Modelling the impact of VIPV

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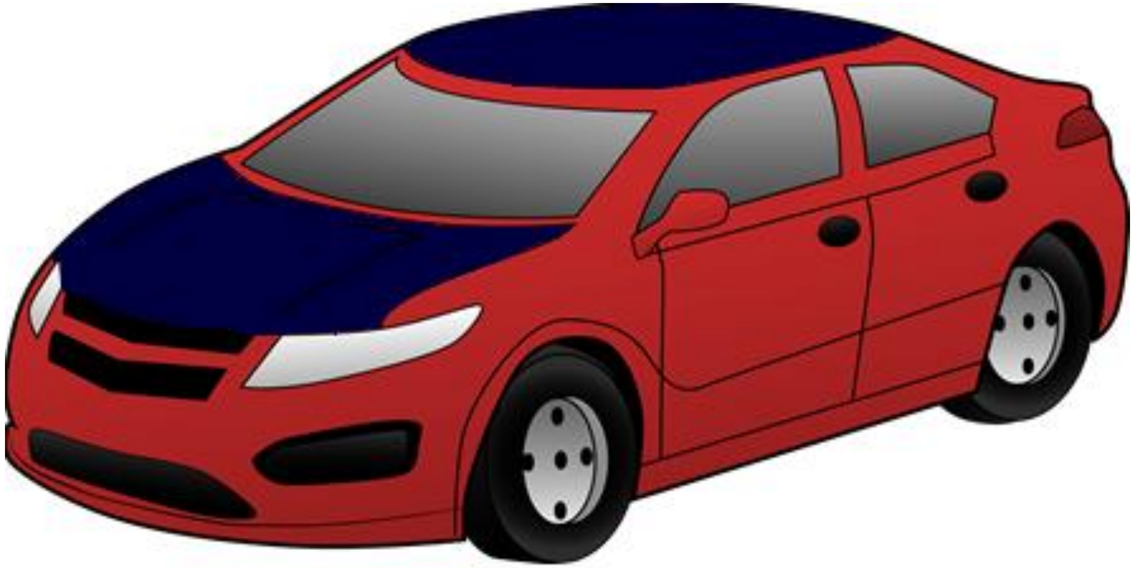
MOVE

Fraunhofer ISE

IM EFFICIENCY

TNO innovation for life

SolarMoves Project

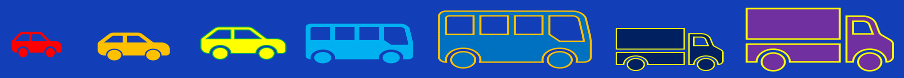


Lightyear

SONO MOTORS

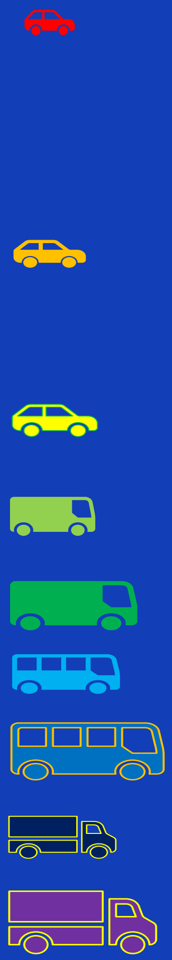
Modelling proces

1. Define the vehicle archetypes = vehicle type + use pattern



Definition of archetypes – Vehicles and use patterns

- A combination of a vehicle category and a use pattern
- Each archetype has an annual mileage based on European averages



Vehicle class and type	Use pattern
Small passenger car	'occasional use'
	‘daily urban commute’
	‘daily periurban commute’
	‘long-distance highway travel’
	‘car sharing’
Medium sized passenger car	‘daily urban commute’
	‘daily periurban commute’
	‘long-distance highway travel’
SUV	‘daily urban commute’
	‘daily periurban commute’
	‘long-distance highway travel’
Small van	‘Local distribution’
	‘Regional distribution’
Large van	‘Local distribution’
	‘Regional distribution’
Low-floor bus	‘Urban public transport service’
	‘Periurban public transport service’
High-floor coach	‘Regional public transport’
	‘Long-distance highway travel’
Rigid truck	‘Urban distribution’
	‘Regional distribution’
Tractor-trailer	‘Regional distribution’
	‘Long-haul freight transport’

