# EU Green Public Procurement (GPP) Policy

European Commission
Environment Directorate-General
Enrico Degiorgis

# Communication (2008)

## Public Procurement for a Better Environment

- Political **target**: **50%** of tendering procedures to be green
- Common **EU GPP criteria** for priority products and services
- Legal/operational **Guidance**
- GPP National Action Plans
- Difficulties of measuring GPP

# EU Green Public Procurement Policy

## GPP support tools

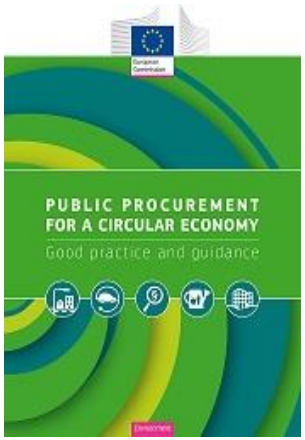
***GPP website of the European Commission:***

- *Full sets of EU GPP criteria and background reports in 20+ languages*
- Buying Green Handbook
- Circular Procurement brochure
- More than 100 GPP Examples
- News and upcoming events

***General Help desk: gpp-helpdesk@iclei.org***

***GPP Newsletter (please sign up!)***

Exchange Platform - https://procurement-forum.eu/




# Buying green handbook

*How to include environmental considerations at each stage of the procurement process*

- ***Subject matter*** *of the contract*
- ***Selection*** *and* ***exclusion*** *criteria*
- ***Technical specifications*** *(use of* ***labels****)*
- ***Award criteria*** *(life-cycle costs)*
- ***Contract performance clauses***

*+* ***Needs' assessment*** *+* ***market engagement***

# EU GPP Criteria


Copying and graphic paper


Computer and Monitors


Road transport NEW


Electricity


Textiles


Cleaning products and services NEW


Office Buildings


Furniture


Food & Catering services


Gardening products and services

# EU GPP Criteria

Water based heaters

Waste water infrastructures

Flushing Toilets & Urinals

Imaging Equipment

Road design, construction and maintenance

Road lighting and traffic signals NEW

Sanitary tapware

EEE Health care sector

Paints and Varnishes NEW

# Criteria under development/revision

- Data Centres
- Public Space Maintenance
- Imaging Equipment
- Computers and monitors: revision will start soon

How to participate to the ongoing work? → http://susproc.jrc.ec.europa.eu/product_bureau/projects.html

# Two levels of criteria

**Core criteria:**

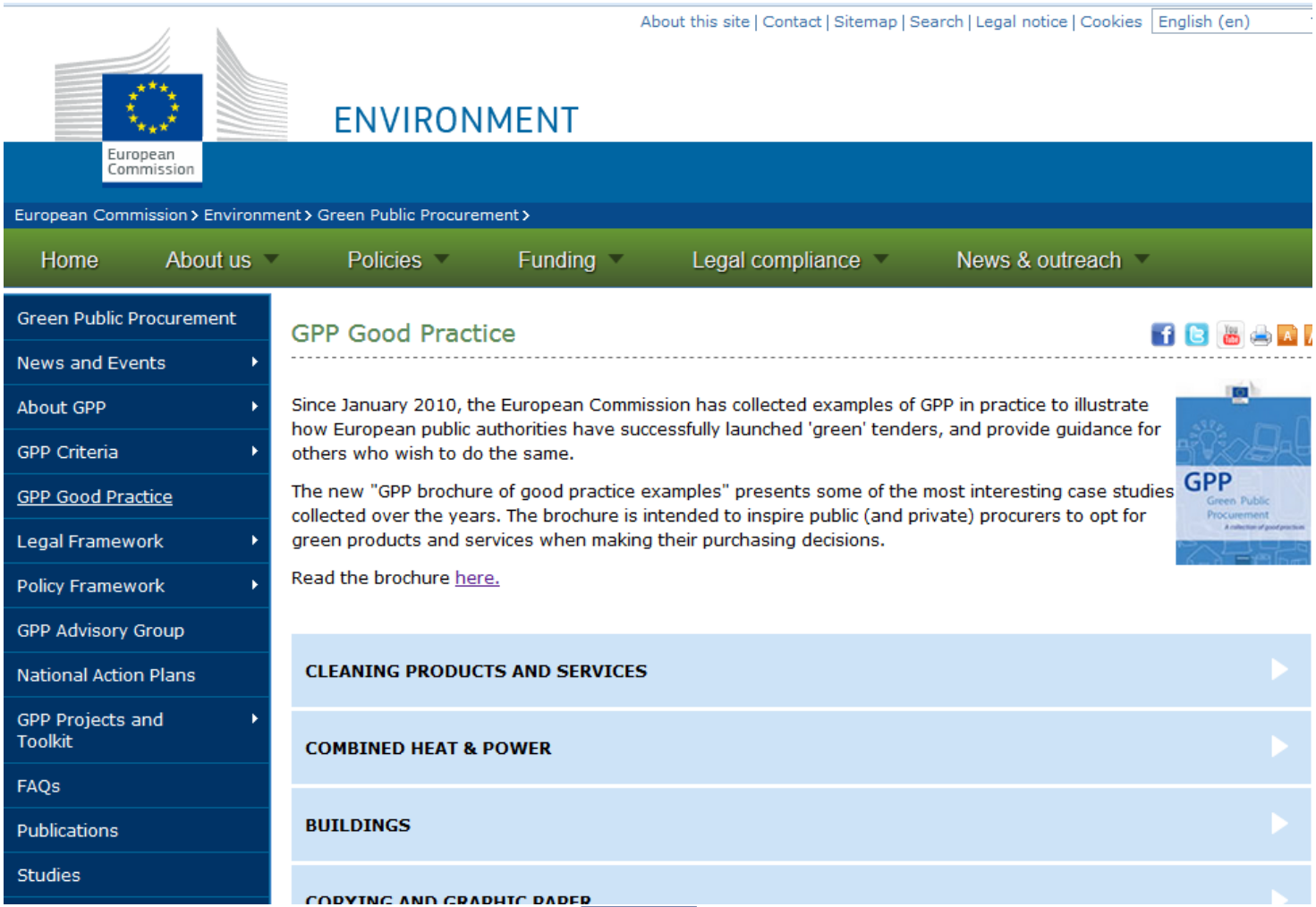
- Aim at addressing the key environmental impacts
- Require minimum additional verification effort or cost increases.

