

# Biogas - fueling the future

Biogas production and use in Norway - benefits and potential



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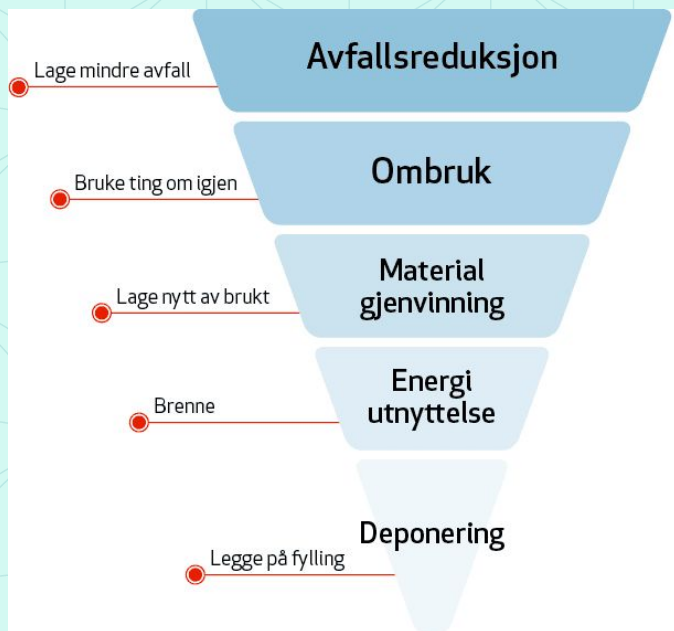
Jens Måge, Technical Advisor Avfall Norge,  
Avfallsforum Rogaland  
March 10, 2022



# Avfall Norge and the Norwegian waste & recycling sector

Avfall  
Norge

Weekly newsletter: [www.avfallnorge.no](http://www.avfallnorge.no)



**Climate change**

**Social inequalities  
/ migration**



**12. April 2021**

**Biodiversity**

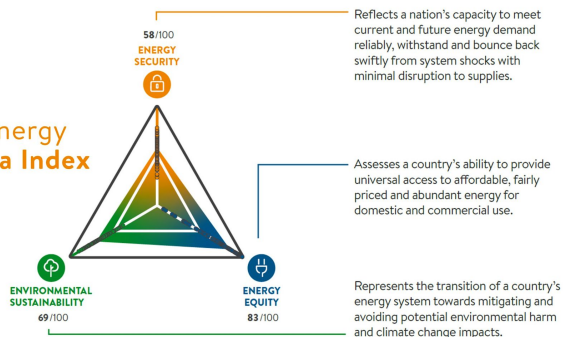
**Resources /  
over consumption**

# Energy security:

## Norway 44th place in the world

### We need all energy we can produce!

#### World Energy Trilemma Index



## Food security:

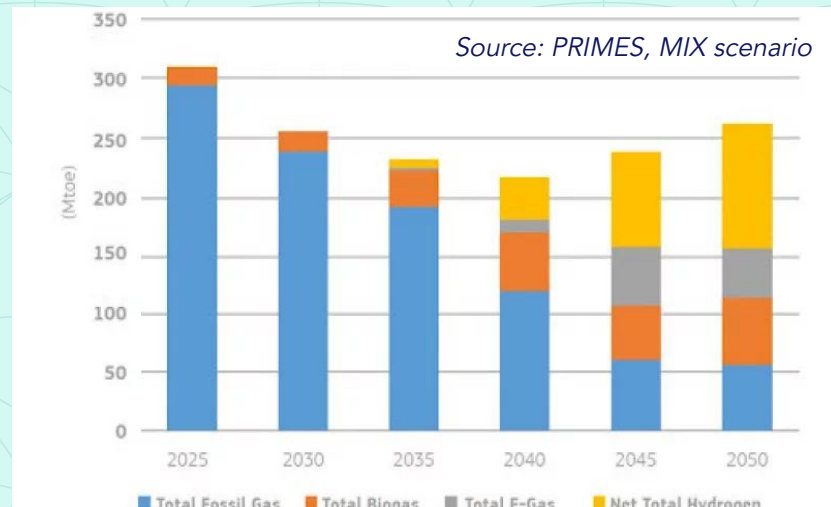
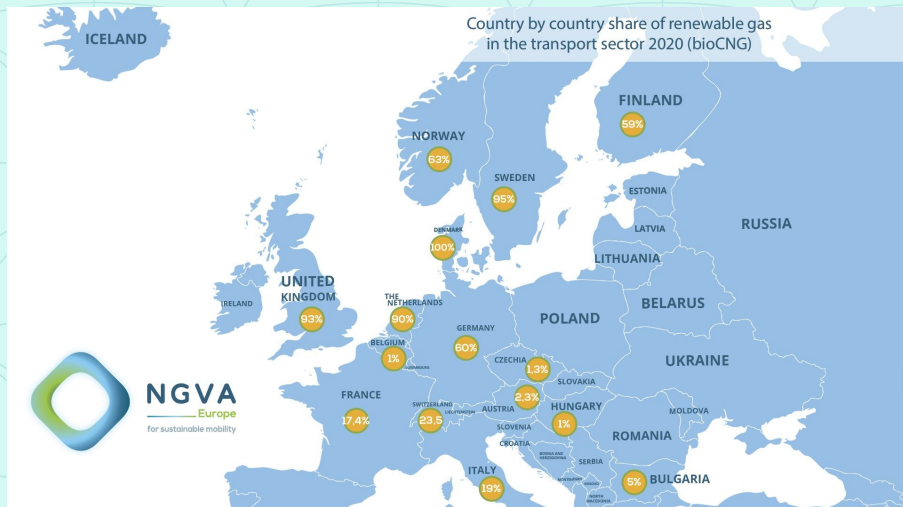
**100% of phosphorus for fossil fertiliser  
is imported from unstable regimes  
(Morocco, Russia and China)**

