

# Carbon Free Footprint

Time to plug in!



*Driving Sustainability*



# Index

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# Circular and Sustainable Society



- Everybody wants to go **green** and **circular**! Municipalities (and political agenda`s) want to be first and trending. Rising consumer awareness for sustainability.
- We see more and more (tender) requests for Full Electric RCV`s.
- Our technology is ready to make a positive **ecological** and **economical** impact.
- International Rules & Regulations are pushing for innovative alternatives.

*Driving Sustainability*

# Rules & Regulations



On 17 May 2018, the European Commission presented a legislative proposal setting the first ever CO<sub>2</sub> emission standards for heavy-duty vehicles in the EU “**2030 climate & energy framework**”.

Expected benefits: Around **54 million tonnes of CO<sub>2</sub>** reduced in the period 2020 to 2030 – equivalent to the total annual emissions of Sweden.



Low Emission Zones (**LEZs**) are areas where the most polluting vehicles are regulated. Low Emission Zones are often the most effective measure that towns and cities can take to improve air pollution. Low emission zones reduce emissions of **fine particles**, **nitrogen dioxide** and (indirectly) **ozone**. These are the three main air pollutants of concern in Europe.

EU Member States are obliged to adopt integrated [National Climate and Energy Plans](#) (NECPs) for the period 2021-2030.

# Low Emission Zones (LEZ)



## Status 2019



- Austria
- Belgium
- Bulgaria
- Czech Republic
- Denmark
- Finland

- France
- Germany
- Greece
- Hungary
- Ireland
- Italy

- Latvia
- Malta
- Netherlands
- Norway
- Poland
- Portugal

- Romania
- Slovenia
- Spain
- Sweden
- Switzerland
- United Kingdom

# LEZ – The Netherlands

- In the Netherlands there is a national Framework of LEZ's
- Most cities include lorrie regulations
- Light duty vehicles are increasingly included in LEZ's
- The exception is the Low Emission Zone in the Rotterdam Harbour for heavy duty vehicles, which is a tighter standard
- No stickers or registrations are currently required





# LEZ – United Kingdom



- London: low emission zone, zero emission zones, congestion charges, and a number of access regulations for heavy duty vehicles
- Inner city London is the first with Ultra Low Emission Zone
- Scotland: has its own national LEZ framework
- From 26 October 2020, Low Emission Zone (LEZ) standards will be tighter. Heavy vehicles including lorries, buses and coaches will need to meet the new standards or pay a daily charge to drive within the zone.







## Low Emission Zone

Aberdeen

Bath

Birmingham

Brighton

Dundee

Edinburgh

Glasgow

Leeds

Leicester

London

London Clean Bus Zones

London ZEZ - Islington and Hackney

Norwich

Nottingham

Oxford



# LEZ – Belgium

- There is a draft national low emission zone framework in Belgium and a Flemish LEZ framework





## Low Emission Zone

Antwerpen (Antwerp)

Bruxelles - Brussel (Brussels)

Bruxelles - Brussel (Brussels) -

Emergency Scheme

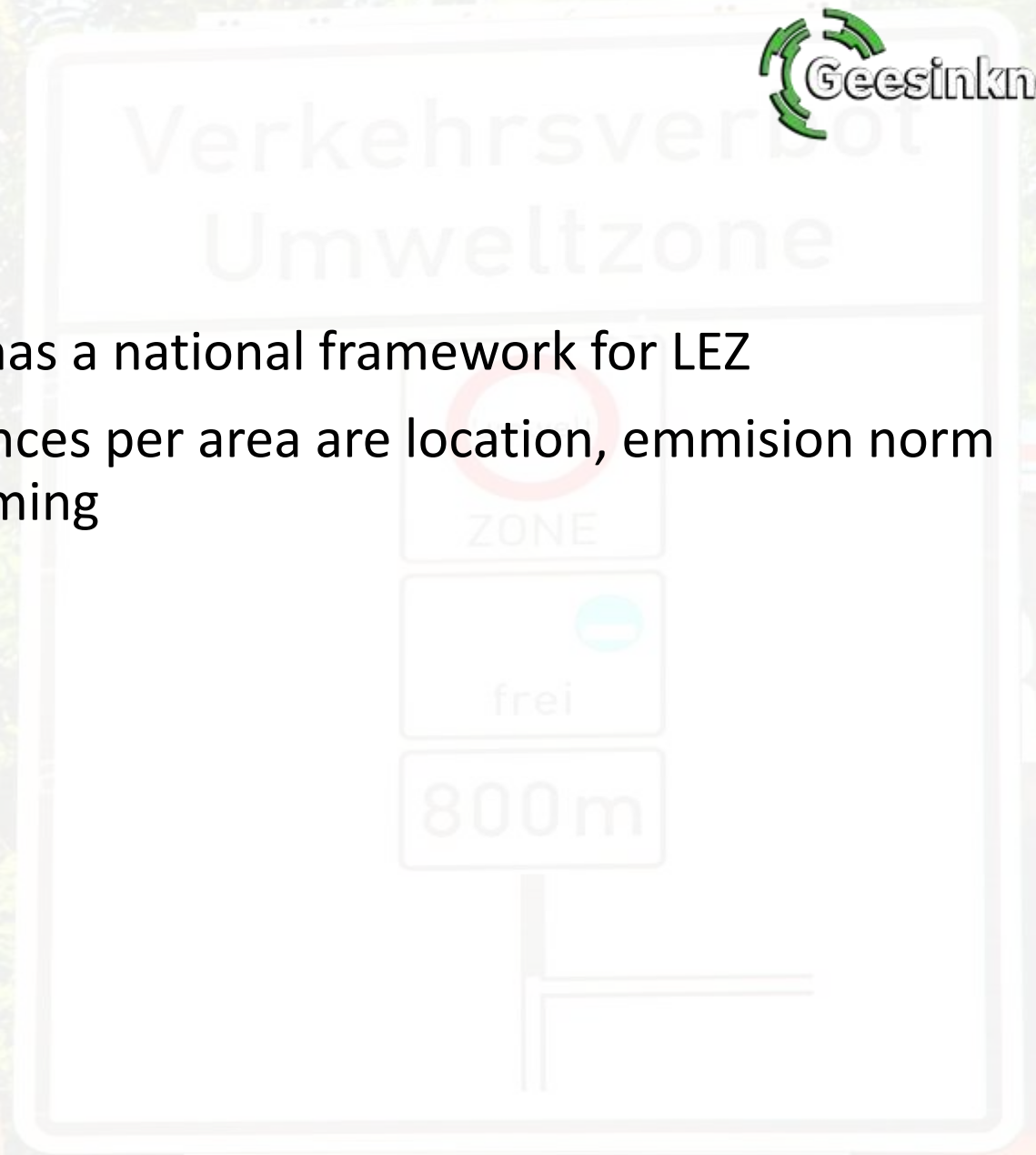
Gent (Ghent)

Mechelen



# LEZ – Germany

- Germany has a national framework for LEZ
- Only variances per area are location, emission norm (sticker) timing



**LEZ Low Emission Zone**

- Aachen
- Asperg
- Augsburg
- Balingen
- Berlin
- Bietigheim-Bissingen
- Bochum
- Bonn
- Bottrop
- Bremen
- Castrop-Rauxel
- Darmstadt
- Dinslaken
- Dortmund
- Duisburg
- Düsseldorf
- Erfurt
- Eschweiler
- Essen
- Frankfurt
- Freiberg am Neckar
- Freiburg
- Gelsenkirchen
- Gladbeck
- Hagen
- Halle (Saale)
- Hamburg
- Hannover

- Heidelberg
- Heidenheim
- Heilbronn
- Herne
- Herrenberg
- Herten
- Ilfeld
- Ingersheim
- Karlsruhe
- Köln (Cologne)
- Kornwestheim
- Krefeld
- Langenfeld
- Leipzig
- Leonberg
- Limburg
- Ludwigsburg & area
- Magdeburg
- Mainz
- Mannheim
- Marburg
- Markgröningen
- Möglingen
- Mönchengladbach
- Mühlacker
- Mülheim
- München (Munich)
- Münster
- Neu-Ulm

