

Transport electrification and V2G

A new purpose for vehicles: catalyzing the transition to sustainable energy

Caribbean countries MOVE webinar
September 2020



ONE
SINGLE
PLANET





TRACKING IRMA

THROUGH NEXT THURSDAY

**U.S. IMPACTS
UNCERTAIN**

EURO MODEL ENSEMBLES

BERMUDA

**LATE NEXT WEEK/
WEEKEND**

**THE
BAHAMAS**

PROBABLE



POSSIBLE

LIKELY

**The
Weather
Channel**

Climate change: a call for smart energy solutions

Our team

Unique global expertise in the field of e-mobility

- Over 10 years of experience
- Largest independent EV Office worldwide
- Multidisciplinary backgrounds
(e.g. technical, commercial, economic, legal)
- International experience with e-mobility
strategy, project management and innovation



Our work



Accelerating EV in 400 projects
in 20 countries



Our clients

Government



Ministerie van Economische Zaken

Energy & Utility



Automotive & Operators



Volkswagen



Our home base



Amsterdam ambition: 100% electric cars in 2030

E-mobility is inevitable



- Purchase **price parity around 2025** – depending on sector & geographical context
- **Lower operation cost** for EV; maintenance down to 30% and energy cost 25-50%



- **>400 km range is the new normal**; enough for the average consumer
- It's a mind shift: instead of fueling you will **charge where you park**; at home or at office



- European grid mix charged **EV results in 50% lower CO2 emissions** over whole lifetime
- Smart charging and Vehicle-to-grid will make EV **an asset for the grid**, instead of a threat



- **Million mile batteries**; long lifetime in the vehicle; and repurposed as second-life battery
- New battery chemistries allow for **75% reduction in cobalt**, nickel, etc.



Today

Transport electrification and V2G

1. The future and the potential
2. The road to get there



Today

Transport electrification and V2G

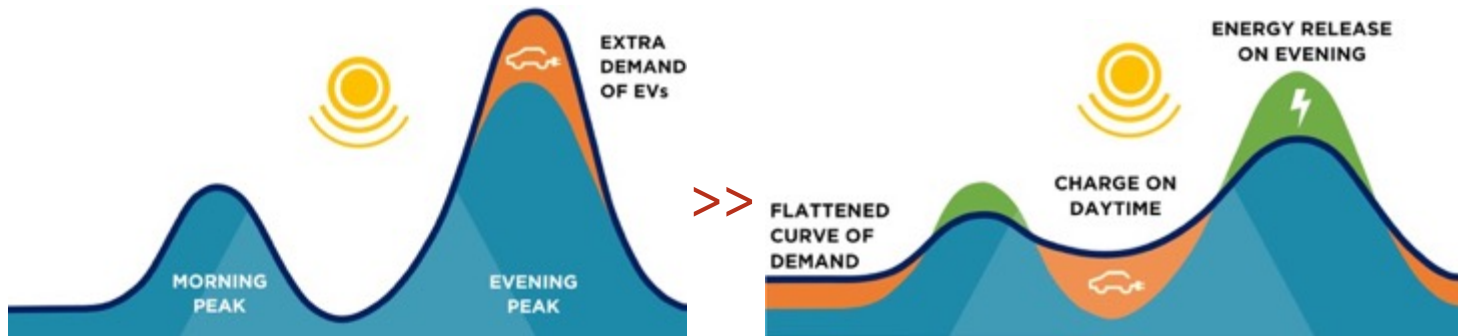
1. The future and the potential
2. The road to get there



V2G: electric car as a grid asset

Energy transition requires flexibility and storage

> can be provided with electric vehicles



Proving that it works



The popular Mitsubishi OUTLANDER PHEV is the first car in the Netherlands to balance the Dutch energy network using V2G-technology. Every Mitsubishi OUTLANDER PHEV and its battery already having the capability to utilize a V2G charge point.

“The Mitsubishi Outlander PHEV, with its 12 kilowatt-hour battery, stores as much energy as the average family consumes in one day.”



▲ De Nissan Leaf kan woonhuizen van groene stroom voorzien, zolang hij genoeg voorraad in zijn batterijen heeft en voorlopig toch even niet de weg op hoeft © Nissan

Electric car supplies Amsterdam neighbourhood with green electricity

Een elektrische deelauto heeft in Amsterdam stroom terug geleverd aan het publieke elektriciteitsnet. De Nissan Leaf van Buurauto leverde tijdens de test elektriciteit aan woningen via een zogenaamde Vehicle-to-Grid-laadpaal van NewMotion.

