EV Charging and Grid Integration Tool

Workshop for the Africa Support and Investment Platform for E-mobility,
31 August 2023

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International Energy Agency

Outline

- Grid integration of EV: manual for policy makers
- EV Charging and Grid Integration Tool
- Q&A

Grid integration of EV: Manual for policy makers

4 key steps for policy makers to successfully integrate EVs

① Prepare institutions for the electric mobility transition

1. Engage electric mobility stakeholders
2. Break silos in planning and policy making

② Assess the power system impacts

1. Define an electric mobility strategy
2. Gather data and develop insights
3. Assess the grid impacts under mobility scenarios

③ Deploy measures for grid integration

1. Accommodate all charging solutions but encourage managed charging
2. Facilitate aggregation by enforcing standards and interoperability
3. Value the flexibility of EVs
4. Co-ordinate EV charging with renewables
5. Incentivise smart-readiness

④ Improve planning practices

1. Conduct proactive grid planning
2. Reflect the full value of EV charging

A framework for grid integration of electric vehicles

PHASE 1: No noticeable impact	**PHASE 2:** EV load noticeable with low flexibility demand	**PHASE 3:** Flexible EV load is significant with high flexibility demand	**PHASE 4:** Flexible EV load is highly available with high flexibility demand
No significant impact yet. Encourage higher EV uptake through incentives and public EVSE deployment.	Distinct variability observed caused by EV charging but demand for flexibility is low enough that simple flexibility measures would suffice.	Demand for flexibility is high, matching the availability of flexible EV load and paving the way for aggregated smart charging.	High flexibility demand along with highly available flexible EV load can provide energy back to the system in periods of deficit.
Co-ordinate charging station deployment in areas beneficial to the grid	**Passive measures:** time-of-use tariffs, vehicle-based charging time delays	Deploy active measures: unidirectional V1G	Deploy active measures, bidirectional charging: V2G
	Norway	**France, Netherlands, United States**	**Island power systems, certain vehicle segments**

Interactive web tool:
EV Charging and Grid Integration tool
http://www.iea.org/data-and-statistics/data-tools/ev-charging-and-grid-integration-tool

Report (December 2022)
Grid Integration of Electric Vehicles: A Manual for Policy Makers
https://www.iea.org/reports/grid-integration-of-electric-vehicles

Menti question – code 2736 4634 (www.menti.com)

Global EV electricity demand equals to total national consumption of...

La demande en électricité de la flotte mondiale de véhicules électriques équivaut à la consommation nationale de...

EV charging and grid integration tool

EV Charging and grid integration tool

Motivation #1

Assessing the impact of EV charging on the power system

Module 1

Simulation of EV charging behaviour

Output: weekly EV charging demand profile

Motivation #2

Assessing effect of measures for mitigating EV charging impacts

Module 2

Simulation of EV charging behaviour with managed charging

Output: weekly EV charging demand profile with managed charging

Motivation #3

Estimating the CO_2 emissions related to EV charging

Module 3

Simplified representation of the electricity mix

Output: calculation of yearly CO_2 emissions

Main tool output: detailed simulation of weekly demand profile

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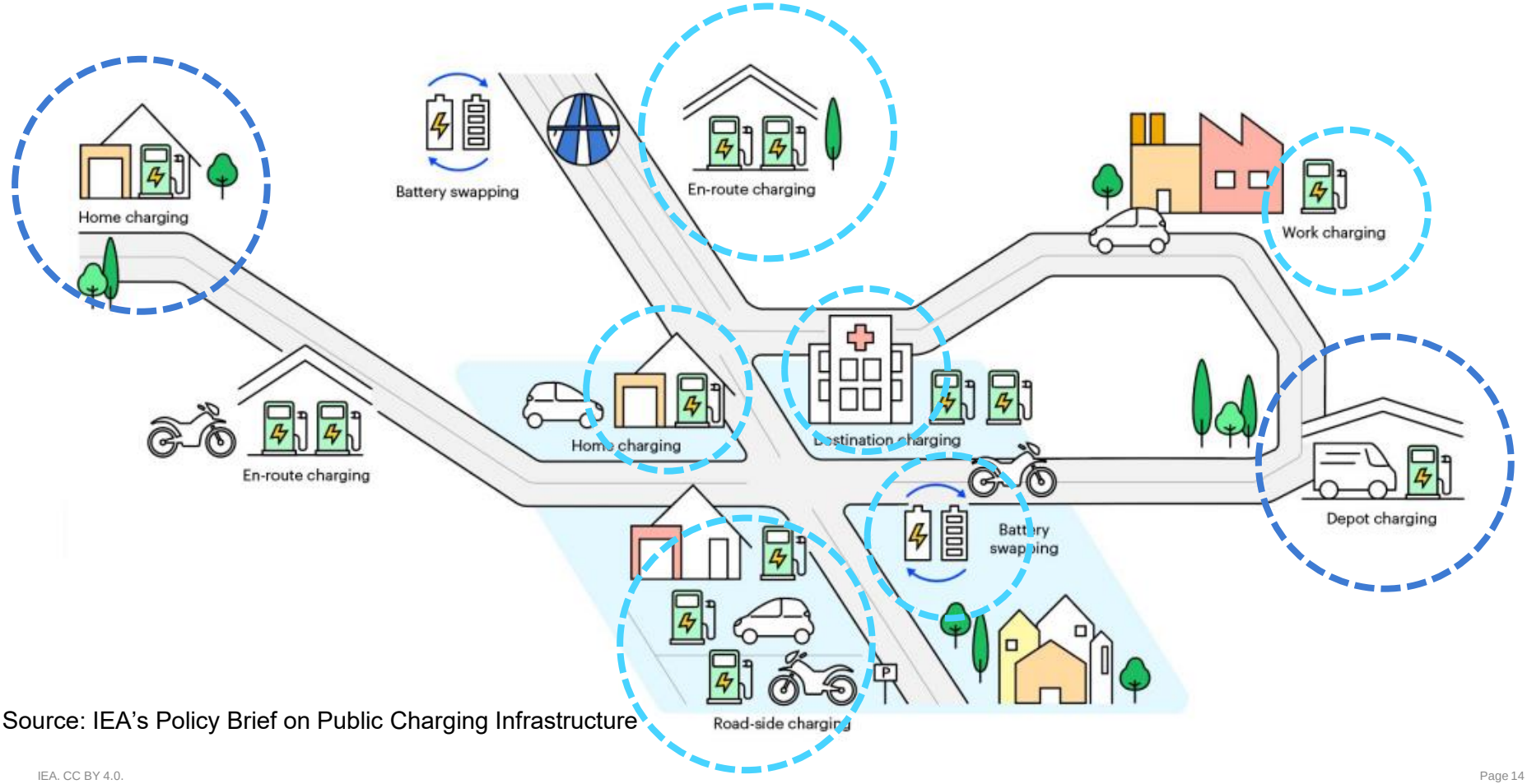
Motivation #1 (Module 1)