- Neuss
- Oberhausen
- Offenbach
- Osnabrück
- Overath
- Pfintzal
- Pforzheim
- Pleidelsheim
- Recklinghausen
- Regensburg
- Remscheid
- Remseck
- Reutlingen
- Schramberg
- Schwäbisch-Gmünd
- Siegen
- Stuttgart
- Tamm
- The Ruhr area, Nordrhein-Westfalen
- Tübingen
- Ulm
- Urbach
- Wendlingen
- Wiesbaden
- Wuppertal



# LEZ – France

- Some LEZ only impact heavy delivery vehicles
- France maintains emergency policy “ZPA” (zone de protection de l'air) during heavy polutions (cities and rural)

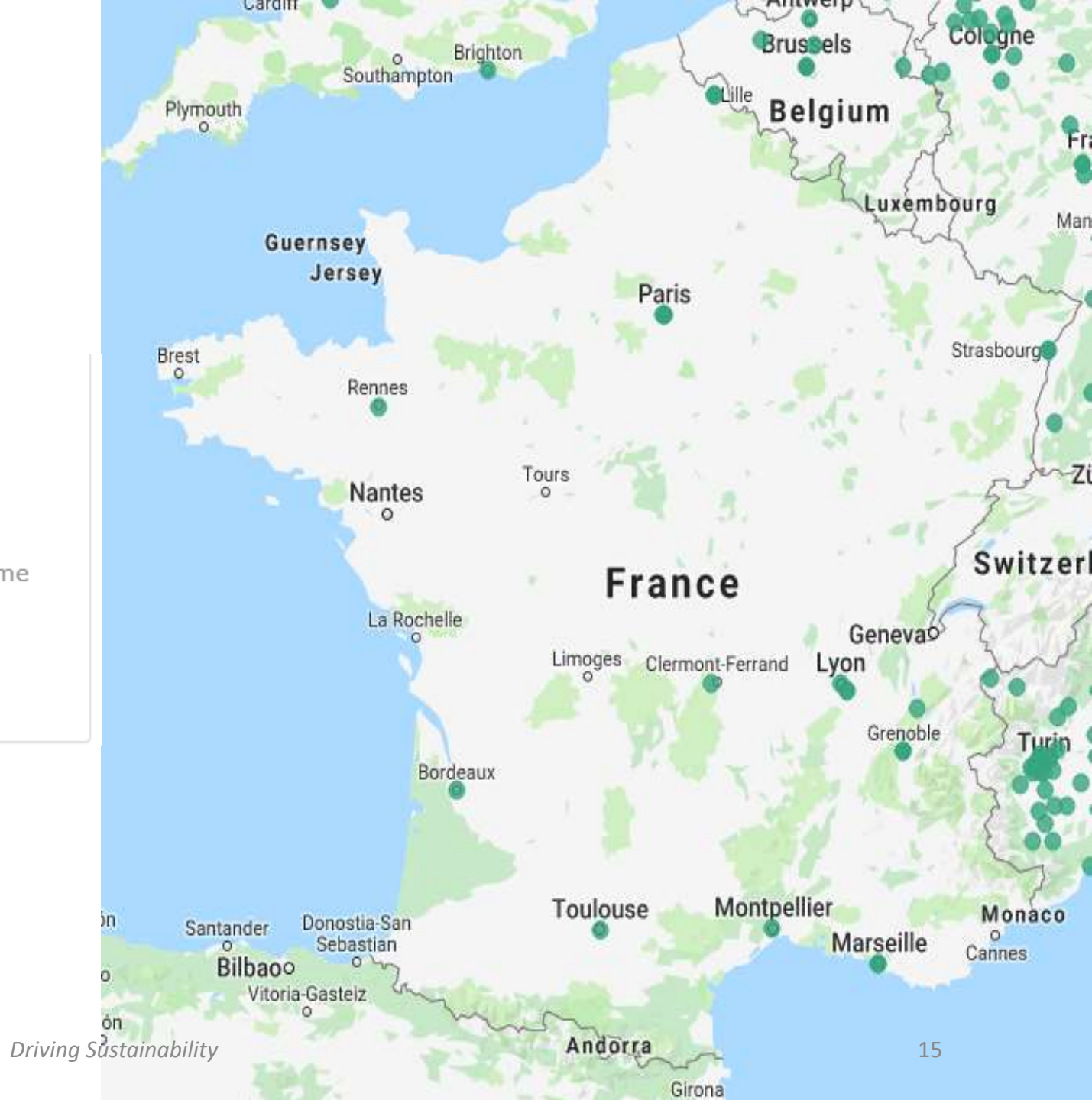




# Low Emission Zone

- Chambery - Noodplan
- Clermont
- Franse noodplannen
- Groot Parijs
- Grotere Reims
- Grenoble
- Grenoble - Emergency Scheme
- Lille - Noodschema
- Lyon
- Lyon - Villeurbanne - Emergency Scheme
- Marseille
- Marseille - Noodstelsel
- Montpellier
- mooi
- Parijs
- Parijs - Emergency Scheme
- Rennes

- Rouen
- Saint-Étienne
- Straatsburg
- Straatsburg - Emergency Scheme
- Toulon
- Toulouse - Noodstelsel



# LEZ – Spain



- Spain has low emission zones, emergency schemes and access regulations.
- Windscreen Stickers are required for the low emission zones
- Environmental zones; Zona de Bajas Emisiones (ZEB) and Area Central Cero Emisiones (ACCE)







## Low Emission Zone

Barcelona

Madrid - Emergency Scheme

Madrid - LEZ - Traffic Limited Zone

Madrid Parking LEZ

Sevilla - Emergency Restriction

Valencia - Emergency Restriction

Valladolid - Emergency Restriction



# LEZ – Italy



- Italy has many different low emission zones with differing standards and time periods
- Mainly in North Italy, but also in mid Italy and Sicily, combined LEZ and urban road tolling schemes in Milan and Palermo.
- There are also over 200 camera enforced Access Regulations all over Italy



Abruzzo



Aosta, Valle d'



Basilicata



Bozen(Südtirol)



