SPP REGIONS
REGIONAL NETWORKS FOR SUSTAINABLE PROCUREMENT

SPP TENDER MODEL

Electric vehicles

Purchase of 8 small EV waste collection vehicles, with tipping tank

Purchasing body:	CIDIU SERVIZI S.p.A.
Contract:	8 electric vehicles for waste collection Awarded: 8th November 2017
Savings:	• 17 tons of CO_2 emissions saved per year • Primary Energy saving of 0.03 GWh/year • Financial savings of 8,524 €/year

SUMMARY

- Supply contract of 8 pure electric vehicles equipped with tipping tank to be used for urban waste collection, length about 3.8 m and width about 1.4 m
- Life cycle analysis shows a substantial economic benefit in the use of EVs
- Vehicles to service 17 municipalities in the province of Turin
- Part of CIDIU's gradual EV fleet replacement scheme
- Tender awarded for 183,920.00 € (VAT excluded) to Exelentia srl

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www.sppregions.eu

Procurement Approach

The purchase of 8 electric vehicles is one of 5 lots, the only one of electric vehicles, of a larger contract for the supply of 20 vehicles with reduced environmental impact (all meeting EURO VI standard).

CIDIU Servizi S.p.A., ISO 14001 certified, is progressively increasing the number of vehicles with low environmental impact, replacing the old ones with the same number of electrically powered vehicles. It already has other electric vehicles in its fleet: 1 high pressure washer for urban furniture cleaning, 1 sandblaster for the removal of dirt from walls, 6 minicars, 1 sweeper and 2 compactors for the collection of organic waste, these last with hybrid power (electric / diesel). CIDIU already has a charging system for electric vehicles that will also be used for the new vehicles.

The choice of new NEV (Neighbourhood electric vehicles[1]) is in line with EU legislation promoting the use of clean mobility solutions in public procurement: these electric vehicles allow people to move and work in an efficient, and environmentally sound way.

The tender was published on 20 July 2017 and the award was made on the basis of the most economically advantageous offer on 8 November 2017.

Exelentia srl has supplied GOUPIL G3 model vehicles fitted with a tipping tank for urban hygiene operations, in particular for manual sweeping, emptying of bins, cleaning of gardens and, thanks to their versatility and reduced noise, they may also be used for urban hygiene operations in historical centres.

Joint procurement

CIDIU is a consortium serving 17 municipalities in the province of Turin: Alpignano, Buttigliera Alta, Coazze, Collegno, Druento, Giaveno, Grugliasco, Pianezza, Reano, Rivoli, Rosta, Sangano, San Gillio, Trana, Valgioie, Venaria Reale and Villarbasse, for a population of around 260,000 residents.

The electric vehicles purchased will be at the service of all the consortium municipalities.

Needs analysis

The Turin metropolitan area frequently exceeds the limit thresholds of the main atmospheric pollutants – in particular PM_{10}. For some years now, during winter, municipal administrations have banned the circulation of the most polluting vehicles. CIDIU has decided to gradually replace most of its fleet with electric vehicles, and has also engaged in environmental education initiatives aimed at schools and citizens.

[1] Small, low speed, low range EVs, designed for use at the neighbourhood level

Market engagement

In collaboration with the NEV Mobility Europe association[2], the availability of neighbourhood electric vehicles on the European market has been explored.

On 22 June 2017, CIDIU organized an event with the collaboration of NEV Mobility Europe (European Association of electric vehicles for proximity mobility in cities and the development of local economy) to promote the use of electric proximity vehicles and to present its environmental policy and future intentions to purchase new electric vehicles.

On 23 September 2017 CIDIU organized a second event to promote sustainable mobility and to present the electric and hybrid vehicles that the company has put in place to operate on the urban territory with a lower polluting impact.