Global review of V2G projects



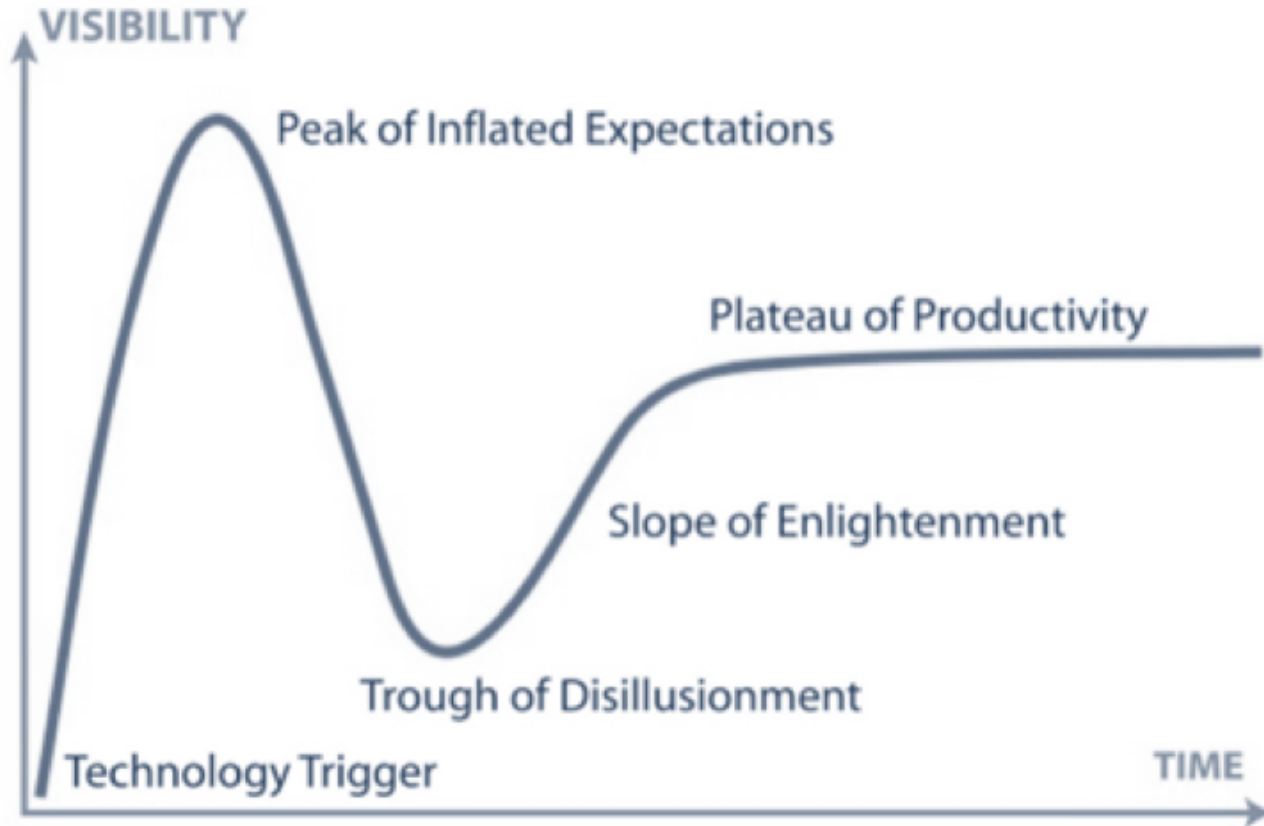
THE V2G MAP OF THE WORLD



Innovate UK

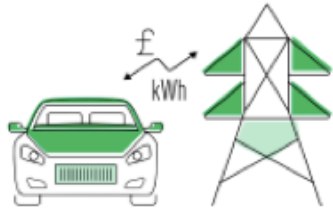


My personal V2G hype cycle

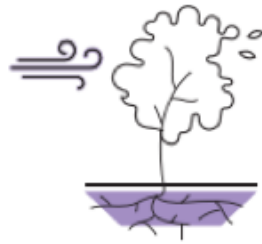


V2G benefits

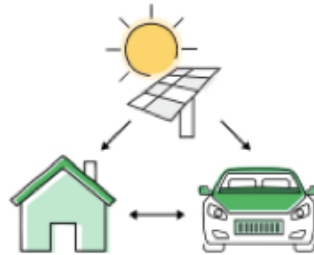
Value Propositions



**Revenue-Generating
Energy Trading**



Resilience



**Personal Net Zero /
Self Sufficiency**



Benefit to Society



**Enhanced Battery
Management**

+650
€/EV/year



Drive for Free with V2G



- Earn annual revenues equivalent to 8,000 EV costed miles a year
- £2,000 for 10kW V2G fast charger + standard installation (similar cost to a normal fast charger)
- Preferential leasing rates on V2G compatible Nissan models
- 5 year contract duration including supply
- Access to customer support
- Smart back office system that includes fleet management and charge scheduling apps
- Guaranteed charge for your vehicle's daily needs