Calabria



Campania



Emilia-Romagna



Friuli-Venezia Giulia



Lazio



Liguria



Lombardia



Marche



Molise



Piemonte



Puglia



Sardegna



Sicilia



Toscana



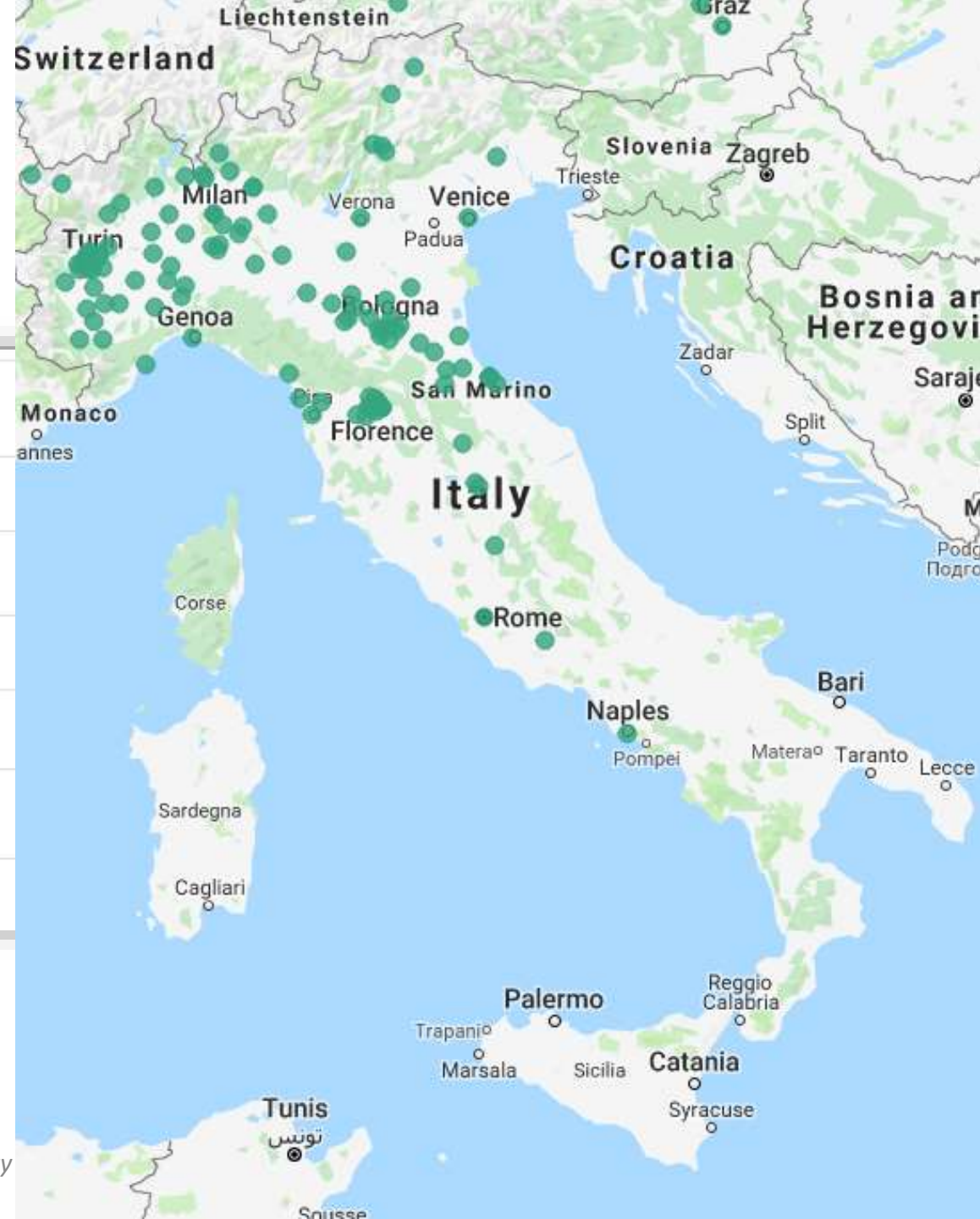
Trentino



Umbria



Veneto



# LEZ – Nordics



- Some Norwegian cities have a Low Emission Zones, in that the cost of the road toll is higher for more polluting vehicles
- Emergency pollution schemes in times of high air pollution have also started some Norwegian cities



- There is a national framework of low emission zones in Denmark, which affects heavy duty vehicles only
- The low emission zones national framework means that all low emission zones have the same standards and dates; only the location varies by city

# LEZ – Nordics

- Sweden has a national framework with low emission zones in 8 cities
- In Finland (Helsinki) there is a low emission zone affecting local public transport buses only, and an access regulation affecting lorries



### Low Emission Zone



Göteborg (Gothenberg)

Helsingborg

Lund

Malmö

Mölnadal

Stockholm

Umea

Uppsala



### Low Emission Zone



Aalborg

Århus

København (Copenhagen) &

Frederiksberg

Odense



### Low Emission Zone



Bergen

Bergen - Emergency Scheme

Oslo

Oslo - Emergency Scheme

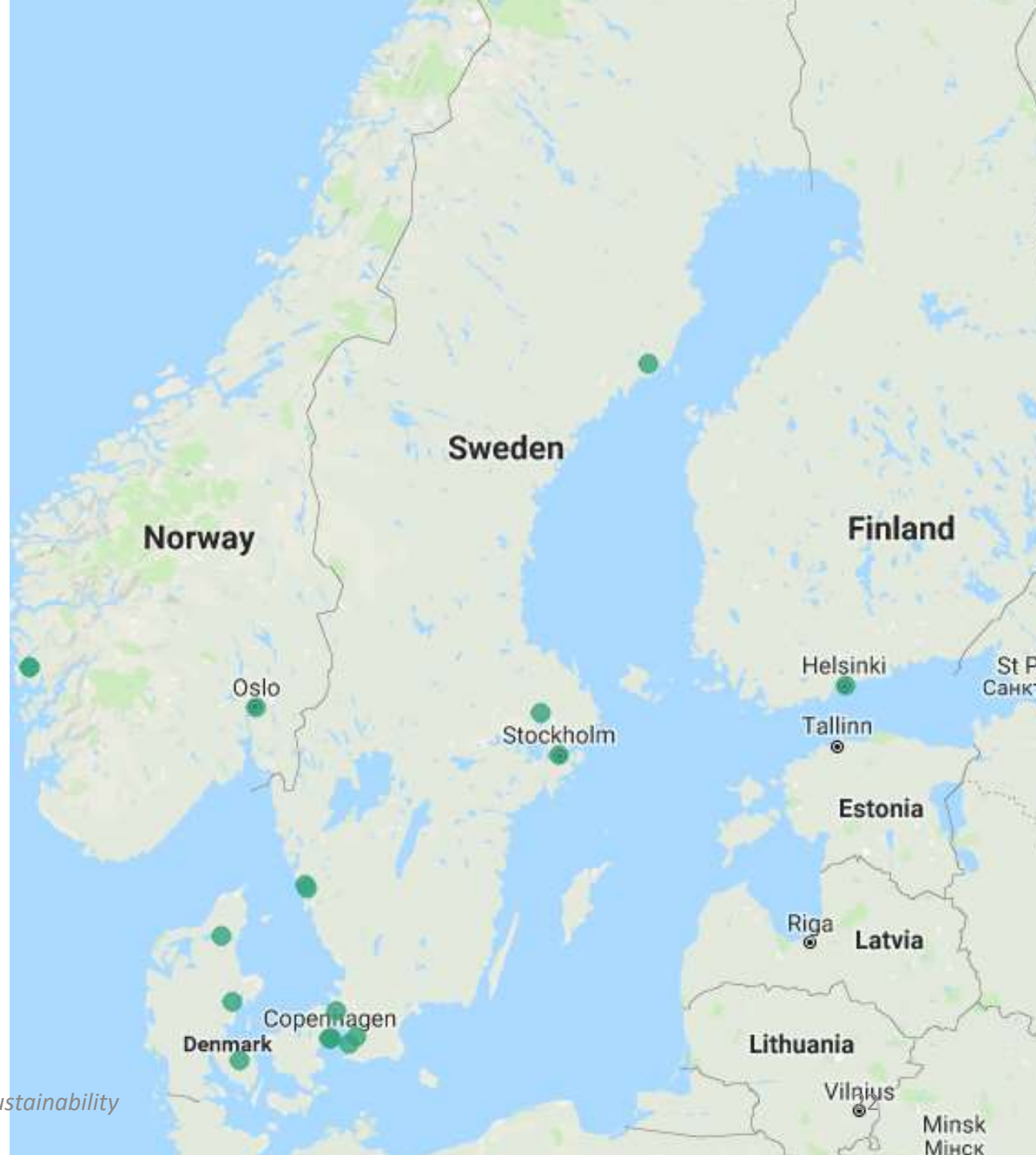
Trondheim



### Low Emission Zone



Helsinki



# LEZ – Austria

- There is a national low emission zones framework with Stickers for lorries
- A number of Provinces and cities have low emission zones for lorries
- Tirol has a 'A12 motorway lorry low emission zone' and various other regulations on the A12 to reduce pollution





## Low Emission Zone

A12 Motorway (Tirol)