Tender specifications and Verification

TECHNICAL SPECIFICATION

- Vehicle with electric engine without brushes, equipped with a tipping tank for garbage collection
- Capacity greater than or equal to 600 kg;
- Width less than or equal to 1,400 mm;
- Length less than or equal to 3,800 mm;
- Turning radius less than or equal to 4,000 mm;
- BATTERY: battery charge autonomy sufficient to travel at least 90 km / day;

AWARD CRITERIA

- Economic offer (max 30points)
- Technical offer (max 70 points) divided into:
    - Manoeuverability (20 points)
    - Characteristics of the tipping tank (19 points)
    - Driving comfort (16 points)
    - Energy consumption of the battery (15 points)

[2] http://nevmobility.eu

VERIFICATION

The vehicles will be subject to acceptance testing within 7 days of delivery to verify compliance with the mandatory characteristics required by the specifications.

Results

Environmental impact

The fleet of 8 vehicles will lead to an estimated reduction in terms of CO_2 emissions in relation to fuel use equal to 66% (17 tons of CO_2 avoided). In energy terms, the use of these vehicles leads to a primary energy saving of 33%, equal to 27.5 MWh/year (see Table 1).

The electricity used by CIDIU is currently purchased by ENEL but CIDIU Servizi SpA is starting the installation of a photovoltaic park on the roof of the vehicles depot, this will be able to generate sufficient energy to recharge all vehicles. Once installed, it is envisaged that these will be used to recharge the batteries directly.

Electric vehicles for waste collection do not emit local harmful pollutants - in particular nitrogen oxides (NOx) and particulate matter (PM) - and noise emissions are also almost absent.
The baseline model is the replaced vehicle (Piaggio Porter Petrol-powered Euro 3).

Table 1: Environmental impacts

Tender	Consumption	Distance (km/year)	CO_2 Emissions (tonne/year)	Primary Energy Consumption (GWh/year)
Baseline – Petrol EURO 3	8 l/100 km	17,829	32	0.10
Conventional tender - Petrol EURO 6	6.5 l/100 km		26	0.08
Green tender - Electric	15.4 kWh/100 km		9	0.05
Savings – Comparison between electric and conventional tender			**17**	**0.03**

CALCULATION BASIS

- CO_2 emission factor set at 0.404652 kg/kWh for electricity
- For primary energy consumption a PEF (Primary Energy Factor) of 2.5 was assumed for electricity
- More detailed calculations are included in the Annex
- Calculation made using the tool developed within the GPP 2020 project (www.gpp2020.eu), and refined within the SPP Regions project. Available on the SPP Regions website.

Table 2: NMVOC, NOx and PM 2.5 local emission

Technology	NMVOC (g/km)	NO_x (g/km)	PM2.5 (g/km)
Baseline – Petrol EURO 3	1,2675	0,2717	0,0188
Conventional tender – Petrol EURO 6	0,5665	0,0997	0,0183
Green tender - Electric	0	0	0

Source: ISPRA "La banca dati dei fattori di emissione medi del trasporto stradale in Italia"

Financial impacts

Electric vehicles are built according to the principle of rationality and efficiency. For this reason they do not have all the wearable parts of the combustion engine vehicles, such as filters, liquids, wearable parts such as clutches or feed pumps. This constructive simplicity drastically reduces maintenance costs by around 70%. For this reason CIDIU decided not to include a full-service in the tender; it was estimated that, despite a change of batteries, maintenance costs would have been lower than the price required for full service.

INNOVATIVE SOLUTION

The use of electric vehicles is ideal in the historical centres of the towns served by CIDIU. In narrow streets and with ancient roads it is very important to reduce air pollution and noise emissions.

LCC analysis shows that the entire fleet allows savings around € 7,500 over 7 years.

Life Cycle Costing

A complete life cycle cost comparison was conducted following the tender by comparing the winning electric vehicle with the petrol fuelled one (potential alternative). This analysis was performed by Arpa Piemonte by using the calculator "Vehicles – Life Cycle Cost (LCC) Calculator" developed by Clean Fleets[3]. In this case, it was a comparison between:

- Piaggio Porter with tipping tank petrol-powered Euro 6 (potential alternative)
- Goupil G3 electric with tipping tank

To calculate, the following variables were defined:

- acquisition cost
- operation costs (bus use, type of fuel, performances, etc.)
- maintenance costs (including battery replacement – likely after 6.5 years)
- environmental costs (emissions), based on the *operational lifetime costs* methodology prescribed within the Clean Vehicles Directive (2009/33/EC), which gives a value to emissions of CO_2, NOx, particulates (PMs), and NMHC[4]

Table 1: LCC analysis results performed by ARPA Piemonte

Tender	Lifetime (years)	Average distance per vehicle in lifetime (km)	LCC (€/unit)*
Petrol EURO 6 – Conventional tender	7	17829	39,436.56
Electric – Green tender			31,978.22

**Hypothesis: Diesel price 1.5 €/L; electricity price: 0.15 €/kWh; petrol-powered maintenance costs:2,000€; electric vehicle maintenance costs -70% compared to the petrol one; petrol powered acquisition cost 15,150€; electric vehicle acquisition cost 22,987.50€; amount of fuel Euro 6: 6.5 l/100km; amount of electricity electric vehicle: 15.4 kwh/100km; duration batteries: 6 years.*

[3] www.clean-fleets.eu/fileadmin/files/documents/Publications/LCC_tool_Aug_2015/Clean_Fleets_LCC_tool_-_EN.xlsm

[4] www.clean-fleets.eu/fileadmin/files/documents/Publications/CVD_Operational_Lifetime_Cost_Methodology_-_Clean_Fleets_Factsheet.pdf

As shown in the following diagram, despite a higher acquisition cost, electric vehicles have lower fuel, maintenance and environmental (due to emissions) costs in the considered planning horizon (7 years). Results demonstrate that these lower costs offset the higher acquisition cost in the longer term.

According to the LCC methodology, the entire fleet allows savings of around € 60,000 in 7 years.

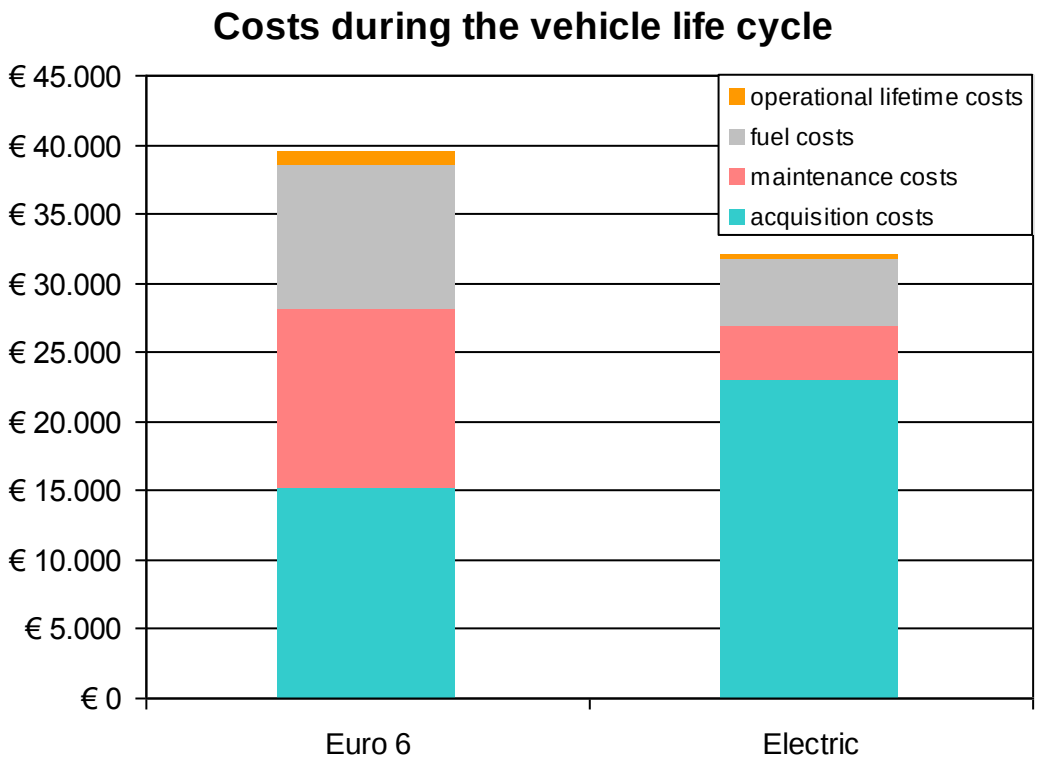

Diagram 1: Total costs for each model at the end of planning horizon

Social impacts

The electric vehicles for waste collection improve the relationship between the company and the citizens because they do not emit harmful substances into the atmosphere and are silent, they represent the best way to operate in historical centres and small towns.

