MaREI
Centre for Marine and Renewable Energy

Greening the Gas Grid

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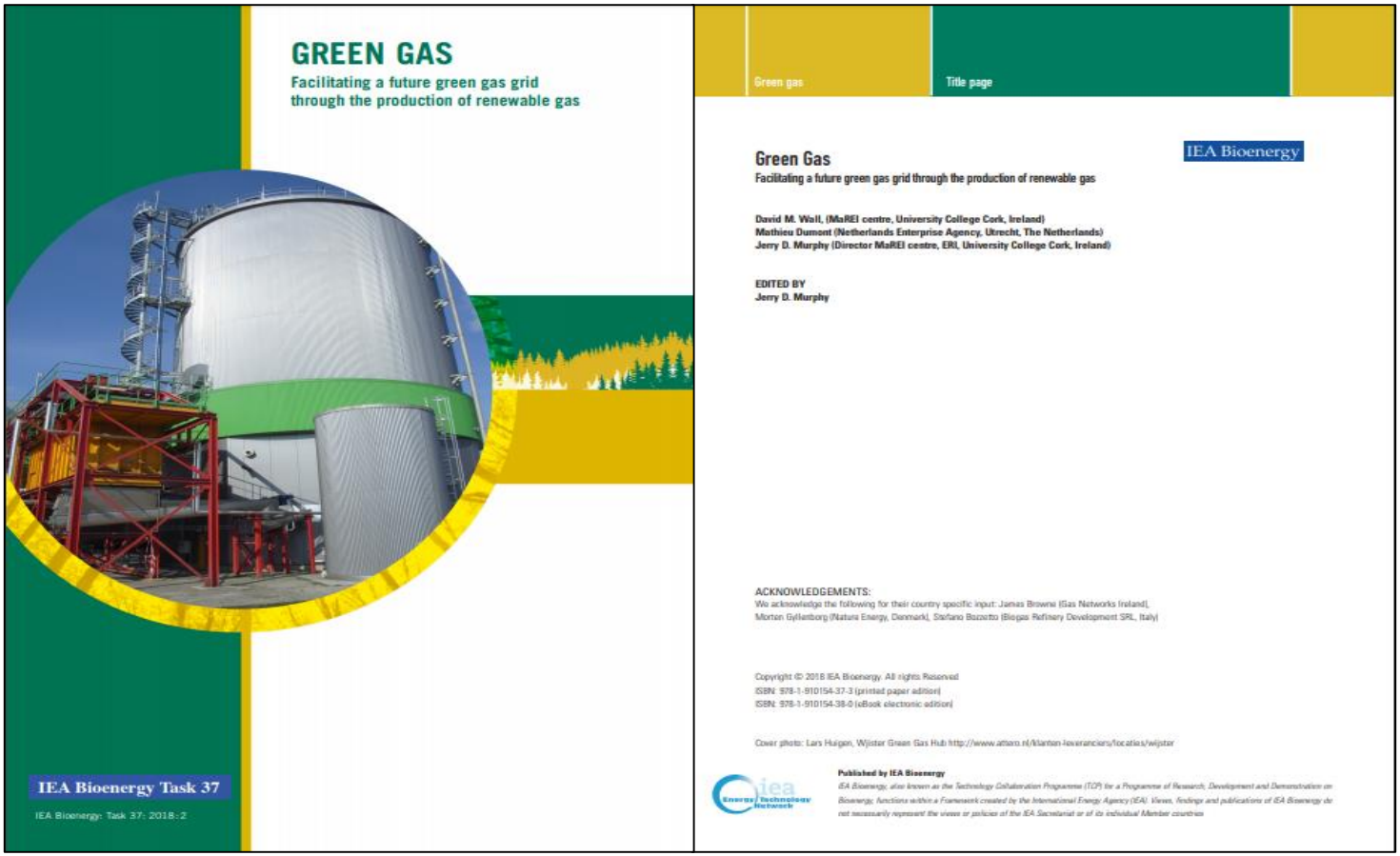
Science Foundation Ireland sfi For what's next

