

THE ROLE OF RENEWABLE GAS IN A DECARBONISED EU ENERGY SYSTEM

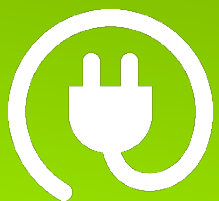
BIOGAS ACROSS BORDERS CONFERENCE,
BRUSSELS 8 NOVEMBER 2018

DAAN PETERS



ECOFYS BECOMES NAVIGANT: GLOBAL ENERGY CONSULTANCY

We collaborate with clients to help them thrive in a rapidly changing environment.



CLIENTS

- ✓ 50 largest electric and gas utilities
- ✓ 20 largest independent power generators
- ✓ 20 largest gas distribution and pipeline companies
- ✓ Leading renewable energy producers
- ✓ International, national and regional government organisations
- ✓ Multiple new energy market entrants and investors



TEAM

- ✓ Industry's largest energy management consulting team
- ✓ Consultants average 15 years of experience
- ✓ 60% have an advanced degree
- ✓ Over 50% have an engineering degree

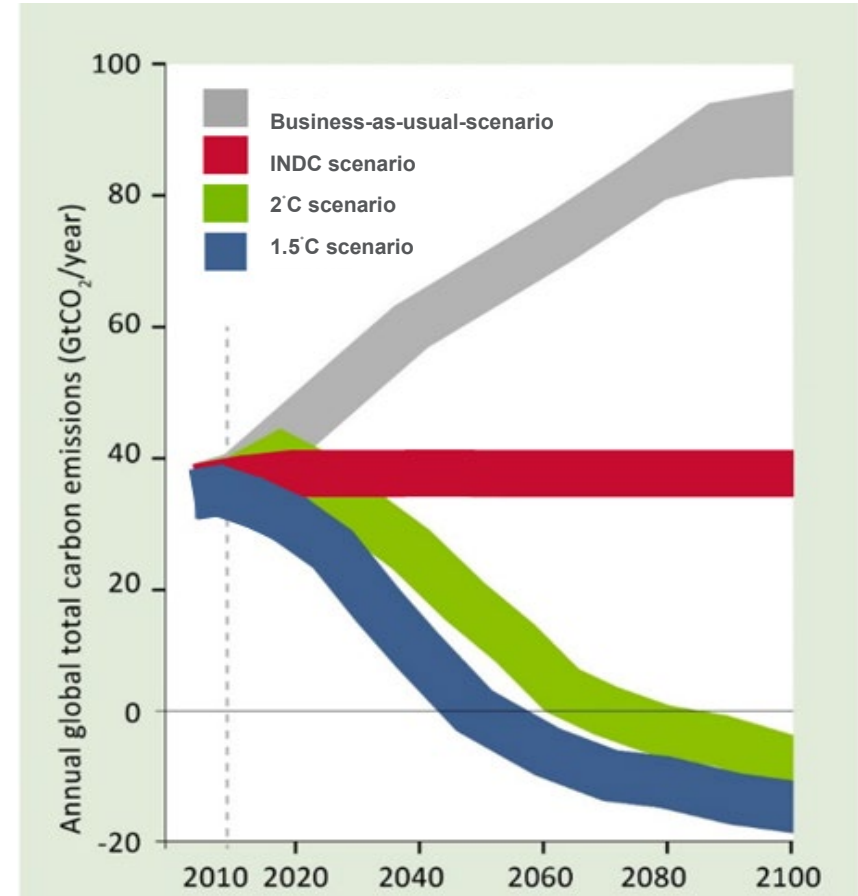


NAME

- ✓ Among Top 10 in Vault's 2017 Best Consulting Firms for Energy
- ✓ Named "Best Advisory – Renewable Energy" in 9th and 10th Annual Environmental Finance and Carbon Finance Market Surveys

DEEP DECARBONISATION OF EU ENERGY SYSTEM NEEDED TO MEET CLIMATE GOALS

- In the 2015 Paris Agreement, 195 countries agreed to limit global warming to well below 2°C, and aim for 1.5°C
- To meet the target, studies show that the world should aim for net-zero carbon emissions by 2050
- This implies that countries (and the EU) need to decarbonise their energy systems



GAS FOR CLIMATE: A PATH TO 2050

The Gas for Climate initiative

A group of seven European gas TSOs and two biogas associations who developed a vision on how to achieve a net zero emissions EU energy system

www.gasforclimate2050.eu



The group consists of :



gasunie



GAS FOR CLIMATE VISION AND ACTIVITIES

" We are committed to achieve net zero greenhouse gas emissions in the EU by 2050 to meet the Paris Agreement target. Renewable gas used in existing gas infrastructure can play an important role in this."

