# Strategic Collaboration & Integration of Policies as Zero Emission Mobility Accelerators.

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## Abstract

Since 2008 the number of Zero Emission Battery Electric Vehicles registered worldwide has reached over 308,000[1], and 106,000 in Europe.

This growing number of Zero Emission Full Electric Vehicles will eventually positively impact the life of many urbanites as well as facilitate the deployment of key Energy transition policies.

A significant, and positive impact on urban air quality, as well as a reduction in noise nuisances in cities are amongst some of the immediate expected positive downfalls. At the same time, an increasing uptake of Zero Emission Electric Vehicles signals the trend towards less dependency on costly fossil fuel imports and allowing the use of fossil fuel for more sustainable use than burning it for transport.
Finally, the availability of a larger number of Battery Electric Vehicles, and the growing energy storage source it will eventually represent, is paving the way for a smart integration of Renewable Energy Sources. A diversity of ongoing transition strategies in Energy policies worldwide will be able to use this strategic energy storage capacity at critical times while preserving the primary objective of the vehicle for transport.

The development of Zero Emission Mobility is impacting a large number of stakeholders, and is enabling a number of transformation and transition policies in the Transport, Energy and ICT sectors. More cooperation and integration of policies is the underlying driver for further acceleration.

With over 106,000 ZE EV on the road today, Europe now ranks first in the world in the deployment of Zero Emission mobility. This paper describes the reasons why Europe must continue to lead the way in ZE initiatives by providing an even wider platform for collaborative cooperation leading to further transitions in Public Health Policies and changes in other strategic sectors.

*Keywords: Zero Emission Electric Vehicle, Strategic Collaboration, Integration of Policies, Europe.*

## 1 Introduction

Zero Emission Mobility may turn out to become one of the most virtuous technologies introduced in this decade, opening the door for wider set of collaborative applications and transition in many strategic industry sectors outside transport.

Since its introduction in Japan in 2008 the successful commercial deployment of Zero Emission Electric Vehicles has called for a strategic collaborative approach rarely experienced before.

In Europe, ZE Mobility has reached the market in conjunction with a number of key European strategic policies in the Health and Energy sectors. Air Quality Improvement plans have been initiated as early as 2007 in some European capital cities such as Amsterdam, or Stockholm, and are aiming at mitigating Public Health Risks associated with urban Air Pollution. At the same time, the 2020 Climate and Energy package calls for a

number of policy measures aiming at bringing further efficiencies in the Energy sector.

One key aspect in the commercial deployment of Zero Emission Mobility is that the Battery of each Electric Vehicle is "connected" to the grid when charging and for that purpose needs a complete new set of infrastructure never seen before in any urban environment. We will see that beyond the actual physical connection, materialized by a charging cable, it is two very different industries, Automotive and Utilities, which have had to learn and work together to make it happen.

**From simple partnerships…**

Back in 2008 the incoming position of the pioneers in the ZE Mobility, like Nissan, was that cooperation between the private and public sectors was required and that the EV charging infrastructure would be installed initially by public entities and later, when the market would start to form, by privates investors.
With that in mind, the initial steps consisted in establishing simple bi-lateral agreements with many cities and regions in Europe, and around the globe. These first and simple partnerships also often served as "awareness-raising" campaigns for Zero Emission in general.

For reference, the starting point for EV charging scenario was that EV drivers would be mainly charging at home, or in the office. But for customers living in condominiums and apartments, a situation that many urbanites are facing in major capital cities across Europe, home, or office, charging was not necessarily an option and the only possibility then lied in publicly-accessible EV charging infrastructure.

However this wide, and convenient, access to a public EV charging infrastructure that many were expecting to see burgeoning proved to be actually slow to become a reality. And the unexpected outcome of this initial slow ramp-up was a number of transformation steps which have eventually created a revolution in terms of collaborative industrial approach in Europe.

**…To multi-party co-funded projects.**

Industry and Public partners coming from very different background, and countries, and who rarely had the opportunity to cooperate on large scale projects have come to the same table and together established clear roadmaps and financial mechanisms to make it happen.

The core groups that had formed simple partnerships as soon as 2009 and 2010 have gradually expanded their reach and engaged in cross-industry co-funded projects. These projects are now aiming at the deployment of market-ready solutions which will have tangible impact on the deployment of the strategies which have been previously discussed and agreed.

As first steps, awareness campaigns should be co-promoted by the public and private sectors and highlighting clearly the availability of affordable EV's and the how they can be easily charged overnight in already existing locations.
Going further in the same direction, the full electrification of urban transport should be prioritized, and synchronized with a smart multi-modal transport solution.

