



Transports Metropolitans
de Barcelona



WELCOME “LIFE” INNOVATION:TMB USE CASE

Barcelona, SEPTEMBER 2017

INDEX

- General figures about public transport.
- TMB figures: Innovation.
- First steps in Electromobility in a bus operator TODAY.

Principle: BUS IS CLEAN TRANSPORT

Alternative fuel technologies should be introduced in a way that not endanger the urban transport mission: Transport people from A to B, safely and efficient

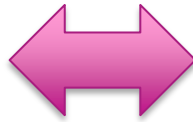
Urban Transport contributes less than 8% to transport pollution

The real environmental benefit will come from a MODAL SHIFT: from private to public transport

OUR GOAL: THE BEST MOBILITY!!!!

- Quality of life of citizens ensuring
- Quality of service to passengers

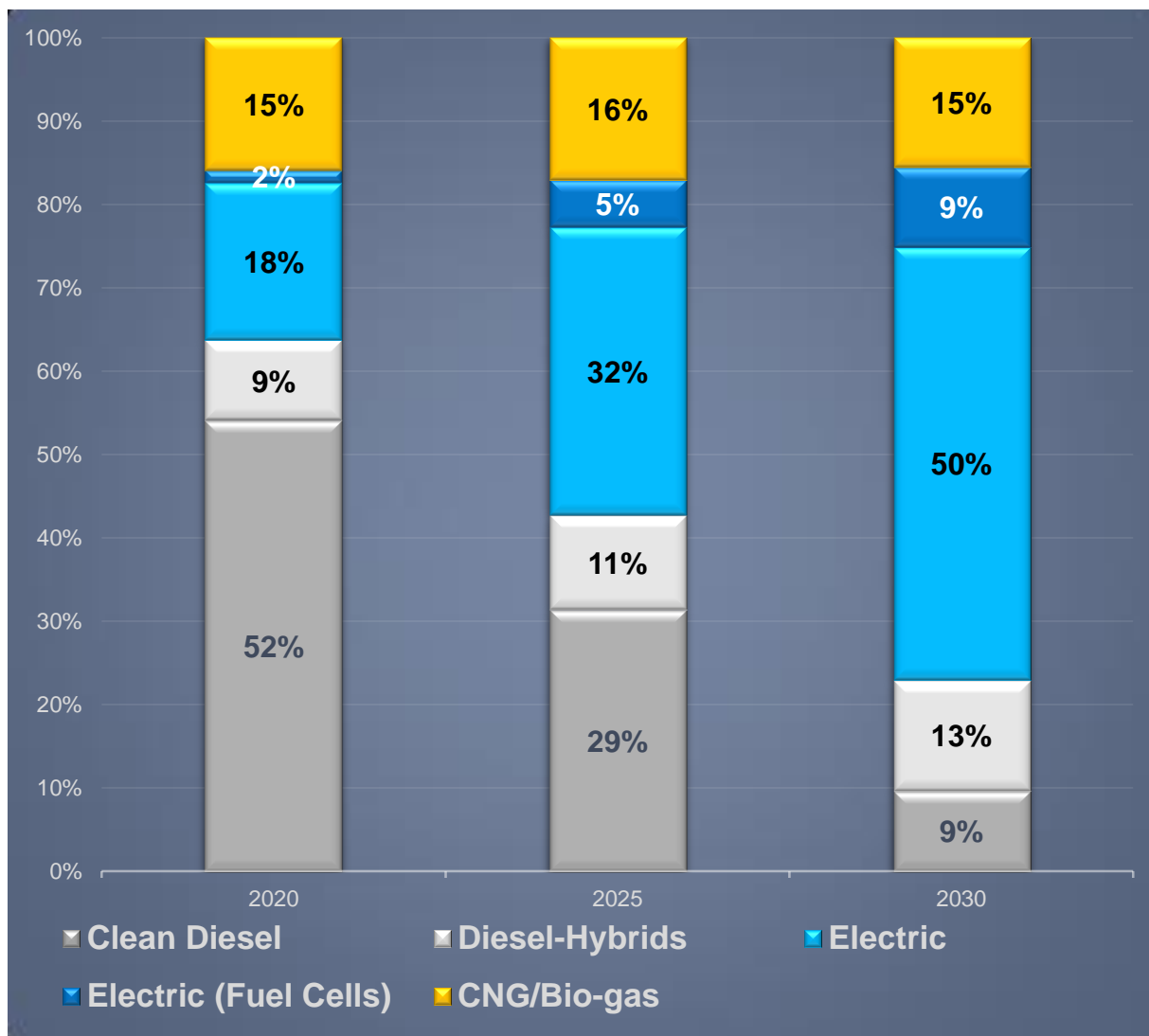
DECARBONISING PUBLIC TRANSPORT



- Accessible, Comfortable, Cleaner **Vehicles**
- Improved **commercial speed**
- **PT Dedicated Infrastructure**
- **Traffic & operations management**
- Efficient **Combined mobility**
- Smart use of **energy in vehicles**
- **Modal shift**



EU URBAN BUS MARKET SHARE EVOLUTION



In Europe today more than 45% of buses are Euro III or older

Renew the old fleet

Bus contribution to urban pollution has must be calculated per passengers per km.


