ECOLOGIC VEHICLES RENEWABLE ENERGIES

EVER MONACO

# Electric vehicles
# and renewable energies interactions
# at the local level

**Monaco – 8 May 2019**

IAEE INTERNATIONAL ASSOCIATION *for* ENERGY ECONOMICS

WWW.IAEE.ORG

ABB

@IA4EE @FR_AEE


EVER MONACO
ECOLOGIC VEHICLES RENEWABLE ENERGIES

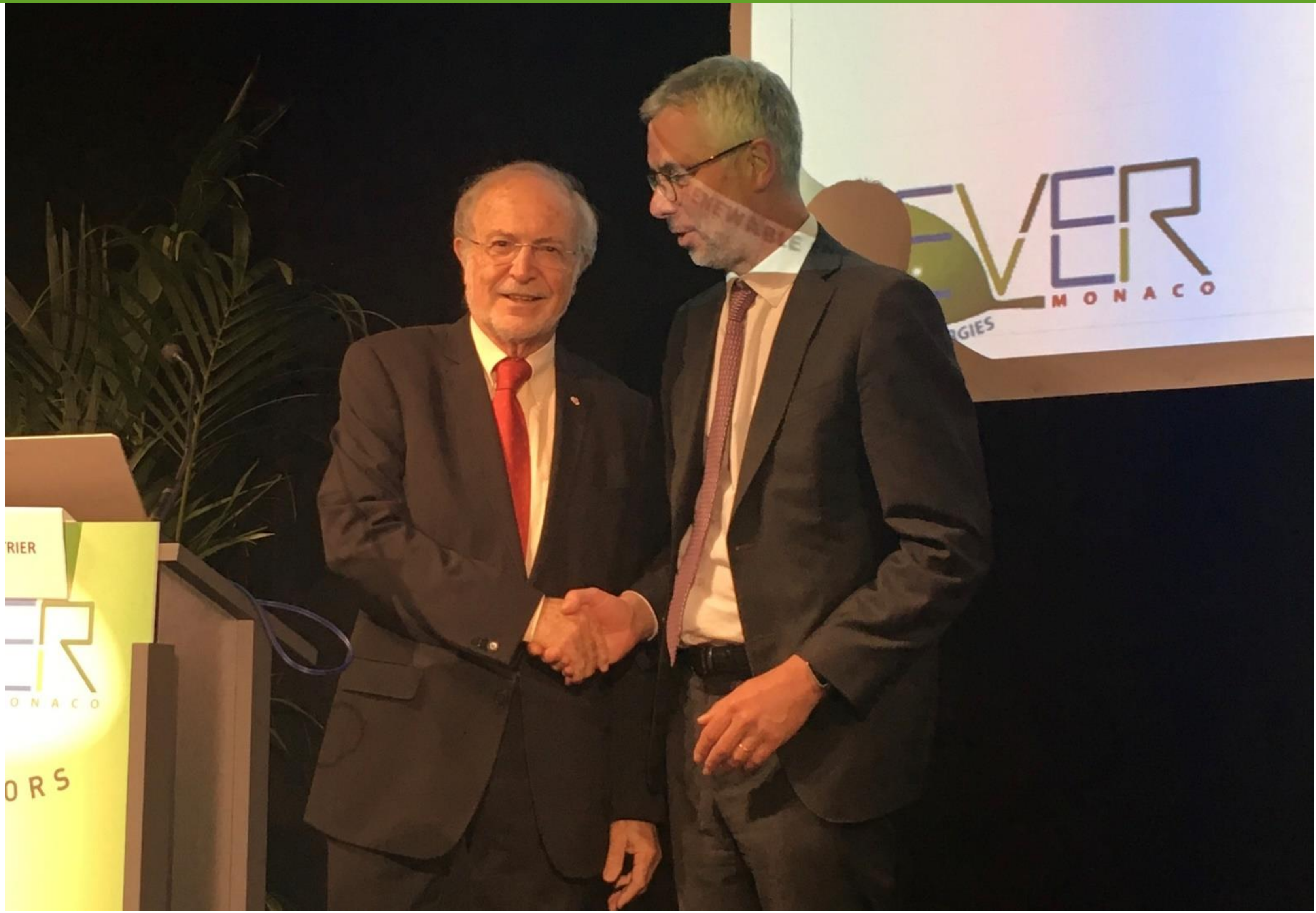
9:30 Welcome ***The main challenges and hurdles for the future efficient coupling of EV and RES locally***

- **The role of EVER in the EV and RES scene over years**

**H.E. Bernard Fautrier, Plenipotentiary Minister**

- **Economists and regulators: unlockers of EV & RES breakers**

**Christophe Bonnery, President IAEE**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# Electric vehicles and renewable energies interactions at the local level: agenda

INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
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- 9:30 Welcome **The main challenges and hurdles for the future efficient coupling of EV and RES locally**
- 10:00-12:30 **International Field Experiments and mobility projects**
- 12:30-14:00 Lunch (reservation or free time)
- 14:00-15:00 **Keynote addresses**
- 15:00 - 17:00 **International feedbacks of local governance for EVs and Renewable deployment**
- 17:00-18:00 Official visit of the exhibition

ECOLOGIC VEHICLES RENEWABLE ENERGIES EVER MONACO

# Electric vehicles and renewable energies interactions at the local level (session 1)

INTERNATIONAL ASSOCIATION *for* ENERGY ECONOMICS
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10:30 – 12:30 ***International Field Experiments and mobility projects***

- *Chair:* **Yannick Perez**, *University Paris-Saclay and Florence School of Regulation, RSCAS-EU*

1. **How to provide flexible services with EVs fleets within households and commercial sectors?**
   - **Paul Codani** *(Nuuve, Gridmotion experiment)*
2. **The innovative charging solution deployed in Europe by Renault**
   - **Yasmine Assef** *(Renault)*
3. **How to manage efficiently EV fleets and distributed energies in the frame of smart Buildings?**
   - **Floriane Petipas** *(Bouygues Energy Solutions)*
4. **What are the complementarities of usage between EVs and PV in different socio-technic environments?**
   - **Alain le Duigou** *(CEA) Flovesol research project funded by ADEME*
5. **How to go from natural experiments to technico-economic regulation for Electromobility?**
   - **Icaro Gomes** *(VEDECOM)*
6. **Managing EVs as distributed energy resources with JuiceNet?**
   - **Vincent Schachter** *(ENEL X e-Mobility)*

10:30 – 12:30 ***International Field Experiments and mobility projects***

- *Chair:* **Yannick Perez**, *University Paris-Saclay and Florence School of Regulation, RSCAS-EU*

1. **How to provide flexible services with EVs fleets within households and commercial sectors?**
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# NUVVE

## We Make Electric Vehicles Greener

### Presentation of the GridMotion project

# Outline

- Introduction to Nuvve
- GridMotion project
- Conclusion

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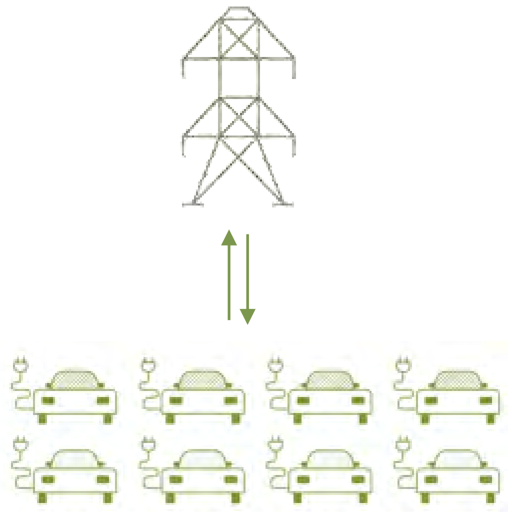
- Introduction to Nuvve
- GridMotion project
- Conclusion