IEA Bioenergy Task 37 report



GREEN GAS

Facilitating a future green gas grid through the production of renewable gas

IEA Bioenergy Task 37

IEA Bioenergy: Task 37: 2018:-2

Green gas | Title page

IEA Bioenergy

Green Gas

Facilitating a future green gas grid through the production of renewable gas

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"Facilitating a future green gas grid through the production of renewable gas"

- Biomethane present and future
- Country roadmaps and technology deployment
- Cascading Bioenergy
- The biomethane economy

Biomethane present and future

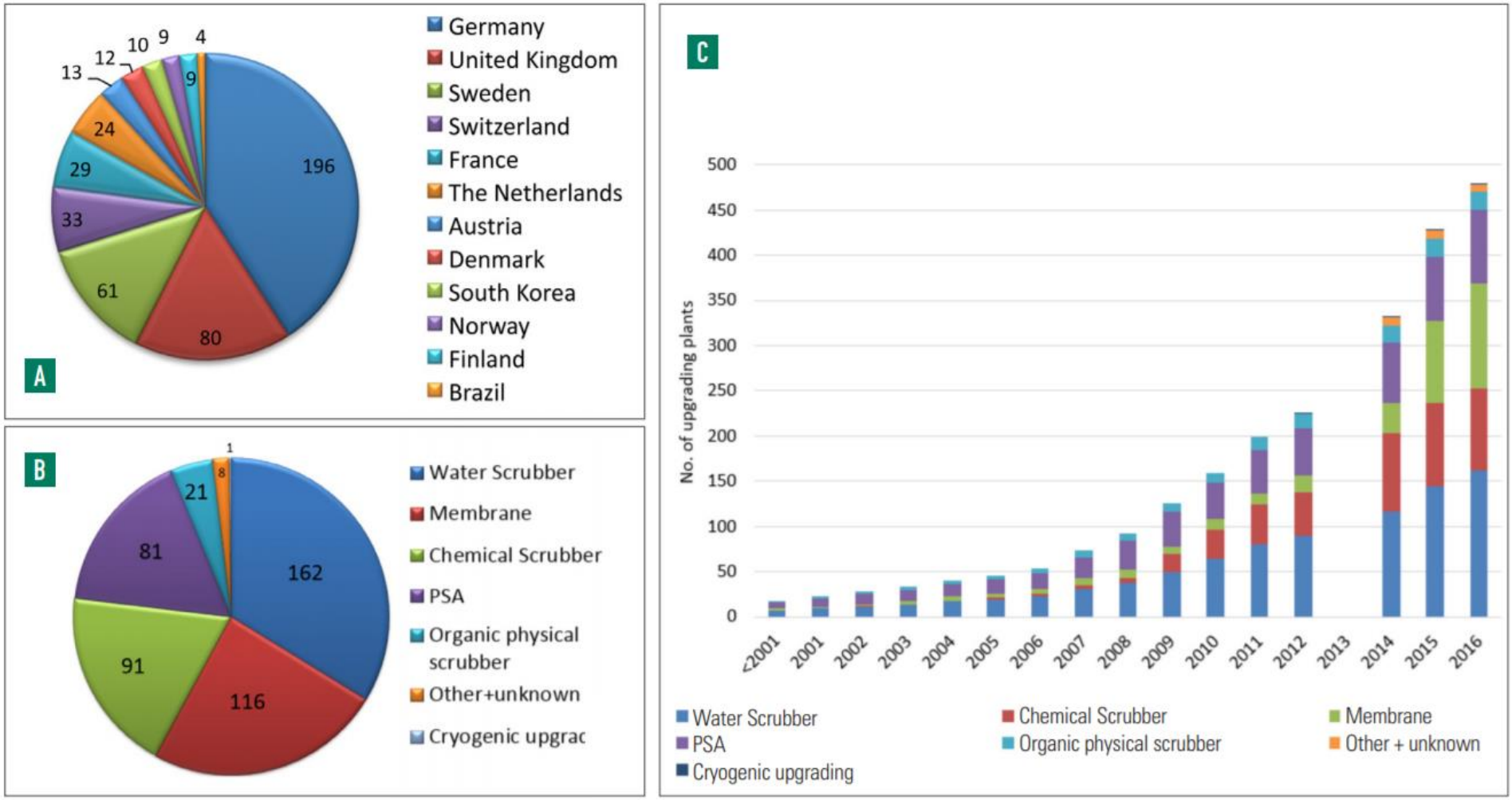

Figure 2.4 A: Number of biogas upgrading plants per country; B: Breakdown of biogas upgrading technologies used at biomethane plants; C: Biogas upgrading technologies uptake over time (IEA Task 37 Energy from Biogas, 2016)

Biomethane present and future

- In 2015, there were 459 biogas-upgrading plants in operation producing 1,230 M Nm^3 of biomethane

- Sweden, the UK, Switzerland, France and the Netherlands have all increased their biomethane production significantly in the last five years.

- Injection of biomethane to gas networks will be the primary focus of this developing industry

- Future renewable gas technologies such as gasification-methanation and power to gas systems have been identified as methods that could contribute substantially to greening natural gas grids of the future.

EU advanced biofuels

"Share in renewable and low-carbon transport fuels (excluding first generation biofuels and including for electrification) is required to increase from 1.5% in 2021 to 6.8% in 2030, with advanced biofuels to make up at least 3.6% by that time"