**Comprehensive criteria:**

- Aim at purchasing the best environmental products available on the market
- possibly requiring additional verification efforts or a slight increase in cost compared to other products with the same functionality.

*GPP criteria for products are largely based on standard Type I ecolabels.*

# GPP Good practice



# Further activities to support GPP

- Contract to develop Life Cycle Costing tools for 5 product groups: Computers and monitors, vending machines, printers/ multifunctional devices, outdoor lighting, indoor lighting (tools to be finalised by end 2019).

- Revision of the GPP training toolkit (in all EU languages): to be published soon.

- Organisation of training activities on GPP in countries that are less advanced in terms of GPP (2019-2021).

*Questions? Please contact:*

enrico.degiorgis@ec.europa.eu

***GPP webpage: http://ec.europa.eu/environment/gpp***

European Commission

# GPP Helpdesk Webinar - EU GPP criteria for Road transport

## 12 April 2019

**Joint Research Centre**
the European Commission's
in-house science service

JRC Science Hub: ***ec.europa.eu/jrc***

Joint Research Centre

# EU GPP criteria for Road Transport
# Scope

- Category 1: Purchase, lease or rental of cars, LCVs and L-category vehicles
- Category 2: Mobility services (New category)
- Category 3: Purchase or lease of buses
- Category 4: Provision of public bus services
- Category 5: Purchase or lease of waste collection vehicles
- Category 6: Provision of waste collection services
- Category 7: Post, courier and moving services (New category)

# EU GPP criteria for Transport Scope

- Category 1: Purchase, lease or rental of cars, LCVs and L-category vehicles
- Category 2: Provision of mobility services
- **Category 3: Purchase or lease of buses**
- Category 4: Provision of public bus services
- **Category 5: Purchase or lease of waste collection vehicles**
- Category 6: Provision of waste collection services
- Category 7: Provision of post, courier and moving services

More relevant for PP

# Category 2: Mobility services

## Scope

- **Special-purpose bus services**
- **Non-scheduled bus services**
- **Hire of buses and coaches with driver**
- **Taxi services**
- **Car sharing**

**+**

- *Emerging ways of mobility* → **combined mobility services**

# EU GPP and (revised) Clean Vehicle Directive

## EU GPP Criteria Transport

- Voluntary instrument
- Shares (in part) the scope with CVD: road vehicles and services
- EU GPP adds other environmental issues
  - **Noise**
  - **Tyres**
  - **Batteries**

## Revised CVD

- Defines "clean vehicle"
- Sets mandatory targets as % public procurement by 2025 and 2030

# GPP and (revised) Clean Vehicle Directive

- EU GPP road transport and Clean Vehicle Directive → revisions coincided in time.
- Comprehensive level of GHG and air pollutant emissions criteria of EU GPP → harmonised with *Commission proposal* for the revision of CVD (COM(2017) 653)
- Modifications of the proposal along the legislative procedure were envisaged → to be taken into account in the next EU GPP revision
  - **EU GPP will be revised before CVD is in force at national level (around 2021)**

# GHG emissions for buses and coaches

- **WTW analysis** → Identification of best technologies showing a WTW GHG emissions reduction potential compared to conventional diesel vehicles

- **Criteria based on metrics? → VECTO** not yet available for buses and data not available → technology-neutral criteria not possible for now

- **Technology-specific approach as interim solution → list of eligible technologies** for each duty cycle (city buses, intercity buses and coaches, and waste collection trucks)
- *+ classification according to GHG reduction potential → formulation of TS and AC*
  - ***Class C → min. 10% WTW GHG emissions reduction potential***
  - ***Class B → > 10 up to 20% WTW GHG emissions reduction potential***
  - ***Class A → > 20% WTW GHG emissions reduction potential***

| Eligible technologies for buses and coaches | Class |
|---|---|
| Active flow control (only for coaches and inter-city buses) | C |
| Boat tails / extension panels (only for coaches and intercity buses) | C |
| Mild hybrid (only for urban and inter-city buses) | B urban, C inter-city |
| Flywheel hybrid (only for urban and inter-city buses) | B urban, C inter-city |
| Full Series hybrid (only for urban and inter-city buses) | B urban, C inter-city |
| Full Parallel hybrid (only for urban and inter-city buses) | B urban, C inter-city |
| Full electric and plug-in vehicle | A |
| *Hydrogen fuel cell vehicle* | *C by default, B or A under conditions* |
| *OEM dual-fuel natural gas vehicle with gas energy ratio over the hot part of the WHTC test-cycle of at least 50%.* | *C by default, B or A under conditions* |
| *High pressure direct injection natural gas vehicles* | *B by default, A under conditions* |
| *Dedicated natural gas vehicles* | *C, B or A under conditions* |

| Technology | Class | Conditions for classification |
|---|---|---|
| Hydrogen fuel cell vehicle | C | No conditions, meaning class C by default |
| | B | Supply of hydrogen produced with renewable sources generated on-site, meeting at least 5% of demand |
| | A | Supply of hydrogen produced with renewable sources generated on-site, meeting at least 15% of demand |

| Technology | Class | Conditions for classification |
|---|---|---|
| OEM dual-fuel natural gas vehicle with gas energy ratio over the hot part of the WHTC test-cycle of at least 50%. | C | No conditions, C as default |
| | B | Supply of renewable methane meeting at least 15% of demand |
| | A | Supply of renewable methane meeting at least 35% of demand |
| High pressure direct injection natural gas vehicles | B | No conditions, B as default |
| | A | Supply of renewable methane meeting at least 10% of their demand, respectively. |
| Dedicated natural gas vehicles | C | Supply of renewable methane meeting at least 10% of demand |
| | B | Supply of renewable methane meeting at least 15% of demand |
| | A | Supply of renewable methane meeting at least 25% of demand |

# GHG emissions for buses and coaches

| | Core | Comprehensive |
|---|---|---|
| TS | Urban buses: class B or A<br>*It excludes aerodynamics, since speed is low* | Urban, intercity and coaches: class A<br>*It excludes hybridisation and aerodynamics*<br>*Dual-fuel natural gas vehicles and dedicated natural gas vehicles require the use of larger share of biomethane.* |
| | Intercity buses and coaches: class C, B or A | |
| AC | Urban buses: class A | NO AC |
| | Intercity buses and coaches: class B or A (more points to A) | |

