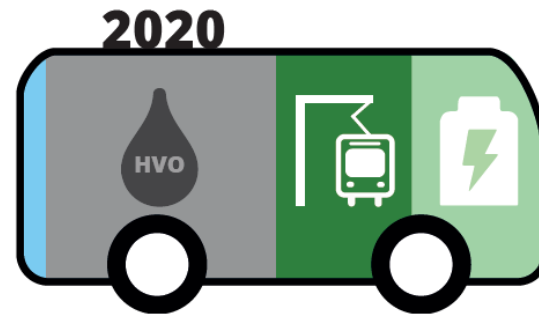
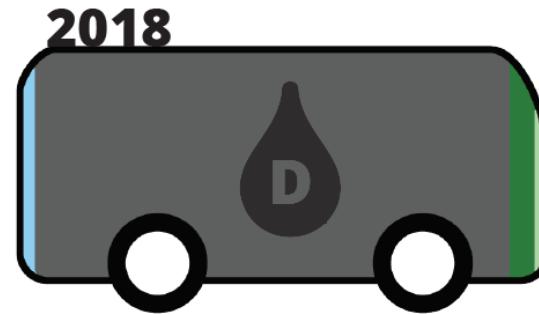


The future is green

Moving towards a zero-emission bus fleet



Erwin Stoker

Program Manager PT Development

 ov bureau groningen drenthe

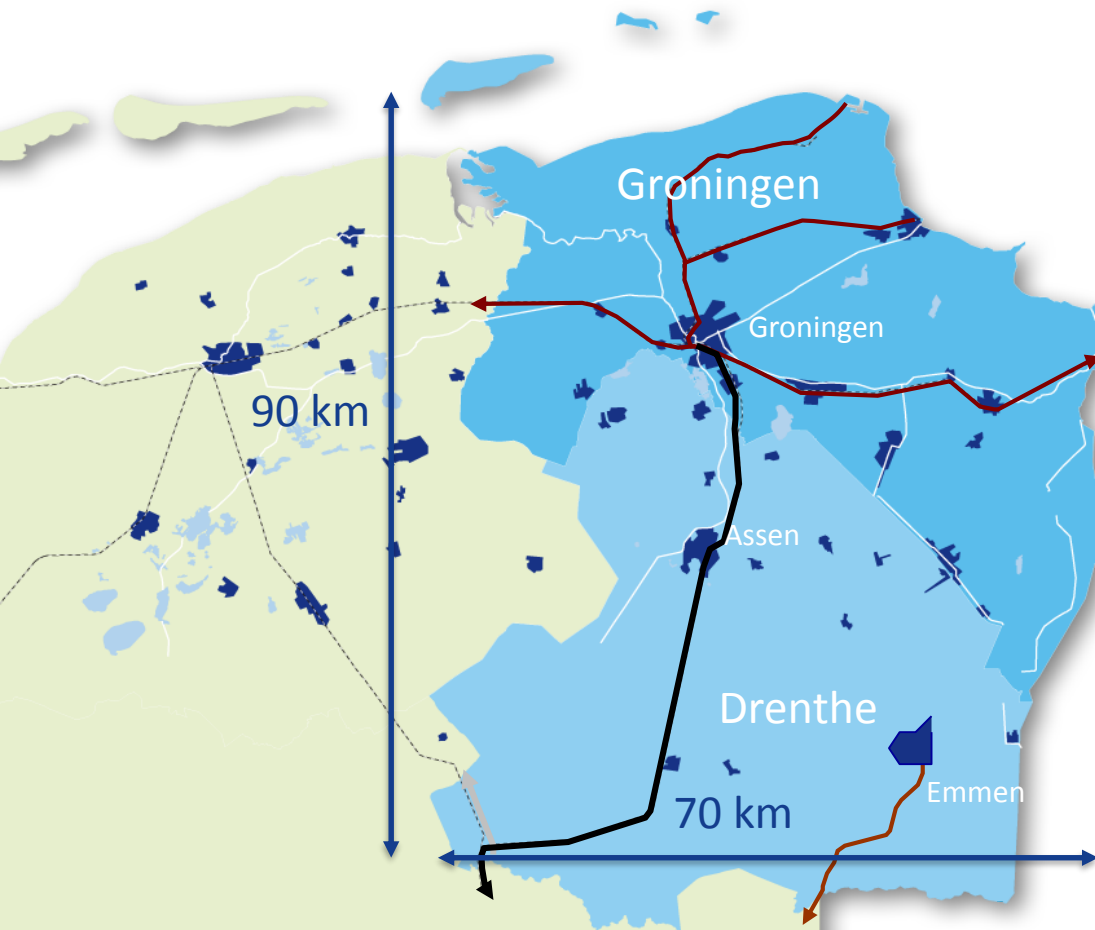


Public Transport Authority Groningen and Drenthe

PT bus contracts
€ 114,5 mln
 Per year

5.600 km²
 > 1 mln inhabitants
 (Groningen 220.000)

PT Operator
Qbuzz



Passengers
27 mln
 per year

Passenger kilometers
290 mln
 per year

360
 buses

2017
 Algemene klanttevredenheid
 GD-concessie

7,7



CO₂ emissions (2017)
113 grams
 per passenger kilometer

ZE Strategy: different solutions



HOV

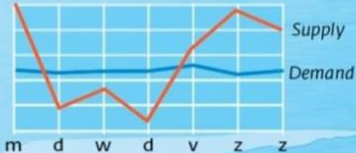
| | |
|--|--|
| | ? (Hydrogen?) 'motorwaybus' 300 km/day 60 km/h |
| | Electric 'BRT' Spelweg en stad 400-600 km/day 35 km/h |

City and Regional

| | |
|--|---|
| | ? (Hydrogen/electric?) Regional bus 250-500 km/day 30km/h |
| | Electric Groningen, Assen, Emmen 150-300 km/day 18 km/h |

