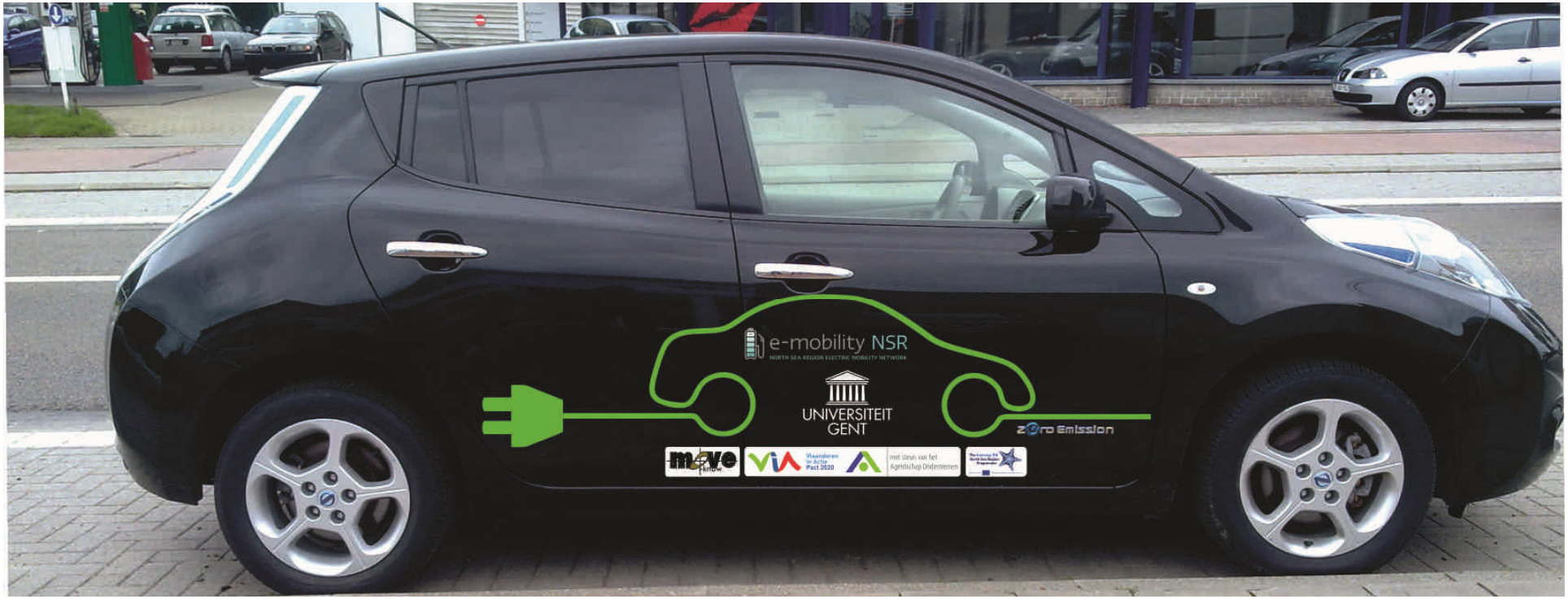
Prof. Sidharta Gautama
i-KNOW Innovation Center

e-mobility NSR



The role of EV consumer behavior in smart grid solutions

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Consumer insight through lab and field tests of EV technology in order to better understand how technology will be used