 Transports
Metropolitans
de Barcelona

TMB: BUS FEATURES

Bus lines	112
Km of lines	972 km
km dedicated bus lines	110 km
Bus fleet	1,070 buses
Number of garages	4
TB staff	4,084
Passatgers/year	180 m
→ Bus stops	2580
→ Comercial speed	12,5 Km/h
→ Bus stopped in whole trip (bus stops, traffic lights, etc..)	50%

FLEET CHARACTERISTICS

Grans línies urbanes i interurbanes:

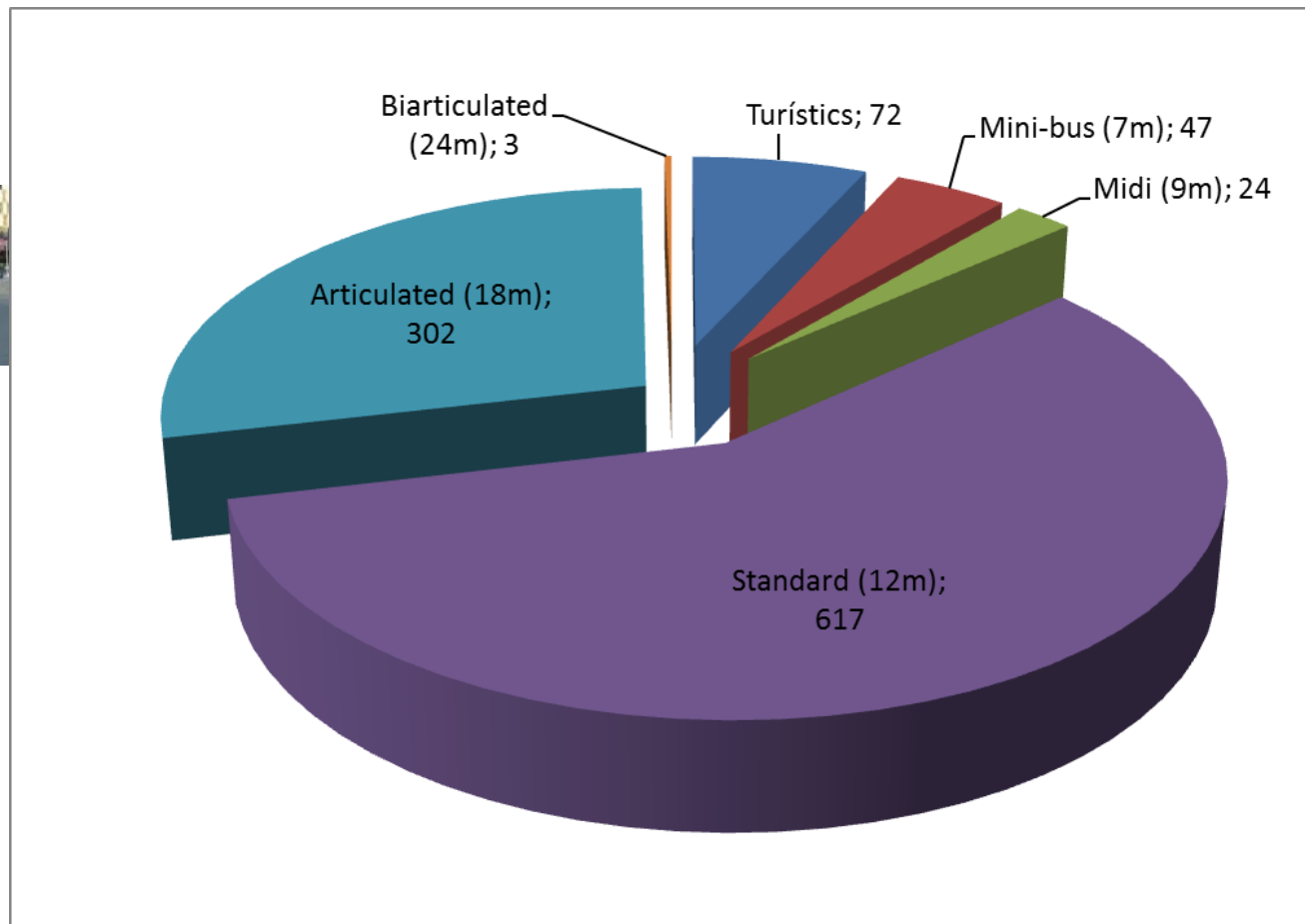


Vehicles midi, standard, articulated and bi-articulated

Bus Turistic:



Vehicles de 2 pisos i jardineres



THE REASONS FOR ELECTROMOBILITY: OUR DRIVERS



COP21/22 with the signing of a historical climate agreement to limit global warming to below 2 degrees Celsius and drive efforts to limit the temperature increase even further to 1.5 degrees

TMB and EFFICIENCY: CHALLENGE

Challenges facing TMB in achieving a surface network that is **sustainable, more efficient.**

- ❑ Design of an ***operating system*** that will reduce a large part of the trips made in private vehicles.

TECHNOLOGY



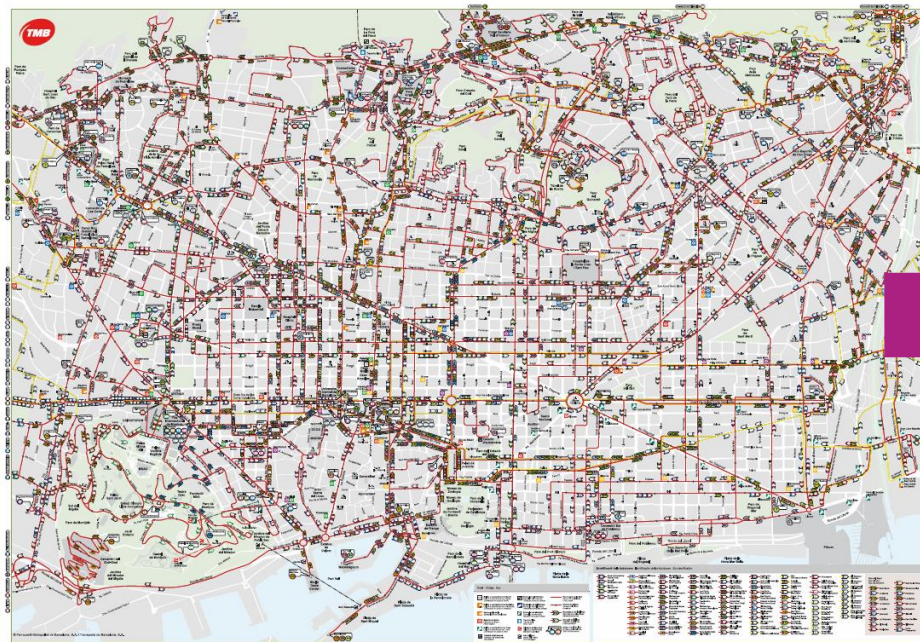
- ❑ Actions taken with respect to the ***existing fleet***



- ❑ Purchase/renewal of ***new vehicles*** with the latest clean technologies.

