

# Smart Charging strategies for the implementation of electric mobility in the electricity grid

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# Research program

✘ Gemeente  
✘ Amsterdam  
✘



Rijksdienst voor Ondernemend  
Nederland



Other involved parties



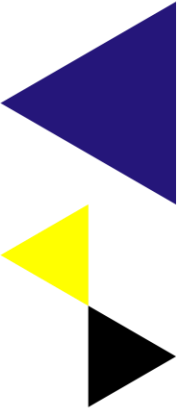
Creating Tomorrow

# Generic problem description



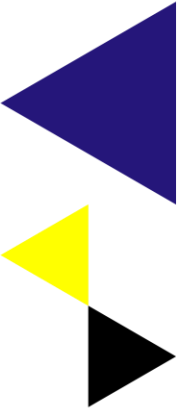
# Main research question

*How can municipalities choose between the (combinations of) different smart technologies for integrating charging stations for electric vehicles into the electricity grid with a balanced consideration of the interests of all supply chain partners?*

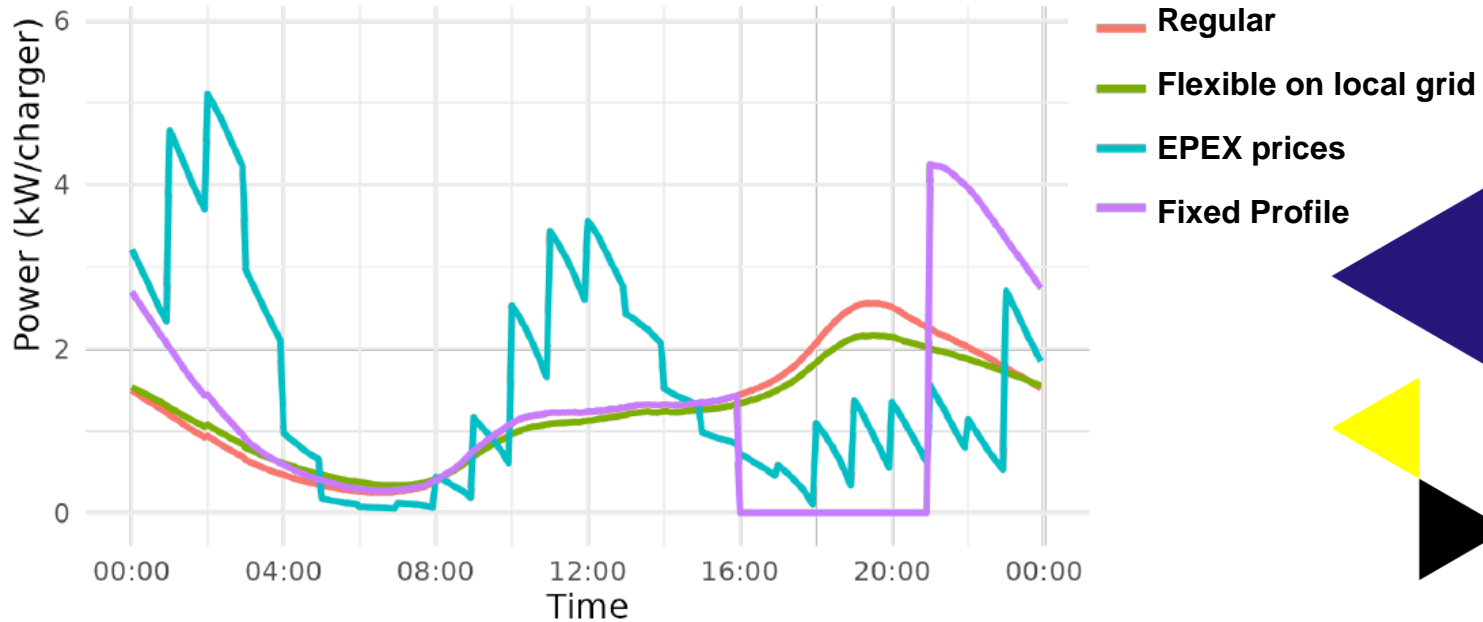


# 50 ways of smart charging

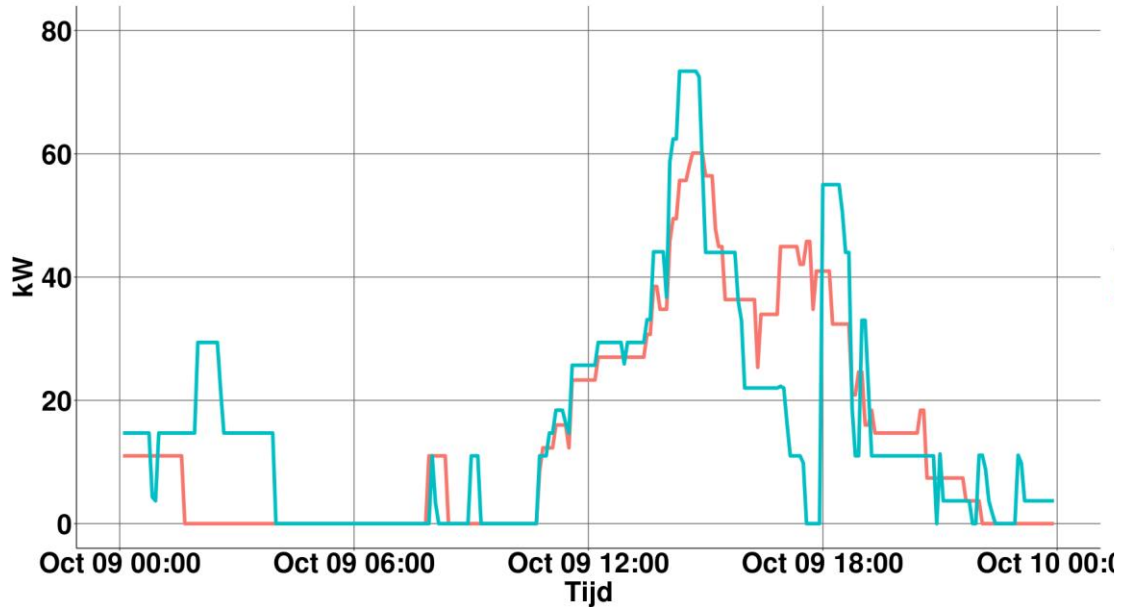
Local grid	Energy system
Load balancing (behind the meter)	EPEX electricity prices
Fixed profile	FCR
Dynamic on current grid load	mFRR
Dynamic on grid congestion markets (GOPACS)	aFFR
Use of stationary battery	CO2 intensity