# GHG emissions for waste collection vehicles

**CORE LEVEL**

**<u>Eligible technologies:</u>**

***Same as urban buses+***

**Vehicles equipped with energy accumulation/recovery systems**

**Vehicles equipped with load-sensing hydraulic systems**

**Vehicles equipped with electric bin lifts**

**COMPREHENSIVE LEVEL**
**<u>Eligible technologies:</u>**

**Electric and semi-electric**

**Hydrogen fuel cell using renewable hydrogen (min. 5%)**

**High pressure direct injection natural gas**

**OEM dual-fuel natural gas vehicle with min. 50% gas-energy ratios and dedicated Natural gas vehicles using biomethane (min. 15%)**

# Air pollutant emissions

- **Euro VI as TS:** buses and trucks have long lifetime → market for used vehicles → need of requesting the compliance with Euro VI

- Results of Euro VI not valid for comparison → AC technology specific to select best technologies at core level:
  - **natural gas**
  - **plug in hybrid electric vehicles (!) (PHEV)**
  - **battery electric vehicles (BEV) and**
  - **hydrogen fuel cell electric vehicles (FCEV).**

More points

- ***Plug-in hybrid electric vehicles*** *→ total daily hours that a city bus is operated in full electric depends on the specific duty cycle and the charging strategy.*
- ***CA needs to ensure that the plug-in hybrid buses will be able to maximise their daily hours of operation in full electric mode along their daily cycles using the charging infrastructure available.***

# Durability of batteries

- Not formal criteria → **technology not mature enough**
- **Explanatory note:** Information to set the warranty terms of the batteries for battery electric vehicles
- Reference to the ZeEUS eBus report *An overview of electric buses in Europe*
- Public authority to look at the latest available information on the market when formulating the call for tenders
- TS or AC on warranty periods and conditions
  - ***LiFePO4 batteries*** → *warranty periods ranging from 2 to 5 years, 4-5 years being the most frequent period.*
  - ***LiNiMnCoO2 or NMC batteries*** → *range from 2 to 6 years.*
  - ***Lithium titanate batteries*** → *up to 15 years*
  - ***Graphene ultracapacitors*** → *from 8 to 11 years.*
  - *Other suppliers offer **tailored warranties depending on the leasing contract,** which may include performance monitoring over an agreed timeframe.*

# Other technical options

- **Tyre Pressure Monitoring Systems (TPMS)**
  - LCVs and heavy duty vehicles must be equipped with **tyre pressure monitoring systems** → system fitted on a vehicle which can evaluate the pressure of the tyres or the variation of pressure over time and transmit corresponding information to the user while the vehicle is running, or, in the case of buses and waste collection trucks, with systems that transmit corresponding information to the operator site**.**

- **Vehicle specific eco-driving information**
  - **ICV**: early shifting, steady speed at low RPM and anticipating traffic flows.
  - **Hybrid and electric vehicles**: regenerative braking to save energy.
  - **Plug-in hybrid and range extender electric vehicles**: specific instructions to maximise the kilometres driven electrically.
  - This information / instructions may be provided in **the form of training sessions** (if the public authority choses this option, it needs to prescribe a minimum amount of hours of training to be provided).

# Other technical options

- **Vehicle tyres – rolling resistance**
  - **The vehicles must be equipped with**
    - Tyres that comply with the highest fuel energy efficiency class for rolling resistance
    - Alternatively, Retreaded tyres

*Not to be used if, for safety reasons, tyres with the highest wet grip class, snow tyres or ice tyres are needed*

*Note: Regulation (EC) No 1222/2009 is **currently under revision**, and as part of this process, the European Commission has put forward proposal COM(2018) 296. This criterion will need to be updated according to the new legislation, once it is in force.*

# Noise

- **Only at comprehensive level**
- **TS on Tyre noise**
  - **The vehicles must be equipped with**
    - tyres whose external rolling noise emission levels are 3dB below the maximum established in Annex II, Part C of Regulation (EC) No 661/2009 = the top category of the EU tyre label external rolling noise class
    - Alternatively, retreaded tyres

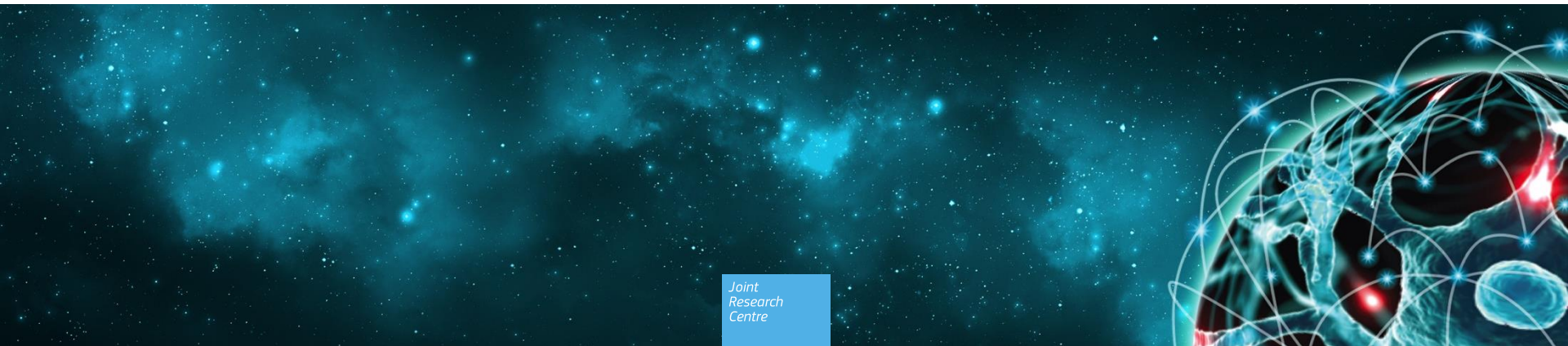
- **AC on vehicle noise**
  - Points will be awarded to vehicles whose noise emissions are compliant with the Phase 3 limits of Regulation (EU) No 540/2014.
  - **Compliant with phase 3 → range 76 – 79 dB(A)**

