

Charging behaviour

How do we charge and why? An overview of 2 years of data-driven research

Rick Wolbertus



Charging Behaviour



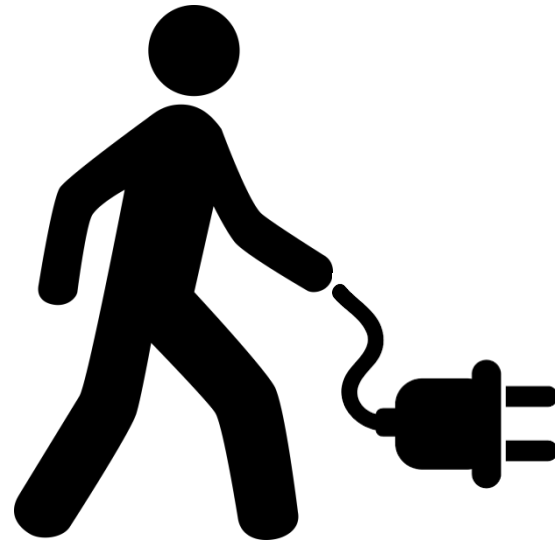
Policy

Strategic placement
Demand-driven roll-out
Fast Charging - Charging hubs
Window times



Incentives

Free parking
Smart charge rewards
Charging fees
Connection fees
Social charging



User groups

Private
PHEV - FEV
Taxi
Car sharing



Location

Roll out strategy
Fast – Regular
Cost effectiveness



Time

Parking pressure
Renewables
Grid congestion



Duration

“Laadpaalkleven”
Smart charging
Vehicle2Grid

Methodology – Applied data-driven research

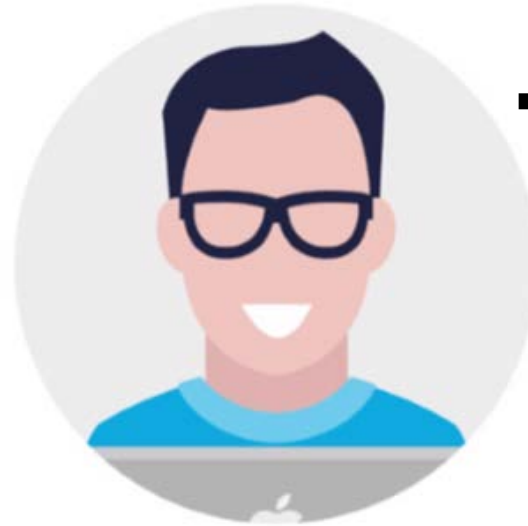
IDO-laad

Logos of participating organizations and municipalities:

- Gemeente Amsterdam (marked with a red X)
- Gemeente Utrecht
- Gemeente Rotterdam
- Gemeente Den Haag
- MRA elektrisch
- ENGIE
- NUON
- Part of VATTENFALL
- OVER MORGEN
- EVBOX
- ENEXIS