# 50 ways of smart -> 50 different results

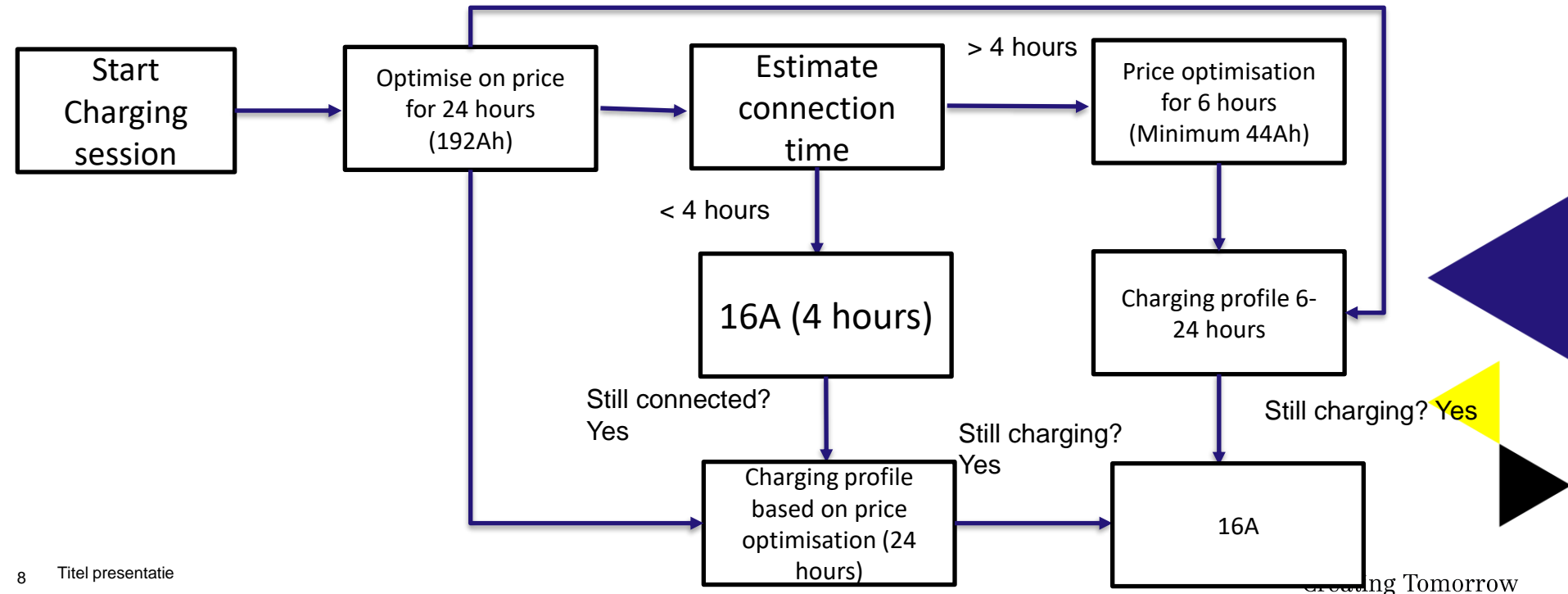


# Some ways of smart create new problems



Regular  
EPEX prices

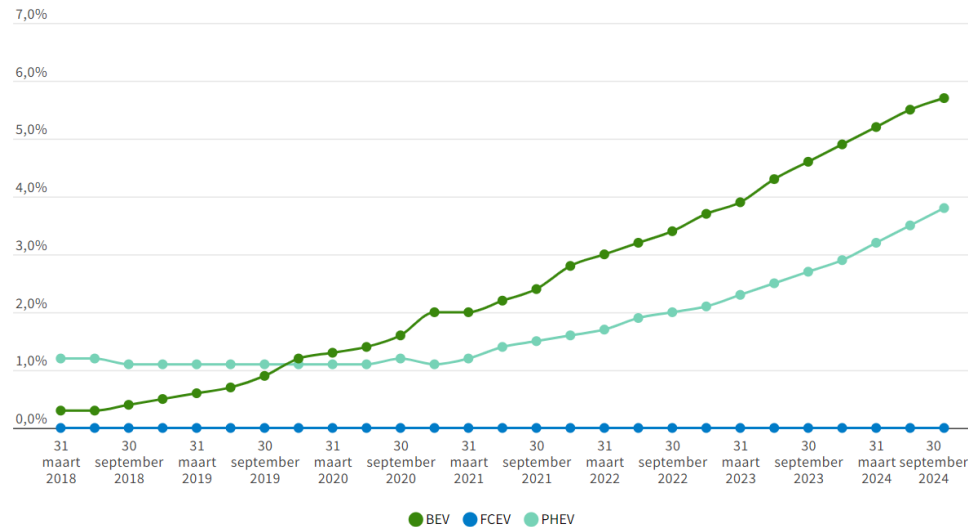
# Combination of new standards create complex new charging concepts