European Commission

# Thank you very much


***http://susproc.jrc.ec.europa.eu/Transport/index.html***

***rocio.rodriguez-quintero@ec.europa.eu***

# Zero-emission delivery of goods and services

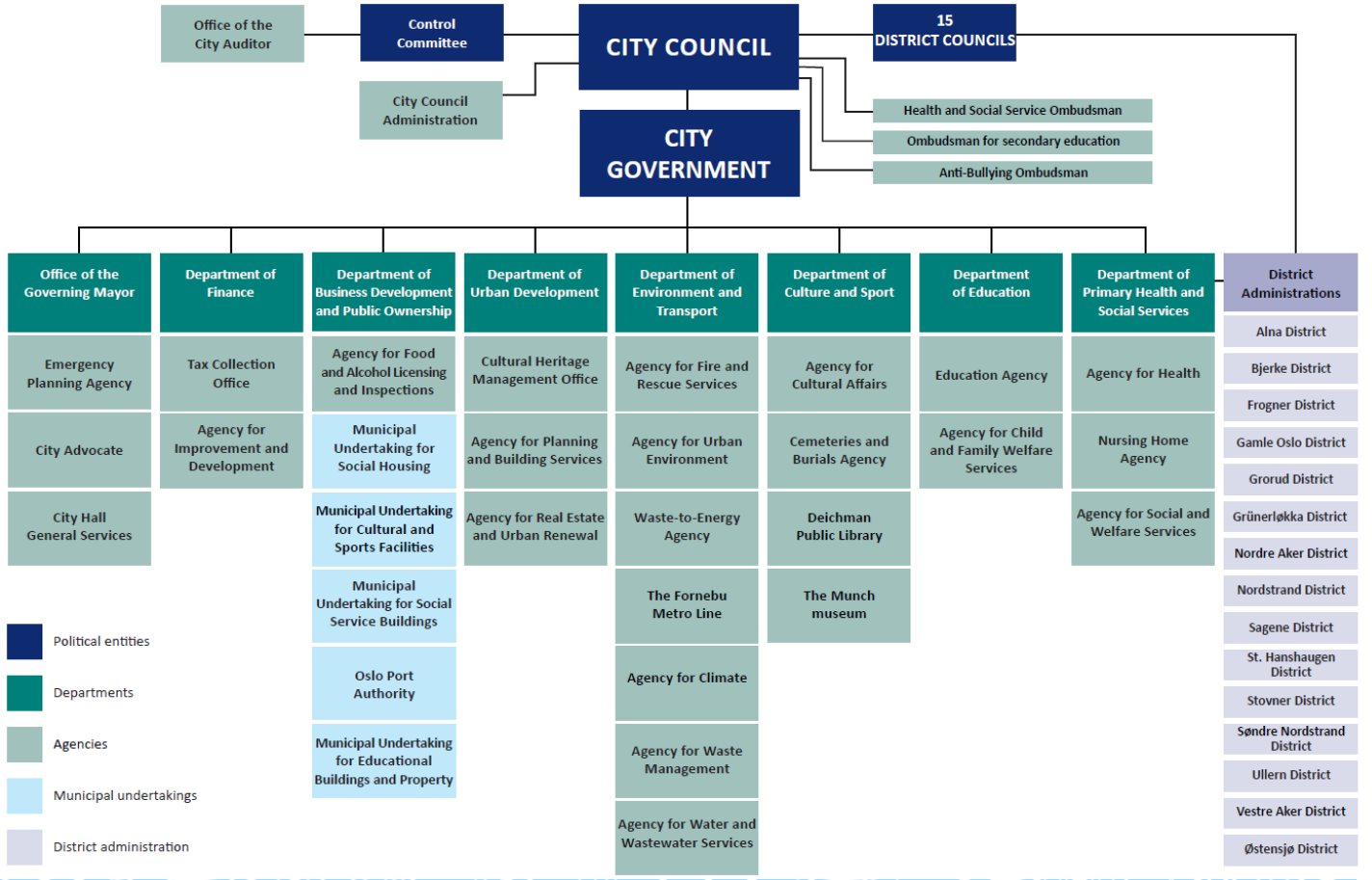
Geir Rossebø, Sustainability Adviser
**City of Oslo**

GPP Helpdesk Webinar
12.04.19

# City of Oslo

- Capital of Norway
- 680,000 inhabitants
- 53,000 employees

- The municipality is a complex organization



# Procurements in the municipality

- City of Oslo has approx. EUR 3 billion in annual procurements and investments
- Decentralized procurement model
  - each agency is responsible for their own procurements
- Regulations based on EU Directive on Public Procurement

# Agency for Improvement and Development

- **Central Procurement Unit**
- Citywide framework agreements (10% of total purchases)
  - more than 70 different contracts
- Advisory services and courses

- **Sustainability**:
  - Climate and environment (GPP)
  - Reduction of labour market crime and social dumping
  - Circular economy
  - Ethical trade