Modelling proces

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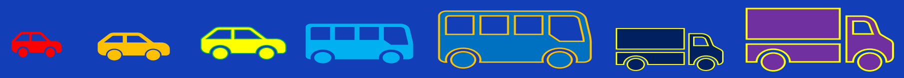
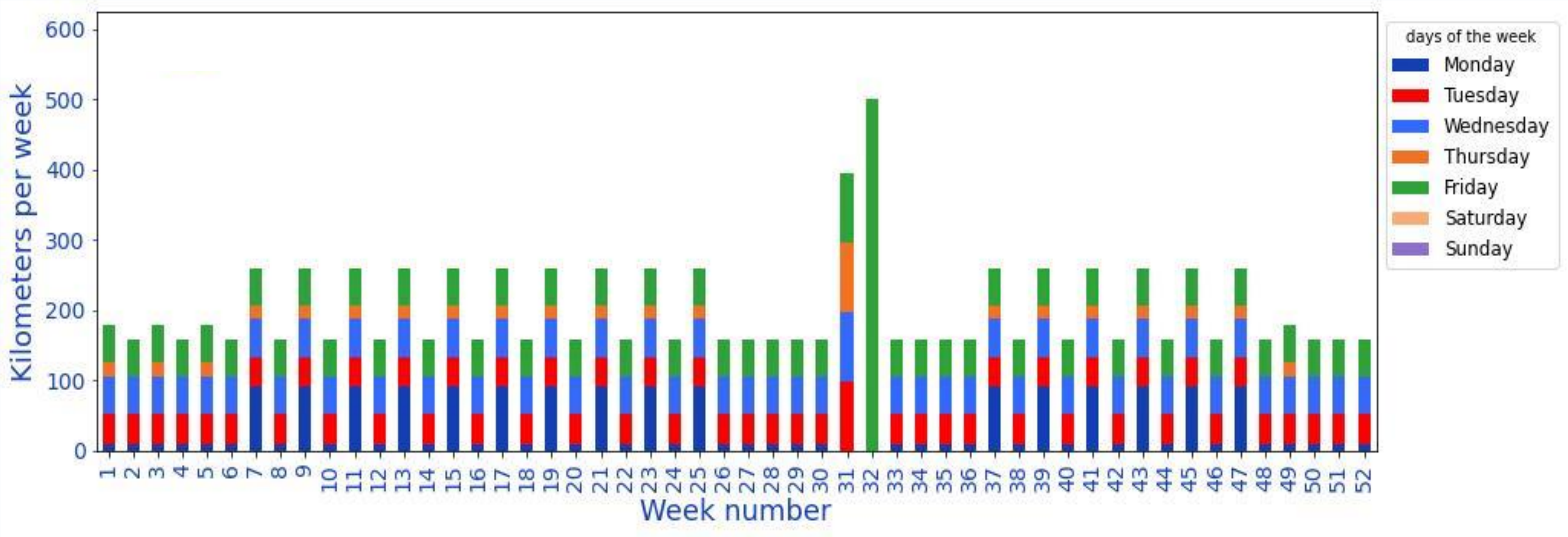


2. Define the trip definition based on the use pattern

Driving profile: Medium sized passenger car



Modelling proces

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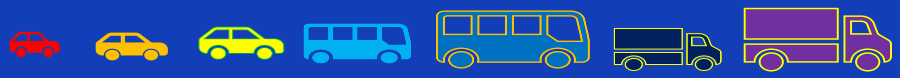

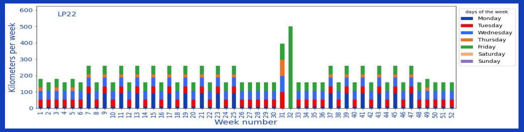

2. Define the trip definition based on the use pattern

3. Run the model MEO model to calculate the energy consumption of the vehicle along the trip

Modelling proces

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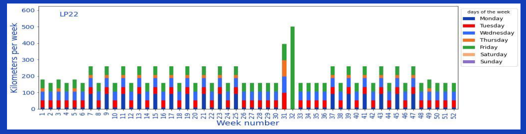
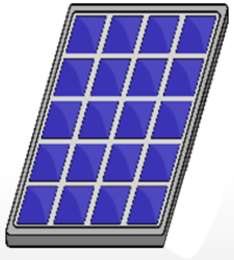


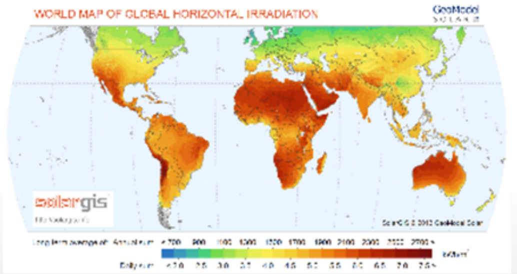
2. Define the trip definition based on the use pattern
3. Run the model MEO model to calculate the energy consumption of the vehicle along the trip
4. Run the Energy Flow Model to determine the State of Charge of the battery and charging moments

