Driving the Renewable Revolution

Electric Vehicles as the Key Enabler to a Renewable Future

June 7, 2023
Introduction

White label platform
In essence, smart charging means **increasing or decreasing the maximum charge rate of an EV.**
Power Grid

Generation  Transmission & Distribution  Consumption
Power Grid

Generation

Must be equal

Consumption
Power Grid

Generation

Consumption

Must be equal

Up to now:
Generation is directed by consumption
Power Grid

Demand side response: Consumption is directed by generation

Generation

Must be equal

Consumption
Power Grid

Generation

Energy Markets:
- Forward and futures
- Day-ahead
- Intraday

Consumption
### Overview

**Rundum Köln**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>71.01 km</td>
</tr>
<tr>
<td>Moving Time</td>
<td>1:53:27</td>
</tr>
<tr>
<td>Elevation</td>
<td>703 m</td>
</tr>
<tr>
<td>Weighted Avg Power</td>
<td>266 w</td>
</tr>
<tr>
<td>Total Work</td>
<td>1,577 kj</td>
</tr>
<tr>
<td>Avg Speed</td>
<td>37.6 km/h</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>143 bpm</td>
</tr>
<tr>
<td>Cadence</td>
<td>91</td>
</tr>
<tr>
<td>Max Speed</td>
<td>74.5 km/h</td>
</tr>
<tr>
<td>Heart Rate Max</td>
<td>172 bpm</td>
</tr>
<tr>
<td>Cadence Max</td>
<td>237</td>
</tr>
<tr>
<td>Calories</td>
<td>1,580</td>
</tr>
<tr>
<td>Temperature</td>
<td>15 °C</td>
</tr>
<tr>
<td>Elapsed Time</td>
<td>1:58:21</td>
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User: Martijn Verbeek

Date: 09:33 on Sunday, 21 May 2023

Location: Innenstadt, Germany

Garmin Edge 1000

Bike: S-Works Tarmac SL6
Power

Some perspective...

A typical EV can take more power than multiple household appliances combined!

Or ~45 CE0s (11 kW)
Flexibility

Definition

“The capability of shifting energy consumption in time, within the boundaries of end-user comfort requirements, without changing its total energy consumption.”
Power

Some more perspective...

Total installed capacity NL (2020): 42.2 GW

10 Million

x 11 kW

Total potential 100 GW of flexible power!!
### Flexibility

<table>
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<tr>
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<th>Cost</th>
<th>Impact</th>
<th>Availability</th>
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<td>+</td>
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</tr>
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<td>+</td>
<td>+</td>
</tr>
<tr>
<td><img src="image" alt="Factory" /></td>
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<tr>
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</tr>
<tr>
<td><img src="image" alt="Appliance" /></td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*greenflux*
### Flexibility

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<th>Cost</th>
<th>Impact</th>
<th>Availability</th>
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</thead>
<tbody>
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<td><img src="positive.png" alt="Positive" /></td>
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<tr>
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<td><img src="negative.png" alt="Negative" /></td>
<td><img src="positive.png" alt="Positive" /></td>
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</tbody>
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*Electric Vehicles are a Key Enabler to a Renewable Future*
Almost got it right!

Ask not what your country can do for you – ask what you can do for your country.

John F. Kennedy
JFK
Almost got it right!

the grid your EV
Ask not what your country can do for you –
ask what you can do for your country.

your EV the grid

John F. Kennedy
Bob Elders
JFK
Almost got it right!

If only we had the technology...

John F. Kennedy
Bob Elders
How we implement it
How we implement it

Energy / Flex Trade Floor

API

Grid Operator

Take any input...

... apply the best algorithms...

... control millions of EVs
We already apply this!

EPEX Price Steering Optimisation

Goal:
Minimize Energy Procurement Costs

Two degrees of flexibility:
• Load reduction
• Time shift
What about Grid Congestion?

MV Transformer Load Reduction
Summary

Balance is crucial in a Power Grid

EVs offer the flexibility we need

Stabilise the grid by optimising for price

We already apply this in the field
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