ASSESSMENT OF PLUG-IN NATURAL GAS VERSUS ELECTRIC VEHICLES IN THE GRONINGEN ENERGY NETWORK

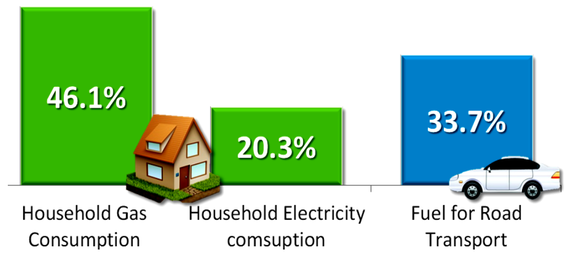
MONTOYA CARDONA, Juliana
E-mail : J.montoya.cardona@pl.hanzel.nl
Hanze University of Applied Sciences, Groningen (Hanze UAS)

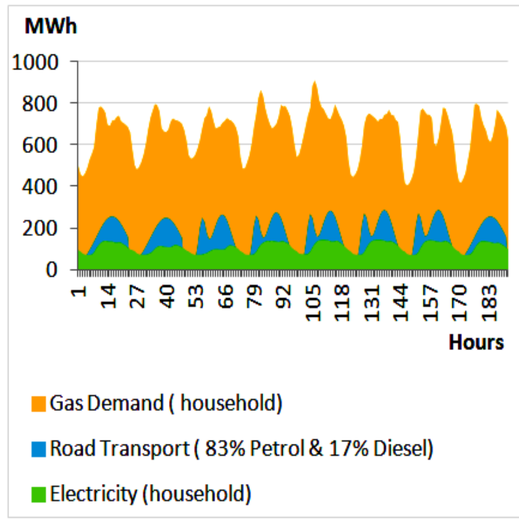
Mobility contributes with a significant proportion to the total energy consumption, In Groningen the main consumer is the residential sector, The high demand is from natural gas during the winter, in contrast during summer is the mobility which determined de demand pattern.

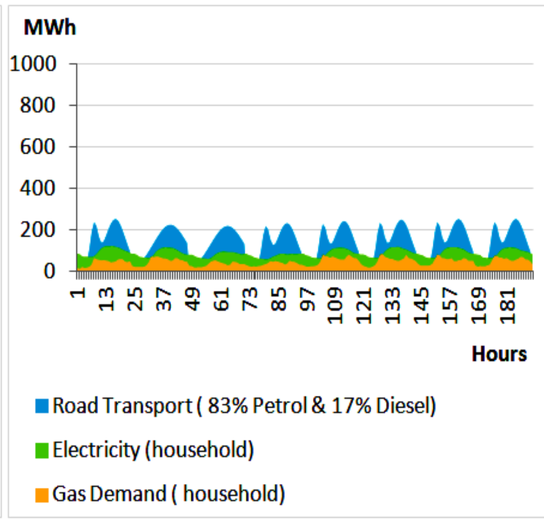
EV (electric vehicles) and NGV (natural gas vehicles) are capable to connect in double-way charging and discharging) to their own network.

The charging profile considered use real data from home charging station combined with the mobility trends in Groningen

Mobility





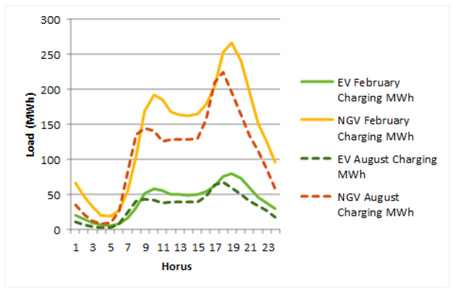


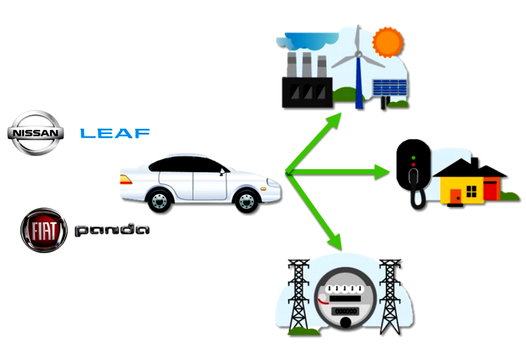
Vehicles fectures

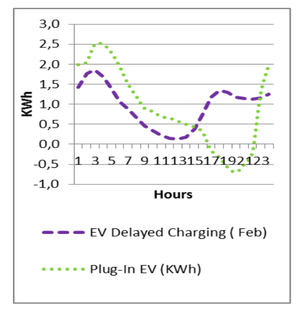
Both NGV and EV are energy consumer and a possible storage facility that could help balance the load, reducing demand during peak periods. There are many issues that can have an effect in the energy network after plug a vehicle into the grid, for example the storage capacities, available power (infrastructure) and the tariff applied by the vehicle's users.

