

Electric Mobility

Purchase and transfer of electric bicycles in the Province of Barcelona



Contracting authority:	Barcelona Regional Council
Contract:	Purchase of electric bicycles for staff and municipal services in the province of Barcelona Awarded: July 2016
Savings:	<ul style="list-style-type: none"> • 9,6 tonne CO₂ emissions saved • 0,032 GWh of primary energy saved

SUMMARY

- Purchase of 201 electric bicycles, transferred to 103 local authorities.
- Support to municipalities in their climate change mitigation policies and the transition towards soft mobility models.
- Supply contract awarded on 06/07/2016 to Freeel Ecomoving Solutions SL, for 120.000 € (VAT included). It includes the bicycles, transport and safety accessories, theft protection elements and basic maintenance training.

Procurement context

The procurement and transfer of electric bicycles is framed within the strategy of Barcelona Regional Council on policies for sustainable mobility and energy efficiency, contained in the Covenant of Mayors for Climate and Energy.

In 2008 Barcelona Regional Council started a programme of purchasing conventional bicycles for the local police forces. The year after, it was expanded to all municipal staff. Over the years, this programme has evolved towards electric mobility, as a soft and efficient mobility model for municipal services. Since 2008 a total of 451 bicycles (both conventional and electric) have been purchased, 141 for local police forces and 302 for other municipal services. A total of 226 local authorities of the Barcelona province have benefited from this service. 2016, the year covered in this tender model, represents a turning point as a total of 201 electric bicycles have been provided to 103 municipalities, a volume much higher than any year before.

The acquisition of electric bicycles has been conducted through a supply contract through an open tendering process with several award criteria.

The transfer of bicycles to municipalities is formalised through a request under the framework of the services catalogue of the Regional Council. Each local authority can request up to 4 bicycles. Each request is evaluated based on several criteria, which favour smaller municipalities that participate in networks (Network of Cities and Towns for Sustainability, Covenant of Mayors, Network of Cities for the Bicycle, etc.) and those that demonstrate a higher commitment to long term use.

On the 3rd of November of 2016 a special event was organised for the transfer of the 201 bicycles to provide visibility to the initiative and basic training to the future users.

Joint Procurement

All local authority signatories to the Covenant of Mayors can request the transfer of electric bicycles. Barcelona Regional Council offers the service for free as a support tool to municipalities. Although not strictly speaking joint procurement, the Regional Council maximises the number of users by acting like a central purchasing body. Thus, the joint purchase has allowed to achieve the following benefits:

- Administrative cost reduction for interested local authorities.
- Savings on the acquisition price of the equipment.
- Offer of complementary services geared to awareness raising and training of bicycle users.

INNOVATION IN PROCUREMENT

This is the largest volume of bicycles purchased so far in the framework of the programme to provide bicycles to municipalities. With this procurement, the electrification of the bicycle fleet of the programme exceeds 60%.

- Strong market signal through the visibility of the demand and use of electric bicycles.

Tender Clauses and Verification

TECHNICAL SPECIFICATIONS

- Bicycle: aluminium fork; white colour; customisation with Barcelona Regional Council logo; aluminium tyres and aluminium / Hi ten components; 7 speed gears; 250W motor; maximum speed of 25 km/h; LED lights; stabiliser (support leg).
- Fittings: red baggage rack with black duffel bag; rigid U chain and spirals; milometer; approved ergonomic helmet.
- Battery: lithium-ion; autonomy of 50 to 60 km; charging time of 4 to 8 hours; at least 500 charge cycles guaranteed; protected with theft protection key; charging cable and accessories.
- Preparation of the bicycles (electric autonomy when delivered of 80% of the battery)
- Provision of basic maintenance training to final users on the day of the delivery event.

AWARD CRITERIA

- Price (up to 80 points)
- Technical improvements on the bicycles (up to 20 points)
 - Portability: foldable bicycle (up to 10 points)
 - Motor assistance without pedalling (up to 10 points)

VERIFICATION

The criteria were evaluated automatically based on the technical information provided by bidders. Before delivering the bicycles, compliance with the specified technical specifications was checked.

