Netherlands Enterprise Agency

5 Years of 'Hybrid and Electric Vehicles' living lab projects

in words and images

>> *Sustainable. Agricultural. Innovative. International.*

In 2010, the Netherlands started up 9 living lab projects for 'Hybrid and Electric Vehicles'. These were implemented within the framework of the National Action Plan for Electric Driving - 'Elektrisch Rijden in de versnelling' - and under the supervision of the Netherlands Enterprise Agency (RVO.nl). This information sheet presents all the ins and outs of the living labs - ranging from user experiences to the lessons learned - and the recommendations of the researchers of Eindhoven University of Technology and Rotterdam University of Applied Sciences, who collaborated within the Dutch-INCERT partnership. In its final assessment, Dutch-INCERT has analysed the experiences gained from the living lab projects in the light of the autonomous market developments since the project started.

Background

Since 2010, the Dutch government has acted to strongly stimulate electric mobility via the National Action Plan. The increasing scarcity of fossil fuels, the increase in CO_2 emissions and rising levels of air pollution in cities are some of the important reasons for stimulating the roll-out of electric mobility programmes. The Dutch government decided to respond by starting up the 'Hybrid and Electric Vehicle' living lab projects in 2010. The living lab projects were not only intended to provide practical experience with electric mobility and the associated charging infrastructure, but also to identify the factors that positively influence the acceptance and growth of electric mobility.

Summary of the 9 living lab projects

The following 9 living lab projects were completed during the period from 2010 to 2015.

1. Electric Greenwheels cars in the G4 area (The Hague, Utrecht, Amsterdam, Rotterdam): Collect Car (Greenwheels) tested 25 electric cars in a car-sharing concept that included the associated charging infrastructure.
2. Prestige GreenCab: Prestige GreenCab used 16 electric cars for passenger transportation, ranging from taxi use to school and medical transport.
3. Electric Mobility Test in Rotterdam: grid operator Stedin, the municipality of Rotterdam and energy company Eneco deployed 75 electric cars in the city of Rotterdam. The emphasis lay on learning about the vehicles and monitoring their consumption.
4. Van Gansewinkel Groep Electric Refuse Trucks: 8 electric Van Gansewinkel garbage collection trucks were deployed in urban areas in a business case designed to investigate whether such vehicles can be operated viably.

5. Texel Hospitality Industry Electric Mobility - Electric Charging on Texel: the Urgenda foundation coordinated a project in which a consortium of 19 businesses and institutions purchased 26 electric vehicles in order to generate support among the island's population and improve Texel's image as a holiday destination.
6. Haaglanden Electric Pool: a development agency in The Hague deployed 11 electric pool cars together with consortium partners. In addition, a courier service put an electric delivery van into operation.
7. Electric urban distribution delivery service: Combipakt put 3 electric delivery vans into operation for urban distribution in the eastern part of the Netherlands.
8. Urban distribution with Hytrucks: 8 medium and heavy trucks were put into operation for urban distribution purposes, ranging from food deliveries to relocation services.
9. Local urban distribution/parcel delivery: UPS deployed 6 electric trucks for parcel delivery in the Amsterdam region.

Each living lab project is characterised by its own dynamics and (market) conditions. For example, the vehicle type, implementation method, timing and project approach were distinctly different in each case. As a result, the living lab projects show major differences in terms of the likely breakthrough of electric mobility in the passenger transport sector and the commercial vehicle sector. This stems from the fact that the vehicles for these segments have reached differing phases of innovation. With this in mind, the 9 living lab projects have been assessed in a social and economic context in order to determine the key success factors (see box) for electric mobility in general, and for the different business cases.

Success and failure factors for electric mobility

The main success (+) and failure (-) factors for electric mobility, as revealed by the living lab projects, are as follows:

+ the contribution of end-users to a clean and green environment and the associated publicity and image upgrade that this generates for companies using electric vehicles;
+ charging electric vehicles; described by end-users as simple;
+ driving an electric vehicle is experienced as (more) comfortable in comparison to a vehicle powered by a combustion engine;
- the total cost of ownership for electric vehicles in the business market is higher than for conventional vehicles, largely due to the high purchase price;
- the range of electric vehicles is frequently considered inadequate, mainly due to the fear of coming to an unplanned halt en route due to a discharged battery (range anxiety);
- in the case of urban distribution, electric vehicle reliability has still not yet proven itself adequate, due to the use of prototypes and first-generation vehicles.

Practical experience

One of the most important areas of practical experience in the living lab projects relates to the vehicle range. When the electric vehicles were coupled with the right end-users and the right market application, some companies discovered that they could replace 50% of their conventional vehicle fleet with electric vehicles.

As for the range, practical experience shows that air conditioning and heating have a significant effect on how far the vehicle can travel. The individual drivers' driving styles also have an effect.

