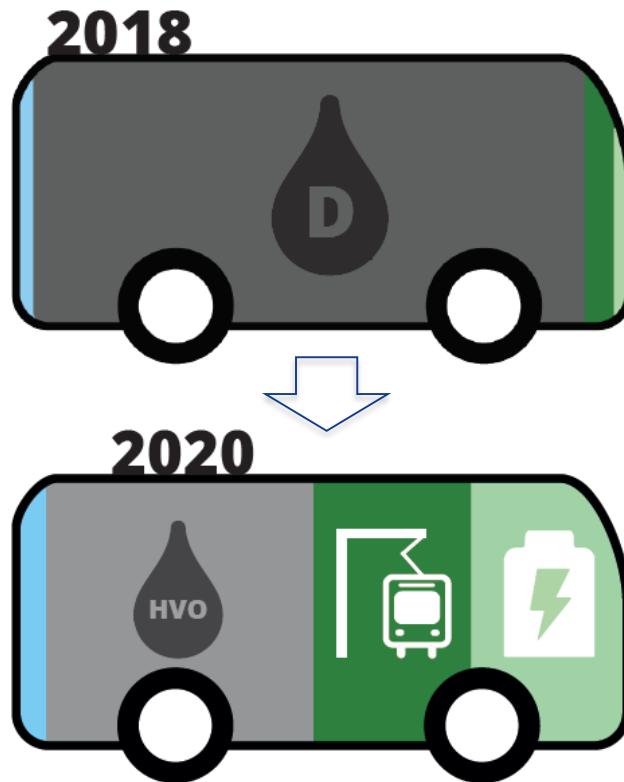


# THE FUTURE IS GREEN

## WORKING ON A ZERO EMISSION BUS FLEET



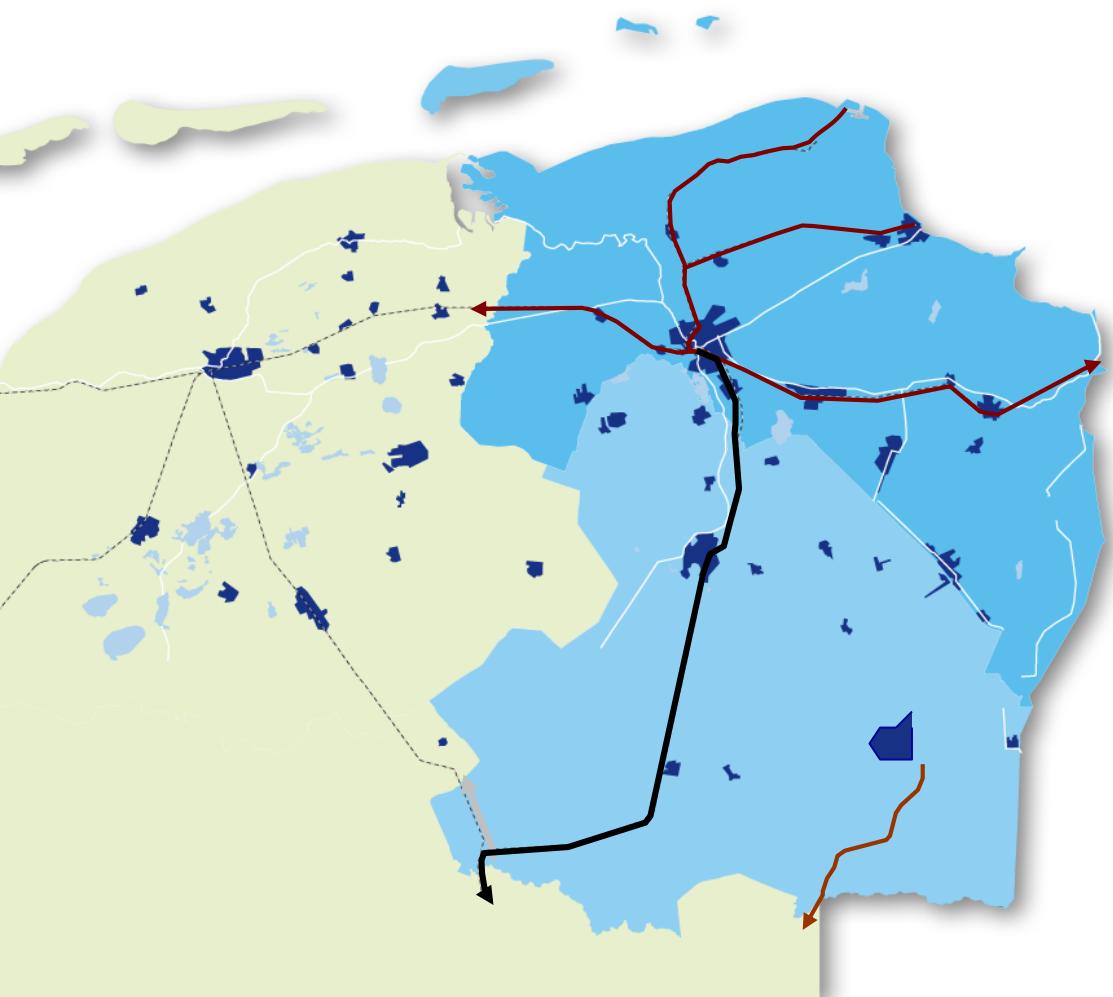
**Erwin Stoker**  
Program Manager PT Development