Regional approach to SPP

The tender documents were prepared and published centrally by Barcelona Regional Council. Nevertheless, they respond to the needs expressed by local authorities in the framework of different partnership structures and exchange forums promoted or participated in by Barcelona Regional Council, notably the Covenant of Mayors Club¹ and the working group on Sustainable Energy of the

¹ The Covenant of Mayors Club is a forum for coordination and exchange among public authorities and other stakeholders involved in the Covenant of Mayors. It consists of the coordinators of the Covenant (the Regional

Network of Cities and Towns for Sustainability managed by the Council, which provides support to the Covenant of Mayors in climate change mitigation measures.

Both structures are committed to integrate the regional focus in processes related to environmental improvement. Specifically, the objectives can be classified in:

- Communication, networking and exchange
- Optimisation of resources and existing structures
- Empowering local authorities in the fight against climate change
- Establish synergies to comply with the objectives

Furthermore, Barcelona Regional Council also manages the elaboration of Local Mobility Plans and Sustainable Energy Action Plans for many municipalities of the province. This contributes to having a complete knowledge of the needs of local authorities and the actions foreseen to achieve a transition towards more sustainable energy and mobility models.

Results

The contract was awarded on the 6th of July of 2016 to the company Freeel Ecomoving Solutions, SL for a total of 120.000 € (VAT included) and a unit price of for 201 bicycles. The maximum unit price set in the tendering documents was 1.000 € (VAT included).

Environmental Impact

The use of the 201 electric bicycles provided to municipalities in 2016 will save, each year, more than **9,6 tonnes of CO₂ emissions**, and **32,10 MWh primary energy consumption**. Additionally, NOx and particulate matter (PM) are reduced.

These results have been estimated from the information gathered since the delivery of the bicycles between November 2016 and March 2017. Data gathered covers about 50% of the disbursed bicycles, including the mileage registered since their transfer, the transport mode they replace and other use parameters. The data allows for an estimation of energy savings consistent with the actual use.

Councils of the provinces of Barcelona, Girona, Tarragona and Lleida and Barcelona Metropolitan Area), the promoters of the Covenant (Network of Cities and Towns for Sustainability and the Council of Local Initiatives for the Environment of the Province of Girona), the members of the Covenant (member municipalities) and partners of the Covenant (private entities).

There has been a notable shift of 46.000 km from hard mobility (cars and motorcycles) to soft, equivalent to 1,15 trips around the globe. Furthermore, the use of bicycles is expected to increase in the short term, as data collection was conducted at a very early stage and climate factors were unfavourable (winter). Therefore, higher savings are expected once the bicycles are completely implemented.

Table 1: Environmental Savings: CO₂ Emissions and primary energy consumption

Tender	Distance covered (km)		CO ₂ Emissions CO ₂ (kg/year)	Primary energy consumption (MWh)
Benchmark: <i>Previous modal distribution</i>	On foot	8.456,91	9.730,76	33,21
	Conventional bicycle	1.509,32		
	Motorcycle	9.336,46		
	Car (diesel)	23.692,11		
	Car (petrol)	13.116,74		
Low carbon solution: <i>e-bikes</i>	56.111.55		136,88	1,11
Savings			9.593,89 (98,6%)	32,10 (96,7%)

Additionally, air pollution environmental savings have been calculated. The use of electric bicycles will save up to **26,95 kg of NO_x** and **1,21 kg of PM** from combustion. The emission factors used for the calculation of these savings are based on *EMEP/EEA air pollutant emission inventory guidebook 2013*. PM attributable to vehicle tyre and brake wear and road surface wear have not been included.

Table 2: Environmental Savings: air pollution

Tender	Distance covered (km)		NO _x (kg/year)	Exhaust PM (kg/year)
Benchmark: <i>Previous modal distribution</i>	On foot	8.456,91	26,95	1,21
	Conventional bicycle	1.509,32		
	Motorcycle	9.336,46		
	Car (diesel)	23.692,11		
	Car (petrol)	13.116,74		
Low carbon solution: <i>e-bikes</i>	56.111.55		0,00	0,00
Savings			26,95	1,21

CALCULATION BASIS

- CO₂ emission factors:
 - Diesel (direct + indirect): 2,755 kg/l
 - Petrol (direct + indirect): 2,786 kg/l
 - Electricity mix: 0,308 kg/kWh²
- NO_x emission factors:³
 - Car (diesel): 0,7421 g/km
 - Car (petrol): 0,5905 g/km
 - Motorcycle (petrol): 0,1736 g/km
- Exhaust PM emission factors:³
 - Car (diesel): 0,0428 g/km

² Catalan Office for Climate Change, emissions factor for the electricity mix for 2016.