CEOs of Gas for Climate members, February 2018

**February
2018**

Study by Ecofys, a Navigant company, on the **role of renewable gas in the EU energy system by 2050**



**September
2018**

Publication of the 2030 Action Plan, presented to the **European Commissioner for Climate & Energy, Mr. Arias Cañete** at a Gas for Climate event in Brussels



**December
2018**

Study on the role of **how sustainable biomethane can generate negative emission** by increasing soil organic carbon accumulation in agricultural soils

**February
2019**

Updated, more refined 2050 study with (1) **updated potentials** of green and blue hydrogen, (2) **more refined energy demand** analysis (incl. industry, transport), and (3) **updated allocation** of renewable and low carbon gas to various demand sectors

**Spring
2019**

Updated, more refined 2030 Action plan. The current '2030 to-do list' will be **enriched** based on in-depth analysis on how selected actions can be successfully implemented in practice

ALL GAS WILL BE RENEWABLE OR LOW CARBON GAS, WHICH CAN BE SMARTLY COMBINED WITH RENEWABLE ELECTRICITY

Vision

Net zero emissions EU energy system by 2050 with gas and electricity

Future gas categories

Renewable gas

Low-carbon gas

Future gas types



Biomethane



Green hydrogen



Power to methane



Natural gas with CCS



Blue Hydrogen

Demand sectors

Electricity

Building heating

Heavy road transport

Heat & feedstock for industry

Passenger cars

Shipping

Enabling factors

Positive externalities bio-methane



Mitigate methane leakage



Capacity utilization of gas TSO grid

Dialogue with NGOs and policy makers

OUR STUDY (FEB 2018) ASSESSED THE POTENTIAL AND COST BENEFITS OF RENEWABLE GASES

Vision

Net zero emissions EU energy system by 2050 with gas and electricity

Future gas categories

Renewable gas

Low-carbon gas

Future gas types



Biomethane



Green hydrogen



Power to methane



Natural gas with CCS



Blue Hydrogen

Demand sectors

Electricity

Building heating

Heavy road transport



Heat & feedstock for industry

Passenger cars

Shipping

ONGOING WORK TO REFINE GREEN HYDROGEN ANALYSIS AND ANALYSE THE ROLE OF LOW CARBON GAS

Vision

Net zero emissions EU energy system by 2050 with gas and electricity

Future gas
categories

Renewable gas

Low-carbon gas

Future gas
types and
their
potentials



Biomethane



Green hydrogen



Power to
methane



Natural gas
with CCS



Blue Hydrogen

Analysis demand
and cost of using
renewable and
low carbon gas in
demand sectors

Electricity

Building
heating

Heavy road
transport

Heat & feedstock
for industry

Passenger
cars

Shipping

Allocation of renewable and low carbon gas to all analysed demand sectors

FEBRUARY 2018 STUDY ANSWERS TWO QUESTIONS

To assess whether a future decarbonised energy system should include renewable gas, research by Ecofys, a Navigant company, answered two key questions:

1

Potential

What is the potential for renewable gas in Europe in 2050?