Car Energy Demand Model

Battery & Charging Model

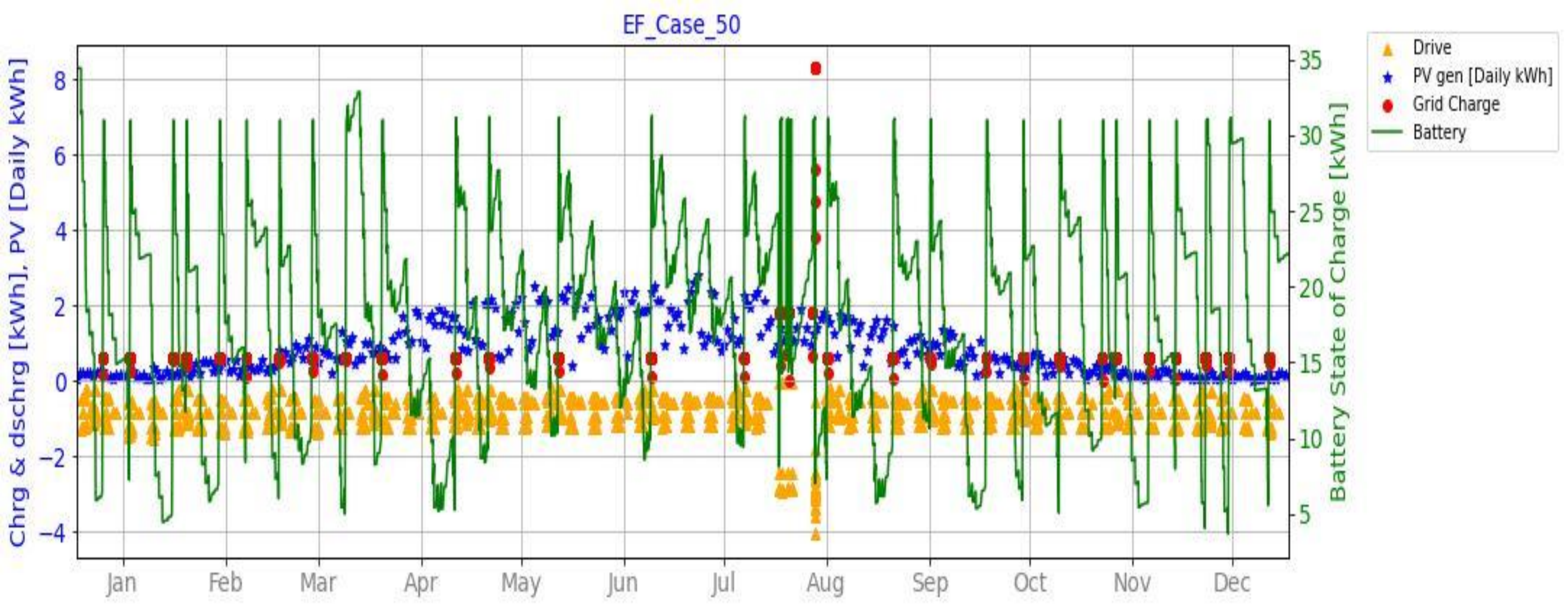


Solar Yield Model

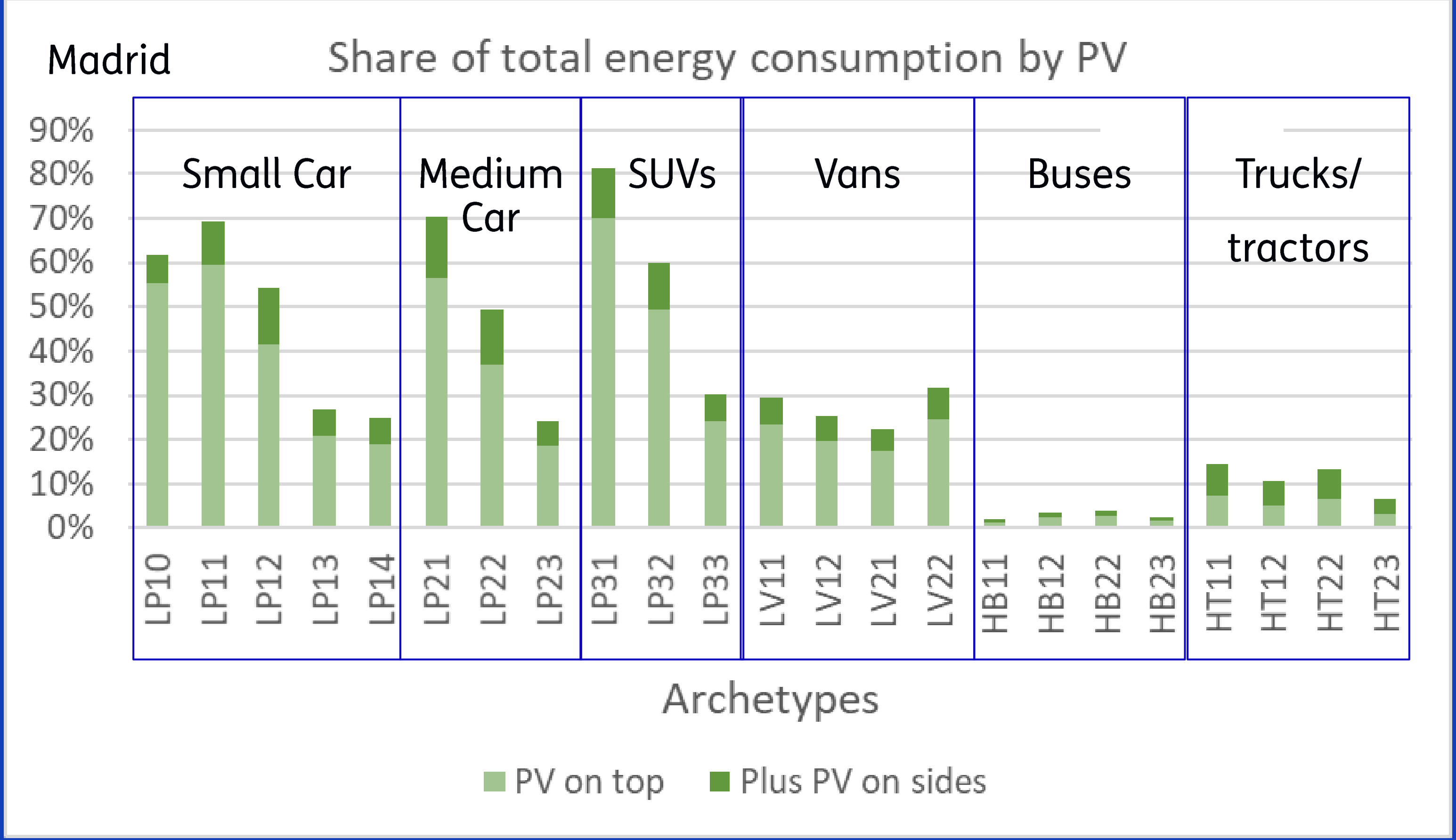


Location and Meteo data

Energy Flow Model Results



PV contribution wrt total energy consumption



- Cars with low annual range: up to 50-80% of PV contribution
- Vans: 20-30% PV contribution
- Busses: PV contributes only small fraction -> relative low area for PV and long distances
- Trucks/tractor:
  - up to 15% PV contribution
  - PV on sides doubles PV contribution

