International Conference on Mobility Challenges

Timing: December 5-6 2019

Location : CentraleSupélec - Université Paris Saclay

The conference is jointly sponsored by:

- Chaire Armand PEUGEOT (CentraleSupélec & ESSEC Business School)
- Chair Energy and Prosperity (Institut Polytechnique de Paris)
- IMD Institut de la Mobilité Durable (Ecole des Ponts ParisTech) Groupe RENAULT ParisTech

Coordinators: Virginie Boutueil (ENPC), Jan Lepoutre (ESSEC), Marc Petit (CentraleSupélec), Yannick Perez (CentraleSupélec), Jean-Pierre Ponssard (Ecole Polytechnique)

Thursday 5th December: Plenary Sessions

9h00 - 10h30: Plenary session 1: The driving force of cities in promoting clean transport

Chair: Gaëlle Lesteven (Ecole des Ponts ParisTech / Laboratoire Ville Mobilité Transport)

- **Juan Pablo Montero** (Department of Economics PUC-Chile): Designing car bans for sustainable transportation

Sustainable transportation may mean: cleaner cars, faster travel, and policies that pay more attention to distributional implications. Different externalities exist, and the presentation focuses especially on local air pollution and traffic congestion. Various policy instruments have been tested, as carbon taxes, vehicle subsidies, pollution and congestion charges or restrictions, high occupancy lanes, or smog checks. The rationing schemes exist in numerous countries and cities around the world, focusing either on reducing local pollution or congestion. They come with three formats: uniform restrictions upon all cars, restrictions with vintage exemptions, and restrictions with toll exemptions. The first one doesn't work; the second one does because older cars pollute a lot more than newer ones; and congestion pricing is hard to implement. Redistributional implications should be carefully studied, and revenues have to be invested in sustainable mobility in order to leave everybody better off after the new policies.

- **Herrie Schalekamp** (Centre for Transport Studies, Cape Town), Beyond BRT: innovation in minibus-taxi reform in South African cities

Johannesburg's BRT has 9 times more bus riders at peak hours than at off-peak hours. The system has to be subsidized to exist, the low population density makes their implementation harder, and urban planning to limit travel distances is difficult. The majority of public transportation is done by minibuses, and there is a need for an efficient bus system, with different policy instruments to improve it: vehicle replacement schemes, dedicated lanes for

buses, and proper system facilities among other instruments. There is an important issue of education and raising awareness about the mobility challenges for the local population, in order to make the mobility more sustainable.

- **Jean Grebert** (Renault – Expert in Transportation and Mobility Systems): Archaic smart cities and future transport ecosystems.

Today, there are 4.5 billion people living in cities, 1 of them being poor people living in self-built areas, 1 other at the opposite being rich people. A Smart City has a lot of important challenges, from climate change, to scarcity management issues and resources preservations. Some observations across the world are shared: reuse of resources in Yemen; air-cooling and irrigation system in Iran; the construction expertise in hazardous areas in the favelas of Brazil; green and circular economy in Uganda (waste transformed into resources, computer repair, electric motorcycles); the use of the scarce resource of space in cities; the management of different resources as water and energy; and low tech innovations. Urban expansion relies on mass transit intensifying last mile connectivity issues. There are 5 opportunities to accommodate electric mobility within cities: develop a full package of local ZEV mobility means; ZEV mobility system as an adjustment pivot for energy management and services; the design of streets space; reshape the city; green building innovation as an infrastructure lever for energy production and ZEV connectivity. There are various ways to accommodate electric cars to the other elements of sustainable mobility: transit-oriented development (TOD) planning, multimodality, autonomous driving to help shared mobility, MaaS implementation. There is a challenge about the use of data and the associated electricity consumptions.