Burgenland

Graz

Niederösterreich

Oberösterreich

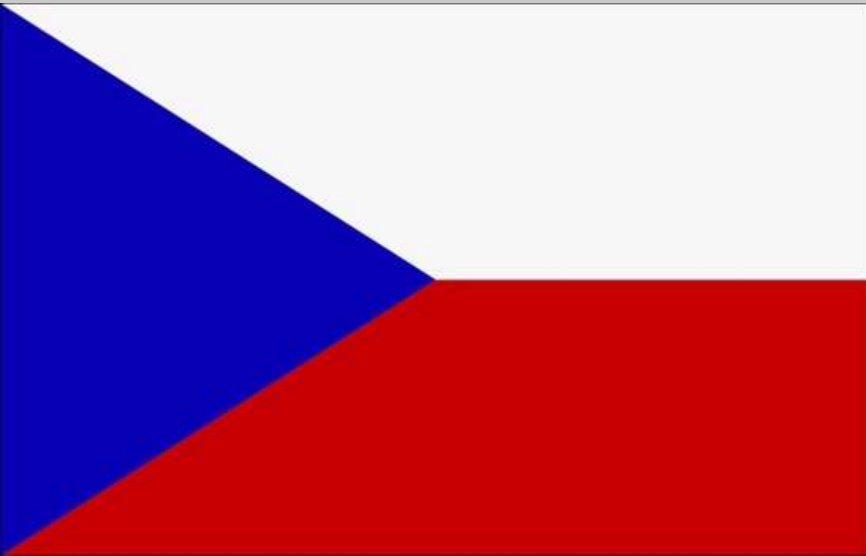
Steiermark

Wien (Vienna)





# LEZ – East Europe



- In the Czech Republic there are a number of cities with Access Regulations. Prague has a lorry permit-low emission zone, and is planning a general low emission zone
- There is a national low emission zone framework, and other cities are considering low emission zones

Poland has a number of Access Regulation Schemes in the main cities





## Low Emission Zone

Praha (Prague)

Praha (Prague) - Access Regulation -

Lorry LEZ



## Low Emission Zone

No Scheme



# Ideal use case today

- Full EV RCV range is app. **150km-500km** so ideal for urban and sub-urban usage (sound emissions).

Bergen

Stavanger

Manchester

Rotterdam

London

Amsterdam

- Any type of our body or compaction mechanisms is suitable (LPP) for electric power. So all fractions can be collected!
- No dedicated charging station needed. Easily charge safely in your own depot (**400VAC 3 phase 63A or 32A** ).

No excuses - access every bin!



# Moving Electric

## Conventional



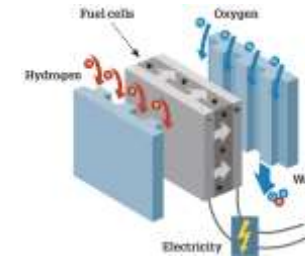
*Removal of:*  
Combustion engine  
Gearbox  
Fuel tanks  
Exhaust system  
Power steering control  
Heater  
Air Conditioning



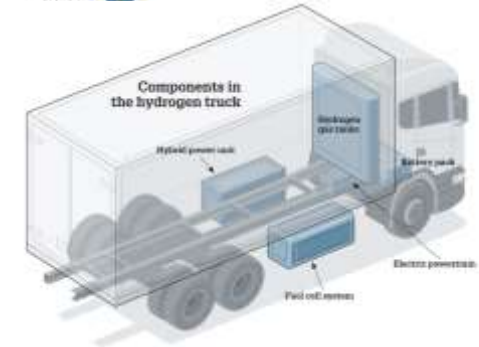
## Full Electric



*Installation of:*  
Electric Drive motor  
Special gearbox (optional)  
Battery pack  
Speed controller  
Charging system  
Power steering control  
Heater  
Air Conditioning



## Hydrogen



*Installation of:*  
Electric Drive motor  
Special gearbox (optional)  
Battery pack  
Speed controller  
Charging system  
Power steering control  
Heater  
Air Conditioning  
Hydrogen fuel cell  
Hydrogen fuel tanks

# Our vision on (Zero-)Emission

We believe that **by 2020** any fleet should be able to collect and manage more resources while being **totally emission free!**

As **pioneers in waste** we have been engineering and developing electrical waste management solutions **since 2003.**

**The results are here, time to plug in!**

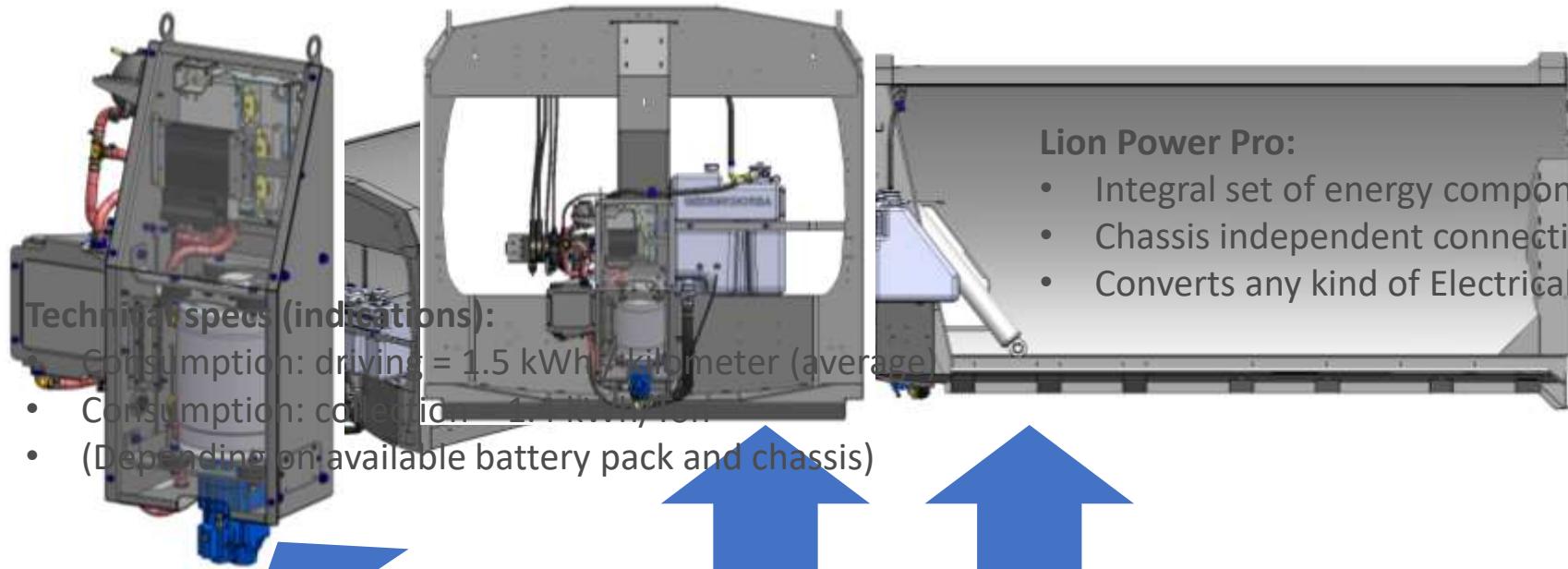
# Powering the body and loader (2)

## Li-On Power Pro



**E-PTO**

# Li-On Power Pro



### Lion Power Pro:

- Integral set of energy components
- Chassis independent connection
- Converts any kind of Electrical input

### Body:

- Single sheet
- Smart durable construction
- Maximum volume

### Loader:

- Short rear build
- Sound emission whispering quiet
- Operating cycle time 25s

### Technical specs (indications):

- Consumption: driving = 1.5 kWh/kilometer (average)
- Consumption: collection = 2 kWh/ton
- (Depending on available battery pack and chassis)