Assessing the impact of EV charging on the power system

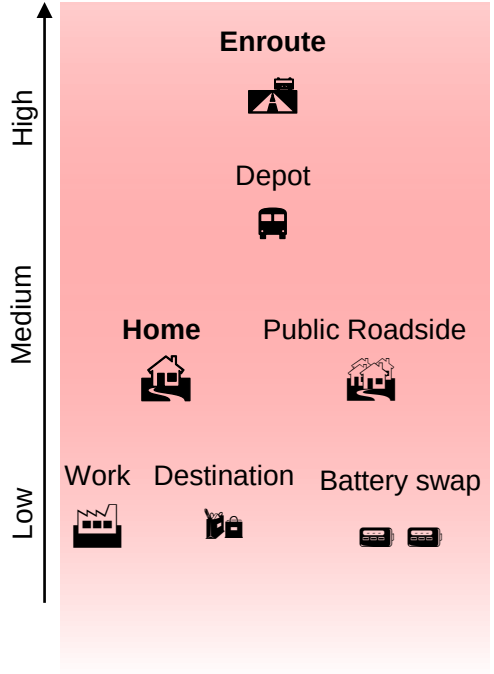
EVs can be charged at several types of locations



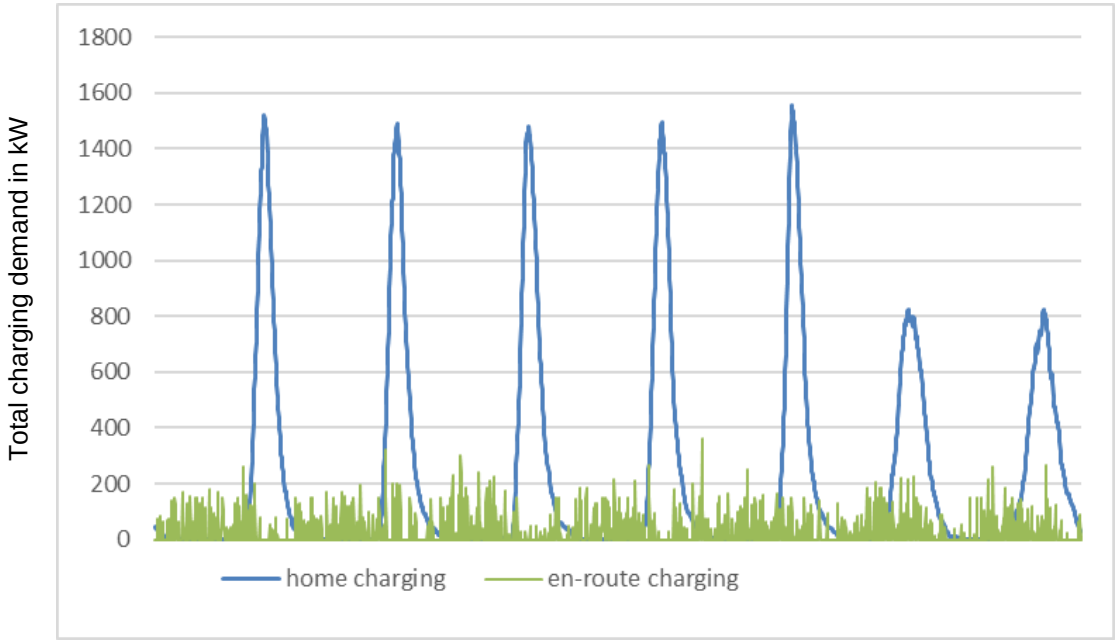
Source: IEA's Policy Brief on Public Charging Infrastructure