Mauritius

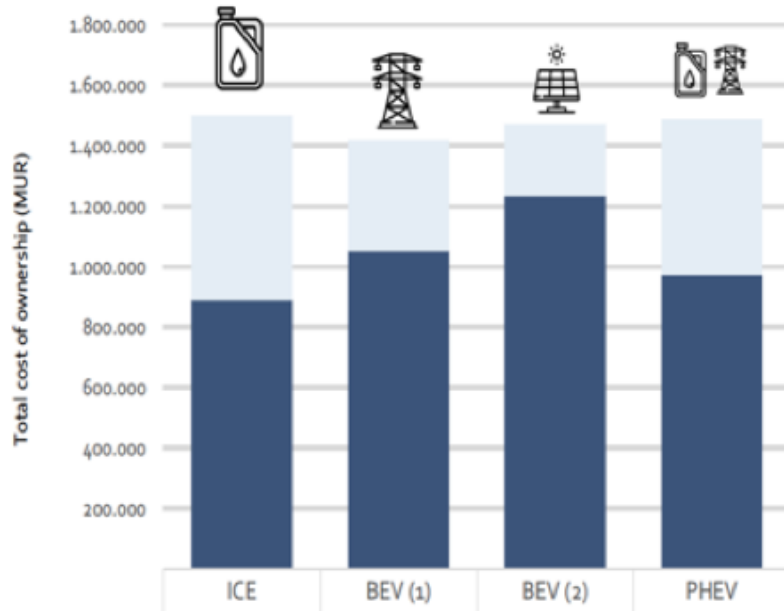


A 10 year Roadmap for the integration of electric cars

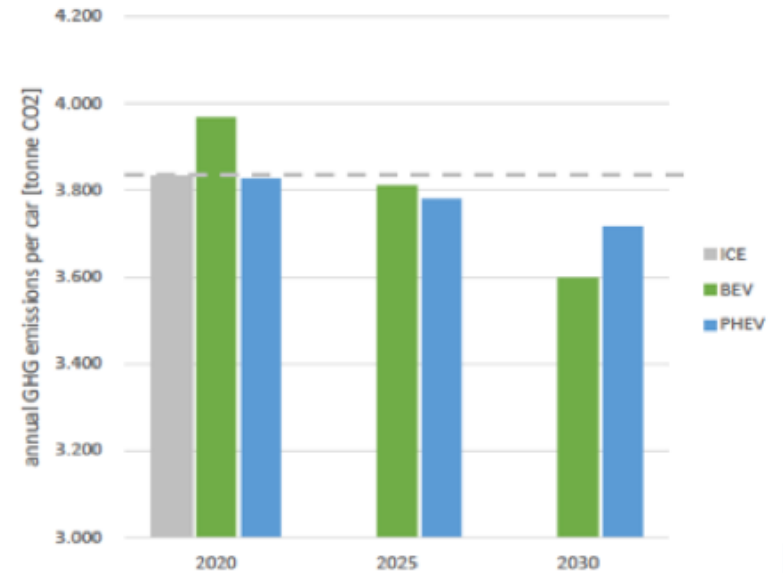


Mauritius

Total cost of ownership

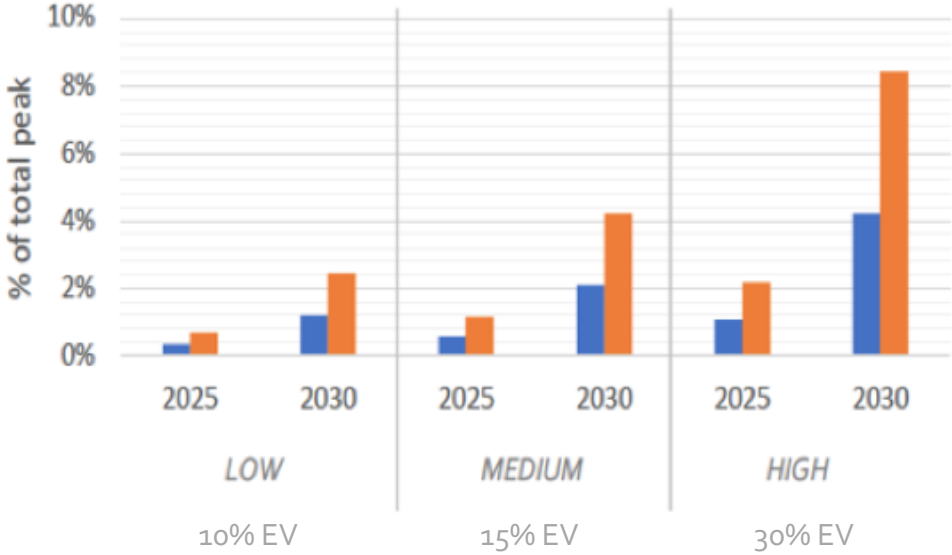


Annual GHG emissions

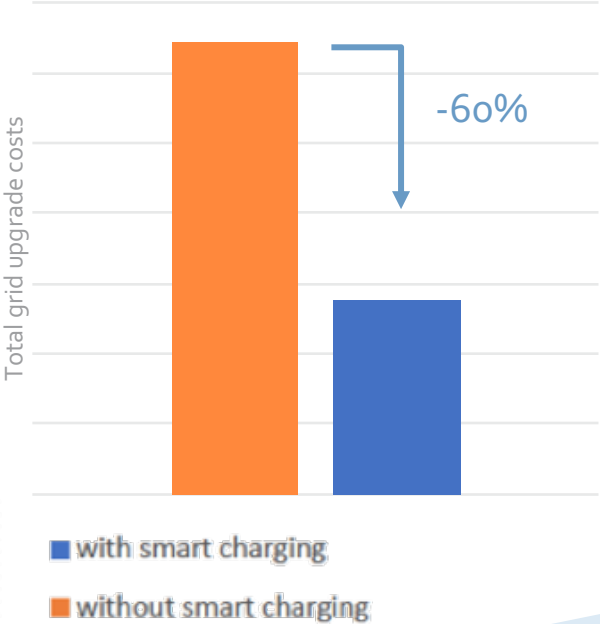


Mauritius

Additional grid peak of EVs



EV grid integration cost

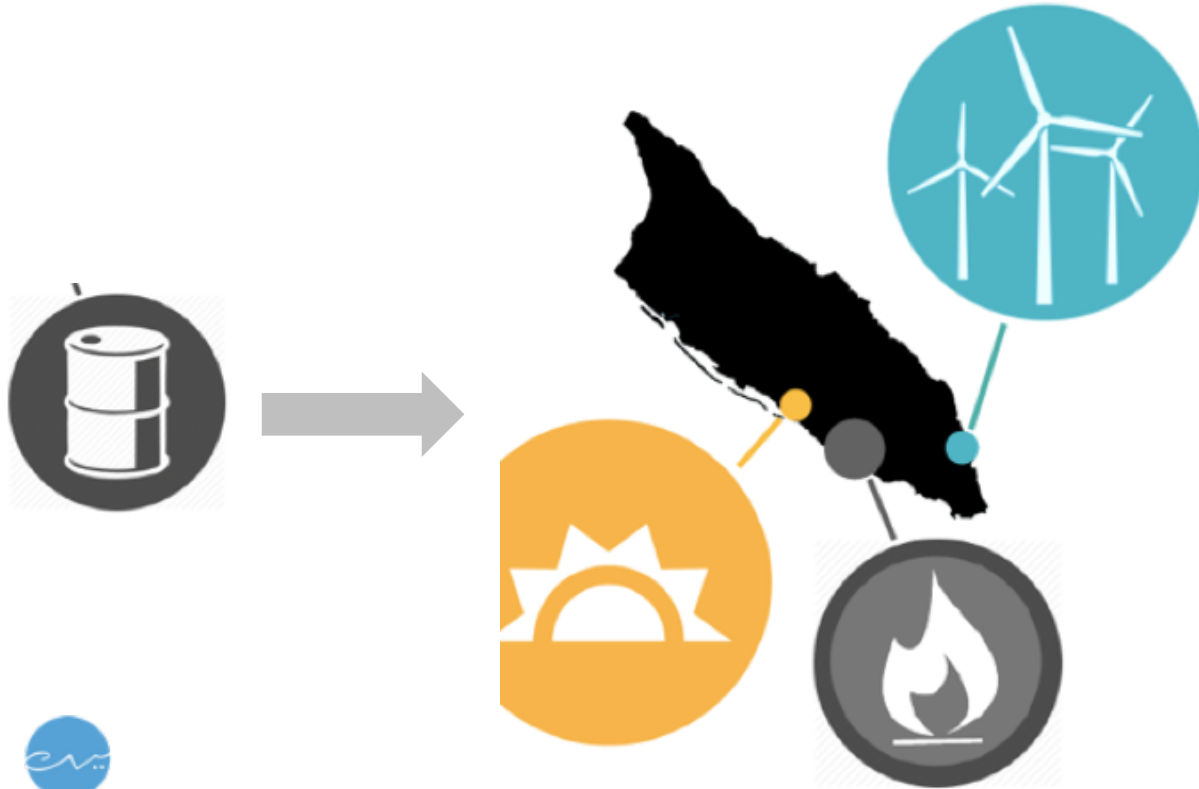


Aruba

- 100,000 INHABITANTS
- 50,000 PERSONAL CARS
- 100 MW AVERAGE DEMAND
- 17% RENEWABLES



Aruba



FUTURE POWER SYSTEM:

= 70% RENEWABLES

TWO SCENARIOS:

- **DOMINANT WIND**

Wind 160 MW

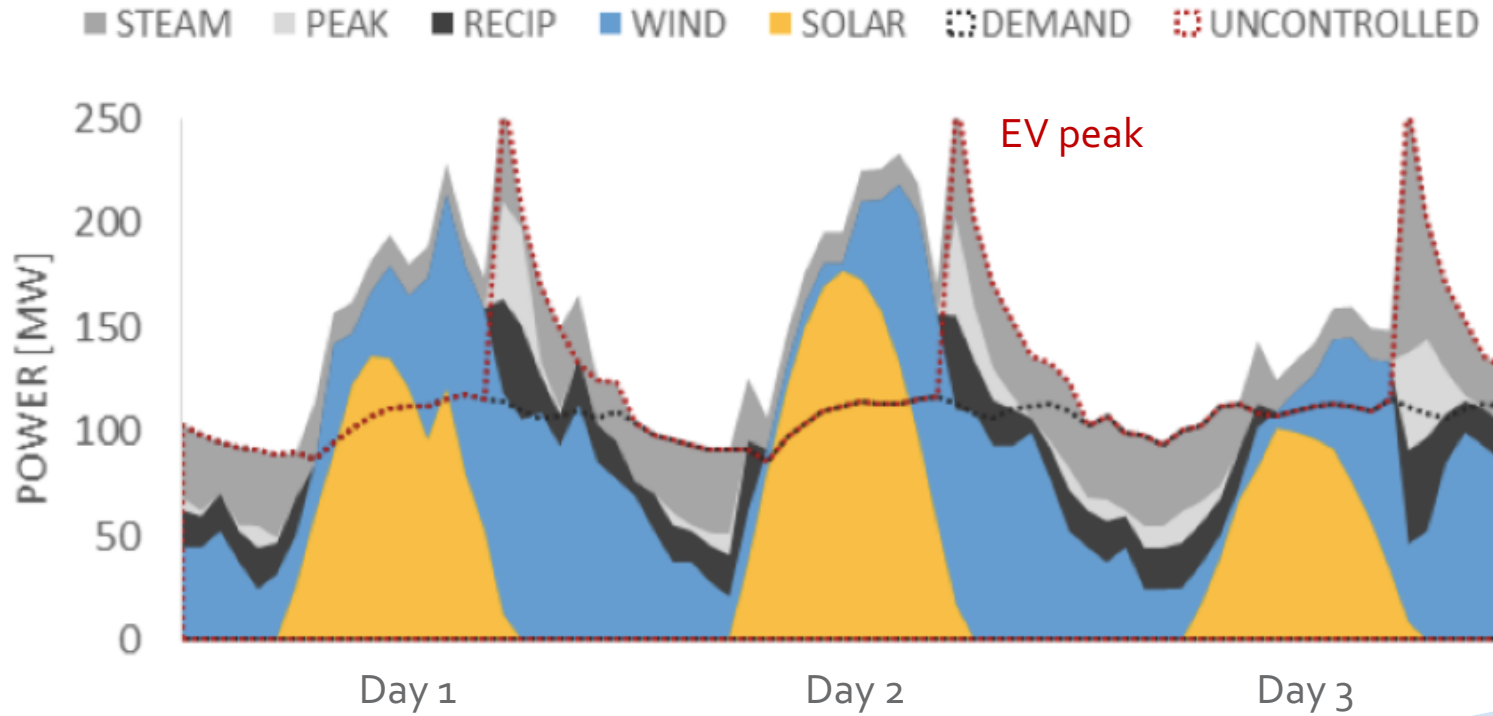
Solar 60 MW

- **DOMINANT SOLAR**

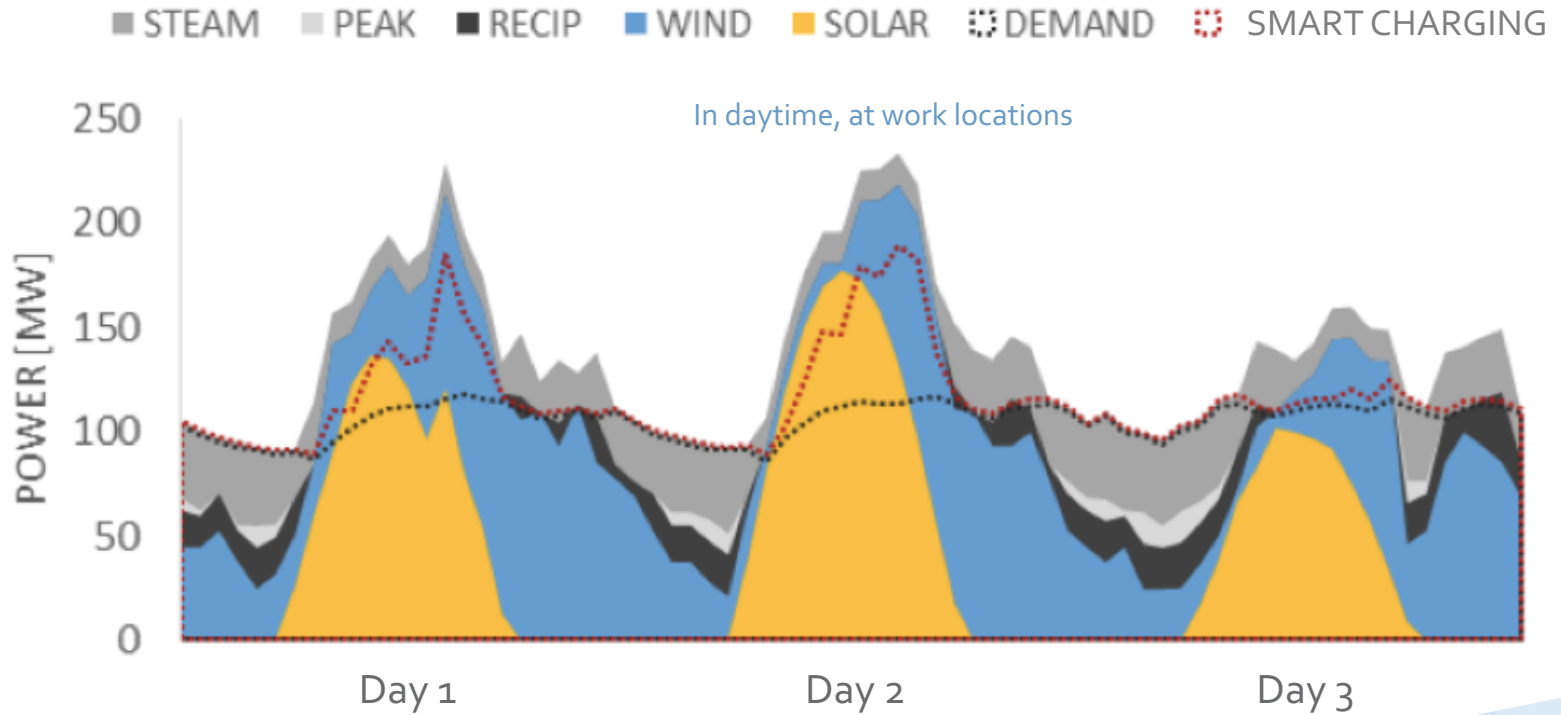
Wind 120 MW

Solar 200 MW

Aruba

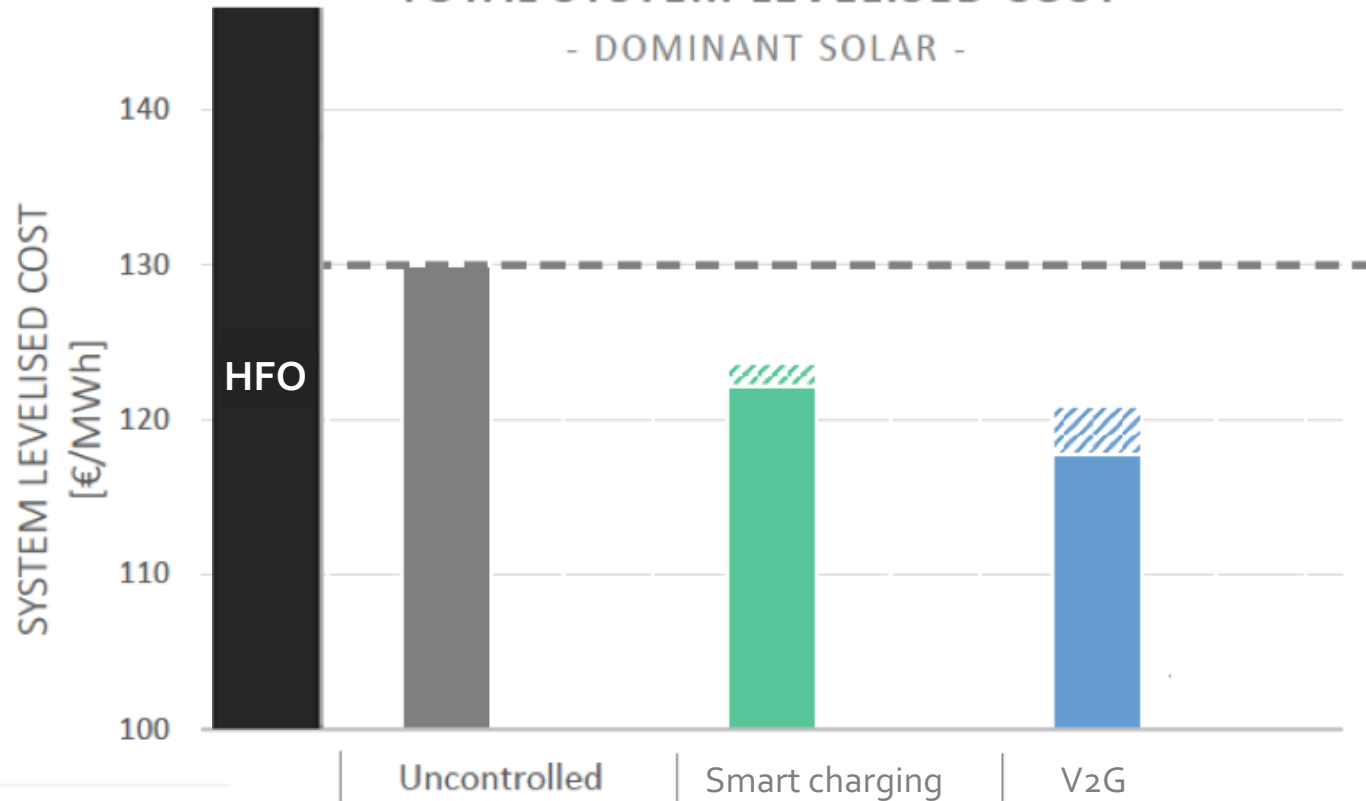


Aruba



Aruba

