

## Electric buses

### 20 Electric buses for Stolichen Avtotransport



<b>Purchasing body:</b>	Stolichen Avtotransport EAD
<b>Contract:</b>	Lease of 20 new electric buses and charging infrastructure To be awarded: April 2018
<b>Savings:</b>	<ul style="list-style-type: none"> <li>• 700 tons of CO<sub>2</sub> emissions saved (330 t compared to a conventional solution)</li> <li>• Primary energy savings – 3.36 GWh (2.02 GWh/yr compared to a conventional solution)</li> <li>• Financial Savings - 576 000 EUR</li> </ul>

#### SUMMARY

- 8 year lease for the supply of 20 urban electric buses (2 - axle, pure electric, length 12 m) and charging infrastructure
- Total leasing cost: 11 350 224 EUR (excl. VAT), covering:
  - Cost of the equipment: 8 527 860 EUR
  - Lease fee: 2 822 384 EUR

## Procurement Approach

This was the first tender for purchase of electric buses for public transport ever by Bulgarian authorities. Considering this, the technical experts and procurers from STOLICHEN AVTOTRANSPORT EAD (transport company owned by Sofia municipality) approached the development of the tender documentation with a great deal of care. For a period of over 6 months different electric bus models (SOR EBN 8, length 8 m, SOR EBN 11, length 11 m, Yutong E12, length 12 m) were given to the municipally for testing.

The procurement approach followed several steps:

- Analysis of overall public transport concept in Sofia;
- Needs analysis of the public transport operator (STOLICHEN AVTOTRANSPORT EAD);
- A period of testing of different buses provided by manufacturers;
- Analysis of financing options for the investment;
- Publishing the tender on the company's website (August 2017);
- Contractor approved in February, contract to be signed in April.

### Needs analysis

In compliance with the Air Quality Management Program of Sofia Municipality, STOLICHEN AVTOTRANSPORT EAD takes measures to reduce the main pollutants emitted by transport, namely nitrogen oxides and particulate matter. In addition to switching to more environmental friendly diesel buses (EURO 6), the municipal company aims to introduce more innovative technologies, namely electric buses.

In order to develop the technical specifications of the tender, the concept for development of the urban transport system in Sofia city and the needs of the operator itself were analyzed. One of the main factors taken into account was the quality of the service (in particular passenger comfort), and the possibility of the new electric buses to be used on other lines in the network in case of accidents and failures.

The analysis of the needed battery capacity was made, based on the assumption that the required minimum daily route is 320 km under normal operating conditions. The charging should be within 5 hours over night.

The tender also demonstrates the commitment of the public authorities to reduce the impact of urban transport on air quality.

#### PROCUREMENT INNOVATION

First tender for delivery of electric buses for public transport in Bulgaria. The technical specifications are based on an in-depth analysis of the needs of STOLICHEN AVTOTRANSPORT EAD, as well as preliminary tests with different electric buses

## Market Engagement

Due to the lack of experience with such type of technologies in Bulgaria, a detailed study was carried out. Different models of electric buses were tested on different lines of the city public transport network for 6 months.

## Tender specifications and Verification

### TECHNICAL SPECIFICATIONS

- Two axle buses with length of 12 m
- Number of passengers - min. 70 (seated and standing without driver)
- Battery capacity - min. 280 kWh
- Heating / cooling power - min. 30 kW
- Engine power - min. 320 kW
- Charging stations - 5 pcs. with min power 120 kW (double) and 10 pcs. with min power 60 kW (single)

### AWARD CRITERIA

- Energy costs - 15%
- Warranty conditions\* - 5%
- Technical characteristics (torque, power, mileage) - 25%
- Total value (excluding leasing cost) - 45%
- Lease cost - 10%

### VERIFICATION

- Based on the presented technical specification of the vehicles

\* Warranty conditions offered by the winning bidder:

- Buses, power units: 48 months
- Anti-corrosive coating, waterproofing: 120 months
- Consumables (e.g. tires, wiper blades, refrigerant, bulbs etc.): not under warranty

## A regional approach to SPP

Both Sofia and Gabrovo are members of the Bulgarian SPP network, established by the SPP Regions project, and are part of the Transport working group, and both decided to tender for electric buses. As the first for electric buses in Bulgaria, this tender strongly influenced the next one published by Gabrovo municipality a couple of months later (see Gabrovo e-buses tender model).

## Results

### Environmental impacts

The new electric buses will lead to an estimated reduction of CO<sub>2</sub> emissions by **700 t/yr** compared to the existing diesel buses. Compared to the conventional solution (EURO 6 diesel buses), the new electric buses will generate 330 tCO<sub>2</sub>/yr less. The results from the calculation of the environmental benefits, as well as the reduction of primary energy are presented in Table 1.

Other benefits from the project implementation are the avoidance of harmful pollutants (NO<sub>x</sub> and dust), as the new vehicles will have zero tailpipe emissions.

**Table 1: Environmental savings green tender compared to benchmark and conventional solutions**

Tender	Consumption (l/yr) (GWh/year)	CO <sub>2</sub> emissions (tCO <sub>2</sub> /year)	Primary Energy consumption (GWh/year)
Benchmark (existing diesel buses)	768 000 L	2115	7.68
Conventional solution (EURO 6 diesel buses)	633 600 L	1745	6.34
Green tender (electric buses)	1.728 GWh	1415	4.32
<b>Savings - green tender compared to benchmark</b>		<b>700</b>	<b>3.36</b>
<b>Savings - green tender compared to standard solution</b>		<b>330</b>	<b>2.02</b>

#### CALCULATION BASIS

- Consumption of the existing buses: 40 l/100km
- Consumption of EURO 6 buses: 33 l/100 km
- Consumption of the new e-buses: 90 kWh/100km
- CO<sub>2</sub> emissions factor for electricity: 0.819 kg/kWh
- CO<sub>2</sub> emissions factor for diesel: 2.755 kg/l
- Primary energy factor for electricity: 2.5
- The calculation has been conducted using the tool developed in the GPP 2020 project ([www.gpp2020.eu](http://www.gpp2020.eu)), and adjusted in the SPP Regions project ([www.sppregions.eu](http://www.sppregions.eu)). The detailed calculations can be found in Annex 1 of the present document.

