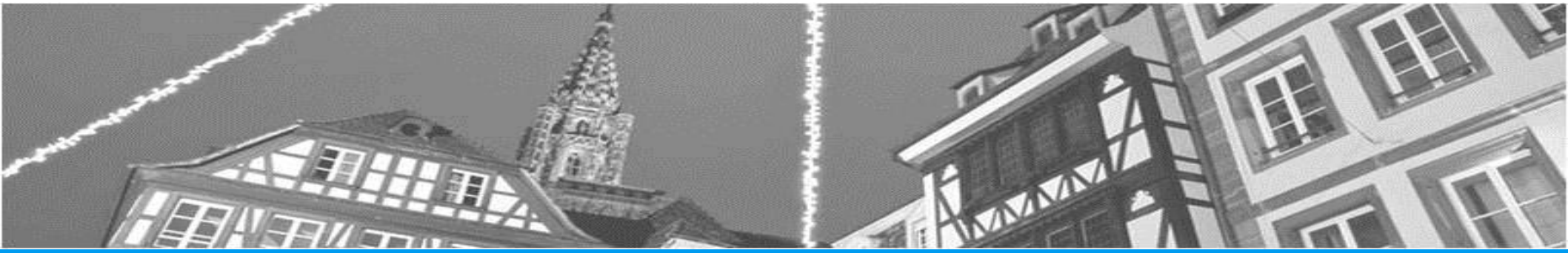
SET Laboratoire Systèmes et Transports

freshmile



Smart communication for Electric Vehicles

Navigare 2012 - Berner Fachhochschule
March 23d 2012

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Fréderic Lassabe: enseignant-chercheur, UTBM

Presentation outline

- Project Alsace Auto 2.0 overview
- Battery monitoring and control
- Benefits for the stakeholders

