

Mobility Patterns and Impact On The Grid

SolarMiles: Output of WP2

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Research Questions

1. What are the **characteristics of the usage patterns** of electric cars, solar PV power generators, technical infrastructure and net balancing of the electricity grid?
2. How can electric cars **use the available amount of solar energy within the limits of the current system** and thus contribute to the grid balance?
3. Where must a **service concept meet users of electric cars to motivate them to adjust their charging pattern** to the available amount of solar energy so that buffering with these cars is optimized?



Bellekom AA, Sandra

MOBILITY PATTERNS

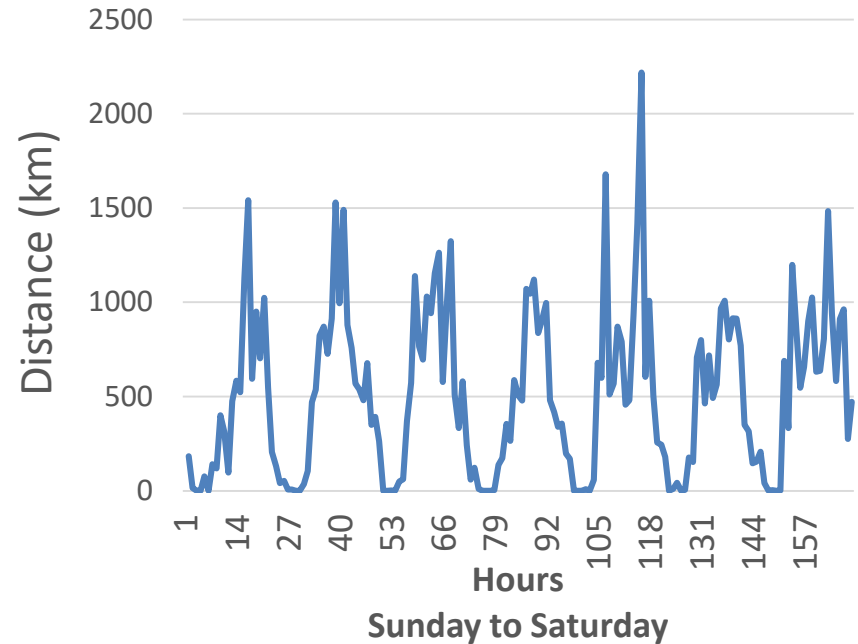
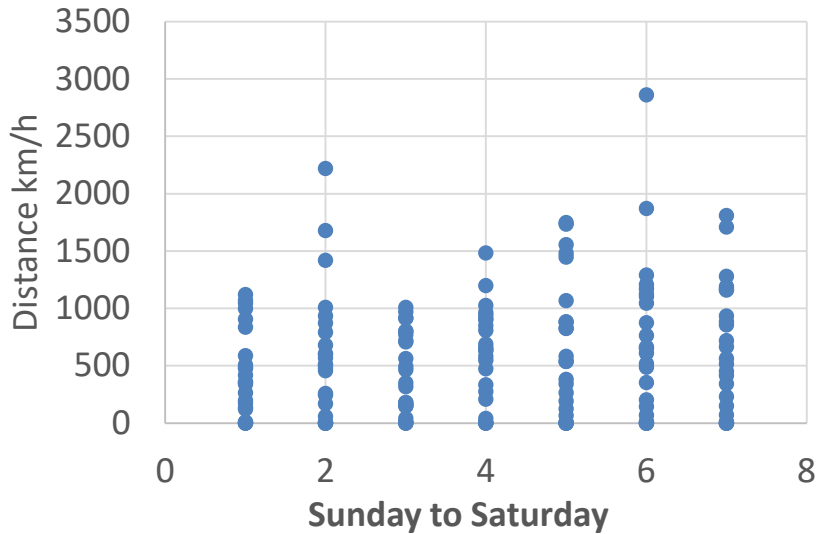


Collecting mobility data

- General:
 - Analysis of OViN data (Onderzoek Verplaatsingen in Nederland)
- Specific:
 - Development of Mobilytics App
 - Analysis of collected position and time data



Mobility pattern Netherlands (OVIN)

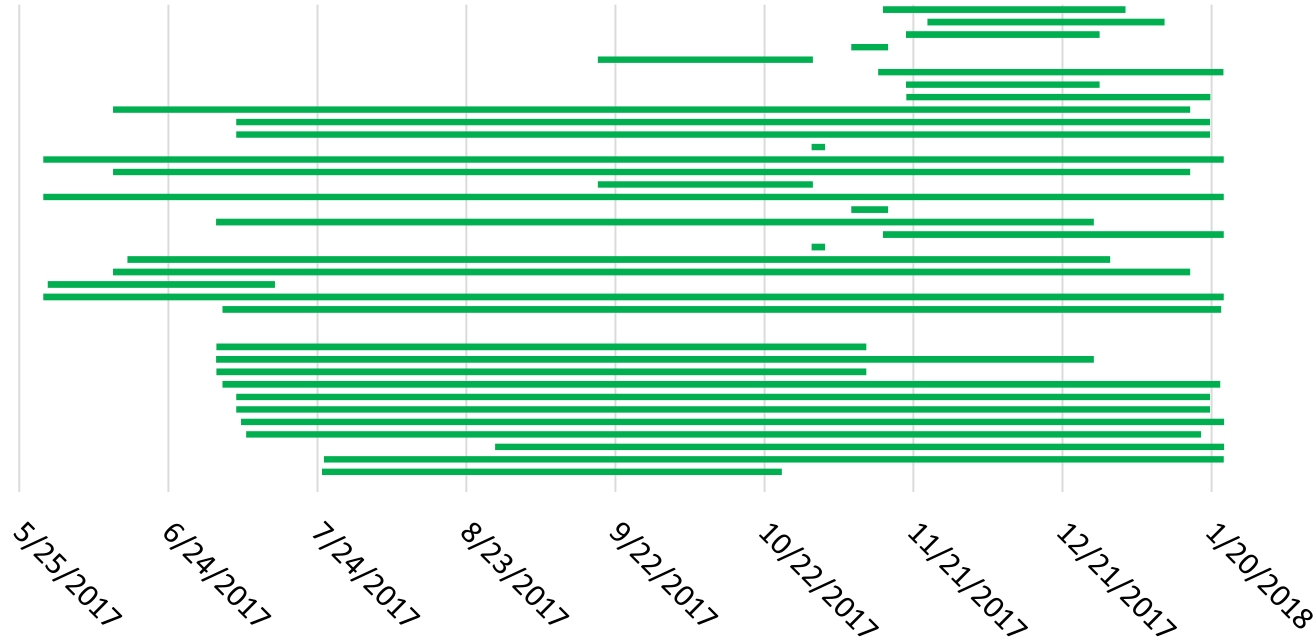


114349 Dutch Mobility Data.
31750 Dutch Vehicles and only 27 Groningen

Mobilytics App

Mobilytics use on Ameland

31 times installed
Almost 1.4 million points collected



Mobilytics output



Route_id

Start of a route

Time stamp

Location
(latitude, longitude)