In the 'Electric Greenwheels cars in the G4 area (The Hague, Utrecht, Amsterdam, Rotterdam)' living lab project, the use of electric vehicles did not deliver the (expected) increase in the number of customers. According to Greenwheels, 'ignorance is bliss' was one of the reasons for this disappointing result. In addition, the company found that the vehicles consumed more energy than they had assumed beforehand, and that the range was too limited. The problems are largely attributable to the fact that this living lab project used first-generation vehicles. Car2Go, among others, has now shown that an electric car-sharing concept is a feasible proposition. The 'Prestige GreenCab' living lab project also encountered the same problems as those experienced in the Greenwheels project. However, a number of different taxi businesses are now successfully operating electric vehicles.

The 'Haaglanden Electric Pool' living lab project focused strongly on end-user charging behaviour and delivered valuable practical information in this area. There was no further sequel to this electric car-sharing concept following termination of the project in this region. The 'Electric Mobility Test in Rotterdam' living lab project generated a great deal of practical knowledge about charging behaviour. In addition, this project also generated significant data about the effect electric vehicles have on the electricity grid. Although legal, financial and organisational problems were encountered initially during the 'Texel Hospitality Industry Electric Mobility - Electric Charging on Texel' living lab project, they were resolved as the project progressed. So successfully in fact that the living lab project has resulted in a significant increase in the number of electric vehicles on Texel's roads.

When the electric vehicles were coupled with the right end-users and the right market application, some companies discovered that they could replace 50% of their conventional vehicle fleet with electric vehicles.

The living lab projects involving light, medium and heavy commercial vehicles resulted in both positive and negative

experiences. For example, the range of the distribution vehicles was found to be adequate for the task at hand, but there was a relatively high after-sales requirement. Combipakt's 'Electric urban distribution delivery service' project encountered problems in finding a suitable supplier due to bankruptcy and other difficulties. Even so, Combipakt was able to experiment successfully with the vehicles that were purchased. The 'Urban distribution with Hytrucks' living lab project also initially experienced difficulties in finding suitable vehicle suppliers. Once the vehicles had been put into operation however, the range was found to be adequate for the urban environment. In addition, the end-users recognised the positive effect that the vehicles had on their company's image.

During the living lab projects, the range, load capabilities, financial aspects, regulatory incentives and image were seen as the main factors influencing the success of electric passenger vehicles.

The 'Local urban distribution/parcel delivery' living lab project also encountered the inevitable start-up problems; however the deployment of 6 light commercial vans by UPS was experienced as very positive. At the end of the test period, all of the teething problems had been overcome and the vehicles compared well to the diesel variants in terms of functionality. In the 'Van Gansewinkel Groep Electric Refuse Trucks' living lab project, the waste collection company successfully deployed 8 electric trucks. The initial negative reactions to the range were resolved by fitting more powerful battery packs in the second series of vehicles.

Lessons learned in relation to passenger vehicles

Financial aspects

The living lab projects have shown conclusively that electric cars do not cost more by definition than a conventional vehicle during their total useful life. Even though the total cost of ownership of an electric car can be lower, businesses often believe the opposite. In some cases companies and consumers are prepared to pay more for an electric vehicle, e.g. if it offers greater functionality. Businesses in particular decide to operate electric vehicles in order to reduce emissions and improve their image.

Use

New strategies are required in order to reduce the total cost of ownership of electric vehicles. For example, companies can allow their employees to use the electric vehicles during the day and make them available to consumers living nearby in the evenings and at the weekends. In the latter case, the vehicle's range and the associated charging strategy must match the users' needs. Suitable market applications include transport for school children and old people, car-sharing projects, public transport and use in urban areas.

Success factors

During the living lab projects, the range, load capabilities, financial aspects, regulatory incentives and image were seen as the main factors influencing the success of electric passenger vehicles. The extent of the range was underestimated by many end-users. The current and next generation of electric vehicles can cover distances that are substantially greater than the daily average travelled by most people. Furthermore, the creation of a more extensive charging network will facilitate recharging electric vehicles during journeys if the desired distance cannot be covered on a single charge.

As for the financial aspects; a lower total cost of ownership than that for conventional vehicles can be achieved increasingly often. The rule that applies here is: the greater the distance driven, the lower the total cost of ownership. Unfortunately, businesses are reluctant to expand their electric vehicle fleets, mainly due to varying incentive arrangements in the different cities.

Image

The living lab projects teach us that while consumers value the sustainability aspects of electric vehicles, they are only willing to pay for them to an extremely limited extent. Even so, it is important that we continue to share positive stories about electric vehicles via (consumer) information channels as they can contribute to a higher rate of adoption.