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...

Underground gas storage Zuidwending
Hydrogen storage in salt caverns

...to consumers

Methanation:
CO₂ from the air reacts with hydrogen to form syngas which can be injected into the natural gas network

Blending H₂ into the natural gas network

Conversion into electricity

Hydrogen fueling stations

Houses

Transport

Industry



Hydrogen bus: 'the other electric bus'



 green hydrogen bus

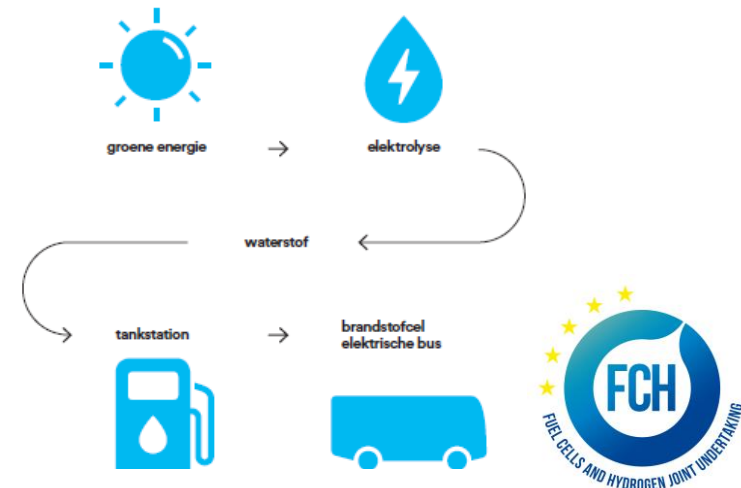
Pilot on regional busroutes

Dec 2017-dec 2022

Green Hydrogen

(waste product from chlorine factory Nouryon Delfzijl)

- 150 tons CO2/year



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



Green Hydrogen Bus

- availability goal in first year: within reach
- 65.000 km's in 2018
- lots of demo's



Hydrogen buses in GD-tender



Requirement:
2 hydrogen buses
HighVLOCity keep
running



Requirement:
20 hydrogen buses extra

- From dec 2020
- Depot Groningen
- H2 will be provided
€ 3,5/kg
- + € 9 mln
(JIVE2, FCHJU)