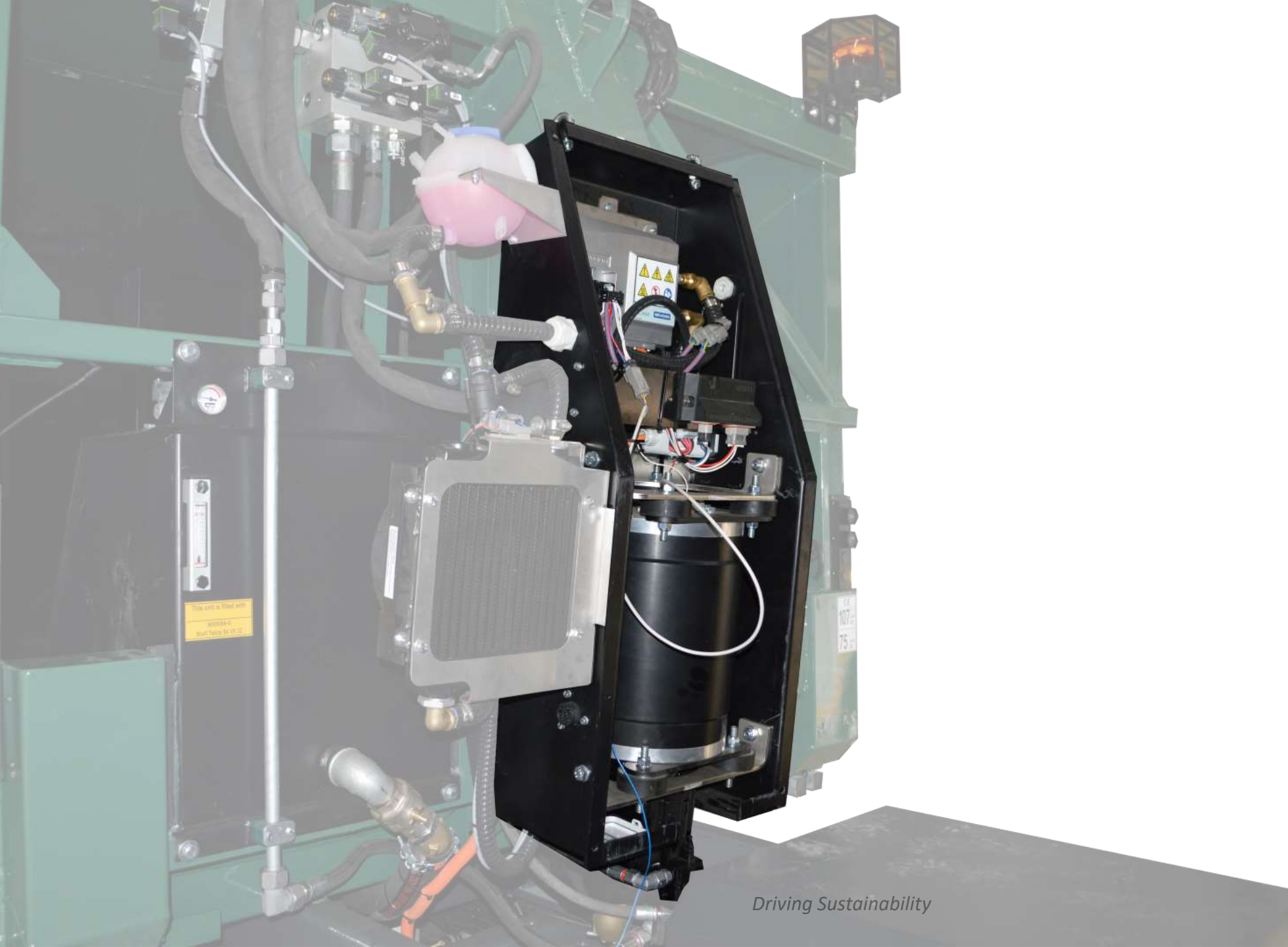




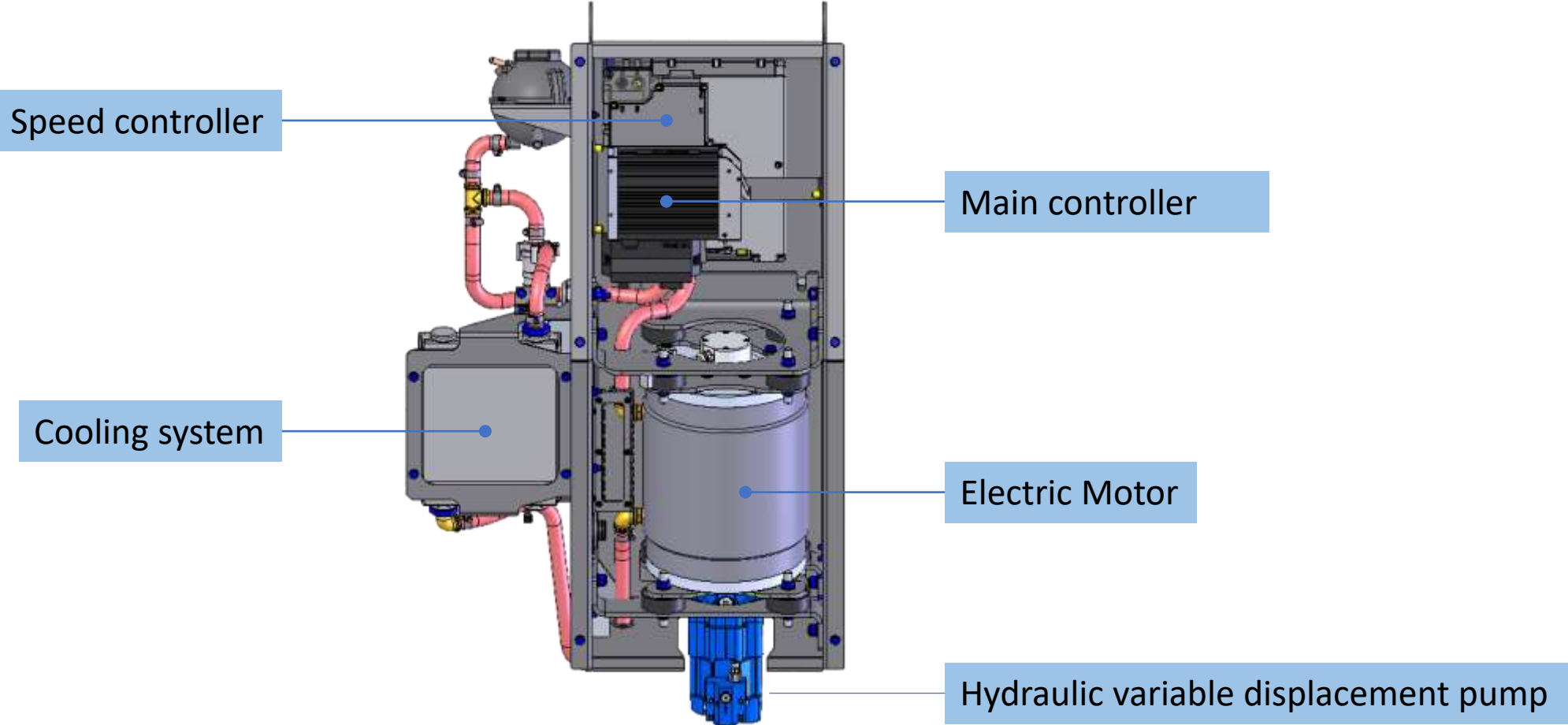
# Chassis independant configurations

**Our Intelligent Li-On Power Pro (LPP) Module connects with any electrical chassis**





# Li-On Power Pro



# Advantages LPP vs E-PTO



## Effectivity:

- The Lion Power Pro is a chassis independent system as we only need a High Voltage (600-800VDC) connection and CAN bus connection.
- Extremely convenient in use for operators as response time from our LPP is very short and thus quick.
- Single power source for both chassis and body, no need to carry extra batteries. Results in optimum payload.

## Energy management:

- LPP controls the body in a smart dynamic way as where E-PTO steers body in a static way (on/off).
- Being dynamic means demand and control of pressure and flowrate is known and verified online. Results in extreme economic use of available energy.
- We can run a GN body using only 1.4kWh per ton collected, compacted and dumped waste. An E-PTO is general developed and oversized. No smart control and thus excessive use of energy.

## Serviceability:

- Clear separation between chassis and body, very clear where responsibility starts and ends, easy to service. Shortest possible downtime.