2

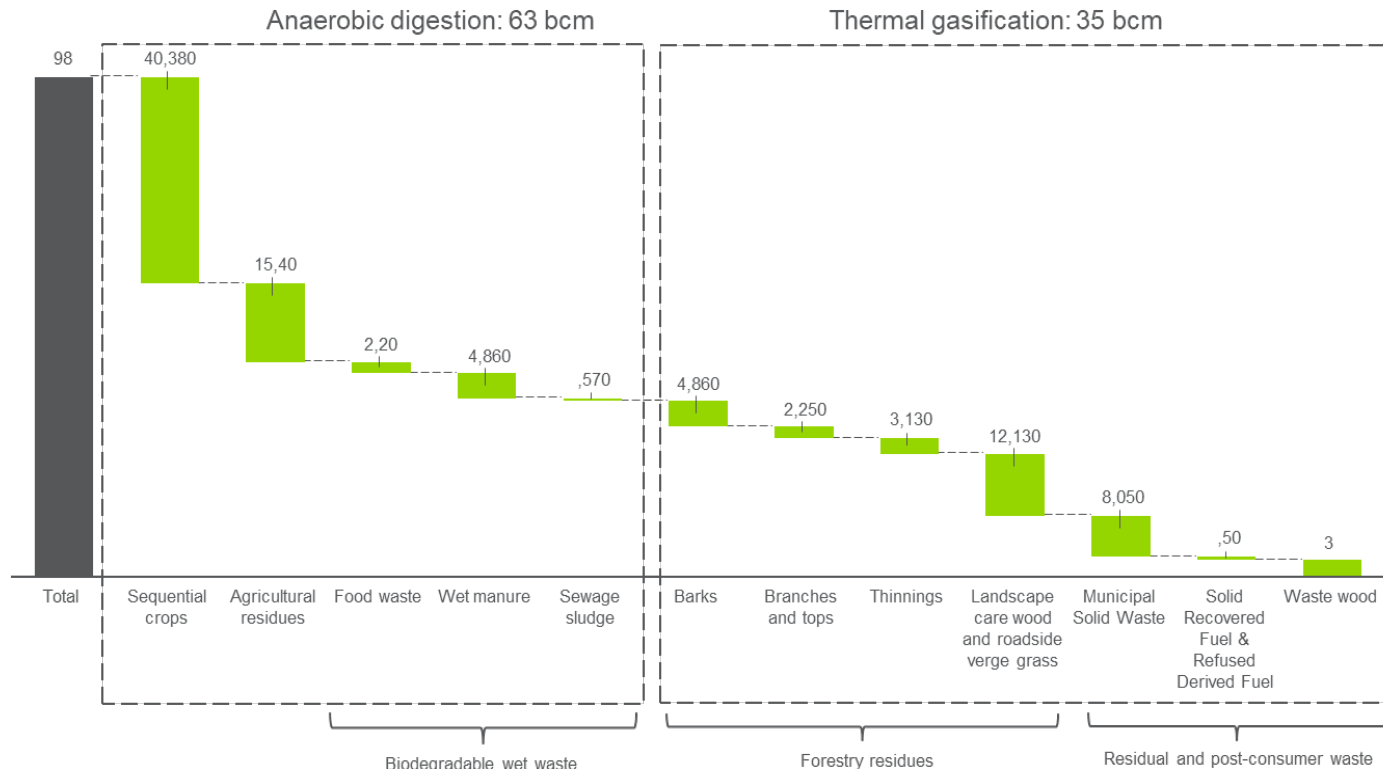
**Cost
Savings**

To what extent can use of this gas through existing gas infrastructure decrease energy system costs in 2050 in a decarbonised system?

IT IS POSSIBLE TO SCALE UP BIOMETHANE PRODUCTION IN THE EU TO 98 BCM BY 2050...

1
POTENTIAL

Biomethane Potential per Conversion Technology and Feedstock Type by 2050



Source: Ecofys

Sequential crops can be maize or triticale silage produced as second crop on 11% of existing EU agricultural land. This concept works in Italy and France and requires further testing 'north of the alps'.

... PLUS AT LEAST 24 BCM GREEN HYDROGEN BY 2050

1

POTENTIAL

A potential exists to produce **24 bcm of hydrogen** (in methane energy equivalent) from renewable electricity in the EU. This potential assumes that hydrogen is produced from surplus renewable electricity that would otherwise be curtailed.

Additional analysis and thoughts on hydrogen

Additional green hydrogen potentials can be possible if, following electrolyser cost reductions, it is possible for green hydrogen producers to pay a price for renewable electricity used to produce hydrogen. This is currently being analysed by Gas for Climate.

