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academy

KNOWLEDGE PLATFORM
FOR THE WORLDWIDE
BUS & COACH SECTOR

Implementing Electric bus operations *-Amsterdam region - Transdev*

Marc Vanhoutte





Transdev Global integrator of Mobility solution of



6.7 bn

net revenue
€4.1 bn outside France



83,000

employees, including
56,390 drivers



43,270

operated vehicle including
26 616 clean vehicles

(Euro 5 & 6, hybrid, electric, CNG, biogas, LPG)



3.5 bn

carried passengers per
year

**N°1 EUROPEAN OPERATOR IN
ZERO-EMISSION MOBILITY**

994 electric vehicles world wide
(in operation + committed for 2020)

**13 MEANS OF
TRANSPORTATION**

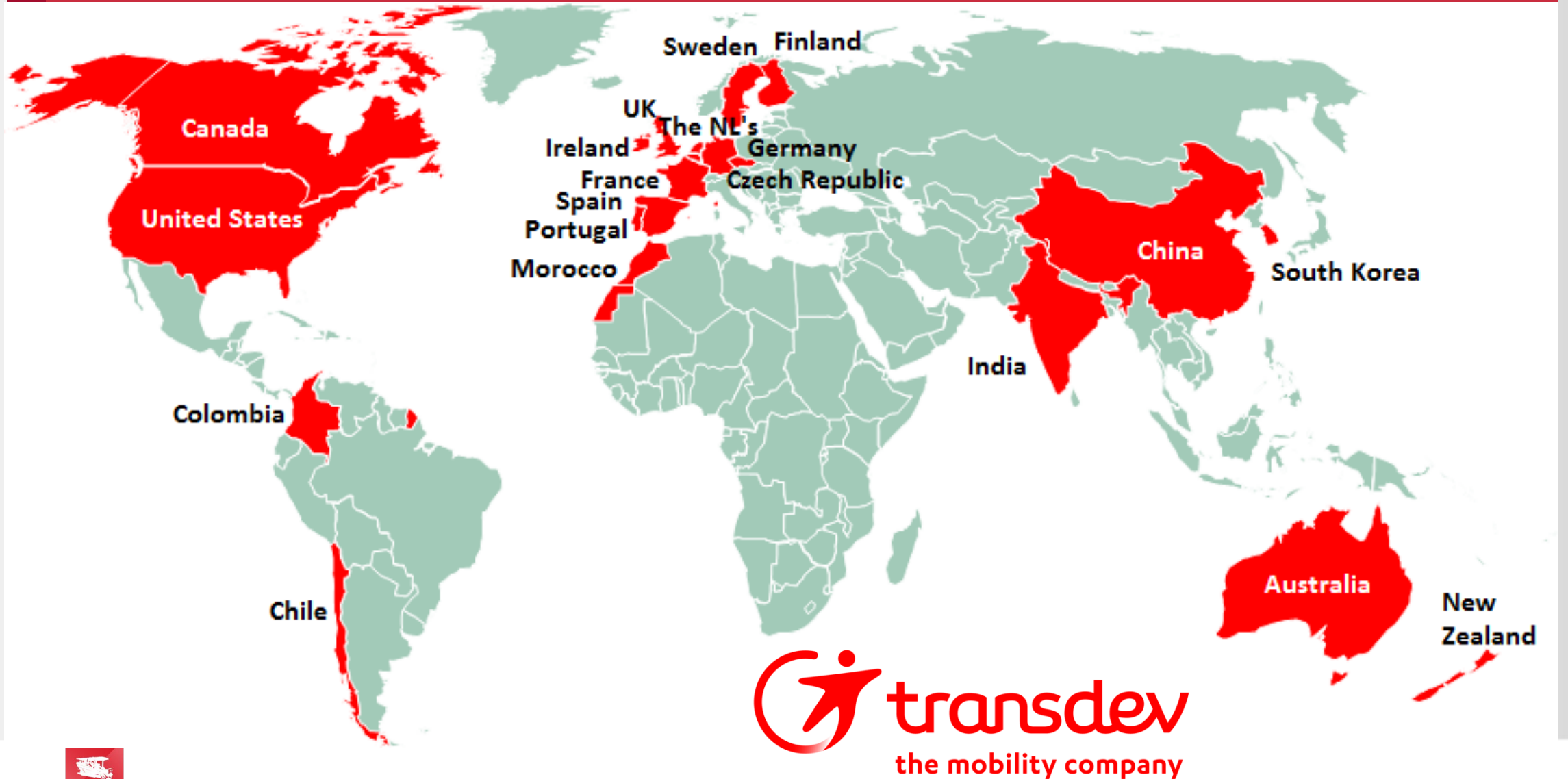
Ex: Super Shuttle, Tram (22 networks),
Ferry in Sydney, CDG Val in Paris, etc.

