

**Integration of electric vehicles and power grids (VGI)**

**Vision 2030 for Germany:  
Reduction of CO<sub>2</sub> without subsidies: up to 39 mtpa**

**10 million emission-free cars in 2030**

**September 2019**

# Make EVs cheaper than conventional cars through creating value from provision of battery energy services



## TMH VGI-Initiative

### TMH Approach

- EV + **bidirectional charger** should become **cheaper** than ICE regarding initial cash investment.
- This will enable **mass adoption** of EVs on socially equitable basis.
- It can be achieved by factoring-in the **value of VGI**.
- For this we need VGI with **equal legal framework** for EVs and stationary storage regarding levies.
- **€4300 per car** – VGI present value over 10 years.
- **€1700 per battery + charger** – VAT reimbursement.

### 2030

- **10 million EVs** in Germany in 2030 are ambitious but **possible\***.
- Norway – **more than 50% of new sales are EVs** as soon as all-in cash costs are lower than ICEs.
- German grid volatility provides unique opportunity to do the same with **no additional burden on taxpayers**.
- Just **regulatory changes** and **VAT treatment** of the battery and the charger as business are needed, to achieve value of **€6000 per car without subsidies** – higher than the current subsidy of **€4000** in Germany.

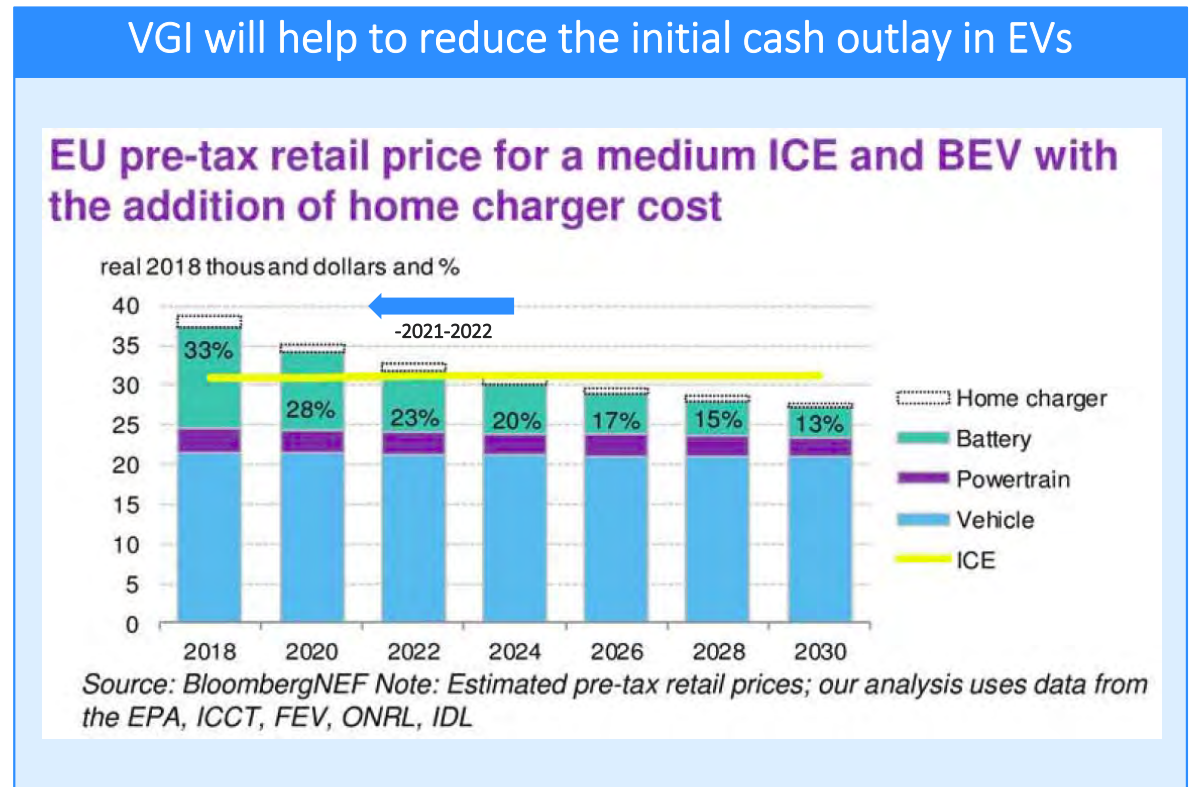
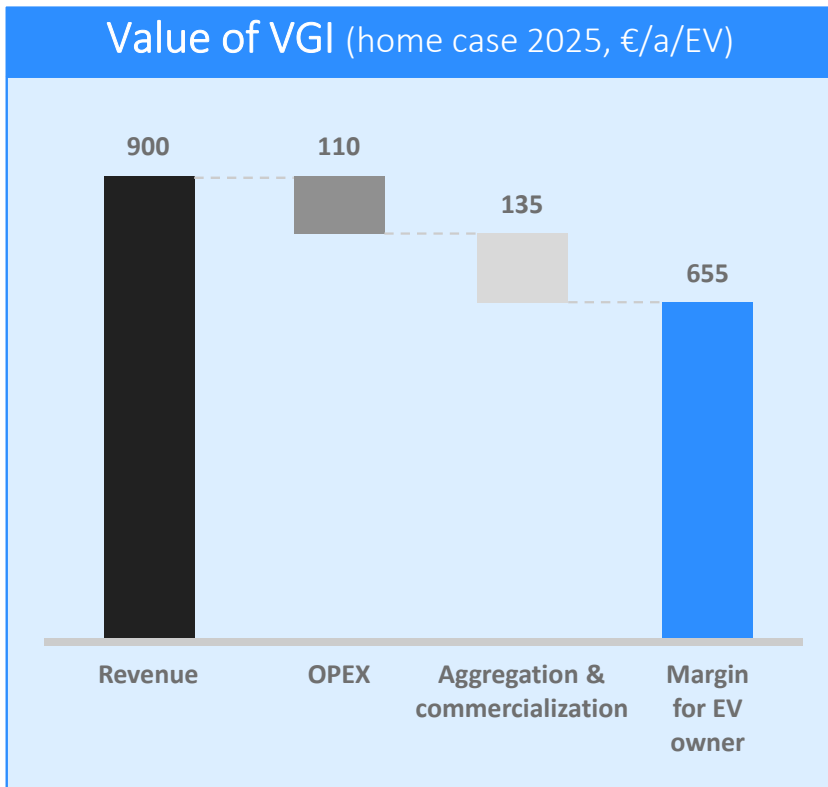
\* NPM (Report by WG1 of the 'Future of Mobility' National Platform, March 2019)  
Source: The Mobility House, NPM