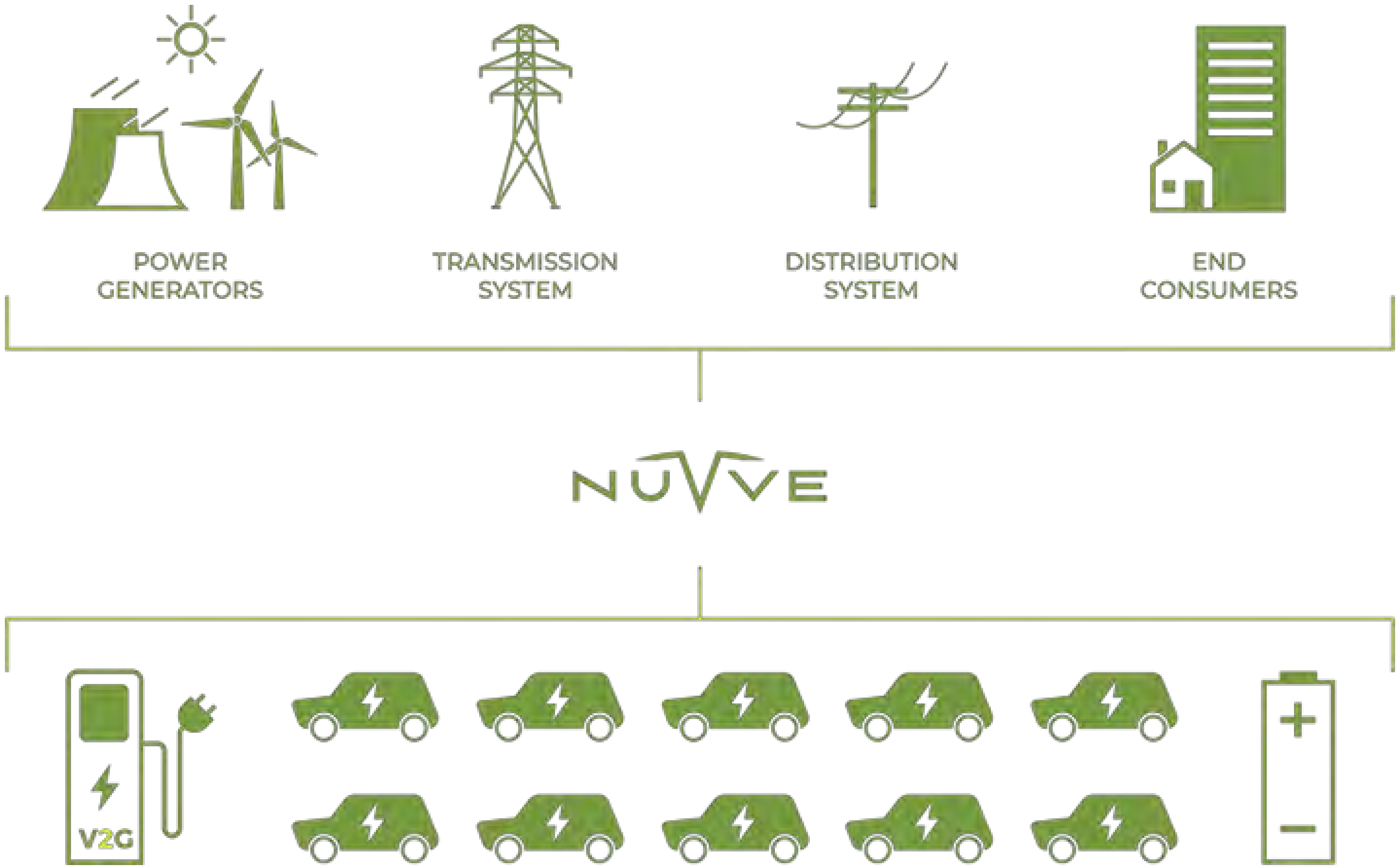
# Nuvve: an Electric Vehicle aggregator

- Nuvve manages the charging / discharging patterns of Evs thanks to its patented **Nuvve GIVe™ platform**
- Nuvve **reduces the TCO** of electric vehicles by monetizing their flexibility on the **energy markets**
- Nuvve makes sure that EV drivers **mobility needs** are always met
- The underlying concept, developed by Nuvve, is called **Vehicle-to-Grid** or **V2G**
- This concept also enables a larger **integration of renewables**



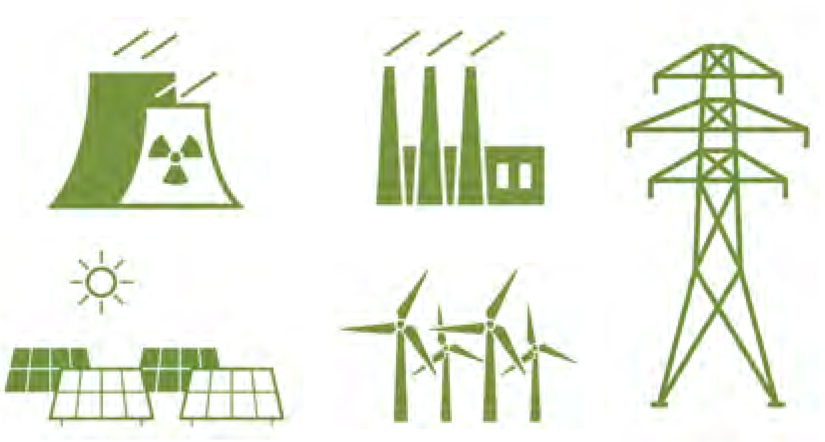
NUVVE

# Nuvve GIVe™ Platform



# V2G Markets

## Transmission System



*Frequency regulation, voltage control*

## Distribution System

*Transformer upgrade deferral, congestion management*

## Behind the Meter

*Peak shaving, tariff optimisation, arbitrage, emergency back-up*

NUVVE

# Nuvve Vehicle-to-Grid deployment

- We operate currently 200+ chargers across 5 continents
- Only commercially ready V2G solution worldwide

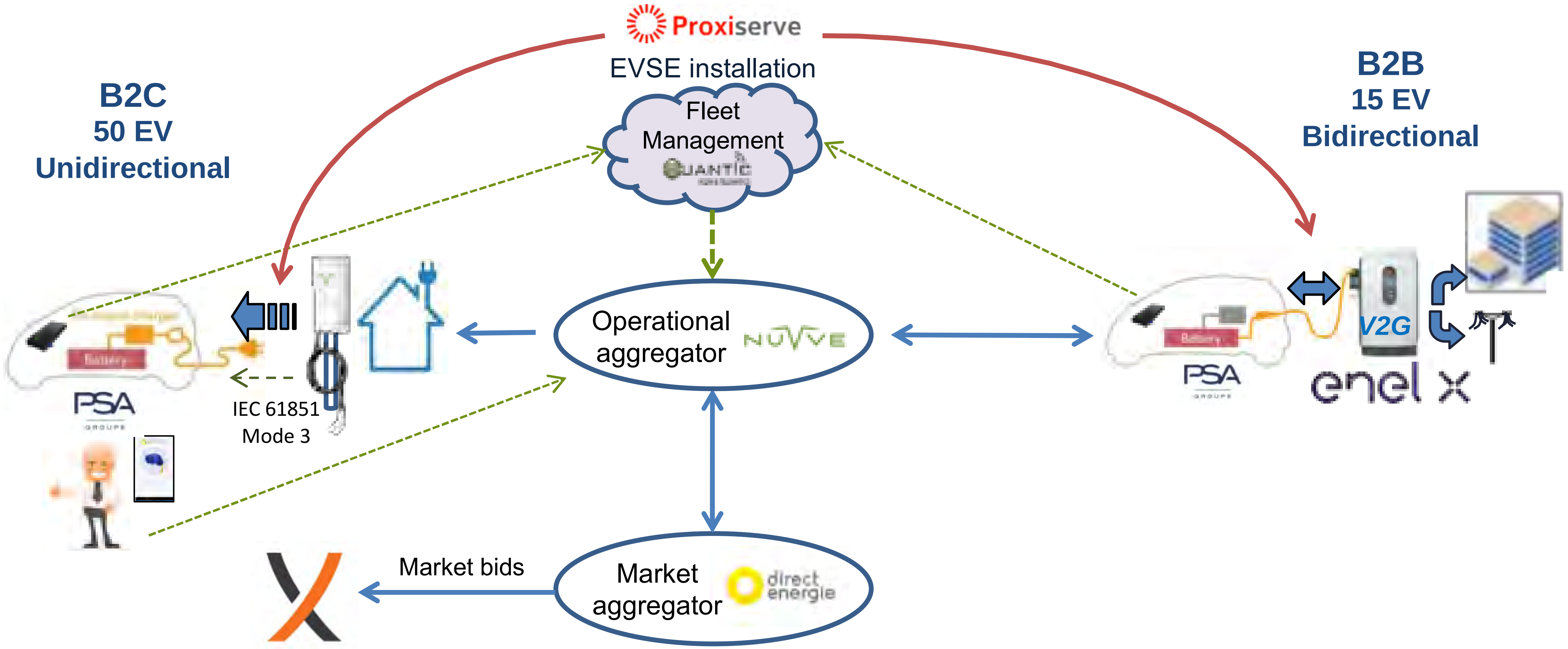
# A Joint-Venture by EDF and Nuvve

- October 2018: EDF reveals it **e-mobility plan**
- One of the three pillar: becoming the **smart charging European leader**
  - 4,000 smart charging points installed and operated in Europe by 2020
  - Strategic partnerships with innovative actors such as Nuvve
- The JV focuses on the **commercialization of V1G and V2G services**
  - Technology agnostic (hardware, communication means, etc)
  - Relying on Nuvve GIVe™ tested and proven platform
  - Benefiting from a unique relationship with EDF networks