20 COUNTRIES

Main operations in
France, Germany, Sweden,
The Netherlands, US, Canada
Australia and NZ



Transdev Worldwide



Transdev within North America of



- Fixed Route
- Maintenance
- Streetcar
- Rail
- Paratransit
- Brokerage
- Ferry
- Taxi
- Autonomous Vehicles
- Link
- Super Shuttle
- Execucar
- Student
- Employer Shuttle
- University
- Airport Service

Serving
North America

200
Contracts

400
Million Passenger Trips

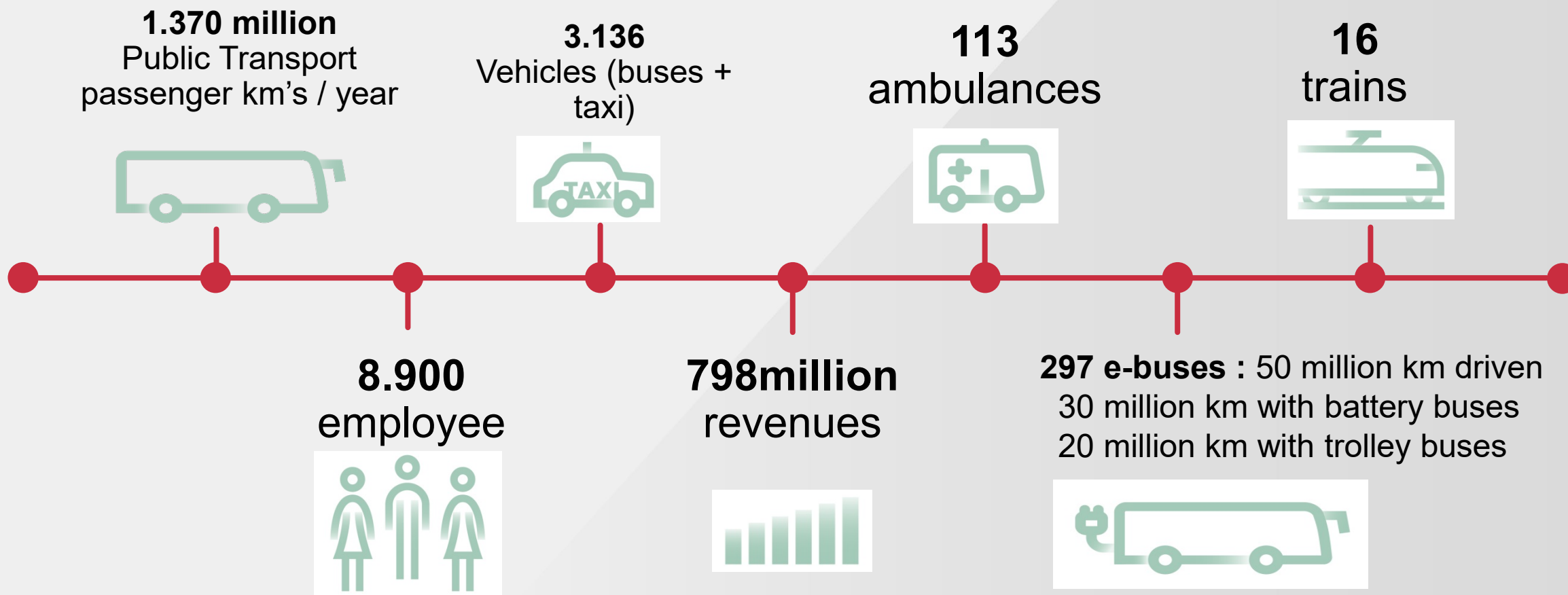
Cities, countries, airports, and universities
In over 200 contracts in North America
Choose Transdev to manage and operate
One or more modes of their transportation
systems