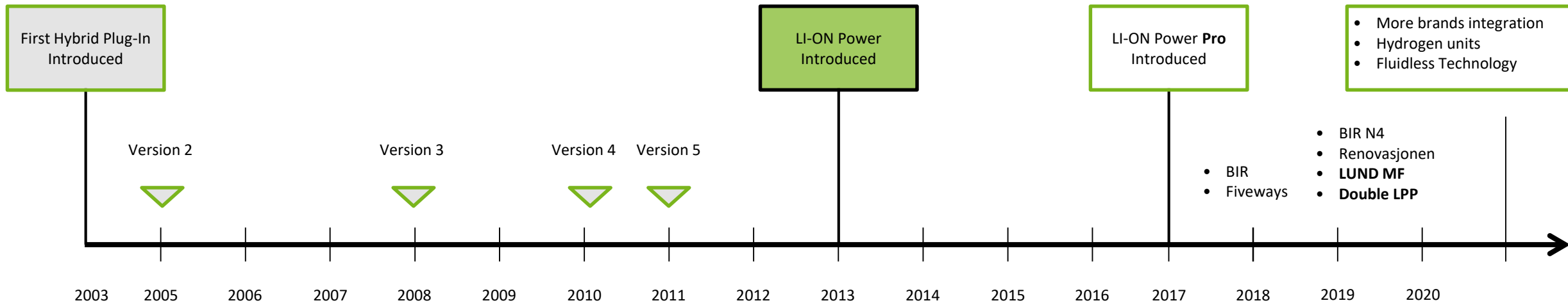
# Electric technology developments

Hybridplugin

LI-ON POWER

**LI-ON Power Pro**

Full Electric RCV



# Technology ready chassis options



LF FA 12t 4x2  
LF FA 14t 4x2  
LF 16t 4x2  
LF FA 19t 4x2



CF FAN 27t 6x2



TGL 12t 4x2



TGM 15t 4x2  
TGM 18t 4x2



TGS 26t 6x2



Mercedes-Benz  
Trucks you can trust



Atego 13.5t 4x2



Antos 18t 4x2



Econic 18t 4x2  
Econic 27t 6x2



Stralis





# Ecosystem partners

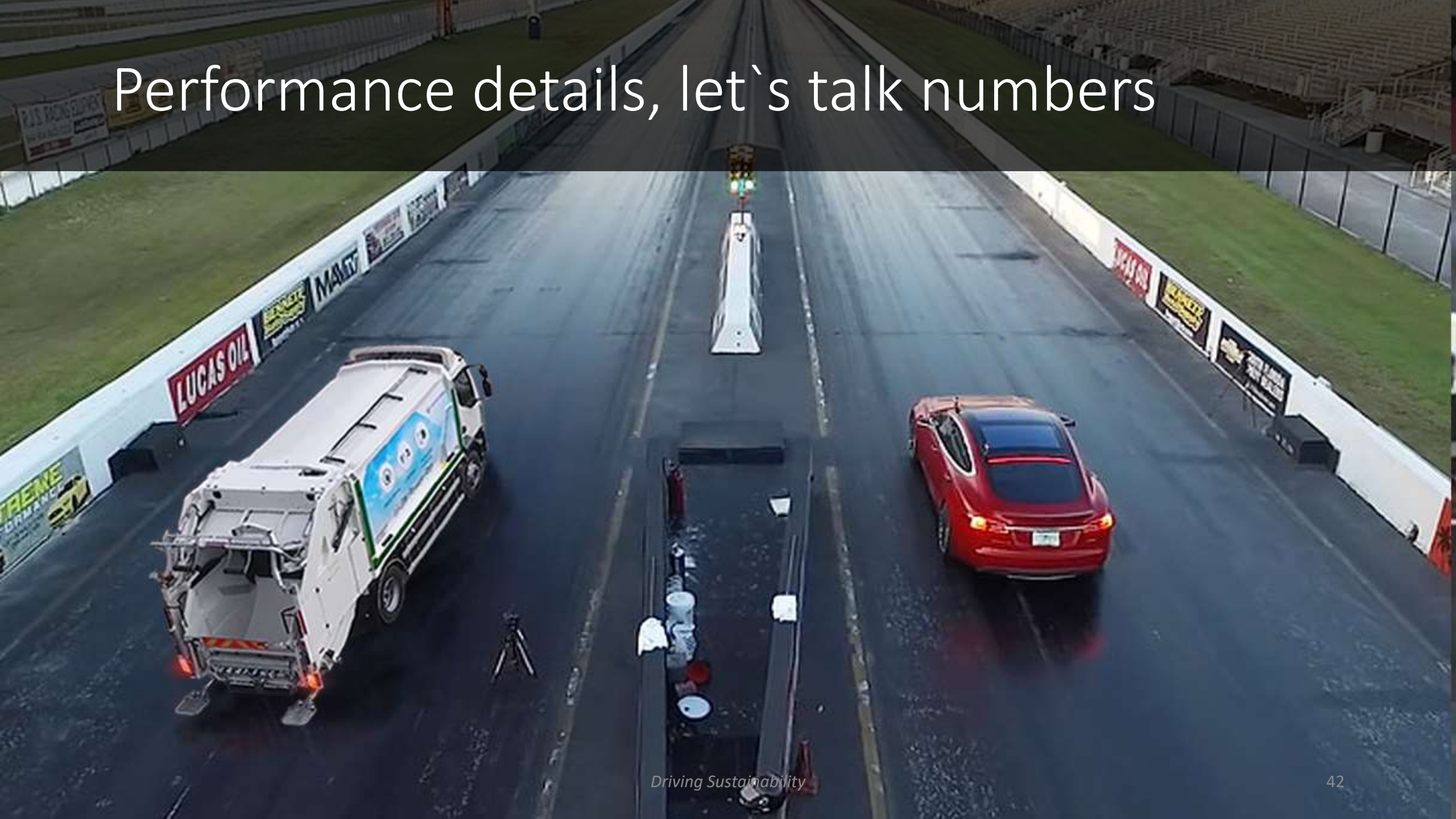


- Electrification Chassis:
  - Emoss (since 2013 EV)
  - E-Trucks (1st hydrogen in pilot phase)
  - E-Force One
- Conversations regarding integration of the Lion Power Pro are going on at the moment with:

	2018	2019	2020	2021
Scania ( <i>Hybrid</i> )	Yellow	Yellow	Green	Green
Renault ( <i>Full Electric</i> )	Yellow	Yellow	Green	Green
DAF ( <i>Full EV</i> )	Yellow	Yellow	Green	Green
BYD	Yellow	Yellow	Yellow	Green
Ginaf	Yellow	Green	Green	Green

The Lion Power Pro is in general praised by the chassis manufacturers

# Performance details, let`s talk numbers



# Performance details



- A full electric RCV consumes between **0.8 and 1.5 kW per kilometer**. This does depend a lot on the driver and way of driving. (Right foot matters)
- Collecting waste consumes in average **1.4 kW per ton** collected and compacted waste. Depending on the type of waste.

	<b>Leeds City Council</b>	<b>Stockton on Tees</b>	<b>Sheffield (Veolia)</b>	<b>Leeds City Council (2)</b>	<b>City of Westminster</b>
	Average Per Day	Average Per Day	Average Per Day	Average Per Day	Average Per Day
<b>Data</b>					
Hours on Shift	6,75	9	7,17	7	9
Tonnage Collected	19,65	18	22,92	21	5
Containers Lifted	907	1158	1100	1055	103
Mileage	80	109	66	55	59
Battery Utilisation KW	181	181	140	161	146
Battery Capacity Used	91%	91%	70%	81%	73%
Power Cost £	18,1	18,13	14	16,1	14,6

Long Distance Test	0.92KM/KWHR	1.08 kWh/KM
56MPH on M40	0.92KM/KWHR	
Leeds to Stockton Mway	1.05M/kW hr	0.95kWh/KM

1 liter of diesel produces 3.13 kg CO<sub>2</sub> (VECTO tool)