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Methodology

EV Battery Technology
EV Consumer Behavior

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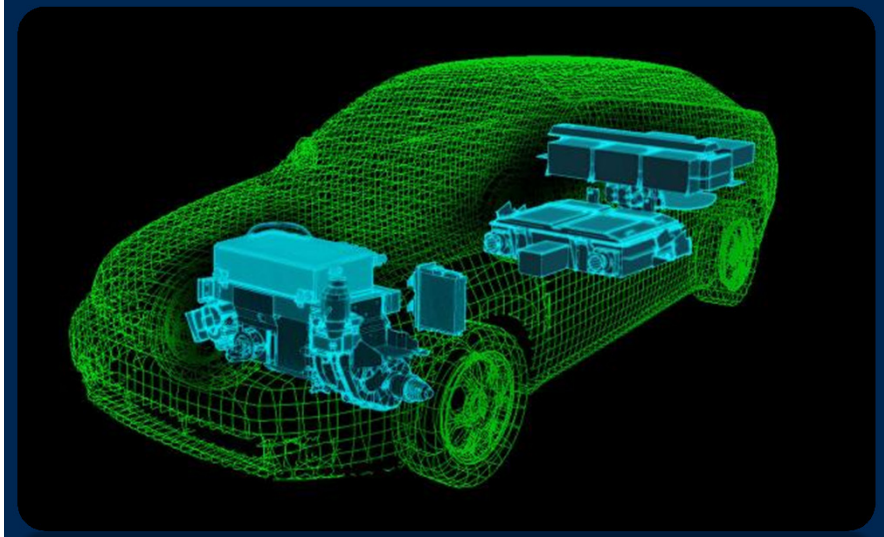
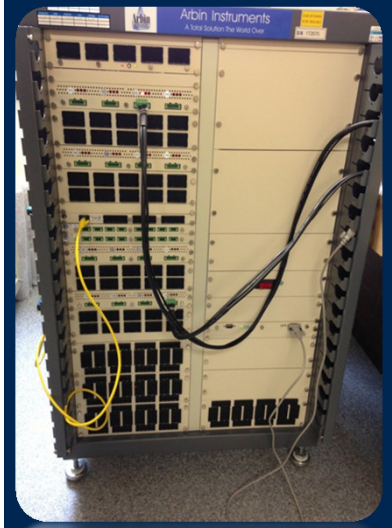
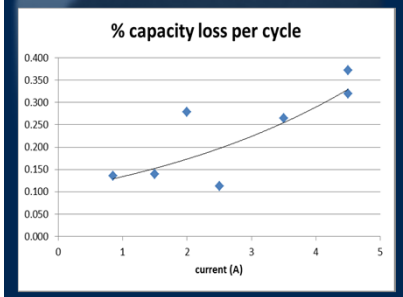


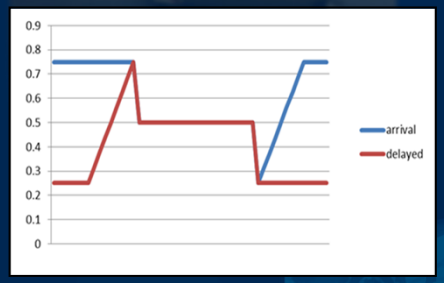
Looking at EV battery technology

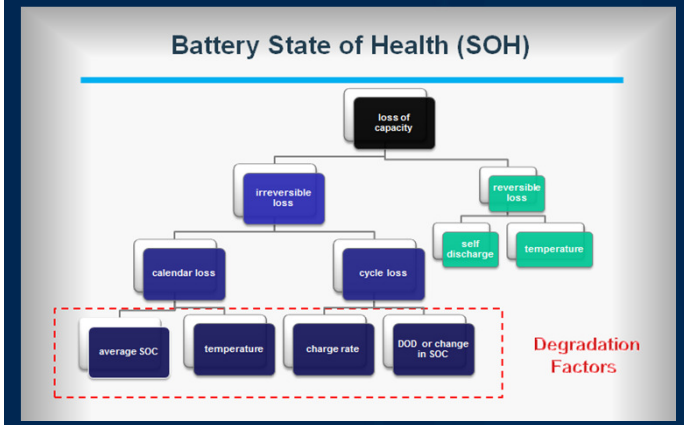
Looking at EV battery technology

By testing batteries using dedicated equipment to monitor and analyse State of Health





