AMSTERDAM
VEHICLE 2 GRID

Two years of electromobility, solar energy and data: March 2014 - March 2016

Amsterdam V2G has demonstrated during the last two years the possibilities of smart energy management. The combination of a household able to produce and consume energy, together with energy storage in an Electric Vehicle (EV), pave the path for large scale adoption of renewable energies in urban environments.
Amsterdam V2G tackles the mismatch between production and consumption of energy (figure 1). The Electric Vehicle acts as energy storage, so less energy must be purchased when there is no Photovoltaic (PV) production. This also prevents energy flows with the grid, what is translated in a less intensive use of it. Overall, Amsterdam V2G does not only allow for clean mobility and more renewables in the energy mix, but also reduces investment in grid refurbishment.

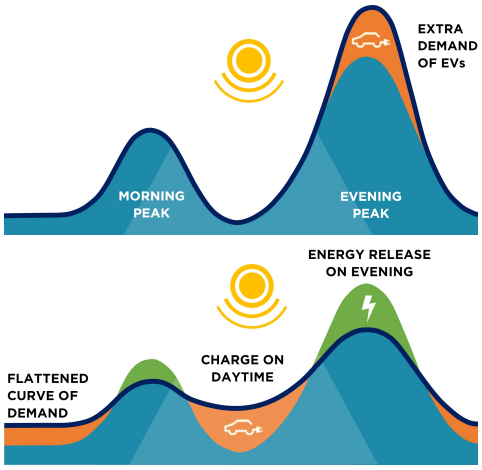
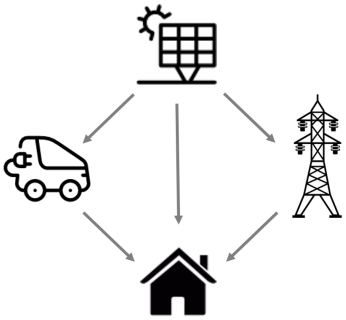


Figure 1: Vehicle to Grid technology allows to flatten the curve o power demand combining PV production and household consumption through an EV.

Key results:

1. Increase in energy autonomy (through renewable energies) by 31 percent (from 34 percent to 65 percent, as seen in figure 3).
2. Reduction of energy exchange with the electricity network by 45 percent compared to situation without V2G (figure 5).
3. The 10 kWh battery yields already most of the potential benefits of vehicle to Grid (figure 6).
4. Battery degradation observed in two years is limited.

Elements of the system:



- Household (Approximate yearly consumption: 3350 kWh).
- PV installation (4000 Wp, approximate yearly production: 3780 kWh)
- Electric Vehicle (battery capacity: 10 kWh).
- Connection to Amsterdam's grid.

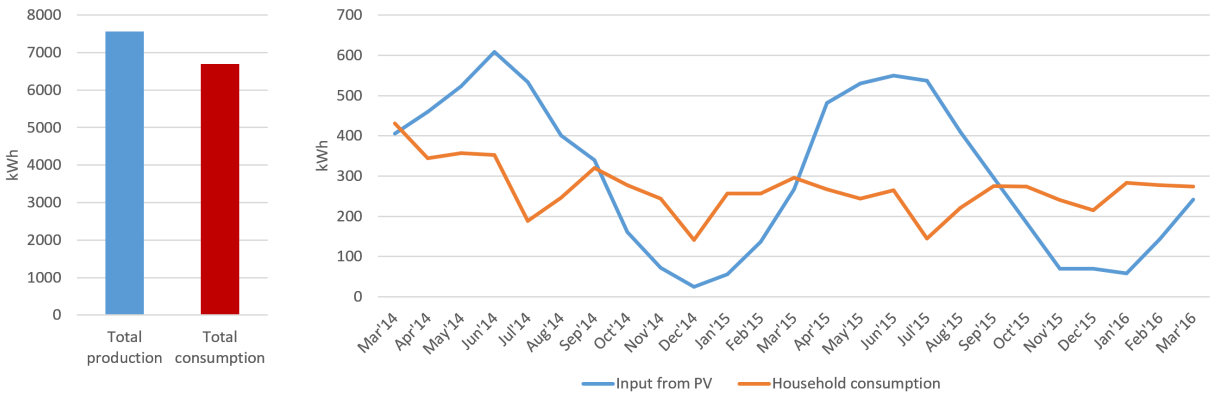


Figure 2: Overall producion and consumption of energy (left), also dissagregated by months (right): The yearly production of electricity exceeds consumption, although there is a surplus in summer and a deficit in winter.