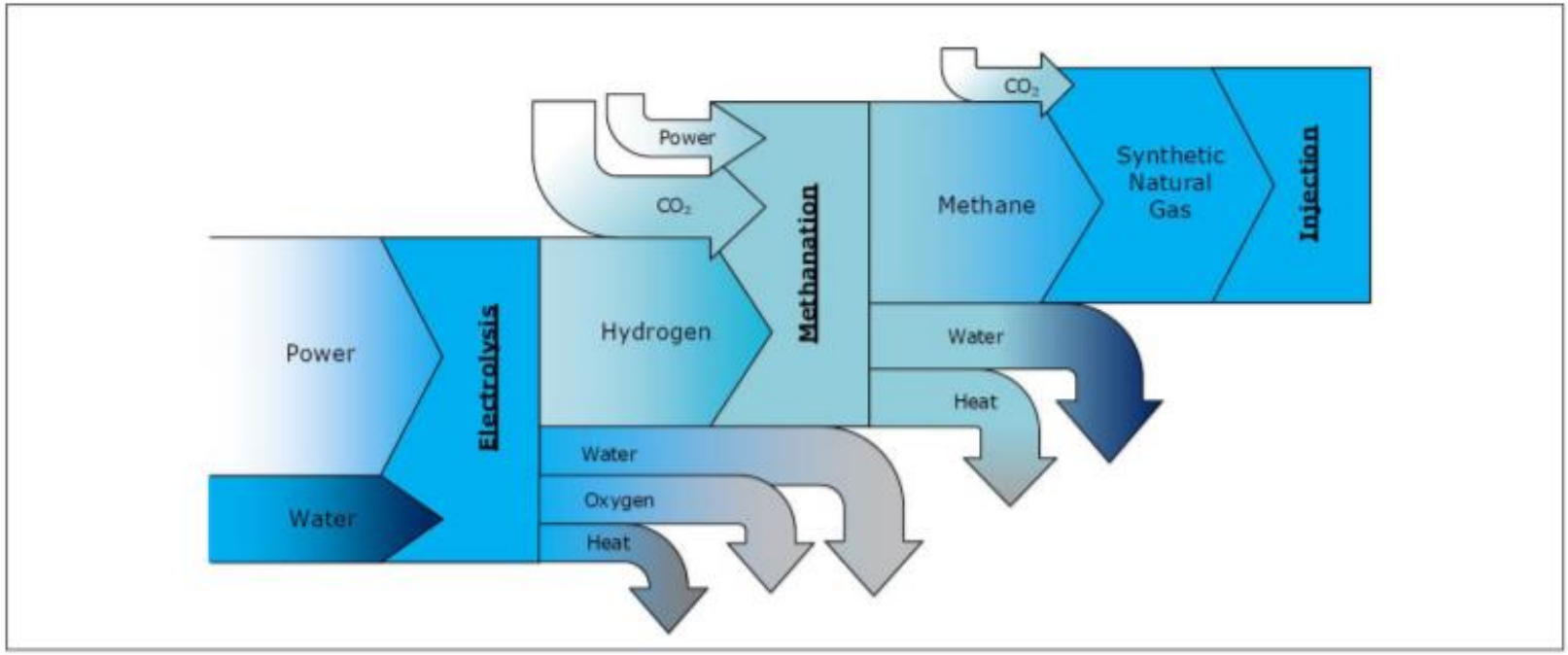

Figure 5.3 Product flows in the Power-to-Gas concept (source: DNV GL)

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Country case study: Ireland

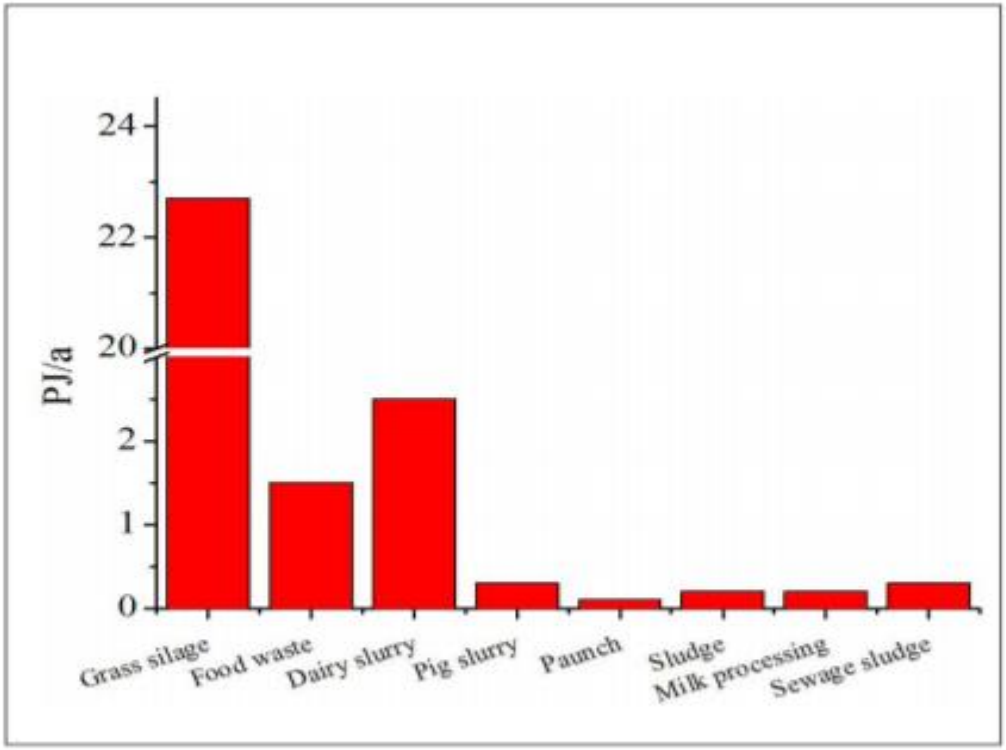

Figure 6.2 Irelands practical biomethane resource from identified feedstocks (O'Shea et al., 2016a; O'Shea et al., 2016b),

The The total practical resource…

Future production of green gas may account for 41PJ (26% of current national gas demand)