Modeling the impact of VIPV

1. Using modelled irradiance based on Meteo data (Global Horizontal Irradiance)

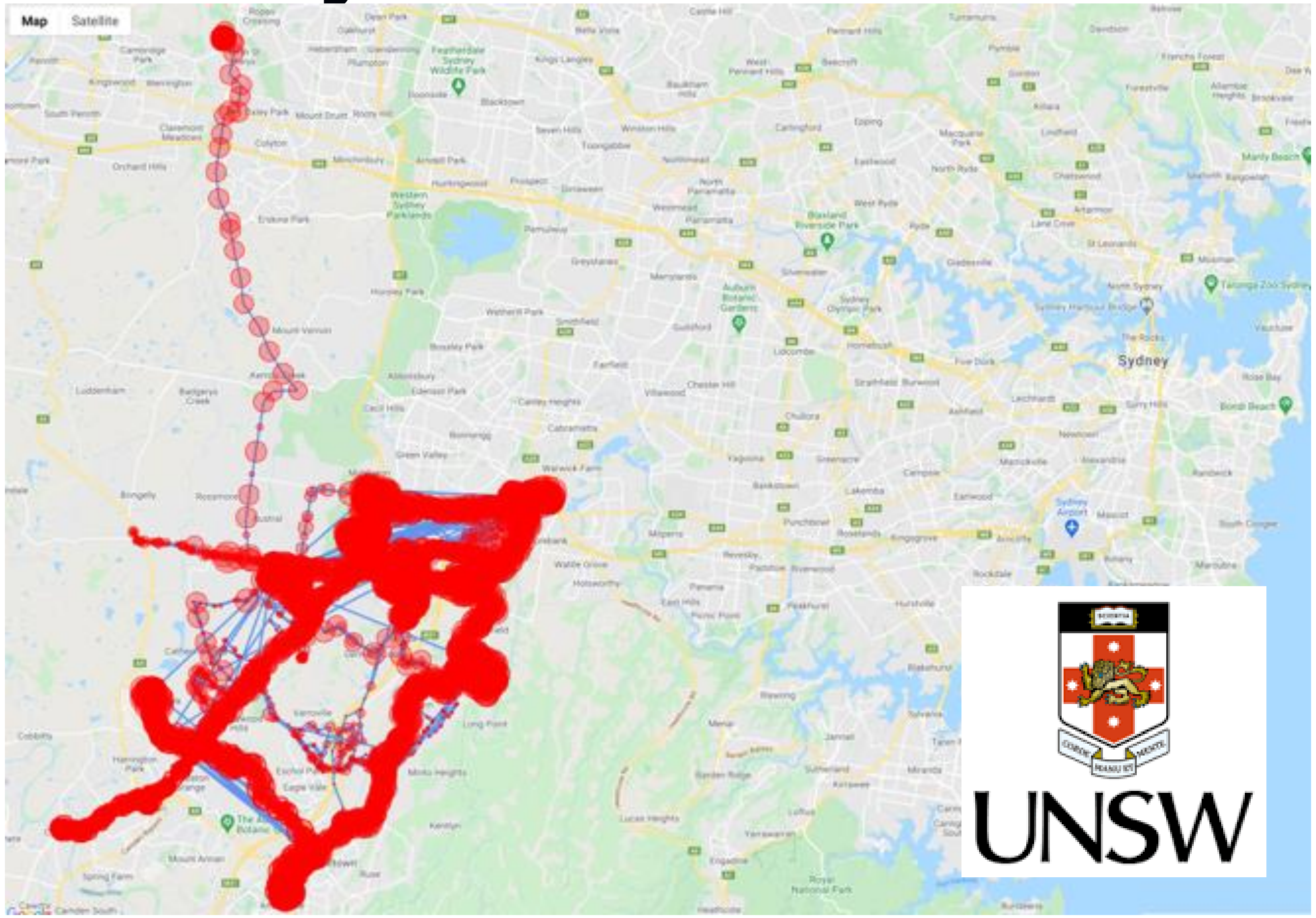
Modeling the impact of VIPV

1. Using modelled irradiance based on Meteo data (Global Horizontal Irradiance)