- ❑ Actions taken in the infrastructures (Garages, facilities, etc..)

NEW NETWORK



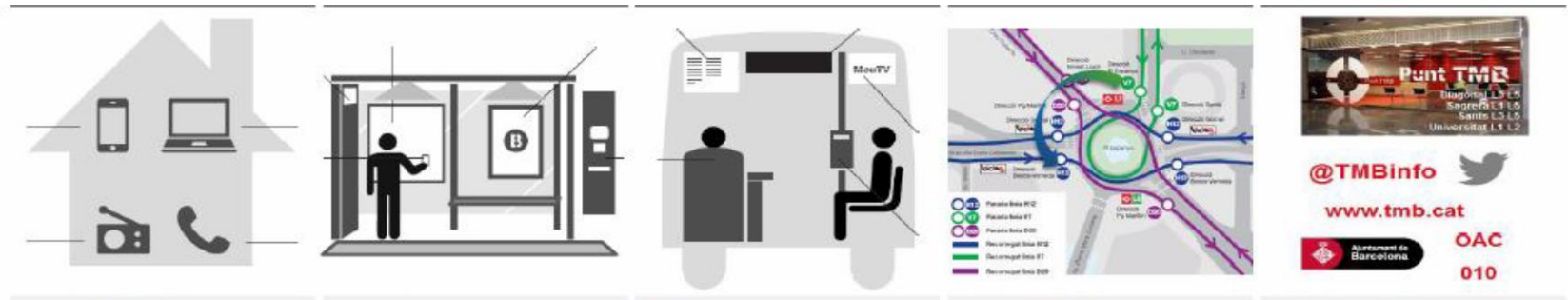
1975-2011 network



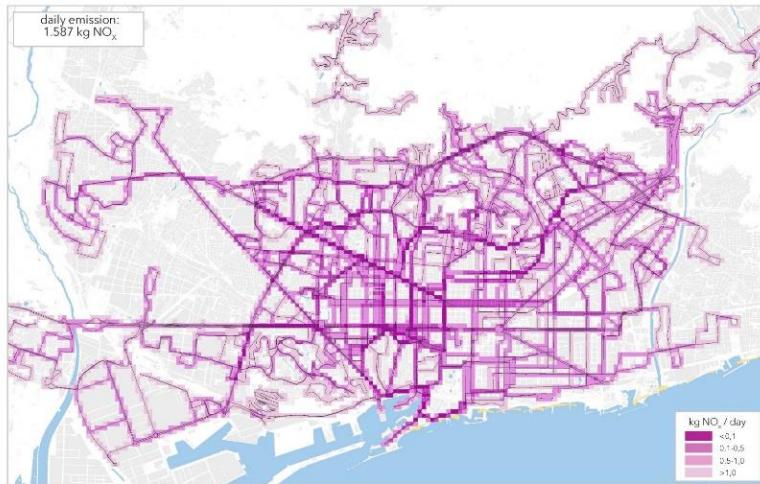
Beginning 2012 NEW network:
Easy to understand
Effective and efficient

MOBILITY AS A SERVICE (MaaS)

at home → at bus stop → on board → connections → destiny

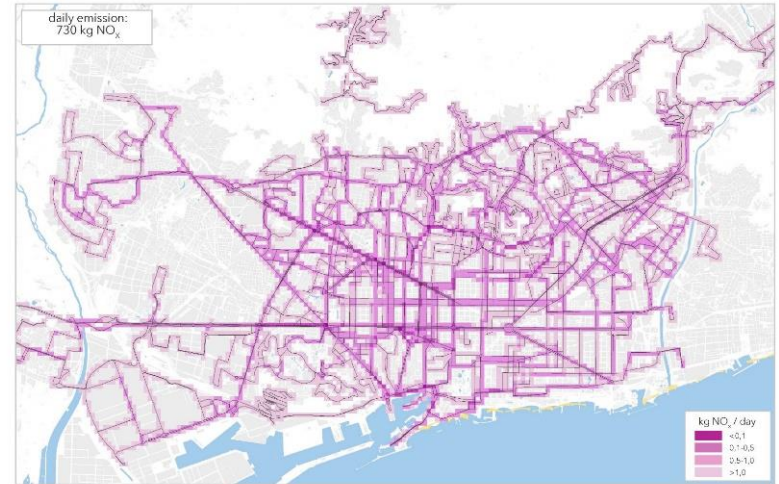


RESULTS: NOx emission map



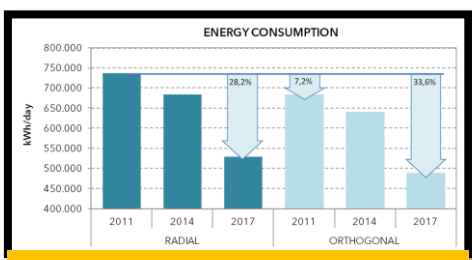
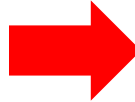
TMB ECOLOGIA NOx Emissions RAD 2011 working day analysis 1:65.000