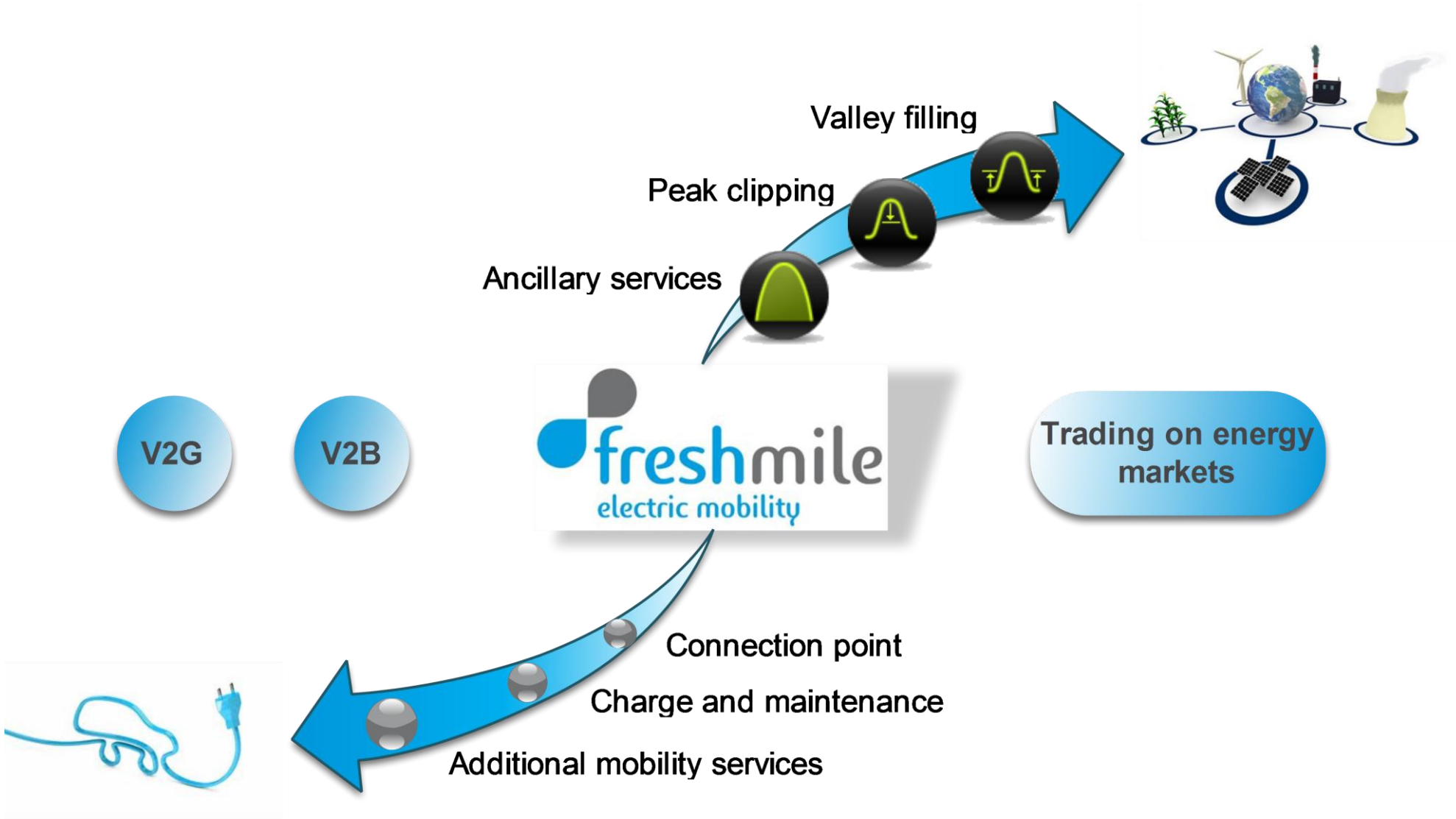
“Alsace Auto 2.0” in a nutshell

- Demonstration project over 2011-2014
- 50 EVs rolled out in Strasbourg and Alsace
- 50 home charging points and 50 workplace charging points
- Freshmile as aggregator of the 50 EVs and batteries: distributed virtual power plant

Goals

- To create a service company offering EVs on a monthly subscription fee, installing for each vehicle a connection point at home and at work
- To provide users with an innovative mobility service at reduced cost, by monetising batteries' storage capacities
- To provide grid operators with distributed storage capacities for grid ancillary services, peak shaving and valley filling

Freshmile
mobility operator and electric load aggregator



Cross-disciplinary developments

Discipline	Responsible
• Project management • Optimization algorithms and software developments • Mobility operator	Novae Alsace
• Design and manufacturing of smart charging points	Hager
• Fast prototyping • Field system (BEV + EVSE) modeling	UTBM
• Operating platform developments	BPL
• Electric vehicle prototyping	FAM

- Key processes:
  - Collect of systems status and constraints
  - Arbitrage and optimization
  - Feed-back and control

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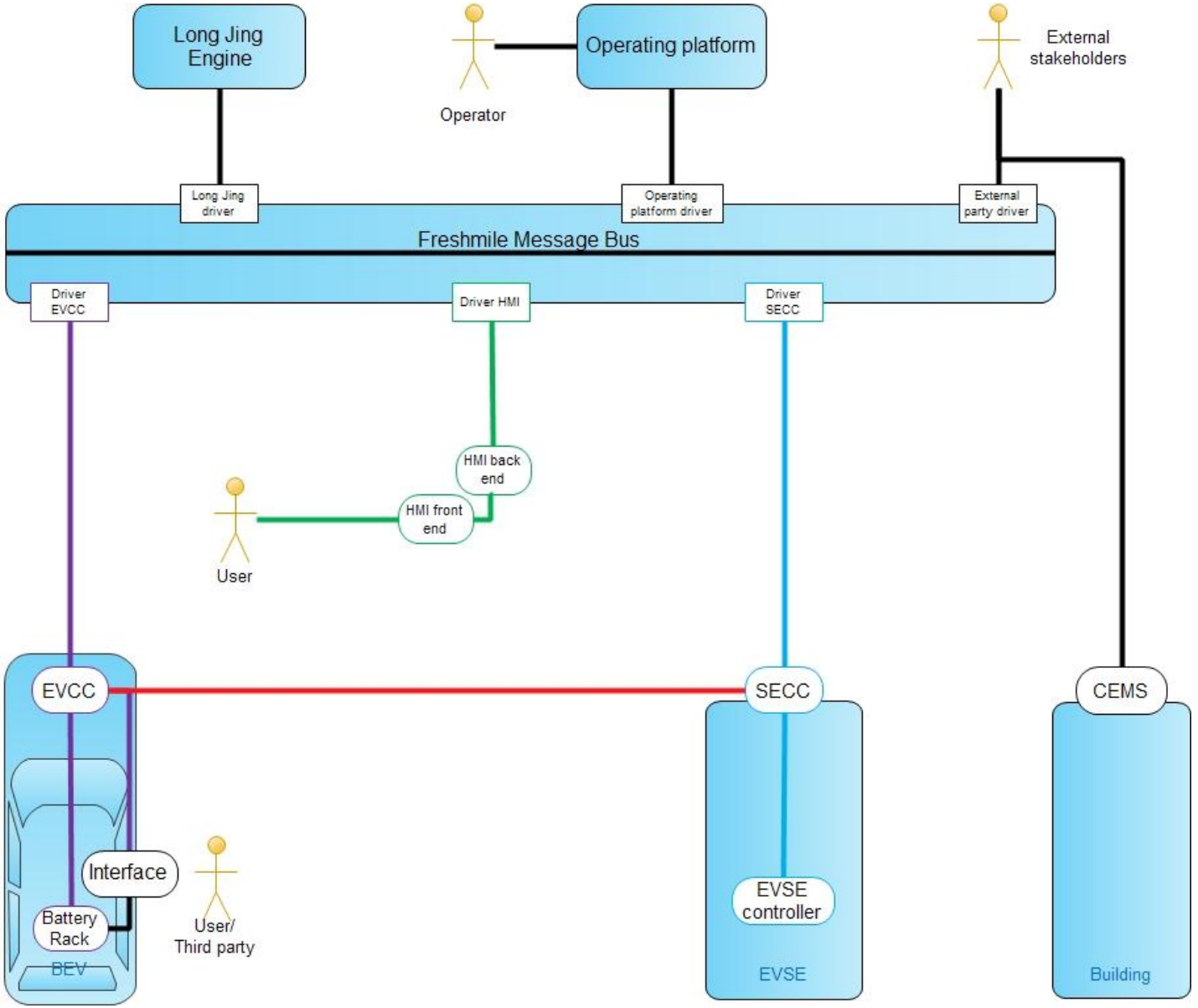
Usual electric vehicle operation

