

THE MUNICIPAL TRANSPORT COMPANY OF MADRID (EMT), SPAIN

Background

The Municipal Transport Company of Madrid (EMT) is a corporation owned by Madrid City Council, responsible for the provision of bus transportation within the City. The company contributes to the overall environmental targets set by the City of Madrid and is committed to reducing the amount of greenhouse gases (GHGs) emitted by its vehicles. It aims to achieve this by making use of new technological advancements, including the latest electric vehicles and alternative fuels such as compressed natural gas (CNG) and biodiesel.

The EMT currently has a fleet of almost 2000 buses and operates a total of 217 lines. It is currently replacing older models with cleaner, more energy efficient buses to work towards its ambition of reducing harmful emissions.

Procurement objectives

In 2010, EMT identified the need to procure 165 low environmental impact buses in order to reach its GHG emissions reductions goal. The tender procedure took place in 2011 for the purchase of 98 standard (12m) buses, 15 midibuses (8-10m) and 52 articulated (18m) buses, to be delivered during 2012 and 2013. EMT carried out an open tender procedure for the three sizes of buses required, specifying that only those powered by electricity or CNG fuel would be accepted. Buses could use either purely electric, electric hybrid (series or parallel) or traditional mechanical propulsion.

The company is in constant contact with a full range of bus manufacturers and is therefore kept abreast of the latest technological advances. EMT habitually trials prototypes from numerous manufacturers, from which staff gain insight into the performance of new models.

Criteria used

Technical specifications: EMT stipulated in the tender specifications that all vehicles must be powered by either electricity or CNG. Buses using CNG as a fuel could be either CNG-electric hybrid or traditional mechanical CNG models.

Award criteria: The final contract award was based on the most economically advantageous tenders (MEAT). The Price:Quality ratio in the award phase was 60:40.

- **10 points** were available according to costs associated with fuel consumption. These values were used to calculate estimated CO₂ emissions.

Fuel consumption was considered as fuel consumption values provided by the manufacturer according to the UITP SORT cycle certified by an official authorised laboratory. If these were not available, EMT would apply results from tests performed on similar buses existing in the EMT fleet. 10 points were awarded to the lowest fuel consumption and 0 points to the offer whose consumption is the maximum of those presented and considered valid. The intermediate fuel consumption values of the bids was assigned an intermediate score, which was inversely proportional to the difference between the maximum and minimum score i.e. the second lowest score, or "cost", would be given the second highest number of points, proportional to the differences between them.

- **10 points** were given depending on tailpipe emissions HC, PM, CO and NO_x, which are those included in the European Emissions Standards.

Emissions were considered as a cost of the pollutant emissions indicated in Table 2 of the Annex to Directive 2009/33/EC, on the promotion of clean and energy efficient road transport vehicles; the "Clean Vehicles Directive" (CVD). These figures were used as part of the second option available under the CVD, i.e. using award criteria to promote clean, energy efficient vehicles". Emissions values were required to be provided by the bidders by means of a certificate from an authorised, official laboratory. If this was not available, EMT would apply results from tests performed on similar buses existing in the EMT fleet. 10 points were awarded to the offer with the minimum emissions costs and 0 points to the offer whose cost is the maximum of those presented, which were considered valid. The intermediate emissions cost values of the bids were assigned an intermediate score, which will be inversely proportional to the difference between the maximum and minimum costs.

- **3 points** were allocated to the levels of external and internal noise emitted by the vehicle.
- **2 points** were awarded for low environmental impact substances including; liquid refrigerants, air conditioning gases, lubricants, tyres and electronic components.
- **4 points** were awarded to bidders who would remove old buses from the EMT fleet when new ones are provided.

Verification: EMT requested evidence in the form of certificates from official laboratories that the buses being offered did in fact meet the criteria specified.

NB: Article 6, paragraph 2 of the Clean Vehicles Directive states: Fuel consumption, as well as CO₂ emissions and pollutant emissions as set out in Table 2 of the Annex per km for vehicle operation, shall be based on standardised Community test procedures for the vehicles for which such test procedures are defined in Community type approval legislation. For vehicles not covered by standardised Community test procedures, comparability between different offers shall be ensured by using widely recognised test procedures, or the results of tests for the authority, or information supplied by the manufacturer.

EMT requested test results under the UITP SORT cycle but, in the event that operators did not have such results, it would apply its own results from tests conducted on similar vehicles in its own fleet. An established correlation exists between these tests and the UITP SORT cycle, but as all operators supplied the requested test results it was not necessary to apply this.

Results

A total of 9 manufacturers made offers and provided all necessary information. EMT established a contract with 5 bus manufacturing companies to deliver a total of 165 buses between 2012 and 2013.

	Standard (12m)	Midibuses (8-10m)	Articulated (18m)
CNG	95	15	32
CNG-electric hybrid	23	-	-

As a result of this procurement, EMT is now one of the public transportation companies with the most CNG fuelled vehicles in Europe. The CNG buses were slightly more expensive and the hybrid buses were 20% more expensive than conventional buses. A grant from the Spanish Institute for Energy Diversification funded the difference in price.

Environmental impacts

The environmental impact of buses can vary greatly according to the vehicle type, energy consumed and the style of use. By using alternative fuels such as CNG, and purchasing electric and hybrid buses, EMT was able to significantly reduce its emissions and environmental impact. By providing its drivers with eco-driving training, EMT further ensures that the environmental impact due to driving style is reduced.

CNG can be produced from biogas, but is typically produced from fossil-fuel sources. In terms of well-to-wheel CO₂ emissions, the use of CNG has the potential to offer only a relatively small benefit compared to traditional diesel engines. It strongly depends on: the type of gas extraction process, quality of the gas, efficiency of the engine and distance from source to refuelling station. A major advantage of using CNG over traditional (pre Euro VI) diesel buses, however, is the reduction of harmful tailpipe emissions including particulates, which are negligible, and NOx emissions, which are substantially lower. The new CNG buses acquired by EMT under this contract produce between just 30 - 50% NOx emissions compared to equivalent buses run on diesel fuel.

Electric vehicles have the potential to save significant amounts of well-to-wheel CO₂ emissions compared to diesel engines, but this is strongly dependant on the electricity mix. The range is approximately between 30% less to almost 100% less if renewable sources of



electricity are used. In 2013, the Spanish national grid used an average of around 48% renewable energy. Electric buses produce no tailpipe emissions, but embedded emissions including carbon, nitrogen and sulphur oxides, depend on the proportion and type of fossil fuels used to generate electricity for the national grid. Madrid and Barcelona have shown that CNG-electric hybrids currently in use in these cities, demonstrate up to around a 30% reduction in the use of CNG fuel, compared to standard CNG buses.

Alongside green tenders such as this, EMT contributes to renewable energy generation with its installation of photovoltaic panels, which feed in to the national grid. They produce an amount of energy equivalent to 25% of the consumption of its plug-in hybrid bus fleet.

Lessons learned

Overall, EMT considers that this was an effective way of procuring the buses required as both economic and environmental factors were taken into account during the purchasing decision.

As a transport operator, EMT emphasises the importance of gaining an in-depth knowledge and understanding of the market, including all available solutions. This is best achieved by maintaining constant contact with manufacturers and getting involved in as many studies and projects as possible. EMT believes this is the only way to ensure that the best solution is opted for in each situation.