CIDIU is engaged in environmental education programs for schools, to which it proposes class meetings to understand the sustainable use of resources, spread the culture of respect for the urban territory, the best practices of waste reduction, reuse, exchange and proper waste management.

Market response

The only offer received was the one presented by the winner Exelentia srl which provided the GOUPIL G3 vehicle model. Goupil (Polaris Industries, Inc. USA) has been producing NEVs (Neighbourhood Electric Vehicles) in Europe for over twenty years at its plant in Bourran, Department of Lot and Garonne, in the South-West of France.

On the market there is at least one other important competitor (Alkè) that probably did not judge the auction base sufficiently profitable. There are also smaller manufacturers who contacted CIDIU but who do not believe they are still able to reliably provide fleets of vehicles of that type.

By 2018 CIDIU intends to further expand its fleet of electric vehicles.

Lessons learned and future challenges

Lessons learned

- The electric vehicles purchased are perfectly able to replace the normal thermal vehicles, thanks to proven autonomy and reliability, as well as reduced overall dimensions and manoeuvrability. Furthermore, the economic efficiency of the purchase can be demonstrated in just a few years.
- The use of proximity electric vehicles gives an immediate image return with the citizens and demonstrates consistency of the entity with the objectives of reducing environmental impact. Furthermore, citizens feel more motivated to collaborate in new activities with low environmental impact.
- The future challenge regards the recharging system, which is often underestimated during the tender phase, while it is very important to clarify all the plant engineering aspects with its own installers.

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Annex 1 - Calculation of environmental savings

Calculation made using the tool developed within the GPP 2020 project (www.gpp2020.eu), and refined within the SPP Regions project. Available on the SPP Regions website.

- *LCC Calculator and Emission savings Calculator*

clean fleets
purchasing clean public vehicles

VEHICLES - LIFE CYCLE COST (LCC) CALCULATO

Please fill in the white cells only

GENERAL CONDITIONS					
ⓘ	Contract length/period of vehicle ownership	Year	7		
ⓘ	Discount rate	%	2,00		
ⓘ	Number of bids/offers		2		
ACQUISITION COSTS					
	Name of bidder/vehicle model		**Euro 6**		**Electric**
ⓘ	Number of vehicles		8		8
ⓘ	Purchase price	€/unit	15.150,00	€/unit	22.987,50
	(or) Lease price	€/unit/year		€/unit/year	
	COSTS OF ACQUISITION € / UNIT		**15.150,00**		**22.987,50**
OPERATING COSTS PER VEHICLE					
ⓘ	Annual use of vehicle	km	17.829	km	17.829
ⓘ	Type of Fuel		Petrol		Electricity
ⓘ	Fuel consumption per vehicle	l/100km	6,5	kWh/100km	15,4
	Fuel price	€/l	1,50	€/kWh	0,15
ⓘ	Add a second fuel type (PHEVs, dual fuel)?		No		No
	Type of Fuel 2				
ⓘ	Fuel consumption per vehicle 2				
	Fuel price 2				
	Replacement battery price	€/unit		€/unit	2.400
	Expected lifetime of battery	Years		Years	6
	(or) Battery lease price	€/unit/year		€/unit/year	
	OPERATING COSTS € / UNIT		**10.337,00**		**4.871,65**
MAINTENANCE COSTS PER VEHICLE					
ⓘ	Estimated annual maintenance costs	€/unit/year	2.000	€/unit/year	600
ⓘ	(or) Annual service agreement	€/unit/year		€/unit/year	
	MAINTENANCE COSTS € / UNIT		**12.943,98**		**3.883,19**
TAXES AND OTHER COSTS/SUBSIDIES PER VEHICLE					
ⓘ	Vehicle tax	€/unit/year		€/unit/year	
	Insurance costs	€/unit/year		€/unit/year	
ⓘ	Infrastructure - one off investment costs	€		€	
	(or) Infrastructure - annual costs	€/year		€/year	
ⓘ	Other costs/subsidies (*click on left + to expand*)				
TOTAL OTHER COSTS AND SAVINGS/ UNIT			**-**		**-**
ⓘ	**EMISSIONS (OPERATIONAL LIFETIME COST- OLC) PER VEHICLE - OPTIONAL SECTION**				
	Do you wish to apply the operational lifetime cost methodology from the Clean Vehicles		Yes		
ⓘ	CO_2 Emissions	g/km	182	g/km	63
	Lifetime cost of CO_2 emissions € / unit		681,42		235,88
ⓘ	NO_x (Nitrous oxides)	g/km	0,0997	g/km	
ⓘ	PM (Particular Matter)	g/km	0,0183	g/km	
ⓘ	NMHC (Non-methane hydrocarbons)	g/km	0,5665	g/km	0
Lifetime cost of pollutant emissions € / unit			324,15		-
ⓘ	Reference Fuel (Cheapest of petrol or diesel before tax)				
ⓘ	Cost of Reference Fuel (before tax)	€/l		€/l	
Lifetime cost of energy consumption € / unit			-		-
OPERATION LIFETIME COST (OLC) € / UNIT			**1.005,57**		**235,88**
END OF LIFE					
ⓘ	Remnant value (at end of contract period)	€/unit			
			-		-
	TOTAL LCC PER UNIT		**39.436,56**		**31.978,22**
	TOTAL LCC		**315.492,46**		**255.825,79**