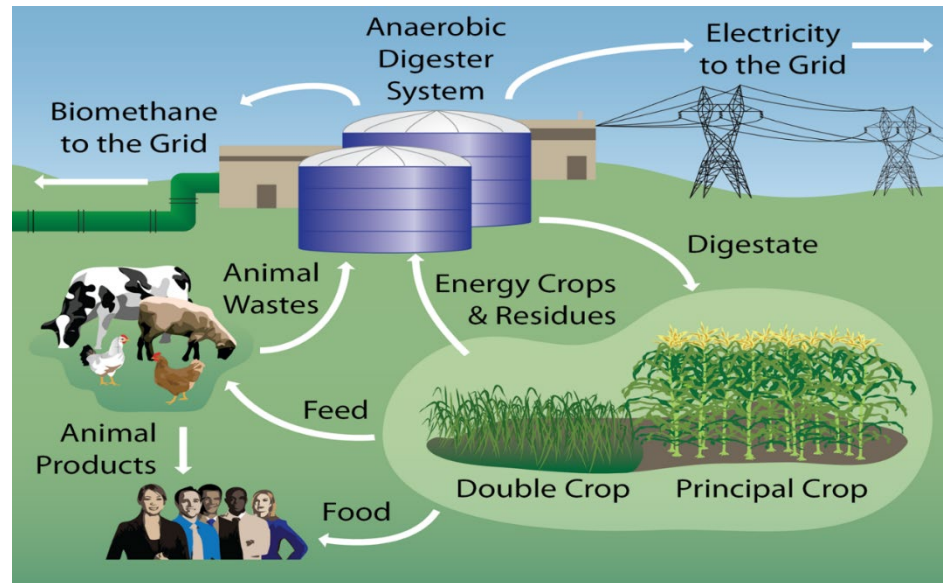
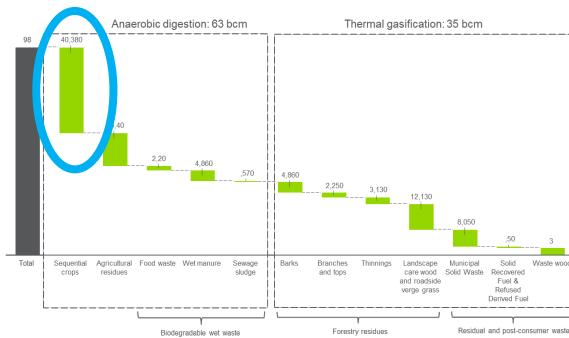
Furthermore, it is possible to produce green hydrogen from solar PV in North-Africa or the Middle-East and transport hydrogen to the EU.