Many factors influence the profile of electricity demand by EV

Grid impacts
of EV charging

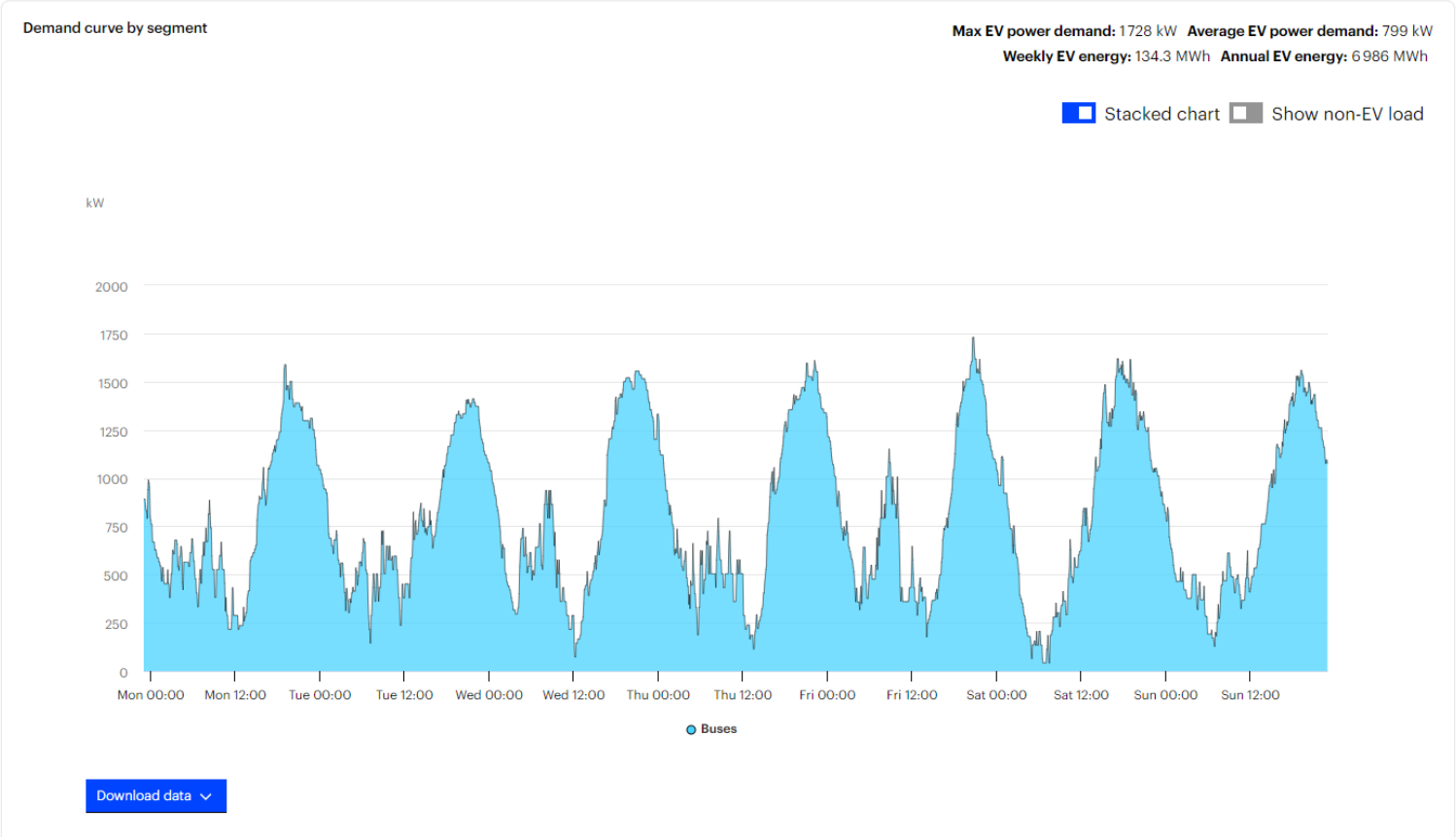


Power demand profile from EV charging
of 1000 private cars driving (one week)

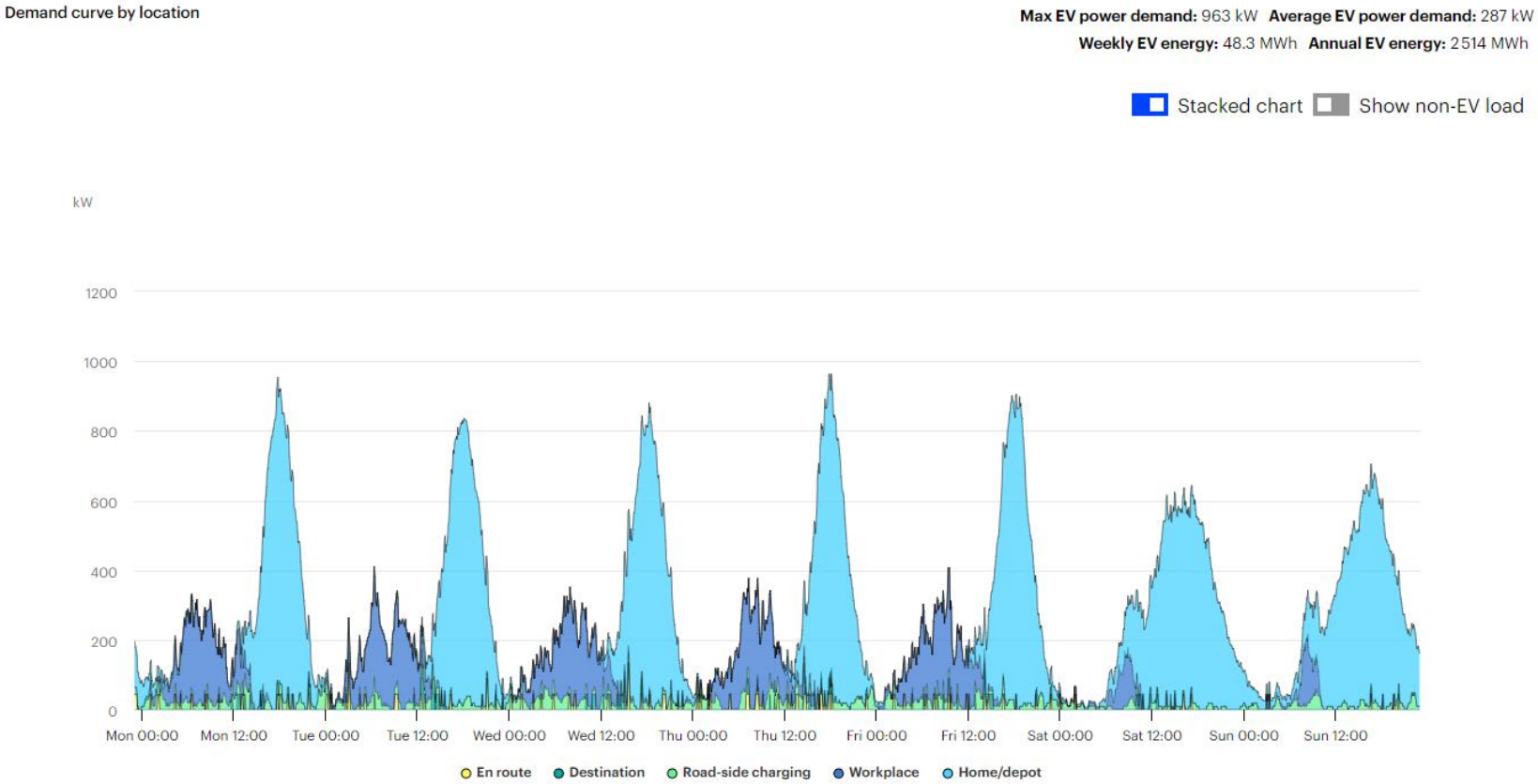


Grid impacts of charging solutions vary based on EV fleet and electricity system characteristics.