		3-1-2018 10:52:13	53.4512176, 5.8008729
		3-1-2018 10:57:12	53.4512176, 5.8008729
16851		3-1-2018 11:00:17	53.4512176, 5.8008729
16851		3-1-2018 11:02:15	53.4469307, 5.7968123
16851		3-1-2018 11:02:15	53.4469307, 5.7968123
16851		3-1-2018 11:02:15	53.4469307, 5.7968123
		3-1-2018 11:02:15	53.4469307, 5.7968123
16851		3-1-2018 11:02:21	53.4469556, 5.7959368
16851		3-1-2018 11:02:26	53.446979, 5.7951523
16851		3-1-2018 11:02:31	53.4469956, 5.7944602
16851		3-1-2018 11:02:36	53.4469876, 5.7937986
16851		3-1-2018 11:02:41	53.4469725, 5.793217
16851		3-1-2018 11:09:08	53.4342096, 5.7750281
		3-1-2018 11:09:08	53.4342096, 5.7750281
16852		3-1-2018 12:55:24	53.4342096, 5.7750281
16852		3-1-2018 12:57:21	53.3968563, 5.8783903
16852		3-1-2018 12:57:21	53.3968563, 5.8783903
16852		3-1-2018 12:57:21	53.3968563, 5.8783903
		3-1-2018 12:57:21	53.3968563, 5.8783903
16852		3-1-2018 12:57:27	53.3969756, 5.8780951
16852		3-1-2018 12:57:32	53.396899, 5.8778291



Legend	
●	31-5-2017 07:54:38
●	31-5-2017 07:59:38
●	31-5-2017 09:39:56
●	31-5-2017 09:59:00
●	31-5-2017 09:59:56
●	31-5-2017 09:59:59
●	31-5-2017 10:00:02
●	31-5-2017 10:00:05
●	31-5-2017 10:00:08
●	31-5-2017 10:00:11
●	31-5-2017 10:00:14
●	31-5-2017 10:00:17
●	31-5-2017 10:00:20
●	31-5-2017 10:04:50
●	31-5-2017 10:09:49
●	31-5-2017 10:14:58
●	31-5-2017 10:17:19
●	31-5-2017 10:35:14

Start of trip

Time gap
=> boat

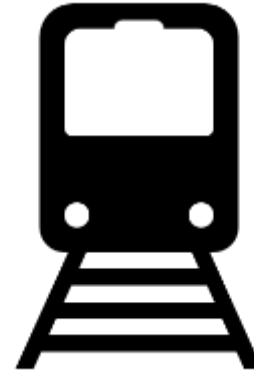
●	31-5-2017 10:00:02
●	31-5-2017 10:00:05
●	31-5-2017 10:00:08
●	31-5-2017 10:00:11
●	31-5-2017 10:00:14
●	31-5-2017 10:00:17
●	31-5-2017 10:00:20
●	31-5-2017 10:04:50
●	31-5-2017 10:09:49

No movement for less than 10 minutes

End of trip



Continue on the same day, another route



Continue on the same day, same route



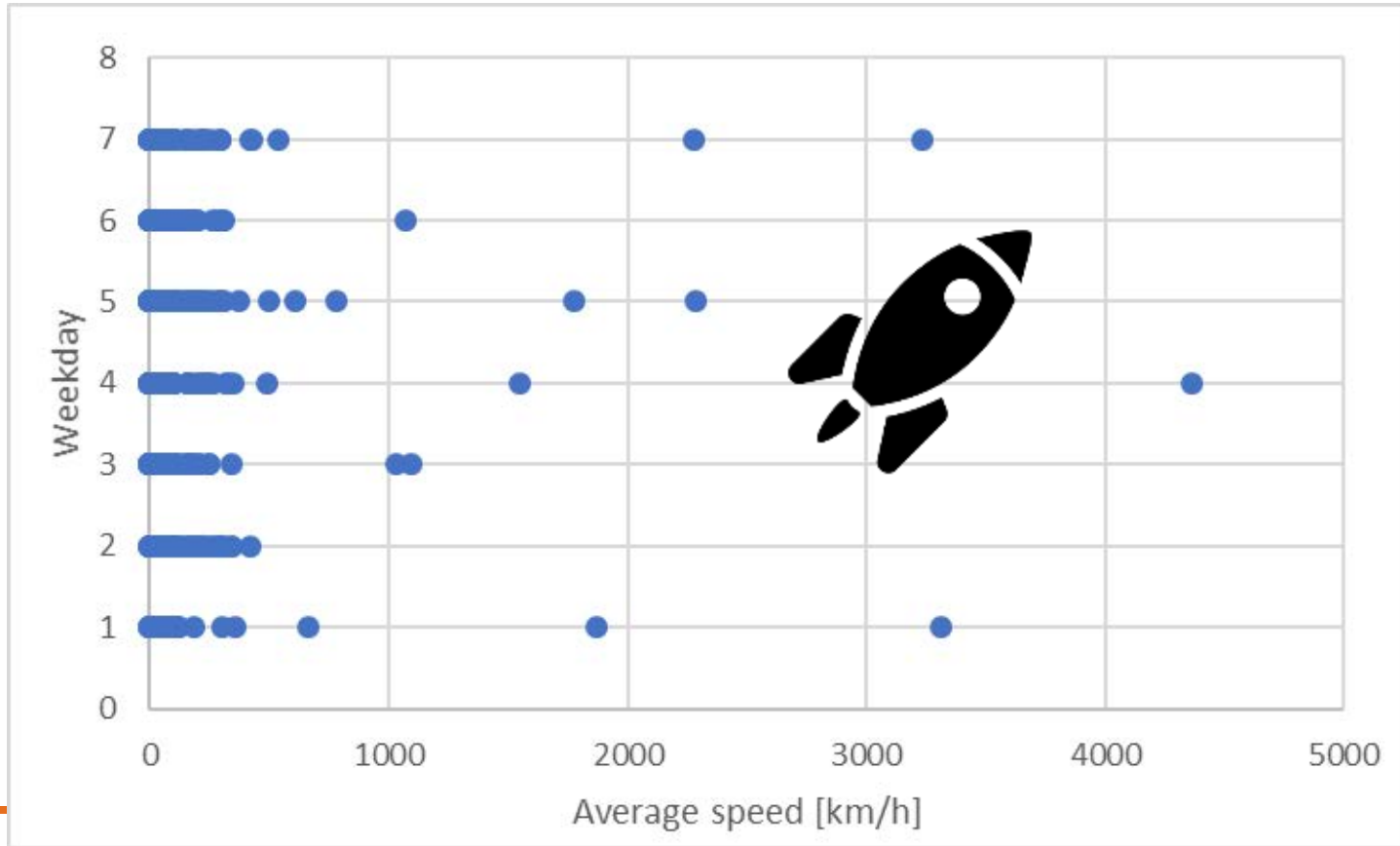
●	31-5-2017 13:25:15
●	31-5-2017 13:35:33
●	31-5-2017 15:14:37