2. Using measured irradiance data

Sydney Bus Irradiance Survey : From Oct. 2020

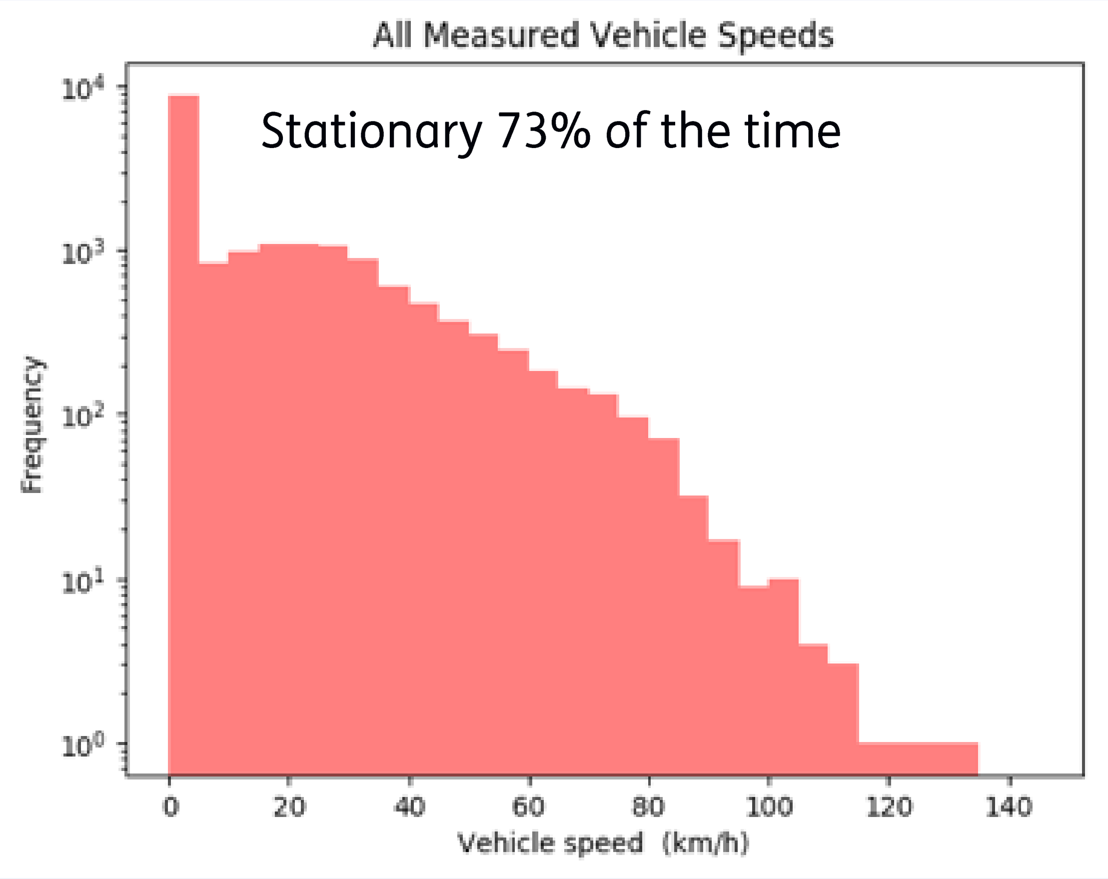
Solar Jinie from EnerJIN Pty installed on bus roof
- Gps
- irradiance