# Outline

- Introduction to Nuvve
- GridMotion project
- Conclusion

# Project architecture



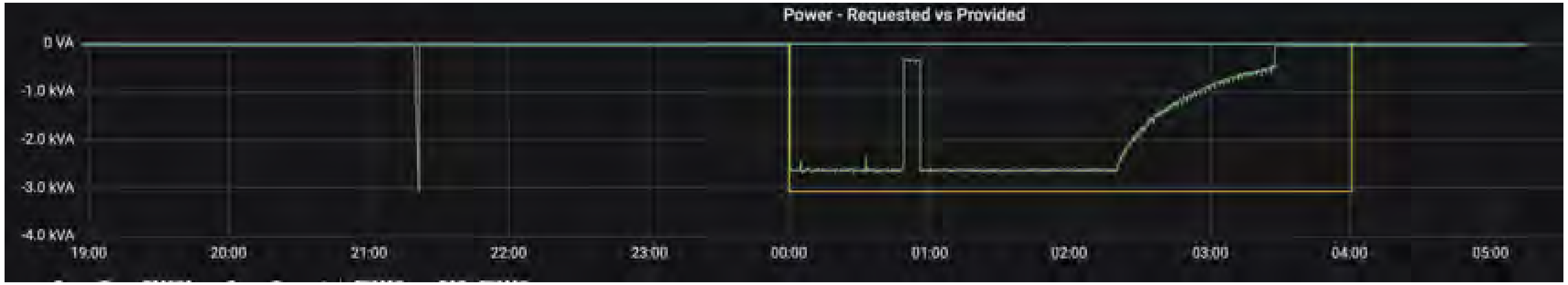
# B2C installations

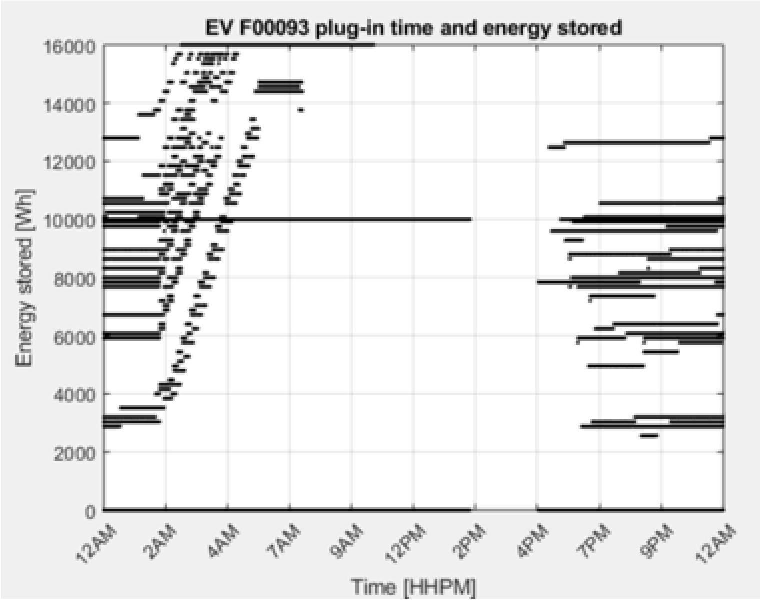
- 35 customers installed as of today

NUVVE

# B2C Energy Service

- Charging when Epex spot electricity prices are low

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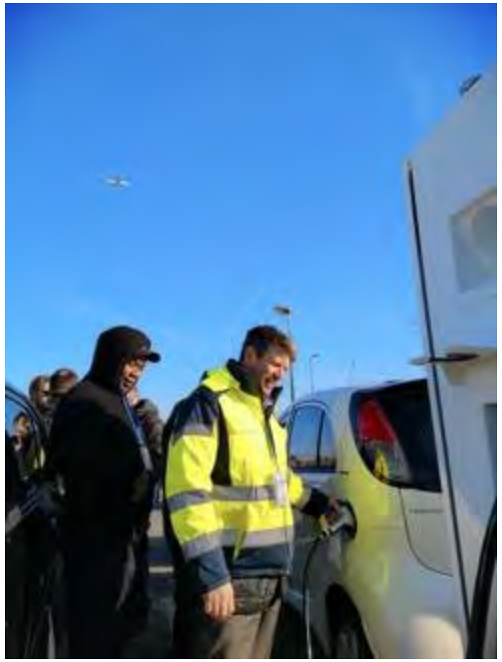
# B2B installations

- Installation of V2G charging stations
- Training users and electricians for maintenance

# B2B energy service

- Providing frequency control services

# Outline

- Introduction to Nuvve
- GridMotion project
- Conclusion

# Conclusion

- GridMotion = first implementation of V1G and V2G services in France at a customer location

- Smart charging and discharging is already a reality in France today

- JV EDF / Nuvve:
  - important ambitions to deploy massively V2G stations in the coming years
  - Commercial offers already available

- If you are interested in our solutions… please do not hesitate to contact us!

# Thank You

**Paul CODANI**

*Project Manager*

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+33 7 81 58 51 67

***JOIN US AT EVS32 IN LYON, FRANCE, MAY 19-22, on CHAdeMO and EDF booths***

# B2B energy service

- Providing frequency control services

10:30 – 12:30 ***International Field Experiments and mobility projects***

- *Chair:* **Yannick Perez**, *University Paris-Saclay and Florence School of Regulation, RSCAS-EU*

## 2. The innovative charging solution deployed in Europe by Renault

- **Yasmine Assef** *(Renault)*

10:30 – 12:30 ***International Field Experiments and mobility projects***

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## 3. How to manage efficiently EV fleets and distributed energies in the frame of smart Buildings?

- **Floriane Petipas** *(Bouygues Energy Solutions)*

10:30 – 12:30 ***International Field Experiments and mobility projects***

- *Chair:* **Yannick Perez**, *University Paris-Saclay and Florence School of Regulation, RSCAS-EU*

## 4. What are the complementarities of usage between EVs and PV in different socio-technic environments?

- **Alain le Duigou** *(CEA) Flovesol research project funded by ADEME*

DE LA RECHERCHE À L'INDUSTRIE

Flovesol

# FLOVESOL

## *Quelles sont les complémentarités d'usage entre les VE et le PV dans différents environnements socio-techniques ?*

**Le Duigou A[1]., Popiolek N[1]., Abdelouadoud Y[2]., Quenard D[2]., Petit M[3]., Lancelot A[4]., Yu H.J.J[1]., Thais F[1]., Perez Y[3]., Seguy A[5]**

*1 CEA, Saclay Center*

*2 CSTB, Marne-La-Vallée and Sophia-Antipolis*

*3 CentraleSupelec, Saclay*

*4 Clem', Champ-sur-Marne France*

*5 Bouygues Immobilier*

du 8 au 10 mai 2019
Grimaldi Forum MONACO

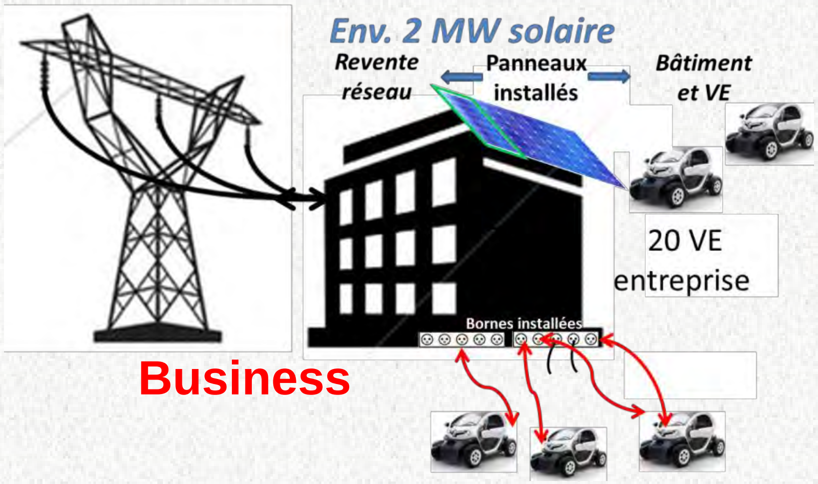
www.cea.fr

- FLOVESOL is part of the Call for Research Sustainable Energy Projects / 2015 ADEME - Total cost = € 486,536 - 3 years
- Technical, economic feasibility and environmental performance of a fleet of electric vehicles recharged with solar panels integrated into buildings: case studies.
- The contributors

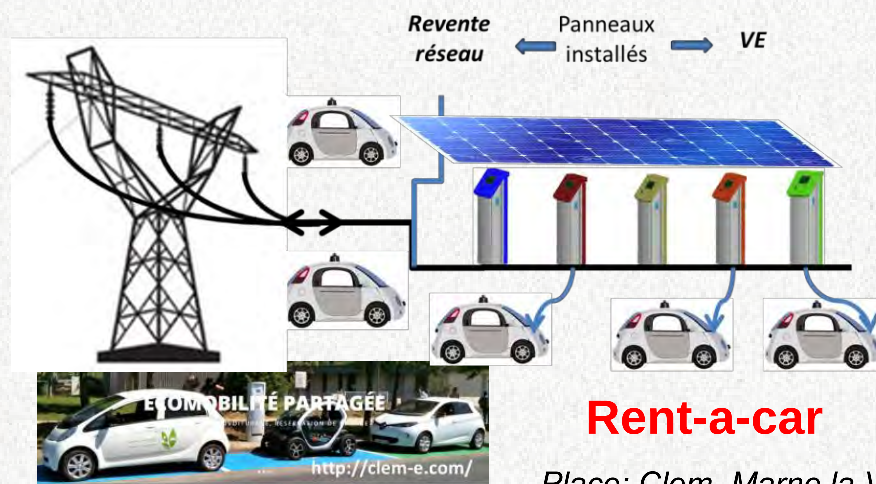
**3 cases studies: business** building, **rent a car** (car sharing), **domestic private** use

