Opportunities for Utilities to Propel the Mobility Transformation

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The journey of e-mobility

STORY:
- Founded in 2007
- Investment of USD 850 million
- 21 operational battery-swap stations
- 1400 cars deployed in Israel and Denmark
- Filed for bankruptcy in 2013

MAJOR PROBLEMS:
- High investments required
- Low demand for electric vehicles
STORY:
- Over EUR 100 million marketing campaign
- Over-optimistic forecast: 2.4 million electric vehicles in 2016 in Germany
- Actual: 74'754

MAJOR PROBLEM:
- High prices of electric vehicles
REGULATORY CHANGES:
- 1996: Import tax exemption
- 1997: Road tolls exemption
- 1999: Free parking in public spaces
- 2001: No VAT (usually 25%)
- 2005: Access to bus lanes
- 2009: Free access to road ferries

Source: Plug-in electric vehicles in Norway, Wikipedia, 2020
The journey of e-mobility: current situation

### Expectations
- 2007: Better Place
- 2009: RWE
- 2011: Norway

### Time

#### Electric market share (2018)

<table>
<thead>
<tr>
<th>Country</th>
<th>Electric Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>2%</td>
</tr>
<tr>
<td>Norway</td>
<td>49%</td>
</tr>
<tr>
<td>Germany</td>
<td>45%</td>
</tr>
<tr>
<td>France</td>
<td>4%</td>
</tr>
<tr>
<td>Spain</td>
<td>3%</td>
</tr>
<tr>
<td>Belgium</td>
<td>2%</td>
</tr>
<tr>
<td>Ireland</td>
<td>1%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1%</td>
</tr>
<tr>
<td>Denmark</td>
<td>1%</td>
</tr>
</tbody>
</table>

#### Number of EVs sold in H1 2019 (‘000)

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of EVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>60,000</td>
</tr>
<tr>
<td>Norway</td>
<td>6,000</td>
</tr>
<tr>
<td>Germany</td>
<td>4,500</td>
</tr>
<tr>
<td>France</td>
<td>3,000</td>
</tr>
<tr>
<td>Spain</td>
<td>2,500</td>
</tr>
<tr>
<td>Belgium</td>
<td>2,000</td>
</tr>
<tr>
<td>Ireland</td>
<td>1,500</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1,000</td>
</tr>
<tr>
<td>Denmark</td>
<td>1,000</td>
</tr>
</tbody>
</table>

### Rank of market size in Europe
- China: 1
- Norway: 2
- Germany: 3
- France: 4
- Spain: 5
- Belgium: 6
- Ireland: 7
- Switzerland: 8
- Denmark: 9
- Sweden: 10

Legend:
- Electric market share (2018)
- Number of EVs sold in H1 2019 (‘000)
- Green indicates all-time high
- Rank of market size in Europe
Manufacturers will have to comply or pay fines

**EU fleet-wide emission target of 95 g CO$_2$/km:**

<table>
<thead>
<tr>
<th>Type</th>
<th>CO$_2$ equivalent (l/100 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrol</td>
<td>ca. 4.1 l/100 km</td>
</tr>
<tr>
<td>Diesel</td>
<td>ca. 3.6 l/100 km</td>
</tr>
</tbody>
</table>

- **2020:** 95% compliance rate
- **2021:** 100% compliance rate

- Penalty: EUR 95 per g CO$_2$/km of exceedance for each car
Car manufacturers have to follow

Largest OEM’s are moving towards alternative fuels...

<table>
<thead>
<tr>
<th>OEM</th>
<th>EV strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Motors</td>
<td>Compact only, mixed strategy</td>
</tr>
<tr>
<td>Ford</td>
<td>Compact only</td>
</tr>
<tr>
<td>GM</td>
<td>Compact + vans</td>
</tr>
<tr>
<td>Honda</td>
<td>Compact only, mixed strategy</td>
</tr>
<tr>
<td>Hyundai</td>
<td>Compact only, in process of changing operations</td>
</tr>
<tr>
<td>PSA</td>
<td>Compact + SUV</td>
</tr>
<tr>
<td>Suzuki</td>
<td>Mixed strategy</td>
</tr>
<tr>
<td>Toyota</td>
<td>Full range under development</td>
</tr>
<tr>
<td>Volvo</td>
<td>Full range by 2022</td>
</tr>
</tbody>
</table>

by 2025, number of electric models will double.