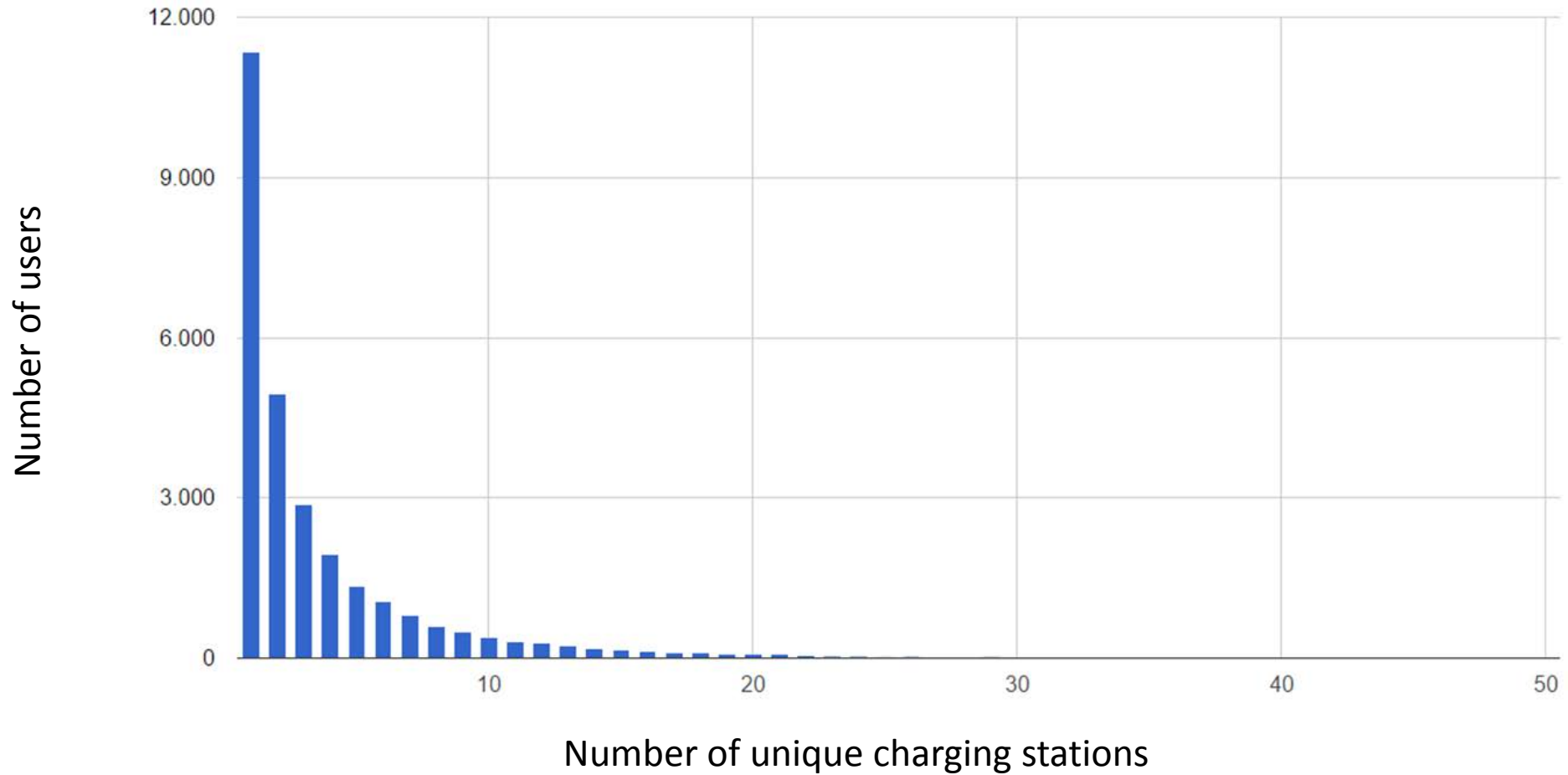
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Habits – 60% of all users use ≤ 5 different charging stations per year





Roll-out strategy



Home

Income
Income
Income



2nd hand market



Visitors

Shops
Restaurants
Free charging



Parking garages



Car sharing

Hubs
Public transport
Business



Greater range

(Montfort et al., 2016)

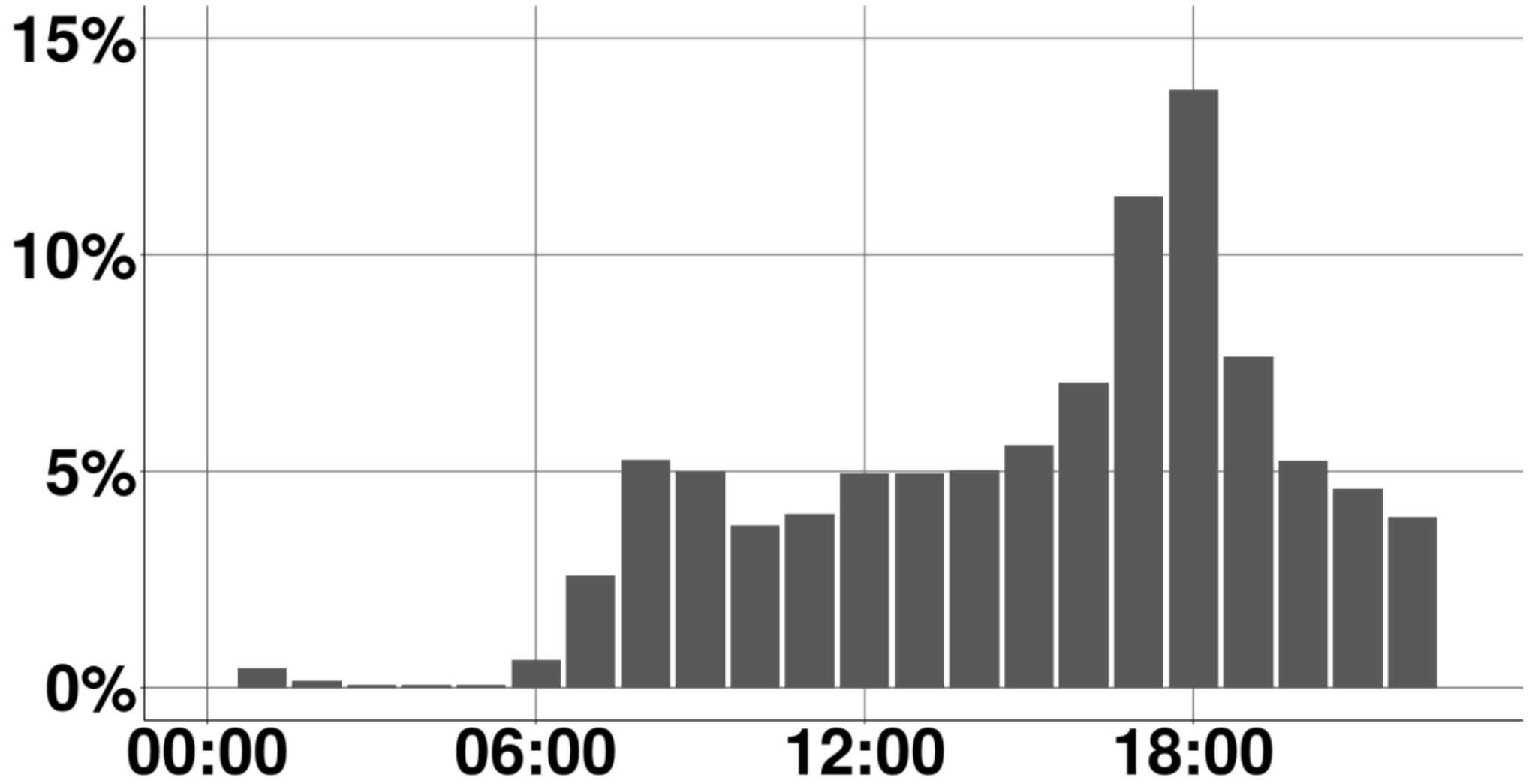
(Van der Poel et al., 2017)