# 2 Background

The mass-market and global introduction of ZE Mobility which was triggered by the California Air Resource Board ZEV Mandate was then relayed by a number of National Plans in countries such as Israel, Portugal, or Estonia. In as much as the CARB policy was based upon Air Quality improvement policies, other National initiatives introduced different approaches based instead on Oil Dependency (Israel), or optimization of Renewable Energy Sources (Portugal).

The success of the ZEV mandate in California has not been equally matched by other National initiatives and the wide diversity in the successful deployment of ZE Mobility has led to a number of publications and communication on the subject.

Certainly California "entry point" was the societal positive impact of improving Air Quality while other regions were focusing on more conceptual and strategic National framework policies. These key differences and their consequences will be reviewed below.

Interestingly, in Europe, in 2009 a unique platform, called Green eMotion, was formed to "identify the necessary steps and measures towards the successful introduction of Electric Vehicles".

Green eMotion is a large 40 members, collaborative project, funded by the EU under the FP7 umbrella, and has resulted in one breakthrough outcome which was to force all stakeholders coming from very different backgrounds to discuss the key issues around the same table. And this first step proved to be decisive. Green eMotion was later followed by FREVUE and this new project is focusing on e-freight in Europe and has provided yet another platform which further enhanced the interaction between key capital cities in Europe and members of the Industry.

# 3 Strategic Collaboration

The consensus approach taken by Japan in preparation for the mass market introduction of ZE EV was also taken by Germany but at slightly different time intervals and with different versions of a somewhat similar technology path. But the two countries shared a view that strategic collaboration was necessary. This paper will demonstrate that this concept should have probably been applied at a faster rate and to a wider scale.

In the meantime, it appeared that some isolated commercial initiatives based on proprietary technology ended up in short lived experiences, and that instead, a simultaneous deployment of interoperable EV charging Infrastructure and sales of BEV was probably the best success model. Better Place in Israel and Mobi.e in Portugal both experienced an imbalanced split of too few EV for the installed infrastructure and back-office systems made available in the market.

The clear understanding that further cooperation was needed came from the deployment of the EV charging infrastructure. While the CPT Directive was still being debated at EU level, Nissan, one of the pioneers in the early deployment of mass market BEV, understood that it needed to quickly demonstrate the business feasibility of operating a Quick Charging network in Europe. To do that it created an innovative financing scheme to "jump-start" the commercial deployment of EV Quick Charging Networks.

Two main reasons behind these strategic steps: First of all, from a customer stand-point, a National Quick Charging network would offer a much-needed charging solution to urban EV drivers, or considerers, with no access to home, or office charging solutions. The same customers would then be able to extend the range of their Zero Emission Electric Vehicles and eventually make it their sole mode of personal transport.
And the second reason sit higher in the value chain with potential investors: for the financial community, these schemes established a unique "business incubator" platform for public or private operators who were looking for a way to mitigate the risk of the initial CAPEX and work closely with a key player to stay in sync with the EV sales ramp up and maximize revenue.

While doing so, it became clear that finding the prime locations and square meters at a reasonable cost to establish the Quick Charging network would be more difficult than initially planned. Site owners, public or private, were somewhat reluctant to give up prime locations to potentially install one dedicated charger per brand, or technology, and that the only way forward was to combine all charging technologies on a single piece of hardware. Making this piece of hardware affordable and with the smallest possible footprint was the next challenge taken by Nissan and other key suppliers. And as result, between 2008 and 2013 the cost of a standard (CHAdeMO) QC came down by a factor of two.

The EV OEMs, members of Green eMotion, quickly realized that they all shared and faced similar blockers in the slow deployment of the EV charging infrastructure, and came up with the concept of Multi-standard chargers as the only commercially and strategically manageable solution. This key concept and, unique to the European region where all standards are presents, came up at the final stage of negotiations and discussion of the CPT directive. The end result was a clear recognition of the technologies needed to co-exist for the benefit of all, and that the market would later decide on the split between the technologies.

This strategic collaborative approach towards the deployment of the EV charging infrastructure in Europe was taken to the next level when the same OEM group received co-funding from EU TeN-T office to initiate a number of National QC network projects across Europe. In the meantime, and after more than five years and following the sales of 110,000 Electric Vehicles, private initiatives in the setting up National QC networks are finally starting in countries like the Netherlands and Denmark.

Other positive examples of strategic collaboration platforms resulting from Green eMotion are EMI3, an ICT initiative aiming at ensuring the inter-operability of the EV charging networks.

# 4 Integration of Policies

The concept of Strategic Collaboration we have described will witness a new impetus when it expands from one industry and goes transversally across other industry sectors and public entities and authorities.

As the number of EVs is reaching critical mass in certain regions of Europe, it is triggering a new train of thoughts on the potential impact it can have on virtuous public policies and private investments.