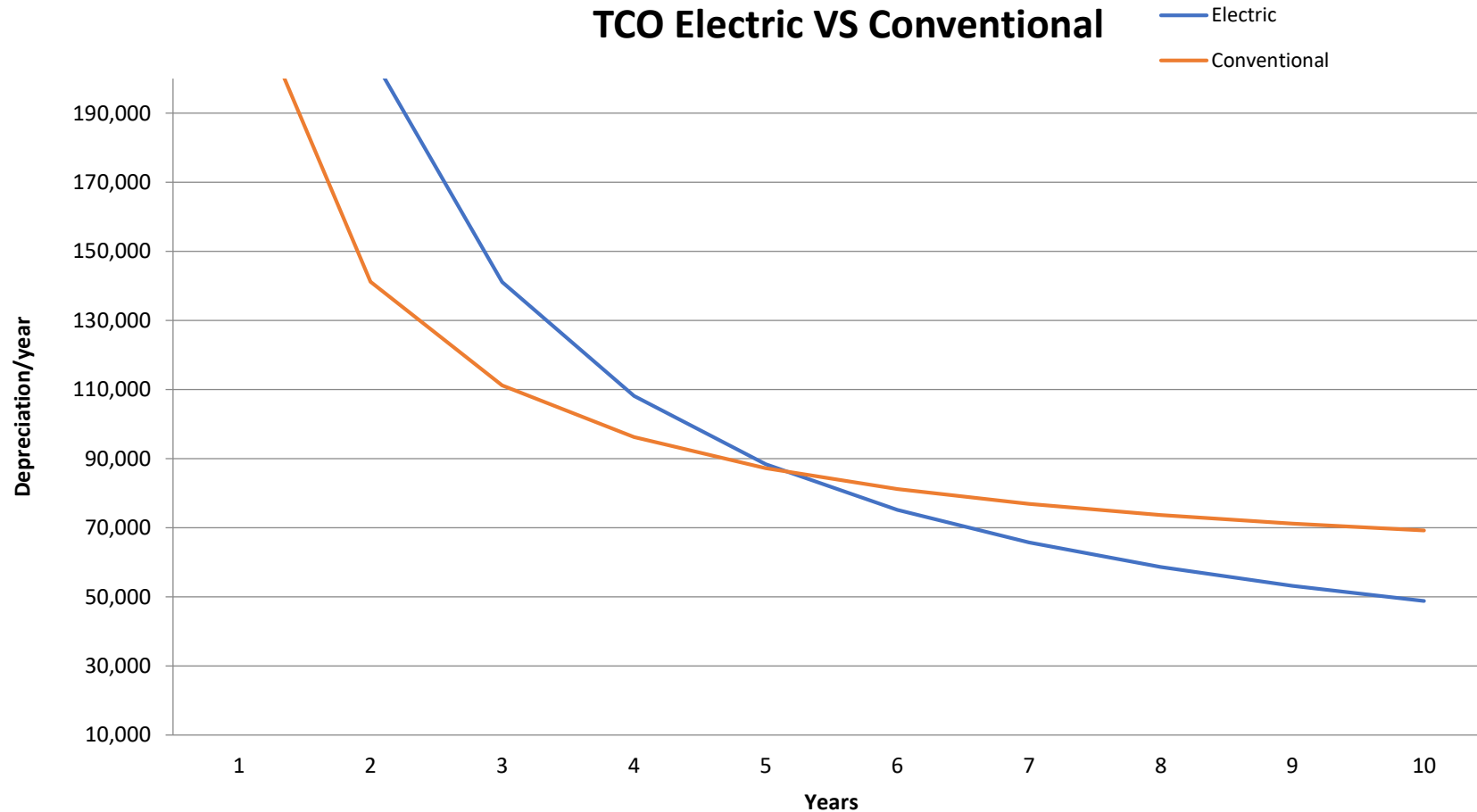
100 km/day results in 313 kg CO<sub>2</sub>/day

Per year **81.4 ton of CO<sub>2</sub> per RCV**

When charging with 100% green power, CO<sub>2</sub> emission is 0



# Total Costs of Operations (TCO)



#### Parameters TCO:

- 260 operational days
- 100km a day
- 8 operating hours a day
- 160 kWh electricity consumption a day
- 100 l diesel comparative
- 100% Depreciation in 9 years
- Costs of electricity E. 0,1 kWh

# Customer thoughts on Full Electric



- **Range:** An average RCV in urban operation does between 60 and 100 km a day. Today depending on the size of the vehicle we can carry batterie packs from 130kWh up to 600kWh.
- **Weight:** Full electric RCV's can be delivered in the same variety as the conventional ones.
- **Wheel base:** as full electric RCV's carry their batteries between front and rear wheel, this cannot be too small and average we need 3900 wheelbase.
- **Body:** Full electric RCV's can be equipped with the same bodies as the conventional ones. No experience yet with KT versions
- **Convenience:** A full electric RCV has the same convenience compared to the conventional ones. Bin lift speeds and compaction cycles are similar as conventional ones.

*“Full Electric & Hydrogen is our  
PRESENT and also the way  
towards the FUTURE”*

*André Lagendijk,  
Product Manager Electric*

# Reference cases





# Ferrovial Spain



## Initial trail from 2017 unit in operations in Spain

### Chassis

Brand	DAF LF 4x2 19 Ton
Wheelbase	4 150mm

### Body & lift

Geesink	GPM IV 16m <sup>3</sup> GeesinkNorba Trade lift
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### Payload

5 200 kg

### Drivline

Engine power	280kW
Engine voltage	740volt

### Gearbox

No gearbox, direct drive.

### Battery pack

200 kWh Lithium- LION  
270 kWh with Narada cells \*

### Charger on board

44 kW

### Range with max load

210 km (50%loaded) N.E.D.C cycle

### Top Speed

85km/h

### Charging Time(44kW)

-100% capacity	4,5 hours
- 50% capacity	2 hours

### Required Power Supply

3 phase, 400V, 63Amp



# RTR



*“Results are beyond expectation”*



### Chassis.

Brand Mercedes Econic 6x2  
27 Ton  
Wheelbase 3 900mm

### Body & lift.

Geesink GPM IV 21m<sup>3</sup>  
Terberg OmniDEL Split Lift  
(3rd Party)

### Payload.

9 900 kg

### Driveline.

Engine power 380 kW  
Engine voltage 650 volt  
Gearbox No gearbox, direct drive ?  
Battery pack 200 kWh Lithium- LION  
Charger on board 44 kW  
Range with max load cycle 135 km (50%loaded) N.E.D.C  
Top Speed 85km/h  
Charging Time(44kW)  
-100% capacity 4,5 hours  
- 50% capacity 2 hours  
Required Power Supply 3 phase, 400V, 63Amp

# Fiveways



A 2<sup>nd</sup> rental unit with delivery in 2019 for UK



<b>Chassis</b>	
Brand	Mercedes Econic 6x2 26 Ton
Wheelbase	3 900mm
<b>Body &amp; lift</b>	
Geesink	GPM IV 21m <sup>3</sup> Geesink Split lift
<b>Payload</b>	9 900 kg
<b>Drivline</b>	
Engine power	350 kW
Engine voltage	650 volt
Gearbox	Alison gearbox
Battery pack	200 kWh Lithium- LION
Charger on board	44 kW
Range with max load	150 km (50%loaded) N.E.D.C cycle
Top Speed	85km/h
Charging Time(44kW)	
- 100% capacity	5 hours
- 50% capacity	2,5 hours
Required Power Supply	3 phase, 400V, 63Amp

# BIR



“In order to meet the region’s environmental credentials and targets set for low emission vehicles working in Bergen city centre by 2020, we selected the GPM Mini hybrid/EMOSS battery powered chassis combination. (John Gaule Kvinge, CEO of BIR)



<b>Chassis</b>	
Brand	DAF LF 4x2 12 Ton
Wheelbase	4 150mm
<b>Body &amp; lift</b>	
Geesink	GPM MINI 7 m <sup>3</sup> GCB 550 lift
<b>Payload</b>	3 600 kg
<b>Drivline</b>	
Engine power	150 kW
Engine voltage	650 volt
Gearbox	No gearbox, direct drive.
Battery pack	120 kWh Lithium- LION 150 kWh with Narada cells *
Charger on board	44 kW
Range with max load	130 km (50%loaded) N.E.D.C cycle
Top Speed	85km/h
Charging Time(44kW)	
-100% capacity	3 hours
- 50% capacity	1,5 hours
Required Power Supply	3 phase, 400V, 63Amp

# BIR



“Every day we are amazed by the performance of the unit being beyond expectation!”