9.000 buses

12.500 employees

 **transdev**
the mobility company

Transdev within the Netherlands



The NL's first mover within Europe regarding ZE PT

Green deal

The Green deal is an agreement between the Dutch National government and local authorities with the aim to improve emissions.

Public Transport is part of the Green deal, this means:

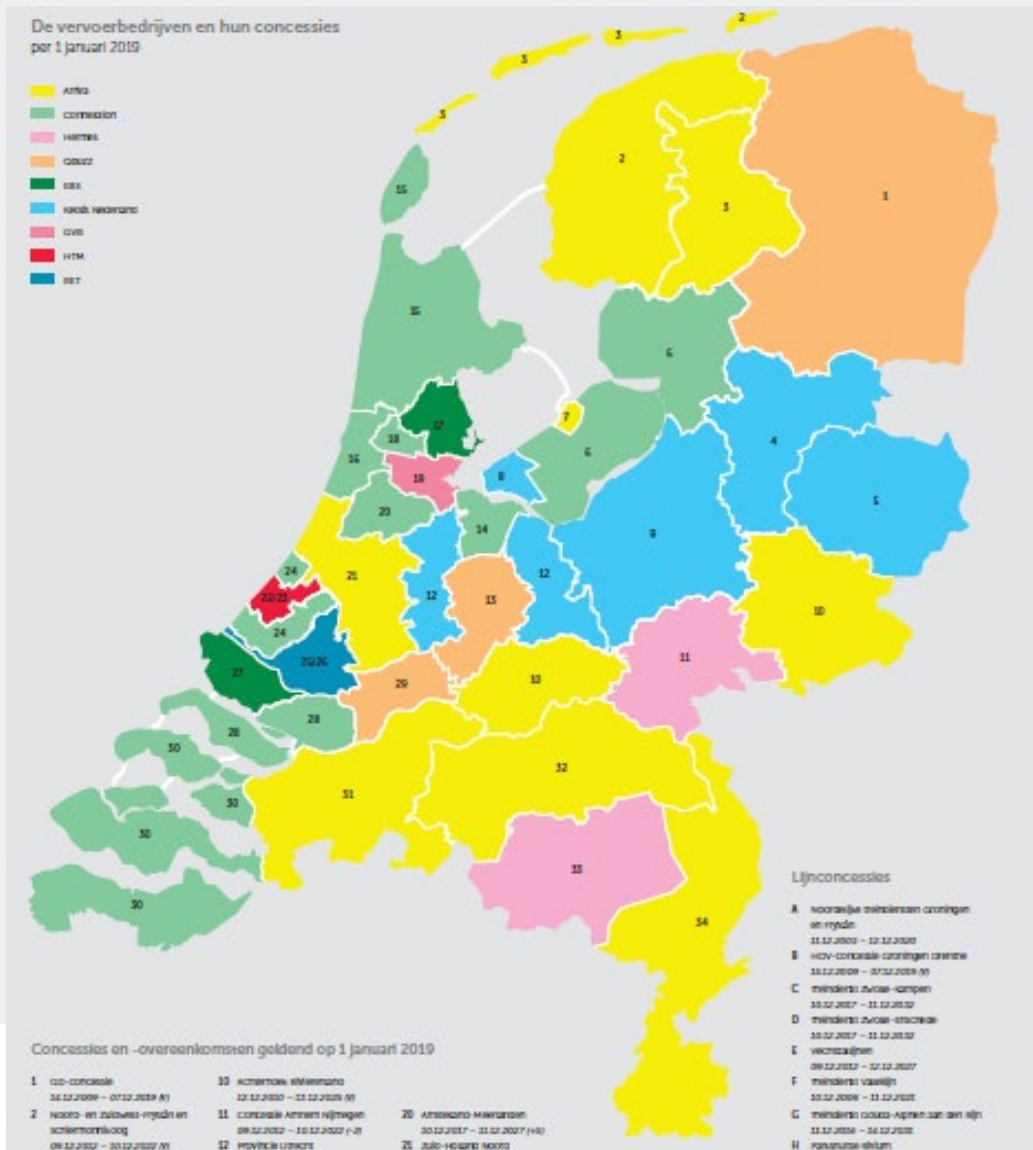
1. **By 2025** all new buses entering operation will be emission-free at the exhaust.
2. **By 2030**, at the latest all bus operations will be completely emission-free at the exhaust.