TOTAL SYSTEM LEVELISED COST - DOMINANT SOLAR -



Hawaii

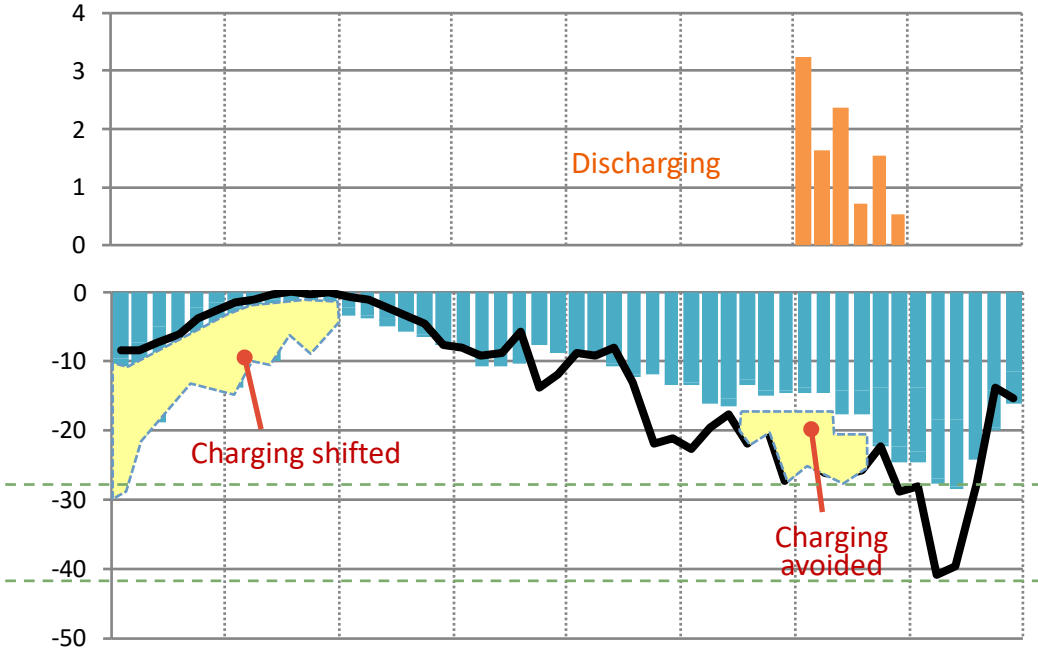
A stylized map of the Hawaiian Islands is shown against a teal background with white speckles. The islands are colored in shades of yellow and light blue.