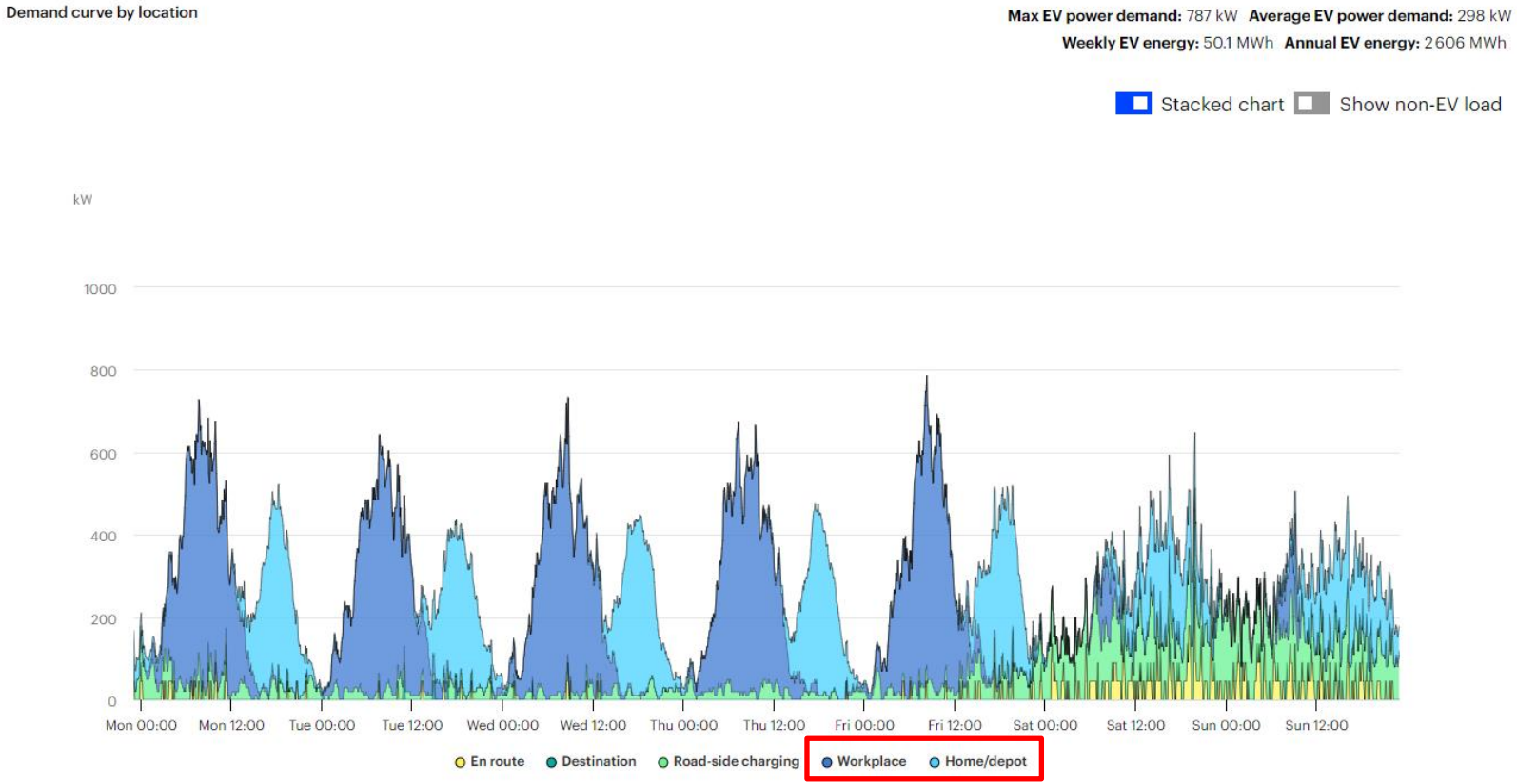
Ex: 100 buses – base example



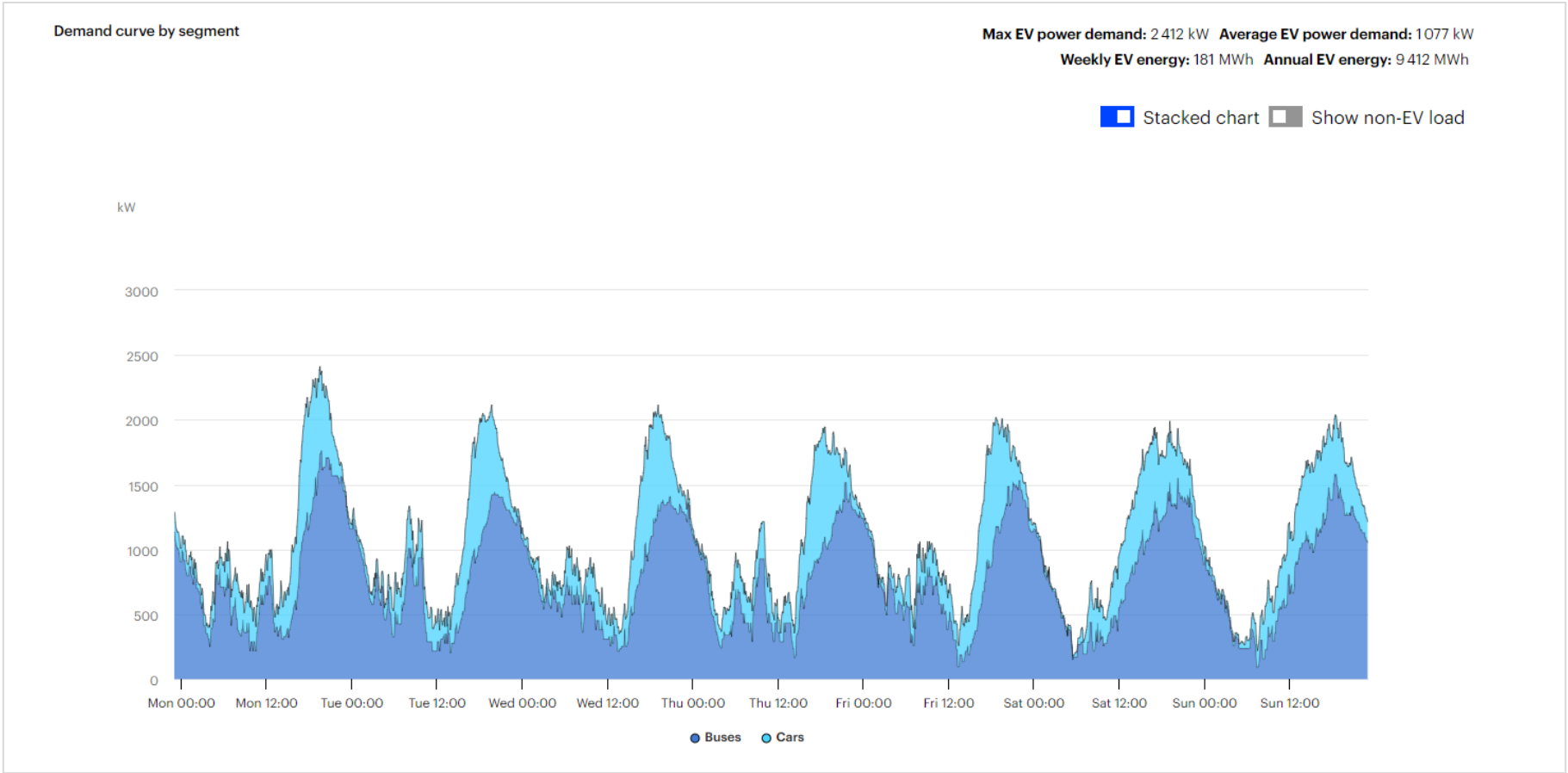
Ex: 1000 cars



Ex: 1000 cars – lower access to home/depot charging



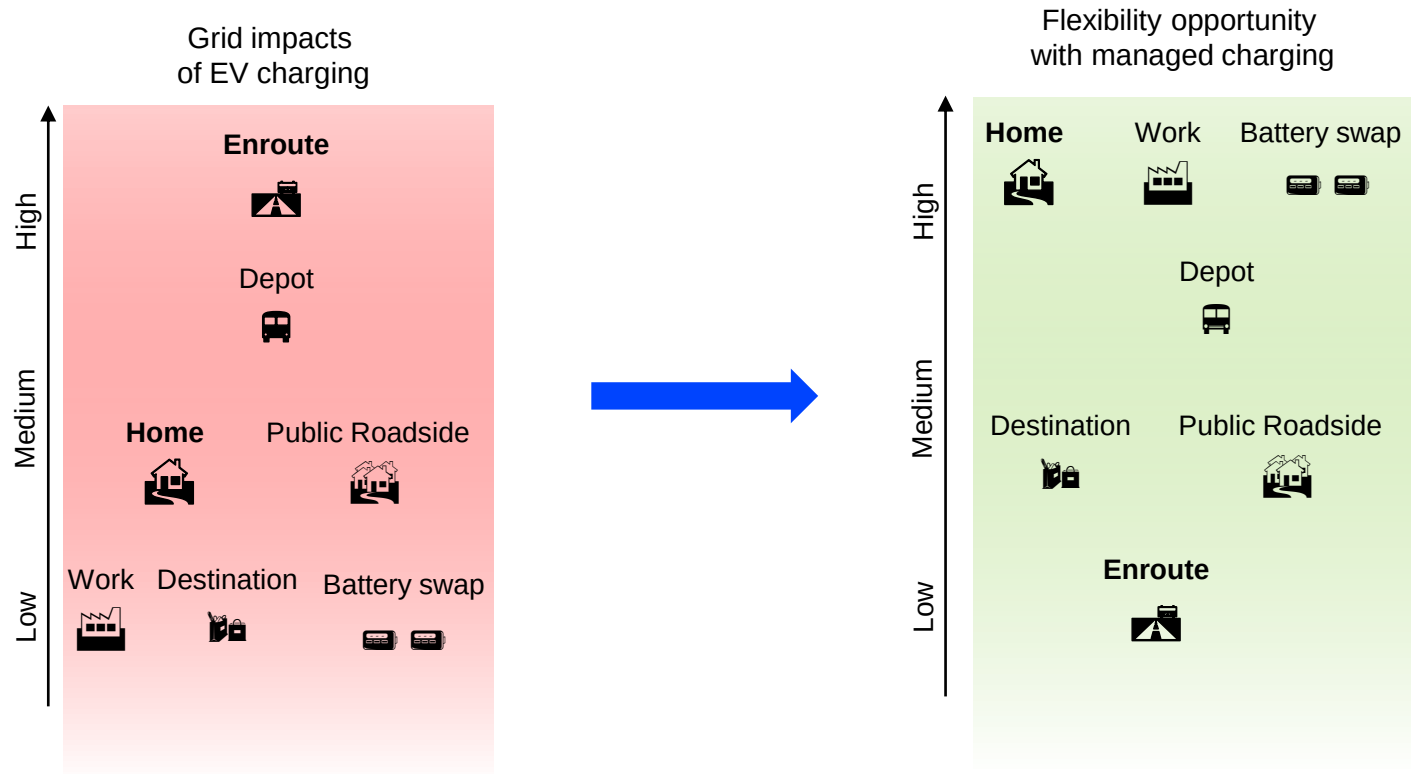
Ex: 1000 cars overlapped with 100 buses



Motivation #2 (Module 2)

Implementing managed (more flexible) charging

Road transport electrification: from challenges to opportunities



Managed (flexible) charging unlocks demand flexibility, reduces peak demand and grid congestions, and accelerates electricity decarbonisation.