Time gap

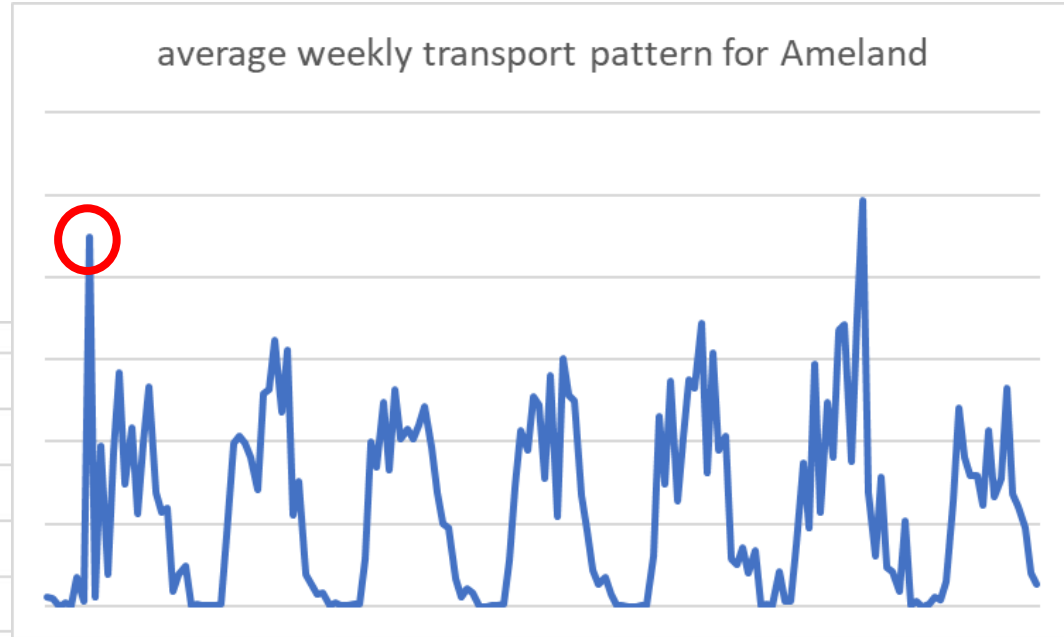
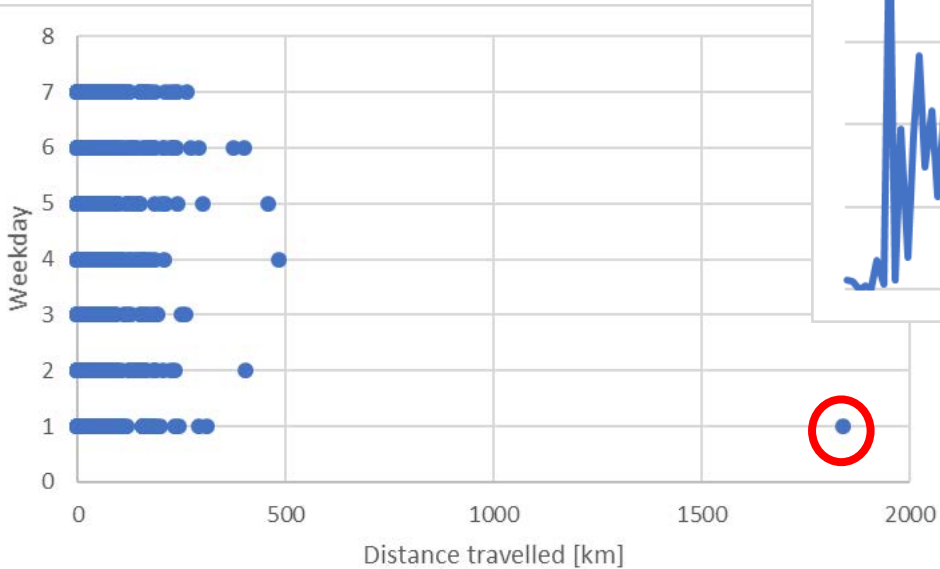


●	31-5-2017	13:35:33
●	31-5-2017	15:14:37
●	31-5-2017	15:40:26
●	31-5-2017	16:00:16
●	31-5-2017	16:38:50
●	31-5-2017	17:55:44
●	31-5-2017	20:20:23
●	31-5-2017	20:31:39

Unfiltered 'car' data from Ameland



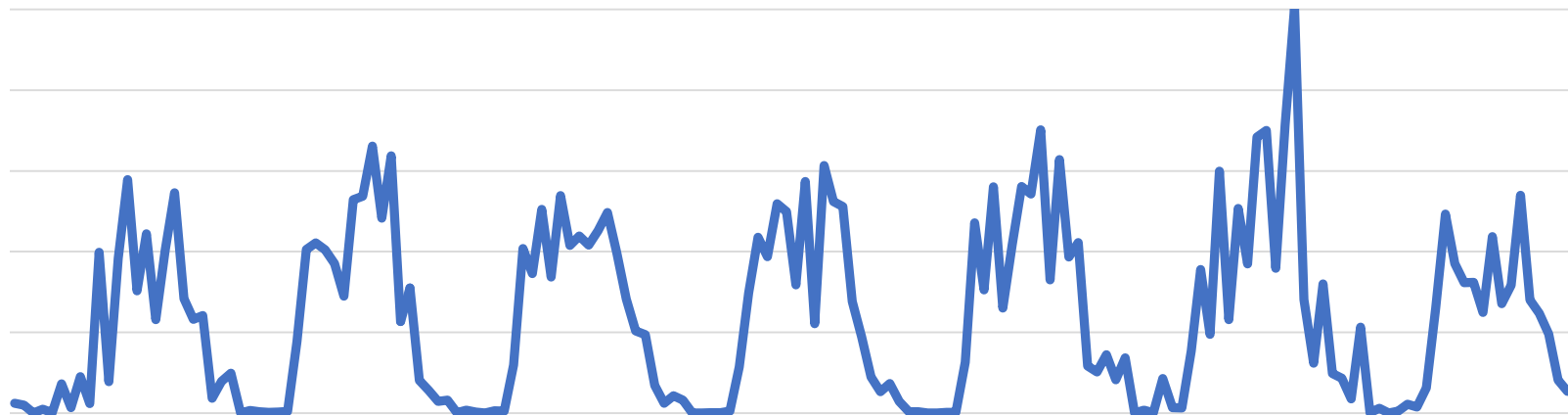
Average speed < 125 km/h



Mobility pattern Ameland

peak at Friday 17:00 h originates from a large number of trips, by different people. It cannot be seen as an error or outlier.