³ *Guia de càlcul d'emissions contaminants a l'atmosfera 2013*, Department of Territory and Sustainability of Catalonia Government (in Catalan).

http://mediambient.gencat.cat/ca/05_ambits_dactuacio/atmosfera/emissions_industrials/guia_calcul_contaminants/

- Car (petrol): 0,0023 g/km
- Motorcycle (petrol): 0,0173 g/km
- Consumption factors (urban)⁴:
 - Car (diesel): 7,53 l/100km
 - Car (petrol): 10,01 l/100km
 - Motorcycle (petrol): 4,47 l/100km
 - e-bike (electricity): 0,792 kWh/100km
- Fuel density:⁵
 - Diesel: 832,5 g/l
 - Petrol: 747,5 g/l
- Energy content of fuel and electricity:
 - Diesel: 36 MJ/l
 - Petrol: 32 MJ/l
 - Electricity: 3,6 MJ/kWh
- For the primary energy consumption of the e-bikes, a primary energy factor of 2,5 for electricity stemming from fossil fuels has been used.
- The calculation has been conducted using a methodology adapted from the tool developed in the GPP 2020 project (www.gpp2020.eu), and adjusted in the SPP Regions project (www.sppregions.eu). The detailed calculations can be found in Annex 1 of the present document.

Economic Impact

The joint procurement of 201 electric bicycles has allowed considerably lower purchase prices to be obtained. The awarded company provided a 40,3% reduction over the maximum unit price set in the tender documents (597,01 € per unit – with the maximum unit price set at 1.000 €). This has allowed the purchase of a higher number of bicycles than initially foreseen, increasing the service to municipalities. Beneficiary authorities don't bear any acquisition cost, as Barcelona Regional Council provides as part of their support services. Furthermore, their generalised use will allow economic savings due to the lower use of combustion vehicles. However, that is not the primary reason for the initiative but the exemplifying role of the measure.

⁴ Report on the monitoring and actualisation of social and environmental costs of the mobility in the Barcelona Metropolitan Region for the year 2012, Metropolitan Transport Authority, Novembre 2015 (in Catalan) (http://doc.atm.cat/ca/dir_pdm_estudis/costos_socials_ambientals_2012_fasel/)

⁵ Decree 61/2006, of January 31, establishing the specifications of petrol, diesel, fueloils and liquid petroleum gases and regulating the use of certain biofuels.

Market Response

Barcelona Regional Council had previously purchased electric bicycles. However this was by far the biggest purchase since then.

Three companies showed interested in the call for tenders and successfully presented offers.

Two of the bids offered technical improvements in line with the award criteria (portability and support without pedalling within what is legally allowed).

The awarded bid offered the lowest price and both technical improvements mentioned above.

Contract Management

In the delivery of the bicycles the only aspect that is checked is that they do comply with the characteristics offered and that the training sessions to final users are adequate.

Regarding the disbursement of the electric bicycles, like for the other services offered by Barcelona Regional Council, an agreement of quality is defined. That is, bicycle users have to evaluate the quality of the service and, if the commitments agreed upon are not achieved, the Council analyses the reasons and proposes relevant corrective measures.

Lessons Learnt and Future Challenges

For its exemplary and demonstrative nature, the use of electric bicycles by local authorities can be defined as a measure for:

- Energy saving and climate change mitigation
- Reduction of air and noise pollution
- Traffic calming (soft mobility)

From an environmental point of view it could be argued that the use of electric bicycles might replace travels previously made on foot or conventional bicycles and, therefore, have environmental costs in terms of consumption of materials, energy and CO₂ emissions. However the analysis conducted for this tender model shows that the main transport modes replaced by the electric bicycles are those by motor vehicles (cars and motorcycles) both in number and in kilometres.

Weather conditions can influence the usage level of bicycles. Users from the interior of the region state that due to the cold temperatures in winter, the use of bicycles has been lower than foreseen during the first months of implementation.