Country case study: Netherlands

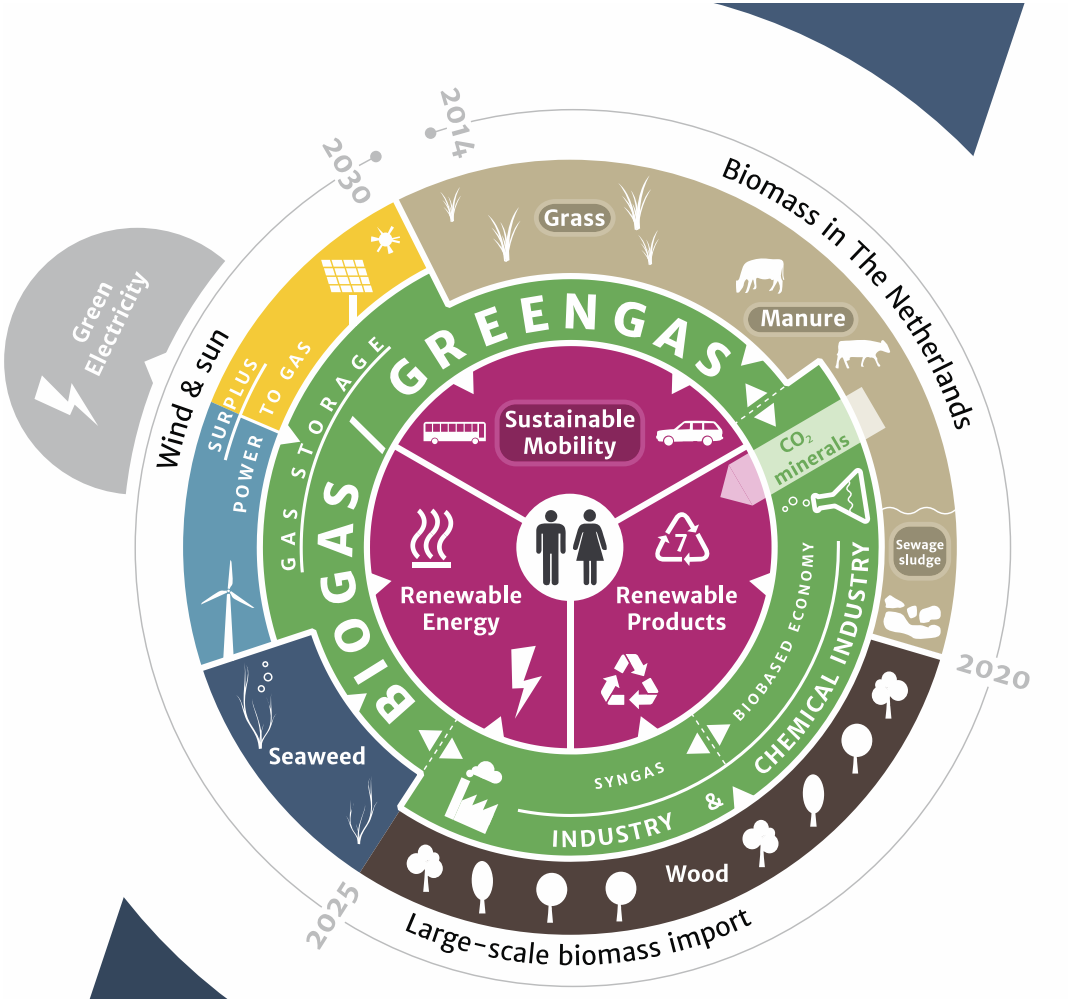

Figure 6.3 Biogas resource potential in the Netherlands (Green Gas Forum, 2014) (Groen Gas Nederland (GGNL))

Future production of green gas may account for 77PJ (24% of current national gas demand)

Country case study: UK

- Strong interest in hydrogen and developing a supply chain
- Produced through steam reforming of methane with carbon capture
- Cluster projects include for Leeds (100% hydrogen) and Liverpool-Manchester (hydrogen-methane blend)

Future production of green gas may account for 280PJ (8% of current national gas demand)