Flovesol

# **Case 1 and Case 2** : from **actual data** - **electric mobility is in place, Proceed to PV**




Location: CSTB Champs sur Marne

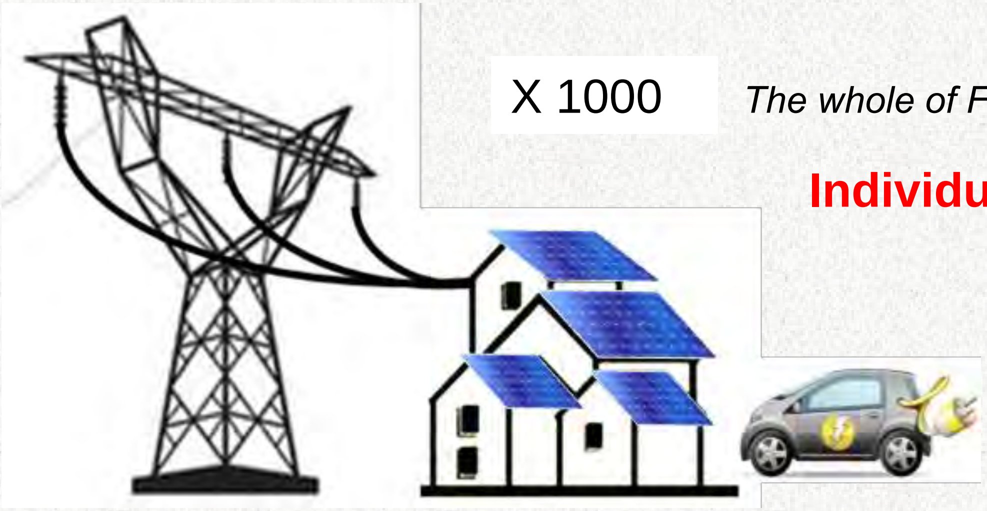



Place: Clem, Marne la Vallée

For the case studies 1 and 2, calculations for adjusting the grid primary frequency. Refilling only at night for the Case 1, and day and night for the Case 2.

**case 3** : from **statistic data**, **electric mobility is to develop**, parallel to the building power (except heating), it is evaluated with and without PV

Individual apartments and houses



X 1000

*The whole of France*

**Individuals**

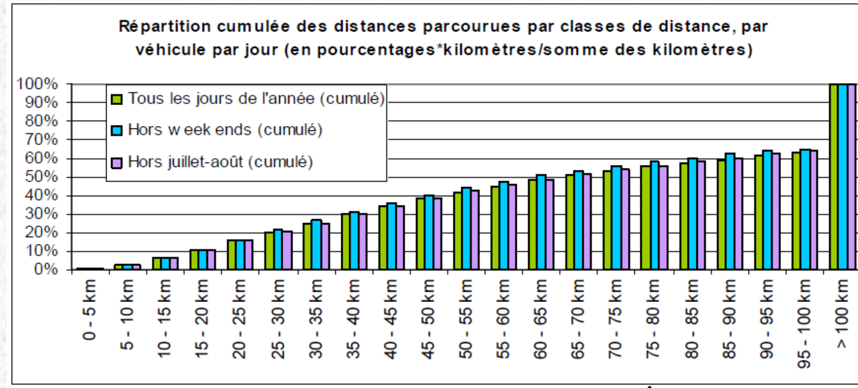
To assess, in all cases: t*he economic balance for stakeholders: individuals, businesses, community (local, State)*

# Mobility

Choosing a vehicle "reference": VE or VT
Comparisons with other vehicle engines

*Existing on the market*

*Or "reconstructed" from a common chassis*




Code dédié au pas horaire

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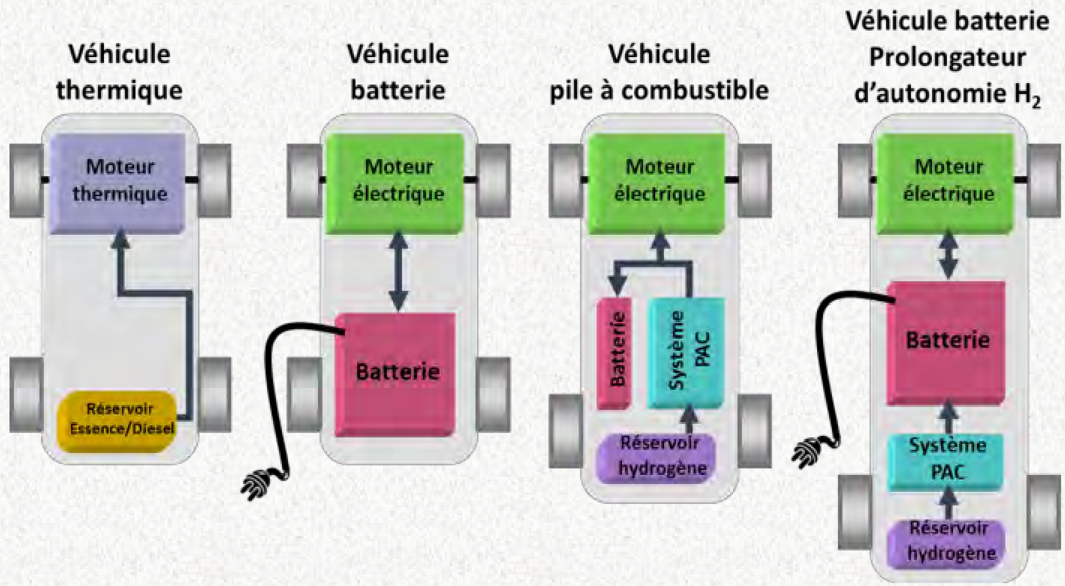
Valorisation des ENErgies REnouvelables




*different discount rates possible for each vehicle*

# Case 1, corporate fleet associated with a professional building

## Grid connected PV electricity costs

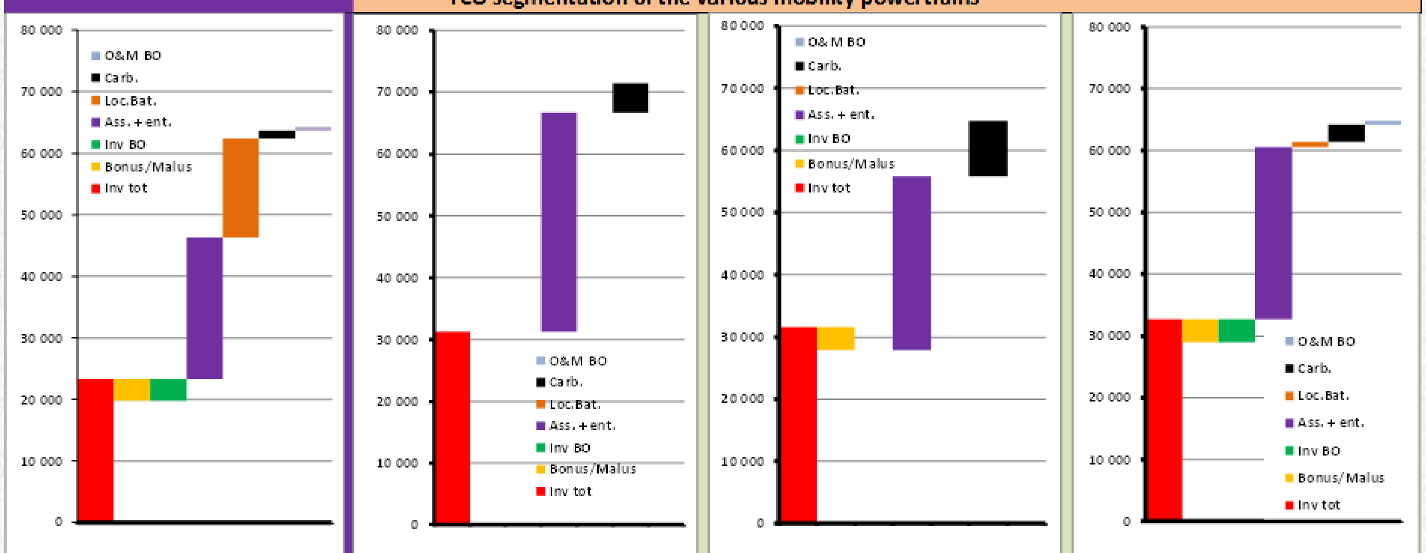
PV curtailment down to grid only connexion power : same electricity cost than without curtailment

A 0% discount rate investment leads to the « grid parity » (costs) / The capital cost (50%) is payed by the State

<u>Combine building and VE in the interest of cost of energy for the VE: the power connection is ca. 80% of the electricity cost if VE only.</u>