# Oslo’s climate targets

EMISSIONS
**-36%**

by 2020

EMISSIONS
**-50%**

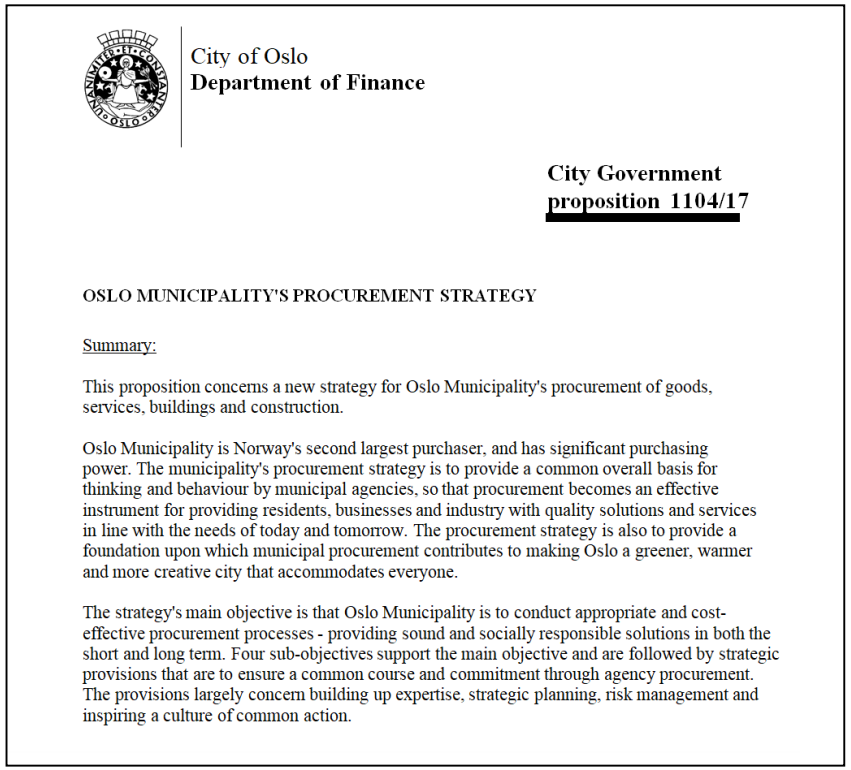
by 2020

EMISSIONS
**-95%**

by 2030

# Steering documents

- Climate strategy
- Climate budget
- Procurement strategy



City of Oslo
**Department of Finance**

**City Government**
**proposition 1104/17**

OSLO MUNICIPALITY'S PROCUREMENT STRATEGY

Summary:

This proposition concerns a new strategy for Oslo Municipality's procurement of goods, services, buildings and construction.

Oslo Municipality is Norway's second largest purchaser, and has significant purchasing power. The municipality's procurement strategy is to provide a common overall basis for thinking and behaviour by municipal agencies, so that procurement becomes an effective instrument for providing residents, businesses and industry with quality solutions and services in line with the needs of today and tomorrow. The procurement strategy is also to provide a foundation upon which municipal procurement contributes to making Oslo a greener, warmer and more creative city that accommodates everyone.

The strategy's main objective is that Oslo Municipality is to conduct appropriate and cost-effective procurement processes - providing sound and socially responsible solutions in both the short and long term. Four sub-objectives support the main objective and are followed by strategic provisions that are to ensure a common course and commitment through agency procurement. The provisions largely concern building up expertise, strategic planning, risk management and inspiring a culture of common action.

# Sub-objective 2: Greener city

- **Provisions in the Procurement strategy:**
  - Vehicles and construction machinery used in connection with performing work for Oslo Municipality are to have **zero-emission technology as a main rule**.
  - Procurements that opens for the use of other technology is to be specifically justified in the contract strategy.
  - For vehicles and machines where zero emissions is not an option, biofuels (preferably biogas) is to be used.

# How do we solve this?

# BuyZET project

- ***BuyZET 'Procurement of innovative solutions for zero emission urban delivery of goods and services'***

- Partnership of cities aiming to achieve ZE from transport in procurements
  - Core cities: Oslo, Copenhagen, Rotterdam
  - Observer cities: Southampton, Brussels Region, Manchester, Bologna, Jerusalem, Bielefeld, Munich

- **Step 1:** Identifying the transport footprint from procurements
- **Step 2:** Market engagement and activities

# Environmental requirements for transport

- Before: Minimum requirement Euro norm 5/V

- In 2017: We introduced environmental performance as award criteria for transport
  - Highest score for zero-emission vehicles

- During 2017-2018: Different methods were applied in tenders

# Standardization process

- Realisation that all procurements seek the same solution → zero-emission delivery of goods and services
  - Generic formulations/specifications needed

- <u>Today's criteria set</u>
  - Minimum criteria Euro norm 6/VI

  - Award criteria on environmental performance:
    1. battery electric/hydrogen  2. biogas  3. other biofuels

  - Contract requirements: Documentation and follow-up

# Award criteria

- Different percentage on weighting, varies from 10-30%

- Suppliers must list all the vehicles they intend to use during the contract period
  - Fossil fuelled vehicles are given 0 points

- In addition to vehicle and fuel technology, extra credit is given to vehicles that are ready from the contract start date.
  - This allows them to introduce ZEV during the contract
  - Suppliers must provide reliable documentation

# Results from tenders in 2018 and 2019

| Citywide framework agreement | Zero-emission | Biofulels |
|---|---|---|
| Mobile phones | **100 %** | |
| Locksmith services | **100 %** | |
| Occupational health services | **100 %** | |
| Charging stations for electric cars | **100 %** | |
| Floor mats (removable) | **100 %** | |
| Cleaning products; paper; plastic and disposable products | 90 % | 10 % |
| Fruits and vegetables | 20 % | 60 % |
| Food and beverages (groceries) | 17 % | 33 % |
| Dairy products | | 100 % |

# Guidance on transport requirements

- Published on the municipal intranet
  - Available for all purchasers

- Shared with other cities, supplier networks and NGO’s
  - No restrictions

- Also available in English → Included in the BuyZET-handbook

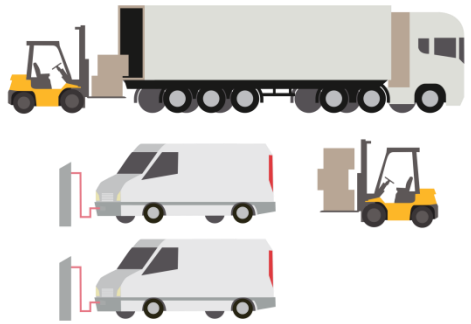
- **June 2019:** Transport requirements will be mandatory for all procurements in the municipality

# Market dialogue is important

- In order to achieve zero-emission the suppliers must be involved on an early stage
- Our experience is that suppliers also want to be a part of the green shift
- They are facing different barriers/problems:
  - Lack of charging infrastructure
  - Low payload on vehicles
  - Low driving range
  - High investment costs

# Next steps

- Zero-emission as a minimum requirement
- Criteria for route optimisation and traffic reductions
- Other means of transport: cargo bikes, battery electric MC or other innovative solutions
- Routines for contract management
- Expand the system boarder



# City of Oslo

## Agency for Improvement and development

Geir Rossebø - Sustainability Adviser

geir.rossebo@uke.oslo.kommune.no

# ELECTRIC TRANSPORT IN TORINO
# GTT EXPERIENCE

*Marco ZANINI*
*Ingegneria di manutenzione / Prodotto Bus*
*Gruppo Torinese Trasporti*

GRUPPO TORINESE TRASPORTI

GRUPPO TORINESE TRASPORTI

**In 2014 Regione Piemonte decided to start a set of actions to improve air quality; part of those actions was reserving specific funds for the purchase of electric buses.**

