Erasmus - Work plan for Cecilia - 2025

This paper includes work plan ideas for Cécilia Lebarbey

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Internship Period: April 7, 2025 – August 1, 2025
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Table of first UC:

Table for SLovenia, summer, one house profile

Scenario	plug in time	plug out time	SOC plug in	SOC plug out	Season	EV battery	PV peak power	Houde demand profile	KPIs/results
UC1 - home workday									
UC2 - home weekend									
UC3 - employeese EV									
UC4 - company EV - workday									
UC5 - company EV - weekend									

4 tabels for Slovenia expected

- summer, small car
- summer, large car
- weinte, small battery
- winter large battery

We were thinking that you can participate in three topics:

- Python - Flexibility potential tool (estimation of flexibility potential of electric vehicles)
  - also in contact with Andraž Janenžič (staff exchange at SEL, Portugal)
  - forecasting, modelling, optimization, clustering

- Development of simple digital V2X model - prototyping with v0.dev
  - For example, model that presents Figure below. Figure was taken from this article

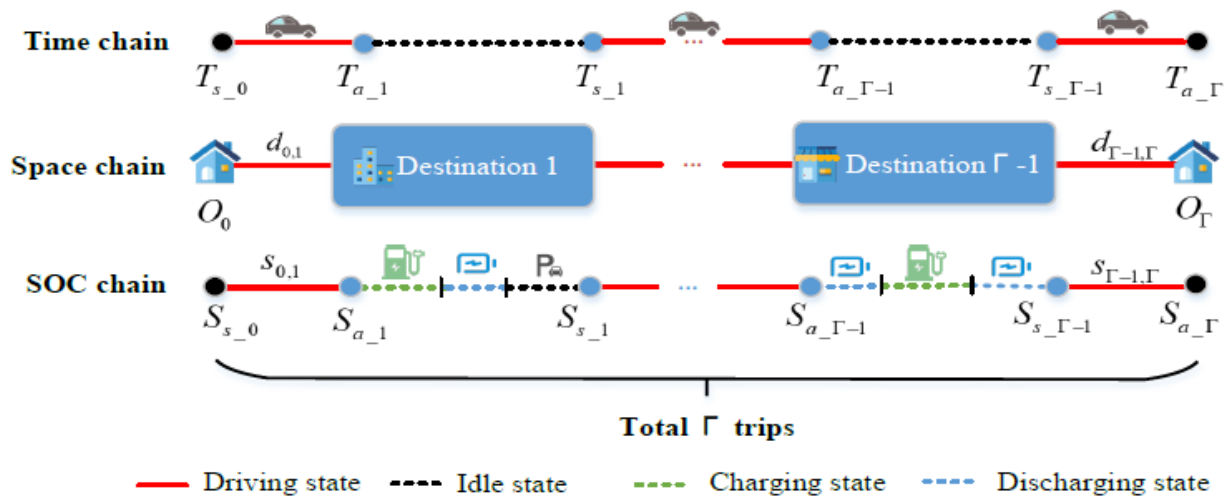

Fig. 1. Diagram of EV time-space-power chain

  - Visualizations of Green energy transition topics
  - digital visualization of V2G concept
  - for example… model that represents Slovenian demonstrator of EV4EU project…

- Arduino (Board V2X)

In the second week we should decide what you will do in the following weeks

But first, we suggest that you read and study the literature below to familiarise yourself with the E-mobility, V2X, V2G and energy grid topics (section "READ")

~~What we expect you to do in the first week please check section "REPORT/WRITE"~~

Week 1 (7.4-13.4) and beginning of week 2 (17.4-23.4):