### *ICE, EV and Range-extender EV TCO similar, better than ICE TCO*

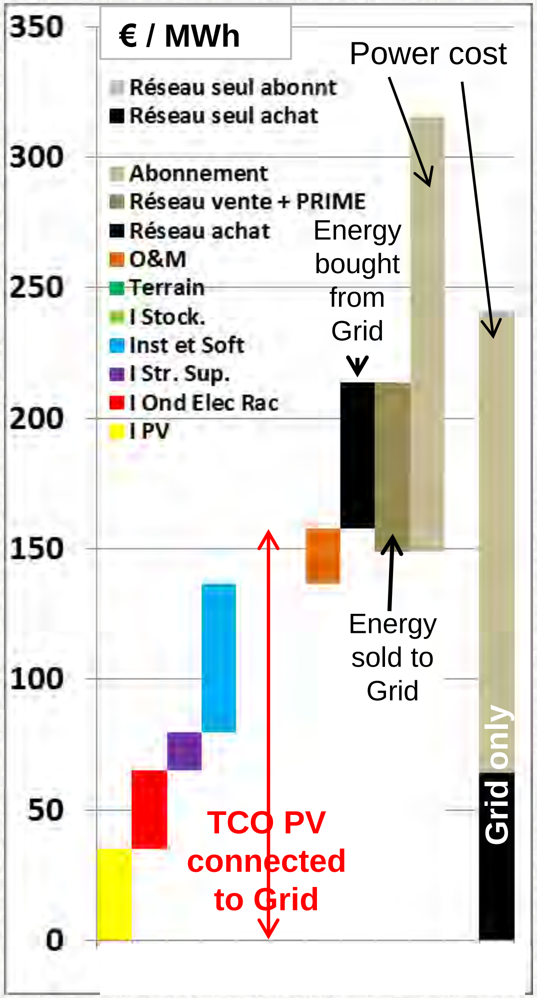
TCO segmentation of the various mobility powertrains




| EV | | | TV | | | EV H2 | | | EV Re-H2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar EV TCO | 64 354 | € | TCO TV | 71 396 | € | TCO EV H2 | 64 791 | € | TCO EV r-e H2 | 65 391 | € |
| Cost per km | 0,643 | €/km | Cost per km | 0,714 | €/km | Cost per km | 0,648 | €/km | Cost per km | 0,654 | €/km |
| *Cost / km (grid only)* | *0,638* | *€/km* | | | | - | | | *Usage de bornes* | *VRAI* | |

# Case 2, vehicle fleet carsharing

## Grid connected PV electricity costs




Disproportionate need for network connection (kW) compared to the energy consumed (kWh): Need to link this system to a consumption structure which would « hide » this problem: a building for instance.

State contribution helpful but do not promote self-consumption.

***ICE, EV, H2 and Range-extender H2 EV TCO***

VE and VE Re-H2 become the most competitive, secondary impact of the electricity price.

Physionomy of costs similar when changing a battery rental model to a battery purchasing model.

Lifetime parameter much <u>less impacting </u>than the kilometers traveled each year.

# Case 3 : from statistic data, electric mobility is to develop, parallel to the supply of buildings

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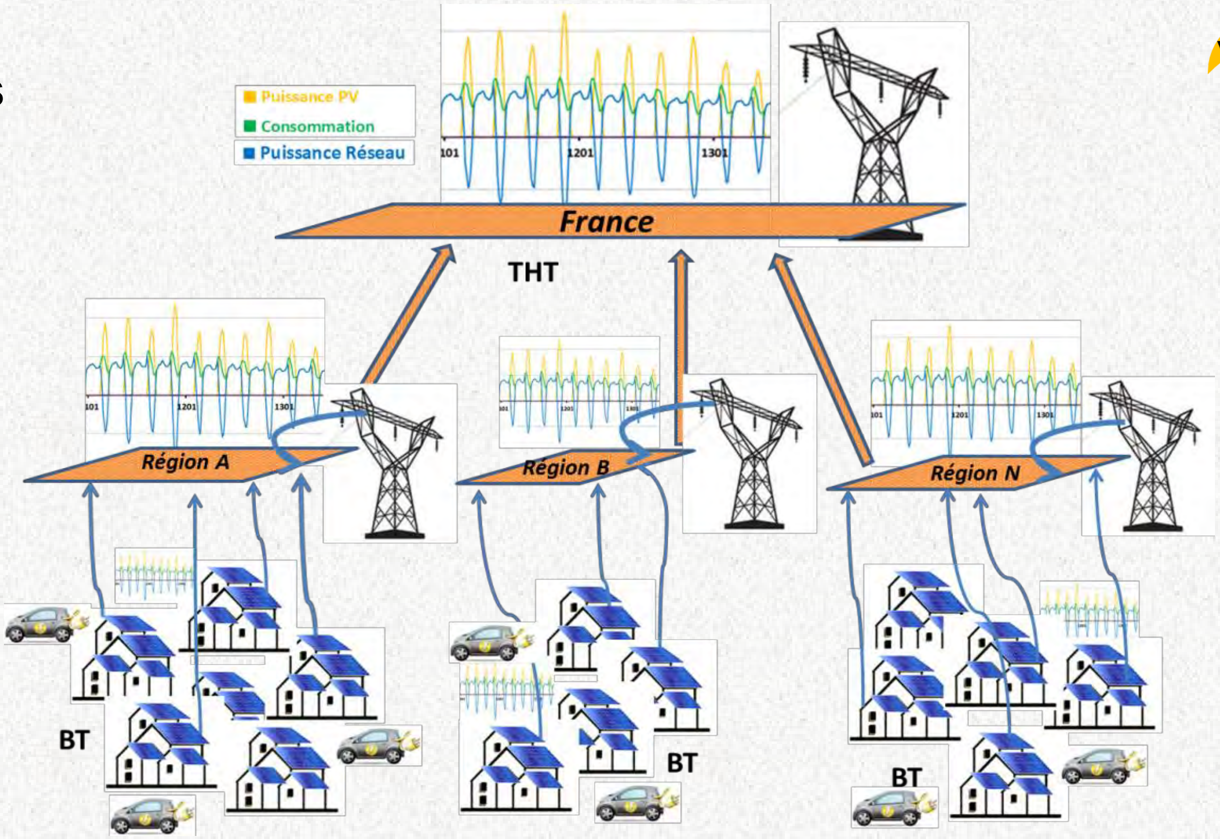
**2 levels of analysis**




**3 EV charging strategies**

**Car base**: the consumer charges at home, when he wants
**Car local opt**: the consumer charges at home outside the domestic consumption peaks, and when the sun is shining
**Car market opt**: the consumer charges at home at the bests electricity spot prices

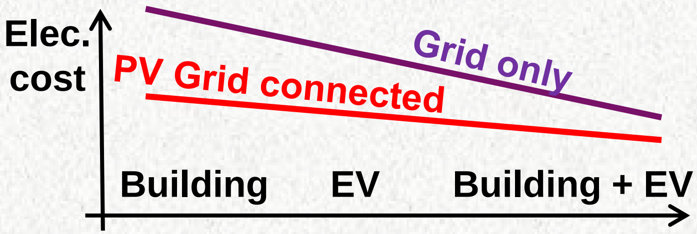
*Public stations charging when needed to finish a displacement*

# Grid connected PV electricity costs

***Whole France** : 93,5% energy coverage, 42% self consumption rate*

***Regions**: 79% (Hauts de France) to 128% (PACA) energy coverage*

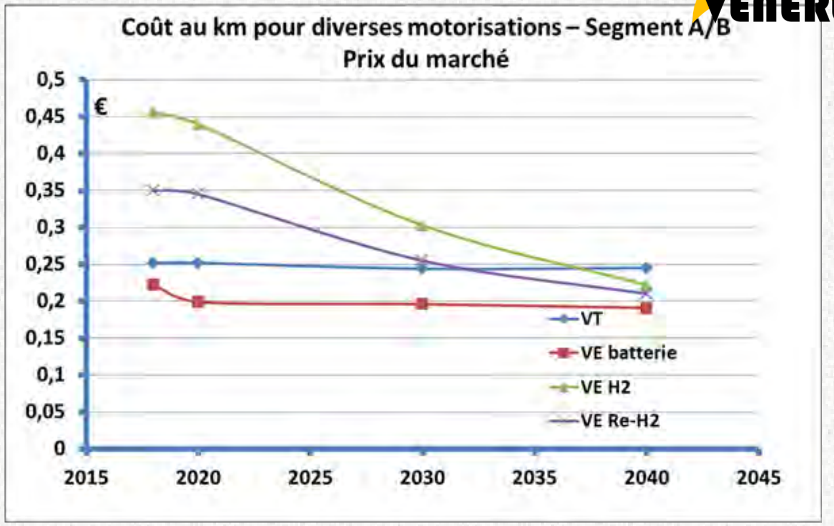
- Electricity cost ratio **0.9 and 0.8 in favor of PV** (electricity surplus and whole sale, “car base” charging).
- Self-consumption rate: + 10 points in VE charge "local opt“ : 52% (opposite for "market opt“)
- EV charging "optimal local" + **PV fully sold**: **same costs if** State contribution / 2.
- **Cost parity reachable if surplus sold :** achievable in the short term (2,55 €/Wc (2,12 in “car base”) instead of 2,86 €/Wc), the State aid is no more necessary
- State aid sufficient to ensure competitiveness, but self-consumption penalized vs. PV fully sold
- **Combined use** of PV for building and EV:
  **costs lowered, but cost ratios higher** with PV vs. use of the network alone

