World Electric Vehicle Journal

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Editorial

The World Electric Vehicle Journal, The Open Access Journal for the e-Mobility Scene

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Abstract: The *World Electric Vehicle Journal* is the first peer-reviewed international scientific journal that covers all studies related to battery, hybrid, and fuel cell electric vehicles comprehensively. The gaining interest in e-mobility and related fast developments in electric vehicles has been leading to the need for the academic and industrial world, as well as the societal stakeholders, to have their own open-access journal in which they can share the latest developments and knowledge about electric vehicles. The journal accepts papers from all different disciplines, from new battery technologies, over propulsion system, and charging infrastructure to market developments and consumer behaviour. The *World Electric Vehicle Journal* is the primary scientific journal serving the interests of the international electric vehicle community. The *World Electric Vehicle Journal* has been managed by the World Electric Vehicle Association for the 10 years, with support from the Vrije Universiteit Brussel, and we have decided to further improve our professional approach by setting up the cooperation with MDPI as our professional publisher. Do you want to be inspired by e-mobility? Read more in the article below.

1. From Immobility to e-Mobility

Electric vehicles have existed since the nineteenth century. The first electric car was developed by Parker in 1884. The first car exceeding the speed limit of 100 km/h was the electric "le Jamais Contente" developed by Jenatzy in 1899. However, the petrol engine vehicle took over the market in the beginning of the twentieth century. Due to the oil crisis in the 1970s, a renewed interest in electric vehicles was observed. In 1979, nine electric vehicles were used for the Brussels Electric Vehicle Experiment [1] at the Vrije Universiteit Brussels. New fast chargers were developed using power electronics, and test drives on the open road were soon to follow. This allowed the distance from Brussels to Paris, on the occasion of the EVS symposium in Versailles, to be covered in one haul using intermediate fast charges.

In the 1990s, there was another wave of interest in electric vehicles. Car manufacturers like Renault, Peugeot, and Citroën in Europe and GM in the US produced tens of thousands of electric vehicles. However, the market was rather "immobile". Even worse, GM recalled all his leased EV1s and crushed them one by one. This is well documented in the film *Who Killed the Electric Car*? [2].

But times are changing. In 8 years, lithium battery prices dropped by 80% while the specific energy of the battery increased significantly [3,4]. As a result, we can expect affordable electric vehicles on the market with a driving range of above 400 km. There is an exciting e-mobility future in front of us.

2. Electric Driving: Sparking Your Interest

While climate change sparks interest in electric driving, it raises many questions as well. Professor Joeri Van Mierlo tackles them one by one [5].

2.1. Is Electric Driving Really the Best Solution for the Environment?

The short answer is yes. When discussing environmental impact, it is important to take into account the full life cycle of a vehicle. This allows looking beyond emissions from the vehicle itself to the environmental impact of batteries, the production of electricity, and so forth.

In a full life cycle, electric vehicles emit two times less carbon dioxide (CO_2) in comparison to diesel engines if we take the European electricity mix. This can be even four times less is we take, for example, the Belgian electricity mix. If cars were driving on sustainable electricity, carbon dioxide emissions could be further reduced by more than 10 times.

If we look at vehicles from a "well-to-wheel" perspective, electric vehicles produce four times less particulates and 20 times less nitrogen oxides (NOx) (Belgian example) compared to conventional vehicles. However, we need to stress that the exploitation and mining of raw materials in South America, Africa, and China leaves much room for improvement. Recycling can further reduce the environmental impact.

It is not so easy to compare all the alternatives. Fortunately, we have scientific methods to do this for us, namely the life cycle analysis models (LCA), which compares all these factors in an unbiased way. If we take into account both climate change and air quality, the difference between petrol, diesel, LPG, and natural gas–driven cars is minimal. Hybrid and plug-in hybrid vehicles can improve scores with a factor two. The overall environmental impact of battery-electric vehicles can be up to five times smaller than conventional fuels when considering the Belgian electricity mix as an example [6,7].

2.2. How do Electric Vehicles Affect Our Economy?

Research indicates that the electrification of our transport system would generate one million additional jobs in Europe in 2030 and double in 2050 [8]. These jobs relate to the production of components for electric vehicles, but they also relate to new services, such as charging infrastructure. Electrification will also reduce our oil dependency. The import of oil costs the European economy one billion euros per day [8]. Investing this in our own economies could mean a vast improvement in employment rates. Families could increase their purchasing power when they no longer need to depend on imported oil products.

It is suggested, however, that loss of income from duties and taxes on diesel and petrol will negatively impact government budgets. However, this does not take into account improved air quality. Improved air quality will have a positive effect on the health budget, resulting in less expenses for health care and the cleaning of monuments, for example.

