



ZERO CARBON GASES – THE KEY TO PORTUGUESE DECARBONISATION

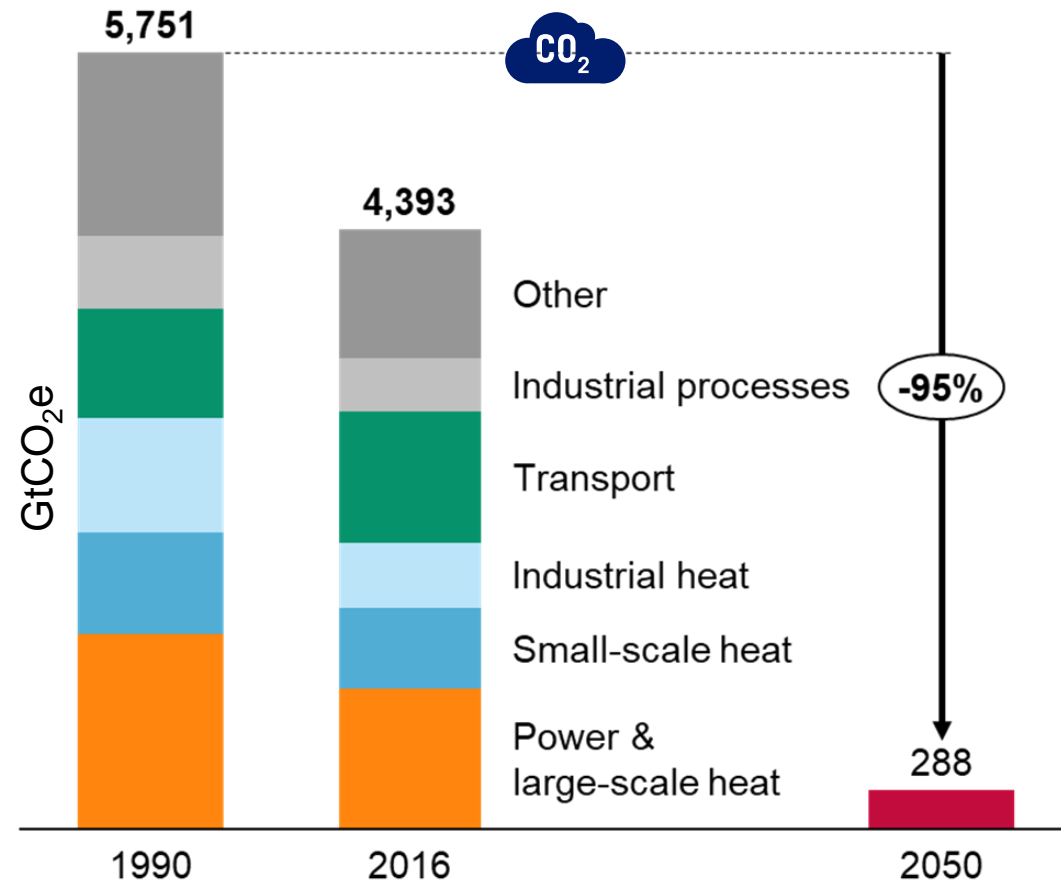
Study presentation to AGN

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THE PARIS AGREEMENT IN 2015 SET AN AMBITIOUS CLIMATE CHALLENGE

If these targets are to have any realistic chance of being met, it is expected that the European economy will need to contribute with a 95% reduction in greenhouse gases compared to 1990



'Other' consists of non-international shipping and aviation, agriculture, food, other land use and waste

- As a result, the EU has adopted a series of strategies to direct its Member States towards meeting these goals:

- 2030 climate & energy framework:**

- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share for renewable energy
- At least 32.5% improvement in energy efficiency



- 2050 long-term strategy:**

- The EU's vision to achieve a climate-neutral economy was presented at the end of 2018 and is set to be adopted by the end of 2020



THE EU'S 2050 STRATEGY IS CURRENTLY BEING DISCUSSED AND WILL BE IN LINE WITH THE PARIS AGREEMENT

Portugal has already published its Roadmap for Carbon Neutrality 2050 which extends the country's NECP2030 objectives to 2050. NECP need to be reviewed by the end of year

	NECP		RCN	
	2030	2040	2050	
GHG reduction*	-45/55%	-65/75%	-85/90%	
CO2 reduction**	-17%	-	-	
Renewable penetration**	47%	70/80%	85/90%	
Energy efficiency	35%	-	-	
Interconnections	15%	-	-	

* Relative to 2005









** On final energy consumption

- The Portuguese Roadmap for Carbon neutrality aims at achieving 65% of final energy consumption from electricity by 2050
- The Roadmap established different levels of electrification for each segment:

	2030	2050
Transport	12%	72%
Industry	28%	53-56%
Residential	44%	74-81%
Services	74-75%	90-91%