Applying managed charging measures

Is managed charging possible?

Checking flexibility

Energy required to charge EV

Flexibility

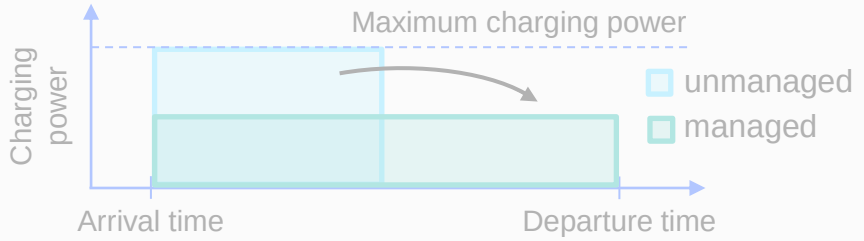
Energy available for charging (during connection time)

Participation rate

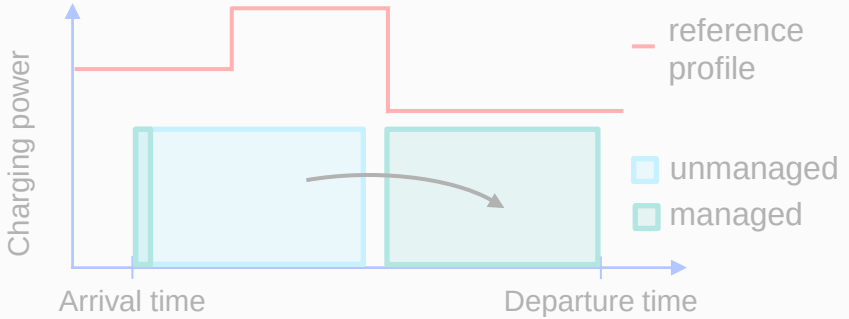
Is the infrastructure adapted? AND
Is the driver willing to participate?