average weekly pattern for Ameland



Sunday-Saturday

Challenges

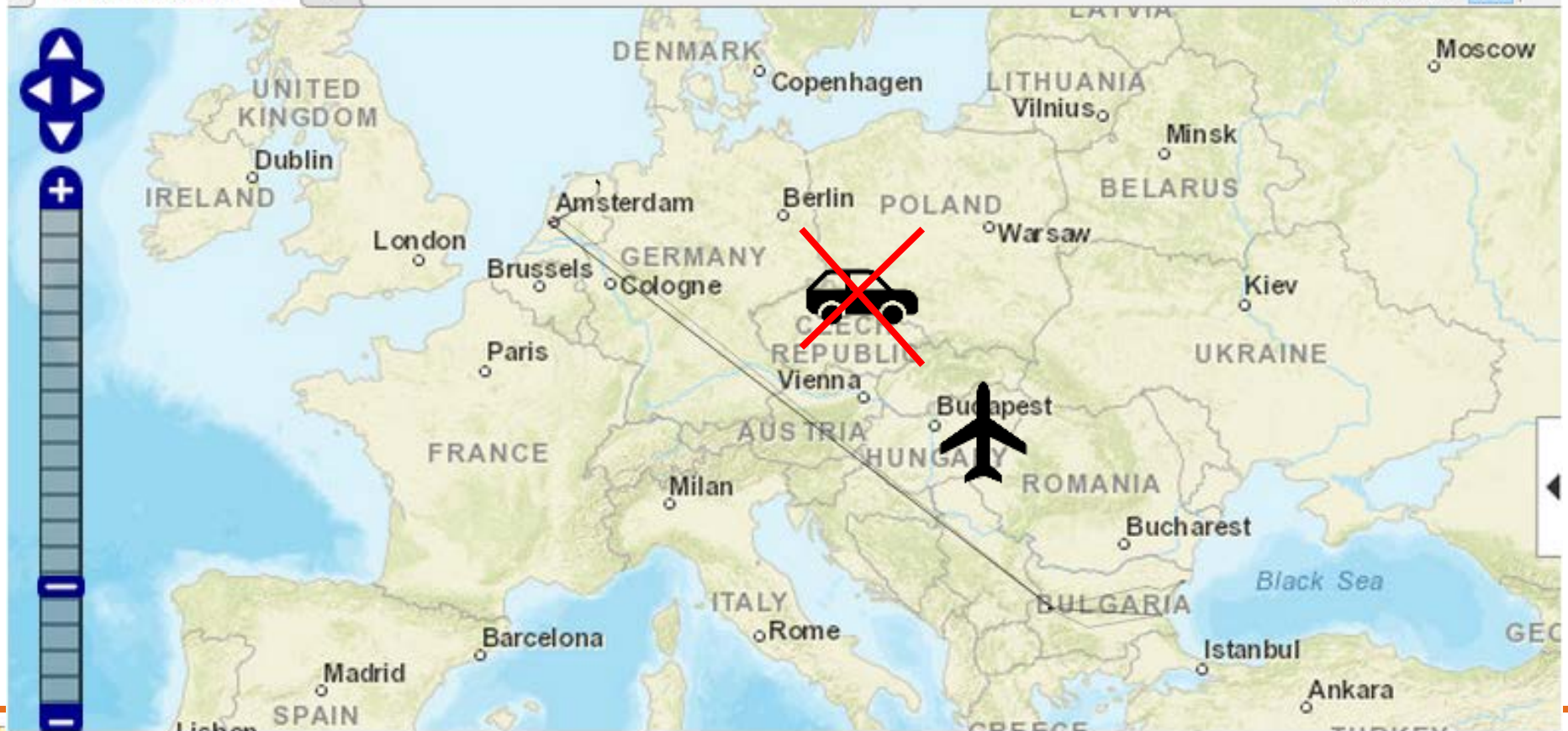
- How to split a route into several parts with different transport mode (car, boat, train)?
- How to distinguish car, boat, train and plane routes?
- How to deal with missing data (periods of no data collection)?

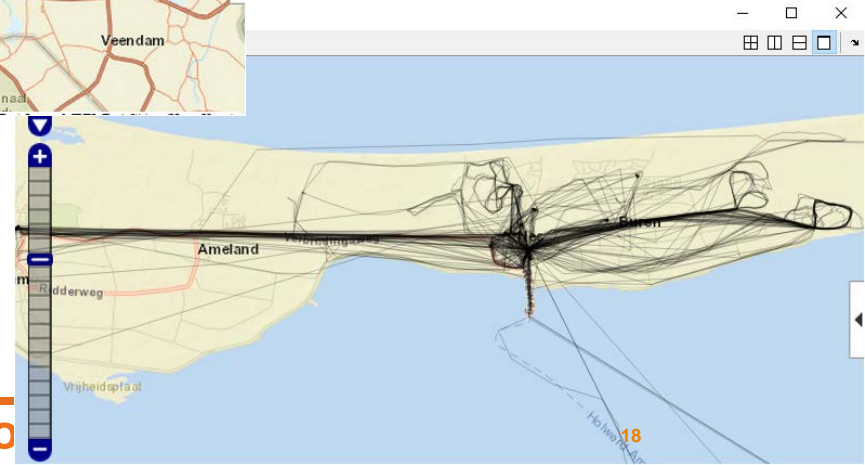
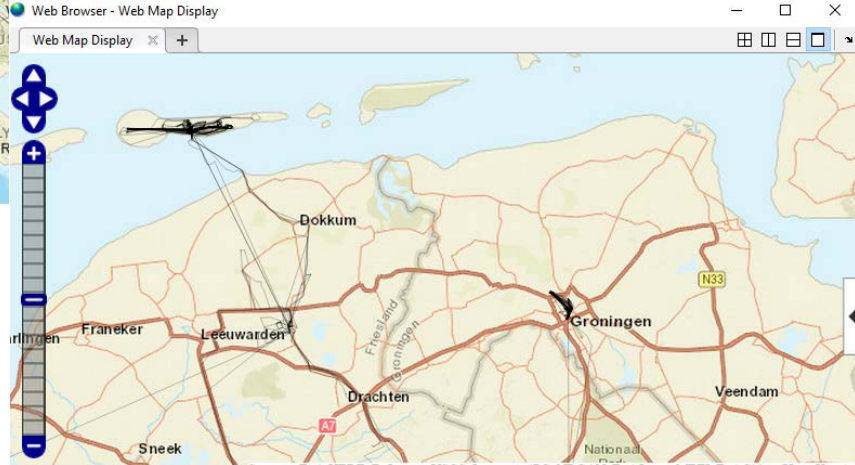
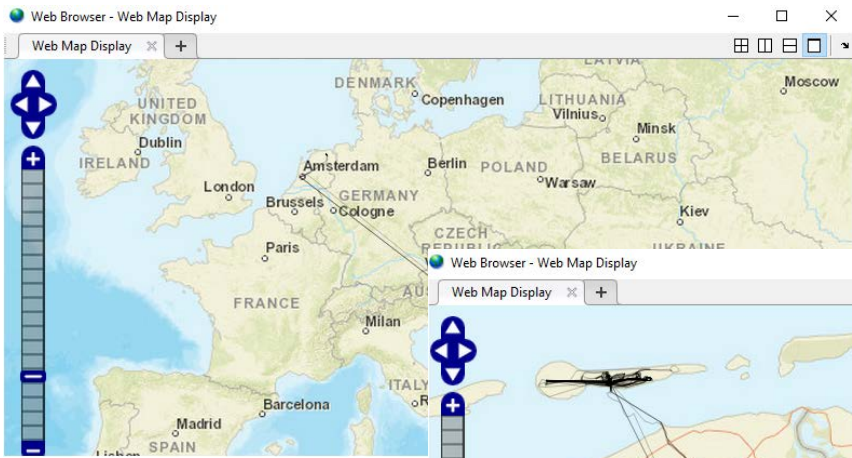