**Regione Piemonte launched a call for transport projects for the public and private transport companies in Piemonte.**

**Each project should be a line to be upgraded from diesel bus operated to electric buses.**

**The projects were evaluated on different factors: air quality of the area, number of passengers, areas of public interest, km per day, etc. creating a ranking.**

**The projects in first positions of the ranking were chosen to be funded.**

GTT
GRUPPO TORINESE TRASPORTI

# The selected projects

- 12m buses : 2 Companies
  - GTT – 3 projects 16 buses
  - SUN – 1 project 3 buses
- 6,5m < buses < 9m : 4 Companies
  - GTT – 2 projects 8 buses
  - BUS COMPANY – 1 project 2 buses
  - AMAG – 1 project 2 buses
  - CHIESA – 1 project 1 bus
- buses < 6,5m
  - ARFEA – 1 project 2 buses
  - ATAP – 1 project 2 buses
  - CHIVASSO – 1 project 2 buses

GTT GRUPPO TORINESE TRASPORTI

**GTT was charged to run the procedure for all the Companies**

**A general market survey about possible suppliers worldwide with information published in newspapers and specialized magazines (April 2015)**

**Pre-qualification: notice published on the official website of GTT and on OJEU1 in order to collect suppliers' requests (September 2015)**

**Selection of suppliers who could meet the technical and financial requirements (October 2015)**

**Request for proposals sent to the selected suppliers (February 2016)**
**The tender was awarded on the basis of the most economically advantageous offer (September 2016).**

GTT
GRUPPO TORINESE TRASPORTI

**GTT decided to base the call of tenders on the projects from the different companies.**

**So the bidder could choose the better solution:**

- **opportunity charging or not**
- **energy amount on bus**
- **type of batteries**

**to fulfil the mission profiles described in the tender documents**

GRUPPO TORINESE TRASPORTI

TECHNICAL SPECIFICATIONS

- BATTERIES: The system must guarantee, under the conditions of the various route profiles indicated, a range without recharging of at least 170 km for 12m, 120km for 9m, 80 km for small ones. The number of batteries is chosen according to the mission profile, routes, stops and road situation.

- CHARGING STATIONS: Depot charging equipments included in bus price. If the minimum daily range requirements are not met, opportunity charging stations must be provided at the terminals, installation included (100 kW maximum).

- FULL SERVICE MAINTENANCE: duration 10 years (the service also includes the traction batteries).

GTT
GRUPPO TORINESE TRASPORTI

AWARD CRITERIA

• Economic offer (max 30 points)

• Technical offer (max 62 points) divided into:

  o Energy consumption (0-5 points)
  o Cockpit (0-8 points) o Passenger compartment (0-10 points)
  o Performance (0-10 points) o Vehicle quality (0-4 points)
  o Drive system: Range without charging, guaranteed lifecycles, battery charger, computer system (0-19 points)
  o Rapid charging stations: charging time and charging type (0-6 points)

• Maintenance and technical assistance (including estimated maintenance costs) (max 6 points)

• Terms of delivery (max 2 points)

GTT
GRUPPO TORINESE TRASPORTI

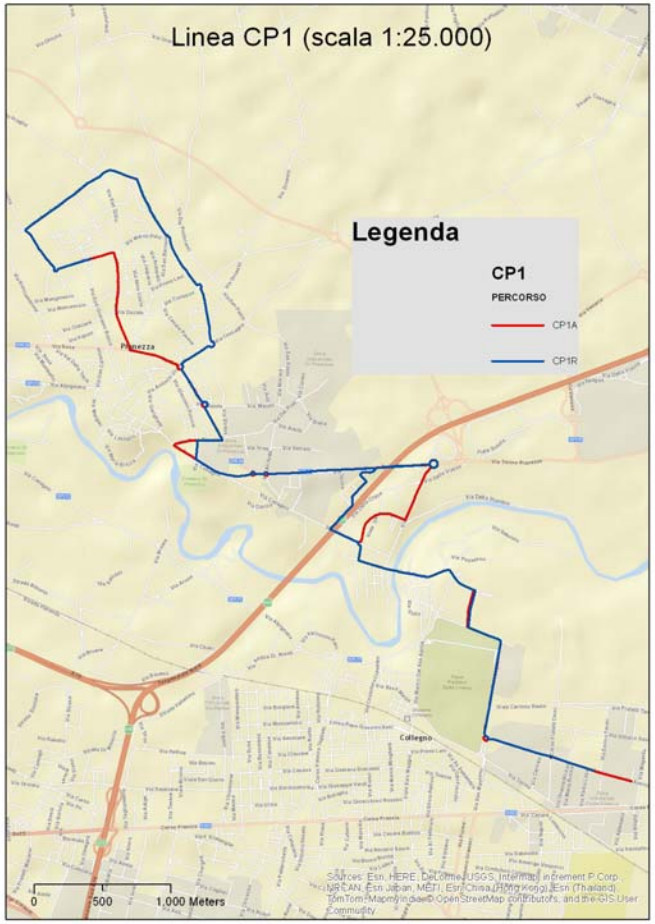
**GTT was charged to launch a call for tenders for the other Companies.**

**Tender for three batches**
- **12 m buses**
- **6,5m < buses < 9m**
- **buses < 6,5m**

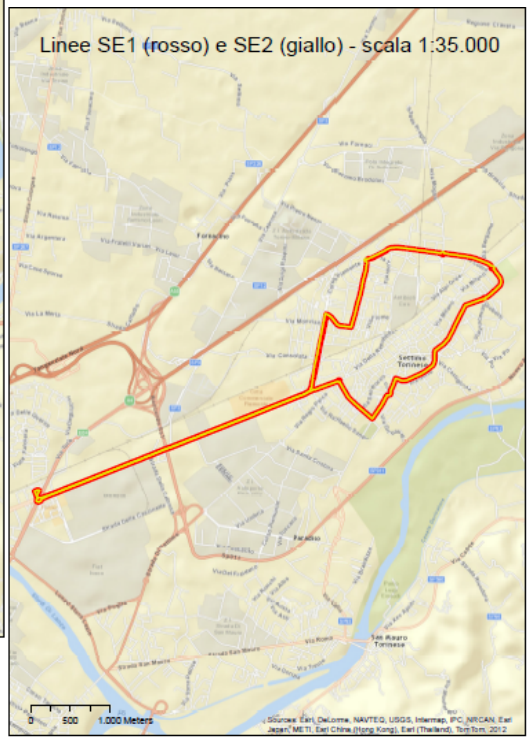
**2016**
**Just one bid for 12m buses**
**No one for the other two batches**
**2017**
**Two bids for 6,5m < buses <9**
**No one for the other**
**2019 (April)**
**New tender for buses < 6,5m**

