

International Conference on Mobility Challenges
8 & 9 December 2022 @CentraleSupélec, Gif-sur-Yvette, France
Chair Armand Peugeot - Chair Energy & Prosperity - Climate Economics Chair

Summary of day 1 (8 December 2022)

Session 1: Fueling sustainable mobility with alternative fuels

The decarbonization of the transportation sector requires carbon-neutral sources of energy. In this session, Marc Baudry (the Climate Economy Chair) moderated three sessions focusing on alternative fuels that might complement electric vehicle (EVs) as complementary solutions.

First, Frédéric Lantz (from IFP) focused on the use of conventional (derived from crops used for human consumption) and advanced biofuels (advanced biofuels are not derived from crops used for food) for the mobility sector. During his presentation, he analyzed the feasibility of achieving European targets. Using a combination of spatial and mass-flow models, he simulated trajectories of the supply and demand of biofuels. He concluded that even if targets set by the EU seem reachable, small unattended constraints from the supply side (such as the war on Ukraine) might stress fulfilling these targets.

Along the same line, Sylvain Nizou (CEA) provided a nuanced perspective to address the use of fuels with carbon content. He proposed that carbon is a required component of several industries and that the objective should be to de-fossilize and not necessarily de-carbonize. De-fossilize for Sylvain meant to produce synthetic carbon fuels that might be recaptured after their use and recycled instead of being emitted to the atmosphere. While doing this, he aims to achieve a circular carbon economy to supply key industries -where the decarbonization might be costly- while still transitioning to carbon neutrality.

Finally, Pierre Cayet (Toulouse Business School) presented an in-depth analysis of the methodologies to assess the deployment of hydrogen charging stations. He argued that previous studies analyzing the subject had taken different assumptions; and that there needs to be more clarity on the most relevant assumptions to consider. While performing a clustering methodology he identified blind spots for each type of assumption. He summarized the approaches in three complementary methods: either using a linearization of equilibrium constraints, a multi-player game, or mixed complementarities.

Session 2: Towards smart and sustainable mobility: in search of data

New mobility business models transforming the transportation sector require considering an additional digital layer. In this session, Jan Lepoutre (Armand Peugeot Chair/ ESSEC) chaired three presentations on collecting and using data to improve transportation sustainability.

First, Konstantina Vallogianni (IE Business School) provided a framework to analyze how rapid innovation in vehicle technology, computing, and artificial intelligence-powered information systems transform the mobility sector. She argued that these had created a digital layer that resides on top of the traditional physical mobility system, which has come with new issues to tackle from the management and economic perspective. Consequently, she proposed seven research opportunities to address the sustainable implementation of the digital layer; these are: designing real-time coordination mechanisms; learning and automating heterogeneous smart, sustainable mobility user choice structures; design of mobility demand response incentives and nudging strategies; designing real-time decision support for CASE mobility asset operations; developing and evaluating digitally enabled smart, sustainable mobility business models; human-AI collaboration in smart, sustainable mobility systems; and investigating intended and unintended consequences of smart, sustainable mobility interventions.

Second, Phil Brown (Circularise) presented another aspect of the relevance of data, this time from the corporate responsibility perspective. In particular, he addressed the issue of the industrial traceability requirements to guarantee that industrial components are sourced sustainably and to improve their second use. He presented his firm, Circularise, which developed a standardized template structure and a smart questionnaire to support the gathering and systematizing of data from firms within their supply chains. Their tools help firms to efficiently provide transparency of their sourcing activities while protecting industrial secrets.

Finally, Jérémie Motin (EDF) presented an overview of the data ecosystem required to perform smart charging from a utility perspective. He mainly addressed the strategy of EDF to become a key actor in the ecosystem and enable the decarbonization of the electricity sector. Within their proposed ecosystem, EDF as an energy utility

played a crucial role as an aggregator of EVs, being the intermediate that coordinates the charge of EVs while maximizing the use of renewable energies for charging.

Session 3: Smart Charging Infrastructure - Lessons from the frontier:

While EVs are at the center of the new mobility ecosystem, smart charging infrastructure is equally important to guarantee that charging management is effectively implemented. In this session, Marc Petit (Armand Peugeot Chair/ Centrale Supélec - GEEPS) chaired three presentations focusing on the economics and business models behind the deployment of charging infrastructure.