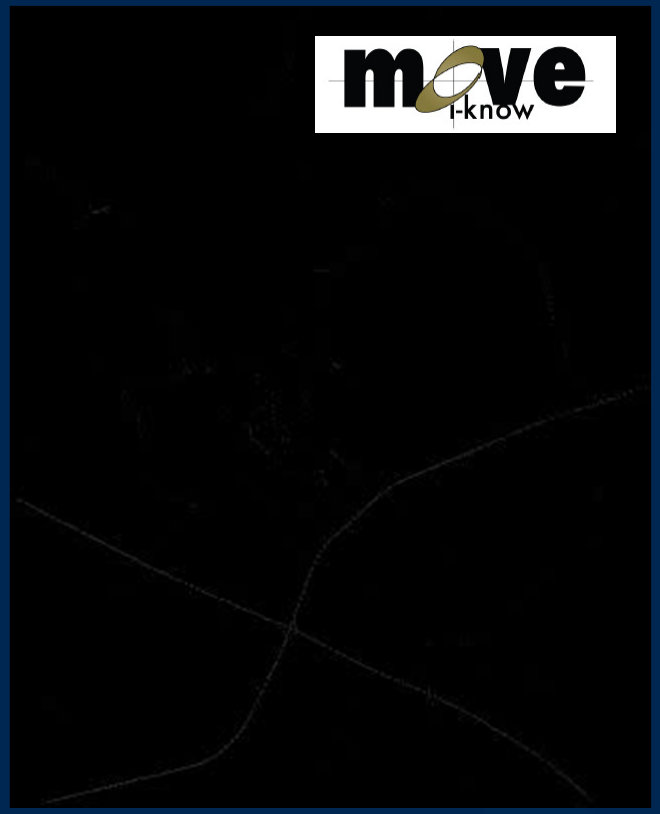




Looking at EV battery technology

By testing batteries using dedicated equipment to monitor and analyse State of Health

By installing continuous data loggers and collecting field data during drive and charge



Looking at EV battery technology

By testing batteries using dedicated equipment to monitor and analyse State of Health

By installing continuous data loggers and collecting field data during drive and charge

8 electric cars
4 car models incl. Leaf, Ion, Think City, Model S

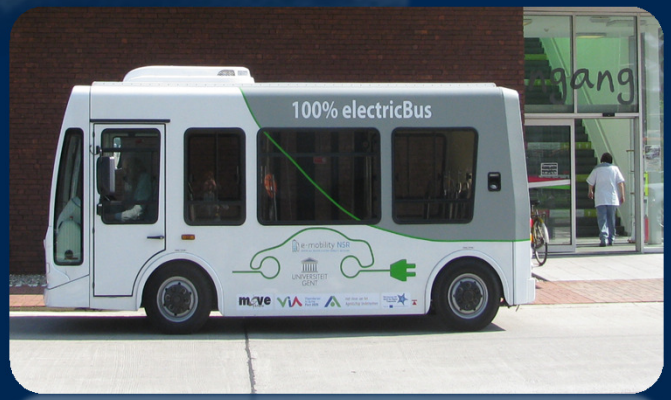
1 electric bus
fleet of 60 electric city buses

6 charging stations

Looking at users of EV

Looking at users of EV

By making vehicles and charging infrastructure available for field test period and examining driving and charging behavior



PEOPLE


e-mobility NSR
NORTH SEA REGION ELECTRIC MOBILITY NETWORK
UNIVERSITEIT GENT
move i-know
Vlaanderen In Actie Pact 2020
met steun van het Agentschap Ondernemen
The Interreg IVB North Sea Region Programme

Looking at users of EV

By making vehicles and charging infrastructure available for field test period and examining driving and charging behavior

In the use case of co-housing, several families with different profiles use a car in car sharing mode

4 co-housing sites in urban, suburban and rural context in the cities of Brussels and Ghent

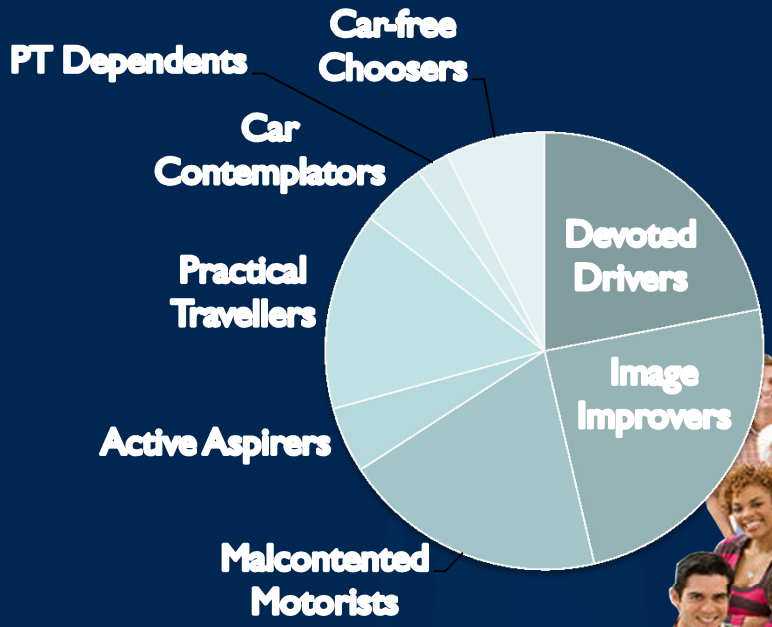
80 inhabitants with mixed ages, situation and attitude