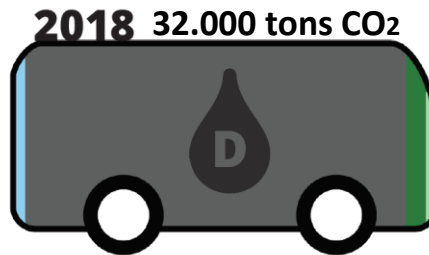
Seperate H2 tender by
OV-bureau



Results of PT tender GD dec 2019-dec 2029



GD concession dec 2009-dec 2019
Qbuzz

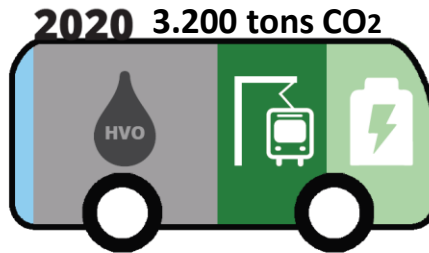


14 Zero emission buses (of 360)

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

GD concession dec 2019-dec 2029
Qbuzz

**- 90% CO₂
in 2020**



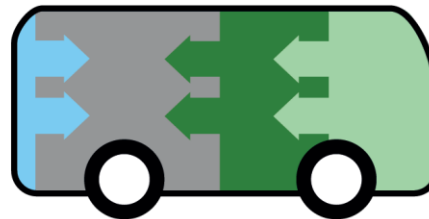
186 Zero emission buses (of 360)

- 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

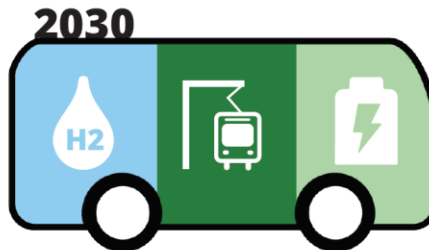
From 2020 to 2030
Transition to
all ZEB



Next steps 26 buses (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)

