Emission reduction potential of biomethane in transport

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Fuels of the Future, January 21st, 2020

CE Delft

Committed to the Environment

CE Delft

- Independent research and consultancy since 1978
- Transport, energy and resources
- Know-how on economics, technology and policy issues
- 60 employees, based in Delft, the Netherlands
- Not-for-profit

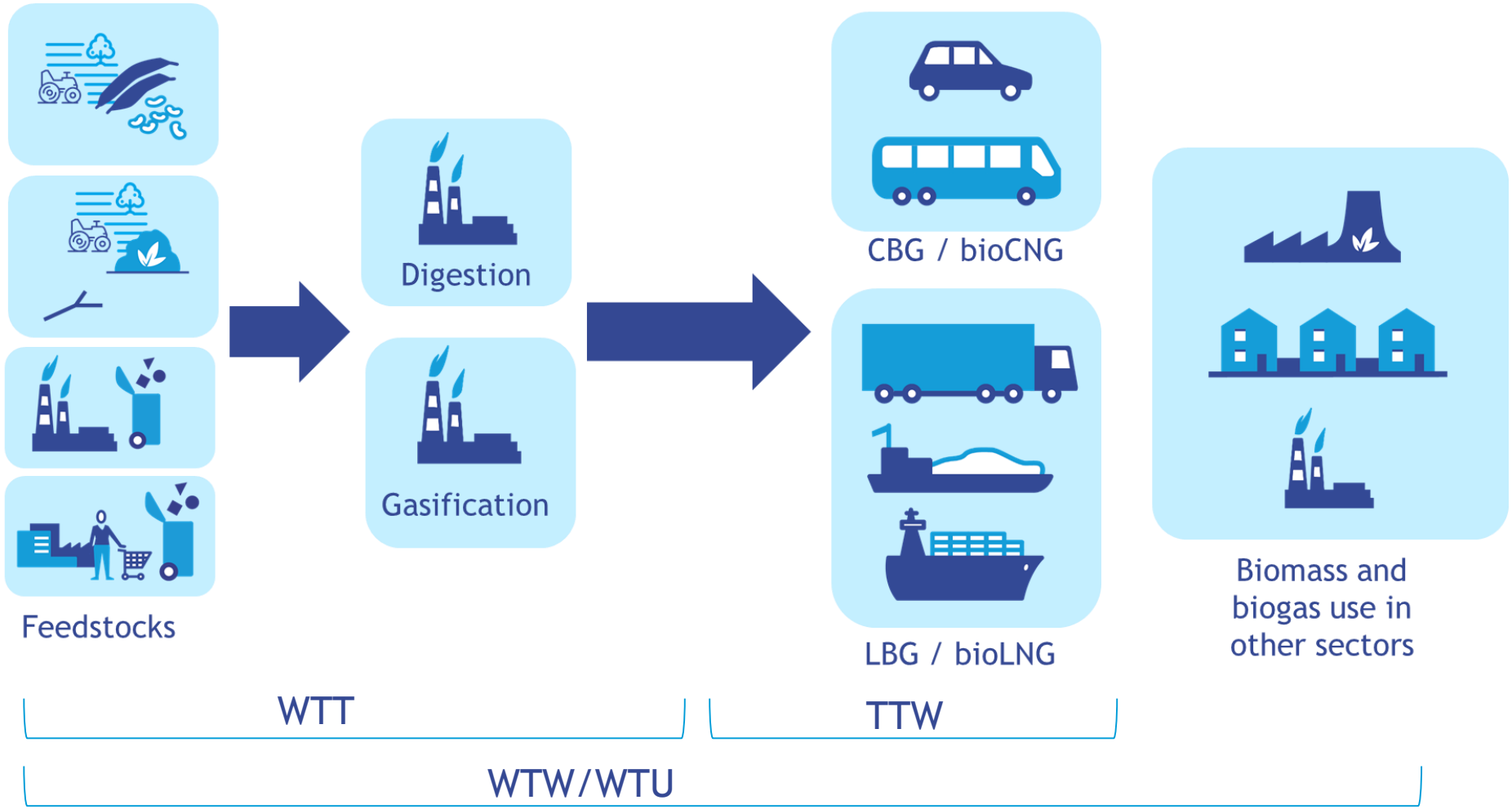
Clients

Industries
(Small and medium size enterprises, transport, energy and trade associations)