55.000 logged EV kms
1.000 monitored EV days
7.000 monitored EV trip legs

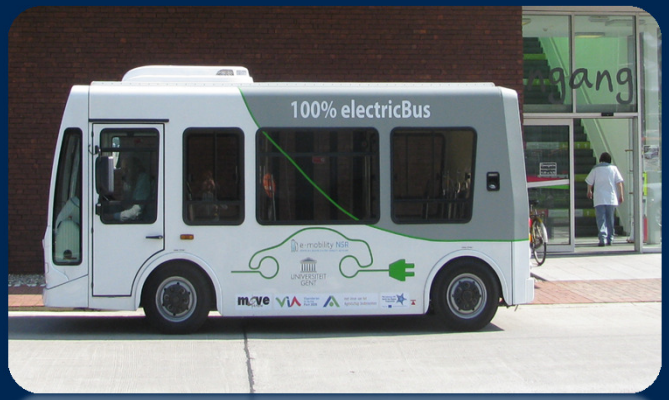
Looking at users of EV

By making vehicles and charging infrastructure available for field test period and examining driving and charging behavior

In the use case of co-housing, several families with different profiles use a car in car sharing mode



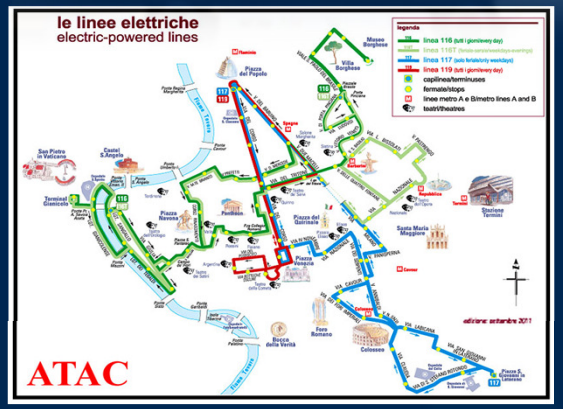
Looking at users of EV

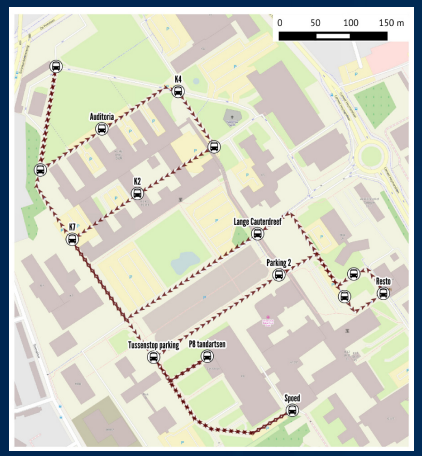


By making vehicles and charging infrastructure available for field test period and examining driving and charging behavior

In the use case of co-housing, several families with different profiles use a car in car sharing mode

In the use case of public transport, an e-bus is used in professional or city transit





e-mobility NSR

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Charging best practices to prolong battery life

e-mobility NSR

A set of best practices have been identified and verified in order to help consumers prolong their EV battery life and to support future smart charging systems.

- *Keep battery temp around 20 ℃*
  - *Ensure BMS keeps cells temperature within range*
  - *Avoid fast charging/discharging, especially when ambient temp is high*
- *Keep average SOC low*
  - *Minimize charging as much as practically possible. Charge before next use -* ***smart charging***
  - *V2G can be used to minimize average SOC!*
- *Keep DOD low*
  - *Allow low charge/discharge several times rather than full recharging/discharging*
- *Keep charging rate low*
  - *Charge at the lowest convenient current rate whenever possible*

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Smart charger

e-mobility NSR

Preparing implementation of smart charger technology.

Existing chargers provide limited controllability and flexibility to the user.