Tortosa Martinez G, Guillermo

DATASET VISUALIZATION



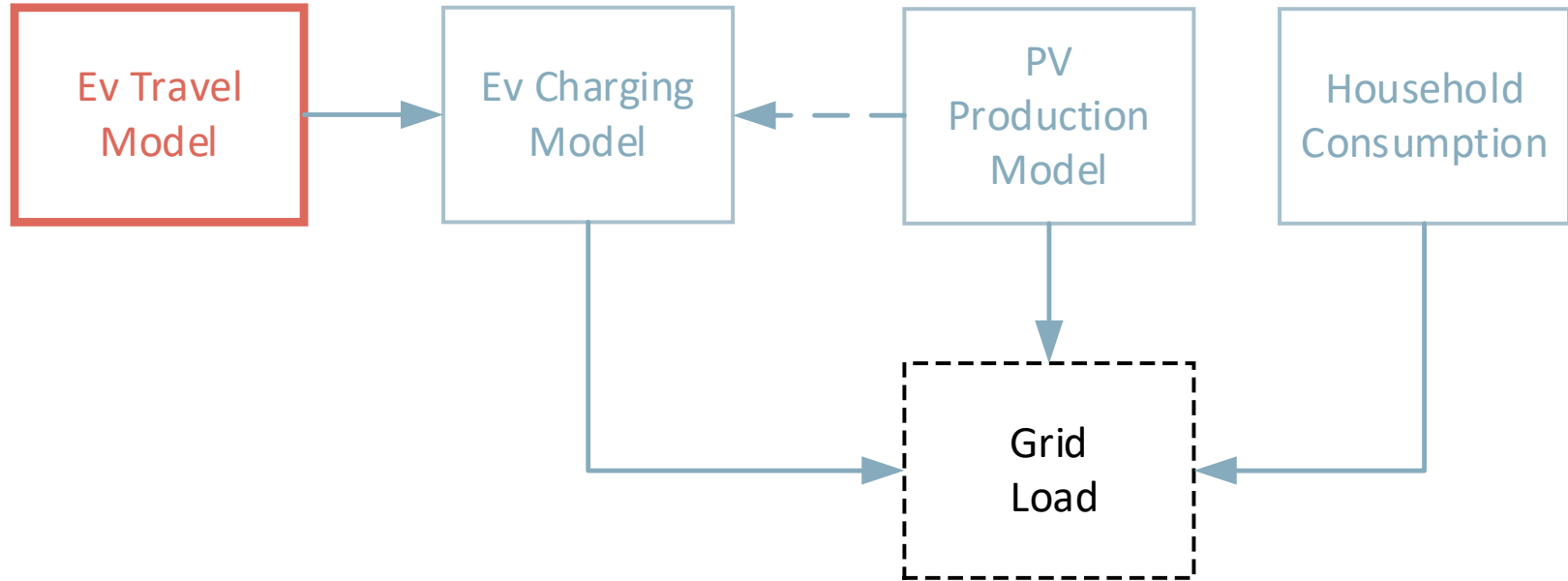




GRID LOAD MODEL

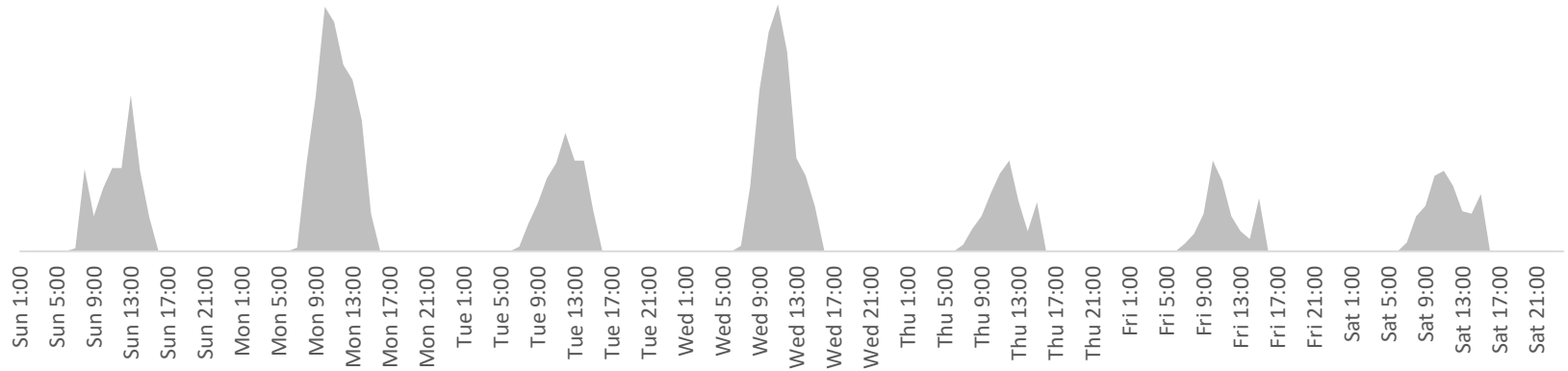


Energy Flows Model

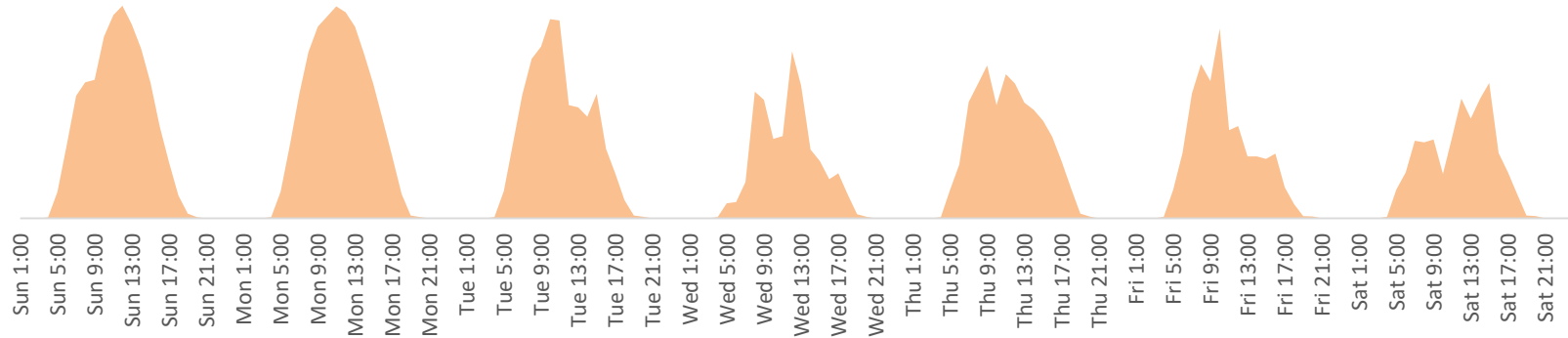


