industrial processes and heating for homes and businesses is perhaps more cost-effective than the same amount of carbon-reduction in transport.
- 3.** A well-functioning market is vital if we want to realise the potential in renewable liquid gases. It is our recommendation that the market should be built on the existing certificate examples. This will allow renewable liquid gases to be produced at the most effective production sites, making it as cost-efficient as possible ●



UGI Roadmap 2030

– a pathway to a more sustainable
future with liquified gas

We leave no one behind in the race to green