BIOMETHANE: 'SECOND CROP' SILAGE INSTEAD OF 'MONOCROP'. TESTING NEEDED IN NORTHERN EUROPE

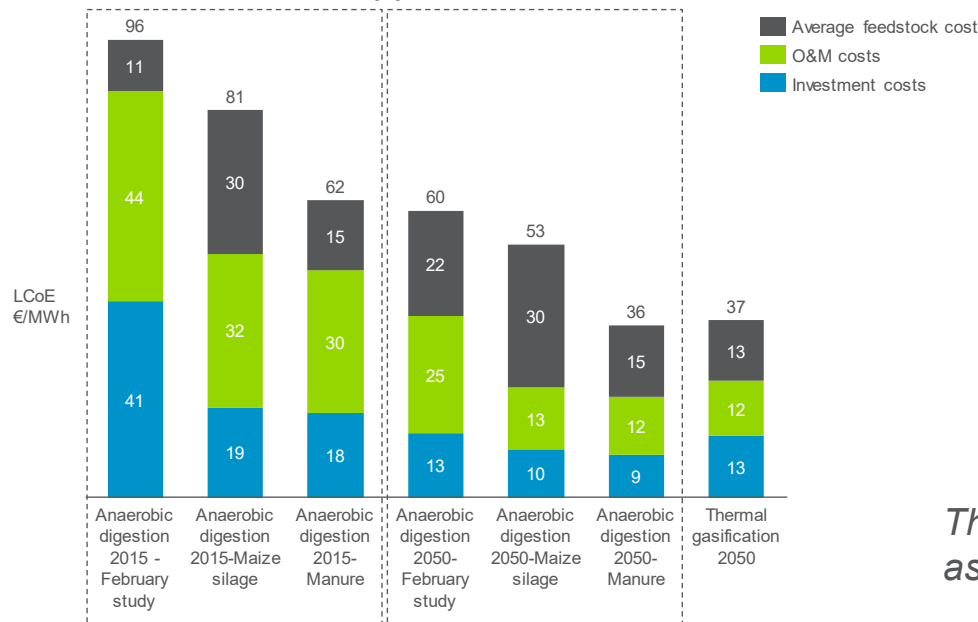
1

Our biomethane potential consists of 58 bcm produced from agricultural and forestry wastes and 40 bcm produced from 'sequential crops' that are produced on agricultural land as second crop. This is part of the 'Biogasdoneright' concept that has been proven to work well in Italy.



WHILE COST REDUCTIONS ARE POSSIBLE, RENEWABLE GAS WILL BE MORE EXPENSIVE THAN RENEWABLE ELECTRICITY

- Current biomethane costs are high. In our February study we assumed current costs of 96 €/MWh for current average sized installations (2.5 MW_{th}). Additional insights lead us to think that today's costs can be 60–80 €/MWh. Higher end of the range when using a large share of expensive maize silage whereas with a large portion of manure, biomethane costs fall at the lower end of the range.
- For 2050, the assumed average plant size is 5–6 MW_{th}. The costs can range between 35–55 €/MWh depending upon the feedstock mix.
- These are social costs calculated using a discount rate of 3.5%. Higher ranges should be expected if commercial discount rates are applied.



These numbers are still under assessment and not yet final

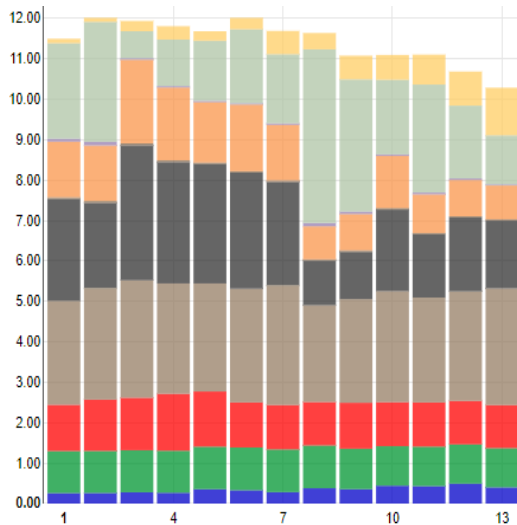
HOWEVER.. RENEWABLE GAS CAN LEAD TO SIGNIFICANT NET ENERGY SYSTEM COSTS SAVINGS IN THREE SWEET SPOTS

2

COST SAVINGS



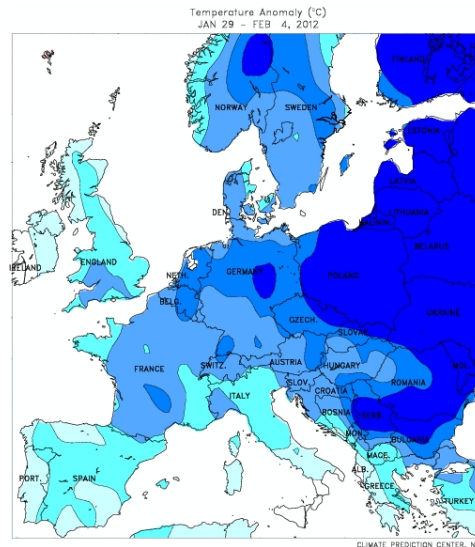
**DISPATCHABLE
POWER**



Source: Energy-Charts.de



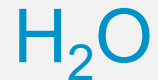
COLD SPELLS



Source: US National Weather Service



**INDUSTRIAL
APPLICATIONS**



SIGNIFICANT ENERGY SYSTEM COST REDUCTIONS

USING 122 BCM RENEWABLE GAS CAN RESULT IN €138 BILLION IN NET SAVINGS ANNUALLY BY 2050

2

COST SAVINGS

Summary of annual costs and cost difference by 2050 between the “no gas” and “with gas” scenarios (rounded) and resulting total annual societal cost savings achieved by using renewable gas in existing EU gas infrastructure.