HAWAII

Smart grid project with 80 bidirectional EVs
for peak shaving & frequency support



Hawaii



“We delivered V2G at scale,
from real world families we
had no control over”

- Project representative, Hitachi

Peak after project start

Peak before project start



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V2G ecosystem



V2G ecosystem

CAR OEMs



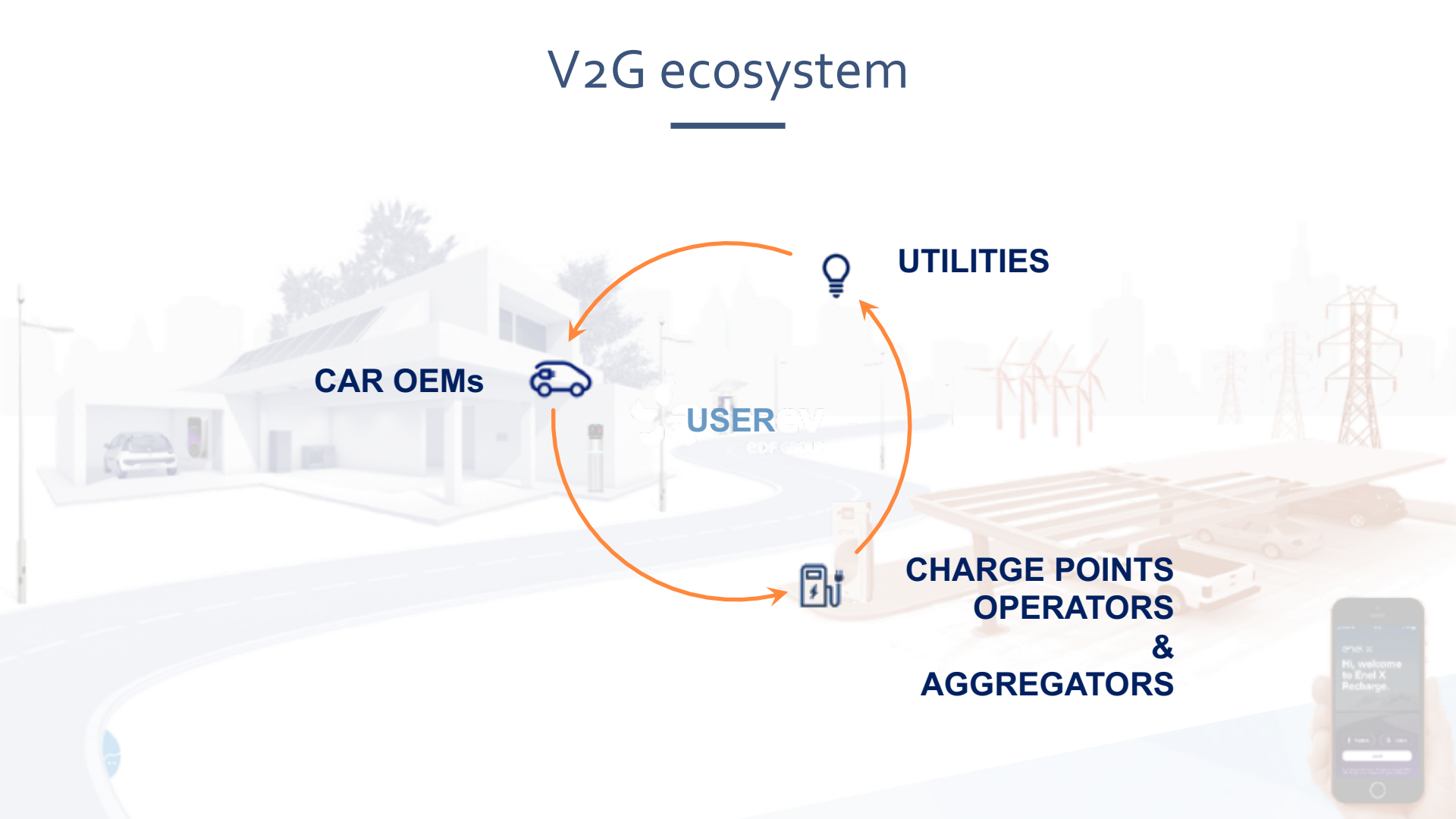
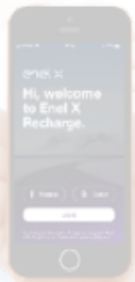
USER EV
EDF GROUP