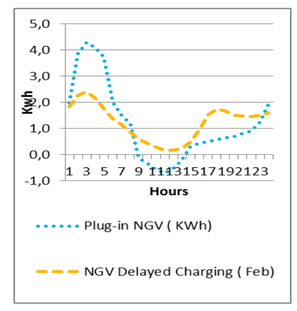
	EV NISSAN LEAF	NGV FIAT panda
Efficiency (including charging efficiency)	0.25 kWh/km	0.43 kWh/km
Charging power	3.6 kW (240v/15A)	5.16 kW
Discharging power (to allow for longer discharge time and minimal battery damage)	1.8 kW	2.57 kW
Min discharge level under discharging scenarios is 30% of battery capacity.		
Battery capacity	35 kWh	50 kWh
Travel powered by the grid	100%	100%

Charging Profiles







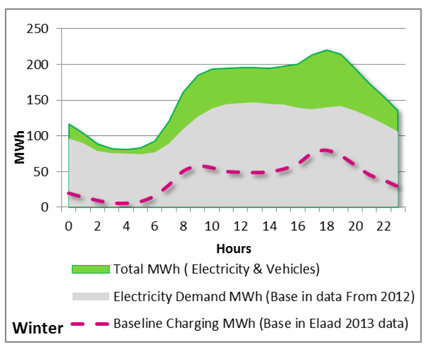


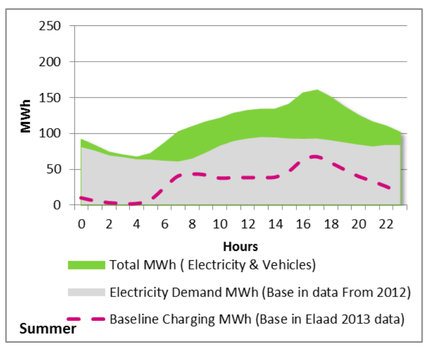
Actual charging

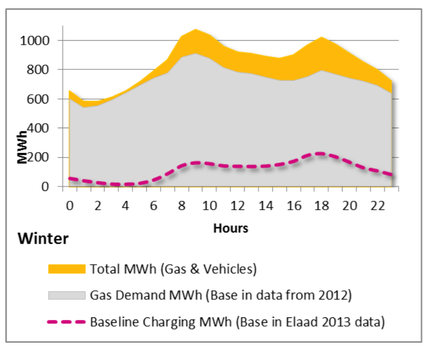
Under smart environment

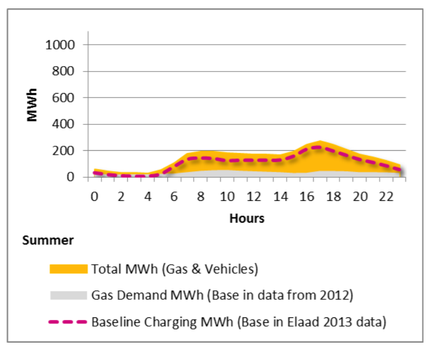
Load Impact

BASELINE SCENARIO

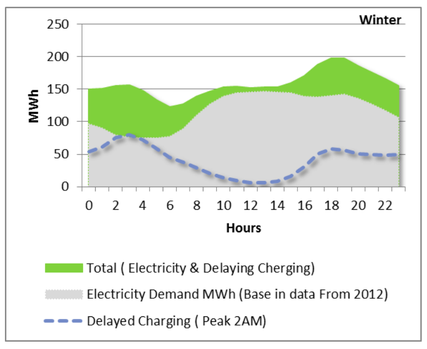


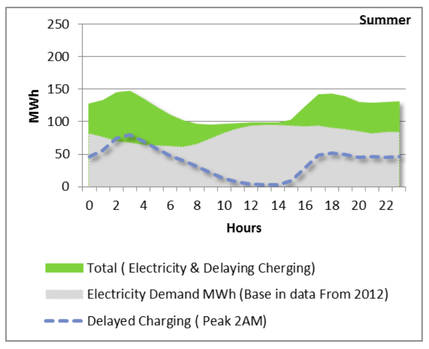


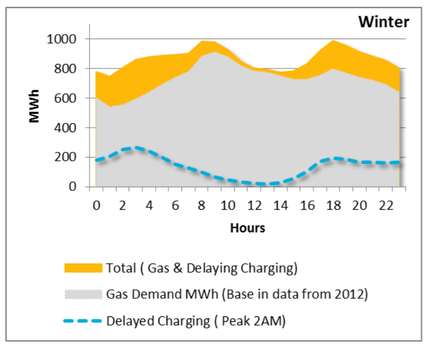


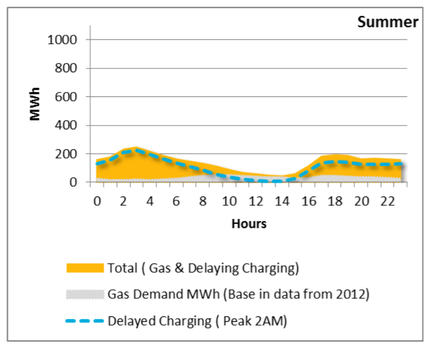


DELAYED SCENARIO

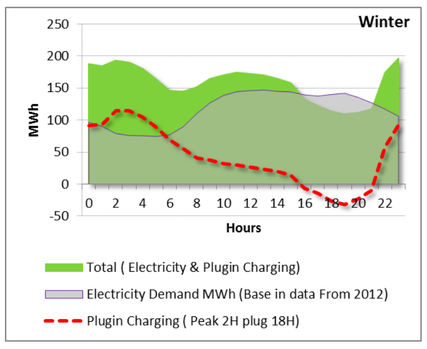


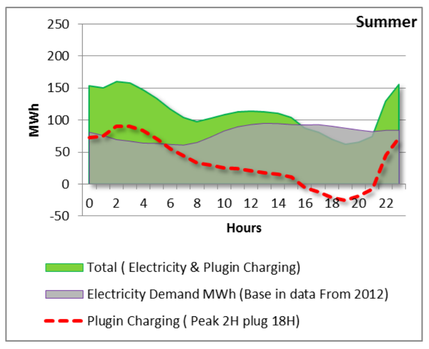


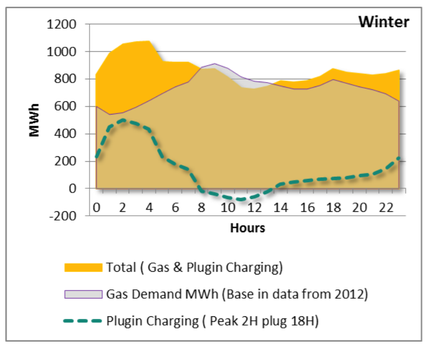


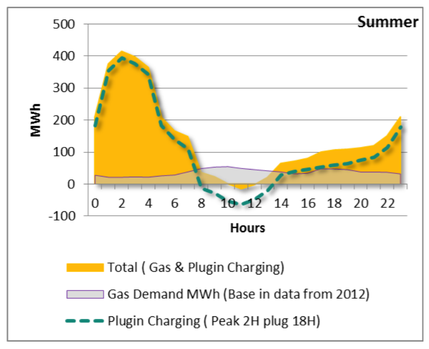


PLUG-IN SCENARIO









Electric Vehicles

Natural Gas Vehicles

CONCLUSION:

Mobility is a significant element in the new energy demand; also represent an opportunity to develop existing and potentially products and services for grid management. In the near term, managed charging of NGV and EV, coordinated among megawatts of charging load, could help provide additional services or emergency reliability services. In the Netherlands using the NGV and EV capability to charging and discharging to the grid, the NGV and EV together could be an important support for the integration of renewable power generation.

References:

"Key Figures 2013," Gemeente Groningen, Groningen, 2013.

"Mobility and Transport," CBS, Netherlands, 2014.

"E-Laad," 2014. http://www.elaad.nl/.

"Nissan LEAF: features + specifications," 2010.

"FIAT PANDA PANDA:SCHEDA TECNICA," Fiat, 2008.

A study of electric vehicle charging patterns and range anxiety, UPPSALA University, 2013.

"Analysis of the lithium battery charge/discharge system using state space averaging

"Refueling domestic," brc fuel maker, 2014.

M. Visser, "DUURZAAM GRONINGEN IN 2035," ENTRANCE, Groningen, 2014.