# Germany can have 10 million EVs on the road in 2030 if cash costs of EVs are lower than ICE sooner rather than later



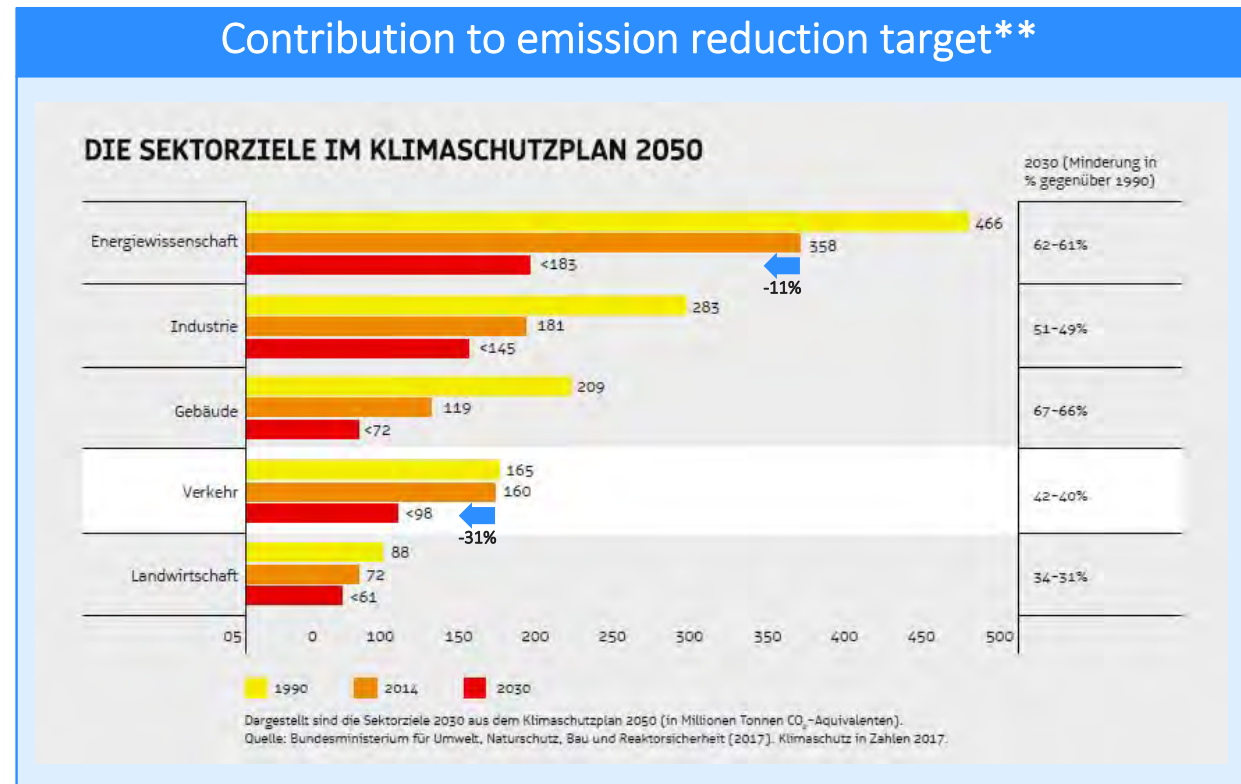
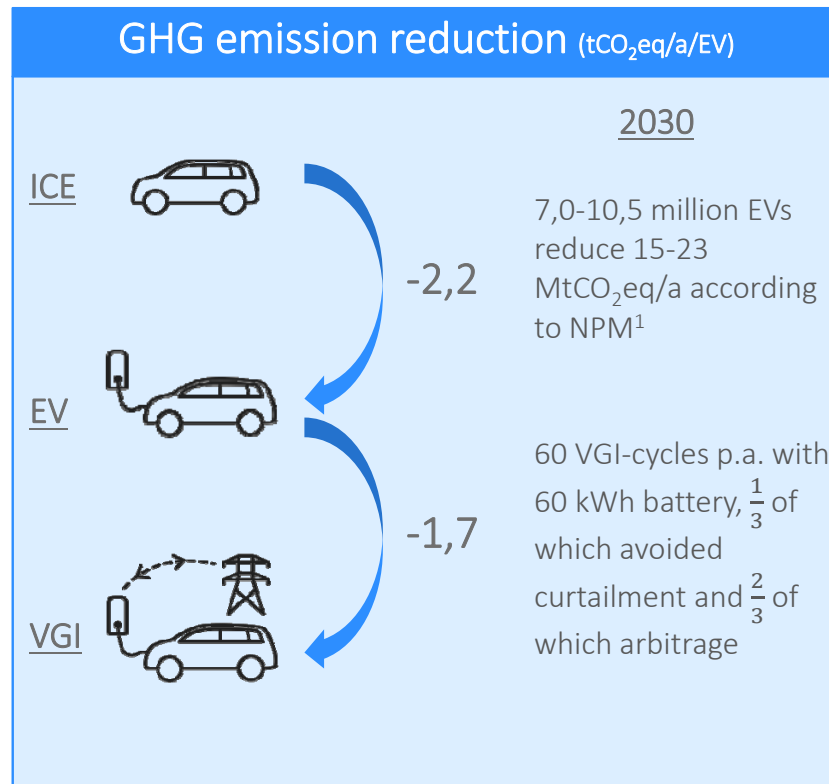
€6000 per car will allow reaching parity between EVs and ICEs as soon as the regulatory changes are made



# VGI can contribute significantly to the emission reduction targets of the German government as well as address curtailment on local level



Prize of VGI – enable Verkehrswende with 10m EVs in 2030 and increase CO<sub>2</sub> reduction per EV