NOx 2011

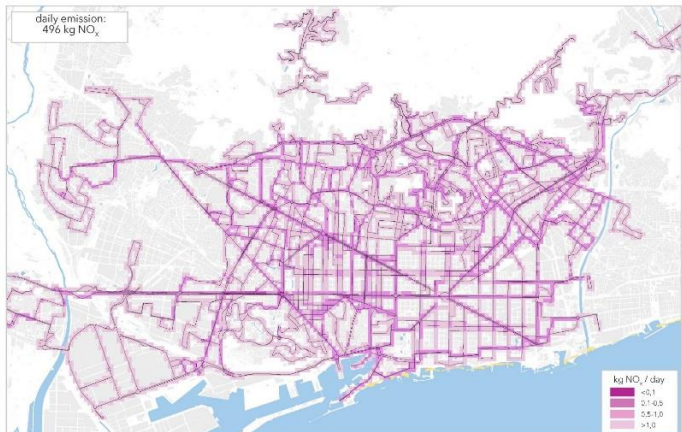


TMB ECOLOGIA NOx Emissions PAR 2014 working day analysis 1:65.000

NOx 2014



- 28,2 % of reductions: only due to fleet improvements.
- 7,2 % of reduction: only due to network improvements
- 33,6 % both affects together (fleet and network)



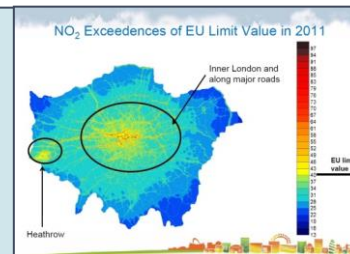
TMB ECOLOGIA NOx Emissions TOT 2017 working day analysis 1:65.000

NOx 2017

TWO Actions taken with the existing fleet

❑ TMB, decided in 2010 to install:

425 PARTICULATE filters + NOx FILTERS (SCR)



RETROFIT HYBRID PROJECT (2010)

70 DIESEL BUSES TRANSFORMED TO HYBRID

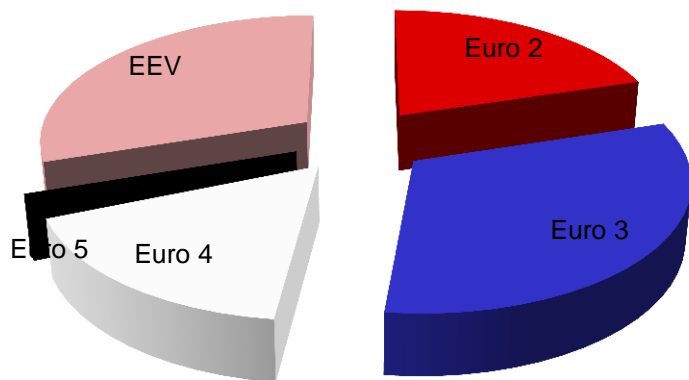
13 CNG buses TRANSFORMED TO HYBRID



ONE OF THE CLEANEST FLEETS IN EUROPE

BUS FLEET
2010

BUS FLEET
2013



Diesel filters.
GNC
Hybrids

ELECTRIFICATION IN EUROPE FIRST STEPS

ZeEUS PROJECT

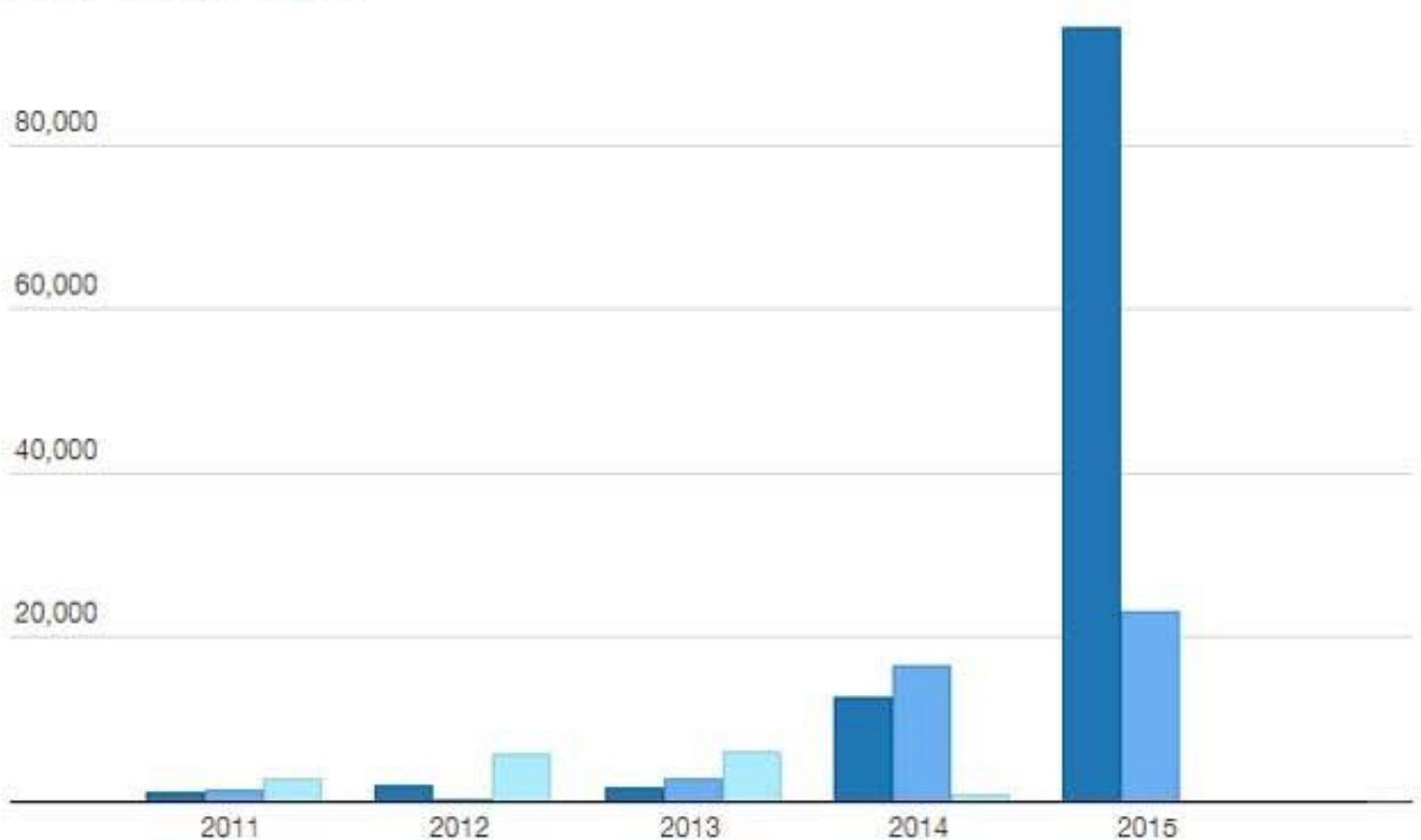


CHINA ELECTRIC BUSES

Here are the figures and a chart we created to visualize them:

Electrified Bus Sales in China

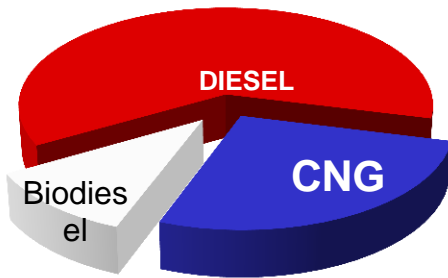
■ BEV ■ PHEV ■ HEV



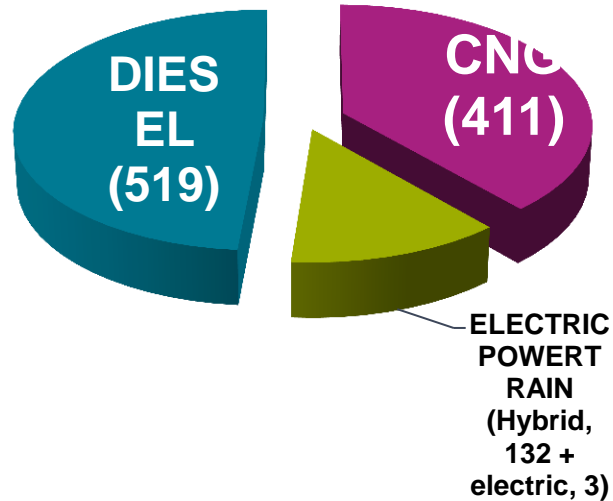
TMB PLAN

- 1060 vehicles
- One of the cleanest bus fleet in Europe

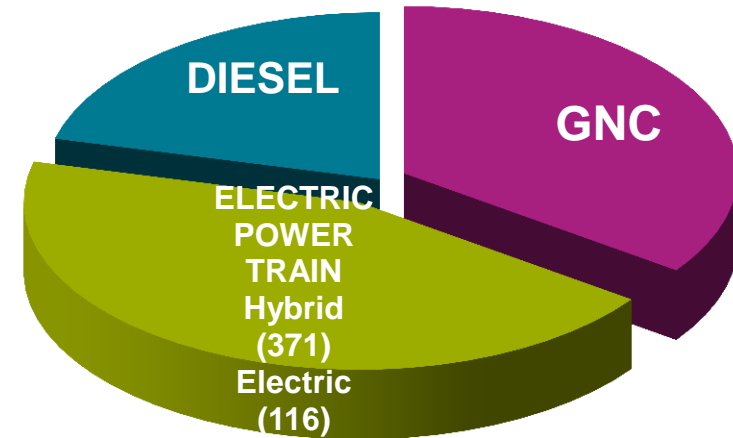
2010



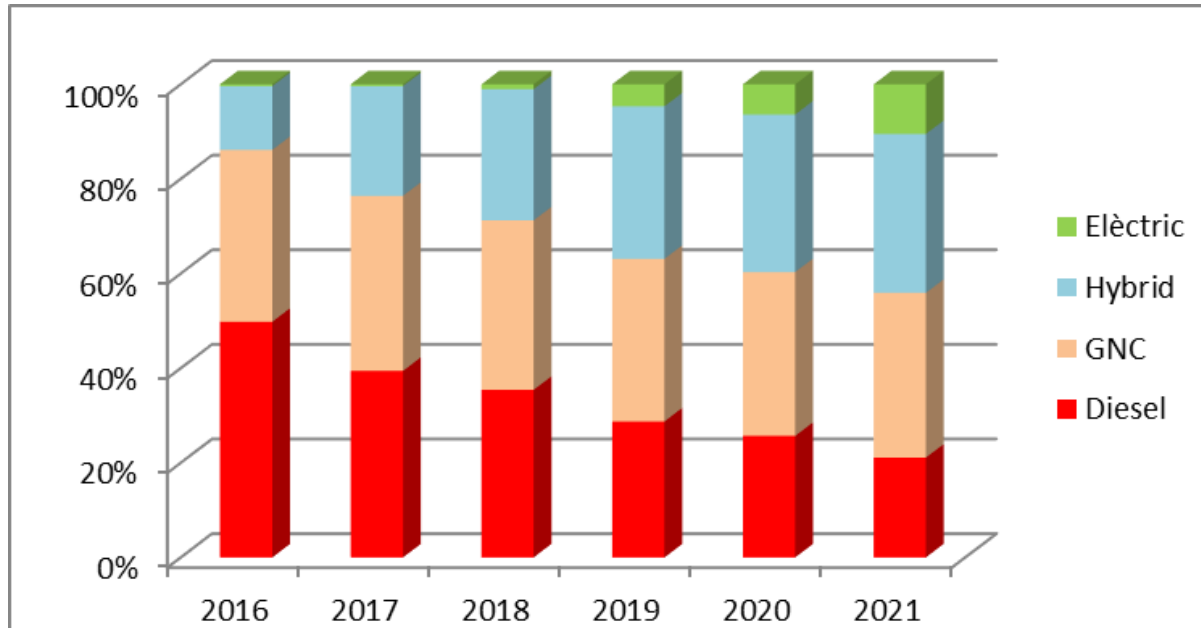
2015