Source: Transport & Environment
Total ownership cost of electric vehicles will be lower than ICE by 2025

EVs already offer cheaper fuel and maintenance costs...  
- Superior efficiency of EV leads to lower fuel costs, even when accounting for cost of charging equipment  
- Cost of maintaining EV is lower than of ICE  
- Also considers 'replacement' cost

...and falling vehicle costs will seal the deal...  

Vehicle cost, 2018

ICE: 21
EV: 24

Vehicle cost, 2025

ICE: 21
EV: 21

Note: Cost in USD; Source: ICCT, 2019
People are Willing To Pay (WTP) more for electric vehicles

Why are people willing to pay more for electric vehicles?

- Environmental mindset
- Hungry for new technology
- Be part of the movement
- Better safety standards

Source: The Future of Electric Vehicles in Southeast Asia, Frost & Sullivan, 2018
From a traditional mobility model towards a much more fragmented and digital one, opening up markets for many players.

- **EV DRIVER**
  - Home charging
  - Destination charging
  - Public / rapid charging

- **POD OWNER**
  - Private company PA

- **ENERGY PROVIDER**
  - Electricity networks

- **POD**
  - Recharging station

- **POINT OF DELIVERY**

- **CHARGING POINT OPERATOR (CPO)**
  - POD contract holder
  - Responsible for the hardware (design, permitting, installation, connection, maintenance)
  - Monitoring and control

- **HARDWARE MANUFACTURER**

- **ELECTRO-MOBILITY MANAGEMENT (EMM)**
  - IT infrastructure management
  - Service provider to other CPO/MSP

- **SOFTWARE DEVELOPER**

- **MOBILITY SERVICE PROVIDER (MSP)**
  - Fare definition, invoicing
  - Customer caring services
Investments into grid and charging infrastructure have increased.

**OPPORTUNITY 1: INFRASTRUCTURE DEVELOPMENT**

**Raises questions:**

- Optimization of charging infrastructure layout
- Identification of suitable charging technology
- Determination of user segments and vehicle types
- Utilization of charging stations
- Estimation of costs and revenues
- Cost of ownership
Beyond only delivering electricity, utilities can provide additional services.

New business areas:
- Smart metering (peak shaving)
- Flexibility for the electrical grid
- Hardware responsibility
- IT infrastructure management
- Questions of ownership and operations
- Provision of subscriptions (e.g. Alpiq Juicar)
Companies are committing to electrify their vehicle fleets

- Electrify their own vehicle fleet
- Build knowledge and act as consultants
- Support others to do so:
  ➢ Taxi companies
  ➢ Cities
  ➢ Co-driving
  ➢ Car rental companies
Our work in mobility spans a range of different areas, from business models to grid connections, to fleet management

**EV charging market entry in China**
- International energy company needed advice for early stage examination of opportunities in EV charging in China
- Screened regional Chinese policies
- Identified the most attractive regions according to screening criteria
- Assessed regulatory environment, cost, typical driving behaviour
- In-depth and localised model for EV charging based on location

**Commercial due diligence for battery storage and EV charging**
- Client was a pension fund looking to invest in a development portfolio of GW scale batteries with private wires to support EV charging
- Helped client to understand and project future revenue streams
- Analysed management business model and assumptions
- Facilitated client understanding of competitive landscape and future evolution

**Electrification of client fleet**
- Supported automotive company in the analysis of regulatory and energy market characteristics on the design and operation DC-fast charging depots for electric vehicle fleets
- Defined parameters of business model and dimensions for charging stations
- Used scenarios in order to answer questions on the energy market/grid connection