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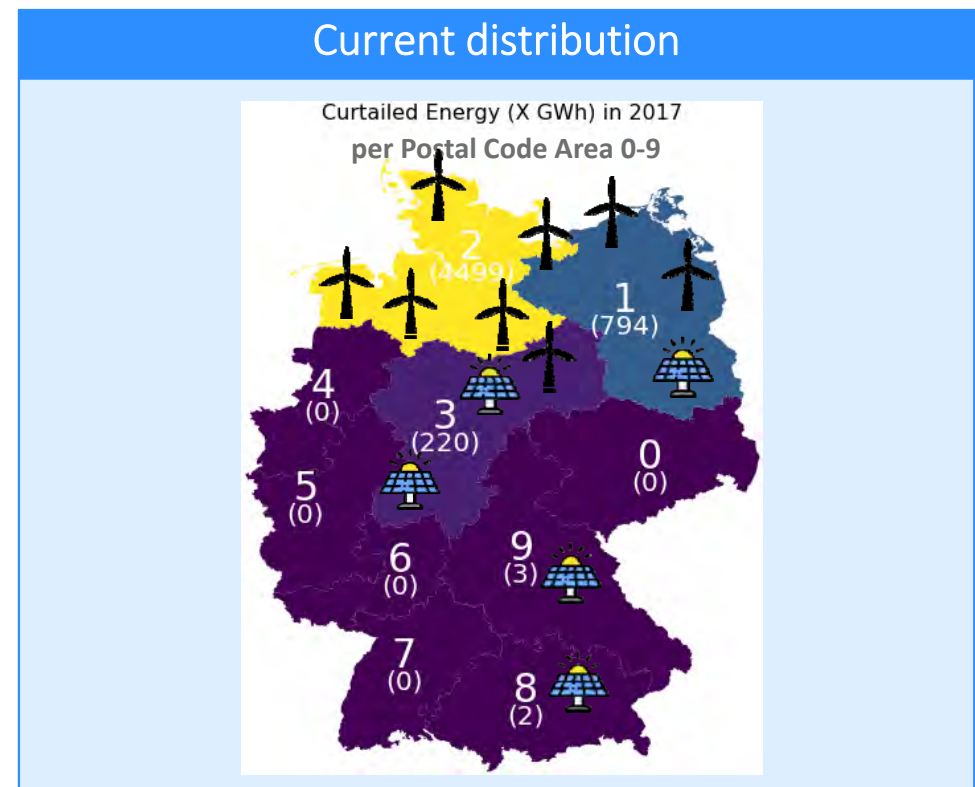
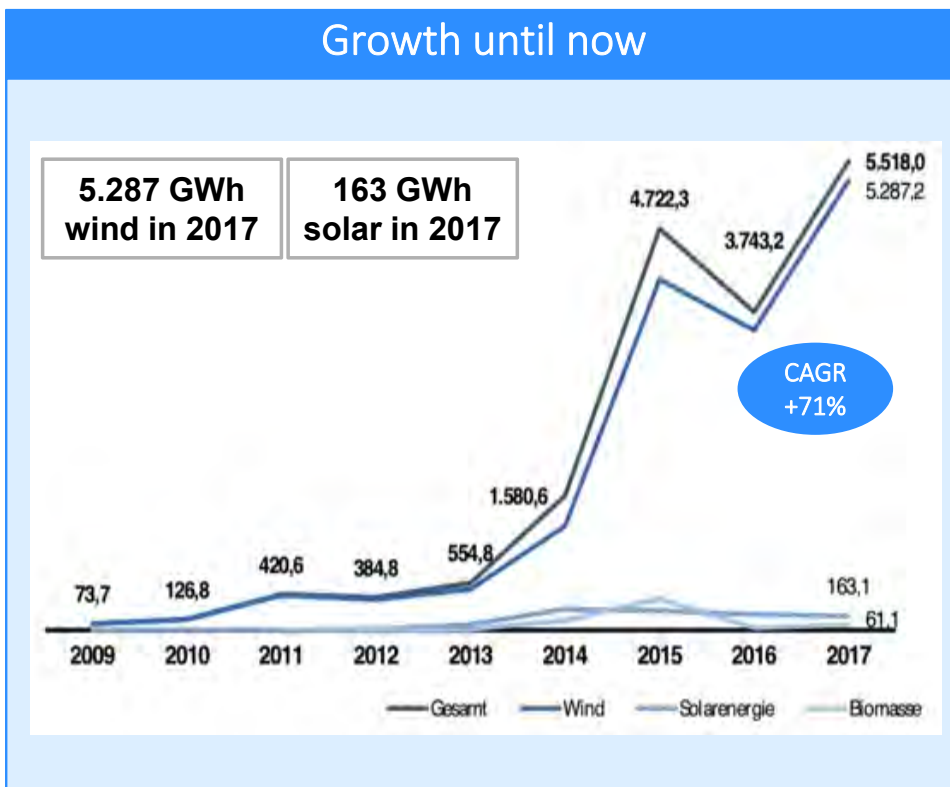
• \*\* Assuming 50-50 allocation to Transportation and Energy sectors