- Battery Electric Vehicle (BEV)
  - Batteries charging while driving
  - Batteries discharging while plugged to a supply equipment (EVSE)
- EVSE provides metering
- Low level communications between BEV and EVSE
- No external control

High level communication

- Based on standard IEC 15118
  - BEV component: EVCC (Electric Vehicle Communication Controller)
  - EVSE component: SECC (Supply Equipment Communication Controller)
- Imposes constraints on communications with secondary actors (the aggregator Freshmile)
- Defines various use cases
  - Charge control from aggregator
  - Constraints from power grid

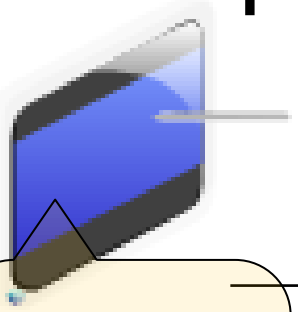
Architecture overview



Alsace Auto 2.0 implementation

- Aggregator
  - Tomcat server with java servlets, most communications are HTTP
- SECC/EVCC
  - Posix C language (portable on many embedded devices)
  - Communications with aggregator are HTTP except for commands sent from aggregator
  - Communications SECC ↔ EVCC at TCP level.
- Messages in XML
- User control: smartphone application to provide needs.
  - Aggregator optimizes based on needs, vehicles status and grid requirements

Example scenario



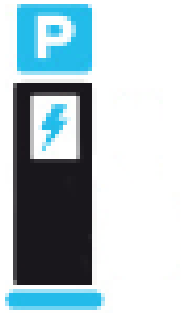
User enters
his needs

Aggregator

<command type=\"target_set\"><longitude>6.8456</longitude>
<time>10:57</time><latitude>47.642</latitude><ev_id>1</ev_id>
</command>

EVSE Status

Charging law
- start
- end
- current



EV Status

SECC might act as proxy

Status exchange

Charging law response

EVSE

BEV

BEV Status

- No polling from aggregator (high bandwidth and system resources costs!)
- Regular status updates (every 30 seconds)
- Alerts
  - BMS status change: SoC, temperature, charging status, charging current,…
  - Forwarded as soon as detected
  - Aggregator always has the up-to-date status → always make decisions on the real overall system status
- Same principle from EVSE
  - Plug status
  - Charging current

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Holistic approach to electric mobility

State and non-state authorities

Environmental benefits

►Pairing with renewable energy production

►Taking care of batteries' second life and recycling

►Removing old cars from the road

Economic benefits

►Avoiding grid costs (peak units, thermal power plant fuel usage)