Country case study: Italy

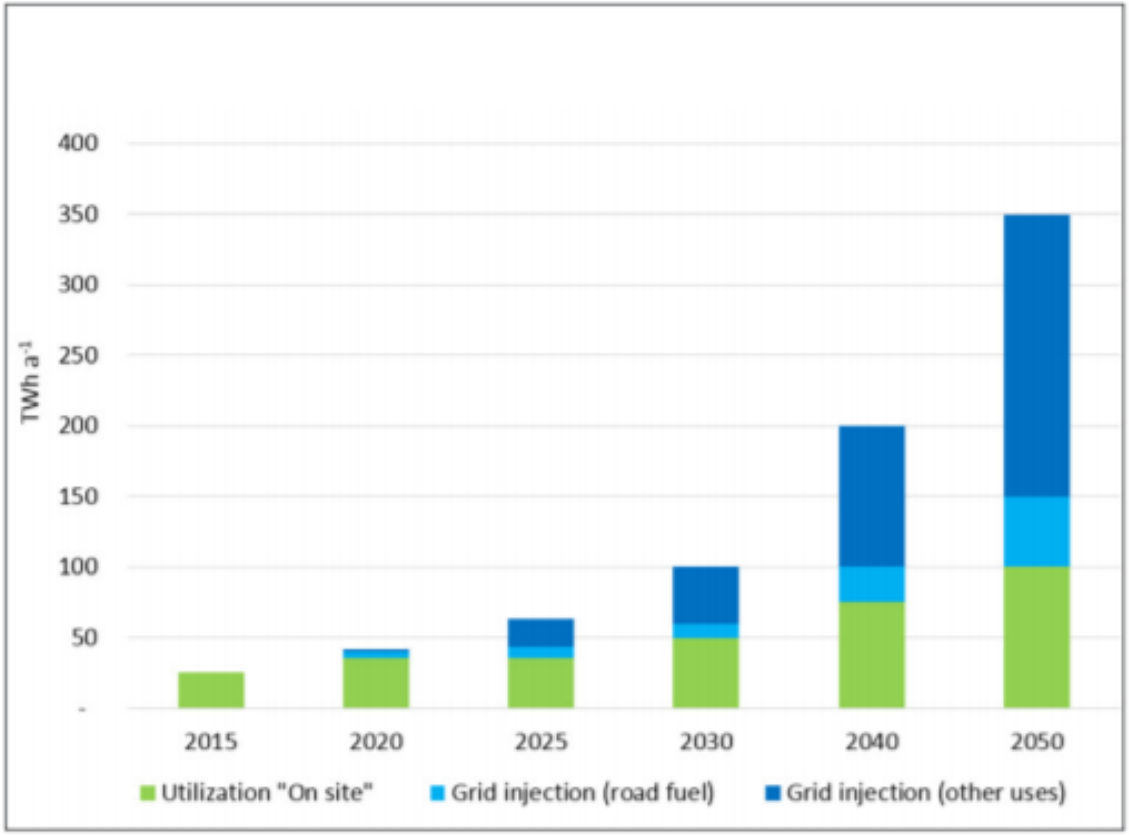

Figure 6.7 Potential future renewable gas production in Italy (Bozzetto et al., 2017)

Future production of green gas may account for 1260PJ (44% of current national gas demand)