**Stockholm**  
2019, Jun 11th

# Public Transport Authority Groningen and Drenthe

PT bus contracts  
**€ 110 mln**  
Per year

5.600 km<sup>2</sup>  
**1 mln inhabitants**  
(Groningen 220.000)



Passengers  
**27 mln**  
per year

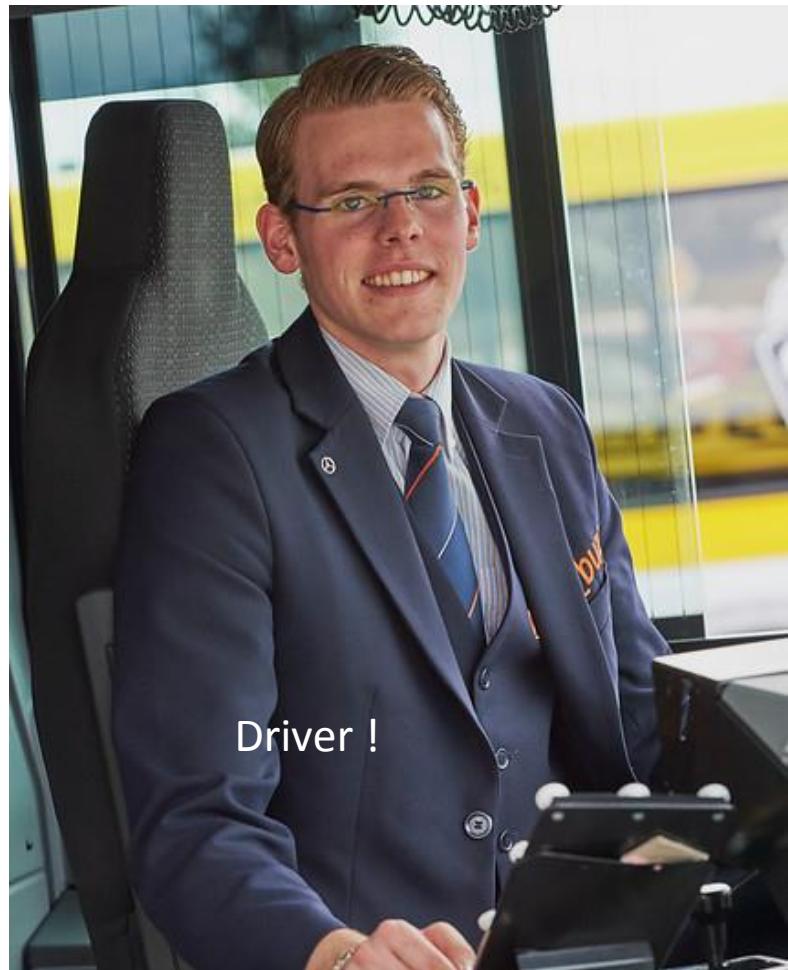
Passengerkilometers  
**290 mln**  
per year