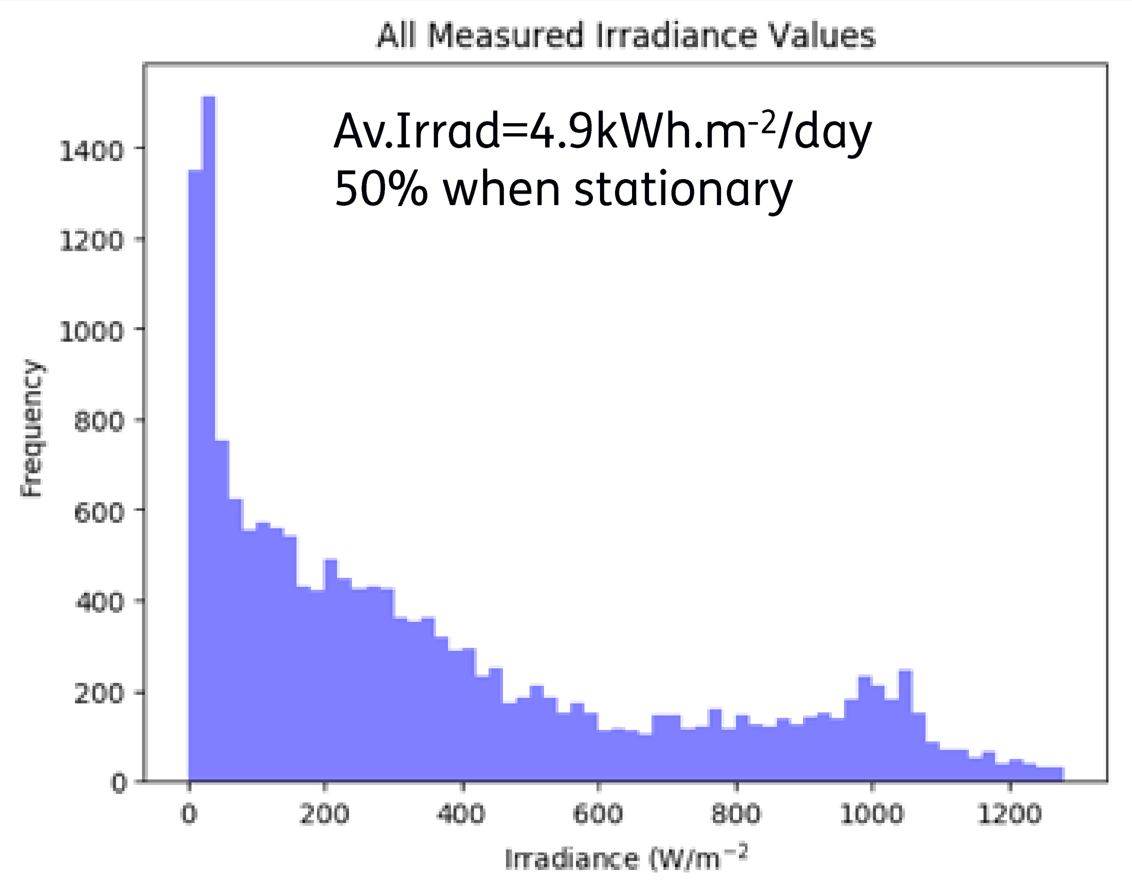


Courtesy Ned Ekins-Daukes - UNSW

Model   Measured data

Sydney Bus Irradiance Survey : From Oct. 2020

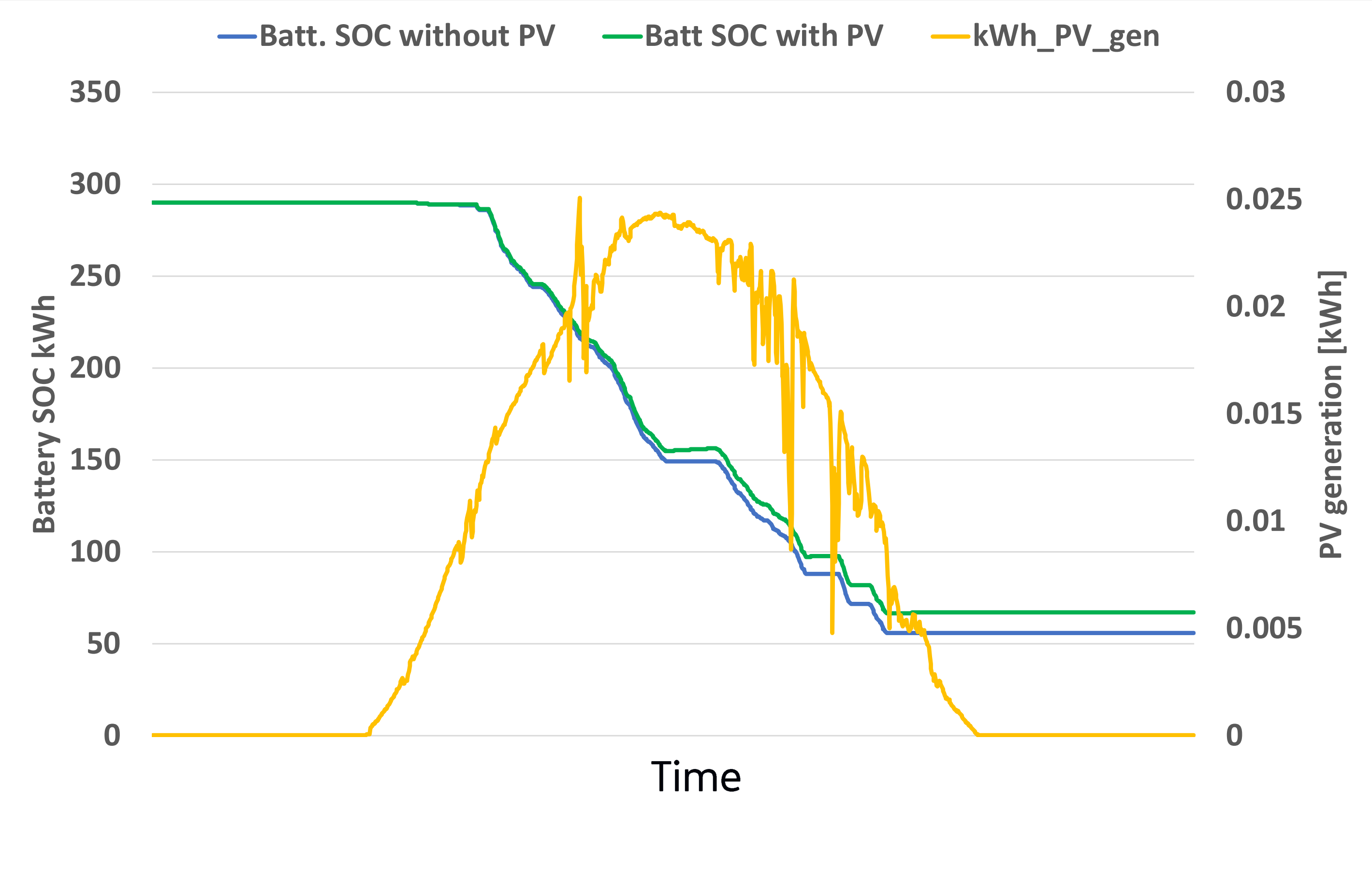




Courtesy Ned Ekins-Daukes - UNSW

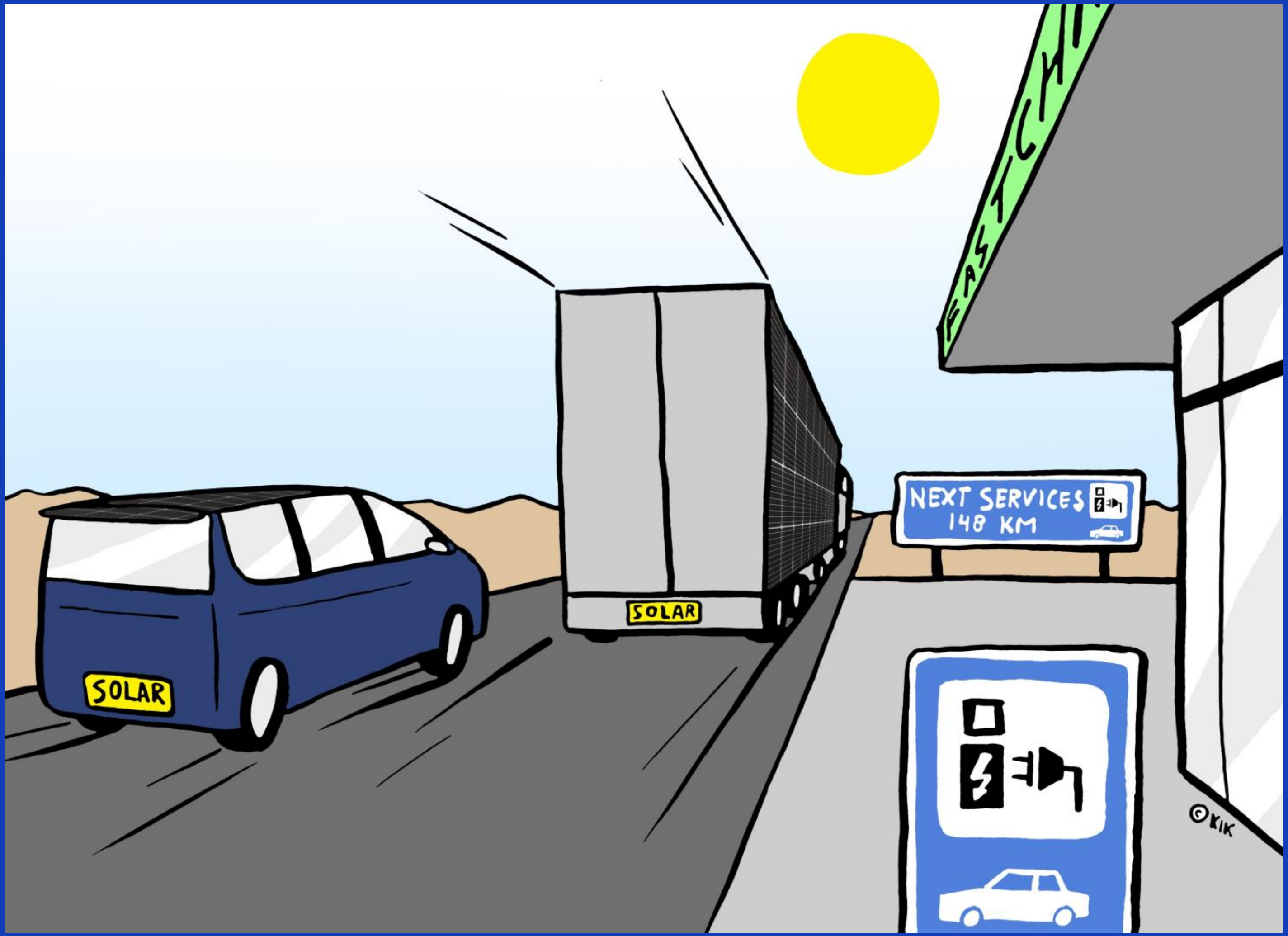
Single day analysis

- 195 km route
- 1.65kW PV (8m²)
- PV generated 11.8 kWh
- Battery used 234 kWh
- Battery size 290 kWh
- PV contribution 5%
- PV utilised 100%



Conclusion

- VIPV can make significant contributions
  - trucks and tractors/trailers up to 15% in Madrid
  - busses up to about 5 %
  - Cars up to 80%
  - Vans up to 30%
- PV has a comparable effect as other energy efficiency improvements
- Also measured irradiance can be used in stead of averaged irradiance data
- Advanced shading model takes into account actual shading along a route



Team

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Thank you for your attention

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