ENERGYCITIES

ELECTROBUS

The city of Barcelona is at the heart of a densely populated metropolitan area between mountains and sea. With 1.6 million inhabitants, it is the core of the largest metropolitan area of the Mediterranean coast of five million inhabitants. It is also a key economic area in Spain. Barcelona is committed to climate change action: the city has set itself the objective to reduce its CO2 emissions by 23% by 2020 on the basis of its Sustainable Energy Action Plan (SEAP). One key action aims at decarbonising urban transportation, by converting the city's buses into hybrid vehicles and redesigning the entire urban transport network.

Website

- Project signed on 8 April 2011
- Grant from ELENA-EIB: EUR 1,921,000

Business model: How the programme is implemented

ELECTROBUS is led by the city's public transport authority TMB (Transports Metropolitans de Barcelona). The goal is to convert the city's buses into hybrid vehicles and to redesign the entire urban transport network.TMB started the ELECTROBUS programme thanks to funding from the ELENA-EIB facility. The programme is expected to allow for energy savings that amount to 61.4 GWh over the duration of the project and an annual CO2 reduction of 16,400 t.

TMB has planned to revamp its bus network to increase its efficiency and the service quality. The programme is not driven by financial benefits. TMB does not count on making profits during the 20-year 'life-cycle' of the project.

The ELECTROBUS programme consists of two strands of action:

- The conversion of the bus fleet into hybrid vehicles and the purchase of new commercial hybrid vehicles;
- The redesign of the bus network for higher efficiency and clarity.

Of these two complementary sets of action, developing the hybrid bus fleet will require the biggest share of the EUR 164 million expected investment over the 20 years of the programme. The EUR 35-40 million of investment mobilised between 2011 and 2015 are also primarily dedicated to the conversion of the bus fleet.

Strand 1: Converting buses

Converting existing buses into hybrid vehicles is expected to yield energy and CO2 savings of 25-30% per vehicle.

The engineering part of the program – designing the buses' conversion process – is made by TMB as part of the project. It is one of the innovative aspects of ELECTROBUS that can be replicated in other cities:

- TMB has an objective of deploying 230 hybrid and electric buses between 2010 and 2015;
- As part of this process, 40 CNG (Compressed natural gas) buses will be converted into hybrids. It notably focuses on the development of the engineering process for converting CNG buses and the physical conversion of the units.

However, the cost of retrofitting a single bus unit is high and requires subsidy from the Spanish government: EUR50,000 are required per unit to get return on investment over the 10 years lifespan (For security reasons, buses typically have a 12-15 years

lifespan. Typically, units that undergo conversion into hybrid typically are 2 or 3 years old, and thus are expected to stay in use for another 10 years) of each unit. TMB can not invest in a single unit if it cannot expect to earn back its investment on a life-cycle cost basis.

As a public transport authority, TMB must respect strict rules for financing its operations. As such, 50% of its budget must come from the sales of travel tickets, and further 50% is subsidised by public authorities such as the city council or regional and national government (e.g. by the Instituto para la Diversificación y el Ahorro de laEnergía). In addition, due to the economic crisis, Spanish public authorities face difficulties in accessing financing and TMB cannot access loans for investing. These factors impeded the implementation of ELECTROBUS. TMB had to generate cash out of its budget, which delayed the delivery of the project.

Strand 2: A new bus network

The redesign of Barcelona's bus network aims at making the bus system more user-friendly and thus easing and increasing the use of public transport:

- The new routes of the network cover the same total distance as before, but they are more evenly distributed over the metropolitan area;
- Special efforts are made to make the new network easier to understand, both for citizens and tourists;
- The new network should allow passengers to change buses maximum once during most of their trips;
- Buses will not run the same route twice (notably thanks to a reduction in redundant routes between the centre and the outskirts) and linkages between peripheral areas will be increased.
  The result is a simpler bus network made of orthogonal lanes. The new network is composed of 28 routes of three different kinds:
- 17 sea-mountain routes that run perpendicular to the sea front,
- 8 parallel-to-the-sea routes,
- 3 diagonal routes that run through large avenues that do not correspond to the orthogonal scheme.

Organisation & partnerships

Behind the ELECTROBUS project is a team of four employees (technicians and engineers) which is financed viathe ELENA grant. It manages the retrofitting of the buses and the revamping of the bus network.

This team closely cooperates with other TMB services such as the unit in charge of other bus conversion programs (ten engineers). Through the cooperation between different TMB units, the learning process and the benefits of the ELENA programme are shared across the company. It also allows TMB to develop an extremely robust expertise on bus retrofitting for both diesel and CNG engines.

To undertake the physical transformation of the CNG buses into hybrid vehicles, TMB worked with several partners. It built on the territorial resources, in particular the broad expertise in car manufacturing of the Barcelona region. TMB was thus assisted by a local engineering firm, Gesmon, during the design process. The physical transformation was made by local independent repair shops.

For the network redesign, Transports Metropolitans de Barcelona benefited from the support of the city council. The council saw this project as a chance to make its Covenant of Mayors commitments a reality. The municipal mobility department provided support to the redesign of the lines. Previous technical studies were provided by the technical centre of Barcelona University. The municipality also provided financial support for adapting the urban infrastructure to the newly designed network. It notably helped finance the changes in bus stops or the ground-marking of bus lines

Results

The ELECTROBUS programme was set up in difficult economic times. The economic crisis of 2008 and its consequences on Spain's economy delayed the project implementation, as TMB was not able to trigger the investment as planned. TMB was however granted a 1-year programme extension by the EIB. Even though the project was not quite scaled up in 2015, the Barcelona City Council provided the necessary political support. The political commitment of the city to the Covenant of Mayors gave good reasons to carry out this action which is inline with Barcelona's Sustainable Energy Action Plan.

Some preliminary results:

- For the year 2014, there is an average 26% reduction in GHG emissions and energy savings thanks to theretrofitting of the bus fleet. This result fits with the forecast made for the ELENA application.
- 13 out of the 28 lines of the new orthogonal network have been deployed in the metropolitan area. They proved to be more satisfying for users than those of the old network. According to a survey conducted during the early phase of the network deployment, passenger satisfaction was rated considerably higher than with the old network.

Promotion

Promotional activities differed significantly between the two action modules of the project:

- Retrofitting the buses into hybrids was rather scarcely promoted with press releases sent out whenever a new lot of retrofitted buses were put into circulation. The goal was to inform citizens of where TMB is investing public money.
- The promotion of the new network was much stronger. Indeed, all travellers needed to be aware of the changes to ensure a smooth transition. Citizens were informed about the new bus lines through the press,TV, radio, etc.

Key takeaways for other public authorities

- The economic crisis had severe consequences on the project implementation.
- ELECTROBUS was well incorporated within TMB's existing hybrid programme and helped create significant synergies between units.
- Beyond the technological aspects, the ELECTROBUS programme shows how the public transport authority can influence citizens to opt for the bus when it offers a transport service which is more adapted to their needs