March 2022: EU bans all imports of potassium potash or potassium chloride from Belarus. One of the three main chemical nutrients used in commercial fertilisers, the other being phosphate and nitrogen.





# EU policy: Decarbonise gas markets



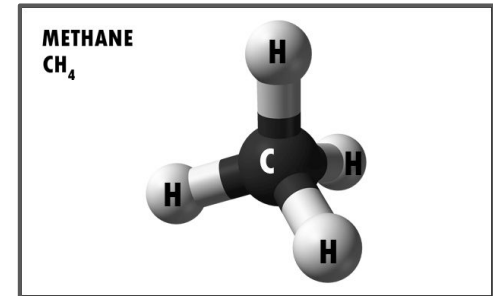
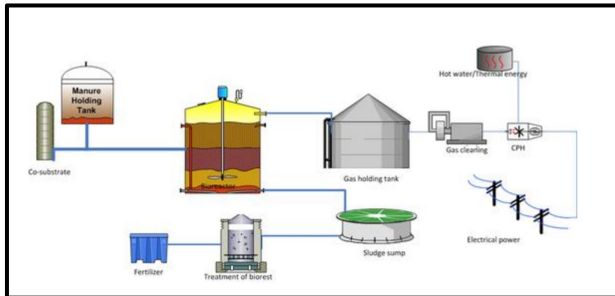
# About biogas

# Production of biogas

As long as we have agriculture, aquaculture, forestry, food waste, and go to the bathroom, nature will produce biogas ON ITS OWN!



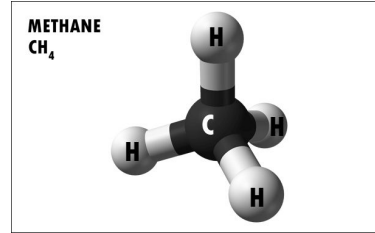
## BIOGAS (60% CH<sub>4</sub>, 40% CO<sub>2</sub>) and BIO-FERTILISER





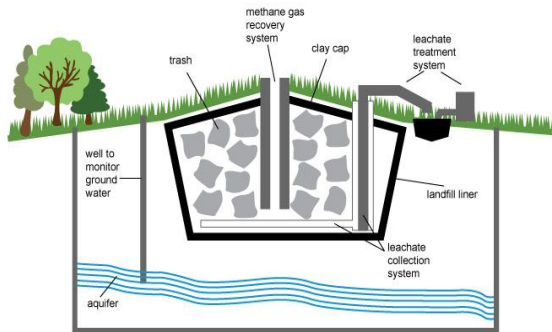
# The methane molecule CH<sub>4</sub>

- Natural and universal
- Versatile - converts to “everything”
- **Potent as a climate gas (86X CO<sub>2</sub> in the short term)**
- Different origins