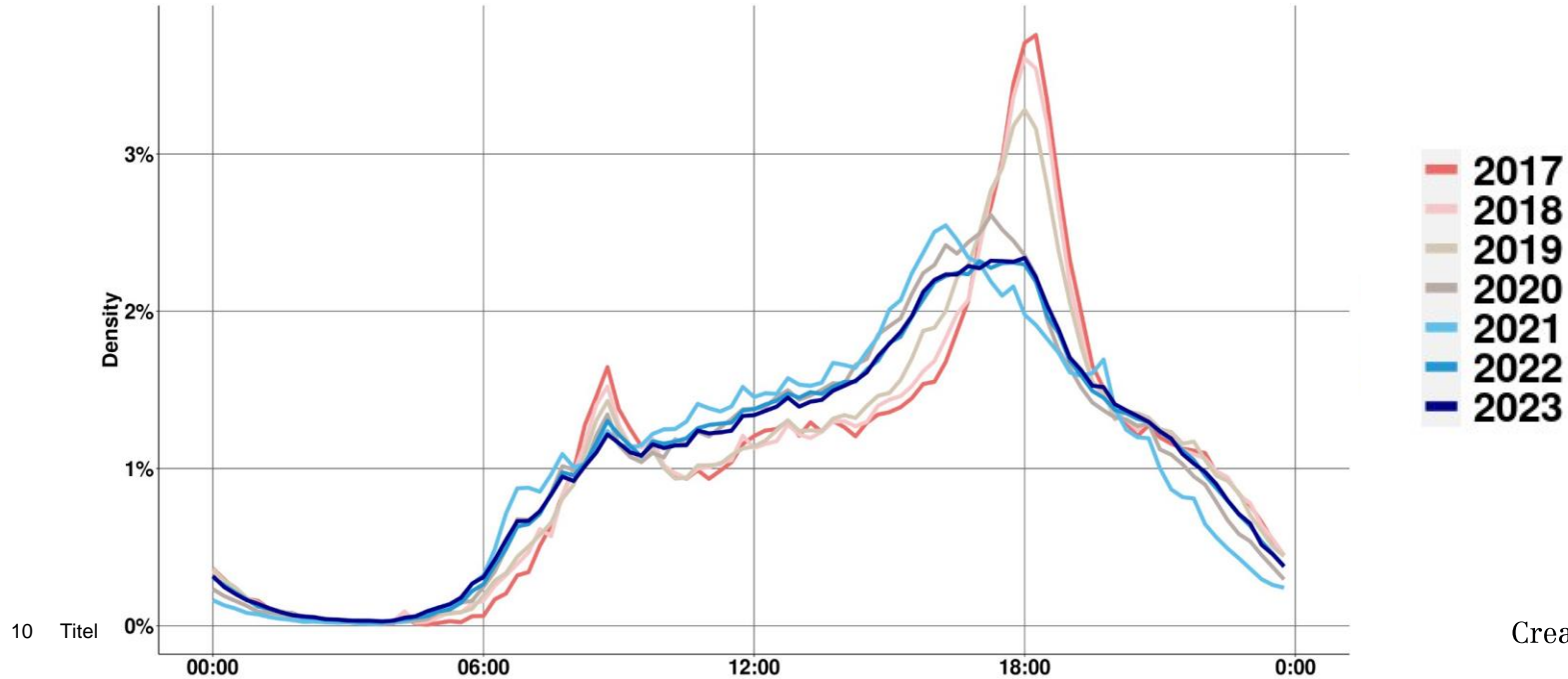
# Adjustments of strategies for smart charging based on trends

- Increase in the number of vehicles
- Shift from plug-in hybrids to full electric
- Increase in battery size
- Shift from single to three phase charging
- Different type of users
  - Passenger cars
  - Trucks
  - Construction
- Shift in charging habits