Apply a managed charging measure

Balanced charging

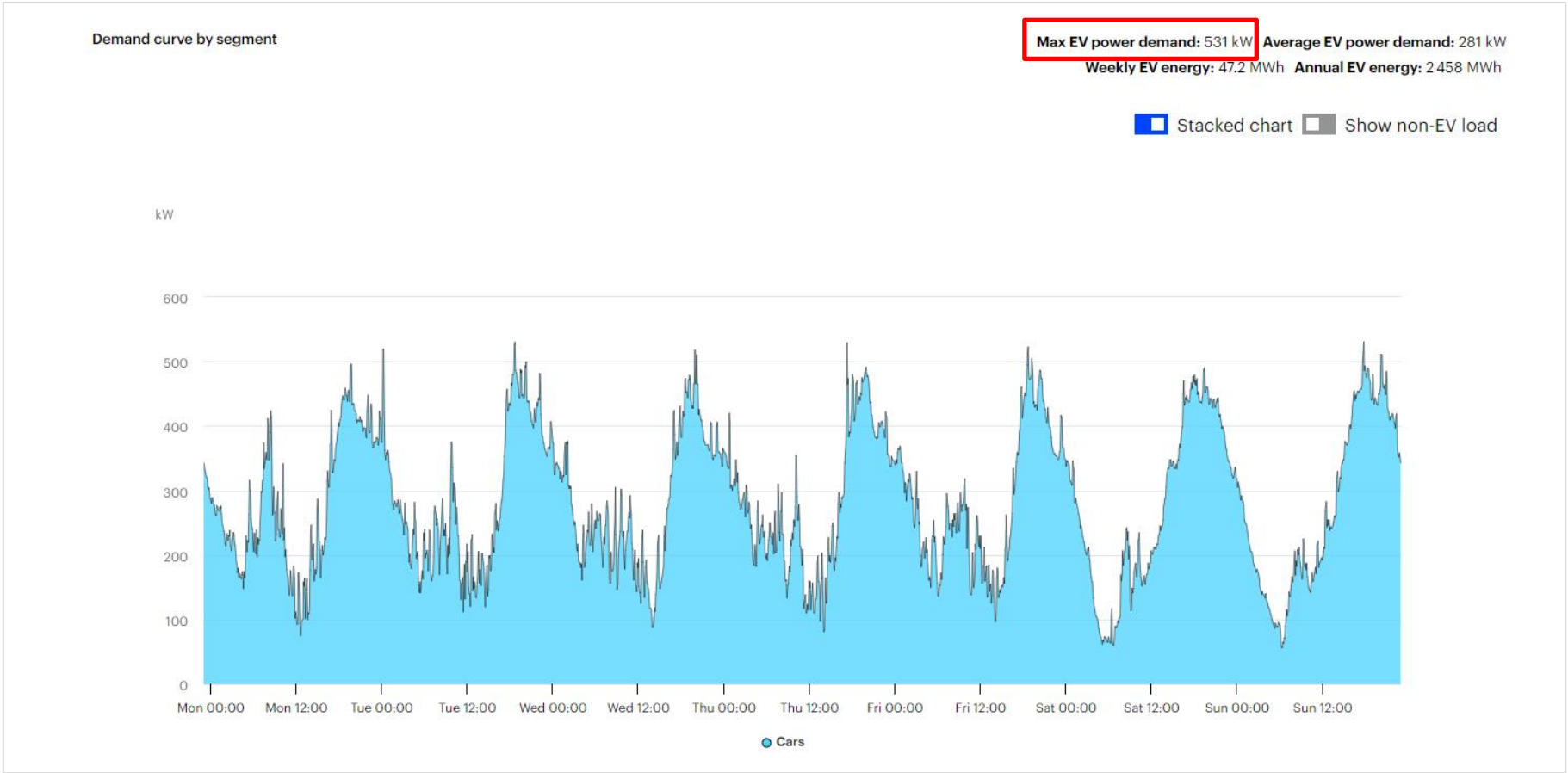


Time-of-Use (ToU) tariffs and smart charging

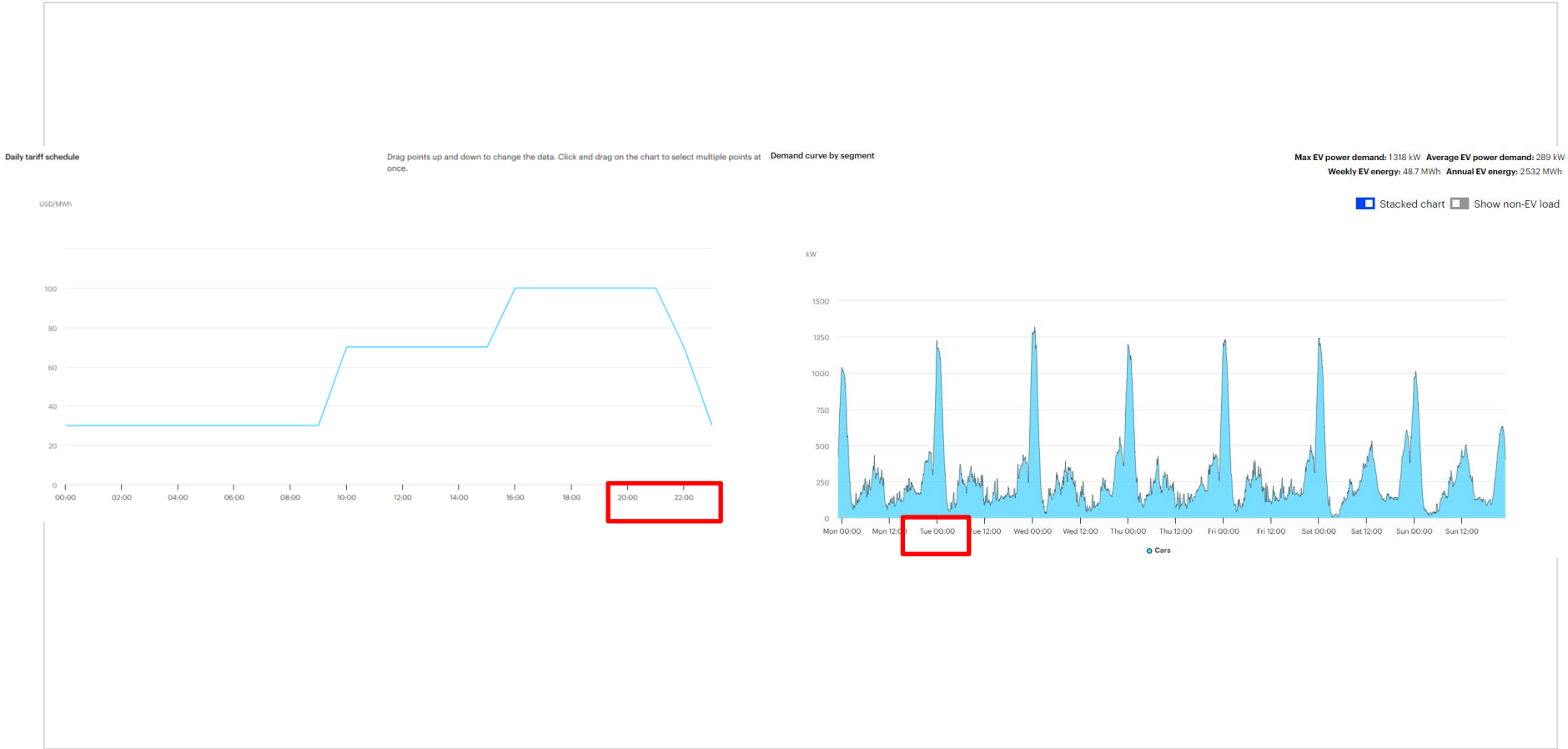


- Shift of energy depending on the **hourly tariff schedule reference electricity demand curve**

Ex: 1000 cars – applying balanced charging



Ex: 1000 cars – applying Time-of-Use tariffs



Ex: 1000 cars – applying V1G

Motivation #3 (Module 3)