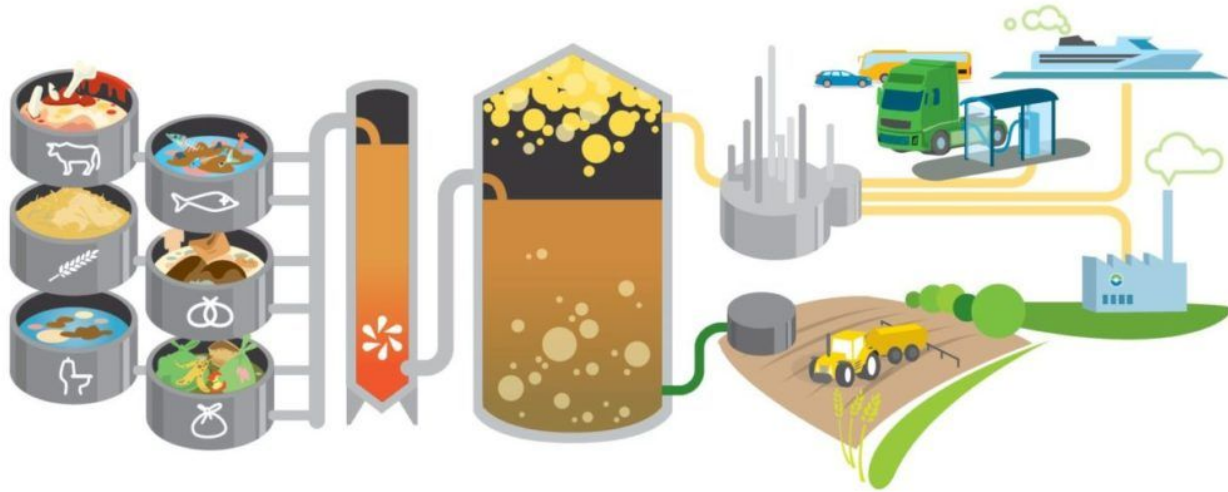


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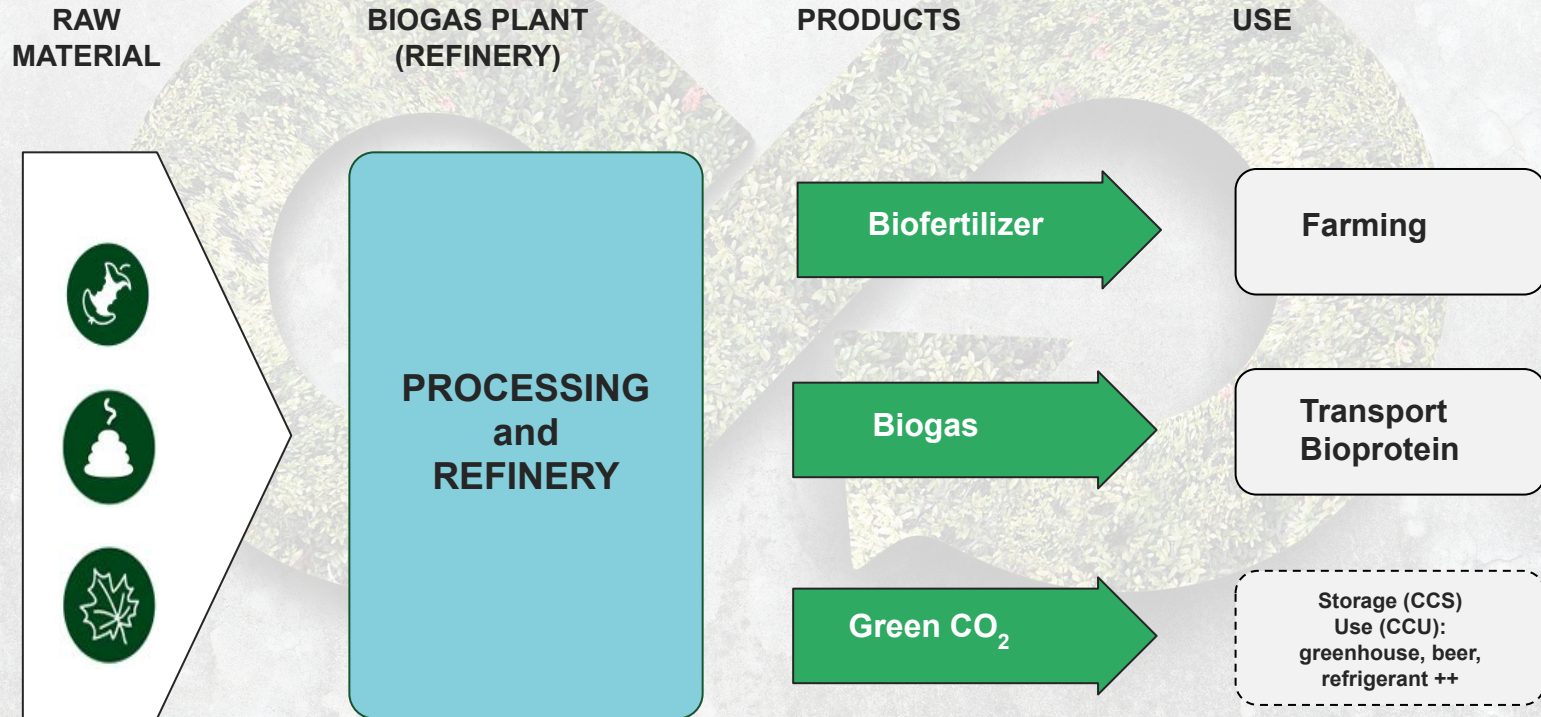
Modern landfill



Source: Adapted from National Energy Education Development Project (public domain)



# Many value chains can provide several products



# In summary: Why is biogas so important?

- Turn waste from a problem into as a resource
- Circular bioeconomy - recycling targets (60% 2030)
- Reduce climate emissions
- Part of a holistic sustainable energy system
- Food supply security - more sustainable farming
- Biogas digestate, compost and biochar saves organics in soils (carbon farming)
- Sustainable jobs and “green value creation”