Country case study: Denmark

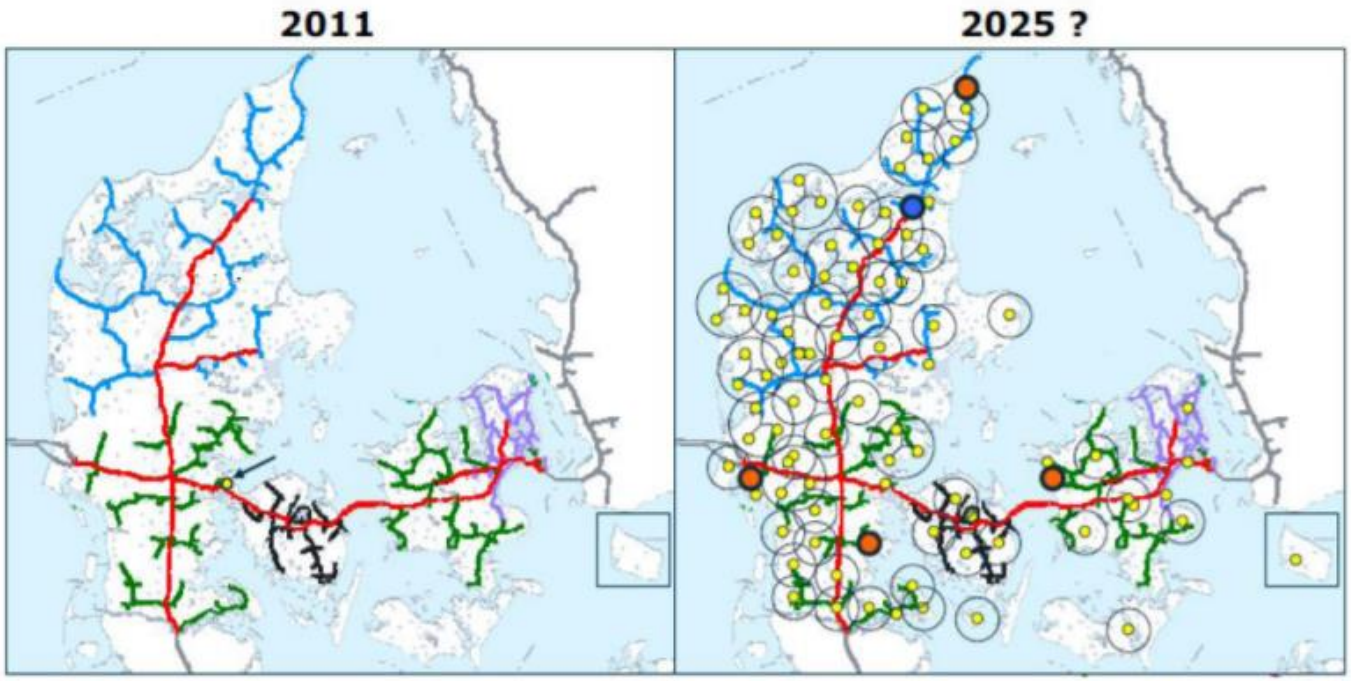

Figure 6.9 The gas grid and the future use of the gas grid with biogas plants (yellow dots) connected to the gas grid in Denmark. (Source: Jakob Lorenzen; Dansk Fagcenter for Biogas)

.8 Historical and future
production and its use in
k 2012-2020.
Jakob Lorenzen; Dansk
er for Biogas; Danish Energy

Future production of green gas may account for 100PJ (75% of current national gas demand)