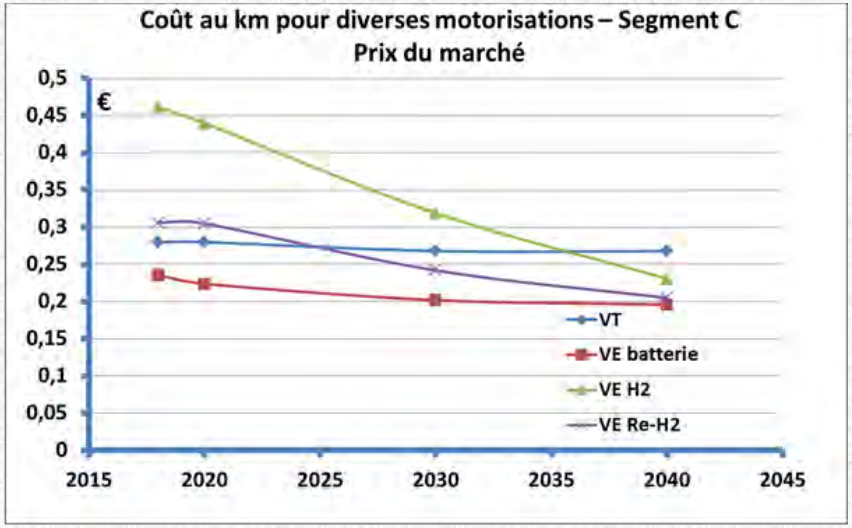


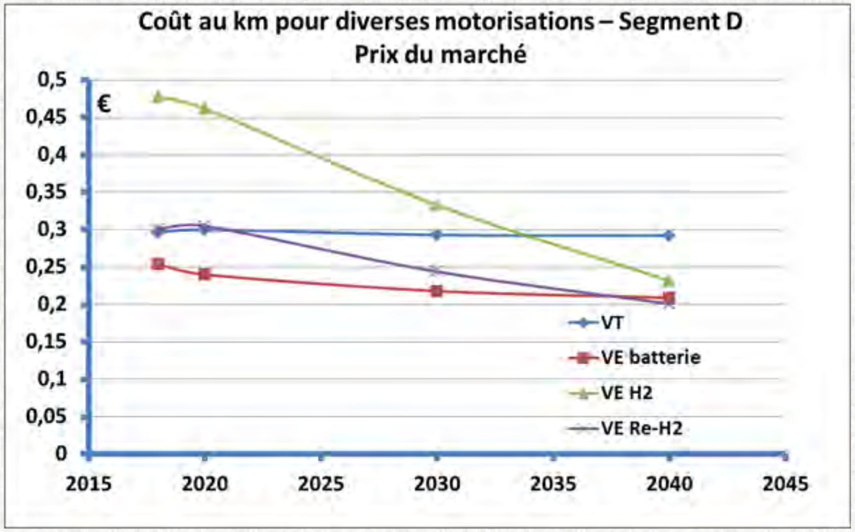

- PV full power sold and curtailment up to no grid connection change: same costs if PV cost 2,55€/Wc instead of 2,86€/Wc: feasible !

# Mobility

France, 3 types of vehicles considered in a CEA / IFPEN study for OPECST
http://www.senat.fr/fileadmin/Fichiers/Images/opecst/quatre_pages/OPECST_rapport_provisoireCAP_2040_2.pdf
[category, kWh battery , kW power]
[A / B, 30, 50], [C, 50, 80], [D, 80, 100].
The basic reference of each vehicle is its power.
6 000 €  incentive considered.



# Mobility / game players

***Assumption: user for whom the mobility transition is neutral in terms of TCO.***

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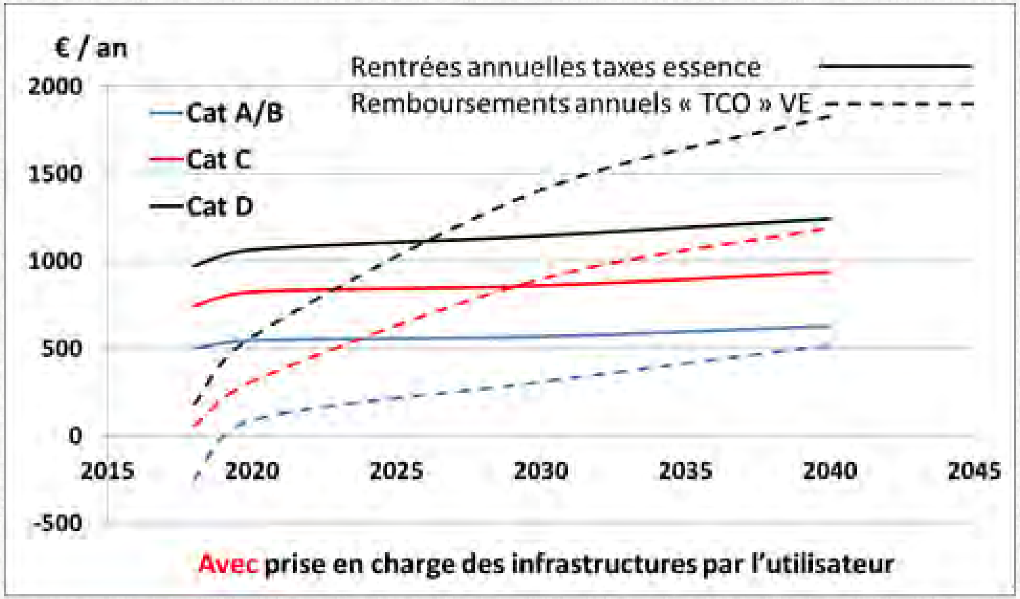
- 1st: State aid to make up for the CAPEX difference between EV and TV
- 2nd: the user refunds the State aid as an « additional OPEX »
- 3rd: the user makes up for the TCO difference between EV and TV (possible from 2020)

« TICPE - like » to make up for the VT lost TICPE and other taxes……
And then in ca. 2027, 2030 and 2045, the French State recovers the taxes as he does now with the TV.




*Then an economic model can exists that can make up, in the short / medium term, the taxes French State could loose with the mobility transition from TV to EV*

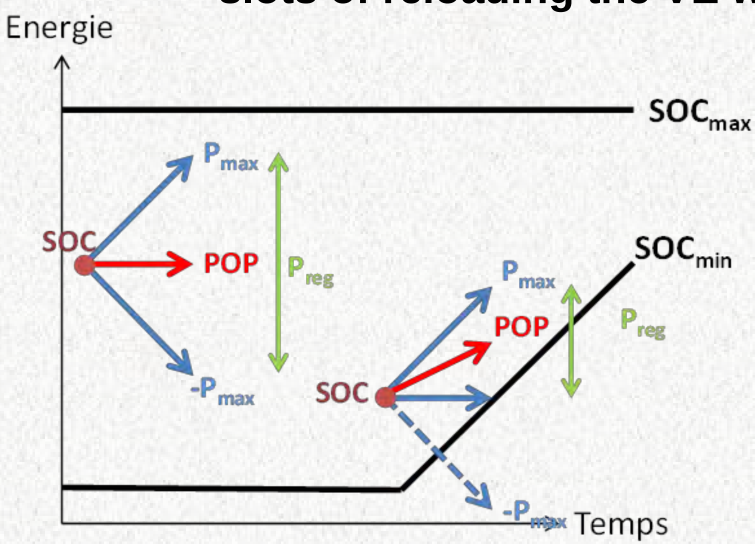
*As regards the scenarios made for the OPECST, the overall cost for the French State could be ca. 75 G€ over the 20 / 30 years to come*

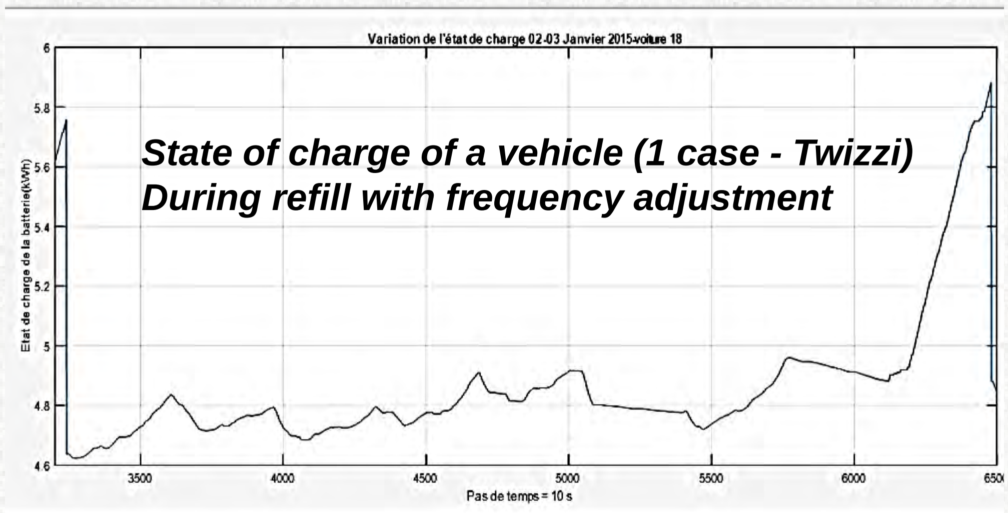
# Primary frequency adjustment

Frequency profiles provided the RTE website. If the frequency decreases, the power generation is increased, and vice versa.

National Reserve about 600 MW, "minimal market » about 50 MW. Each battery is made available for 15 minutes, upward and / or downward - aggregator for regulation.

Upon assumptions about the flow direction of the batteries and the speed and load levels (minimum (20%) and maximum (80%)), **one can perform frequency adjustments in the time slots of reloading the VE while maintaining the refills constraints**.




**Case 1**, Frequency adjustment at night: constant average control price 16.8 € / MW available, total annual gain about € 2950, slightly less than € 150 per vehicle.

# *Primary frequency adjustment*

This study allowed to make estimates of the valuation of two Types EV fleets participation in the primary frequency adjustment service bidirectionally. Based on the algorithm developed by Supelec and using the Case 1 and Case 2 data, the results gave the following orders of magnitude:

- for Twizy Fleet from **1 to 10 € / month per vehicle**
- for the car sharing fleet : **about 60 €/ month for a charging station with a vehicle**.