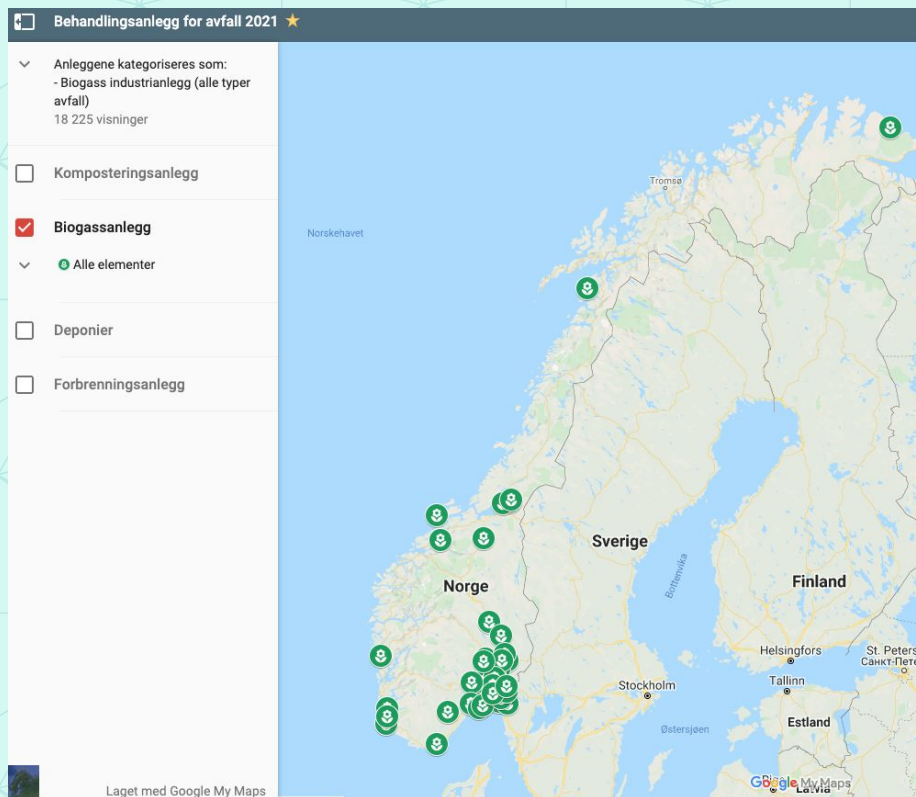


# Market development

## A - Production



# Biogas plants in Norway 2022



[Map](https://www.avfallnorge.no) over treatment plants and  
landfills in Norway at  
[www.avfallnorge.no](https://www.avfallnorge.no)

41 plants registered

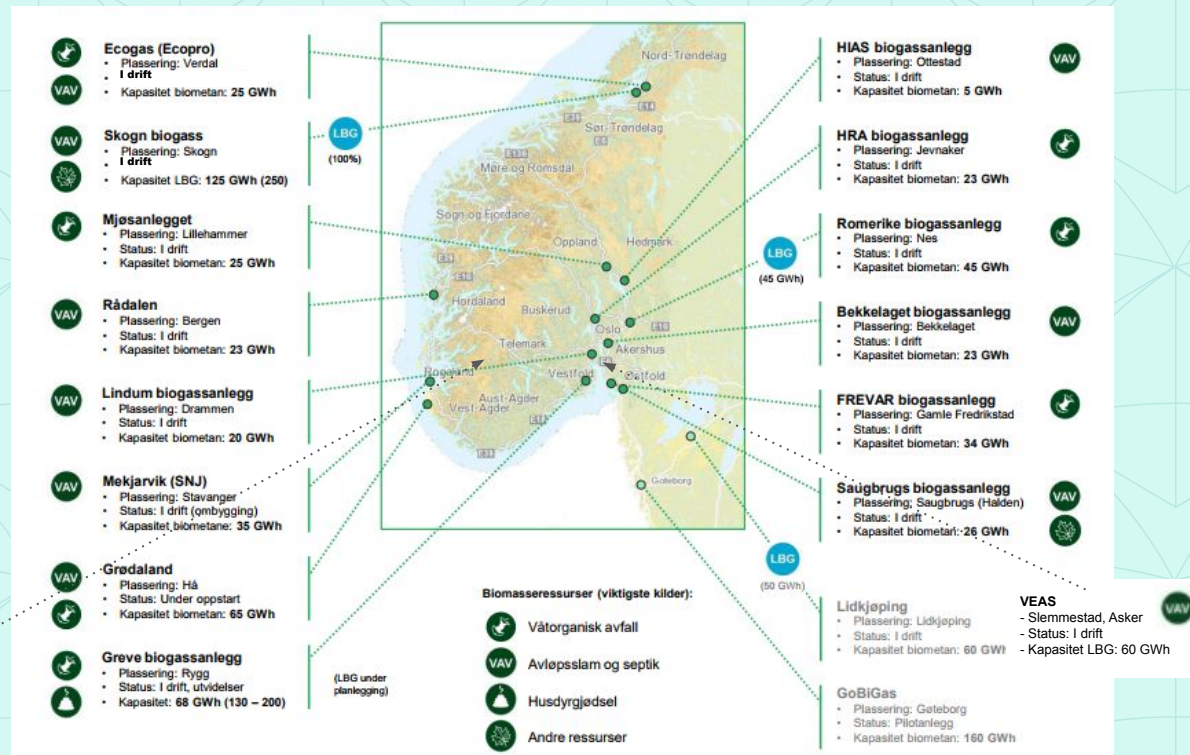
2021: Total 700 GWh production



# Production of biogas for transportation

- 12 CBG / 4 LBG plants \*
- 7 (8) food waste + manure
- 7 (8) wastewater sludge and other industrial waste
- Capacity before expansion: 652 GWh
- Production 2021:
  - CBG 157 GWh
  - LBG 125 GWh
  - Sum 282 GWh