Smart chargers can take into account:

- User requirements (e.g. Charging time and length of next journey)
- Battery State of Health
- Grid support
- Charging from renewable energy resources

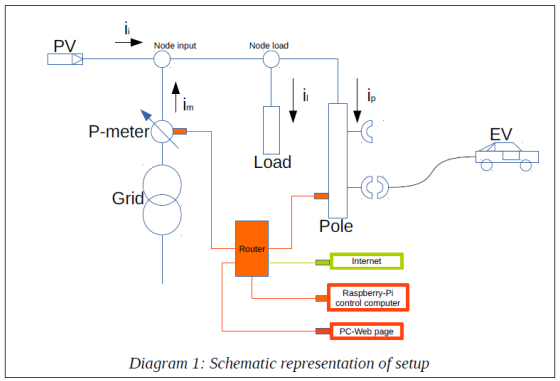

Diagram 1: Schematic representation of setup

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Grid simulation tool

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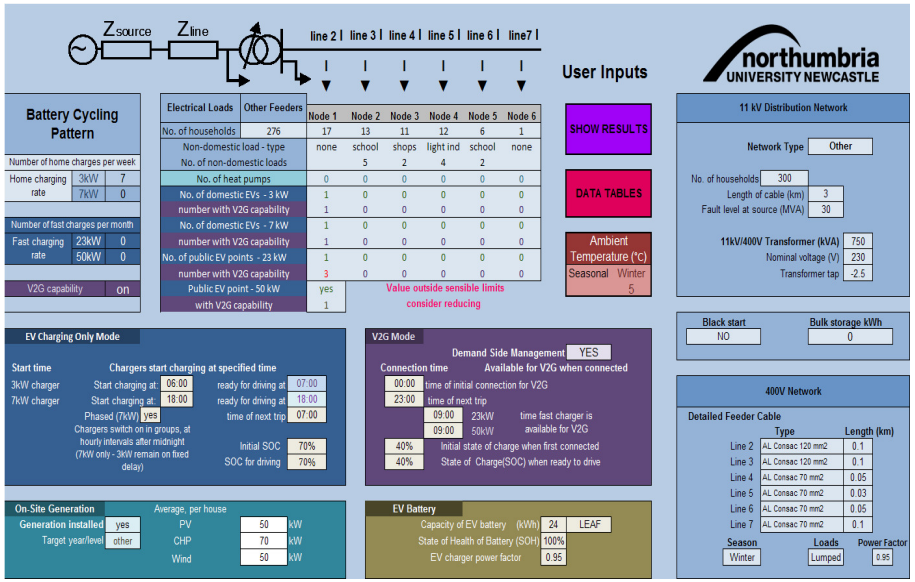
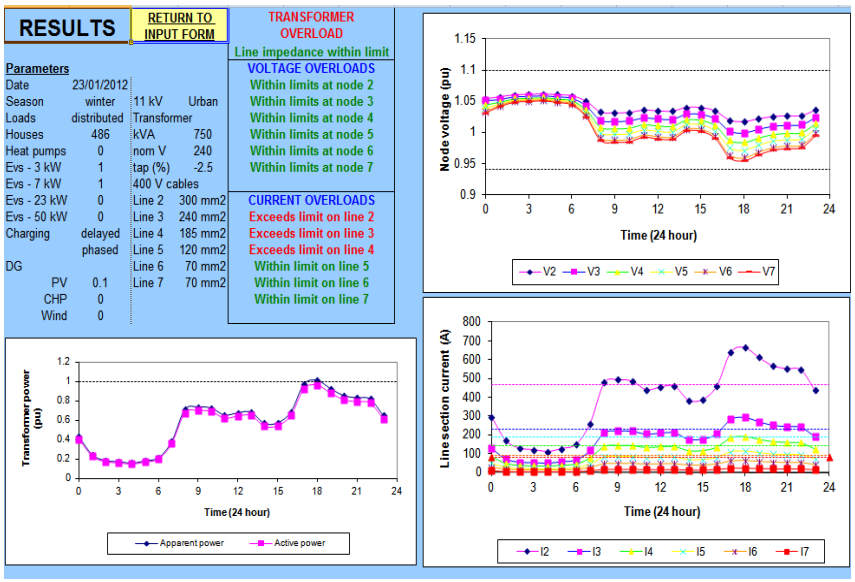
A computer model was developed to simulate a typical LV network and to show how the power flow and voltage vary though a 24 hour period with and without EVs, renewable energy sources, battery energy storage, heat pumps, etc.

The model allows evaluation of the impacts of EV charging posts and analysis of smart grids solutions, G2V, V2G, smart charging and the impact of battery cycling on the battery state of health.





The modelling tool was developed as part of a project funded by Charge Your Car North (Electric Vehicle Infrastructure – Smart Grids and EV Infrastructure Regional Impact).