Source: The Mobility House, NPM

# Curtailment occurs currently primarily in northern Germany and grew annually by 71% on average since 2009, with 5.5 TWh curtailed in 2017



Curtailment growth will continue as renewables increase from 38% in 2018 to 65% in 2030



# 10 Million EVs with VGI in Germany would be a key element for achieving German 2030 CO<sub>2</sub> reduction targets



## Call for action – what is needed?

- **Equal footing of EV swarm batteries on vehicle-grid-integration technology with other sources governed by the German Renewable Energy Act (EEG)**
  - Apply grid and renewables' levies only to energy consumed for driving, **not** the temporarily stored energy.
- **Commitment to using decentralized storage to avoid curtailment of renewable energy and to supply system services to relieve pressure on the grid**
  - Create unlimited access to ancillary services and short-term energy markets for EV swarms by reducing the commitment periods and power thresholds.
  - Use the features of battery storage such as precision, fast reaction & ramping times and their distributed nature with corresponding grid service products – as already successfully in place in some US regions.
- **Cooperation of stakeholders (BNetzA, DSOs and TSOs, car manufacturers, car leasing companies, lenders, KfW and aggregators like TMH) to work together to develop new models for funding VGI**
  - TMH has systems and processes in place and the model's technical feasibility has been verified with leading car manufacturers and successfully tested in pilot projects in Germany and Europe.

**TMH has proven track record in VGI**

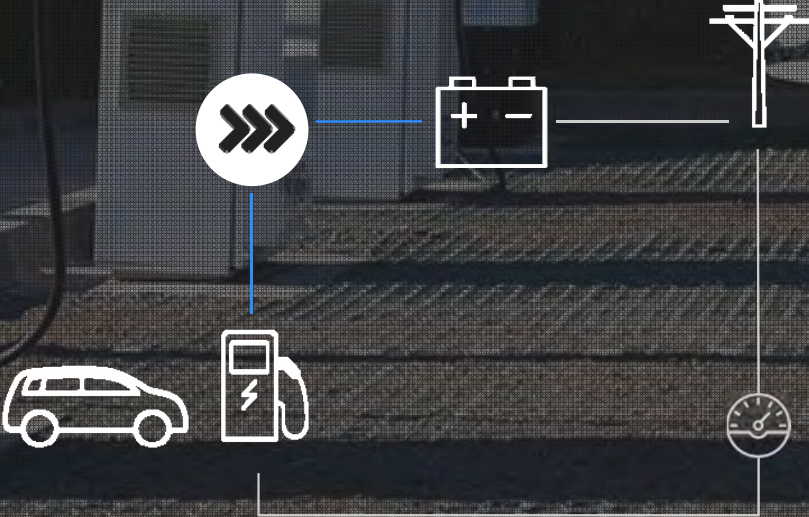




# First EV stabilizing German electricity grid

## FCR with EVs

- > Generation of revenues through supply of FCR (Frequency Containment Reserve)
- > Prequalification for FCR following TSO directives identical to a large-scale power plant