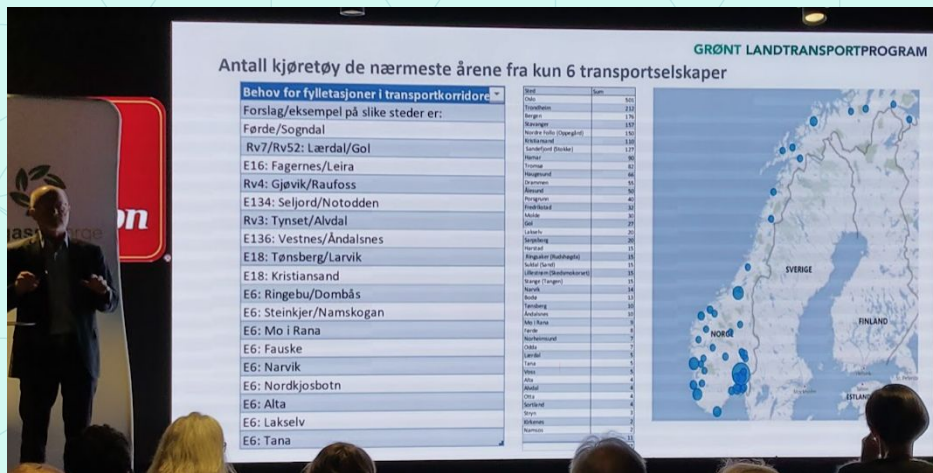
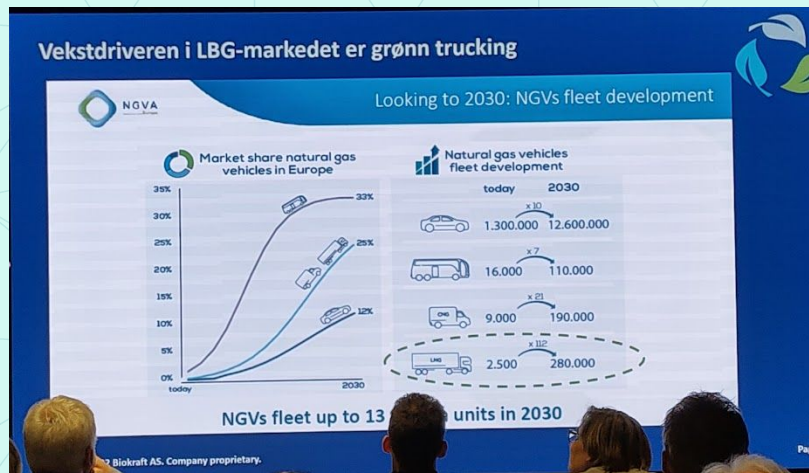
\* Incl 50 GWh from Renevo, Stord, from 2022/23..



# Market development

## B - Demand and use

# Still bus and renovation (70-80%), but expected strong growth in other transportation + industry and maritime















# Long and regional transportation

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# Development for long-distance transport

	2018	Viktigste barrierer	2030	Forutsetninger
<b>HVO</b>		<ul style="list-style-type: none"> <li>Økende kostnad?</li> <li>Begrenset tilgang på bensinstasjoner</li> </ul>		<ul style="list-style-type: none"> <li>Bærekraftig tilgang blir mer utfordrende ved økt volum</li> <li>Bruk til tungtransport prioriteres</li> </ul>
<b>Biodrivstoff fra trevirke</b>		<ul style="list-style-type: none"> <li>Umoden produksjonsteknologi</li> <li>Høy kostnad</li> </ul>		<ul style="list-style-type: none"> <li>Usikker tilgang</li> <li>Høy kostnad</li> </ul>
<b>Biogass</b>		<ul style="list-style-type: none"> <li>Infrastruktur og tilgang på biogass på transportruten</li> <li>Tilgang på transportmidler</li> </ul>		<ul style="list-style-type: none"> <li>Krever LBG og tankanlegg underveis</li> <li>Flere modeller på LBG</li> </ul>
<b>LNG</b>		<ul style="list-style-type: none"> <li>Infrastruktur langs transportruten</li> <li>Tilgang på transportmidler</li> </ul>		<ul style="list-style-type: none"> <li>Økt fokus internasjonalt på skip</li> <li>Flere modeller på LNG</li> <li>Infrastruktur i transportkorridorer</li> </ul>
<b>Batteri-elektrisk</b>		<ul style="list-style-type: none"> <li>Rekkevidde</li> <li>Kostnad</li> <li>Infrastruktur og høy effekt</li> </ul>		<ul style="list-style-type: none"> <li>Redusert kostnad, økt energitetthet og energieffektivisering</li> <li>Infrastruktur i transportkorridorer</li> </ul>
<b>Hydrogen</b>		<ul style="list-style-type: none"> <li>Umoden teknologi, høye kostnader</li> <li>Skala for å redusere kostnad</li> </ul>		<ul style="list-style-type: none"> <li>Teknologiutvikling</li> <li>Økt skala</li> <li>Antall kjøretøy i produksjon</li> </ul>



# Industry initiatives

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# NHOs Grønt landtransportprogram (GLP)

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# What to expect?

**2030:** 10% of all new trucks = 1.450 trucks - 300 GWh (Klimakur 2030, Mdir 2020)

or...

**2025:** 2.000 new heavy duty vehicles (GLP market inquiry among 6 large transporters, 2021) - 400 GWh

## GRØNT LANDTRANSPORT-PROGRAM

**Goal:** 4.000 vehicles in total in 2025 (indicates a mature market)



Erling Sæther fra Grønt landtransportprogram holdt innlegg under Biogasskonferansen 2022. Foto: Ole Peder Glæver/Biogassbransjen.no.