The new buses will use 100% renewable energy or fuel by 2025.

Public transport concessions have the best possible score on well-to-wheel CO2 emissions per passenger kilometer.



Public Transport organization within the NL's



Concessions within the Netherlands

- ✓ The provinces and Transport Entities (VRA) are the Public Transport Authorities.
- ✓ They have different concessions within their region which are subject of a tender process.
- ✓ These tenders consider city, regional, student transportation.

Granting conditions

- ✓ Fixed yearly subsidy granted by the PTA
- ✓ Evaluation of different criteria (to which the PTO replies).
- ✓ Transition plan towards ZE buses during the concession period with regards of the green deal.

Public Transport organization within the NL's

Evaluation of different criteria – example from AML tender (Amsterdam region)

- ✓ VRA is the Public Transport Authorities (Vervoerregio Amsterdam)
- ✓ They have different concessions within their region which are subject of a tender process.
City of Amsterdam, Zaanstreek, Amstelland-Meerlanden (AML).

Granting conditions:

- ✓ Fixed yearly subsidy granted by the PTA
- ✓ Evaluation of different criteria (to which the PTO replies).
- ✓ Transition plan towards ZE buses during the concession period with regards of the green deal.

Exceptions – 3 cities where the PT is not subject of a tender process

- ✓ GVB: Amsterdam city transport
- ✓ RET: Rotterdam city transport
- ✓ HTM: The Hague city transport



The first PT concession with e-buses in The NL's

South East Brabant concession

The first concession requesting a complete transition towards ZE against 2025.

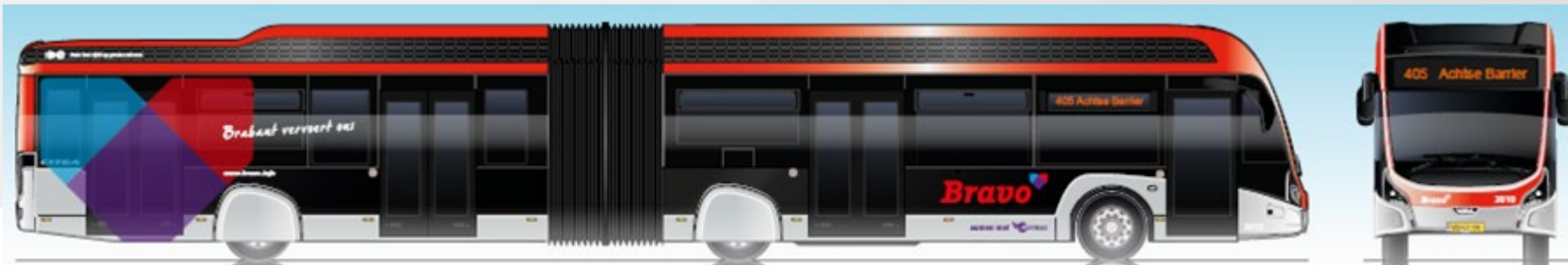
Operation started in December 2016

Number of vehicles: 43 articulated E-buses

Charging method: Combination of overnight and opportunity charging.

