2EL2240 – Mobility issues

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Department: DÉPARTEMENT GÉNIE INDUSTRIEL ET OPÉRATIONS
Language of instruction: ANGLAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 60
On-site hours (HPE): 35,00
Elective Category : Fundamental Sciences
Advanced level : No

Description

The course will examine three innovations that are set to profoundly transform the industry associated with personal mobility.The first two are primarily technological in nature, they are the autonomous vehicle and the electric vehicle - battery or hydrogen. The third is related to the penetration and generalization of new information and communication technologies and the IoT in mobility which allows the implementation of the principles of the sharing economy.
The motivation for studying the combination of these three innovations is to determine the conditions for moving from a model of individual ownership of mobility goods with considerable negative externalities in terms of pollution, congestion, accidentology to uses of services. of autonomous, electric and / or shared mobility which could provide solutions to the aforementioned problems.
This transformation of the means of mobility is therefore at the crossroads of engineering approaches (how to set up autonomous mobility, what uses of 5G for mobility, how to use artificial intelligence, how to include electric vehicles in electricity networks for smart recharging based on renewable energy, etc.), the industrial economist (what underlying economic models, what regulation of uses, what games of players in an industry undergoing profound reorganization) and analyzes of mobility needs and consumer behavior (what incentives for adopting behavior, acceptance of car-sharing, new behavior and micro-mobility, multimodal transfers, etc.).

Quarter number
SG8

Prerequisites (in terms of CS courses)
nothing

Syllabus

Course 1: Introduction to energy transition and mobility.
Course 2: Electric Vehicle for Everything: Income Flow Framework
Course 3: Design pricing for EVs and renewable energy.
Course 4: Theories and applications of infrastructure deployments.
Course 5: Car Sharing Economics
Course 6: Car Sharing Economics an application in the Paris region
Course 7: Autonomous and shared electric vehicles: definitions, cost of technologies, shared mobility
Course 8: Exploring the system impact of automated taxis via simulation
Course 9: New technologies for urban and last-mile deliveries
Course 10: Mobility as a service
Course 11: New perspectives on urban mobility

Class components (lecture, labs, etc.)

During the 3 hour session, the first hour and a half will be led by a speaker (professor, researcher, town planner, economist, etc.) specializing in the topic. The tutorials will be held during the following hour and a half. In the tutorials, the students, in groups of 3, will make presentations on research articles made available to them by the speakers.

Grading

The course will be evaluated on the group work carried out during the tutorials for 60% of the final grade.
The 2-hour final exam will consist of 10 questions, one per course, for 40 % of the final grade

Course support, bibliography

Main Reference

Sperling, Daniel (2018) Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future. Island Press/Center for Resource Economics

Complements

· Icaro Silvestre Freitas Gomes, Yannick Perez, Emilia Suomalainen 2020 Coupling small batteries and PV generation: A review, Renewable and Sustainable Energy Reviews 126 (2020) 109835.

· Andrew Thompson and Yannick Perez 2020, Vehicle-to-Anything (V2X) Energy Services, Value Streams, and Regulatory Policy Implications, Energy Policy 137 (2020) 111136

· Quentin Hoarau & Yannick Perez, 2019, Network tariff design with distributed energy resources and electric vehicles, Energy Economics, Volume 83, September, Pages 26-39.

· Olfa Tlili Christine Mansilla David Frimat Yannick Perez, 2019 Hydrogen market penetration feasibility assessment: Mobility and natural gas markets in the US, Europe, China and Japan, International Journal of Hydrogen Energy Volume 44, Issue 31, 21 June 2019, Pages 16048-16068.

· Ramírez Díaz Alfredo, Marrero Gustavo, Ramos-Real Francisco, Perez Yannick, 2018 Willingness to pay for the electric vehicle and their attributes in Canary Islands, Renewable and Sustainable Energy Reviews Volume 98, December 2018, Pages 140-149.

· Ramírez Díaz Alfredo, Ramos-Real Francisco Javier, Perez Yannick, Barrera Santana Josue, 2018, Interconnecting isolated electrical systems. What is the best strategy for the Canary Islands? Energy Studies Review-Vol. 22 (2018) pp. 37–46.

· Hoarau Quentin and Perez Yannick, 2018, Interactions Between Electric Mobility And Photovoltaic Generation: A Review, Renewable and Sustainable Energy Reviews 94 (2018) 510–522.

· Rodríguez Brito Maria Gracia, Ramírez-Díaz Alfredo Jesús, Ramos-Real Francisco J., Perez Yannick, 2018, Psychosocial traits characterizing EV adopters' profiles: The case of Tenerife (Canary Islands), Sustainability 2018, 10, 2053.

· Codani Paul, Perez Yannick and Petit Marc 2018 Innovation et règles inefficaces : le cas des véhicules électriques, Revue de l'Energie n° 638, Mai-Juin

· Borne Olivier, Yannick Perez and Marc Petit 2018, Market integration or bids granularity to enhance flexibility provision by batteries of Electric Vehicles, Energy Policy, Volume 119, August 2018, Pages 140–148.

· Borne Olivier, Korte Klaas, Perez Yannick, Petit Marc and Purkus Alexandra 2018, Barriers to entry in Frequency-Regulation Services Markets: Review of the status quo and options for improvements, Renewable and Sustainable Energy Reviews. Volume 81, Part 1, January 2018, Pages 605–614.

· Codani Paul, Perez Yannick and Petit Marc 2016, Financial Shortfall for Electric Vehicles: economic impacts of Transmission System Operators market designs, Energy, Volume 113, pp 422-431.

· Eid Cherrelle, Codani Paul, Perez Yannick, Reneses Javier, Hakvoort Rudi, 2016, Managing electric flexibility from Distributed Energy Resources: A review of incentives for market design, Renewable and Sustainable Energy Reviews, Volume 64, pp 237–247.

Resources

One large room and 4 smalls for TDs

Learning outcomes covered on the course

Analyze the technical, economic and social potential of electric, autonomous and shared mobility. Highlight the limits of the proposed solutions, the business models under development and the needs to be met to implement this new low-carbon mobility in smarter cities.

Description of the skills acquired at the end of the course

C1.1 Study a problem as a whole, the situation as a whole. Identify, formulate and analyze a problem in its scientific, economic and human dimensions
C1.3 Solve the problem with a practice of approximation, simulation and experimentation
C1.5 Mobilize a broad scientific and technical base as part of an approach transdisciplinary.
C2.4 Create knowledge, in a scientific process
C3.6 Evaluate the efficiency, feasibility and robustness of the proposed solutions
C4.1 Think customer. Identify / analyze the needs, challenges and constraints of other stakeholders, particularly societal and socio-economic.
C7.1 To convince on the merits. Be clear about the objectives and expected results. Be rigorous about the assumptions and the process. Structure your ideas and argument. Highlight the value created.
C8.1 Work in a team / collaboration.
C9.4 Demonstrate rigor and critical thinking in approaching problems from all angles, scientific, human and economic