Weather conditions, together with the terrain, safety and thefts are some of the main known obstacles when talking about regular use of conventional bicycles. The electric bicycle is a good solution to counterbalance the terrain effect. The requirement within the tender for safety elements such as the helmet and security elements (chain and key for the battery) tries to cover the other barriers.

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Annex 1 – Calculation of the environmental savings

The calculation has been conducted using a methodology adapted from the tool developed in the GPP 2020 project (www.gpp2020.eu), and adjusted in the SPP Regions project (www.sppregions.eu).

A survey to the municipalities that were given electric bicycles in 2016 was conducted. A total of 50 replies from the 103 registered municipalities were received with information for 85 of the 201 given bicycles. Therefore the sample is considered representative.

For each bicycle the following information was gathered:

- a) Km registered since the putting into service of the electric bicycles
- b) Month of the putting into service
- c) Types of users (municipal staff, local police, tourist routes, others)
- d) Replaced transport mode (on foot, conventional bicycle, motorcycle, car⁶, public transport⁷)
- e) Use frequency (daily, a few times a week, occasional)

Based on this information projections have been made on the annual distance travelled by all bicycles as well as the distribution between the different transport modes replaced by the bicycles. The mileage obtained is the basis for the benchmark and low carbon scenarios.

For the calculation of the CO₂ emissions and primary energy consumption, consumption factors for each transport mode adjusted to urban conditions were used. For conventional bicycles and on foot the physical consumption has not been considered, therefore their energy consumption is null.

For the low carbon solution, the energy consumption of the electric bicycles was estimated based on the technical specifications of the acquired model, considering a range of 40 km and a load losses of the battery of 33%.

Additionally, calculation of air pollutant -NO_x and exhaust PM- savings has been performed. Distances covered of the different motorized transport modes replaced by the bicycles have been multiplied by the corresponding emission factors. The emission factors used are based on the methodology

⁶ The distribution between petrol and diesel has been made based on a previous study by Barcelona Regional Council on the vehicle fleets of municipalities in the region of Barcelona. A distribution of 64,4% diesel cars and 35,6% petrol cars was used

(http://xarxaenxarxa.diba.cat/sites/xarxaenxarxa.diba.cat/files/diba_parco_mobil.pdf)

⁷ Only one response mentioned the replacement of public transport by the electric bicycle and with a very low magnitude over the overall results. Therefore that response was eliminated from the sample and thus public transport doesn't appear in the breakdown of modal results.

described in the *EMEP/EEA air pollutant emission inventory guidebook 2013*, adapted to the Catalan fleet by the Department of Territory and Sustainability of the Government of Catalonia.⁸

	Benchmark					
Transport mode	Mileage (km)	Fuel consumption (l-kWh)	CO ₂ emissions (kg CO ₂ /year)			Primary energy consumption (MWh)
			direct	indirect	total	
On foot	8.456,91	-	-	-	-	-
Conventional bicycle	1.509,32	-	-	-	-	-
Motorcycle (petrol)	9.336,46	417,34	925,78	236,74	1.162,52	3,71
Car (diesel)	23.692,11	1.783,45	4.337,66	574,87	4.912,54	17,83
Car (petrol)	13.116,74	1.312,38	2.911,23	744,48	3.655,71	11,67
Electric bicycle	-	-	-	-	-	-
Total	56.111,55	3.513,17	8.174,67	1.556,09	9.730,76	33,21

	Low carbon tender					
Transport mode	Mileage (km)	Fuel consumption (l-kWh)	CO ₂ emissions (kg CO ₂ /year)			Primary energy consumption (MWh)
			direct	indirect	total	
On foot	-	-	-	-	-	-
Conventional bicycle	-	-	-	-	-	-
Motorcycle (petrol)	-	-	-	-	-	-
Car (diesel)	-	-	-	-	-	-
Car (petrol)	-	-	-	-	-	-
Electric bicycle	56.111,55	444,40	-	-	136,88	1,11
Total	56.111,55	444,40	0,00	0,00	136,88	1,11

⁸ *Guia de càlcul d'emissions contaminants a l'atmosfera 2013*, Department of Territory and Sustainability of Catalonia Government (in Catalan).
http://mediambient.gencat.cat/ca/05_ambits_dactuacio/atmosfera/emissions_industrials/guia_calcul_contaminants/

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



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