Start time – Main peak in the evening

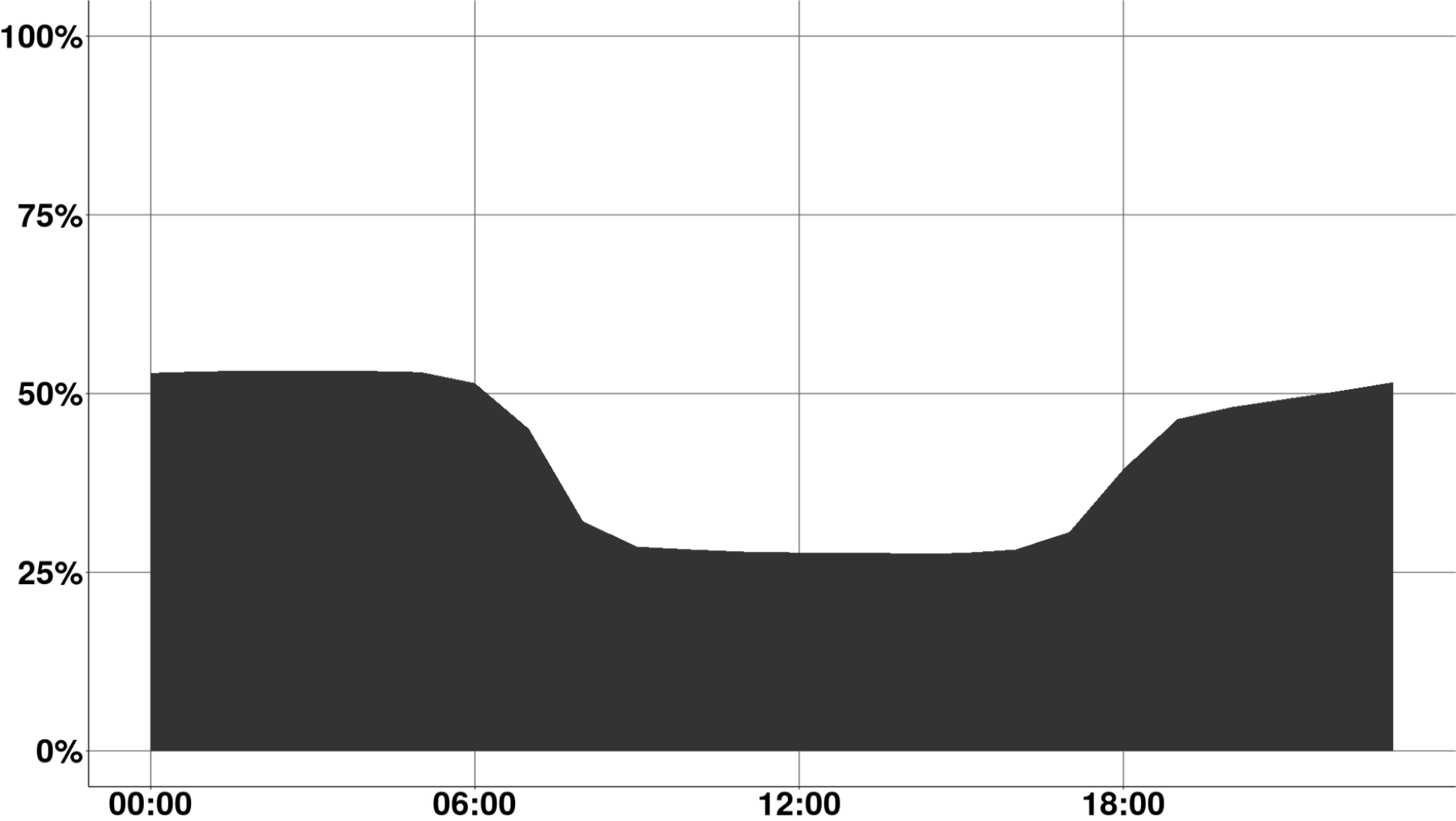


(Wolbertus & Van den Hoed, 2016)



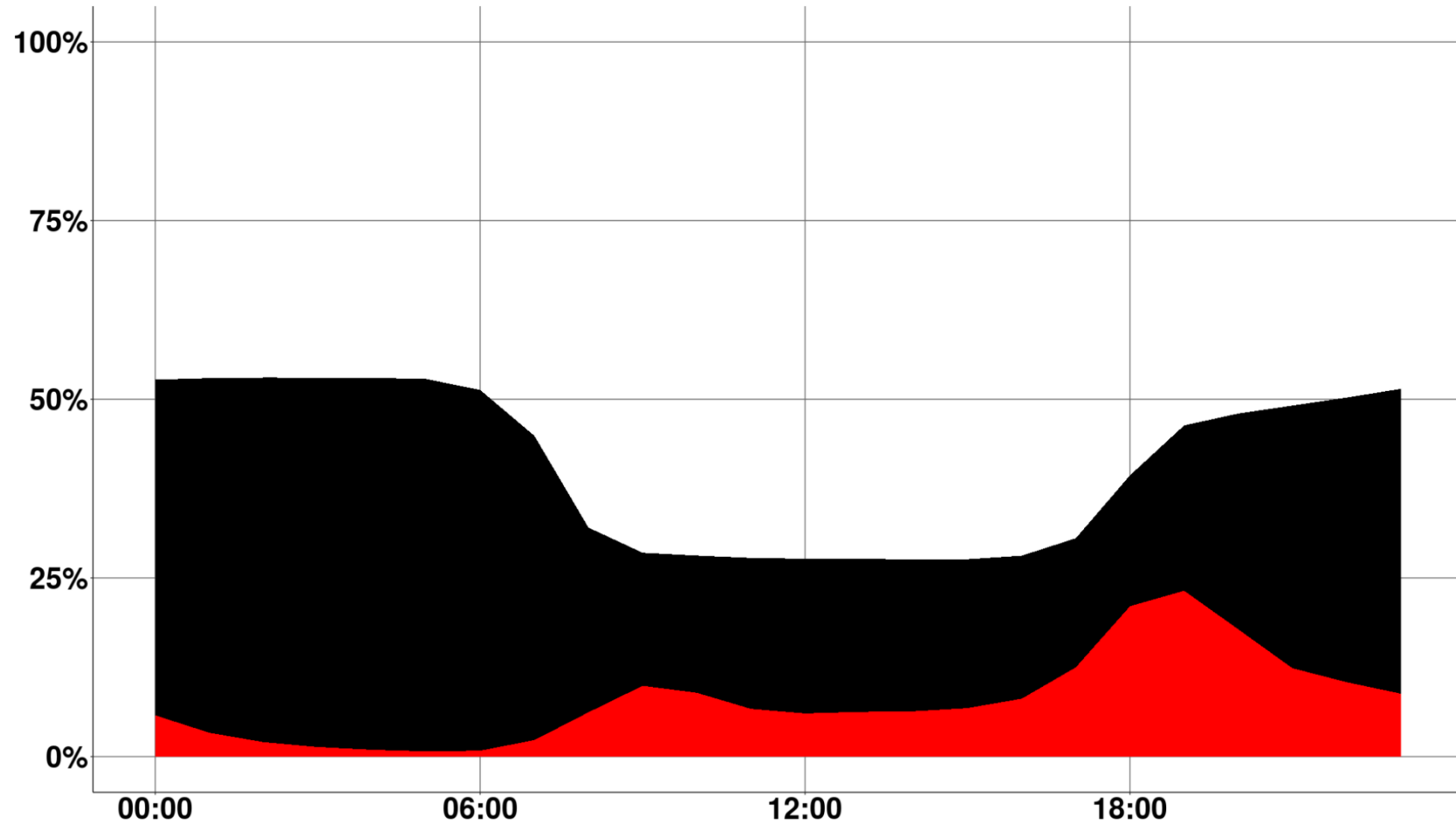


Occupation – Time and location dependent





Time charging – Enough room to move evening peak to night time

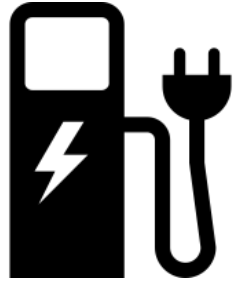




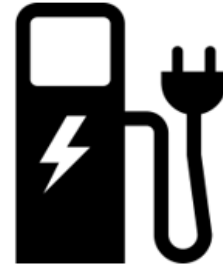
Parking policy – Daytime charging can prevent mis- and underutilization of charging stations