Estimating the CO2 emissions related to EV charging

EV charging emissions depend on power mix at time of charging

Estimate of emissions

Net load without and with EV charging

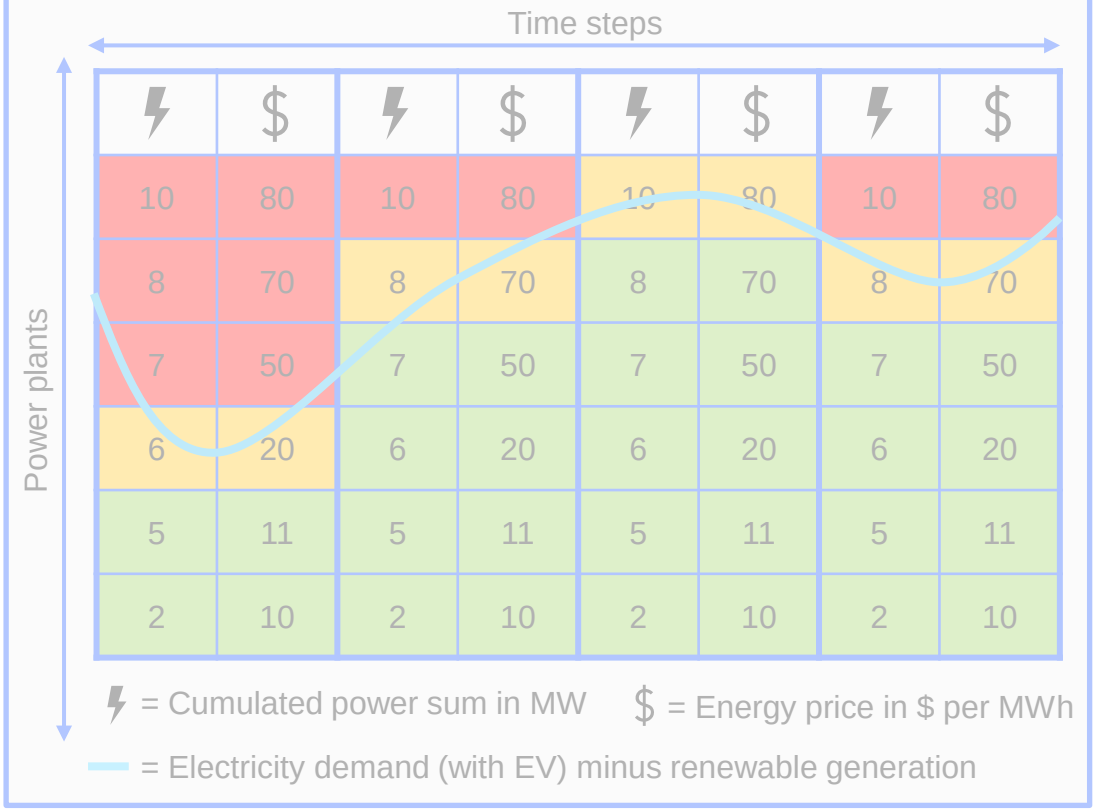
↓

Running power plants

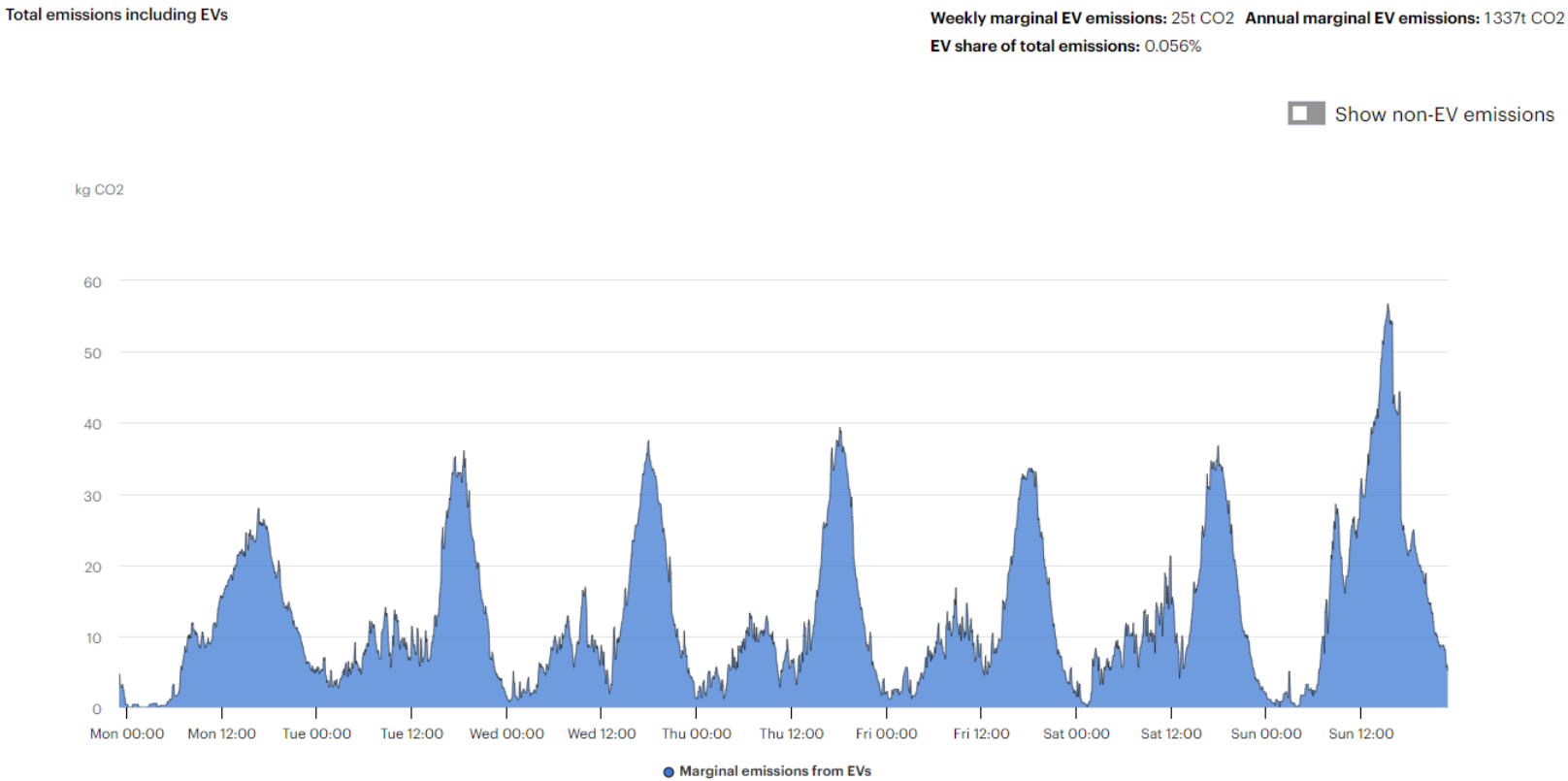
↓

EV charging related emissions by comparison

Simplified dispatch simulation



Ex: 1000 cars – CO2 emissions estimates



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Q&A

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Thank you for your attention.

Thank you to all contributors:

- Tool specifications: **Luis Lopez, Jacques Warichet**
- Algorithm developers: **Luis Lopez, Juha Koÿkka, Woan Ho Park, Andreas Bong**
- Digital support (web tool and API): **Barbara Moure, Jon Custer**
- Guidance and review: **Per-Anders Widell, Julia Guyon, Javier Jorquera Copier, Shane McDonagh, Elizabeth Connelly, Brendan Reidenbach, Alejandro Hernandez, Pablo Hevia-Koch**