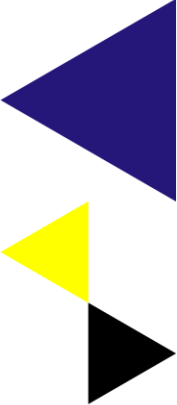


# Monitoring of charging trends

Distribution of charging sessions across the years

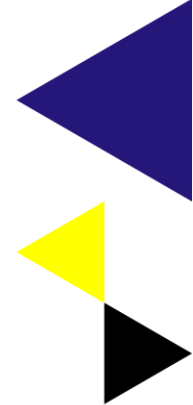
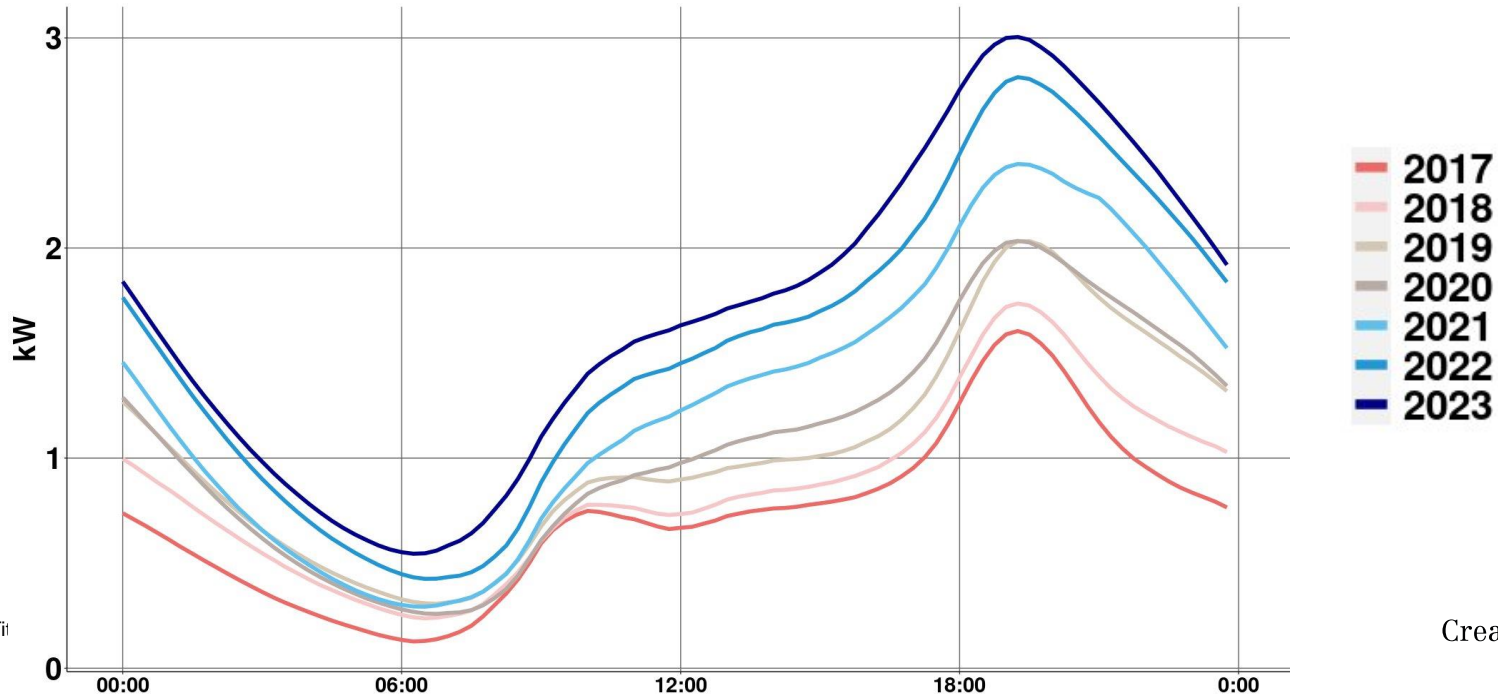