PÖYRY HAS INVESTIGATED TWO POTENTIAL PATHWAYS TO ACHIEVE CARBON NEUTRALITY IN EUROPE

Renewable electricity generation will play a key role in all decarbonisation pathways, but the challenge will be about how to complement this and still decarbonise the much more difficult heat sector

 'All-Electric'	'Zero Carbon Gas' 
<p><i>Main focus of an 'All-Electric' pathway is to electrify transport, heat and industry and relies on renewables and nuclear to deliver decarbonisation.</i></p>	<p><i>Main focus of a 'Zero Carbon Gas' pathway is to minimise risks and costs of decarbonisation by allowing a mix of renewables and zero carbon gases.</i></p>
<p> No policy support for biomethane, hydrogen or CCS</p>	<p>All technologies are available to contribute to the solution, based on economics </p>
<p> No development of non-electric technologies, such as fuel cell vehicles or hydrogen boilers</p>	<p>Gas networks that are in place already are retained and used as required </p>
<p> Reliance on nuclear, electricity network reinforcement and interconnection</p>	<p>Reduces the need for nuclear (no new build), electricity network reinforcement and interconnection </p>

A ZERO CARBON GAS PATHWAY COULD SAVE UP TO 1,150BN€ IN EUROPE COMPARED TO AN 'ALL ELECTRIC' PATHWAY

The 'Zero Carbon Gas' pathway represents a future where the gas industry has the opportunity to adapt to the requirements from decarbonisation if economic



Transport

Electric vehicles dominate in lighter segments while fuel cell vehicles are a more economical alternative in heavier transport segments.



Heating

Boilers, heat pumps and hybrid systems play an important role in utilising biomethane and hydrogen. CCS installations are used widely. District heating networks are retained and decarbonised.



Power generation

While renewable sources account for the majority of capacity, they are balanced mainly with CCS plants using natural gas as fuel. Nuclear capacity decreases.



Smart networks

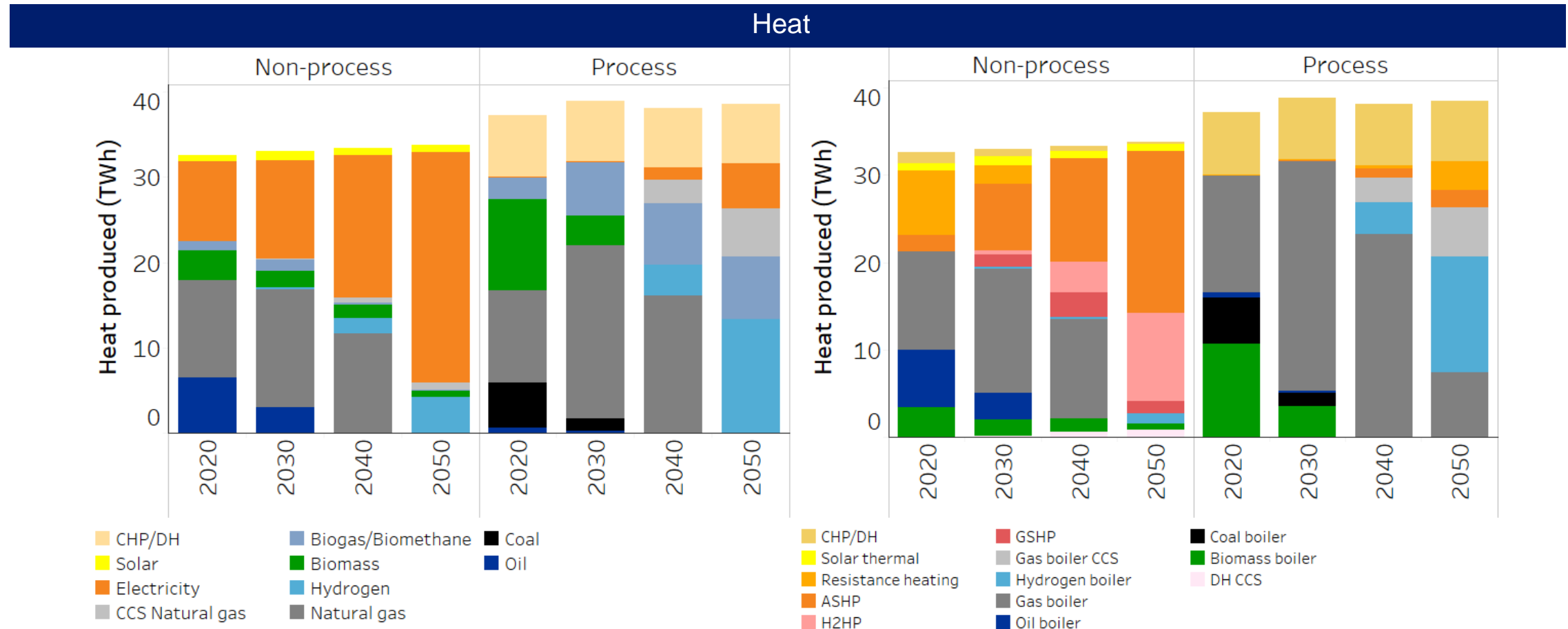
Power networks allow demand side response. Many gas distribution networks convert to hydrogen. A CO₂ network is established to transport CO₂ to offshore storage sites.