## 4.1. Health Policies: Zero Emission & Zero Noise Urban Zoning

In 2013 the World Health Organization [2] identified Air pollution as "causing premature death, chronic cardio-vascular diseases, acute health problems, e.g. myocardial infarction". It is estimated that "over 1.4 mio years of healthy life lost each year due to urban air pollution".

So there is little doubt that Air Quality is a major Public Health issue to be tackled by major capital cities.

The same WHO report outlines that in Barcelona, 27 months of life expectancy could be gained with a decrease in PM2.5 to WHO AQG (10 μg/m3) for ages ≥ 30 years. In 2009 the mayor of Amsterdam was acknowledging that living in Amsterdam with its level of Air Quality meant having a life expectancy of 2 years less than in the rest of the Netherlands.

From a pure macroeconomic perspective, Public Health Spending is one of the biggest lines of most European countries' Public deficits. The implementation of measures improving Air Quality conditions could be a major driver for economic growth (longer life expectancy will favor Consumption and reduce Public Spending)

Zero Emission & Zero Noise Urban Zoning is becoming a priority and at the same a breakthrough urban concept, now made possible for a number of key factors. It is also calling for the development of more elaborate models of public/private collaboration platforms.

**"Bottom-up" Adoption**

One can probably only evaluate the potential impact of ZE & ZN zones on the public opinion when revisiting for instance the effectiveness of the deployment of the smoking-ban policies. The mass adoption and positive public opinion of smoking-ban policies in public perimeters today is almost unanimous and this bottom-up adoption is critical.

The implementation of an experimental ZE & ZN street should sit high on many European capital cities as a first step to demonstrate the full potential of the scheme in the future and leading to further deployment is larger areas.

**"Top-Down" Push**

At the same time, one must recognize that smoking-ban policies were not put in place by only concerned individuals each deciding not to smoke in designated buildings. There was instead an initial strong push from the public office acting for the good of the many and mandating the law. This first initial step was fully endorsed by the public opinion once the clear benefits were experienced in public spaces. This combined process is required here as well.

**Diversity of ZE mobility solutions.**

The fact that a number of ZE & ZN mass market mobility solutions are now available at an affordable cost, and coming from a diversified supply base, ensure compliance with public tenders process and represent one deciding factor.

ZE-vans, for last-mile delivery, ZE-taxis, ZE-bikes, ZE-car sharing schemes, ZE-boats, now fully complement the existing stock of personal electric vehicles already on offer for many years and make the full array of ZE solutions available for public and private procurement.

Innovative ICT platforms make possible the implementation of convenient multi-modal ZE urban solutions. And the move towards a full electrification of transport in city centers makes best use of existing infrastructure in many cases.

Traffic Congestion issues and Parking issues which remain some of the most critical urban agenda points may be partially solved by a more balanced distribution in the deployment of the public infrastructure.

**Prime Livable European Cities**

Some cities across Europe are now investigating the principles, and necessary steps towards ZE & ZN zoning, and work on the principle that Air Quality and Noise Reduction targets must be met but also that the streets and neighborhood adopting the scheme will see an increase in residential and business real estate values and overall desirability of the associated school districts among other things.

Cities are home to over 70% of the EU population. Some of them are becoming mega-cities (i.e. > 5 million inhabitants) and will face tremendous challenges in keep on meeting basic livable standards.

Turning onto ZE & ZN zoning will not only contribute to mitigating the public health spending but will also raise the citizen's political consensus.

**Implementation Roadmaps**

The successful implementation of ZE&ZN zones in limited and iconic urban places at the beginning probably needs an urban tolling system aligned with the objectives and a smart fail-proof ZE recognition system recognized by all. The Norwegian system based upon the principle of the "Polluters Pay" has shown some good success and reasonable positive public adoption. With such a system, local authorities with limited budget would be in a position to elaborate a multi-annual viable financial roadmap[3]. A similar approach is now being considered by other European countries with a number of macro and micro initiatives all based on the "Polluters Pay" principle.

Each ZE mobility solution implemented in an urban environment should be seen as an investment and best use of taxpayers' money.

## 4.2. Energy policies: Smart Integration of Renewable Energy Sources.

Member states across Europe have somewhat different agenda in terms of Energy policies but generally aiming for better efficiencies and sustainability.

Dismantling of aging and CO2-intensive production assets, transition from Nuclear Energy, aggressive integration of Renewable Energy Sources, these are some examples of National agendas in terms of Energy policies across Europe while at the same time the demand for electricity for many utility companies remains stable at best.

The ramp-up of ZE electric vehicles can play an active role in many of these transition scenarios.