First, Marc Olivier Metais (Vedecom / LGI CentraleSupélec) provided a methodology to rationally deploy charging infrastructure given key criteria that might maximize its use by EVs. Based on a multi-agent simulation, he offered a deployment strategy considering actual mobility behavior in Berlin while optimizing the comfort of EV users and minimizing any detours. One of the main results of his simulations was that to satisfy the charging needs of EV users within the urban area of Berlin, fast charging infrastructure was not required, as the optimal allocation of slow charging infrastructure was the most economically efficient alternative. At the same time, fast chargers might be helpful on the highways when EV users have long trips.

Then, Leonel Causse (TotalEnergies) presented the business model strategy of Total Energies. Their plan mainly focuses on selling energy to the customers and not installing the infrastructure. However, selecting the best places to position themselves is critical to their strategy. Within the factors that might constrain their business model, the time of connection and installation was a vital issue, as the Distribution System Operators (DSO's) connection times for new charging infrastructure can often be too long for the customer's needs. Hence, anticipation is key. In addition to selling electricity to the EV, their strategy includes bill management to manage the charging costs for their customers.

Finally, Matthieu Lanéelle (Allego) presented a different perspective from charging point operators. Their strategy, slightly different from the one of TotalEnergies, is to focus on the deployment of fast charging; to do this, they have innovated in the development of new methods to install charging infrastructure, pre-installing within their factories the charging infrastructure into modules that can be quickly built in the field.

Session 4: Assuring the affordability of electric mobility solutions

Maria Eugenia Sanin (chair Energy and Prosperity) chaired this session which involved three presentations

Implementation of low-emission-zones: electro compatibility and affordability of EV at stake Jean-Philippe Hermine (IDDRI)

The Mobility in Transition initiative of the Institute for Sustainable Development and International Relations (IDDRI) is dedicated to creating the conditions for a successful transition in the mobility and transport sector, through events and platforms allowing dialogue between industry, territory and NGOs. In the Low Emission Zones (LEZ) in city centers, access is restricted for the most polluting vehicles. LEZs were introduced in the loi LOM in 2019 in the 10 agglomerations that exceed the emission thresholds set by the EU (health risks for inhabitants). It is reinforced in 2021 by the Loi Climat et Resilience and becomes compulsory in all agglomerations with more than 60,000 inhabitants. Some local authorities, such as Strasbourg, Paris and Lyon, are ahead of this schedule. For professional users of LCVs and HGVs, 90% of the fleet studied is made up of diesel vehicles. There is therefore a strong and specific need for support, as the second stage of exclusion planned by Paris, Lyon and Strasbourg (Crit'air 2) excludes diesel vehicles from the EPZ. IDDRI has developed a tool to support the implementation of the EPZs, which is being tested in Strasbourg and Lyon. The methodology is as follows: first, collection of data on the vehicle fleet in circulation and the companies that own these vehicles (SIV, SIRENE, CGDD surveys and interviews); second, analysis of the data with a segmentation between 7 sectors of activity and 4 fleet sizes; third, impact studies and recommendations, in order to set up targeted measures for each category of user, adapted policies (exemptions) for each sector, and aid envelopes to support professionals. In the example of Strasbourg, the building and public works sector represents 30% of the companies in the metropolis, and 22% of the professional vehicles. Because of the potentially distant sites, the heavy loads to be transported and the current fleet of rather old vehicles, this sector is very fragile to electrification. Fast charging stations on the territory with priority access to professionals are recommended to encourage the transition of construction professionals. It is also considered whether the Crit'Air timetable could correspond to the natural renewal of the fleet. The first stages of the timetable (banning Crit'Air 5, 4 and then 3) are in line with the recent evolution of the fleet and are therefore considered realistic. On the other hand, the ban of Crit'Air 2 vehicles in 2028 requires a doubling of the rate of fleet renewal, which will require strong support.

Finally, the platform estimates the impact of the EPZ on improving air quality, which is one of the main issues in city centers. This impact, even with a derogation, is estimated as acceptable. Derogations are therefore flexibility tools, especially for people in the periphery who have to travel to the EPZ.