GRUPPO TORINESE TRASPORTI

# GTT PROJECTS








GRUPPO TORINESE TRASPORTI

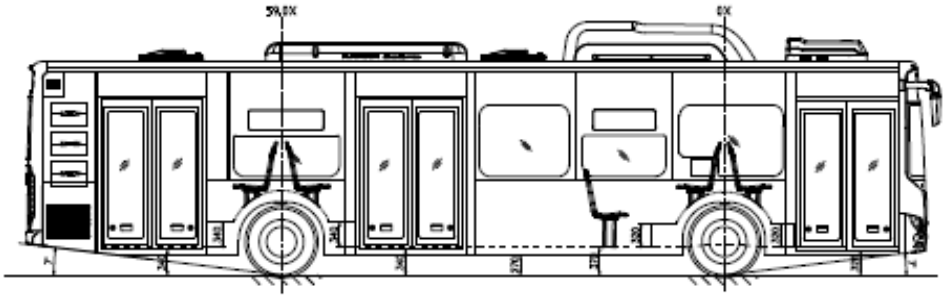
# Electric buses in GTT

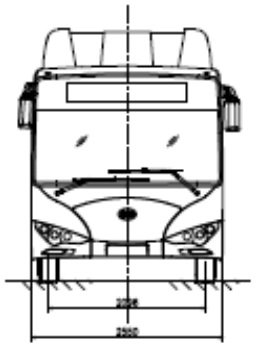

23 EPT Cacciamali “ELFO”

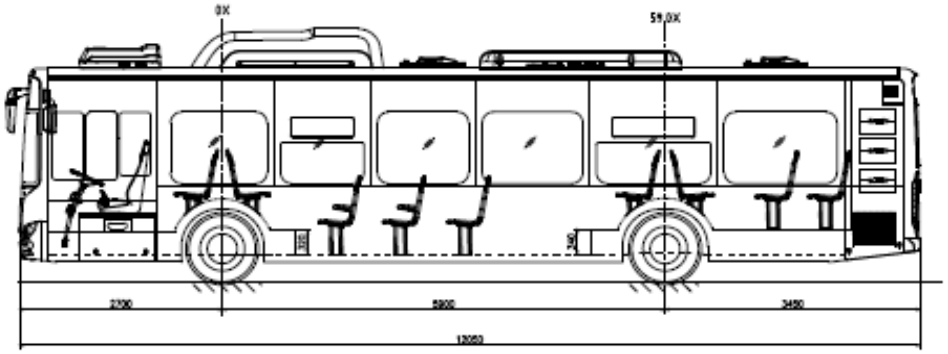

20 BYD K9

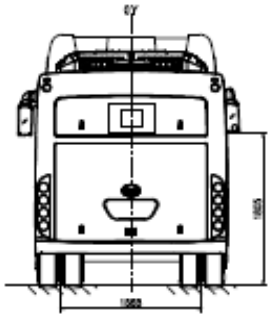

8 BYD K7

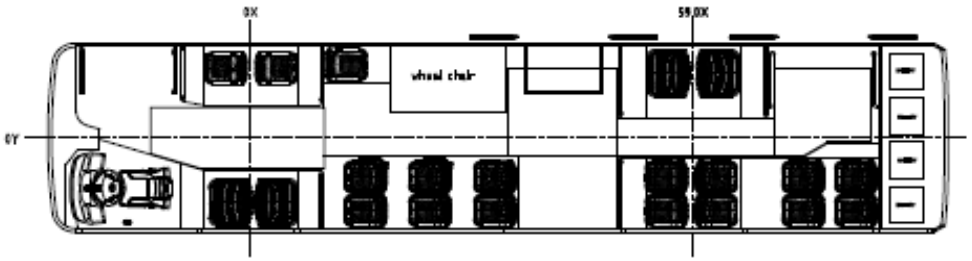
**The fleet is composed by 20 BYD buses, fully electric.**
**BYD offered a vehicle with enough range to complete the mission profile requested in the tender without need of opportunity charging.**












| PASSENGERS | | |
|---|---|---|
| | | |
| seats | 21 | 21 |
| standing | 55 | 62 |
| wheelchair | 1 | - |
| total | 77 | 83 |
| | | |

# ENVIRONMENTAL FEATURES

| BYD K9UB 12M | | | |
|---|---|---|---|
| PERIOD | FROM OPERATIONS STARTING TO 31/03/2019 | | |
|  | BUS IN OPERATIONS | | **20** |
|  | KM RUNNED FROM OPERATIONS STARTING | | **1.405.705** |
|  | SAVINGS (RESPECT TO EEV BUSES) | CO2 (*) [t] | **1.737** |
| | | PM10 [kg] | **116** |
| | | NOx [kg] | **11.787** |

(*) for the CO2 savings we considered:

- CO2 amount for a EEV diesel for the same km range
- the CO2 emissions for electric energy production up to 31-12-2017 (from 1-1-2018 energy is totally from renewable energy sources)

GRUPPO TORINESE TRASPORTI

# THE LAST ARRIVAL : BYD K7


| PASSENGERS | | |
|---|---|---|
| | | |
| seats | 21 | 21 |
| standing | 28 | 36 |
| wheelchair | 1 | – |
| total | 50 | 57 |

GRUPPO TORINESE TRASPORTI

# ENVIRONMENTAL FEATURES

| BYD K7 8,70M | | | |
|---|---|---|---|
| PERIOD | FROM OPERATIONS STARTING TO 31/03/2019 | | |
|  | BUS IN OPERATIONS | | 8 |
|  | KM RUNNED FROM OPERATIONS STARTING | | 69.842 |
|  | SAVINGS (RESPECT TO EEV BUSES) | CO2 (*) [t] | 90 |
| | | PM10 [kg] | 6 |
| | | NOx [kg] | 586 |

(*) for the CO2 savings we considered:

• CO2 amount for a EEV diesel for the same km range

GRUPPO TORINESE TRASPORTI

# LESSONS LEARNED

It's important to consider the electric bus is a "system"

1. BUS
2. BATTERY PACK
3. CHARGING EQUIPMENTS

The bus configuration is not standard as for diesel buses: the appropriate design of the three elements depends on the specific service configuration.