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EV consumer profiles

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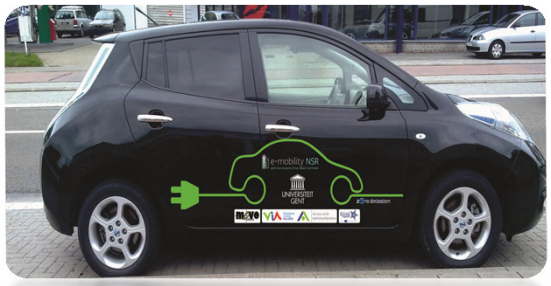
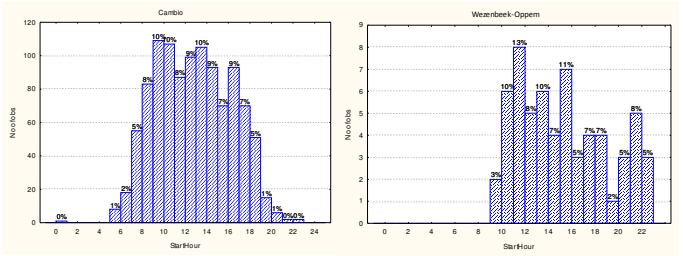
Profiles that define how consumer and professionals use electric vehicles and charging. These profiles can support future business models in domains like car sharing, public transport and smart grid.

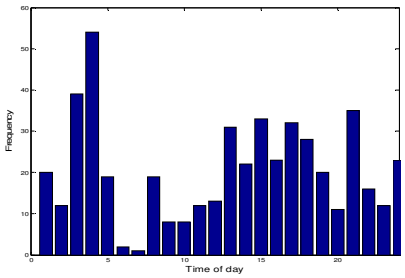


- *consumer type*
- *consumer attitude*
- *#km/day, #trips/day*
- *start/end SoC*
- *charging time*



Time of charging in
(a) commercial car sharing
(b) co-housing

- *PT schedule*
  #stops, distance, schedule
- *#km/day*
- *start/end SoC*
- *charging time*



Time of charging in
E-bus fleet for public transport

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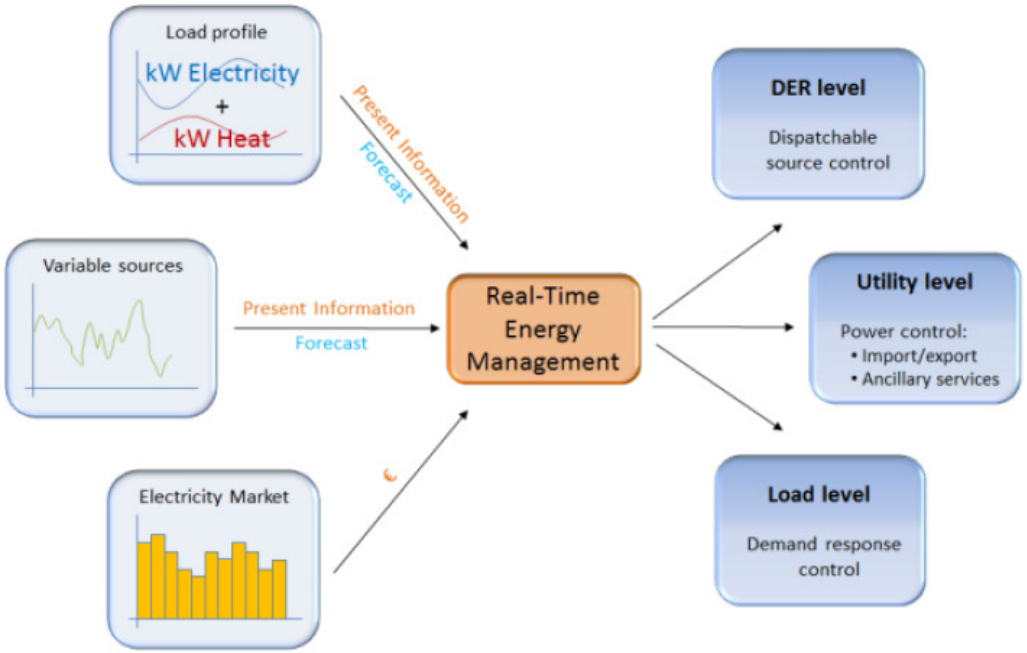
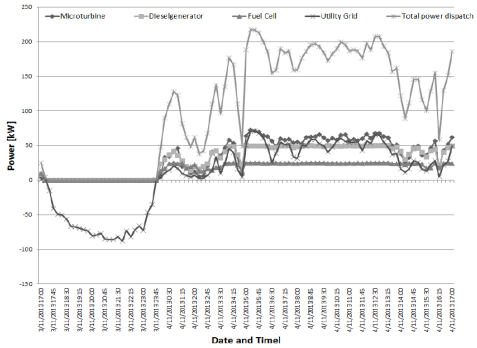
Smart grid cost model