3 Situations to prevent

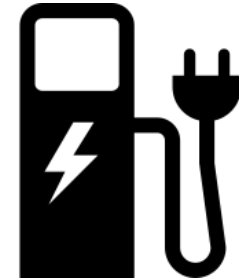
Misutilization



Underutilization



“Laadpaalkleven”



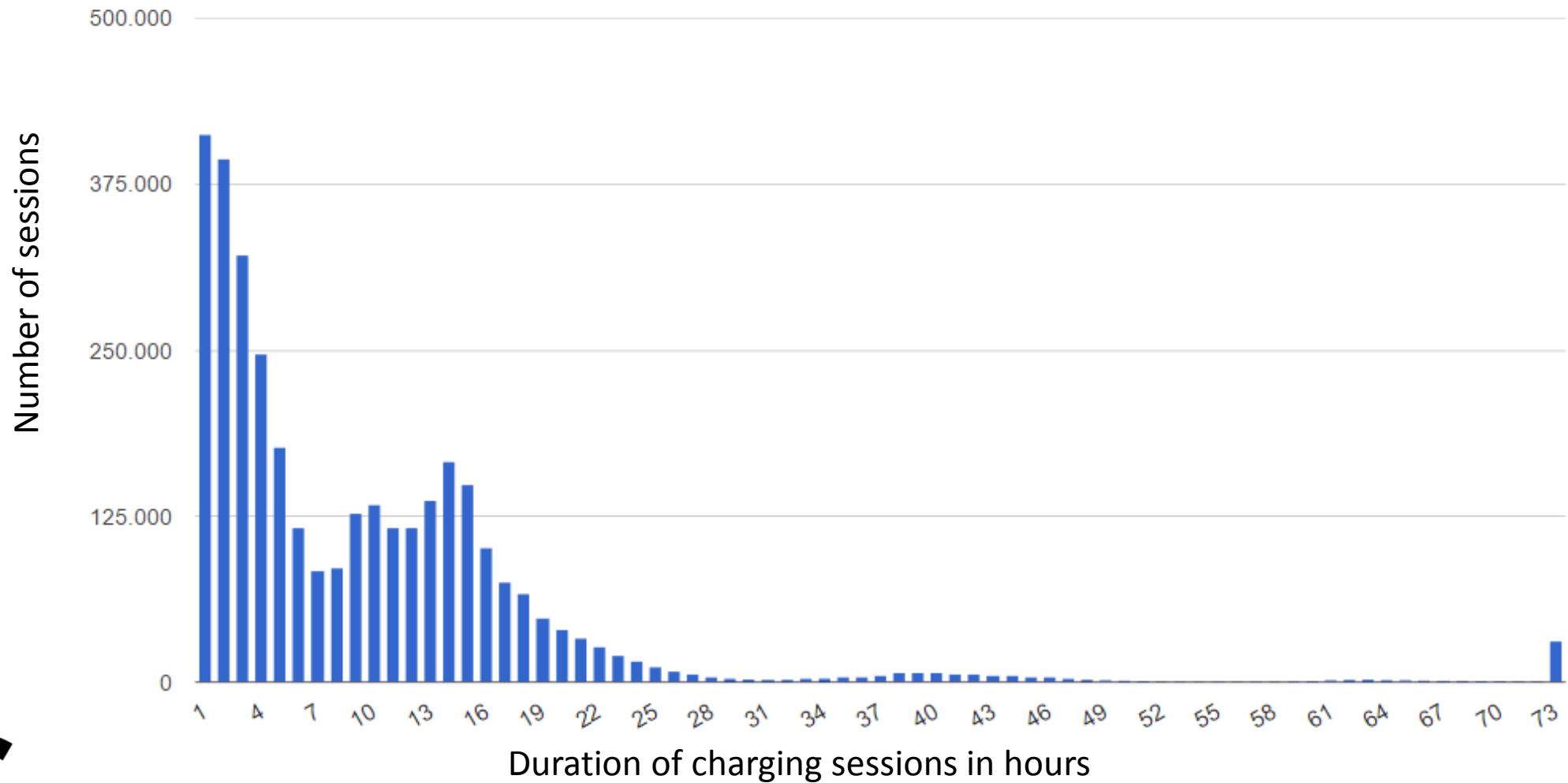
(Wolbertus & Van den Hoed, 2017a)