2.3. What Will Our Vehicle Fleet Look Like in 2050?

Apart from electric cars, self-driving or autonomous vehicles will have made their appearance by 2050. Even though both technologies are not dependent on each other, electric cars are better

candidates to become self-driving cars. Autonomous cars depend on electronics for their control. It therefore makes sense to equip them with an electric motor. Autonomous vehicles need different charging infrastructure then the electric vehicles that are on the market now. The self-driving car from 2050 will seek its own charging point when needed, and charging points will therefore be organised differently and in other locations. It will no longer be necessary to own a car. You will be able to use your smartphone you plan your car or mobility needs the same way you plan other items in your agenda today. At 7 am, a fully charged vehicle will be waiting in your driveway.

2.4. Will Electric Driving Cause Power Shortages?

If 10% of our fleet becomes electric, this would only mean an additional demand for electricity of 1.4%. We should not forget that the introduction of renewable energy sources is gearing up. Their share in the production of energy will only increase. It does create other issues, however. What if there is no wind and sun? At these moments, we either need to rely on other sources, or we need to invest more in energy storage. The battery of an electric vehicle can play an important role in energy storage. When too much wind or solar electricity is produced, it can be stored in the batteries of cars. When there is not sufficient electricity, they give it back to the grid. This is what has been called V2G or 'vehicle to grid'. Will there be enough electric cars to make this possible? We do indeed need a large fleet of electric vehicles to realise this, and at the moment, electric vehicles are entering the market very slowly. In anticipation of this gradual introduction, we need to rethink our electric supply system drastically if we want to increase the share of renewable energy sources. In other words, our grid will need to be remodelled, independent from the introduction of electric vehicles, purely because of the need to increase the share of renewable energy sources.

V2G applications have some impact on the life expectancy of the battery of an electric car. It is therefore important to research how we can give batteries a 'second life' and how they can be recycled. If the capacity of a vehicle battery declines to 80%, we assume it is no longer serviceable for a car. However, it still has 80% storage capacity, so it could be used for other applications, such as to support the grid, for micro-grids, or home storage.

2.5. How Far Can You Get in An Electric Car?

Driving range is an important issue and depends on many factors, the first of which of course is the battery. In a Tesla, you can cover 400 km today, but the typical autonomy of electric cars is more in the range of 150 km. Driving range is also dependent on driving style, weather conditions, and desired comfort. If you would like a temperature of 22 degrees in your car in the middle of winter, this demands a lot of energy from your battery. Manufacturers are now looking into new ways of tackling these issues.

For the average consumer, driving range is a key factor when considering a car. We call this 'range anxiety'. Yet more than 95% of our daily trips are less than 100 km. On average, 30% of all our vehicles never drive more than 100 km per day. We could make a start by replacing these 30% with electric vehicles. Yet consumers have a tendency to upscale their car for the occasional longer trip. Most of the cars on our roads are oversized, with a large trunk for the annual summer holiday.

The need for public charging infrastructure is dependent upon families owning a garage. In cities, this is a problem. Almost 90% of families in Brussels, for example, have no private garage and depend on public charging infrastructure. Apart from standard charging points, fast chargers will find their place on motorways, in cities, and in suburban areas. These fast chargers can fully charge a battery in 15 to 25 min.

The development of batteries is taking fast leaps forward. Within five years, a battery will double its storage capacity, and by 2020, its price will be halved. Many car manufacturers are bringing the coming years affordable electric vehicles on the market with a driving range of above 400 km.

2.6. Will Everyone Drive Electric Vehicles in the Near Future?

No more combustion engines, breathing clean air in our cities, hearing birds instead of traffic . . . is it an unrealistic vision for the future? The reality is that we cannot change an entire fleet overnight. The average lifetime of a car is 14 years. In other words, if you buy a diesel car today, it will still be on the road in 2030.

Nevertheless, we are at a turning point. It is not just diesel gate that drives the market. Tesla has opened the market by offering models that go way beyond the small city car. A whole new type of consumers is now interested in electric cars. All manufacturers are working on electric models. So, things are moving.

We also depend on policy makers and the incentives they offer. As a result of fiscal policy, in Norway, for example, the best-selling car is not petrol or diesel but an electric car.

But we still have not answered the question about the number of electric cars in 2050. Or should we look at the issue from a different perspective? How many electric cars do we need by 2050 to generate additional employment, improve our health and quality of life, and slow down climate change?

3. The *World Electric Vehicle Journal*—Your Primary Scientific Journal

So, why should you publish your recent scientific work and new developments in the *World Electric Vehicle Journal* (WEVJ)?

Being part of this exciting transition from fossil-based transportation toward almost zero emission system based on e-mobility is a clear motivation for our authors to publish in the *World Electric Vehicle Journal*.