Lessons learned in respect of commercial vehicles

Financial aspects

Because the transport sector is extremely competitive, businesses have difficulty in justifying the financial resources required to fund innovative developments such as electric vehicles. If businesses are to move in this direction, electric vehicles must at the very least offer a lower total cost of ownership. However due to the significantly higher purchase price, the total cost of ownership is often unattractive. In the absence of government grants, tax benefits and/or tax privileges, no viable business case exists in this sector as yet. City buses are the only positive exception.

Use

Based on the living lab projects and other data, alternative drivelines are only expected to play a limited role in the heavy truck segment during the period up to 2025. High battery costs, reduced cargo space and range requirements are the main barriers opposing the use of electric vehicles in the short term. On the other hand, the light commercial vehicle segment - e.g. electric delivery vans - offers a wealth of opportunities in the areas of parcel delivery services, courier services and urban distribution for the hotel and catering industry.

Success factors

The number of suppliers, the investment costs and operational availability are the main success factors for electric vehicles in the business segment. At present, no manufacturers offer medium to heavy electric vehicles as a standard factory product. As a result, an electric driveline has to be fitted to existing conventional trucks. A process that substantially increases the cost price. Furthermore, transport companies perceive the high initial investment as a bottleneck. With this in mind, full availability of the electric vehicles is of crucial importance for businesses. As a minimum, potential buyers therefore require suppliers to provide technical support and warranty cover.

Scale size

In the case of commercial vehicles, urban environments also offer the greatest potential for operating the vehicles. While some light commercial vehicles are already suitable for widespread use, medium and heavy commercial vehicles still require further development.

Image

Entrepreneurs in the transport sector are enthusiastic about the effect electric vehicles have on their image. The motivation for operating the vehicles is strongly dependent on economic conditions. The fiercer the level of competition they experience in their daily operations, the less inclined they are to purchase sustainable vehicles.

Conclusions and recommendations

First of all, the researchers conclude that the positive impact on a clean and green environment is one of the most important benefits of electric passenger vehicles. Besides potentially increasing the speed of adoption among end-users, communication about this positive impact may also encourage entrepreneurs in the commercial vehicle segment to purchase vehicles. Doing so gives them an innovative and environmentally conscious image. Communication about electric mobility should also emphasise that end-users find normal charging and fast charging simple and easy. Interoperability in the Netherlands – the ability to charge vehicles at any public charging station using a charge card – is even seen as the leading system worldwide. Finally, the researchers conclude that end-users find electric vehicles to be equally or more comfortable than conventional vehicles.

The total cost of ownership, uncertainty about the range and about reliability may stand in the way of a large-scale roll-out of electric vehicles in the researchers' opinion. They also conclude that the high

purchase price in relation to the total cost of ownership is the main disadvantage for electric vehicles. In the absence of government grants, this means that the total cost of ownership still exceeds that for a conventional vehicle.

The costs are higher in the case of commercial vehicles in particular. The vehicles offered in the medium to heavy truck segment are mainly conventional vehicles that have been converted, which is very expensive. There is a pressing need for mass-produced vehicles. In addition, planned and fixed charging times are considered to have maximised availability in most of the leading lab projects. Whereas the first-generation vehicles suffered from reliability problems, vehicles of the second and third generation were no longer affected by this issue. Unfortunately, the researchers also had to conclude that this does not apply in the case of commercial vehicles. The commercial vehicle segment has not progressed beyond the first-generation vehicle phase.

Recommendations

The Dutch electric mobility market has developed at a breathtaking pace during the course of the living lab projects. After Norway, the Netherlands has the highest sales percentages for electric vehicles in Europe. Not only the level of sales, but also the charging facilities in the Netherlands set the standard for other countries to emulate worldwide. A position which the Netherlands has achieved due in part to the living lab projects.

Entrepreneurs in the transport sector are enthusiastic about the effect electric vehicles have on their image.

In the case of passenger vehicles, the pioneering phase has been concluded. However, this phase is still in full swing for commercial vehicles. Electric mobility has been anything but a 'one size fits all' solution to date and we need to continue to experiment with electric vehicles during the coming years in order to gain experience within different product/market combinations.

This is a publication of:

Netherlands Enterprise Agency
Croeselaan 15
PO Box 8242 | 3503 RE Utrecht
T +31 (0) 88 042 42 42
E klantcontact@rvo.nl www.rvo.nl/elektrischrijden

This publication was commissioned by the Ministry of Economic Affairs.

Netherlands Enterprise Agency is a department of the Dutch Ministry of Economic Affairs that implements government policy related to agriculture, sustainability, innovation, and international business and cooperation. Netherlands Enterprise Agency is the contact point for businesses, educational institutions and government bodies for information and advice, financing, networking and regulatory matters. Netherlands Enterprise Agency is part of the Ministry of Economic Affairs.