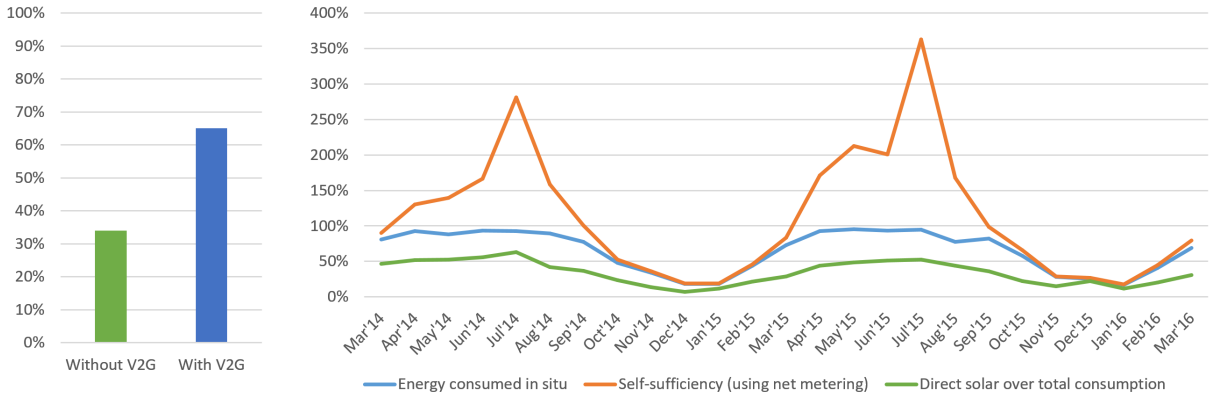


Figure 3: Self-sufficiency measured in percentage; overall (left) and dissagregated by month (right). On a yearly basis, the energy autonomy rose from 34% to 65% thanks to V2G implementation.

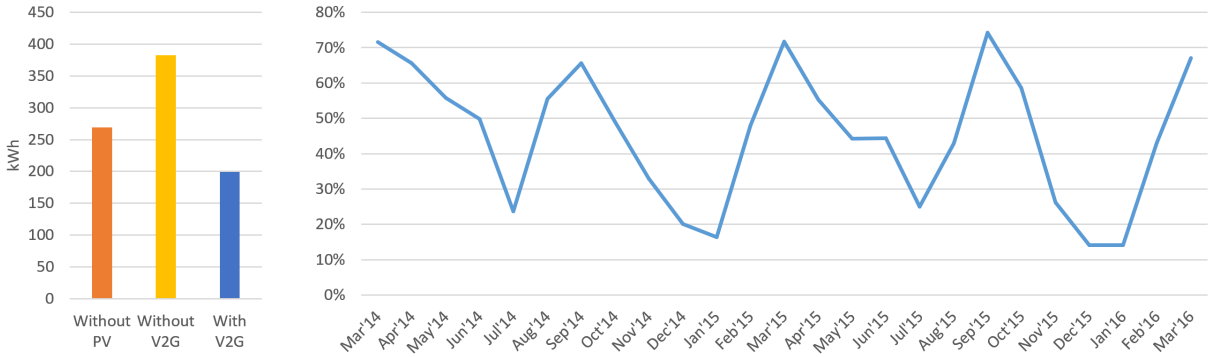
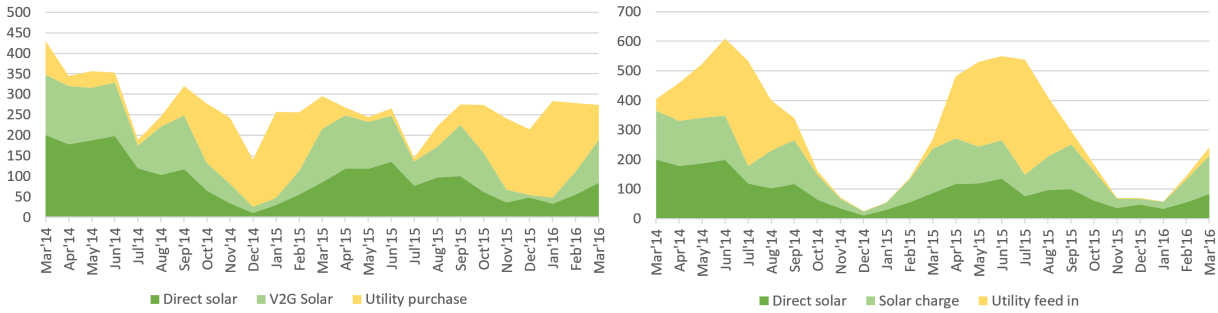


Figure 4: Energy exchanged with the grid on an average month (left). At right, the percentage of energy reduction exchanged with the grid thanks to V2G implementation. Note the outstanding reductions in spring and autumn, when the battery is most intensively used



(a) Origin of the energy consumed by the household.

(b) Destiny of the energy produced by the PV installation.

Figure 5: Energy flows inside the system

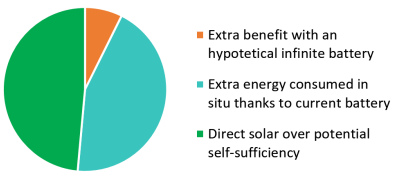


Figure 6: Proportion of energy produced and consumed.

How much self-sufficiency could be achieved with a bigger battery? Without battery, almost half of the energy produced by the PV installation is already yielded (figure 6). The rest would be exchanged with the grid. The presence of the 10 kWh EV battery solves mostly this situation; up to the point that with a bigger battery, the self-sufficiency of the system could only be optimized by seven percent. The wearing of the battery, as measured by data in the months of March and September, is approximately six percent over two years, after approximately five hundred cycles of charging cycles.

More information

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