2021

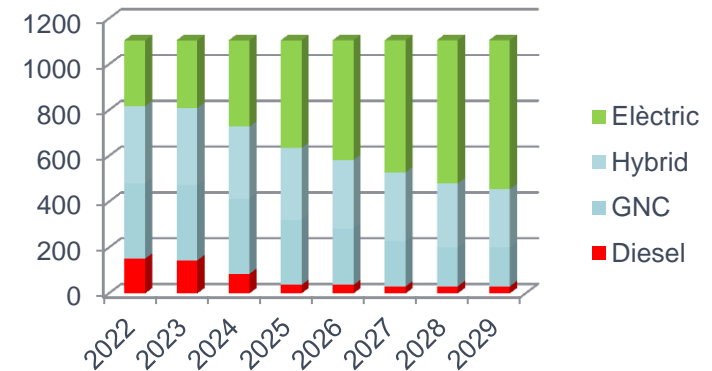


BY TECHNOLOGY:

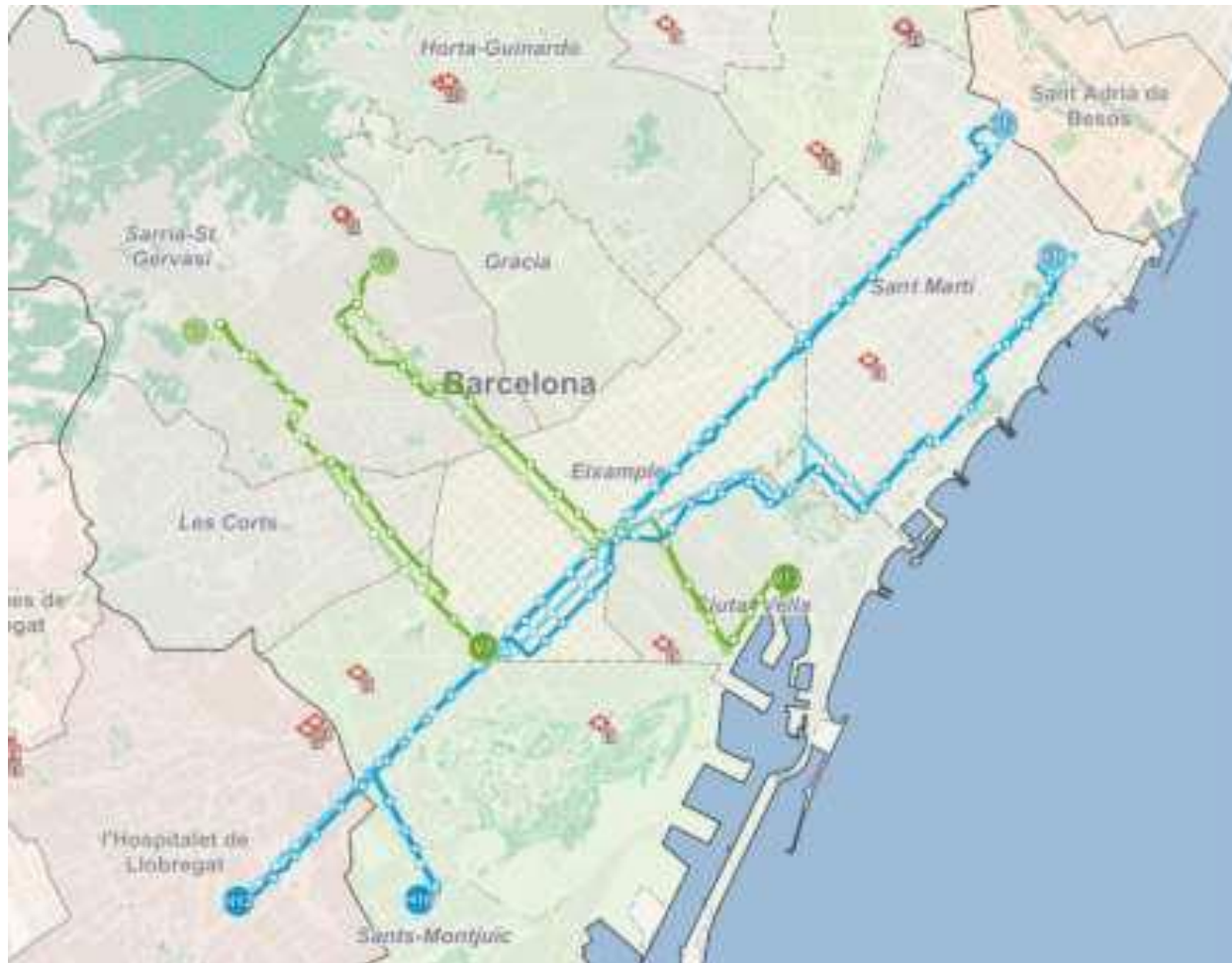


TMB keep the GNC fleet until 2021

2022: no more hybrid buses.



TMB PLAN ELECTRIC BUS LINES:



TWO MODES OF OPERATION

1. OVERNIGHT VEHICLE of 12 meters:

BATTERY CAPACITY > 300 KWh
This it means:

- More weight of the batteries
- Less passenger capacity

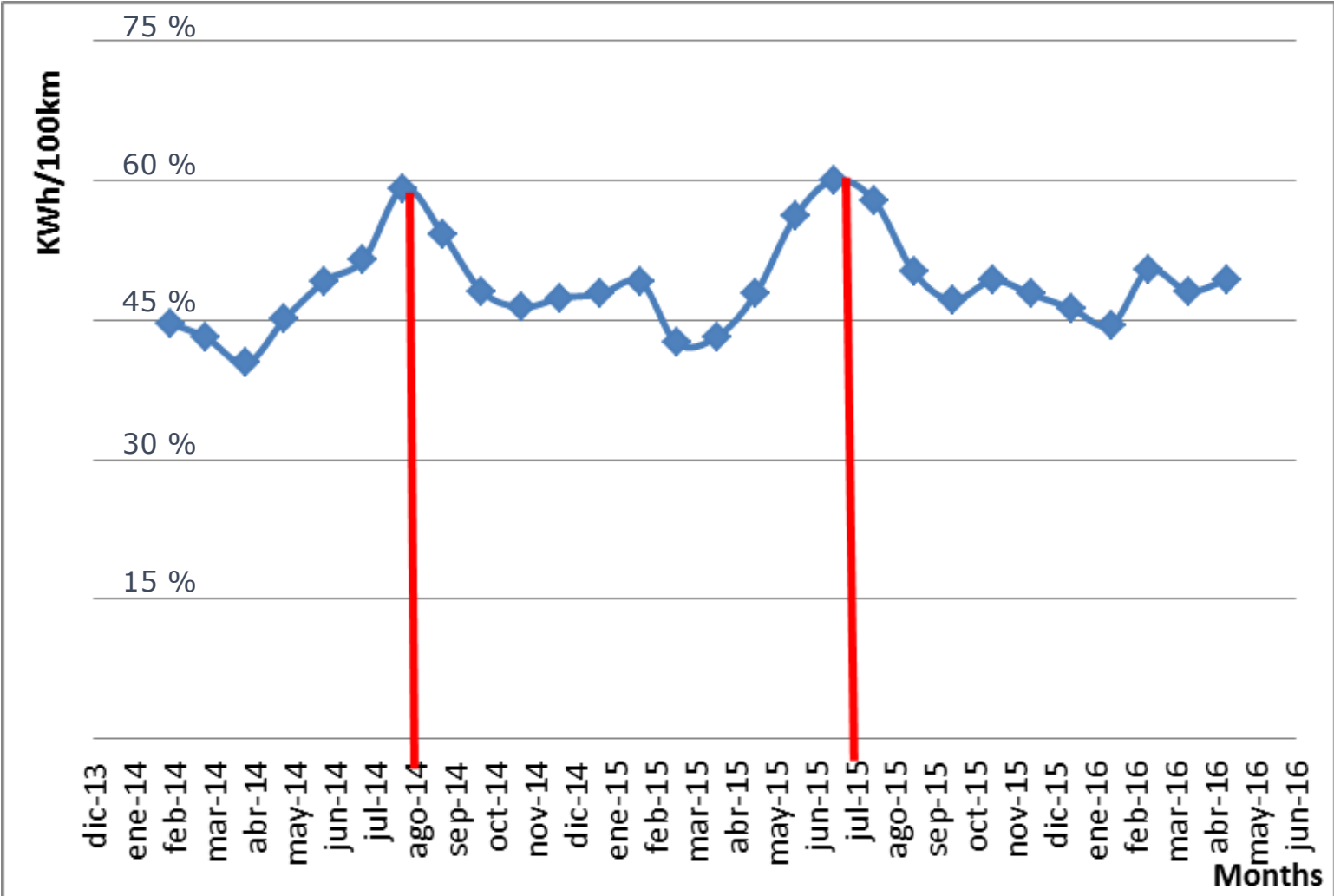
2. OPPORTUNITY CHARGING VEHICLE of 18 meters (articulated buses):

BATTERY CAPACITY 125 KWh
This it means:

- Less weight of the batteries
- More passenger capacity
- It need some charging station on the street

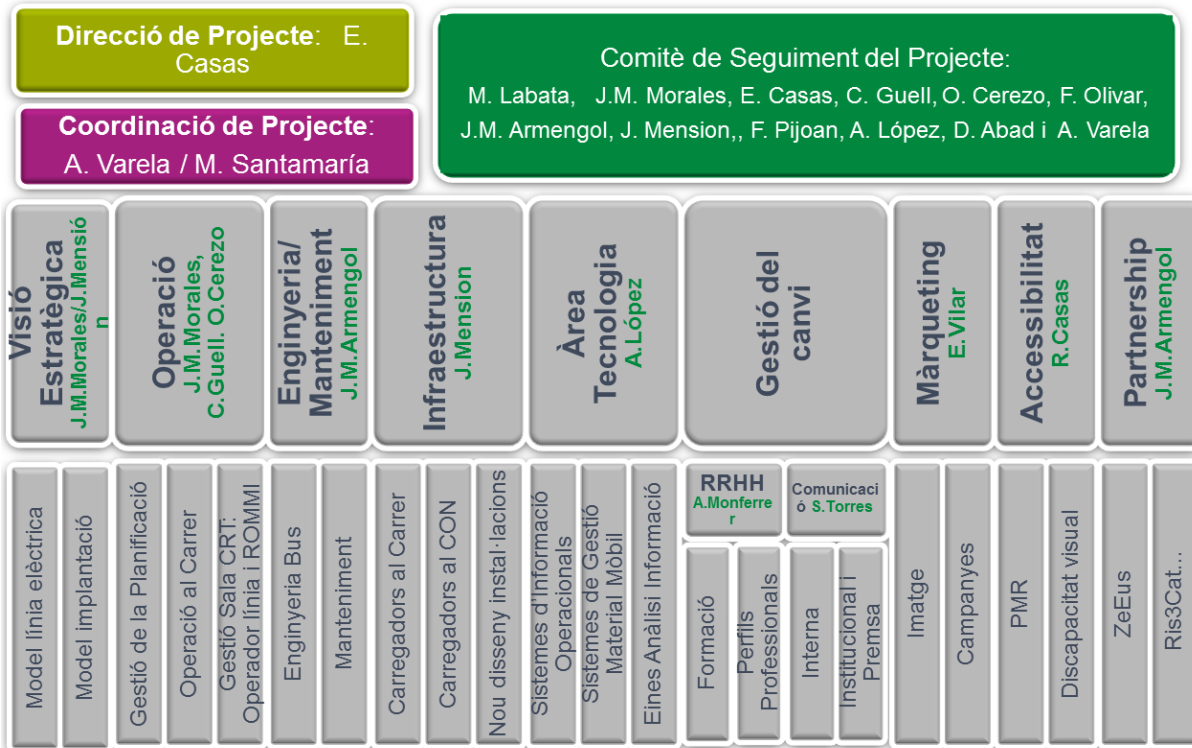


Monthly trend of the average linked with the temperature from the purchase date until now