Against end of 2024 the complete fleet (>200 buses will be electric)

Till end of 2019 > 9 million electric kilometers



VDL Citea-e
18 m (60 foot)

Amsterdam region – Amstelland Meerlanden



Amsterdam region – Amstelland Meerlanden



Amstelland - Meerlanden Public Transport tender

Transport Authority: VRA “Vervoer Regio Amsterdam”

Inhabitant within the Concession and the wider area of Amsterdam: 3.4 Million

<i>Planning :</i>	<i>Tender publication:</i>	June 8, 2016
	<i>Submission date:</i>	November 21, 2016
	<i>Awarding date:</i>	December 15, 2016
	<i>Start concession:</i>	December 10, 2017
	<i>Contract length:</i>	10 years, ending at December 9, 2027
	<i>Optional contract period:</i>	5 years, contract ending at December 9, 2032

Once the operator has been chosen, a period of 6 weeks is provided for, during which any operator who has participated may submit an objection.

The optional contract extension was granted in December 2019.



Awarding conditions

Evaluation table used by the PTA for awarding the AML concession:

- The PTA provides a loan of 100 million Euros under certain conditions. (approx 101 M\$)
- *Connexxion (Transdev NL)* has met these conditions as they were committing to start the operation with 100 electric articulated buses.

Criteria	Subj/Obj	Max. score
Increased use of PT		25
<i>Offered revenue growth</i>	<i>Obj</i>	<i>10</i>
Development plan	Subj	15
Transport offering		48
<i>Transport plan</i>	<i>Subj</i>	<i>10</i>
<i>Transport packages above minimum requirements</i>	<i>Obj</i>	<i>10</i>
Number of time table kilometers	Obj	20
<i>Transport packagesBasic mobility</i>	<i>Obj</i>	<i>1.5</i>
<i>Extra deployment on fixed routes for basic mobility</i>	<i>Subj</i>	<i>1</i>
<i>Alternative forms of basic mobility</i>	<i>Subj</i>	<i>2.5</i>
<i>Mobility chain director</i>	<i>Subj</i>	<i>3</i>
Comfortable and reliable PT		12
<i>Rolling stock plan</i>	<i>Subj</i>	<i>8</i>
<i>Operationplan</i>	<i>Subj</i>	<i>4</i>
Sustainable PT		15
<i>Euro standard rolling stock</i>	<i>Obj</i>	<i>6</i>
<i>Reduction of CO2 emission</i>	<i>Obj</i>	<i>6</i>
<i>Other SCR measures: environment</i>	<i>Subj</i>	<i>2</i>
<i>Other SCR measures: social return</i>	<i>Subj</i>	<i>1</i>
TOTAL		100



Amstelland - Meerlanden Rolling stock specifications

- The bus fleet is evaluated for as much as 20% of the total score.
- The PTA requested electric buses for the Schiphol network and the operator was challenged to provide as much as possible electric buses during the contract period.
- For this purpose, an evaluation system was set up that encourages bidding with e-buses.