Governments
(European Commission, European Parliament, regional and local governments)

NGOs

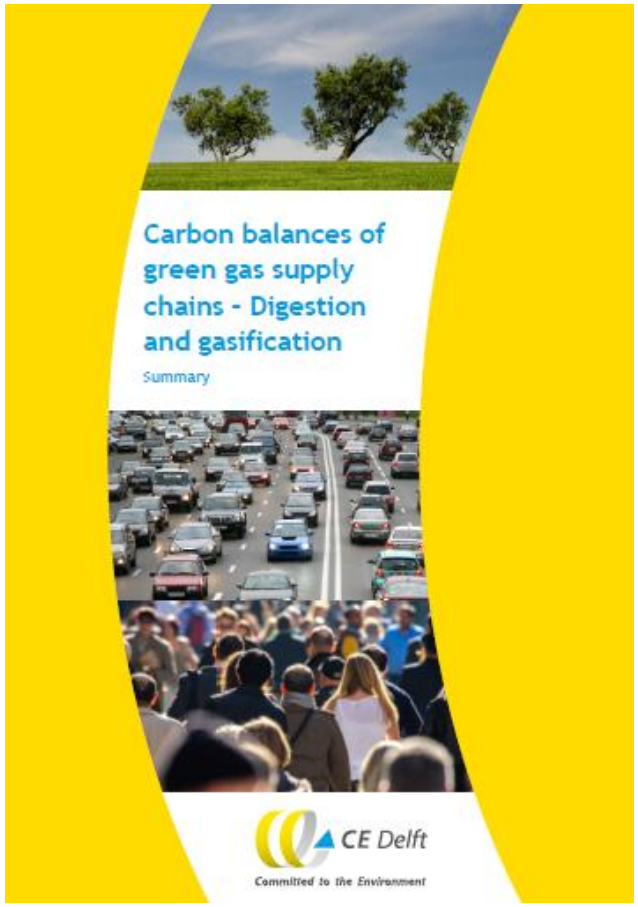
Schematic overview of supply chain



Overview of this presentation

- Well-to-tank (WTT): Carbon balances of green gas supply chains (CE Delft, 2019)
- Feedstock availability biomethane scenarios in the Netherlands (CE Delft, 2018)
- Current ongoing discussions on TTW emissions for
  - Trucks
  - Maritime shipping
- Final remarks

Carbon balances of green gas supply chains



- Study commissioned by Groengas Nederland (GGN)
- Well-to-usage carbon emissions of green gas supply chains
- Outdated data: co-digestion, 33% CO2 reduction
- Current practice of biomethane in the Netherlands fundamentally different
- Goal to provide an up-to-date picture
- End use:
  - LNG production
  - H gas for main transportation grid
  - G gas for distribution grid

Digestion pathways

	Carbon emissions according to RED methodology (kg CO2-eq./GJ)	Emission reduction; no CCS, no avoided products /processes
Conventional mesophilic digestion		
Domestic biowaste	23.4	68%
Pig slurry		
Excl. impact of avoided emissions from manure storage	41.7	42%
Incl. impact of avoided emissions from manure storage	-89.8	225%
Effluent treatment plant sludge	36.0	50%
Carbon emission baseline	72	

Source: CE Delft, 2019

Gasification pathways

	Carbon emissions according to RED methodology (kg CO2-eq./GJ)	Emission reduction; no CCS, no avoided products /processes
Supercritical water gasification		
Seaweed after protein extraction	8.5	88%
Effluent treatment plant sludge	9.1	87%
Allothermal gasification		
Logs	17.4	76%
Industrial by-products	16.4	77%
B-grade wood	17.8	75%
Carbon emissions baseline	72	