- **READ**
  - **EV4EU**

- V2X, V2G
  - M.Eisler, 2023, False Starts: The Story of Vehicle-to-Grid Power
  - Marentič, T., Mendek, I., Kos, A., Malenšek, M., Morais, H., & Zajc, M. (2024, June). Estimation of electric vehicles with V2G capabilities potential for market participation.
  - D1.2 Impact of V2X in energy and power systems. DOWNLOAD PDF
  - D1.5 V2X Use Cases Repository. DOWNLOAD PDF
- Slovenian demonstrator of EV4EU project
  - D4.4 Impact of mass deployment of V2X in energy markets and services. DOWNLOAD PDF.
  - D7.1
- EVs flexibility
  - Lopez, 2023, Characterising the flexibility of electric vehicle charging strategies: a systematic review and assessment
  - Striani et al, 2024, Flexibility potential quantification of electric vehicle charging clusters
- EVs, V2X, V2G, EV flexibility potential studies/simulations, optimization, forecasting, Flexibility potential tool
  - Marentič, T., Mendek, I., Kos, A., Malenšek, M., Morais, H., & Zajc, M. (2024, June). Estimation of electric vehicles with V2G capabilities potential for market participation.
  - Li, J., Huang, Y., & Zhang, T. (2023, May). Spatial-temporal distribution forecasting of electric vehicle charging and discharging loads based on urban V2G application.
  - M.Secchi, 2025, Centralised vehicle-to-grid smart charging supported by PV generation for power variance minimisation at the transformer: A user's perspective analysis
  - D3.4 Definition and Development of a City-Level Co-simulation Platform for V2X. DOWNLOAD PDF.
  - Mendek, I., Marentič, T., Anžur, K., & Zajc, M. (2024). A Case Study on Electric Vehicles as Nationwide Battery Storage to Meet Slovenia's Final Energy Consumption with Solar Energy.
  - T.Marentič et.al., 2023, Bidirectional electric vehicle charging for flexibility services development (for ideas look only figures)

  > https://www.dropbox.com/scl/fi/uol17xmakk1u3pmupuc2c/ERK2023-Marentic-Zajc-finalno.pdf?rlkey=mg6vfyrvmdz6vft81ygfxaut4&dl=0

  - Loschan_2023_Flexibility potential of aggregated electric vehicle fleets to reduce
  - **Modelling Electric Vehicle Charging Stations Flexibility for Long-Term Distribution Network Planning.** António Maria Jerónimo (Instituto Superior Técnico I INESC-ID – Portugal). THESIS PDF.
  - FlexiGen: Stochastic Dataset Generator for Electric Vehicle Charging Energy Flexibility
  - Striani et al, 2024, Flexibility management of electric vehicles based on user profiles: The Arnhem case study
- Traffic
  - ICCT Roadmap model

- Li, J., Huang, Y., & Zhang, T. (2023, May). Spatial-temporal distribution forecasting of electric vehicle charging and discharging loads based on urban V2G application.
- Chen, L., Yang, F., Xing, Q., Wu, S., Wang, R., & Chen, J. (2020, October). Spatial-temporal distribution prediction of charging load for electric vehicles based on dynamic traffic information.
- Mahmoudi, E., & Ruppert Filho, E. (2021, April). Spatial-temporal prediction of electric vehicle charging demand in realistic urban transportation system of a mid-sized city in brazil.
  - **Clustering (EV profiels), Forecasting**
    - M. Cañigueral, 2022, Flexibility management of electric vehicles based on user profiles: The Arnhem case study
    - X.Li_2025_Electric vehicle charging flexibility assessment for load shifting based on real-world charging pattern identification
  - **Models in regard to EVs, V2X, V2G**
    - V2G simulation simple example and UCs

> https://www.dropbox.com/scl/fi/2k3ew8apsqs6j5qm67znz/V2G_operation_simulation_EN.pptx?rlkey=vd2x4x0p7qw0dm818mibbhl8g&dl=0

  - We also had a student project where we were developing interactive models in the field of e-mobility and energy communities
    - You can read more here (please use google translate)
  - **Optimization algorithms**
    - D2.3 Optimal management of V2X in parking lots. **DOWNLOAD PDF**.
    - D2.4 Optimal management of EV fleets in companies. **DOWNLOAD PDF**.
    - D2.6 Control strategies for the optimal operation of electrified road freight and public transport. **DOWNLOAD PDF.**
  - **Other**
    - 3 level charging

- **REPORT/WRITE**
  - Do you have any ideas what would you like to do based on the literature you read?
    - Prepare a work plan what you want to do based on our ideas and literature you have read
    - For example
      - prepare a few ideas what can you do in Python... in regard to flexibility estimation, optimization of EVs charging/discharging
      - prepare a few ideas how and which models you would like to prepare in the scope of E-mobility, V2G, V2X, energy grid etc.

Ideas for later

- Prepare a simple Python code that estimates flexibility potential of parking lot with 10 EVs, for different UC for example, home, work, shopping....etc.
- Prepare a simple digital model, that presents
    - substation to which are connected CSs, PV, consumers,
    - this model presents how EVs come and go, while they are plugged in they are charging or participating in V2G flexibility services