#### Chassis.

Brand DAF CF 75 Day Cab 4x2  
26 Ton  
Wheelbase 4 000mm

#### Body & lift.

Geesink Norba N4 22 m<sup>3</sup>  
New L200

#### Payload.

10 000 kg

#### Drivline.

Engine power 250 kW  
Engine voltage 650 volt

#### Gearbox

Alison gearbox.

#### Battery pack

280 kWh Lithium- LION with Narada cells  
400 kWh with Narada cells & 4 600 WB \*

#### Charger on board

44 kW

#### Range with max load

210 km (50%loaded) N.E.D.C cycle

#### Top Speed

85km/h

#### Charging Time(44kW)

-100% capacity 6.5 hours  
- 50% capacity 3,5 hours

#### Required Power Supply

3 phase, 400V, 63Amp

\* Possible to get but need wheelbase of 4 600mm

# Renovasjonen IKS



I am confident buying waste collection vehicles from Geesinknorba Nordic because the after sales and back up service is first class (Mr Kjel Age Nygard)

- Location: Stavanger
- Year delivered:2019
- Number of units:1
- Type of unit
  - Chassis:DAF
  - Body: GPM mini
  - Loader:GCB 550
  - Other:



# Solution benefits

*“ELECTRIC VEHICLES ARE MORE PROFITABLE AND INTERESTING THAN EXPECTED!”*



Purchase Manager

*“THE LOW MAINTENANCE AND OPERATIONAL COSTS ARE A GAME CHANGER”*



Fleet Manager

*“ELECTRIC RCV DRIVES AND OPERATES BRILLIANT PLUS I`M HOME EARLY!”*



Waste Collector

# Advantages Li-On Power Pro

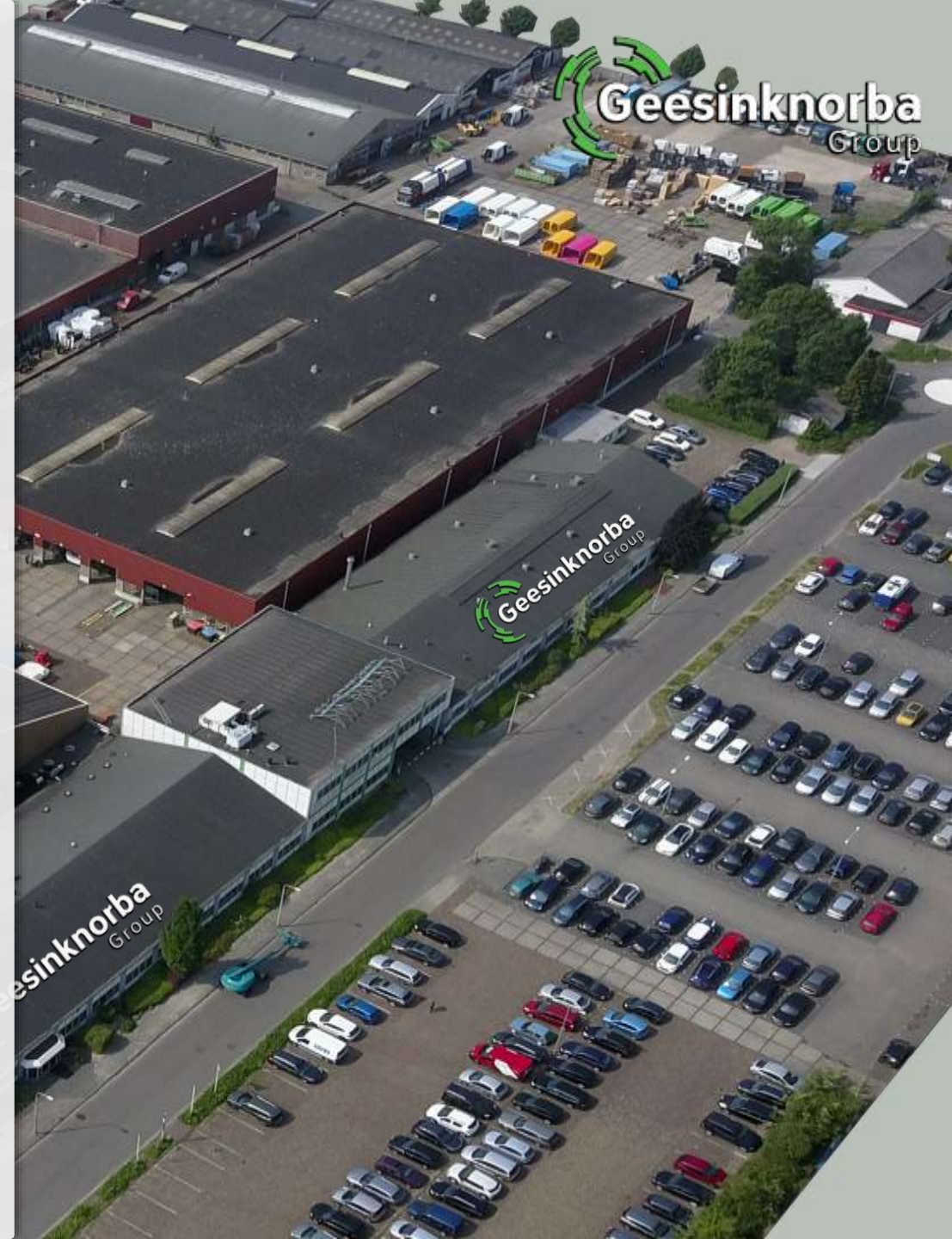


- Product benefits Li-On Power Pro:
  - *Proven technology*
  - *Chassis agnostic*
  - *2nd life for chassis (conversion)*
- Ecological and image benefits:
  - *Zero-emission of: noise, particles and carbon!*
  - *Cleaner working environment for collection industry*
  - *Enthusiastic drivers and loaders*
- Economical / Financial benefits:
  - *Lower operational costs (TCO)*
  - *Future prove investment (0-emission program)*
  - *Applying to rules & regulations*



# About Geesinknorba

- Almost 150 years waste collection excellence
- All disciplines in-house
- Coverage all across Europe
- Focus on innovation



# Company Profile

## Factories



**RCV Production**  
Geesink & Norba  
(Emmeloord, NL)



**Compactor  
production**  
Kiggen (Spain)

## Service Locations



97 Service Locations



57 Service Vans



32 Warehouses

## Employees



530



39

## Instal base



RCV 7,500+








Compactors 2,000+

# Coverage



 **GNG United Kingdom**

 **GNG Nordics**

-  GNG Service van
-  GNG Service location
-  GNG Warehouse
-  External Service location
-  External Warehouse

 **GNG Benelux**

 **GNG Export Russia / Poland**

 **GNG Germany**

 **GNG France**

 **GNG ROW**

 **GNG Spain**

 **GNG Italy**

 **GNG Export EE**

We are always there to keep you moving!



# GNGConnect - Telematics



*GNG Connect offers real-time body performance information that will help you to optimize your collection activities*



- Insights in routes per vehicle
- Real time display vehicle
- Insight in daily use/abuse of the vehicle
- Cumulative counters



- Detailed vehicle information:
- Body - #lifts, running hours, engine RPM
- Chassis - Fuel levels, oil indication, speeds, mileage
- Events (PTO on/off, engine on/off)
- Overview collected # bins, both 2W and 4W
- Engine parameter overview



- Export to Excel or XML file for further analyzes

**“It is our mission to become a leading global company in the waste management industry by driving the electrification of waste collection products and services”**

*(XAVIER MARTI DURAN, CEO GEESINKNORBA)*

Thank you for your attention!