Source: CE Delft, 2019

Methodological choices

- Differences between Dutch National Waste Management Plan (LAP) (consequential LCA-analysis) and RED-methodology (attributional LCA-analysis)
- Avoided emissions (for example from manure storage)
- The role of CCS/CCU
- CO2-capture vegetation and in the soil
- Allocation of byproducts
- Economic system and value of byproducts
- System boundaries

Methodological choices

- Supercritical water gasification:
  - Indicative GHG balance
  - Higher emission reduction potential in case CO2 present in synthesis gas post methanisation can be used as feedstock for e.g. ‘green concrete’

- Seaweed:
  - reduction associated with cultivation and short-cycle CO2 capture not being factored in;
  - excl. emission reduction related to protein extraction (substitution of animal protein)

Feedstock availability for large-scale biomethane use in NL

- CE Delft, 2018, Exploratory study on transport bioLNG, Fact-finding, market exploration, business cases
- Letter of Intent Port of Rotterdam, stakeholders linked to Dutch National LNG Platform
- Exploration of largescale liquefaction in the port area and use of biomethane in the transport sector
  - Fact finding technology feedstocks and policy & regulations;
  - Market demand trucks, inland shipping, maritime shipping.
  - Business cases based on supply/demand scenarios, origin of feedstocks, location of liquefaction
  - Excl. gasification routes

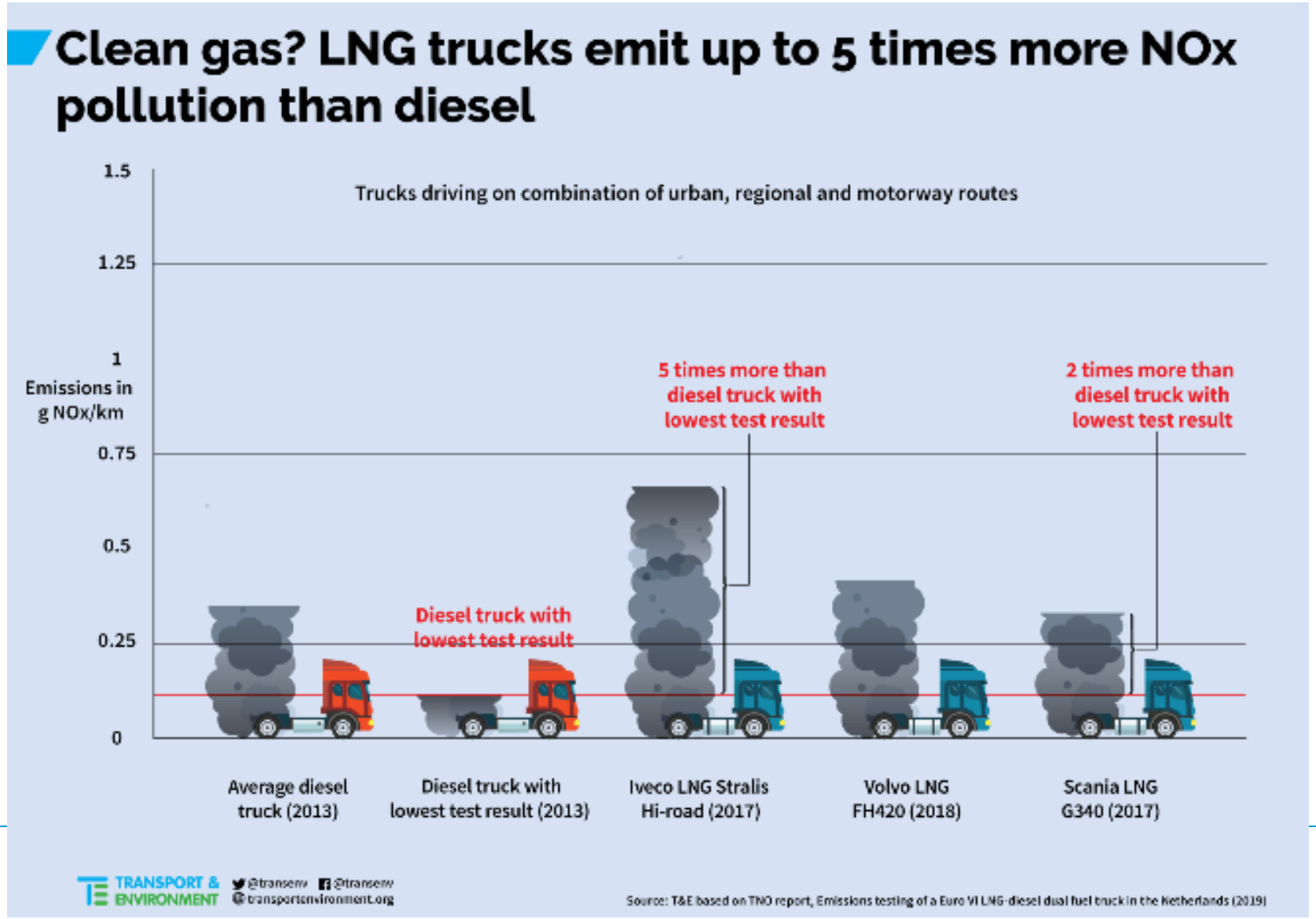
Scenarios for biomethane in the Netherlands (CE Delft, 2018)