Within the 20% is included

<i>Material plan:</i>	<i>8 points</i>
<i>Euro standard:</i>	<i>6 points</i>
<i>CO2 savings:</i>	<i>6 points</i>

Evaluation of the material plan

<i>ZE buses:</i>	<i>6 points/bus</i>
<i>Euro VI Hybrid buses:</i>	<i>3 points/bus</i>
<i>Euro VI:</i>	<i>1,5 points/bus</i>
<i>EEV:</i>	<i>0 points/bus</i>



Amstelland - Meerlanden Rolling stock specifications

- For the Schiphol network BHLS buses were requested (*buses with a high level of service*).
- **Additional requests:**
 - Passenger air-conditioning system
 - Individual WIFI connections, USB
 - Kneeling systems
 - etc...
- The PTA's requirements do not indicate the number of buses that the operator should offer. It is up to the tenderer to determine the number of vehicles and the different vehicle sizes they are offering, taking into account the number of kilometers travelled and the transport guarantee he has to offer to the passengers.



Amstelland - Meerlanden Rolling stock specifications

➤ **Transport guarantee.**

The operator must be able to transport every passenger present at a bus stop, on the next journey.

- **Rush hour:** it is accepted that passengers have to stand up.
- **Outside rush hour period:** there is a 90% chance of passengers being seated

In the event of unforeseen additional offers from passengers, the carrier must ensure that all passengers are carried as soon as possible after the scheduled time of arrival of the bus.



Amstelland - Meerlanden Rolling stock specifications

➤ **Alternative vehicles**

- **Hydrogen buses:** are not allowed to drive through tunnels.
- **Trolley buses:** are allowed, but impossible to have an agreement with several municipalities during the tendering period.

➤ **Transfer of buses at the end of the contract.**

- The operator winning the next tender is obliged to take over all e-buses the residual value based on a linear depreciation over 15 years.
- Investments in new batteries during the contract period will not be added to the bus value.



Amsterdam region – Amstelland Meerlanden

Preparing the offer – fleet composition

Electric buses at the start of the concession

- **Schiphol net:** *e-buses and BHLS compulsory*

Proposed: **51** articulated e-buses based on the buses in operation at the South Brabant concession (Eindhoven): VDL Citea-e 18 m.

Yearly kilometer load Schiphol Net: 105.000 km/bus

- **Options:** *regarding the composition of a fleet with around 271 buses to be offered*

All other buses diesel Euro VI: impossible to win the tender.

All other buses electric: not acceptable for the PTA (feasibility to have charging equipment for such a fleet in less than a year).

Mix of diesel and e-buses has been chosen: **49** articulated e-buses offered for R-net

Yearly kilometer load R-Net: 105.000 km/bus.

Integration plan for the introduction of e-buses during the contract period (10 years)



Fleet of buses at the start of the contract

Supporting net

VDL Sprinter 8 + 1



x1

Iveco Crossway



x7



x14

Iveco Crossway

Basic mobility

Total fleet
of
271 buses



x2



x4



x5

R-net

13 m Low Entry
Diesel



x47

Double Decker
Diesel



x18

20 m artic diesel



x33

18 m artic
diesel



x40

18 m artic
Electric



x49

SchipholNet

18 m artic
BRT
Electric



51x



Opportunity charging at Amstelland – Meerlanden



R-Net: Electric articulated buses:
49 Buses with 3 double doors
Battery capacity: 170 kWh
Passenger capacity: 127



Schiphol-Net: Electric articulated buses:
51 Buses with single door at front and 3 double doors.
Battery capacity: 170 kWh
Passenger capacity: 124



Amstelland - Meerlanden Charging infrastructure

- **Charging points, charging equipment, connection to the electricity grid**
 - ***Charging points:***
 - ✓ Feasibility to be examined by the operator (charging strategy – permits)
 - ✓ No guaranty that the proposed plan can be realized (permits).
 - ***Connection to the grid:***
 - ✓ Connection to the grid for two charging hubs and depot Cateringweg together with the transformers on Schiphol land are provided by Schiphol authorities.
 - ✓ Connection to the grid and transformers for the bus depot at Amstelveen is on the responsibility of the operator.
 - ***Charging equipment:***
 - ✓ Development, charging strategy and installation of equipment on the responsibility of the operator.