EXAMPLE



Source: The Mobility House



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**EXAMPLE**

# Audi opens battery storage on Berlin EUREF Campus

Multi-use Stationary Storage with Volkswagen Group





# Impressions inside of battery storage

## Stationary Storage with Daimler

Spare part batteries



Source: The Mobility House

Second life batteries

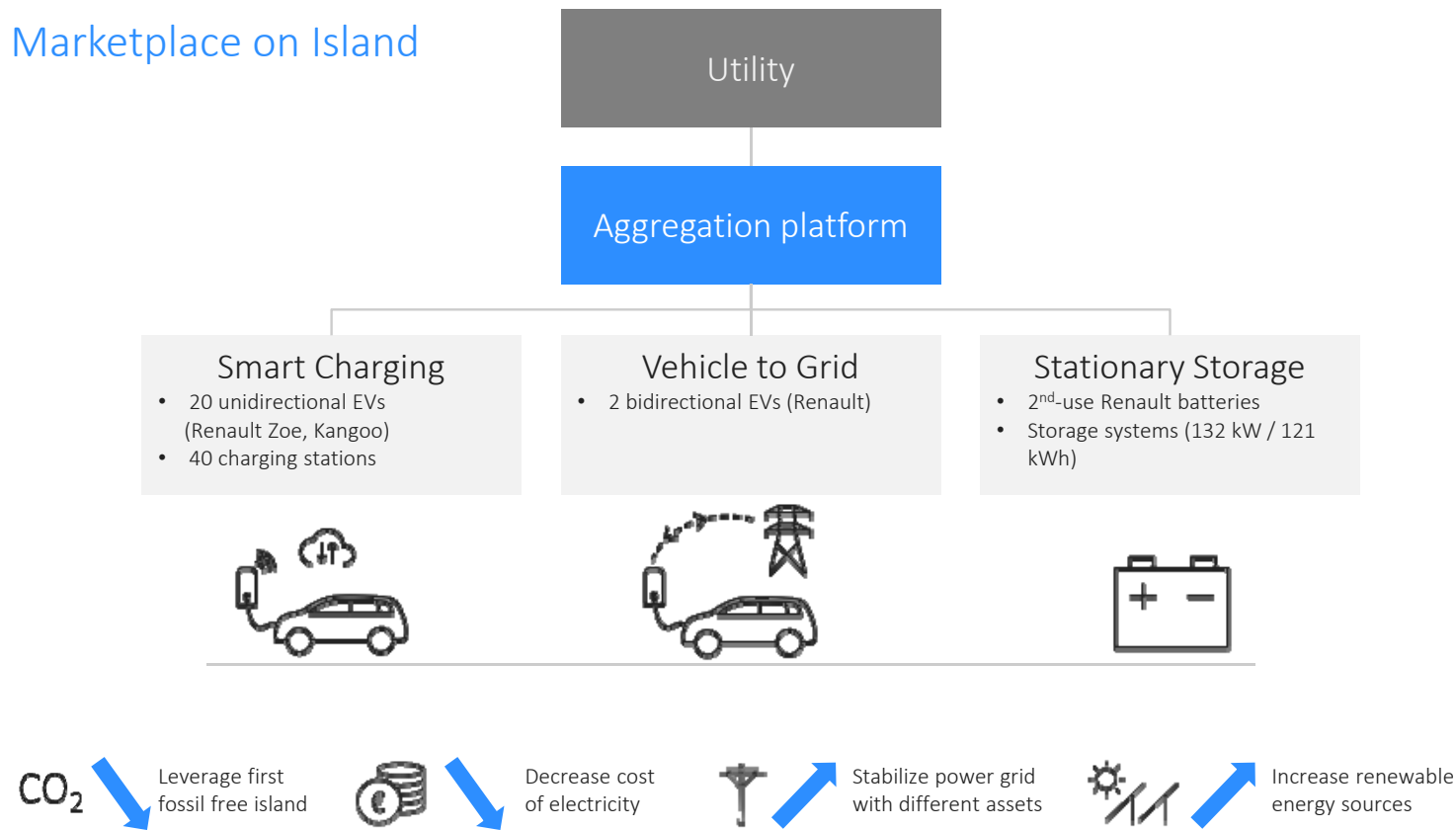


Inverter and DC cabinets



# Porto Santo is the first island powered by Renault EVs managed by TMH

## Marketplace on Island



<http://www.mobilityhouse.com/en/the-mobility-house-groupe-renault-realizing-first-smart-electric-ecosystem-porto-santo-island/>

Source: The Mobility House

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**EXAMPLE**

# EV-battery based multi-use storage system generates revenues through various services

ESS Amsterdam



Optimized PV Integration



Peak Shaving & Backup Power



Grid Services



Vehicle-to-Grid



EV Car Sharing



*3 MW / 2.8 MWh storage system made of 148 Nissan Leaf batteries*



**JOHAN CRUYFF  
ARENA**



Source: The Mobility House