UTILITIES



**CHARGE POINTS
OPERATORS
&
AGGREGATORS**



V2G cars

2013

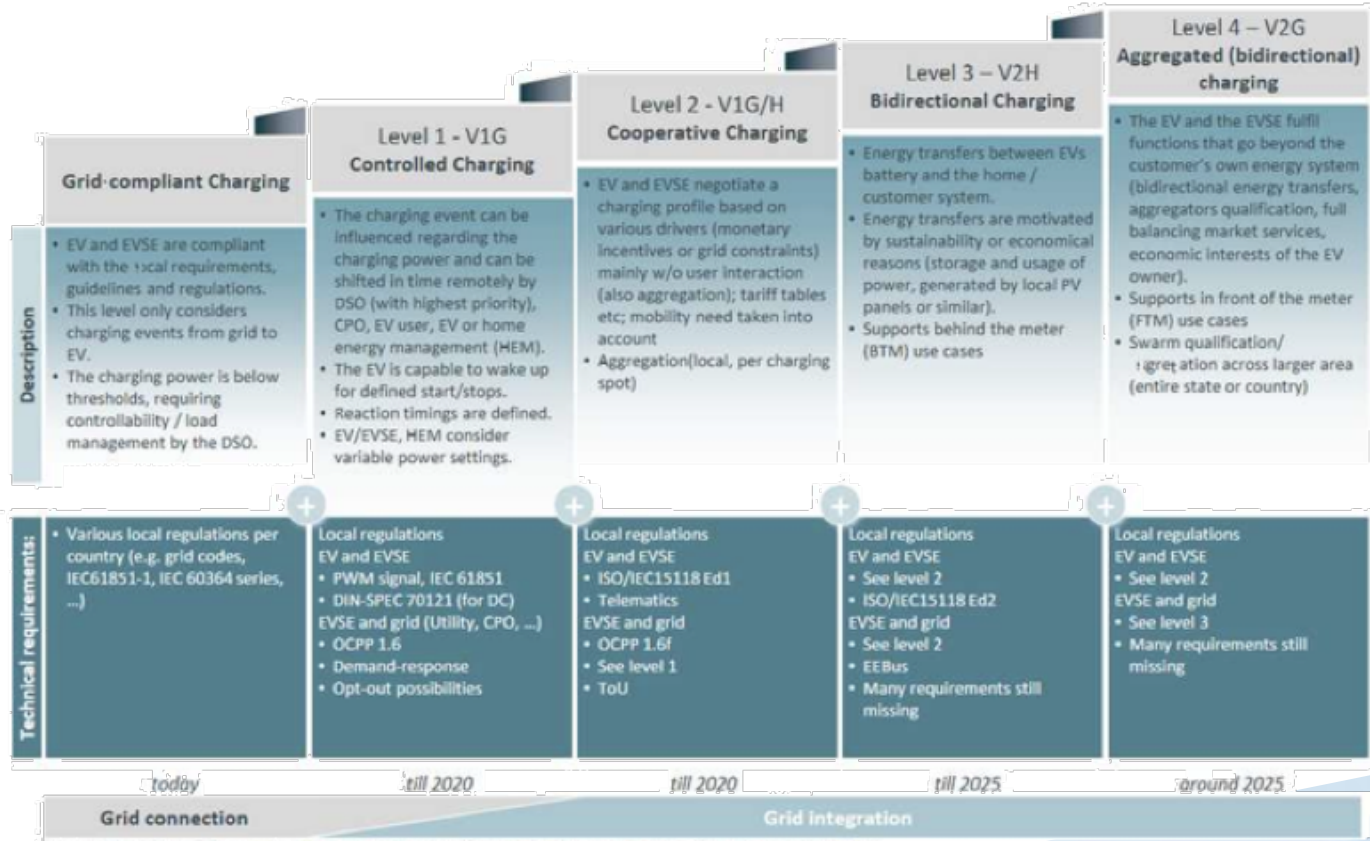
2019

2020

<2025



V2G standards



EV – electric vehicle, EVSE – electric vehicle supply equipment, DSO – distributed system operator, CPO – charge point operator