11h00 - 12h30: Plenary session 2: New organizational forms for new mobility patterns

Chair: Yann Chazal (Renault)

- **Adam Cohen** (Transportation Sustainability Research Center, Berkeley) Integrated mobility and the commodification of transportation: growth, trends and indicators to watch

The evolution of mobility shows different trends and policies across time, from past to future: it focused first on motorization, then the rise of environmental and safety regulation, transportation demand management, the rise of sharing, and then the rise of disruption. In this context of evolving trends, the question about the proactive or reactive role of governments and public policies will be particularly crucial. Three digital trends are impacting the economy: disintermediation, disaggregation and dematerialization (from physical to virtual world). Also the frontier between public or private transports appears weaker. The recent period sees a rise in shared mobility services, changing attitudes toward technology, innovative partnerships and emerging technologies that change consumer travels. This raises issues on how are evolving public agencies, changing consumer expectations in a rapidly changing environment. There are 5 converging mobility innovations: electrification; shared (micro-)mobility and last-mile delivery; digital information; the commodification of transportation; and automation. About the public transit (PT) and shared mobility relationship, the built environment, the density and the shape of cities are very important features. The barriers to behavioral change also include the

habitual experience, convenience, cost, lifecycle factors, and equity/access issues. The relationship between PT and shared mobility are multiple, and could be complementary for instance for last-mile connectivity or to supplement PT for low density areas.

- **Jane Zhao** (Kansas University): Resource Orchestration in Meta-Organizations: The Role of Catalytic Orchestrators in Large-Scale Innovation Meta-Organizations

We are in a fascinating period of changes in mobility, which is very interesting for the possible large scale actions and how they can be coordinated. In particular, there is a fast emergence of innovation partnerships in Chinese auto industry, related to: reducing the weight of the vehicles to reduce their consumption (vehicle lightweight; VLW); deployment of electric vehicles (EVs); intelligent and connected cars (ICV). Three innovation meta-organizations and innovation alliances are studied for these three trends of VLW, EVs and ICV. They present different numbers of member organizations, various levels of technology readiness and cross-sector membership. These innovation partnerships pursue common goals that none of the partner organization could achieve alone, due for example to the different suppliers and R&D capabilities they need to gather. But these partnerships are also highly prone to failures, as the lack of trust, the diversity of technologies, institutional logics, and organizing approaches involved, and the difficulty of governance. The study shows the indispensability of orchestrators, as industry and academic experts and staff commissioned for the partnership. They are especially important for motivation and communication purposes, as well as providing third-party neutrality to the partnership.

- **Jan Lepoutre** (ESSEC): Robust disruption: Competition and collaboration dynamics in the launch of electric vehicles in the automotive industry

There are some debates about the disruptive innovation electric vehicles (EVs) represent or not. Then the question addressed in the presentation is to understand what really happened in the past decades about innovations and disruptions, and what lessons it brings to know how disruptive the electric vehicle deployment is. A disruption makes the older technologies not competitive with the new technology, because it changes the bases of competition by changing the performance metrics along which companies compete. The interfirm collaboration is one way to deal with the uncertainty related to a possibly disruptive innovation (for instance the partnership of Volkswagen with Tesla). The history of the deployment of EVs is then studied. One reason for reluctance to EV deployment is the smaller revenues and profits from EVs than from ICE (internal combustion engines) vehicles, while the automotive industry is characterized by heavy sunk costs and is R&D intensive, elements that would encourage collaborating with other actors. Historically, the disruptor appears not to be Tesla but General Motors, which won the World solar challenge in 1987, which has been followed by the development of the “Impact” program, aiming at producing the first electric car designed with the objective of mass production. It triggered the California Air Resources Board (CARB) and the Japanese government to implement regulations to help electric vehicles deployment. But this trial was a failure for California in 2002. The next period (2002-2012) was marked by the Lithium-ion technology, launched especially by Daimler and Toyota. Since 2012, this is the

time for the technology and infrastructure diffusion. Finally, it appears that disruption is never the result of a single actor innovation, but needs collaboration of the disruptor with disrupted actors, maintaining flexibility over the possible existing future options.

14h00 - 15h30: Plenary session 3: Fast charging infrastructure for electromobility

Chairman: Damien-Pierre Sainflou (PSA Groupe)

- Erik Figenbaum (Institute of Transport Economics, Oslo): Charging into the future: Analysis of fast charger usage

Norway have 200k BEVs and 100k PHEVs in 2019. Charging infrastructure include 1k 50kW chargers, 7k public chargers. 90k home chargers. 94% of EV owners charge at home. Several policies have made EVs cheaper at purchase and much cheaper in annual costs.
The study analyses several datasets of charging transactions from operators from 2016 to 2018 and a survey of vehicle owners from 2018. Results indicates average energy, durations and power per charging event. The study has highlighted four types of users : occasional charge when range problem (30%), frequent (10%), professional or no home charging, long distance (rare). For most users, the majority of charging in a single province. There are important heterogeneities in for fast charging due to traffic heterogeneities, leading to queues or underutilisation.
The study brings several recommentations. The charging network should be dense enough to allow users to charge efficiently while local daily use is needed to ensure the profitability of chargers. Further information is needed for an efficient use of fast chargers especially during peak demand times. Importantly, approval tests of fast charging must be run at different ambient temperatures. Finally, along with a balanced BEV roll-out accross the country, the government should implement measures for non-profitable corridor chargers.