Location	Italy		CO_2-emissions per kWh (kg CO_2/kWh)	0,405												
Input	**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	
Standard Engine - fuel 1	8	17.829	Petroleum	8,0	l/100 km	8	17.829	Petroleum	6,5	l/100 km			Diesel		l/100 km
Standard Engine - fuel 2			Diesel		l/100 km			Diesel		l/100 km			Petroleum		l/100 km
Electro Engine			Electricity		kWh/100km			Electricity		kWh/100km	8	17.829	Electricity	15,4	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
TOTAL	**8**	**17.829**				**8**	**17.829**				**8**	**17.829**			

Total consumption and emissions	**Baseline**				**Conventional tender**				**Green tender**			
	Annual fuel consumption		Primary energy consumption (GWh/yr)	CO_2-emissions per year (t)	Annual fuel consumption		Primary energy consumption (GWh/yr)	CO2-emissions per year (t)	Annual fuel consumption		Primary energy consumption (GWh/yr)	CO2-emissions per year (t)
Standard Engine - fuel 1	11.410	l	0,10	32	9.271	l	0,08	26	0	l	0,00	0
Standard Engine - fuel 2	0	l		0	0	l		0	0	l		0
Electro Engine	0	kWh	0,00	0	0	kWh	0,00	0	21.965	kWh	0,05	9
Hybrid Engine												
Electricity (combined test cycle)	0	kWh	0,00	0	0	kWh	0,00	0	0	kWh	0,00	0
Fuel (combined test cycle)	0	l		0	0	l		0	0	l		0
TOTAL			**0,10**	**32**			**0,08**	**26**			**0,05**	**9**

Savings	**Total savings (Baseline / Green tender)**				**Savings (Conventional tender / Green tender)**			
	Energy savings (GWh/yr)	CO_2-savings (t/yr)	% of energy savings	% of CO_2-savings	Energy savings (GWh/yr)	CO_2-savings (t/yr)	% of energy savings	% of CO_2-savings
Standard Engine - fuel 1	0,10	32	100%	100%	0,08	26	100%	100%
Standard Engine - fuel 2								
Electro Engine	-0,05	-9	#DIV/0!	#DIV/0!	-0,05	-9	#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)								
TOTAL FOR THE PROJECT	**0,05**	**23**	**46%**	**72%**	**0,03**	**17**	**33%**	**66%**

SPP REGIONS
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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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