Rouen-Normandie collaborates with Renault in designing solutions for affordable electric mobility Aurélien Cagnard (Metropole Rouen Normandie) and Fabienne Jougleux (Renault)

In the Rouen urban area, $\frac{2}{3}$ of journeys are made by car. Of the 71 communes, the public transport network covers a small part of the territory. There are 41 low density communes, with little transport network and no bus lines. The EPZ represents 13 communes but more than half of the inhabitants. Rouen represents $\frac{1}{3}$ of the jobs, concentrated on 3% of the territory. This generates a lot of travel to the city centers with intensive car use. The EPZ concerns 30,000 Crit'Air 4/5/NC cars, which will increase to 93,000 cars with Crit'Air 3. It is therefore necessary to find zero-emission solutions for daily transport, meeting different criteria: daily mobility (up to 100 km/day), adapted for low-income households, in sparsely populated areas, with incentives to share journeys. Switching to an electric vehicle does not generate additional costs, if we take as a reference a 4-year-old vehicle that costs 2,500 euros per year. At a constant vehicle budget, however, the cost structure is different for the EV, with a larger item for depreciation and lower running costs. Various innovative mechanisms are being studied: EV4All (mechanism to buy a small vehicle) and EM4All (mechanism to lease a small vehicle). These mechanisms represent a shift away from the classic OEM business for Renault and require collaboration with public authorities. The aim is to achieve a vehicle costing 100 euros per month for a small EV (which is impossible with larger batteries). Small EVs have a lower carbon impact, but demand is low on the new market because of their lack of versatility. There is therefore a big risk for the car manufacturer. The innovative mechanisms studied make it possible to overcome this limitation. Concerning EV4ALL (electric vehicle for all), zero-interest loans and the replacement of the ecological bonus on purchase by a monthly subsidy based on mileage could make it possible to democratize access to everyday EVs on the new market thanks to faster repayment of loans. Concerning EM4ALL (electric mobility for all), it is necessary to set up a regional structure or cooperative with public investment, to lease vehicles over their lifetime. The issue of access to EVs is essentially financial. Despite the large number of grants, the "one-shot" system is not very suitable, as it is necessary to be able to advance the amount of the grants. Many solutions exist: aid upstream of the purchase of the vehicle, mileage subsidies until the amount is exhausted in the case of a loan, and the setting up of a public electric mobility service. An ad hoc entity to federate public authorities, operators and companies is in the process of being validated by the elected representatives of the Rouen metropolis.

Citroen AMI – Internal disruption in the automotive industry. Jan Lepoutre (ESSEC Business School)

The Citroën AMI is a unique vehicle: it is a quadricycle (L6), drivable from the age of 14, and is cheaper than other L6s. The real innovation of the Citroën AMI lies in the fact that the development cycle of the Citroën AMI was completed in 2.5 years, compared to the normal development cycle of about 5 years. In the automotive industry in 2017, the genesis of a vehicle is done by a modular platform to reuse parts and components between vehicle generations (different phase: exploration, concept definition, architecture & styling, manufacturing design, pre-series and production). Commercialization is also essentially B2B, with a marketing, advertising and communication managed by brands. The significant technological and regulatory changes in the automotive industry today require an increase in the automotive industry's clockspeed. This work presents elements allowing such an acceleration, through the study of the process study, archive data and interviews (R&D, brand, engineers) around the case study of the Citroën AMI. The product brief for the Citroen AMI was directed by Carlos Tavares, and not according to brand strategy. The idea was to design a vehicle with the lowest possible cost, to become a substitute for other forms of urban mobility, electric with a range of up to 100 km. The vehicle had to be brand-agnostic and its design was supposed to have a high level of secrecy. The genesis of the Citroen AMI started in 2017 and ended in 2020, and was completed thanks to external partners. This speed is due to the fact that quadricycles (L6) have lower safety and quality test requirements than cars, that the reputational risk is reduced for this type of vehicle, but also thanks to the multidisciplinary steering committee set up. From a sales point of view, the success is explained by the fact that consumers do not have to go to a Citroën dealer, as the vehicle was available first at the FNAC/Darty and then in full-online mode. Thanks to the creation of an online community experience and management, customers became sales ambassadors themselves. Citroen AMI was thus an organizational sandbox, which resulted in much higher adoption than expected in peri-urban and even rural communities. In the 20th century, radical innovations in the automotive industry were not technological, but

organizational. Organizational experiments are needed to make the organization adjust to ever faster technological and market challenges.