PV Power

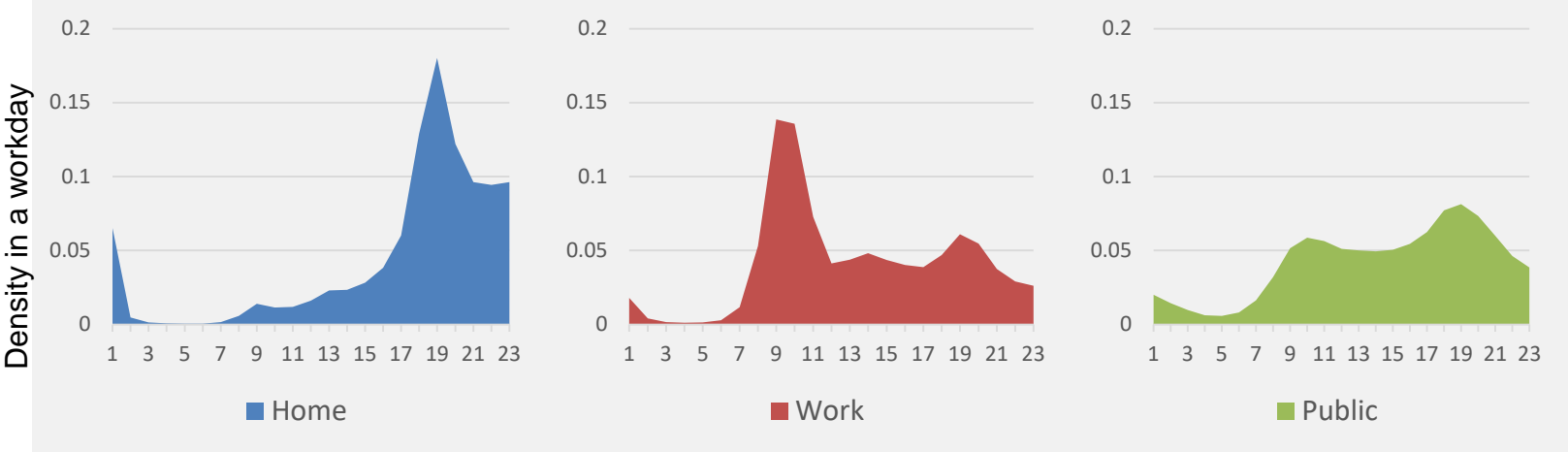
Winter



Summer

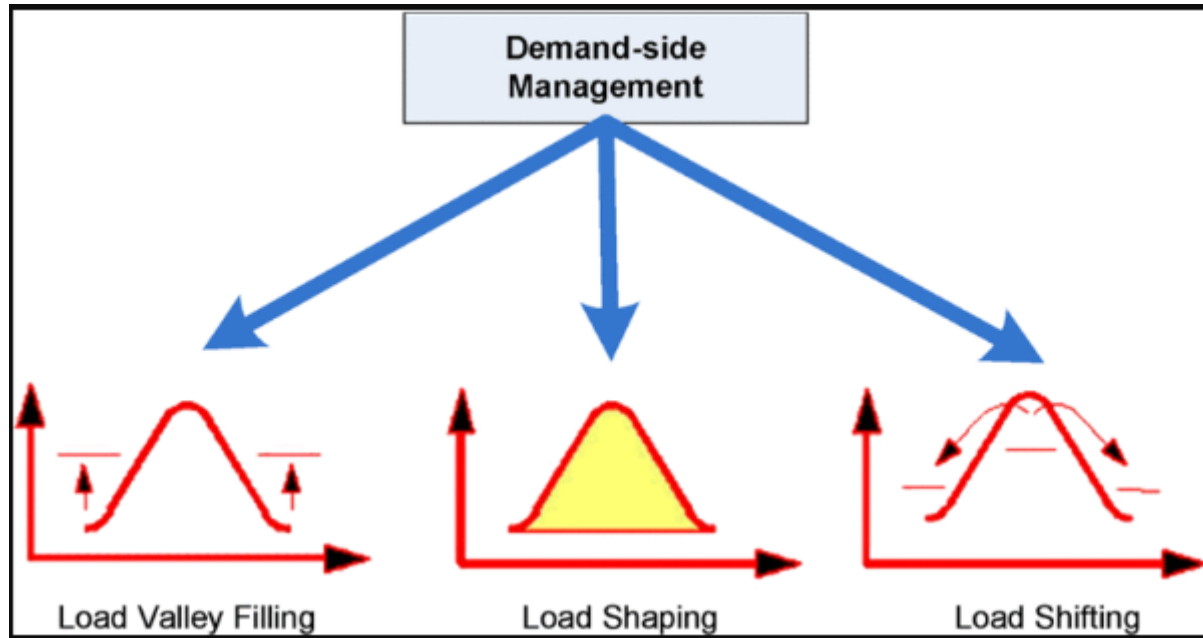


Charging Strategies



From E_Laad

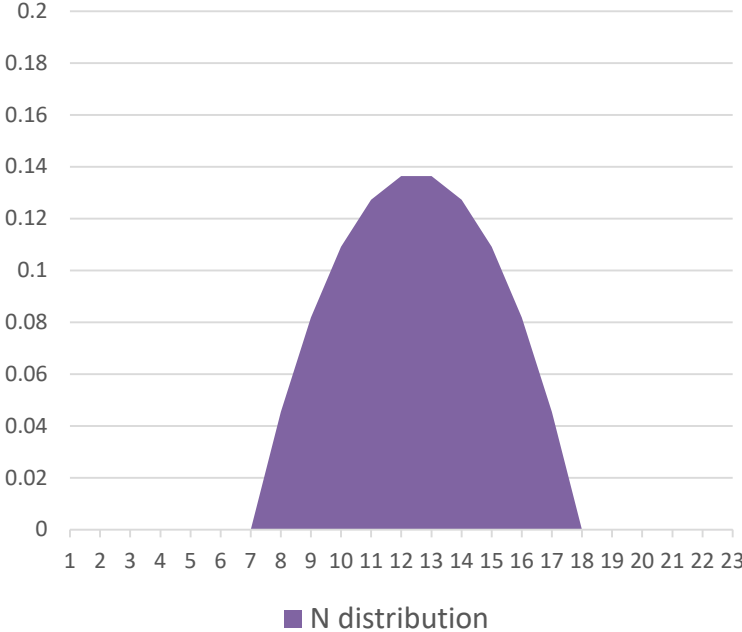
Charging Strategies