Distribution of connection times – Many short sessions but a long tail

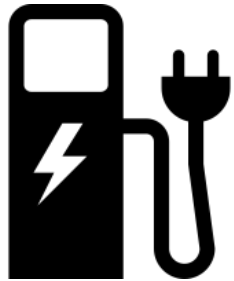




Factors that influence connection times



Timing



Charging Station



User Type



Parking Fees



Charging Fees

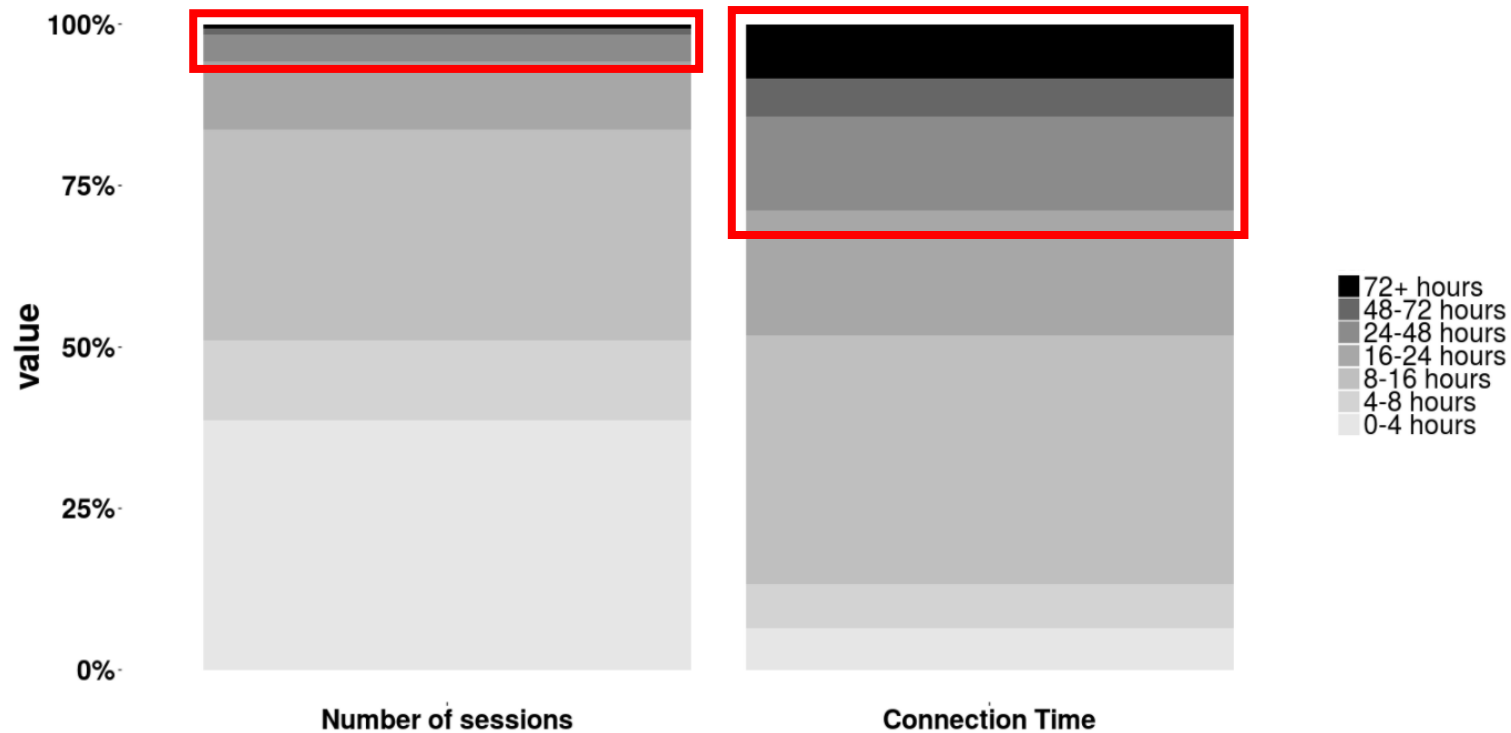
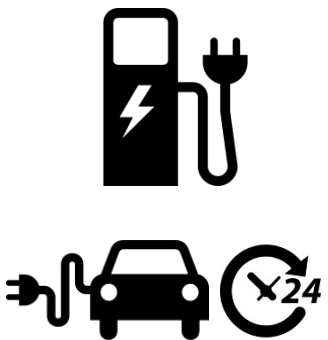
(Wolbertus, Kroesen, Van der Hoed & Chorus, 2018)

(Hardman et al.,2017)





Charging station hogging – 5% of the longest charging sessions cause >25% of occupation