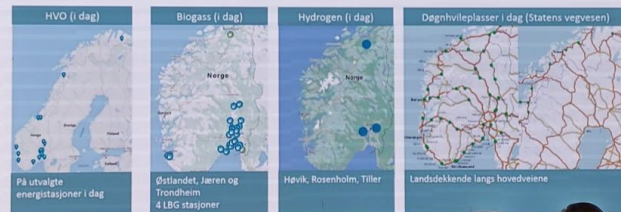
Biogasskonferansen 2022:

**– Må sikte mot 4000 gasslastebiler før 2025**

Målet for Ahlsell og Grønt landtransportprograms foreringsprosjekt er å bygge et modent marked for biogass til transport i Norge.

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Dagens infrastruktur for lastebiler er lite utbredt, døgnhvileplasser kan være et naturlig sted å vurdere oppbygging av infrastruktur



Antall kjøretøy de nærmeste årene fra kun 6 transportselskaper

Behov for fyllestasjoner i transportkorridorene

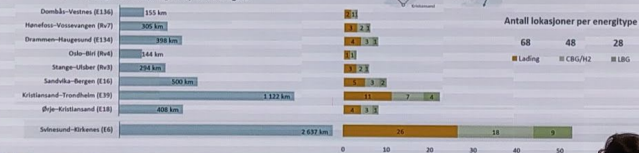
Forslag/eksempel på slike steder er:

Rv7/Rv52: Lerdal/Gol  
E16: Gjøvik/Leira  
Rv4: Gjøvik/Raufoss  
E134: Seljord/Notodden  
Rv3: Tynset/Alvdal  
E136: Vestnes/Åndalsnes  
E18: Tønsberg/Larvik  
E18: Kristiansand  
E6: Ringe/Dombås  
E6: Steinkjer/Namskogan  
E6: Mo i Rana  
E6: Fauske  
E6: Narvik  
E6: Nordkjøbotn  
E6: Alta  
E6: Lakselv  
E6: Tana



Et eksempel på hvor mange lade- og fyllestasjoner som trengs for å dekke behovet i hele landet  
I en andre utbyggingsfase mot 2030

- I neste fase utvider vi med Nord-Norge og flere veier i Sør-Norge
- Dette gir flere km vei
- ...og flere stasjoner for start/stopp:
  - Oslo, Trondheim, Stavanger og Bergen som på forrige slide
  - Tromsø, Narvik, Kirkenes og Alta i tillegg
- Totalt:
  - 60 + 8 lokasjoner for lading
  - 40 + 8 lokasjoner for fylling av gass (hydrogen og/eller biogass), og
  - 20 + 8 lokasjoner for fylling av flytende biogass

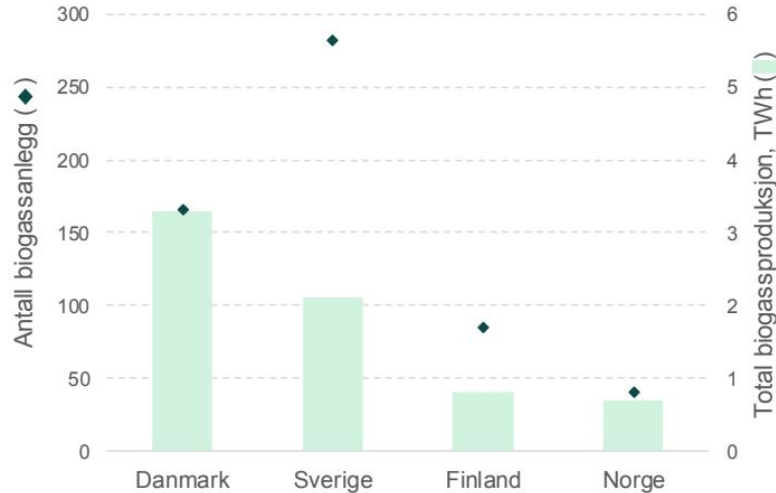


Merk at dette kun er et eksempel. En utvikling i Nord-Norge kan komme tidligere enn 2030 dersom det f.eks. opprettes hubber (m. annen transport/produksjon) langs veiene.

