Conceptual design of solution for electromobility development in connection with the decentralized electricity production

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Problem context of electromobility development

- **1.35 million fully or partly electric cars** will be in operation in the EU by the end of 2019 (demand rose by 42%).
- Electric cars have a total share of all cars sold around **2%**.
- Norway is the European leader in electromobility with 36,500 units sold in the first half of the 2018, with a **market share of 37%**.
- **So we can expect future rapid grow of electromobility.**

Electromobility is a big problem for future

- Currently, Norway has problems with the possibility of charging electric car batteries.
- The possibilities of charging are limited and electric power transmission infrastructure is not ready for rapid development of electromobility.

- **But what is the situation in the Czech Republic a what does it mean for the future development of electromobility?**

Electromobility is a big problem for future

- In 2025, it is estimated that **20-100,000 electric cars** (depending on state support) will be operated in the Czech Republic (the total number of cars is 5.8 mil.).
- It is expected that **the obstacle to the development of electromobility in the Czech Republic** is the capacity of the distribution network to transmit increased amounts of electricity in the event that electric cars will expand "only" to several percents of the total number of registered cars.

How to (partially) solve the problem

We have to find solution that won't be dependent only on the main electricity distribution infrastructure.

We have to use also local sources of electricity and combined them with main electricity distribution infrastructure possibilities.

Possibilities for the Czech Republic

There are two possibilities to distribute electricity to customers with the electric car:

1. Electricity will be distributed from power plant (via electric power transmission infrastructure) to local chargers and customers. **But infrastructure is not ready.**
2. Electricity will be generated and storage locally (local energy sources as solar panels on the houses, hydroelectric power plant, wind power plant) and customers have to come to charge his or her car. **But it is only 10% of all generated elektricity in the Czech Republic.**

Project goal

We would like to **develop smart navigation** which will connect **local energy producers** and possibilities of traditional electric power transmission infrastructure with users of electric cars (customers).

Project outputs

- **The project will not be able to create a functional ecosystem** and ensure adoption of the designed system in the Czech Republic, because we need to connect very different producers/sellers of electricity (that have their own associations, charge systems, APIs, higher interests).

- But **we can prepare a pilot study and after that sell functional solution** to a more powerful organization (e.g. to energy distributor, electric car manufacturer, electromobility association).

Project and solution complexity

- We need to prepare **GPS navigation** for main mobile phones platforms (ideally connectable with a car and using smart contracts).

- We need to prepare **model that connects** distributed energy sources (chargers) with map of the Czech Republic and some other data sources (e.g. traffic data).

- And after that, we have to solve several parallel problems...

Examples of parallel problems

- Is the electric car driver able to charge the battery on several different chargers near the expected range?
- **Is the charger near the planned route?**
- **Will the electric car driver use air conditioning or heating?**
- What is technical parameters of charging systems (method and capacity of connection to the distribution network)?
- What is charger usage history and users behavior?
- What is the history of electric car rides?
- **What is current traffic situation?**

…

Illustrative example

- John's electric car has a battery capacity of 25 kWh with car range of 180 km. His drive will be approx. 250 km long, so he needs to charge the battery.
- **The navigation takes into account all available data** (e.g. traffic data, chargers reservation, range, weather...) **and offers several routes:**
  - 252 km (+12 km); 3:20 (+25 min. for charging); 15 Kč/kWh
  - 251 km (+20 km); 3:35 (+35 min. for charging); 10 Kč/kWh
  - 250 km (+9 km); 3:05 (+20 min. for charging); 26 Kč/kWh
  - 252 km (+2 km); 2:55 (+135 min. for charging); 6 Kč/kWh
- John chooses one route and **navigation will book charger** (smart contract) and John‘s journey can start.

Conclusion

- We would like to design a **solution that will integrate several data sources related to electromobility.**

- Proposed navigation solution will offer the best way how to easily charge the battery during the journey.

- Online database of chargers will consist of the traditional chargers (using main electric power transmission infrastructure) and chargers using local energy sources

=> **so it can help with electromobility development in the Czech Republic**.

Conclusion

- BUT we can prepare only a pilot study in the selected region.
- We can learn from the designed solution and recommend improvements.
- We can sell the final solution (with GPS navigation) to a more powerful organization, that can modify the solution for their conditions and ensure adoption in the Czech Republic.