- Gas industry is at the centre of the decarbonised energy sector in 2050 and beyond
- Existing natural gas infrastructure adapts to support the deployment of CCS, biomethane and hydrogen
- It is expected that networks will need to be upgraded significantly to allow for the two-way demand side response from electric vehicle customers



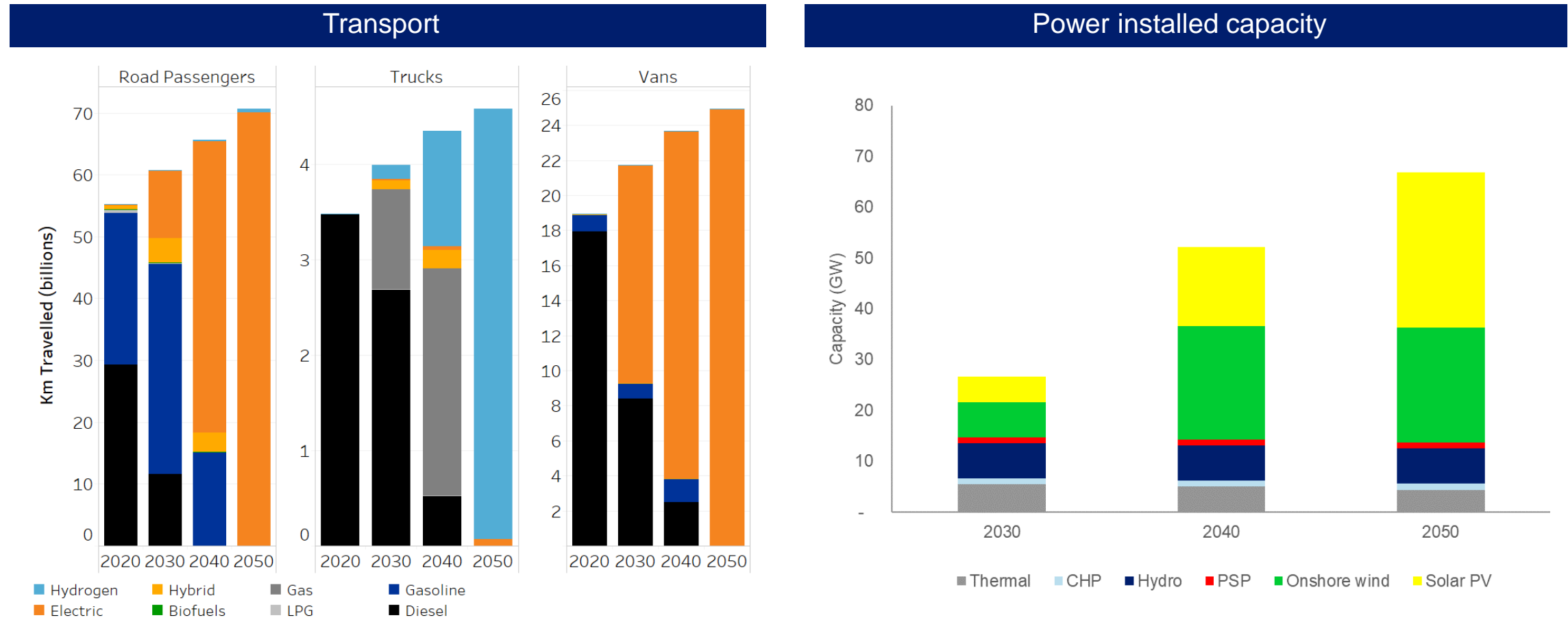
FULL DECARBONISATION OF PORTUGUESE ENERGY SYSTEM BY 2050 IS POSSIBLE

Space heating transitions towards heat pumps while industry mostly converts to hydrogen alongside some biomethane as well as clusters of CCS