- 2017
- 2018
- 2019
- 2020
- 2021
- 2022
- 2023



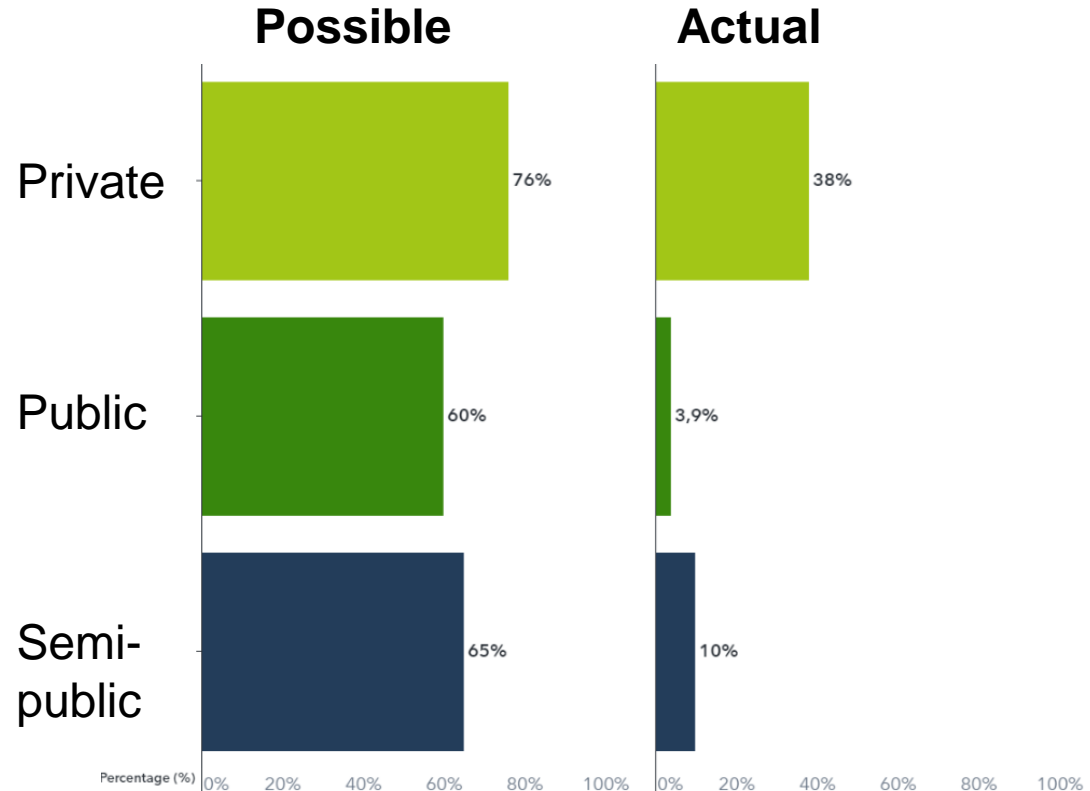
# Distribution of load on the electricity

Charging station (public – 2 sockets)



# Creating uniform standards & monitoring

- Standard communication between grid operators and CPOs
- Prioritisation of areas where to implement first
- Monitor on national scale on progress



# Communicating on smart charging towards users - public

Project	Terminology	User options	Communicated benefits	User benefits
FLEET	Slim laden (op basis van flexibele nettarieven)	Opt-out QR	Grid congestion Costs energy transition Costs charging infrastructure	Price Sustainability
ROBUST	Slim laden	No information	Grid congestion	
SCALE	Smart Charging	No information	Facilitate large fleets	User friendly
VAP-DC	Slim laden	Through charge point selection	Integration of renewables	-
Smooth-EMS	Slim laden	Not possible	Grid congestion Increase number of chargers	Price Sustainable grid
MRA-e Groen Laden	Green charging	Opt-out ChargeAssist app	Grid balancing CO2 emissions	Sustainability
Flexibel laden EQUANS	Flexible Charging/ Grid Conscious charging	No information	Grid congestion	Little interference
Proeftuin slimme laadpleinen	Slim laden	Not possible	Increase number of chargers Grid congestion	More charging stations
Flexpower3	Slim laden	Not possible	Grid congestion	User friendly Price
Re-ESCAPE	Smart Charging	Opt-out, project documentation does not define how	Grid balancing Grid congestion Integration of renewables	Price Sustainability

# Communicating on smart charging towards users - private

Supplier	Terminology	User options	User benefits
Zonneplan	Powerplay (slim laden)	Charge scheduling Opt-out	Price
Vattenfal	Slim laden	Charge scheduling Opt-out	Price
ANWB	Slim laden	Charge scheduling	Price Sustainability
ENGIE	Slim laden	Charge scheduling Opt-out	Price
Smappee	Slim laden	Charge scheduling	Price
Eneco	Slim laden	Charge scheduling Opt-out	Price Sustainability
Vandebron	Slim laden	Opt-out	Price Sustainability Grid balancing
Frank Energie	Slim laden	Charge scheduling Opt-out	Price

Work by Frank Kuipers

# Conclusions

- Smart charging is a term that encompasses many different types of optimisation strategies
- Implementation of these strategies can have very different outcomes
- Policy makers and grid operators have to balance these interests
- Long term charging trends influence the possibilities and impact of smart charging strategies
- Communication towards end users is very diverse
- Large differences in optimisation goal between public (grid congestion/stability) and private (price)