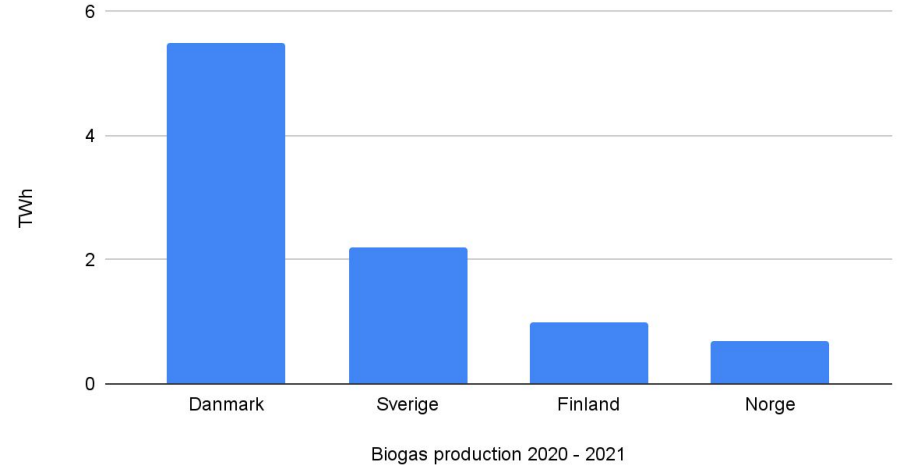
THEMA Consulting

# Energy potential

# Production in 2017 vs 2021 Nordic countries



Biogas production 2020 - 2021 Nordic countries



**Denmark: 70% growth!**



# Potential Norway: 2,5 - 33 TWh

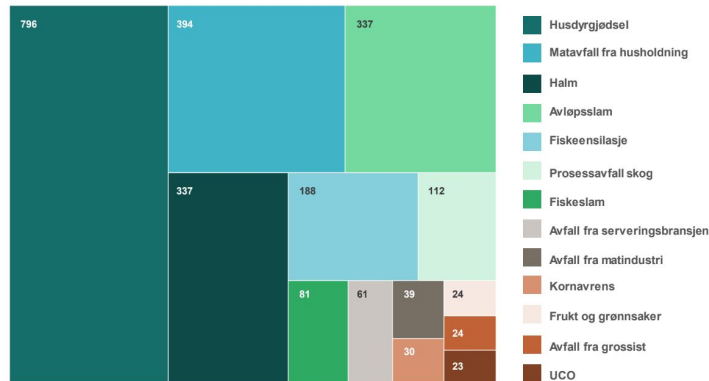
Many potential studies - different assumptions:

- Enova / Østfoldforskning 2008: 6 TWh
- The industry 2016: 10 - 12 TWh \*
- NVE 2017: 5 - 33 TWh \*\*\*
- Miljødirektoratet 2019: 2,5 TWh \*\*

\* provided better framework conditions

\*\* business as usual

\*\*\* incl macro algae



Carbon Limits / Miljødirektoratet 2019

SYSLA GRØNN

USD: 7.96  
EUR: 9.33



Busser i Bergen sentrum. Foto: Rune Sævig

**Biogass fra avfall og gjødsel kan dekke behovet til alle bussene i Norge**



Norges  
vassdrags- og  
energidirektorat

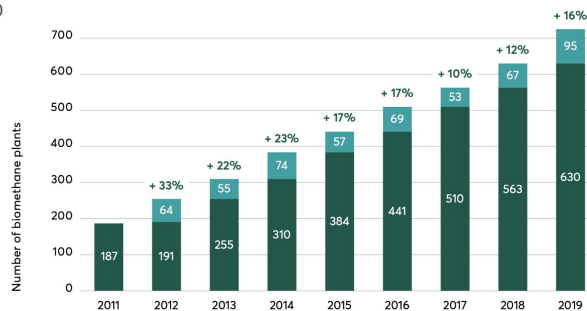
NVE 2017

# Large growth potential

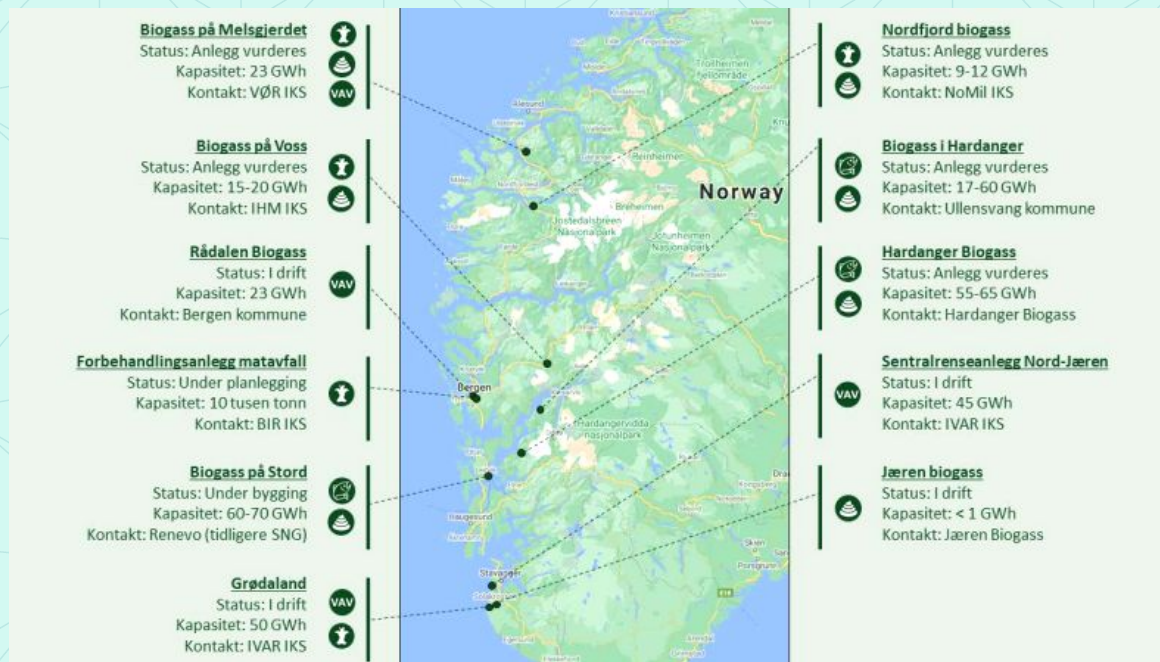
- Norway: 10 - 12 TWh, incl waste from forestry (pyrolysis), agri- and aquaculture
- Denmark: 30-40 TWh incl Power-2-X