360  
buses

CO2 emissions  
**113 grams**  
per passengerkilometer

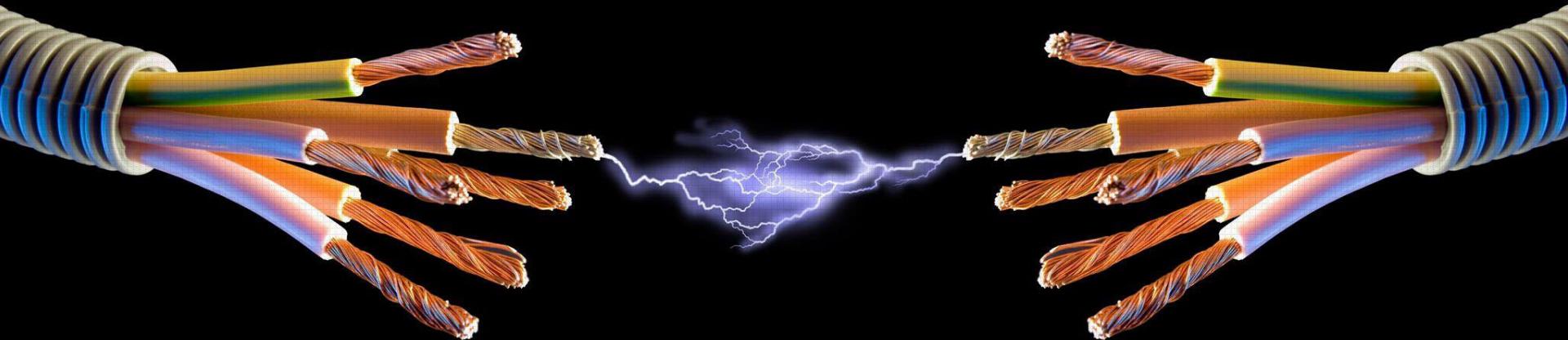


# Towards zero emission: System approach

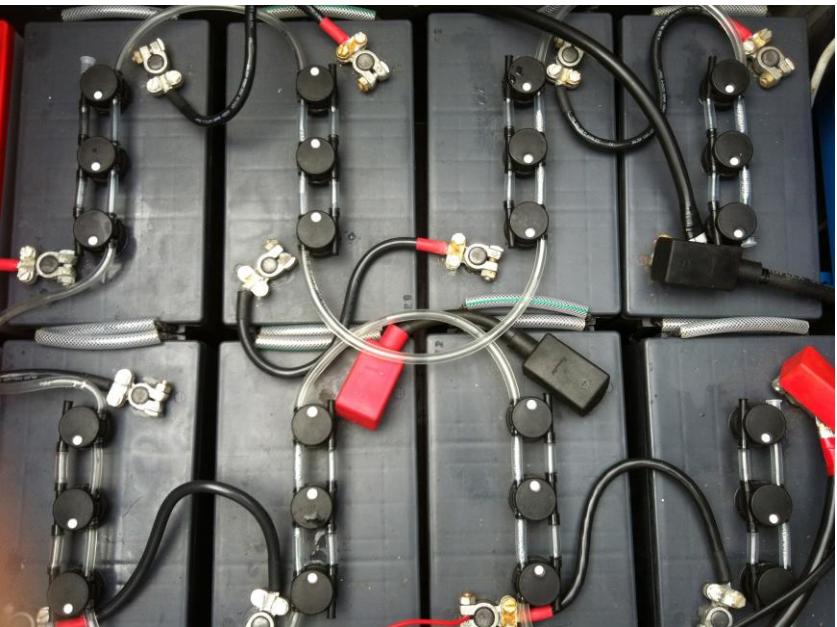


Step 1: energy efficiency

## Step 2: Zero-emission bus: the future is electric



# Batteries or passengers



- Short distances: BEV
- Longer distances: ? (H2?)