Coordination Office CharIN

G/Ö-Inng.: Sperlsh GmbH

V2G chargers

2017



2020



V2G chargers

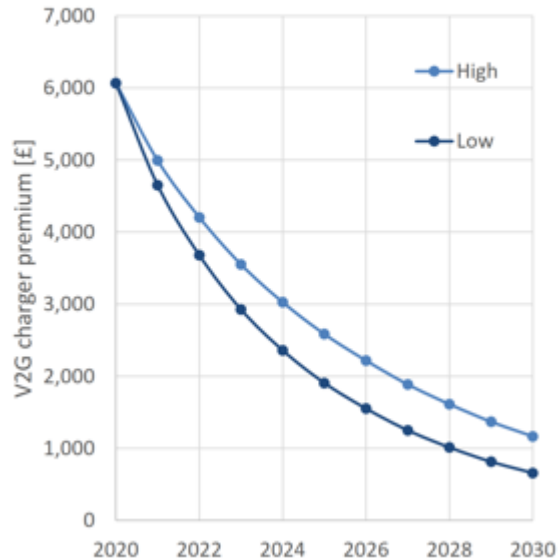


World's first compact bidirectional home charger



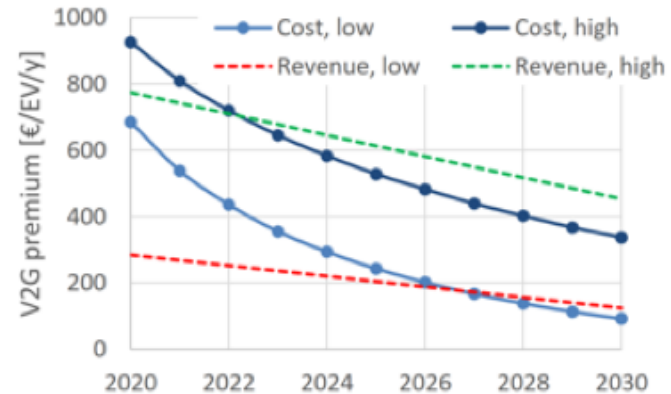
V2G business case

Cost-down trajectory for V2G charger



Cost vs revenues 10y lifetime

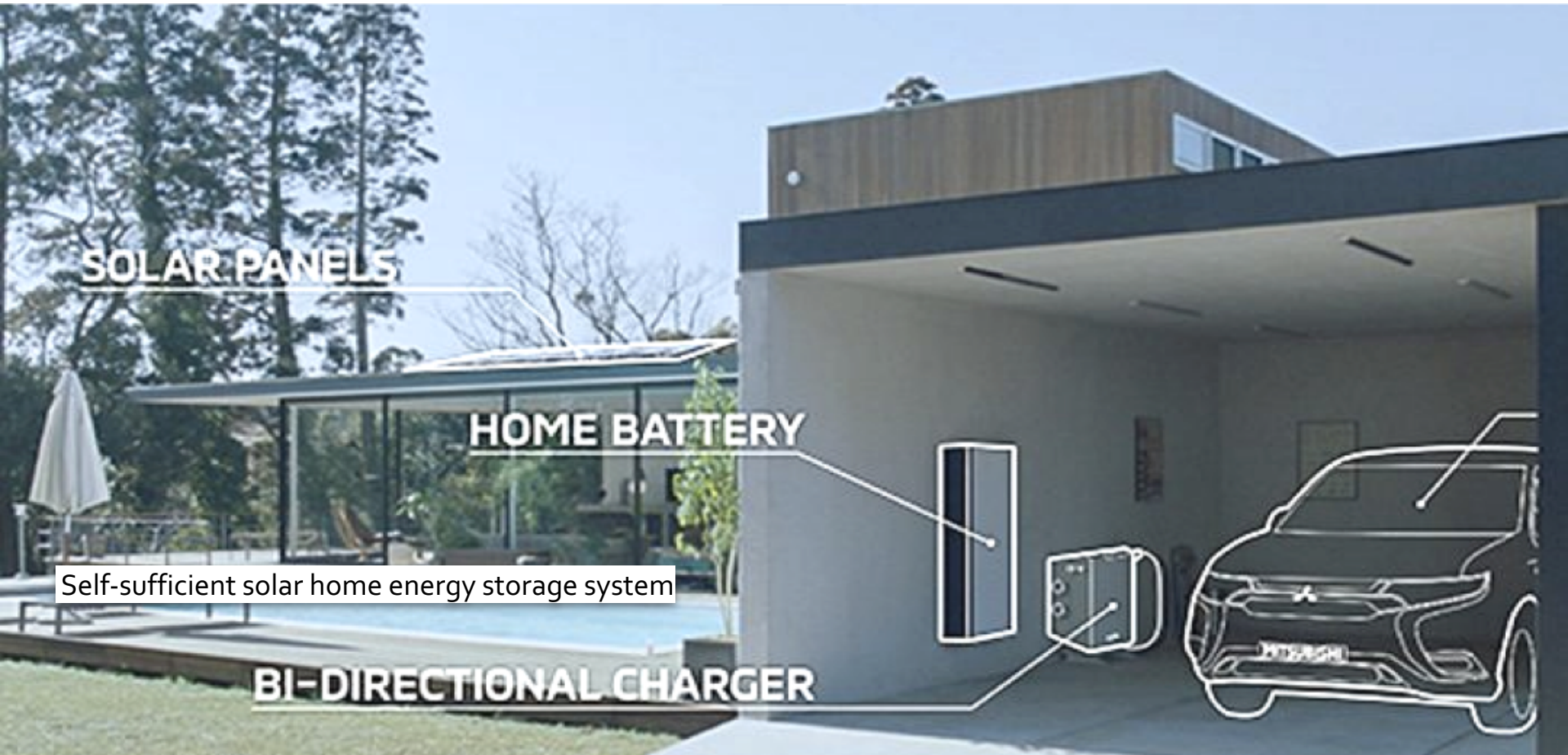
elementenergy



- Costs include HW, aggregation and battery degradation costs
- Cycle life degradation assuming 4500kWh/year throughput
- High revenues estimated in high-congestion DSO areas



V2G customer proposition




V2G customer proposition

Entry price \$100 per month

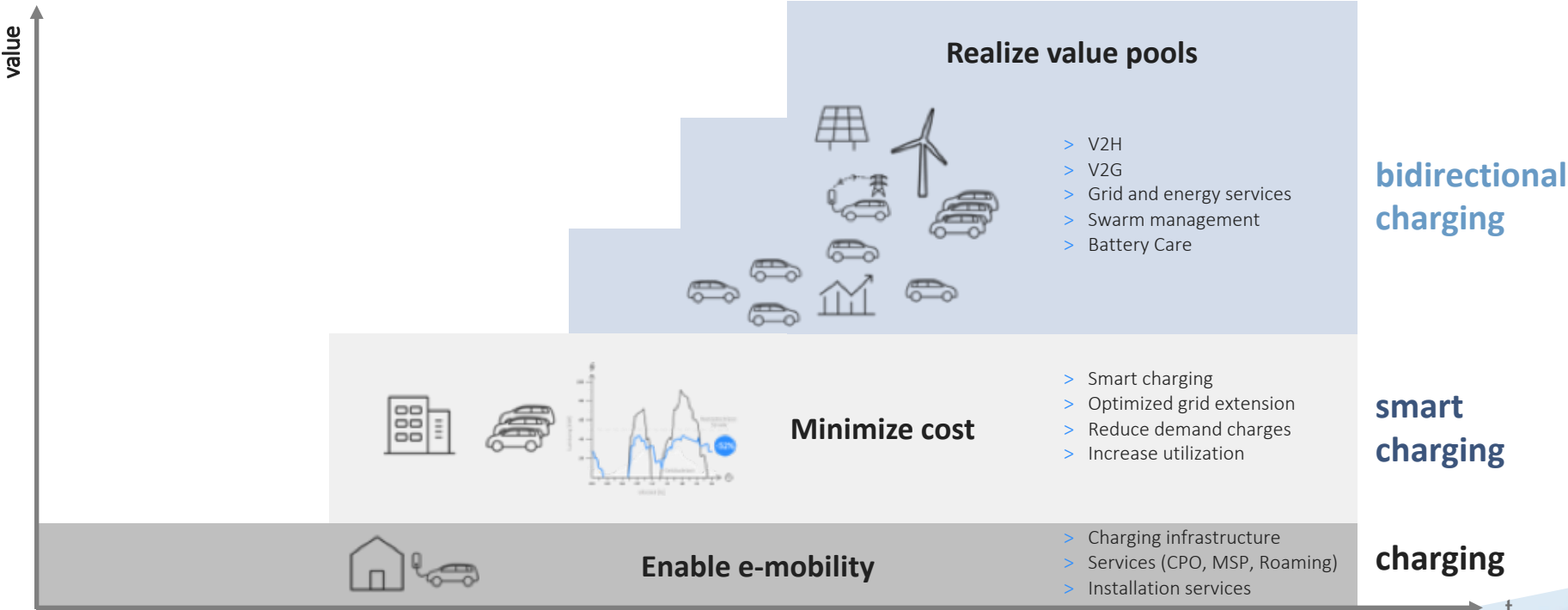
App for reservation and opening

Shared, smart, solar powered electric cars

WE DRIVE  SOLAR



From charging to V2G



Yesterday

Today

Tomorrow

t

Policy



"V2G-ready" smart charge hubs in 25 Dutch cities

Policy

1

Clean power for EVs from renewable sources; solar carports

2

Start small and scale EV by target groups: taxi, corporate & government

3

Incentivise nationwide network of fast chargers at hotels, malls, highways

4

Build the EV Community for raising awareness & knowledge sharing

5

Staged smart charging & vehicle-to-grid strategy

Implementation



- > 15% renewables
- > 20 unidirectional EVs
- > 2 bidirectional EVs AC
- > 2 2nd life stationary batteries (132 kWh capacity)



Implementation



HOW V2G
TECHNOLOGY
AND ELECTRIC
SCHOOL BUSES
CAN HELP CURB
POWER
BLACKOUTS

US School buses as grid support & stabilization

Implementation



Amsterdam ArenA: Football stadium as energy & mobility hub

Implementation



World's largest bidirectional solar charging plaza



PAVING THE ROAD TO RENEWABLES

SMART INTEGRATION OF ELECTRIC VEHICLES
TO INCREASE UTILISATION OF INTERMITTENT
RENEWABLES INTO AN ISLAND ENERGY MIX



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Delft University of Technology



Find me on LinkedIn, Twitter

What I work on:

EV strategy: Roadmaps - EV modelling - Fleet transition plans

Innovation: Charging hubs - Smart Charging - V2X

- World-first Global Review of Vehicle-to-Grid projects
- Smart Charging Strategy & Roadmap for DNO UK Power Networks
- Market sizing for V2B services in the UK
- Fast charging rollout business case for supermarket chain in France
- Fleet transition plan for City of Amsterdam
- World-first online EdX course on electric mobility (>140,000 learners worldwide)