**Shared Assets**

The ZE EV featuring sufficiently large battery size can serve a double purpose of providing ZE mobility, and when parked, of offering Energy Storage. If managed properly, this unique double capacity can help avoid excess investment in single-purpose asset deployment as well as many other useful smart charging solutions.

Smart Charging can be a good way for home owners to take advantage of dynamic pricing, or split tariff.

Alternatively utility companies may elect to contract the access to their customer's EV battery for a fee and be able to access this storage when they need it.

**Bi-directional charging**

When fitted with a Vehicle-to-home or Vehicle-to-Building device the battery of a ZE EV can contribute more effectively and actually reverse the charging process to provide energy to a home, business, or building.

By doing so it could for instance save costly demand charges, or allow "peak shaving" in critical demand times, or also provide frequency regulation.

For home owners who have their home fitted with roof-top PV equipment, and there are more than 700,000 of them in Germany alone, this could make sustainable residential energy management a reality. In 2013 and 2014 during the months of June to September the combined PV production in Germany is enough to reach over 20 GW and cover above 40% of the national energy demand.

**Virtual Power Plants**

When the necessary financial mechanisms are in place, and most certainly coming because of a high ration of RES availability, a national scheme giving for instance wider access to hourly dynamic pricing, large e-fleets, clusters of e-vans or e-taxis can start acting as Virtual Power Plants.

The demand for energy can be managed dynamically by large e-fleet managers with the objective of optimizing its Total Cost of Ownership on the e-fleet while preserving safe required mobility patterns. On-site PV power generation offers an added opportunity to lower the demand and overall fleet operating cost.

For users demonstrating sufficient technical credentials the fixed cost required to make this system a business reality would have to be financed by the revenues generated when trading energy on the national Energy spot markets.

**High Renewable Energy Concentration Sites**

In regions where RES are representing close to 100% of the supply, such as Norway, Austria, or Switzerland, e-fleet clusters can represent a unique opportunity to avoid loosing, or worse having to pay for, excess energy supply on national or neighboring grids. In the case of Hydropower this excess energy can be avoided but in the case of PV or Wind energy, a full control is not possible and energy storage is a viable solution.

Negative pricing patterns coming as a result of an excess in RES supply should be avoided with the smart deployment of larger e-fleet, like postal services, last mile delivery companies, municipal fleet, e-taxis, car sharing schemes, etc… especially those whose

usage patterns calling for vehicles standing idle near warehouses or dispatch centers.

These active e-clusters providing large amount of energy storage can contribute on the spot to avoid abrupt changes in supply patterns, regulation of the frequency, or structurally in avoiding the investment in energy transport infrastructures.

**Decommissioning of old, and CO2-intensive, Production Asset**

A study led by the MEUC in the UK in 2013 shows that "88% of UK businesses are worried about the security of their energy supply… And that (with) the planned closure of some coal and nuclear power stations, OFGEM is warning that spare capacity could fall from today's 14% level to just 4% in three years, with a risk of 'brownouts' and 'blackouts' starting in the winter of 2015-16."

The same study indicates that installing on-site generation assets is a solution considered by 43% of respondents in order to guarantee the security of their energy supply. Local energy management solutions combined with e-fleet mobility/storage solutions would represent an optimum use of every Pound invested.

**Full Integration and Financial Roadmaps**

The integration of Energy policies with Transport Policies in Europe is becoming an absolute necessity and will most probably represent high CAPEX and OPEX savings. It will result in an acceleration in the joint deployment of RES and e-Mobility a double win for all stakeholders.

This smart integration will be facilitated by the empowerment of recommendation coming from such cross-industry groups as PlangridEV and other collaborative projects looking at smart grids solutions. It will be enabled by defining the financial mechanisms and necessary tax regimes coming in support of the business models.

# 5 Conclusions

The paper focuses on how Europe has managed to take the lead in Zero Emission e-Mobility deployment during the past years.

It demonstrates how a pro-active Strategic Collaborative approach in Europe has, for instance, fostered the right environment leading to the collaborative deployment of Multi-standard EV Charging hardware as well as inter-operable ICT platforms. These critical steps will in turn ensure a faster adoption rates on Zero Emission Electric Vehicles and continue position Europe in the lead of ZE EV adoption.

Going forward, Europe is in a unique position to take this Collaborative Framework to the next level and take full benefit of transversal actions further linking the Transport sector with the Energy sector. All actions should be prioritized to maximize further synergies between an accelerated deployment of Renewable Energy Sources and the adoption of Zero Emission e-mobility plans.

As importantly the Health agenda, taking the form of pro-active Urban Air Quality and Noise Reduction Policies must be quickly brought into perspective in this deployment to guarantee that Europe can stay ahead in this field where other regions around the world have already decided to make it a National priority.

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