To optimize:

- Costs
- Weights (passengers capacity)
- Components life

Is important to define the service characteristics.

# LESSONS LEARNED

In the tender it's necessary producing the most number of information you can about the service

- type of service: to be defined precisely
  - Range per day
  - Route
  - Stops distances
  - Line time schedule
  - Average speed
  - Morphology
  - Time at terminals
  - Time in depot (maximum time to charge)
  - Depot distance to terminals
  - Maximum power for depot charging
  - Maximum power for opportunity charging (if possible)
  - Other specific expects
- charging equipments: it's important to considered the whole system so in the tender consider buses + depot charging equipments + opportunity charging

GTT
GRUPPO TORINESE TRASPORTI

# LESSONS LEARNED

In the tender it's necessary producing the most number of information you can about the service, so the Manufacture could design properly the size of the subsystems and the best LCC.

type of service: to be defined precisely

- Range per day
- Route
- Stops distances
- Line time schedule
- Average speed
- Morphology
- Time at terminals
- Time in depot (maximum time to charge)
- Depot distance to terminals
- Maximum power for depot charging
- Maximum power for opportunity charging (if possible)
- Other specific expects

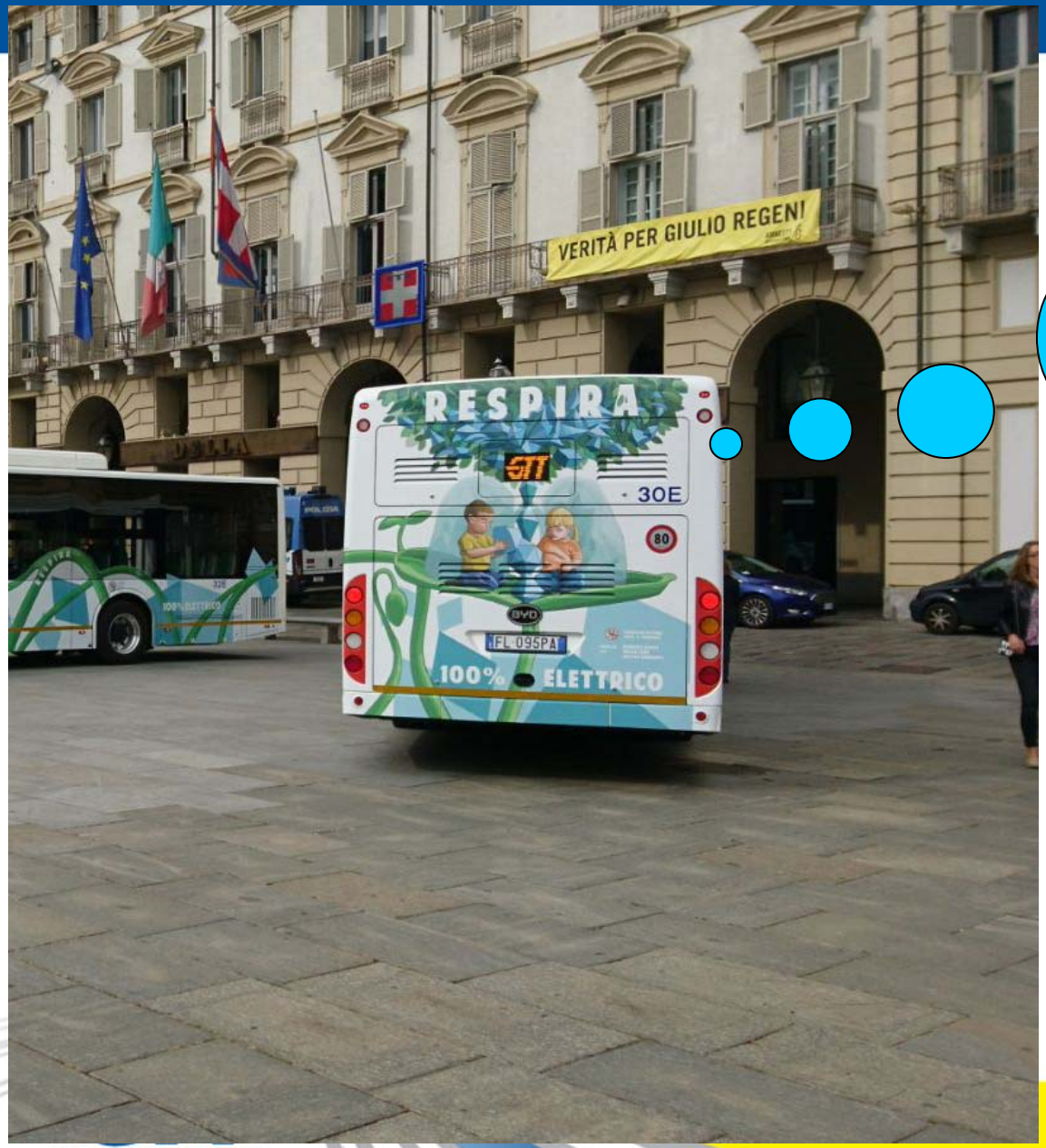
- charging equipments: it's important to considered the whole system so in the tender consider buses + depot charging equipments + opportunity charging

GTT
GRUPPO TORINESE TRASPORTI

# LESSONS LEARNED

For a future wide spread of electric buses some conditions need to be satisfied

- Price and range of the buses (according to the specific route profiles);
- Charging station costs (and interface standardisation to enable use for different types of vehicles);
- Power available for quick charging station (physical limit of the power distribution network);
- Potential financing for the charging infrastructure, and potentially servicing, as well as the buses




**RESPIRA**

**BREATH**

*Marco ZANINI*

Tel. : +39 011 5764484

e-mail : zanini.m@gtt.to.it

**G.T.T. Gruppo Torinese Trasporti SpA**
**Via Daniele Manin 17**
**10153 Torino – Italy**

**Web: www.gtt.to.it**