- Simon Funke (Fraunhofer): Invest in fast-charging infrastructure or in longer ranges?

The presentation provides an international comparison of public charging infrastructure (with a focus on Germany), a review of influencing factors on needs for public fast-charging infrastructure and a comparison on the costs of public fast charging infrastructure with costs of higher vehicle range.
Germany and France are in a similar situation with relatively high infrastructure density (charging points/EV), a low share of fast charging points and a high share of home-chargers. In comparison, Norway and the US have a much lower infrastructure density while China has a much higher share of fast chargers.
Major influencing factors on the need of public fast-charging infrastructure are the possibility of home-charging, the ranges of EVs and charging durations.
Authors found that large uptake of EVs is possible in Germany, and the necessary fast-charging infrastructure should be designed according the average battery capacity of EVs.

- Régis Le Drezen (Enedis): Connection of fast charging station to distribution grids.

France has 800 gas stations with at least one 43kW charger. Fast charging is also important for bus fleets, electric taxis, boats and trucks. Enedis is part of more than 40 projects on fast charging. Simulations have shown that power network of Enedis is ready to accommodate electromobility with fast charging. However, fast charging should not prevent from implementing smart charging. Smart charging would lead Enedis to be a smart DSO, with better network planning and better network management. Enedis calls for the co-building of projects with mobility actors.

16h00 - 16h30: Daniel Sperling (University of California – Davis): Three Revolutions, Steering Automated, Shared and Electric Vehicles to a better future.

Reducing GHG emissions from transportation goes with three strategies: zero emission vehicles, low-carbon fuels and reducing vehicles-kilometers-traveled VKT) with mobility and land use transformation. So far, only a small amount of academia have been used in policy making. Therefore, a major challenge for academics is about messaging on facts and needed policies. Such messages are that many aspects of decarbonization of transportation results are not expensive measures, and especially with creative policies that eliminate costs for taxpayers (eg feebates, LCFS, tradeable credites for performance standard). Until now,
decarbonization strategies involves massive electrification of all vehicles and the use of biofuels for aviation. However, further research must be done on the decarbonization of trucks and the related policies.
VKT is more problematic as it has been increasing in the US for a long time. It could be reduced with micromobility (scooters, bikes, ridehailin, pooled-rides) and an active road planning. Smart policies should involve local government and transit agencies (eg Uber, Lyft...). Automated vehicle will be useful only if shared.

16h30 - 18h30: Round Table: V2G

Chairman: Ladimir Prince (PSA Groupe)

- Willett Kempton (Delaware University): New experiments with EVs and electricity storage

To face the challenge of the energy transition, we have to implement already existing technologies. This means a massive electrification coupled to renewable electricity (eg wind and solar). As the latter are intermittent, massive storage capacities will be needed at large scale in order to optimize the system. If current storage options (batteries, power-to-gas) are expensive (around 1000$/kW) and may double the cost of renewables, electric vehicles may provide wide and much cheaper storage solutions (50$/kW), with V2G solutions. NUVVE is the main startup of VtoG in the world, and develops pre-commercial projects in the US, Denmark, France, UK…

- Paul Codani (DREEV): First commercial experiments of VtoG in Europe

DREEV is the first commercial roll-out for V2G in Europe. It is a joint-venture created by EDF and NUVVE. DREEV provides the management the charging of fleets of electric vehicle while using V2G. In return for the use of their electric vehicles for V2G, customers are paid 20€/month.

- Emilia Suomalainen (VEDECOM): Challenges for VtoH – VtoB

V2H and V2B concist in a variety of services provided by electric vehicles “behind the meter”. Main motivations are reductions of costs and GHG emissions. It may be simpler than V2G to implement. Main technical challenges are the adding and improvement of V2X capabilities in EVs or in the charging infrastructure, the managing of the induced battery degradation, communication standards and protocols, cybersecurity, data sharing… Other challenges include users participation and the coordination between users, aggregators, DSOs and regulators.

