Optimisation of electrical vehicles

What is Flexity: Flexity is one of the leading Use Cases within the IO.Energy Ecosystem. Flexity investigates which household assets (EVs, boilers,...) can be technically operated and which value can be offered to the end-consumer in return. Moreover, Flexity investigates how the digital meter can be used to facilitate the settlement of new services on residential level.

Objective of this note: this note summarises Flexity's test results from the optimisation of electrical vehicles performed by Jedlix and ENGIE.

Approach

Storable load assets such as electrical vehicles (EVs) have a significant amount of flexibility, which can generate value for the end-consumer when optimised effectively. Flexity optimised multiple EVs according to following optimisation strategies, which are **complementary** and can therefore be **stacked[1] to generate the maximum value possible**:

Day/Night optimisation (or D/N optimisation)	A typical EV-driver arrives home at 17h, leaves at 07h in the morning and charges his car for about 3 hours. Moving the charging process towards the night period results in a lower electricity cost for those end-consumers with a D/N contract. On top of that, day-night optimisation is an effective instrument to prevent high peak demand on the LV-grid.
Optimisation in function of Day-ahead-prices (or DA-prices)	Suppliers source electricity on a wholesale market (where prices fluctuate on an hourly basis) before delivering the electricity to the end-consumer. By planning the charging session on those moments when market prices are at their lowest, Jedlix allows Suppliers to minimise their energy sourcing cost. The supplier can then share value with the end-consumer (e.g. on-demand earnings pay-out[2]).
Participation in the aFRR[3] market	The inherent flexibility of the charging process can help to maintain the balance of the grid. For example, when electricity consumption exceeds generation on the grid, the charging process of 100s of EVs can be interrupted instantaneously. The Balancing Service Provider who operates this flexibility receives a remuneration[4] from the TSO and can share some of these benefits with the end-consumer.

1. In a next step, Flexity aims to test residential flexibility at a larger scale to confirm the extent to which the various optimization strategies can be fully stacked. These demonstration test will also provide additional insights on potential trade-offs that need to be made between different value streams when operating such flexibility at a large scale.
2. Ex. ENGIE offers a reward € 1,5ct per kWh optimised volume, represented as an earning on top of the potential energy bill savings
3. Automated Frequency Response Reserve
4. Capacity fee (€/MW) and an activation fee (€/MWh)

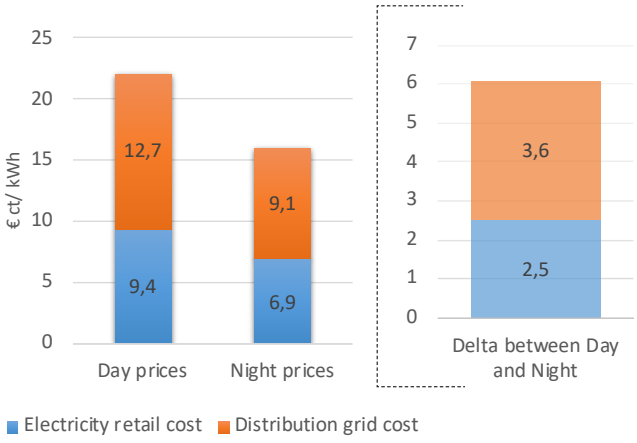
Results

The results of the tests are summarised below according to the optimisation exercises that were carried out

1. Day/night optimization

Drivers at the basis of this exercise

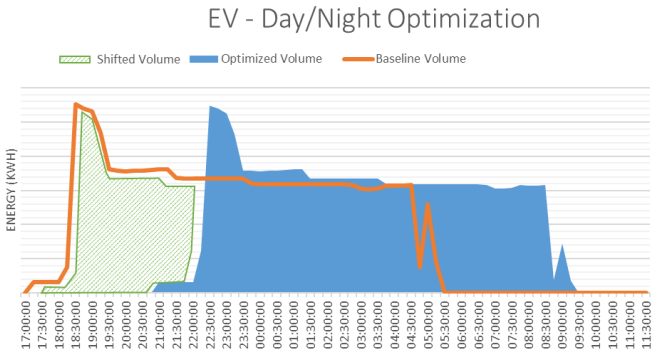
The most important driver for this exercise is the difference in price between day and night: both the **electricity retail cost** and **distribution grid cost** are **significantly lower at night compared to day**. Shifting one kWh from day period to night period generated on average a **saving of € 6.1ct/kWh** (2.5ct/kWh coming from the retail cost and € 3.6ct/kWh from the distribution cost).



Results of the testings

Jedlix optimized **in total 10 charging sessions in Flexity** (February, March) **of 2 EV-drivers** and shifted on average **15% of the load from day to night**. The main driver from these savings came from **differences in distribution grid costs**[5] (up to 60% of total savings).