This difference between the two cases is related to the lower power of the terminal for the Twizy (3 kilowatts against 7 kilowatts, knowing that the service fee considered is made on the power availability) and weaker capacity of the Twizy battery (6.1 kWh against 24 kWh).

SO…Good news

Impacts of the discount rates, curtailments, and especially …..

Buildings and EV charging **synergies**

Importance of **EV charging strategies**

**Quite high self-consumption rates**

Opportunities to **achieve cost parities** with or without PV

Seems that **resale of surplus electricity** seems to be the good solution, at least **in the objective of eliminating the State aid**

**A possible economic model** to limit the French State contribution to the mobility transition

**And easily reachable primary frequency adjustment**

Flovesol

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alain.le-duigou@cea.fr

10:30 – 12:30 ***International Field Experiments and mobility projects***

- *Chair:* **Yannick Perez**, *University Paris-Saclay and Florence School of Regulation, RSCAS-EU*

## 5. How to go from natural experiments to technico-economic regulation for Electromobility?

- **Icaro Gomes** *(VEDECOM)*

INSTITUT VEDECOM
DU VÉHICULE DÉCARBONÉ ET COMMUNICANT ET DE SA MOBILITÉ

# How to go from natural experiments to techno-economic regulation for electromobility?

Icaro Freitas-Gomes

EVER Monaco - 08 May 2019

version 10/05/2019

# AGENDA

# AGENDA

**3** research **domains** covering
**3 major societal stakes**:

**Vehicle electrification**

- **Improve air quality**

**Driving delegation and connectivity**

- **Provide sustainable, safe and fluid mobility**

**Shared mobility and energy**

- **Optimize mobility systems in the territories**

Entreprises / Companies — Recherche / Research — Institutionnels / Institutional

FONDATEURS / FOUNDERS

DONATEURS / DONORS

EN COLLABORATION AVEC / IN COLLABORATION WITH

SOUTENU PAR / SUPPORTED BY

**50 members** & partners from different sectors **collaborate** on **pre-competitive** and **pre-normative research projects**

Certified as **Institute for Energy Transition** in 2014 by ANR

AGENCE NATIONALE DE LA RECHERCHE

INVESTISSEMENTS D'AVENIR

**VEDECOM, hub de recherche coopérative, créé en 2014**
*VEDECOM, a cooperative research hub, created in 2014*

Industriels
Industrials

Académiques
Academics

Territoires
Local authorities

**50 members & partners**

3 domaines de recherche - *3 fields of research*
1 centre de formation - *1 training center*

Vehicle electrification

Driving delegation and connectivity

Shared mobility and energy

FORMATION
TRAINING

**175 employees**
- **110 R&D**
- **45 PhD**
- **20 Staff**

€ **30 millions/year**

**> 100 publications**
**69 thesis**
**28 patents**
**18 software program deposits**

**7000 m²** of workshops and offices dedicated to research

In 2017
**14 training modules**
**120 hours**
**242 trained people**

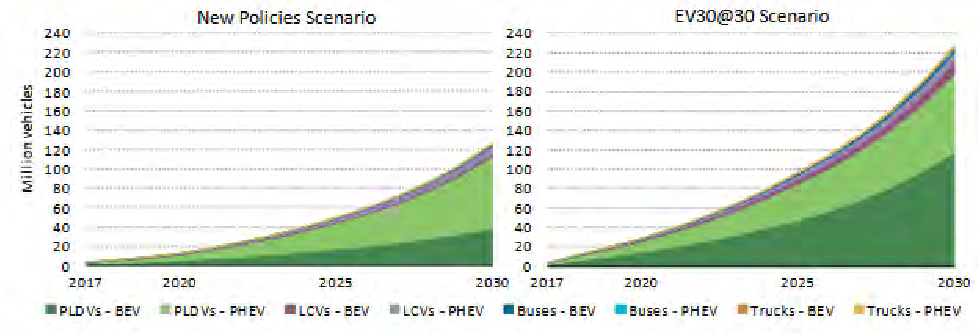
# AGENDA

## Automotive Industry

Increase of Electric Vehicles sales, supported by public policy, to decarbonize transport sector:

- Restrictions on CO2 emissions.
- Subsidy on EV sales.
- Development of the charging infrastructure.

Diversification of models to reach mass market




## Electricity Industry

Decarbonization of electricity sector:

- Rapid development of wind and solar energy.
- Increasing flexibility needs.

Liberalization of the sector:

- From monopoly to competition.
- Creation of different electricity markets with diverse time-frame and products.

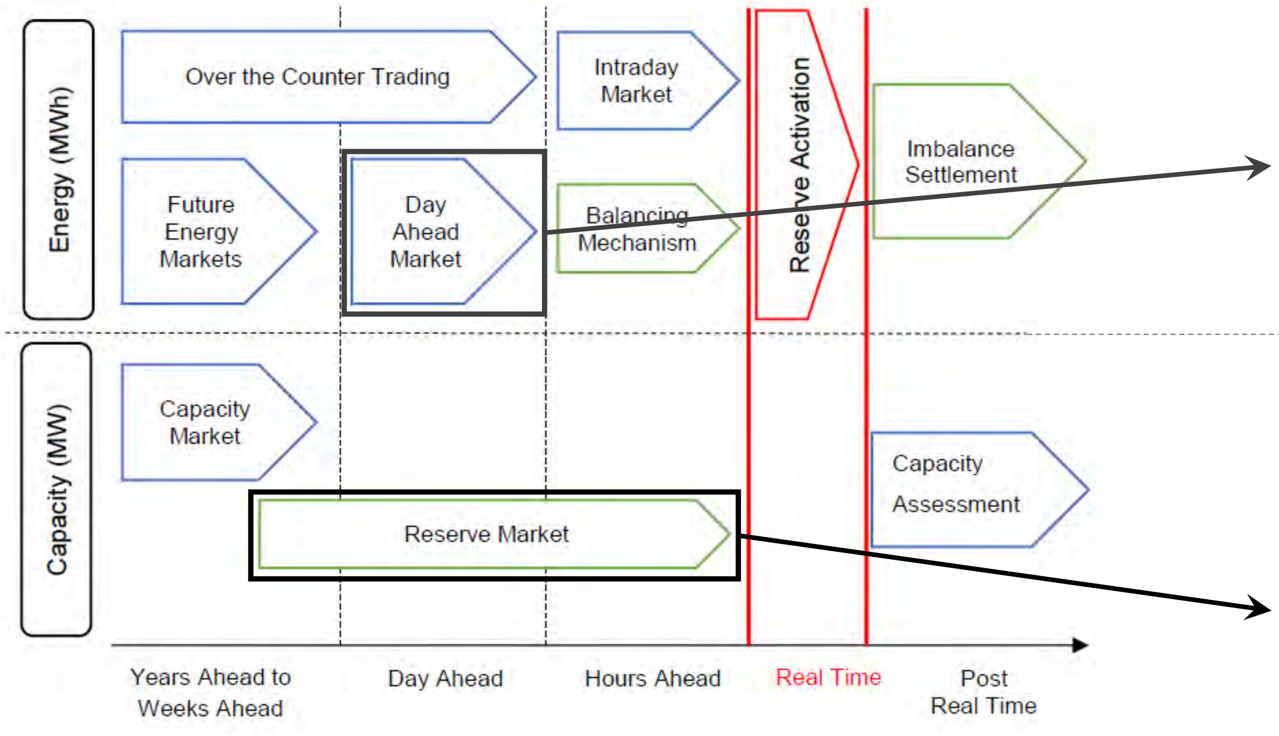
Are EVs a threat in this context?

- Context of decrease of electricity consumption.
- But important contribution to peak consumption.
- Opportunity as new flexibility source.

- **Smart Charging:** Manage actively charging patterns of the EV to offer flexibility services.
- **Bidirectional Capability:** Possibility of having reverse flow from the battery to the grid.
- **Aggregator:** Third party managing (dis)charging patterns of a fleet and biding on electricity markets.

## Which markets for Electric Vehicles?

- Identify market best adapted for EVs equipped with bidirectional chargers.



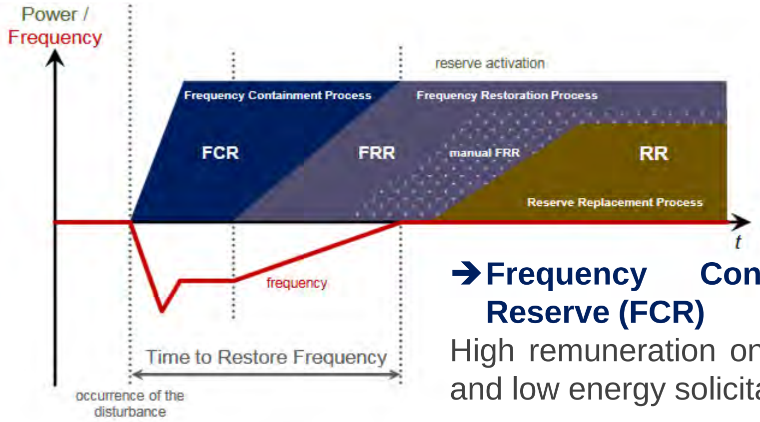

### Energy Arbitrage

**Charge** ➔ At periods where electricity price is low.

**Discharge** (optionnally) ➔ When the spread is the highest.

Significant savings with simple delayed charging.