## Financial impact

The total cost for the purchase of the new electric buses (vehicles, charging station, system for telemetry monitoring, software, etc.) is 11 350 244 EUR, including the lease cost of 2 822 384 EUR. The calculated fuel savings equate to financial savings of about 576 000 EUR per year, depending on the change of fuel and electricity prices.

## Market response

Only one bidder submitted a proposal for this specific tender. Based on discussions with the procurers and technical experts there are two main reasons for this: the required daily route of 320 km is sometimes hard to be reached by some manufactures; the leasing of such an amount is frightening for the smaller leasing companies.

## Lessons learned and future challenges

- Continuous testing of different buses in normal conditions (if possible) makes the development of the technical specification in the tender documentation easier.
- The type of technology of the buses may be defined by the procurers, based on detailed need analyses and where other technologies are not relevant. The overall concept for development of the public transport in each specific municipality should also be taken into consideration.
- The reduction of the batteries' capacity over the years should be considered in order to ensure full functionality at the end of the vehicles' life.

### CONTACT

Stefan Aragon ([s.aragon@sofiabus.bg](mailto:s.aragon@sofiabus.bg))

### СТОЛИЧЕН АВТОТРАНСПОРТ

Tel: +359 (2) 955 41 32

[www.sofiabus.bg](http://www.sofiabus.bg)



Столичен  
автотранспорт

## Annex 1 - Calculation of environmental savings (if relevant)

Calculations made using the tool developed within the GPP 2020 project ([www.gpp2020.eu](http://www.gpp2020.eu)), and refined within the SPP Regions project. Available on the SPP Regions website.

Location	Bulgaria		CO <sub>2</sub> -emissions per kWh (kg CO <sub>2</sub> /kWh)	0,819																				
<b>Input</b>	% Green electricity for Electro engine (if any)				0%				% Green electricity for Electro engine (if any)				0%											
	Baseline								Conventional tender								Green tender							
	Quantity of vehicles	Average distance per vehicle per year (km/yr)	Kind of fuel	Amount of fuel per 100 km	Quantity of vehicles	Average distance per vehicle per year (km/yr)	Kind of fuel	Amount of fuel per 100 km	Quantity of vehicles	Average distance per vehicle per year (km/yr)	Kind of fuel	Amount of fuel per 100 km	Quantity of vehicles	Average distance per vehicle per year (km/yr)	Kind of fuel	Amount of fuel per 100 km								
	Standard Engine - fuel 1	20	96 000	Diesel	40,0 l/100 km	20	96 000	Diesel	33,0 l/100 km						Petroleum	l/100 km								
	Standard Engine - fuel 2			Diesel	l/100 km			Diesel	l/100 km						Diesel	l/100 km								
Electro Engine			Electricity	kWh/100km			Electricity	kWh/100km	20	96 000	Electricity	90,0 kWh/100km												
Hybrid Engine																								
Electricity (combined test cycle)			Electricity	kWh/100km			Electricity	kWh/100km							Electricity	kWh/100km								
Fuel (combined test cycle)			Diesel	l/100 km			Diesel	l/100 km							Diesel	l/100 km								
<b>TOTAL</b>	<b>20</b>	<b>96 000</b>			<b>20</b>	<b>96 000</b>			<b>20</b>	<b>96 000</b>			<b>20</b>	<b>96 000</b>										

<b>Savings</b>	Total savings (Baseline / Green tender)				Savings (Conventional tender / Green tender)			
	Energy savings (GWh/yr)	CO <sub>2</sub> -savings (t/yr)	% of energy savings	% of CO <sub>2</sub> -savings	Energy savings (GWh/yr)	CO <sub>2</sub> -savings (t/yr)	% of energy savings	% of CO <sub>2</sub> -savings
Standard Engine - fuel 1	7,68	2 115	100%	100%	6,34	1 745	100%	100%
Standard Engine - fuel 2								
Electro Engine	-4,32	-1 415	#DIV/0!	#DIV/0!	-4,32	-1 415	#DIV/0!	#DIV/0!
Hybrid Engine								
Electricity (combined test cycle)	0,00	0	#DIV/0!	#DIV/0!	0,00	0	#DIV/0!	#DIV/0!
Fuel (combined test cycle)								
<b>TOTAL FOR THE PROJECT</b>	<b>3,36</b>	<b>700</b>	<b>44%</b>	<b>33%</b>	<b>2,02</b>	<b>330</b>	<b>32%</b>	<b>19%</b>

## About SPP Regions

SPP Regions is promoting the creation and expansion of 7 European regional networks of municipalities working together on sustainable public procurement (SPP) and public procurement of innovation (PPI).

The regional networks are collaborating directly on tendering for eco-innovative solutions, whilst building capacities and transferring skills and knowledge through their SPP and PPI activities. The 42 tenders within the project will achieve 54.3 GWh/year primary energy savings and trigger 45 GWh/year renewable energy.

### SPP REGIONS PARTNERS



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649718. The sole responsibility for any error or omissions lies with the editor. The content does not necessarily reflect the opinion of the European Commission. The European Commission is also not responsible for any use that may be made of the information contained herein.