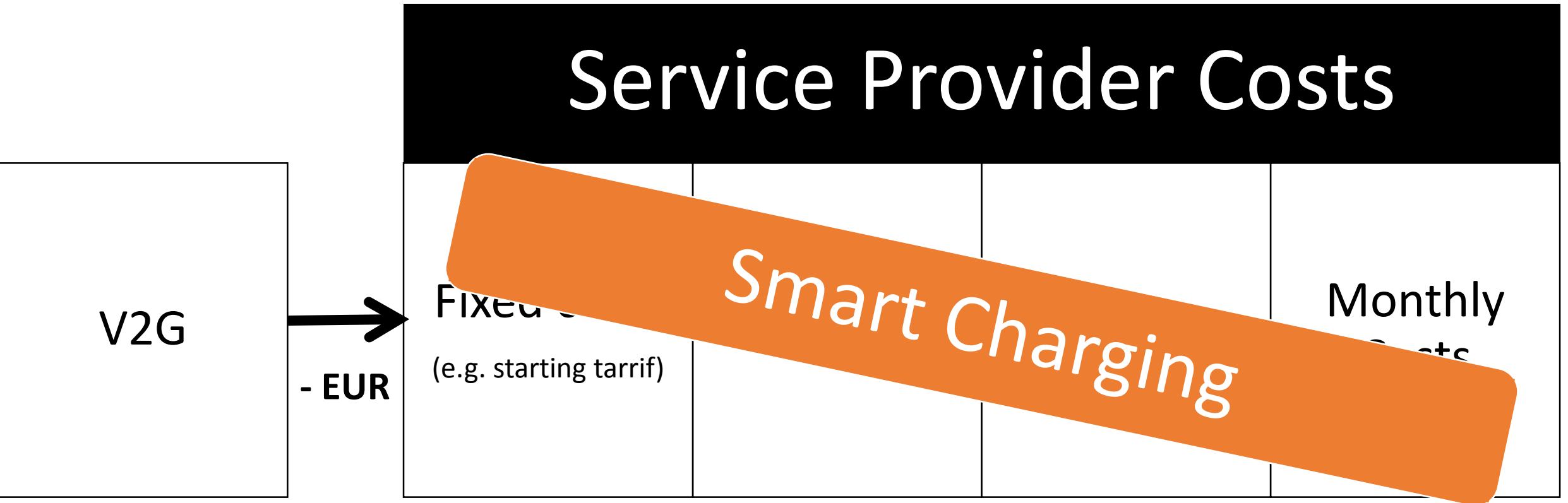
Solutions

- Pricing strategy
- Social charging
- Valet charging
- Unplugging

(Wolbertus & Van den Hoed, 2017b)



Pricing – 10+ different strategies active



(Blog – The jungle of charge tariffs, Wolbertus, 2017)