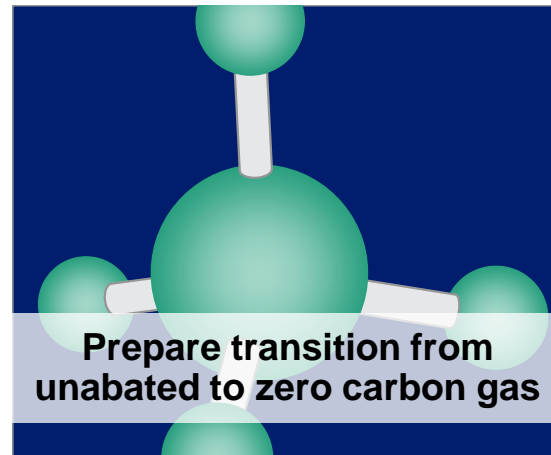
FULL DECARBONISATION OF PORTUGUESE ENERGY SYSTEM BY 2050 IS POSSIBLE

Transition across in Portugal requires significant supply chain build up plus infrastructure investment in key new technologies – especially in EVs, Hydrogen, Renewables and electricity grids

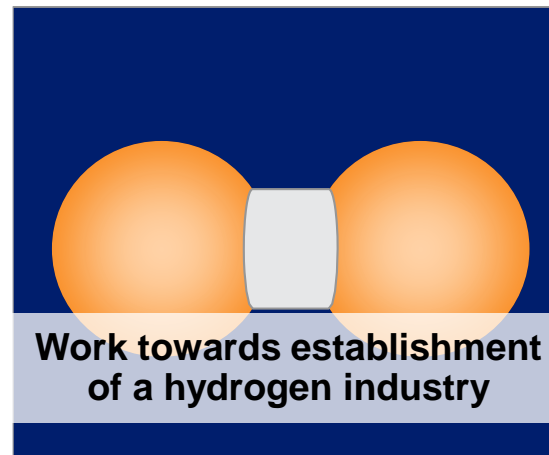


IN PORTUGAL, A ZERO CARBON GAS PATHWAY COULD SAVE UP TO €9BN COMPARED TO AN 'ALL ELECTRIC' PATHWAY

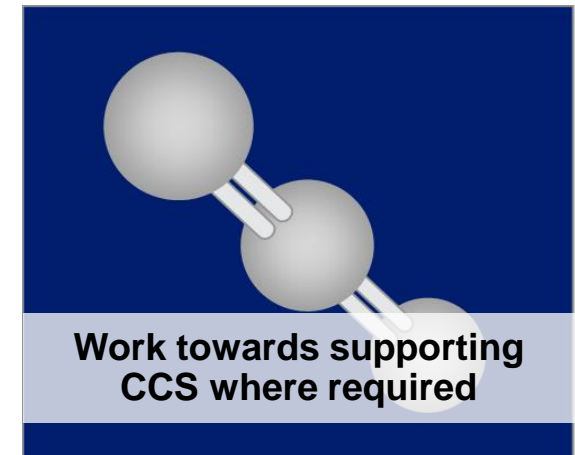
Pöyry and AGN have investigated the role of gas infrastructure in a Zero Carbon Gas pathway in Portugal and found fostering zero carbon gases is an efficient way to achieve decarbonisation



- During the transition period, zero carbon gases such as biogas and biomethane will allow for a reduction in emissions
- In many industrial applications there are no practical or economic electric solutions so need zero carbon gases



- Converting existing gas networks to hydrogen enables this fuel to be developed at scale
- Hydrogen avoids the need for a disruptive conversion, allowing for better social acceptability



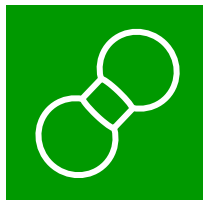
- Industrial process emissions will need to be mitigated with CCS
- Where industrial heat and process emissions co-inside the establishment of CCS clusters represents the most economic solution for their decarbonisation

RECOMMENDATIONS TO PORTUGUESE POLICY MAKERS

The Roadmap for Carbon Neutrality in Portugal should be updated to reflect the clear benefits that come from re-purposing gas networks to support deployment of biomethane and hydrogen – and CCUS clusters where required



“Targets should be set for zero carbon gases levels in the energy mix so Portugal can take advantage of its privileged solar and wind resources”



“Portugal’s abundant solar resource means hydrogen can be produced at scale and at the cheapest level across Europe”



“The re-purpose of the Portuguese gas network reduces the required expansion of electricity grids by half compared to an all electric scenario”



“Portugal is well placed to be at the forefront of decarbonisation as its modern gas network can easily be used and adapted to support biomethane and hydrogen deployment and CCUS clusters, reducing the risks and costs”

In 2019 ÅF and Pöyry became AFRY

- In February 2019 ÅF and Pöyry joined forces in order to become an international engineering, design and advisory company, driving digitalisation and sustainability for the energy, infrastructure and industrial sectors all over the world.
- In November 2019 ÅF Pöyry launched a new common brand, AFRY. The name is a combination of the letters in ÅF and Pöyry: AF+RY [ei:fji]
- With a strong focus on sustainable solutions we bring the best from ÅF and Pöyry into the new brand AFRY.





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Fully decarbonising
Europe's energy
system by 2050

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