e-mobility NSR

An economic-environmental power dispatch model in support microgrid optimal operation. The model fulfills the time-varying energy demand while minimizing the costs and emissions of the internal production and imported energy from the utility grid.





Environomic dispatch profile

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Mobile App e.CODRIVER

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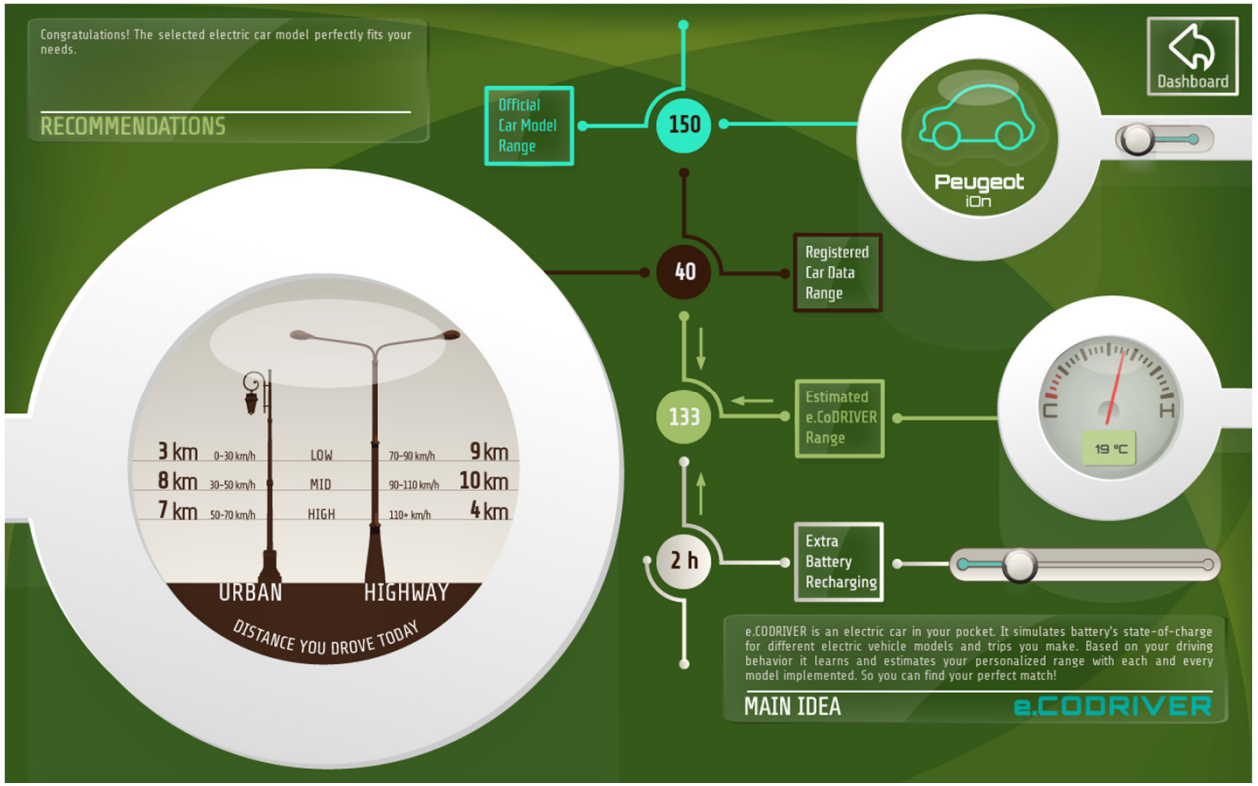
A mobile app that simulates the battery behavior and charging of commercial electric vehicles while driving your own car. In the end, you see if the EV car fits your needs or not.



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Available for free download on Google Play

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The role of EV consumer behavior in smart grid solutions

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Flanders State of the art

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