Amstelland - Meerlanden

➤ **Transfer of charging equipment**

- The operator winning the next tender is obliged to take over all charging equipment at the residual value on linear depreciation over 15 years.

➤ **Special conditions**

- A loan of 100 million Euros is granted if the chosen operator fulfills the condition regarding the level of investment within e-buses.
- Conditions for extending the contract with 5 years
 - 42 MEUR investment within the first 5 years of the contract regarding electric buses and charging infrastructure.
 - Receive an adequate rating from the start of the concession in the PT customer barometer



Charging infrastructure

1



Schiphol, Cateringweg, depot: 51 ZE buses

- 7 fast chargers, 450 kW (opportunity charging)
- 21 depot chargers, 60kW with 2 contact hoods
- Grid connection: 5 MW

2



Schiphol, P 30 – parking (charging hub)

- 4 fast chargers 450 kW
- Grid connection: 2 MW



Charging infrastructure

3



Schiphol, Node – North (charging hub)

- 4 fast chargers 450 kW
- Grid connection: 2 MW

4



Amstelveen, Meerlandenweg, depot **49 ZE buses**

- 8 fast chargers, 450 kW (opportunity charging)
- 21 depot chargers, 60kW with 2 contact hoods
- Grid connection: 5 MW (10 MW phase 2)



Amstelveen depot



Delayed introduction of electric buses

➤ Start concession December 10, 2017

Start Electric buses 1. April 2018

➤ **Delay caused by:**

- Delay in obtaining the necessary permits for the construction at Schiphol and Amstelveen.
- Soil contamination at P30
- Soil stability examination – Heavy construction
- Connection towards the energy grid at Amstelveen depot



ELECTRIC BUSES
AT AND AROUND
SCHIPHOL
AIRPORT

2018



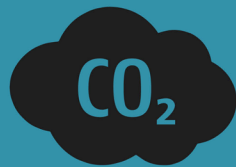
UPON INTRODUCTION **100 BUSES**
Largest electric bus fleet of Europe



phase 2



>210
ZERO EMISSION
BUSES



15,000 ton
reduction a year

24/7 in company



4
charging stations



30,000
ELECTRIC KILOMETRES
A DAY

Phase 2 : December 2020.

- As described within the initial offer, before the start of 2021 additional electric buses will be put in operation.
- These buses will be put on the R-net.
- The Dutch manufacturer named **Ebusco** won the tender for new electric buses, they will supply:
 - 56 units 12 m (40 foot) 2 door low entry buses
 - 21 units 13 m (43 foot) 2 door low entry buses

Both of these bus types will be equipped with a battery pack of 362 kWh, LFP (lithium Iron phosphate) for slow charging.



Phase 2 : December 2020.

56 units 12 (40 foot)
21 units 13 m (43 foot)