# A hydrogen hub in the North Netherlands

A solution for huge fluctuations between supply and demand



From electricity...

...to hydrogen...

Electrolysis: separating water into hydrogen and oxygen

...to storage...

...to consumers

Methanation:  
CO<sub>2</sub> from the air reacts with hydrogen to form syngas which can be injected into the natural gas network

Blending H<sub>2</sub> into the natural gas network

Underground gas storage Zuidwending  
Hydrogen storage in salt caverns

Conversion into electricity

Hydrogen fueling stations

Houses

Transport

Industry

# Mai 2017: Battery electric city bus (2)



# Dec 2017 Q-link (BRT) – Groningen-Zuidhorn (10)



# Hydrogen bus: 'the other electric bus'



green hydrogen bus

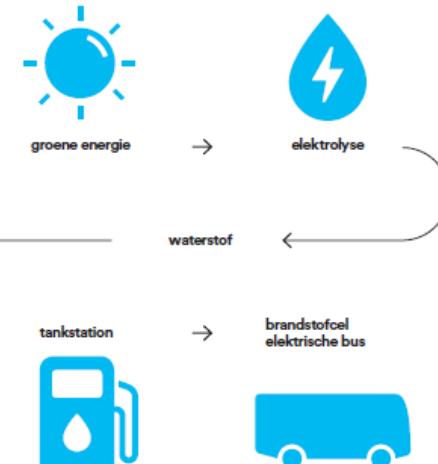
Pilot on regional busroutes

Dec 2017-dec 2022

Green hydrogen

(waste product from chlorine factory Nouryon Delfzijl)

- 150 tons CO<sub>2</sub>/year



Deze pilot is onderdeel van het Europees project HighVLOCity. Partners:

# Experiences so far



Q-link electric (dec 2017)  
(VDL SLFA 180kWh)

- availability higher than diesel (99%)
- range depending on weather dependent, better than expected
- drivers satisfaction high
- 'the best bus we have'



Hydrogen regional pilot bus (dec 2017)  
(Van Hool A330 FCB)

- availability goal 80% of planned operation in first year within reach
- 65.000 km's in 2018
- lots of demo's

# There is more than one way to Rome



# Tender strategy GD tender dec 2019-dec 2029

## Tender requirements

HOV	'motorwaybus' 600-800 km/day 60 km/h  'BRT' Snelweg en stad 400-600 km/day 35 km/h	70 buses (15m and DD)  80 buses (18m)	Stimulus CO2 reduction  Full electric (Opportunity Charging, estimated + € 10 mln e-infra)	
City and Regional	    <b>Streek</b>    <b>stad</b>  	<b>Regional bus</b> 250-500 km/day 30km/h  <b>City bus</b> Groningen, Assen, Emmen 18 km/h	<b>180 buses</b> (12m and 18m)  <b>30 buses</b> (12m and 18m)	<b>Stimulus CO2 reduction</b> (and 22 H2 buses)  <b>Full electric</b> (estimated 0 extra cost)