Efficiency through pricing

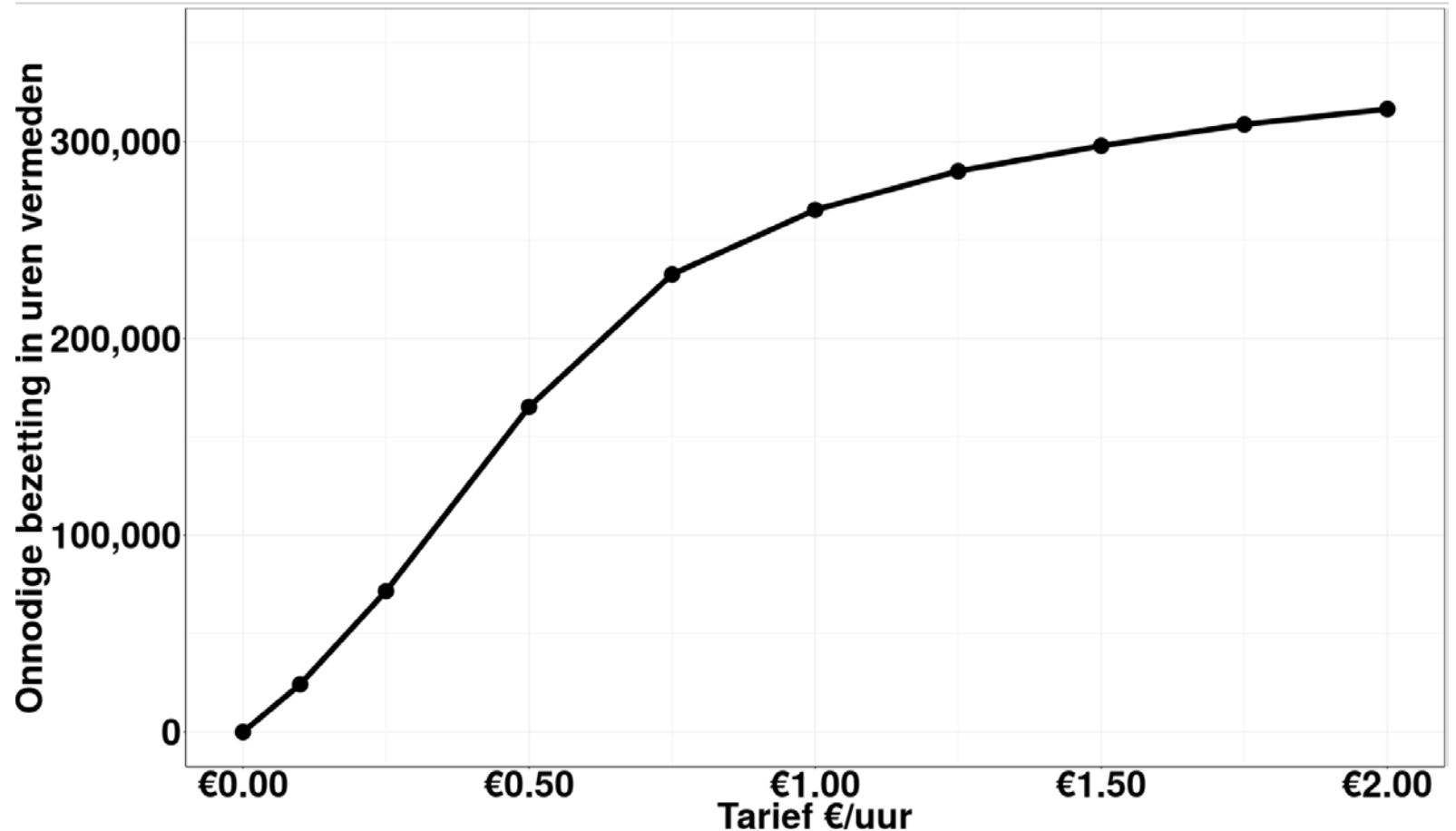
Idle fee



Different effects on different user types

Relation to parking

Putting it to practice

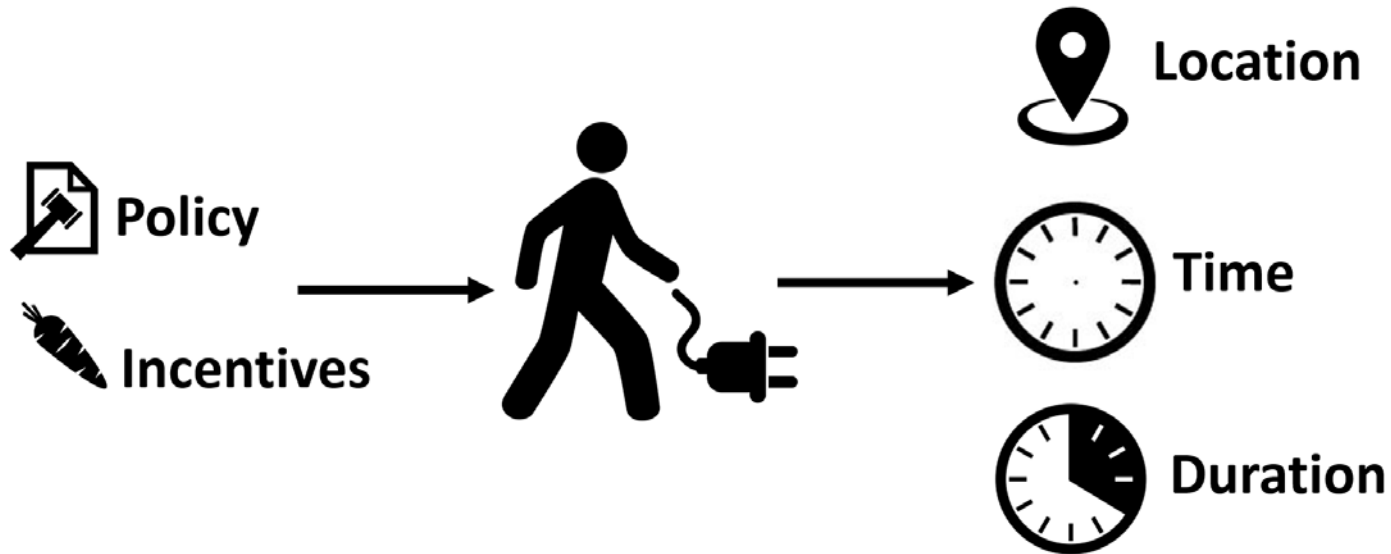


(Wolbertus & Gerzon, 2018)



Lessons learned

- ⇒ Effective roll-out to facilitate charging behaviour
- ⇒ Policies and incentives can be effective ways to steer behaviour
- ⇒ Take different user groups into account when designing policies



Thank you!



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