**0 % CO₂
in 2030**



20 Van Hool A330 FC



Regional lines
Range 300+
HRS Groningen Peizerweg

Planning

- Ordered: June 2019
- Delivery: sep-nov 2020
- Operation: Dec 2020

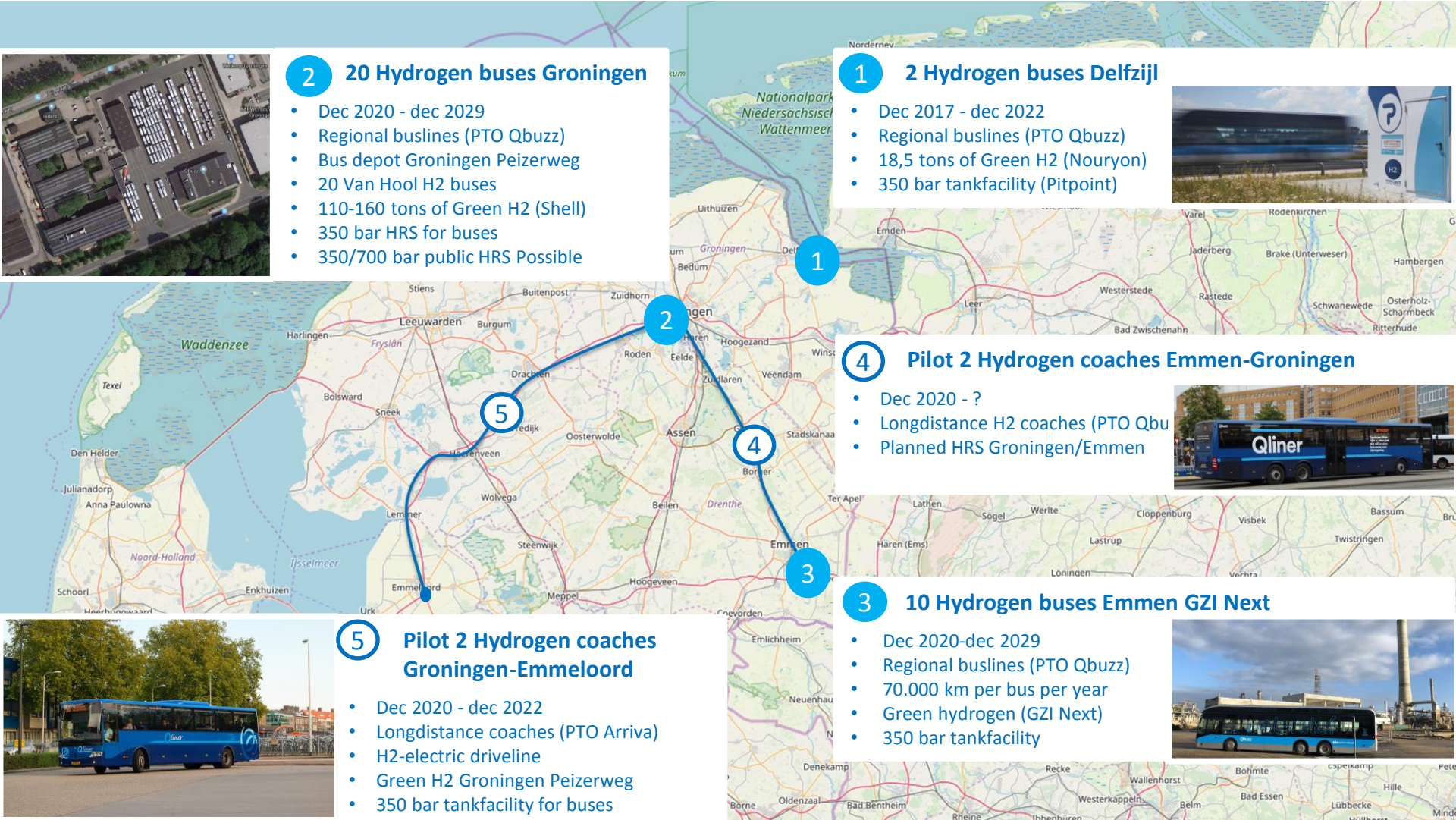


Hydrogen

- 110-160 tons per year
- Tender for 'tank-ready delivery at the nozzle'
- Reliable, Safe
- 99,999
- Contract awarded Aug 2019
- Green Hydrogen
- Delivery by dec 2020



5 hydrogen projects in PT bus in the Hydrogen Valley



2 20 Hydrogen buses Groningen

- Dec 2020 - dec 2029
- Regional buslines (PTO Qbuzz)
- Bus depot Groningen Peizerweg
- 20 Van Hool H2 buses
- 110-160 tons of Green H2 (Shell)
- 350 bar HRS for buses
- 350/700 bar public HRS Possible

1 2 Hydrogen buses Delfzijl

- Dec 2017 - dec 2022
- Regional buslines (PTO Qbuzz)
- 18,5 tons of Green H2 (Nouryon)
- 350 bar tankfacility (Pitpoint)



4 Pilot 2 Hydrogen coaches Emmen-Groningen

- Dec 2020 - ?
- Longdistance H2 coaches (PTO Qbu)
- Planned HRS Groningen/Emmen



3 10 Hydrogen buses Emmen GZI Next

- Dec 2020-dec 2029
- Regional buslines (PTO Qbuzz)
- 70.000 km per bus per year
- Green hydrogen (GZI Next)
- 350 bar tankfacility



5 Pilot 2 Hydrogen coaches Groningen-Emmeloord

- Dec 2020 - dec 2022
- Longdistance coaches (PTO Arriva)
- H2-electric driveline
- Green H2 Groningen Peizerweg
- 350 bar tankfacility for buses



Next step: hydrogen in taxi and other vehicles



Hydrogen or electric train ?





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

- Lonely Planet

Come see for yourselves
In Groningen and Drenthe !