Are you developing Electric, Plug-in Hybrid, Hybrid Electric, or Fuel Cell Vehicles? Are you an expert in these vehicles' drive and propulsion systems or their batteries? Do you have recent scientific results on charging infrastructure, wireless power transfer, V2x technology, or intelligent energy management strategies? Are shared, autonomous, electric vehicles your cup of tea? Or do you have new insights on the environmental performance of vehicles? Maybe you have developed socio-economic evaluation tools to assess the market introduction of electric vehicles and the related consumer behaviour or the required policies.

If so, the *World Electric Vehicle Journal* is the place for you to publish your latest results and innovations.

The journal offers a fair, fast, rigorous, and transparent peer review method through a collaborative process between the submitting authors, editors, and the professional staff at MDPI.

The *World Electric Vehicle Journal* is open-access (free access for readers) covering the best papers of the International Electric Vehicle Symposium and Exhibition (EVS) next to the latest e-mobility developments published at a very low Article Processing Charge (APC). We consider it key to keep publishing it as an open access journal as the community for which this journal is relevant has so many members in academia and in industry, government organizations, NGOs, etc., most of which would not have access to a subscription journal.

The journal accepts papers form the academic world, research centres, NGOs, public authorities, and last by not least the industry.

The *World Electric Vehicle Journal* has a distinguish editorial board of experts in the e-mobility field. Most of them are also very active in the World Electric Vehicle Association and its member associations. The World Electric Vehicle Association (WEVA) is an international organization launched in 1990 with the objective of promoting the research, development, and dissemination of electric vehicles. It is also responsible for coordinating the EVS symposia. WEVA consists of three regional organizations—the European Association for e-Mobility (AVERE), the Electric Drive Transportation Association (EDTA), and the Electric Vehicle Association of Asia Pacific (EVAAP).

We hope to read your latest innovations in our next volumes giving the greatest possible reach and research impact to your work!

The *World Electric Vehicle Journal* is the primary scientific journal serving the interests of the international electric vehicle community.

Conflicts of Interest: The author declares no conflict of interest.

Appendix

- Volume 1, following EVS-22 in Yokohama, Japan
- Volume 2, following EVS-23 in Anaheim, California
- Volume 3, following EVS-24 in Stavanger, Norway
- Volume 4, following EVS-25 in Shenzhen, China
- Volume 5, following EVS-26 in Los Angeles, California
- Volume 6, following EVS-27 in Barcelona, Spain
- Volume 7, following EVS-28 in Guiyang; Korea
- Volume 8, following EVS-29 in Montreal, Québec

References

1. Van Mierlo, J. Blast from The Past: The 1979 Brussels Electric Vehicle Experiment. 2018. Available online: http://mobi.vub.ac.be/mobi/news/blast-from-the-past-the-1979-brussels-electric-vehicle-experiment/ (accessed on 25 April 2018).
2. Wikipedia. Who Killed the Electric Car. Available online: https://en.wikipedia.org/wiki/Who_Killed_the_Electric_Car%3F (accessed on 25 April 2018).
3. Omar, N.; Daowd, M.; Bossche, P.; Hegazy, O.; Smekens, J.; Coosemans, T.; Mierlo, J. Rechargeable Energy Storage Systems for Plug-in Hybrid Electric Vehicles—Assessment of Electrical Characteristics. *Energies* **2012**, *5*, 2952–2988. [CrossRef]
4. Berckmans, G.; Messagie, M.; Smekens, J.; Omar, N.; Vanhaverbeke, L.; Van Mierlo, J. Cost Projection of State of the Art Lithium-Ion Batteries for Electric Vehicles Up to 2030. *Energies* **2017**, *10*, 1314. [CrossRef]
5. Van Mierlo, J. Electric Driving: Sparking Your Interest. 2016. Available online: http://mobi.vub.ac.be/mobi/news/electric-driving-sparking-your-interest/ (accessed on 25 April 2018).
6. Messagie, M.; Boureima, F.-S.; Coosemans, T.; Macharis, C.; Van Mierlo, V. A Range-Based Vehicle Life Cycle Assessment Incorporating Variability in the Environmental Assessment of Different Vehicle Technologies and Fuels. *Energies* **2014**, *7*, 1467–1482. [CrossRef]
7. Hooftman, N.; Oliveira, L.; Messagie, M.; Coosemans, T.; Van Mierlo, J. Environmental Analysis of Petrol, Diesel and Electric Passenger Cars in a Belgian Urban Setting. *Energies* **2016**, *9*, 84. [CrossRef]
8. Cambridge Econometrics. Fuelling Europe's Future: How Auto Innovation Leads to EU Jobs. 2013. Available online: http://eurobat.org/sites/default/files/51cfcb6d4d573d59c7852a06e9782d1f.pdf (accessed on 25 April 2018).