# Hydrogen buses in GD-tender



Requirement:  
20 hydrogen buses extra

- From dec 2020
- Depot Groningen
- H2 will be provided  
€ 3,5/kg
- + € 9 mln

Separate H2 tender by  
OV-bureau

Requirement:  
2 hydrogenbuses  
HighVLOCity keep  
running

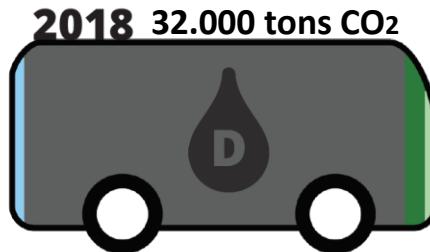
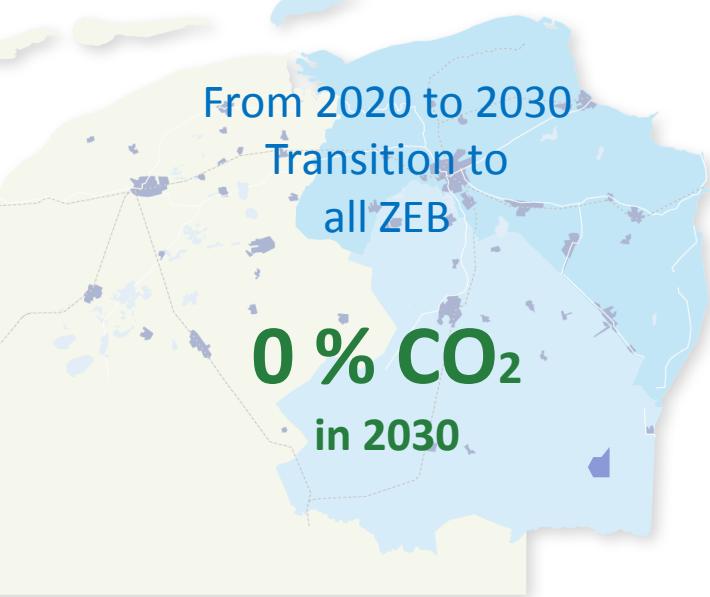


# Results of PT tender GD dec 2019-dec 2029

GD concession dec 2009-dec 2019  
*Qbuzz*

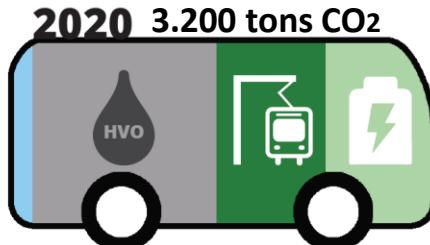
GD concession dec 2019-dec 2029  
*Qbuzz*

- 90% CO<sub>2</sub>  
in 2020



14 Zero emission buses (of 360)

- 10 Q-link (e)
- 2 citybuses (e)
- 2 regional buses (H2)



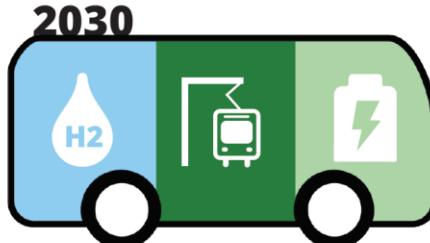
186 Zero emission buses (of 360)

- 59 Q-link (e)
- 45 (all) citybus (e)
- 60 regional buses (e)
- 22 regional buses (H2)
- HVO in the rest of the buses



In planning:

- 10 regional buses (H2) Emmen



Next steps (already contracted)

- + Dec 2022 4 Q-link 12 (Emmen) (e)
- + Dec 2023 13 Q-link 6 (Delfzijl-Gn) (e)
- + Dec 2027 9 Q-link 15 (Zernike) (e)

# Next step: hydrogen in taxi and other vehicles



# Next step: H2 in 'coach' Qliner



- Coach market equals PT (and higher mileage)
- High floor, 100 km/h
- OEM's can't deliver (yet)
- Use of existing HRS
- Is retrofitting an option?



In operation



Planned

# ZE can be done, don't wait !

Shorter distances: BEV

Longer distances: BEV and Hydrogen are coming

Bus manufacturers: step up for hydrogen and ZE coaches

Create a Hydrogen Valley, not only public transport



When it comes to a night out in the Netherlands, **Groningen** nightlife has no equal.

- Lonely Planet

Come see for yourself  
In Groningen !