	Trucks			Inland shipping			Maritime shipping			Total (kton biomethane)		
	low	medium	high	low	medium	high	low	medium	high	low	medium	high
National moderate pace	3%			0%			0%					
	2	6	9	0	0	0	0	0	0	2	6	9
Inter-national moderate pace	10%			4%			3%					
	5	21	29	1	10	15	34	68	101	40	99	145
National fast pace	50%			30%			10%					
	27	106	145	10	78	113	113	225	338	149	409	596
Inter-national fast pace	100%			100%			100%			100%		
	55	212	290	32	260	378	1.125	2.250	3.375	1.211	2.722	4.043

Feedstock availability compared to biomethane demand

- Total production of biogas (digestion) in NL in 2030: 1.173 tonnes
  - feedstock availability at the national level not the limiting factor for first three scenarios
  - problematic for 100% biomethane scenario
- 35% suitable for biomethane production: 412 kton biomethane
  - no problem for demand for biomethane from trucks in all scenarios
  - combined demand trucks and inland shipping: only sufficient availability for low and medium scenario
  - availability not sufficient for complete demand from maritime shipping
- Gasification has not been taken into account

Ongoing discussions on TTW emissions from LNG in trucks



Ongoing discussions on TTW emissions LNG in trucks

- Similar emissions for LBG/bioLNG (because almost identical to LNG)
- A lot of comments from industry stakeholders, for example from the NGVA
- Discussions on:
  - Studies/measurements taken into account;
  - Driving conditions (motorway / urban / rural)
  - contribution of NO2 to the overall NOx emissions
  - Project Equilibre results: 40% to 60% reduction of NOx emissions compared to diesel
  - PM number emissions
  - Reference vehicles

Ongoing discussions on LNG in maritime shipping

- Similar discussion as on LNG in trucks
- Thinkstep, 2019 vs Lindstad, 2019
- Conclusion Thinkstep (commissioned by SEA/LNG and SGMF):

'if the whole world fleet shifted from traditional fuels to LNG, the maritime greenhouse gas (GHG) emissions could be reduced by around 15%.'

Some of the discussion points:

- *Global Warming Potential, load factors, test cycle*

Data quality and need for more data

- Most discussion on TTW air polluting emissions and WTT emissions of natural gas
- GHG emission reduction of LBG less questioned
- Emission reductions strongly depend on assumptions, circumstances and chosen reference fuels and vehicles

- Need for more data and continuation of the debate on data quality and methodological choices
- Transparency on assumptions and approach
- Clear communication towards policy makers and stakeholders: needs to be understandable for every actor

Need for action

- We should challenge analyses, but it should not paralyze the transition
- Biomethane, like liquid biofuels, can play an important role in the realisation of the decarbonisation targets
- Assess individual supply chains and opportunities to compare various alternatives to determine the best available decarbonisation options at that moment in time

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