DIFFERENT WAYS TO WORK

BUS OPERATOR



BUS MANUFACTURER

ENERGY PROVIDER

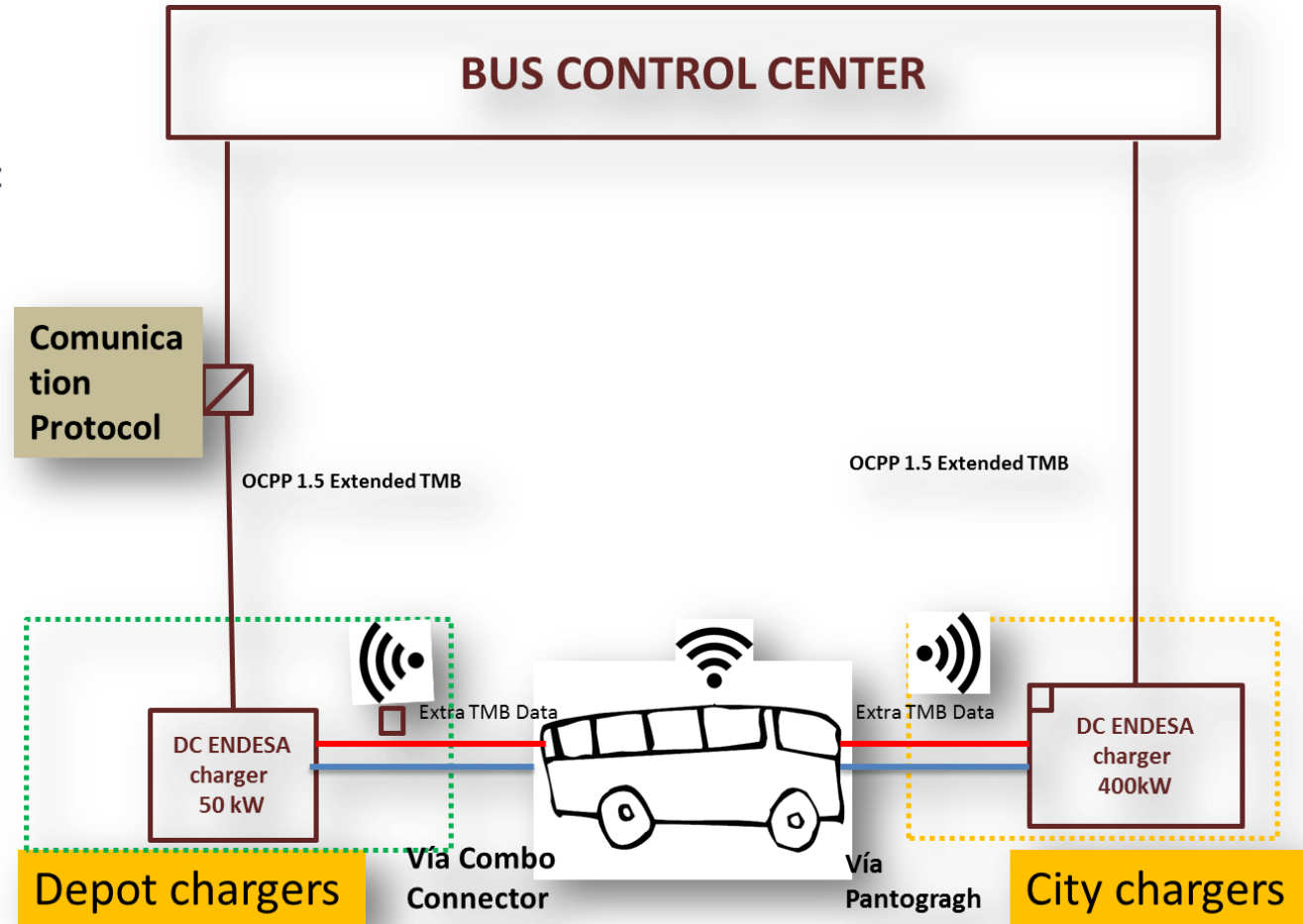
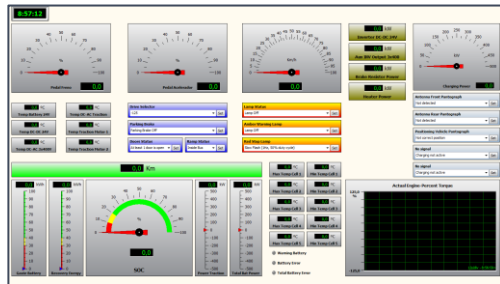
PARTNERSHIP

INTEROPERABILITY
STANDARITZATION
DIGITALITZATION

Communication system (the KEY of the bus electric system)

The control centre has to know:

- Where is the bus always and what is the information about: Technical Alarms and SOC
- The information about the charging station:
 - On the depot
 - On the street



LIFE CICLE COST (LCC/TCO) 12/18m

DIESEL

ELECTRIC

CNG

ADQUISITION PRICE

MAINTENANCE COST
(BATTERIES, GNC bottles, etc.)

CONSUMPTION (fuel, kWh in peak hour, etc..)

Environmental cost (Directive 2009/33)

INFRASTRUCTURES

Cost of SLOW charging station at the depot (does not include the cost of civil engineering).....40.000€

Cost of FAST charging station on the street (does not include the cost of civil engineering).....350.000€

PROCUREMENT
PROCES

MANY THANKS FOR YOUR ATTENTION!!!

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