►Decreasing road fuel consumption

►Making EV cheaper

Societal benefits

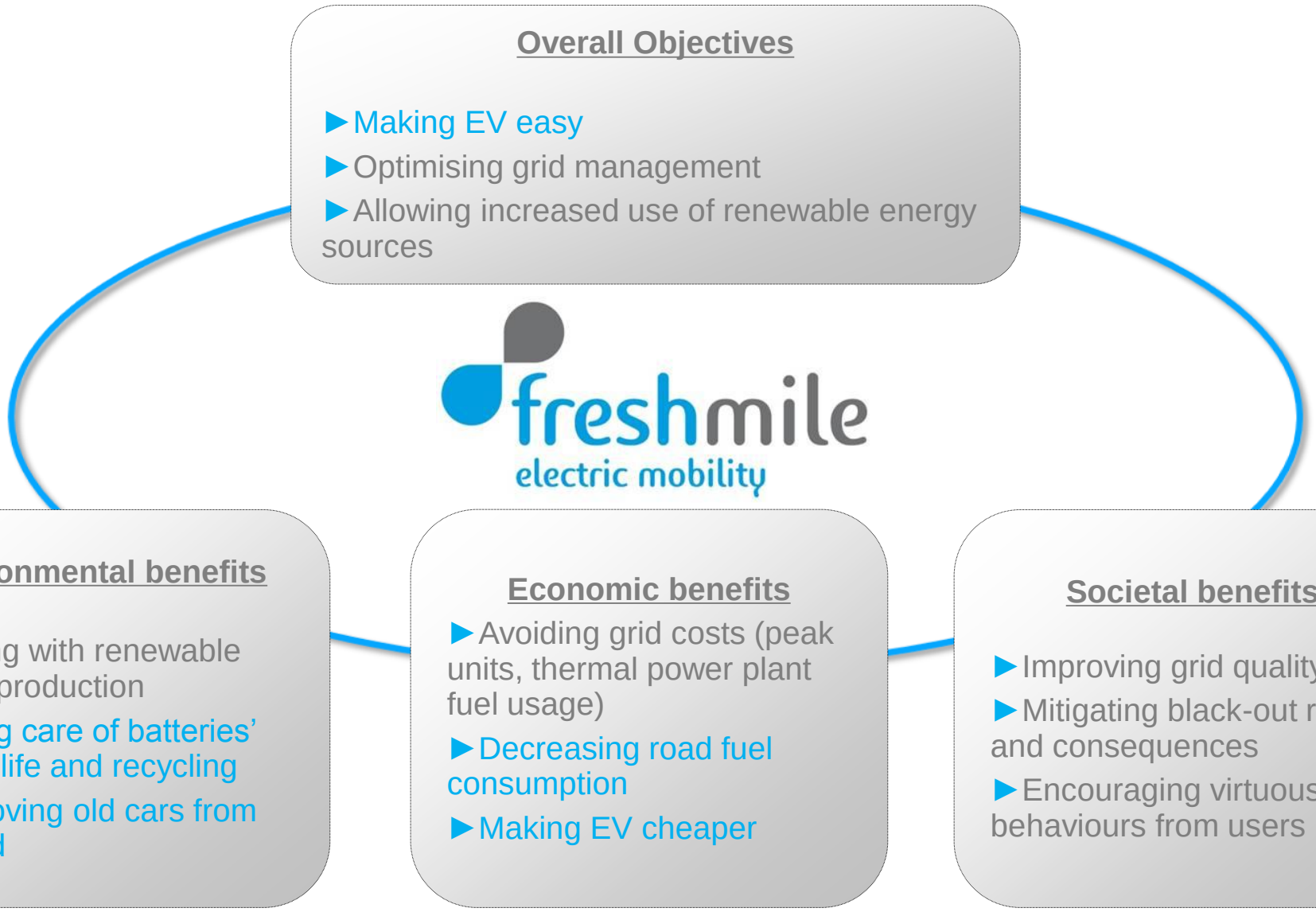
►Improving grid quality

►Mitigating black-out risks and consequences

►Encouraging virtuous behaviours from users

Holistic approach to electric mobility

Car and battery manufacturer



Holistic approach to electric mobility

End users

Overall Objectives

- ►Making EV easy
- ►Optimising grid management
- ►Allowing increased use of renewable energy sources

freshmile electric mobility

Environmental benefits

- ►Pairing with renewable energy production
- ►Taking care of batteries' second life and recycling
- ►Removing old cars from the road

Economic benefits

- ►Avoiding grid costs (peak units, thermal power plant fuel usage)
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Holistic approach to electric mobility

Electrical industry

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