## EBA Statistical Report 2020

Development of the number of biomethane plants in Europe, 2011-2019



# 19 new projects on the table in Norway

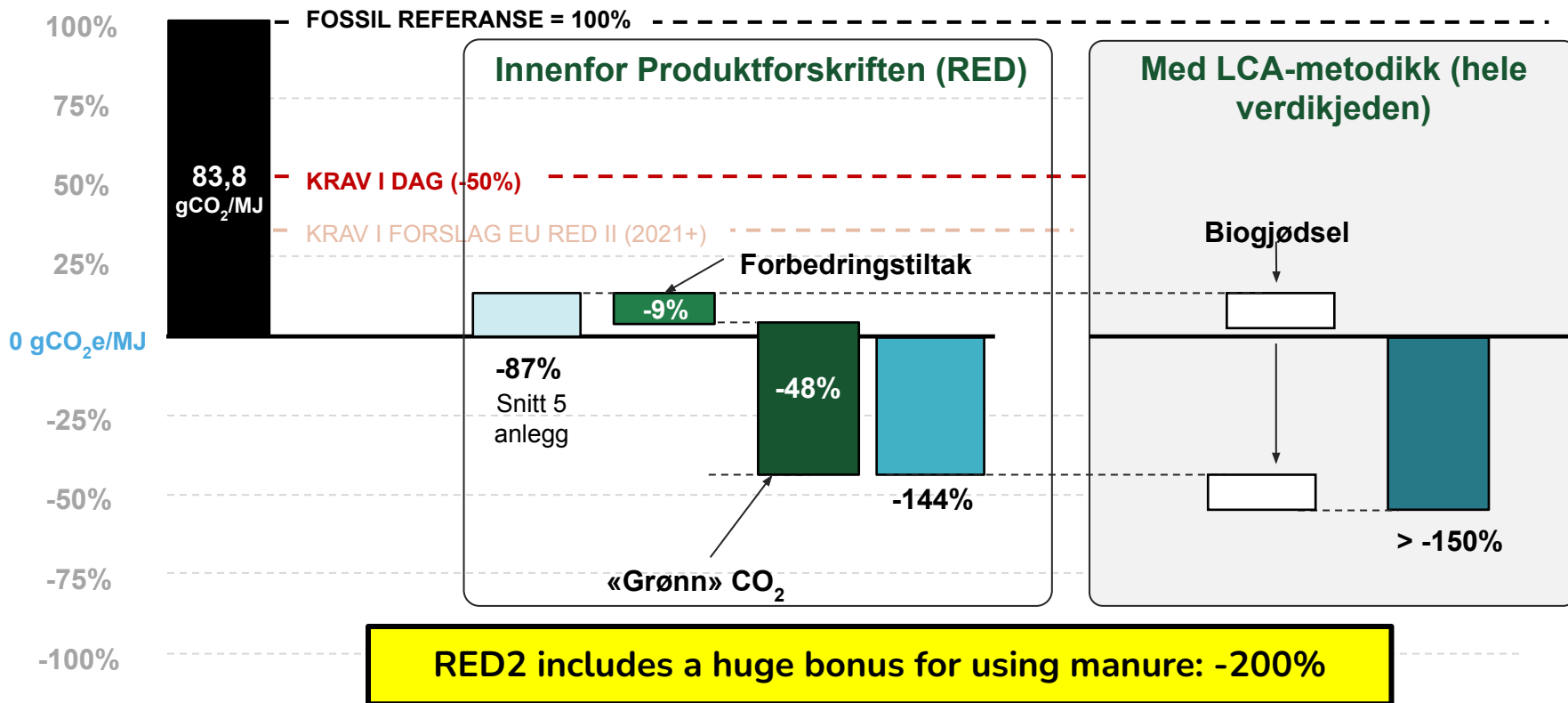


Map: Biogass Vestland, presented at Avfall Norges bioseminar 2020

# Climate potential



# Biogas can give large emission reductions - more than «zero emissions» (CCUS)





# Potential - incl CCUS (Carbon Capture Usage and Storage)

3,2 mill tons CO2 equivalents  
= 6,9 % of Norway's total  
(preliminary estimates)



Thank you for your attention! See you here?



# Bli med på studietur til Milano

Avfall  
Norge



## City of Milan – key numbers



**1.36 million**  
Inhabitants

**7,518**  
Inh./km<sup>2</sup>

**800,000**  
Commuters/day

**6,8 millions**  
Tourists in 2018 (ISTAT)



**695,313**  
T of Municipal  
Waste (2018)



**60%**  
Separate  
collection in  
2018



**55,000**  
waste collection  
points (door to  
door)



**1,330**  
vehicles for  
waste collection  
and cleaning  
service  
CNG: **33%**



**23,000**  
Bins in  
streets and  
parks



**5**  
civic amenity  
sites and **2**  
mobile Eco  
centers



**8**  
bring banks  
for WEEE



**13**  
T-recycle  
e-bikes