End prosumers saved on **average 4.5%** on their energy bill. A typical EV-driver who drives between **2,500 and 3500 kWh** (12,5000 km – 17,500 km) at an average cost of 0.24€/kWh saves between **27 EUR and 38 EUR** on a **yearly basis when charged exclusively at home.**



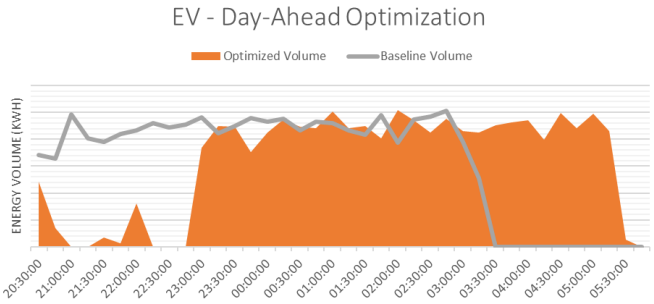
2. Optimization in function of hourly wholesale prices

Set-up of the exercise

Earnings from DA-optimization come on top of the savings that were induced from **day-night optimization** and are therefore **incremental**.

The optimization in function of DA prices allows the Supplier to reduce his sourcing cost, under the condition the Supplier/BRP portfolio is constructed based on real quarter-hour metering data instead of SLP profiles. This is expected to change thanks to the smart meter roll-out.

With the roll-out of the smart meters we can also expect that **dynamic retail price contracts** (based on DA-prices) will emerge, which would allow end-prosumers to directly benefit from this optimization exercise (a direct bill saving)



Results of the testings

Jedlix optimized **594 charging sessions in Flexity** (February, March) **of 27 EV-drivers** and shifted on average **37% towards moments when DA-prices were cheaper.**

The optimization exercise allowed ENGIE to reduce his sourcing cost with **0.5 ct per kWh**, which is **€ 15/year** per EV-driver who charges up to 3,000 kWh (15,000 km) at home.

5. The potential savings when the charging process is optimised function of the proposed capacity tariff of VREG are likely in the same order of magnitude, but this requires further investigation.

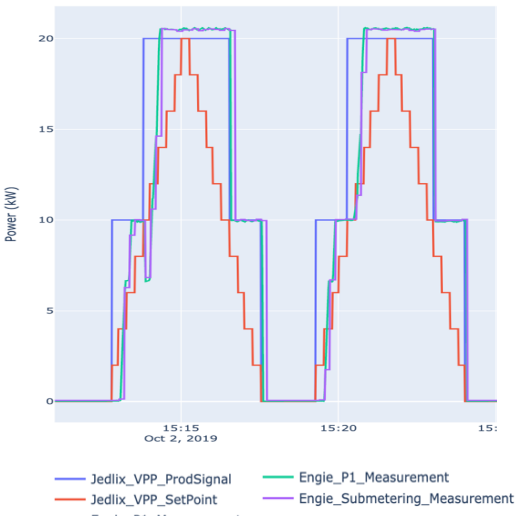
3. Participation in the aFRR balancing product

Set-up of the exercise

Objective of the exercise: test the **capability to steer** and **provide accurate metering data** for the aFRR product

2 Tesla EVs were used and operated by Jedlix via the back-end system of the car manufacturer.

Earning from participation in the aFRR balancing product come on top of the savings that were induced from **day-night optimization** and earnings from DA-optimization.



Results of the testings

Stop and start charging commands are well within the limits of the aFRR product

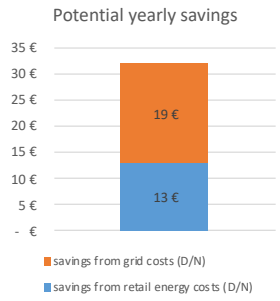
Capable to provide accurate metering data on a pool basis for the aFRR product

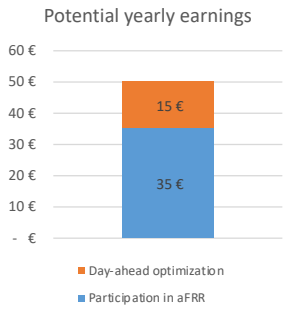
Service providers can generate between **€30 and €40 on a yearly basis per EV driver**

4. Value stacking[6]

€32 of direct savings can be generated for an end-consumer by an optimization in function of D/N prices.

Additional earnings up to € 50 can be generated by the Supplier (and his SP) for the flexibility value of an EV-driver





Conclusion and moving forward

Jedlix and ENGIE demonstrated that they are able to accurately operate electrical vehicles across a variety of value streams and offer value for the end-consumer in return. We have seen that a major part of the potential earnings come from participation in the aFRR market. The opening of the aFRR balancing market for residential load is not only a key enabler to boost the development of flexibility from electrical vehicles but even more a precondition for Flexity to build a robust value proposition for the end-consumer.

Other value streams are also emerging: the capacity cost component that will go-live in January 2022[7] will incentivise end-consumers (and their service providers) to reduce their average monthly peak and generate bill savings accordingly.

6. In a next step, Flexity aims to test residential flexibility at a larger scale to confirm the extent to which the various optimization strategies can be fully stacked.
7. More information can be found on the site of VREG: https://www.vreg.be/nl/toekomst-nettarieven-capaciteitstarief

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