Costs for:	Sector	No Gas (€ billion)	With Gas (€ billion)	Difference (€ billion)
Heating Technologies	Building	210	173	37
Insulation	Building	180	159	21
Energy Production for Heating	Building	61	67	-6
Gas Infrastructure Cost	Infrastructure	20	24	-4
Electricity Distribution Infrastructure	Infrastructure	31	30	1
Electricity Transmission Infrastructure	Infrastructure	70	65	5
Heat Infrastructure Cost for Heating	Infrastructure	37	37	0
Electricity Production	Energy	386	302	84
Total		995	857	138

Source: Ecofys

GAS FOR CLIMATE ACTION PLAN: ACHIEVING THE 2050 VISION REQUIRES ACTION STARTING TODAY

Gas for Climate presented its Action Plan to boost renewable gas to EU Commissioner for Climate & Energy Miguel Arias Cañete (*Brussels, Sept 2018*)



Gas for Climate: how to scale up renewable gas in Europe

The Paris Agreement goal to limit global temperature increase to well below two degrees requires deep decarbonisation. This can only be achieved through long-term energy system planning starting today and shared determination of all involved in the energy system. Gas for Climate is committed to achieve a net zero emissions EU energy system by 2050 and is convinced that this can be achieved by a smart combination of renewable electricity and renewable gas.

Gas for Climate is a group of seven leading European gas transport companies (Enbridge, Fluxys, Gasunie, GRTgaz, Open Grid Europe, Snam and Terna) and two biomethane industry associations, European Biogas Association and Consorzio Italiano Biogas. The group embraces deep decarbonisation by 2050 and highlights the valuable role that renewable and low carbon gas can play in this, alongside increasing quantities of renewable electricity.

In February 2018, Gas for Climate published a study by Ecofys, a Navigant company, that analysed the future role of renewable gas in the EU energy system. The Ecofys study showed that, using conservative assumptions, it is possible to scale up renewable gas production within the EU to 122 billion cubic metres (bcm) by 2050, utilising both hydrogen and biomethane. This renewable gas can be transported, stored and distributed in existing gas infrastructure and the synergies offered by renewable electricity and renewable gas allow the EU to achieve a net zero carbon energy system by 2050, while saving €138 billion annually compared to a scenario without any gas.

To achieve a net zero carbon EU energy system by 2050 is a cost-effective way we believe that renewable gas production within the EU needs to scale up. This requires action by many different stakeholders, starting today. Gas for Climate members, both biomethane producers and Transmission System Operators (TSOs), are committed to support decarbonisation by facilitating a scale up of production and ensuring the infrastructure to store and transport renewable gas is ready. Gas for Climate also sees the need for an improvement of renewable gas business cases

“ We are committed to achieve net zero greenhouse gas emissions in the EU by 2050 to meet the Paris Agreement target. Renewable gas used in existing gas infrastructure can play an important role in this. The CEOs of Gas for Climate members ”

Thierry Trouvé, CEO of GRTgaz, on behalf of the Gas for Climate consortium:

“This Action Plan demonstrates our unequivocal commitment to the energy transition and decarbonisation of the European gas grid. It provides recommendations on how to increase the production of renewable gases and facilitate their trade and transport. It also presents our plans to 2030 with real projects that are driving the energy transition today in preparation of the carbon neutral energy system of tomorrow.”

GAS FOR CLIMATE MEMBERS COMMITMENTS FOR 2030

As included in the Action Plan



Source: Ecofys

GAS FOR CLIMATE ACTION PLAN: A 'TO DO LIST'

The Action Plan puts forward a 'to do list' for businesses and policy makers, e.g.:

1. Recommending an ambitious EU target (at least 10%) for renewable gas in final consumption by 2030, broken down in Member State specific targets.
2. Producing costs must be reduced, requiring action from companies. Also, support schemes should be tailored towards fostering reductions of biomethane and green hydrogen (electrolyzer) production costs. This is justified based on the net-value dispatchable renewable energy brings to the energy system.
3. Cross-border trade of biomethane and green hydrogen should be facilitated.

[For more information please read the Gas for Climate Action Plan](#)



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