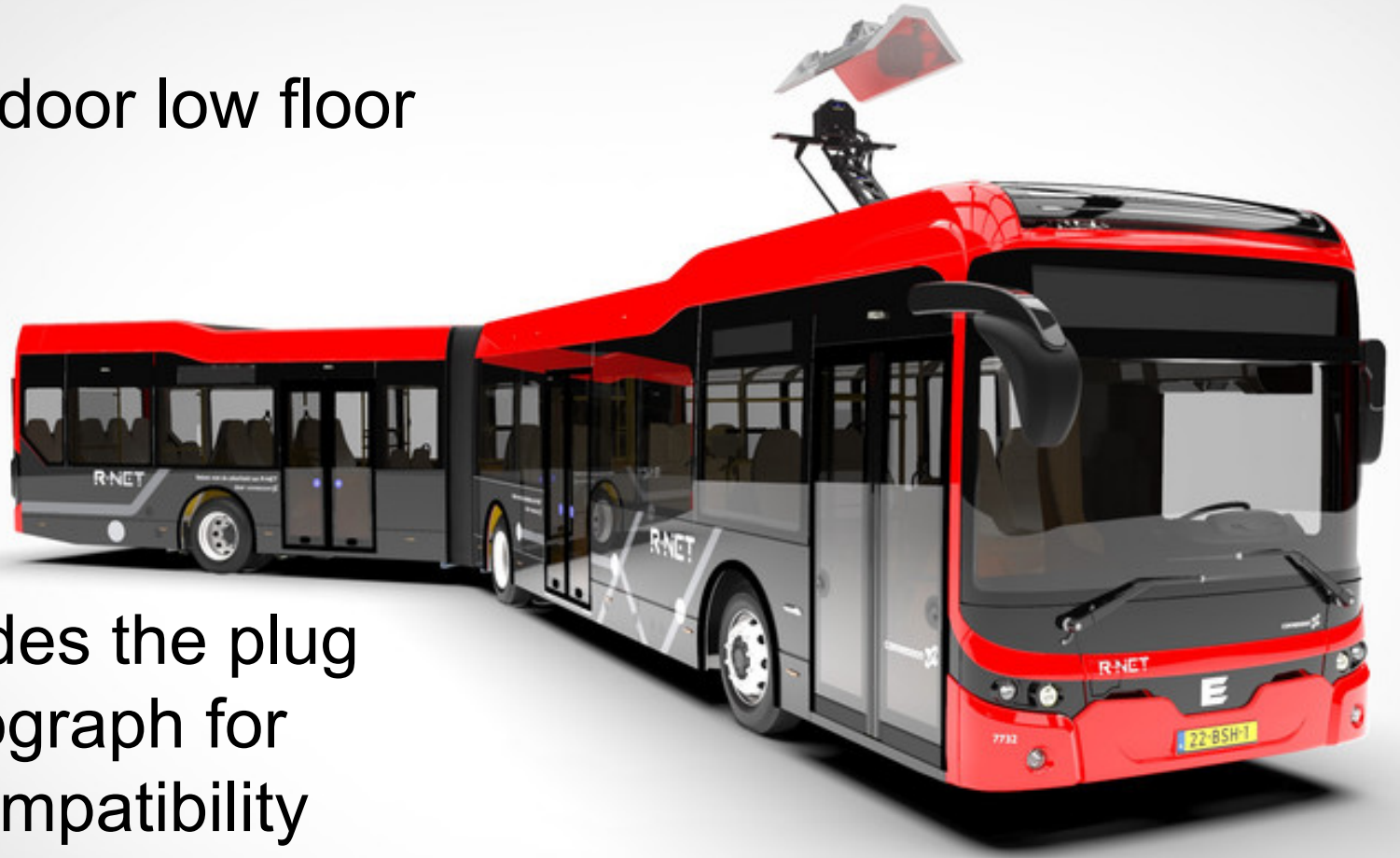


Phase 2 : December 2020.

They will also supply:

- 34 units 18 m (60 foot) 3 door low floor buses
- Battery capacity: 544 kW

All Ebusco buses are besides the plug also equipped with a pantograph for charging the batteries – compatibility with VDL buses



Phase 2 : December 2020.

Charging equipment – consequences

- 6 additional charging hubs
- Primary charging hubs for Ebusco buses in the city of Haarlem with:
 - *46 chargers with a capacity of 50 – 60 kW (t.b.d)*
 - *15 chargers with a capacity of 240 kW*and “Schiphol South” charging hub with
 - *45 chargers with a capacity of 50 – 60 kW (t.b.d)*
 - *2 chargers with a capacity of 240 kW*
- The articulated Ebusco buses can be slow charged with 450 kW therefore 11 chargers with a capacity of 450 kW will be recuperated from the existing equipment and divided over 3 of the new charging hubs.



Phase 2 : December 2020.

For the neighboring public transport concession where Connexxion is also the operator, they have also ordered:

- **45 Ebusco 12 m buses**

The buses will also be partly used for the inter-concession connections towards Amsteland - Meerlanden.