- Romain Beaume et Maël Guilbaud (Watt&Well)

Watt&Well is an agile power electronics supplier in the industries of aerospace, oil and electromobility. Among other products and engineering services, it has developed four generations of (unidirectional and bidirectionnal, on-board and off-board) chargers.

Friday 6th December: Parallel Sessions

9h00 - 10h30

Session 6: Infrastructures deployment: Jan Lepoutre ROOM SD 201

- Paper 1: **Bassem Haidar** (Chaire Armand Peugeot): Charging Infrastructure Projects: Did They Really Boost the French Electric Vehicle Market?
- Paper 2: **Jean Hassler** (PSA – CentraleSupélec-GeePs): Fast charging infrastructures for EVs
- Paper 3: **Yacine Sehimi** (INSEA-VEDECOM): Analysis of the performance of a Vehicle-to-Vehicle fast charging infrastructure based on a fleet of shared electric vehicles.

Session 2: Policies driving the transition towards sustainable mobility: Virginie Boutueil and Jean-Pierre Ponssard ROOM SD 202

- Paper 1: **Guy Meunier, Lucie Moulin and Jean-Pierre Ponssard** (Institut Polytechnique de Paris): The case of Fuel Cell Buses in Europe
- Paper 2: **Christina Littlejohn and Stef Probst** (U de Leuven): What Role for Electric Vehicles in the Decarbonization of the Car Transport Sector in Europe?
- Paper 3: **Anna Voskoboynikova** (LVMT): Comparison of Car Sharing Policies and Services in 4 European Cities

Session 3: Forecasting Electric Mobility impacts and energy transition: Yannick Perez ROOM SD 203

- Paper 1: **Aurélien Bigo** (Institut Polytechnique de Paris): Scenarios to decarbonize transport by 2050
- Paper 2: **Francisco Ramos-Real** (Universidad La Laguna): LCA of different types of light personal electric vehicles in the Canarian Islands
- Paper 3: **Remy Lauvergne** (CentraleSupélec – LGI- RTE): Electric mobility scenarios for 2050

Session 4: Business models and Vehicle to potential usages (VtoX): Willett Kempton (U Delaware) ROOM SD 204

- Paper 1: **Icaro Gomes** (CentraleSupélec – LGI- Vedecom): Tariff design with distributed energy resources and EVs: A Californian case study.
- Paper 2: **Dirk Lauinger** (EPFL - Vedecom): Reliable frequency regulation through vehicle-to-grid

11h00 – 12h30

Session 5: Autonomous Vehicles: Guy Fournier ROOM SD 201

- Paper 1: **Guy Fournier** (Hochschule Pforzheim): Potential influence of internet economy on urban mobility - The example of Autonomous vehicles
- Paper 2: **Fabio Antonialli** (LGI-CentraleSupélec): Multi-criteria evaluation of the economic impact of collective autonomous transport
- Paper 3: **Dimitri Konstantas** (U. Geneva): Cybersecurity: challenging issues for autonomous vehicles
- Paper 4: **Remi Maniak** (CRG): Autonomous Vehicle, from B2C to B2X

Session 6: Electric Vehicles and Distribution Grids: Marc Petit ROOM SD 202

- Paper 1: **Felipe Gonzalez Venegas** (Chaire Armand Peugeot): Can DERs fully participate in emerging local flexibility tenders?
- Paper 2: **Abderaman Benchekroun** (Geredis/Séolis – Yncréa-L2EP): Demand-side management of electric vehicles and electric water heaters connected to distribution grids

Session 7: EVs in Emerging Countries: Virginie Boutueil ROOM SD 203

- Paper 1: **Pradyumna Bhagwat** (EUI – Florence School of Regulation): Charging up India's Electric Vehicles: Infrastructure deployment & power system integration
- Paper 2: **Haruki Sawamura** (ENPC) Electric Vehicle Taxi Fleets in Bangalore (India) and beyond
- Paper 3: **Mohamedou Macire** (PSA, CentraleSupelec-GeePs, UMI): Moroccan power system in 2030: renewable sources and EV flexibility"