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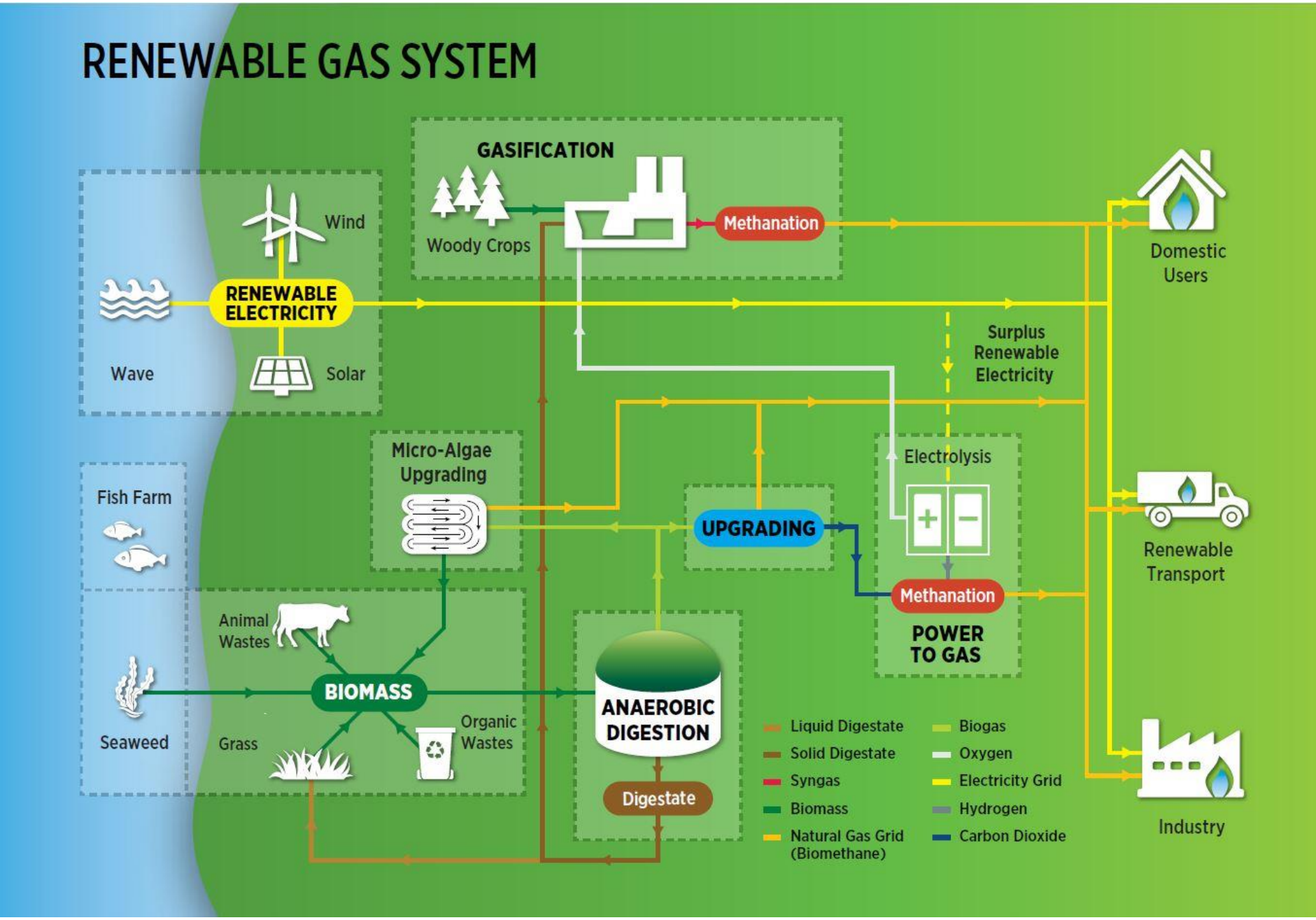
RENEWABLE GAS SYSTEM
GASIFICATION
Woody Crops
Methanation
Wind
Wave
Solar
RENEWABLE ELECTRICITY
Domestic Users
Surplus Renewable Electricity
Micro-Algae Upgrading
Fish Farm
UPGRADING
Electrolysis
Renewable Transport
Methanation
POWER TO GAS
Animal Wastes
BIOMASS
Seaweed
Grass
Organic Wastes
ANAEROBIC DIGESTION
Digestate
Industry
Liquid Digestate
Solid Digestate
Syngas
Biomass
Natural Gas Grid (Biomethane)
Biogas
Oxygen
Electricity Grid
Hydrogen
Carbon Dioxide

Cascading bioenergy

- Biomethane is a flexible energy vector for both the thermal and transport sectors

- Advanced biofuels can provide improved sustainability through carbon capture for future energy systems

- Integration of biomethane technologies such as anaerobic digestion, gasification, and power to gas, along with feedstocks such as macro-algae and micro-algae can facilitate future green gas industry

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The biomethane economy

Potential is there…

Greening the gas grid: Challenges and solutions?

Conclusions

"Facilitating a future green gas grid through the production of renewable gas"

- Gaseous fuels have a significant role to play in future energy markets in industry (breweries, distilleries), in heating (buildings connected to the gas grid) and in transport in natural gas vehicles (NGVs).

- Biomethane, due to its flexibility as an energy carrier, can be considered the future of renewable gas.

- Gasification-methanation and power to gas systems can be deployed at a much larger scale and potentially expand the production of renewable gas.

- Cascading bioenergy systems whereby CO_2 is captured and reused may lead to increased decarbonisation and circular economy approach.

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