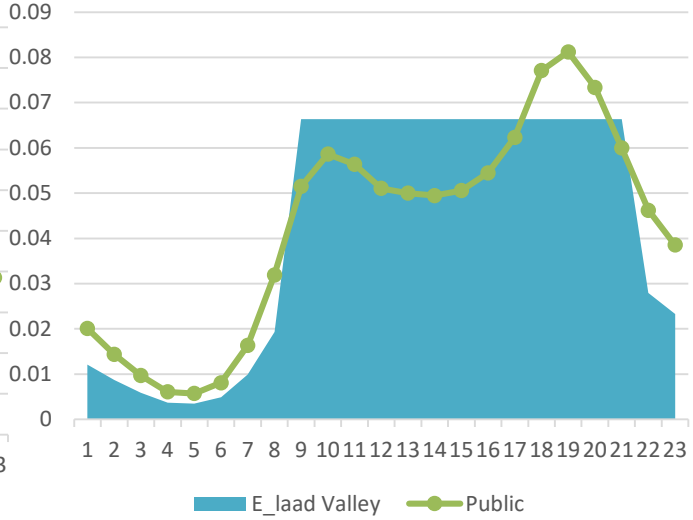
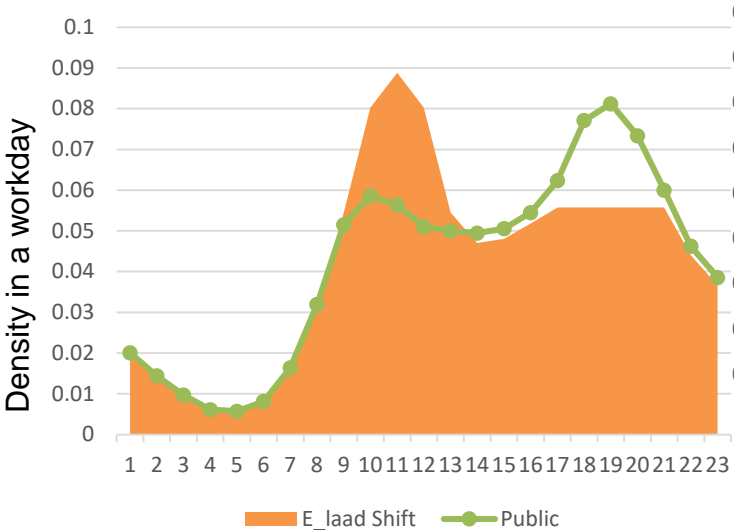
Demand side management strategy

Charging Strategies

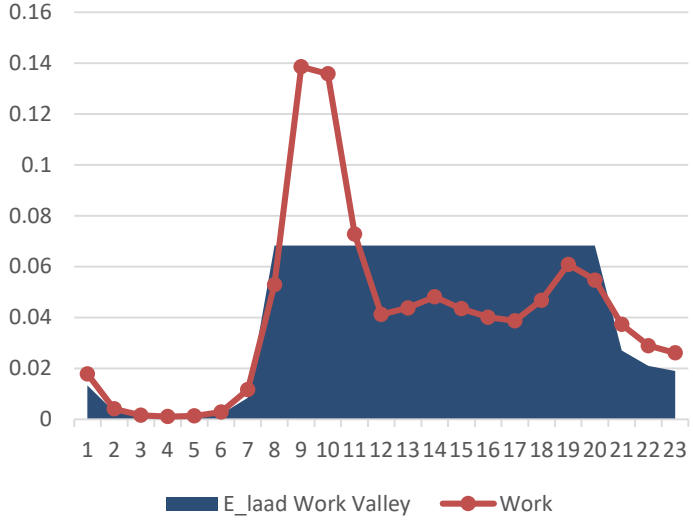
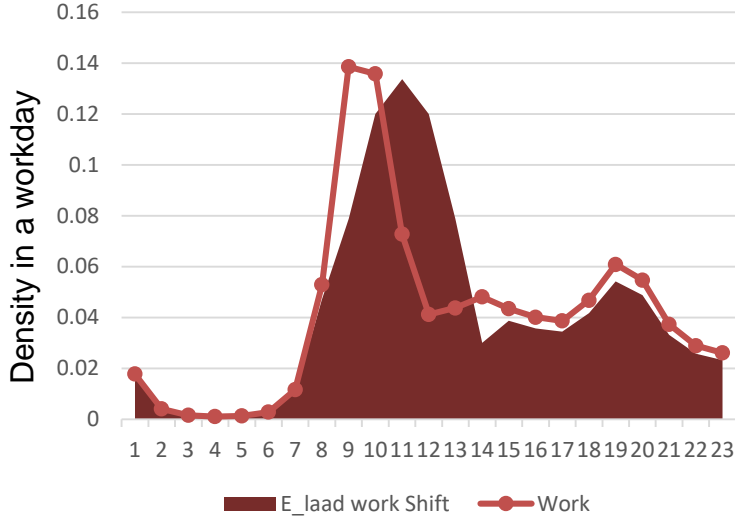
Density in a workday



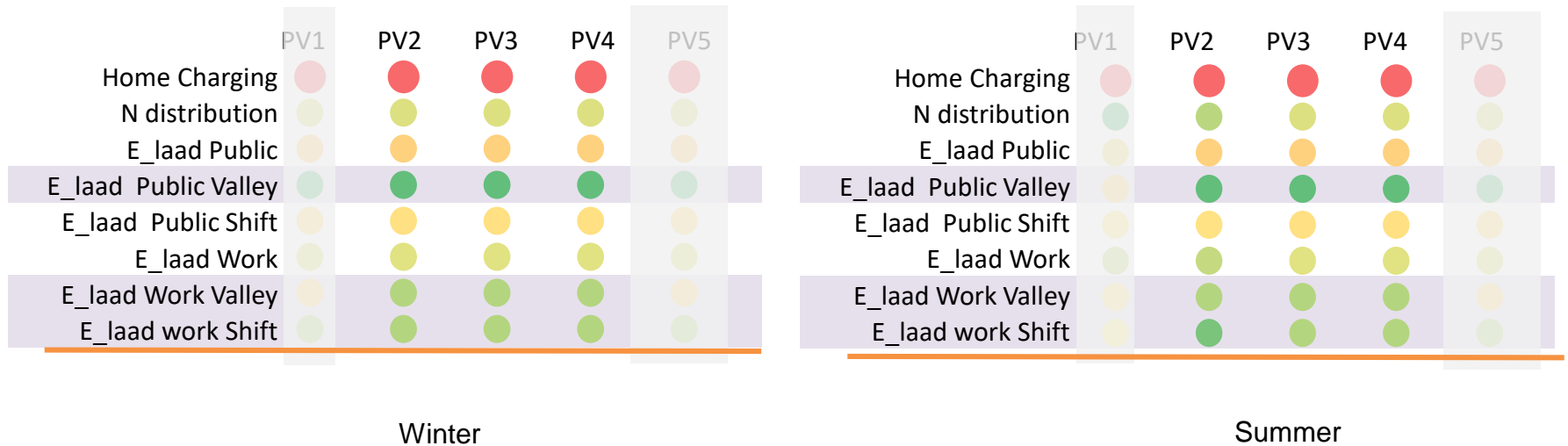
Charging Strategies



Charging Strategies

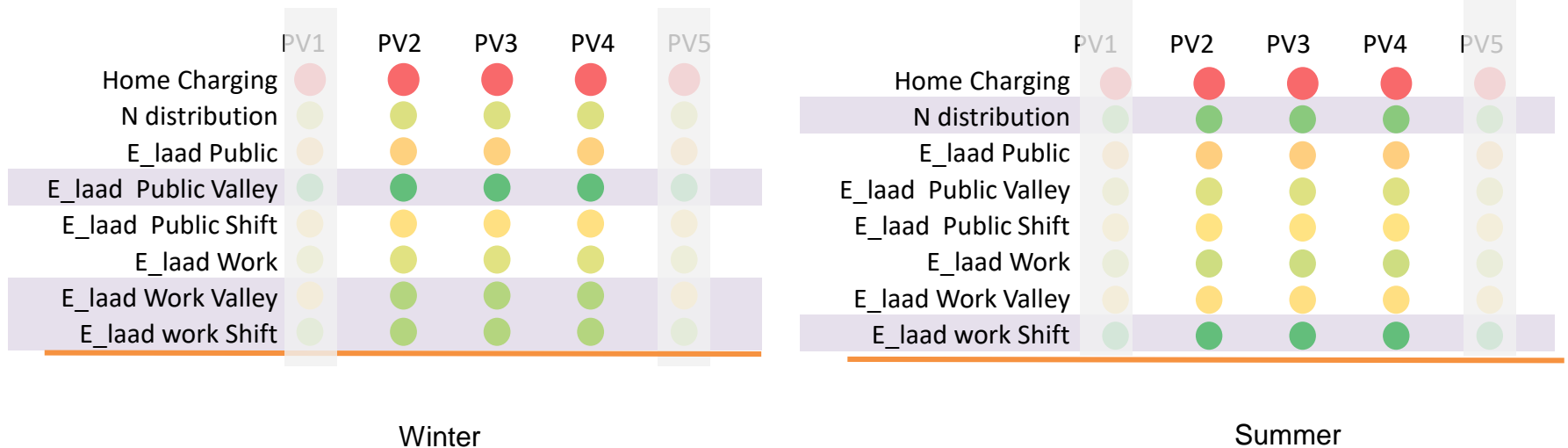


Grid Load



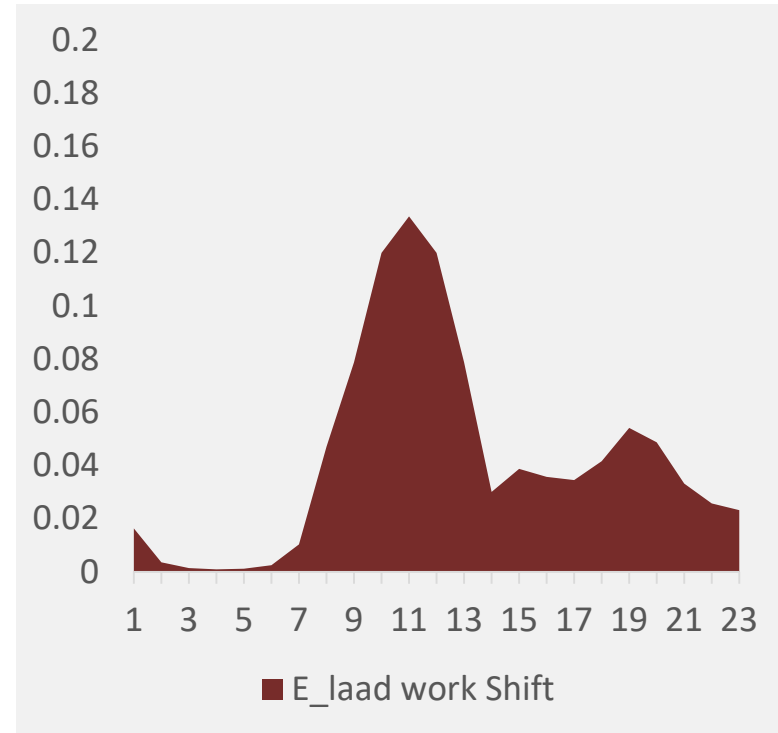
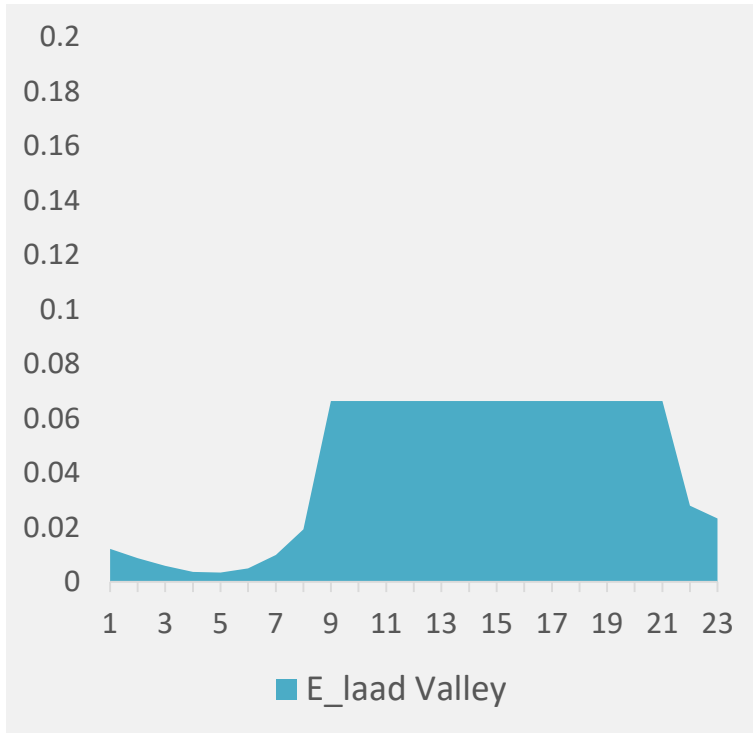
General Travel Data

Grid Load with Ameland Mobility Pattern



Specific Travel Data

Top Charging Strategies





When, where and how long are (electric) cars parked?



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