### Reserve Provision




➔ **Frequency Containment Reserve (FCR)**
High remuneration on capacity and low energy solicitation

| From | To |
| --- | --- |

## Literature & academic research:

- Most of the research focused on the development of smart charging **algorithms.**
- Very few literature trying to assess economic viability of the proposed solutions.

## Past experiments:

- Most of the experiments focused on technical feasibility of V2G services (coms + algorithms), with EVs not being driven and to economical revenue estimation.
- Few experiments on real usages from customers or fleet owners.

## Presentation methodology:

- Understand the technical barriers and barriers to entry in flexibility markets.
- Evaluate the profitability of the solution.

**➔ Focus on FCR**

- Existing market with high value for V2G.
- Discuss about large fleets simulations to evaluate costs and its orders of magnitude.
- Propose the most adapted market rules.

# AGENDA

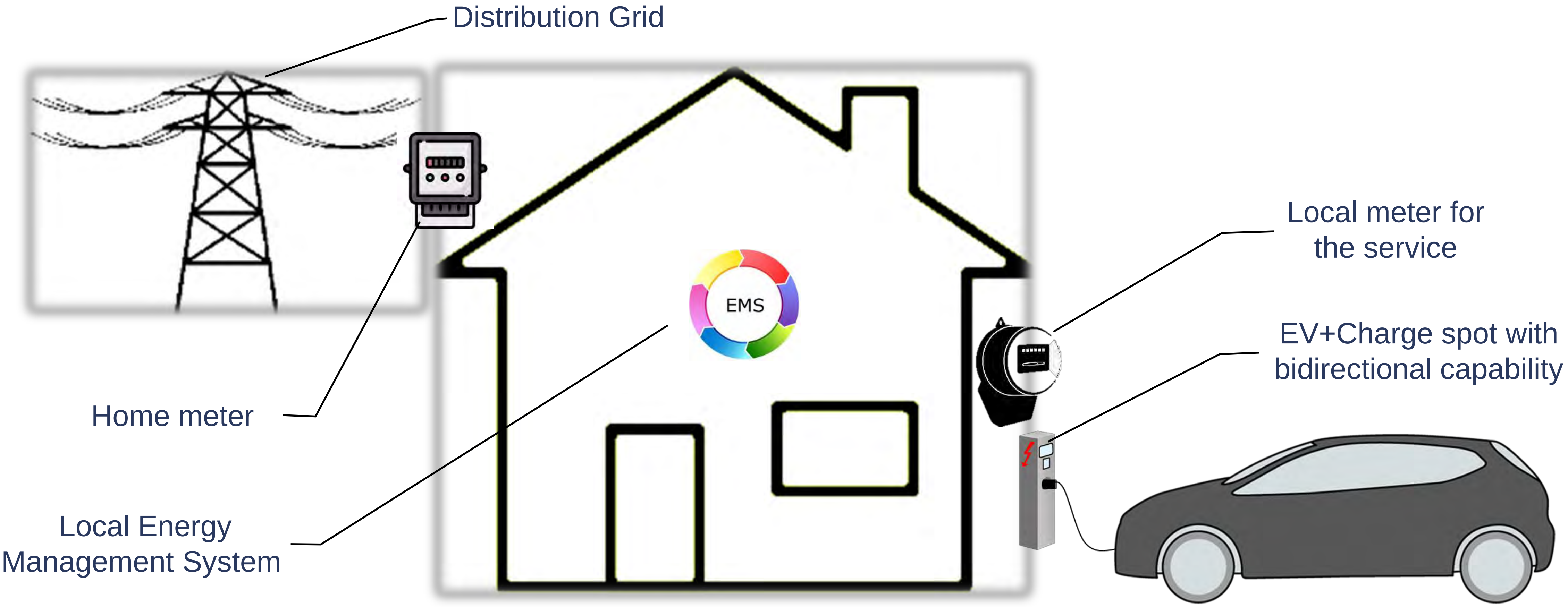
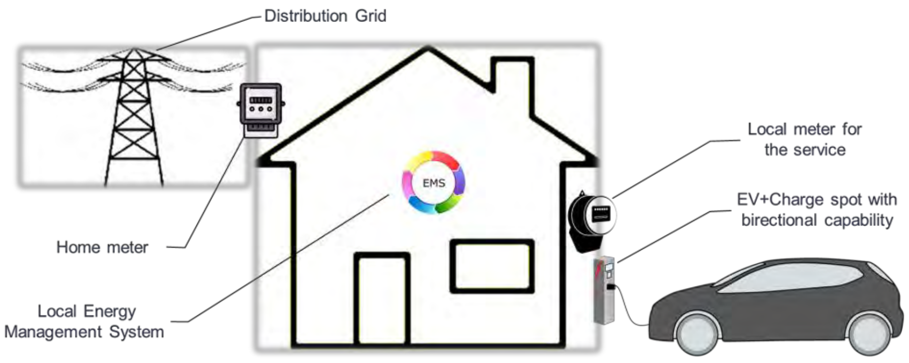



Figure 1: EV based architechture for FCRs services

### Linked to systems and actors




### Meter

- For FCR services, a specific meter is requested 10 seconds interval measurements instead of profile measurements.
- Will this meter be included with the home meter?
- How then to fulfill with GDPR (General Data Protection Regulation)?

### Energy Management System

- How to assure that FCR services could be offered?
- One possible solution, the EV + charge spot declare how much power they need to reserve when the service is subscribed and the EMS keep this margin free from any other uses.

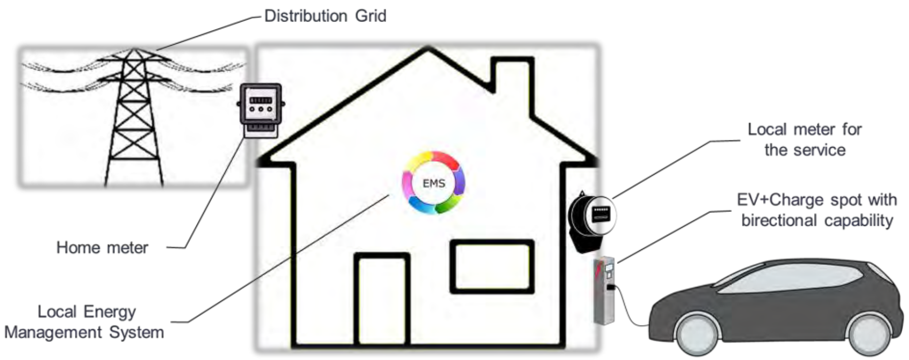
### DSO

- Who defines the hierarchy of services?
- How to insure that the hierarchy will be respected?
- A high granularity of products will help to find solutions.

## For the customer confidence

### At service level

- The revenue a customer participating in this service will get depends on the global performances of the system.
- These performances are not only the converter performance but also that of the communication, gateways and EMS.




What will be the customer confidence in case he buys an expensive and high performance EV but the service is limited by a low performances of the EMS or of a communication gateway.

### Proposition (based on an original idea from DTU):

- To develop performance indicators included in each part of the system.
- Performance indicators are values between 0 and 1 that could be easily multiplied between them in order to have the global expected performance.
- Expose these indictors to the customer in order for him to know where the limitations come from.

# AGENDA

## Comparison of three different market zones in 2016, for FCR and aFRR:

France: No existing market mechanism, allocation of reserve to centralized units, regulated tariff.
→ Modification of rules to join « FCR Cooperation », common market between Germany and neighboring countries.

Germany: No discrimination for DERs, product length of one week, pay-as-bid, not in favor of DERs participation.
→ Reduction of length of offers and marginal pricing in coming years.

Denmark : Identified as the most adapted market for DERs, 4 hours product and marginal pricing.
→Target rules in the FCR Cooperation.

FCR cooperation market: over 3000 MW, 1 week product length, 1MW of minimum bid and bid increment.

## Calculation of revenue for different scenarios of:

- Temporal Granularity;
- Volume Granularity;
- Rated Power of the EVSE.

| | | |
|---|---|---|
| Temporal Granularity | Temp-1 | One-week |
| | Temp-2 | 4 hours |
| | Temp-3 | 1 hour |
| Volume Granularity | Vol-1 | Minimum bid 1 MW, Bid Increment 1 MW |
| | Vol-2 | Minimum bid 1 MW, Bid Increment 0.1 MW |
| | Vol-3 | Minimum bid 0.1 MW, Bid Increment 0.1 MW |
| EVSE | EVSE-1 | Home : 3 kW, Work: 0 kW |
| | EVSE-2 | Home : 3 kW, Work: 7 kW |
| | EVSE-3 | Home : 7 kW, Work: 22 kW |

| | |
|---|---|
| Battery capacity | 50 kWh |
| Minimum SOC | 20% |
| Maximum SOC | 90% |
| Consumption | 0.18 kWh/km |
| Efficiency of the charger | 90% |
| Average Price of Reserve | 12 €/MW/hr |

A changing in FCR market rules can have highly positive economic consequences for EV fleets development.

# 4 – FCR MARKET BARRIERS

## 4.2 – Revenues of FCR

### Net present value per vehicle is studied:

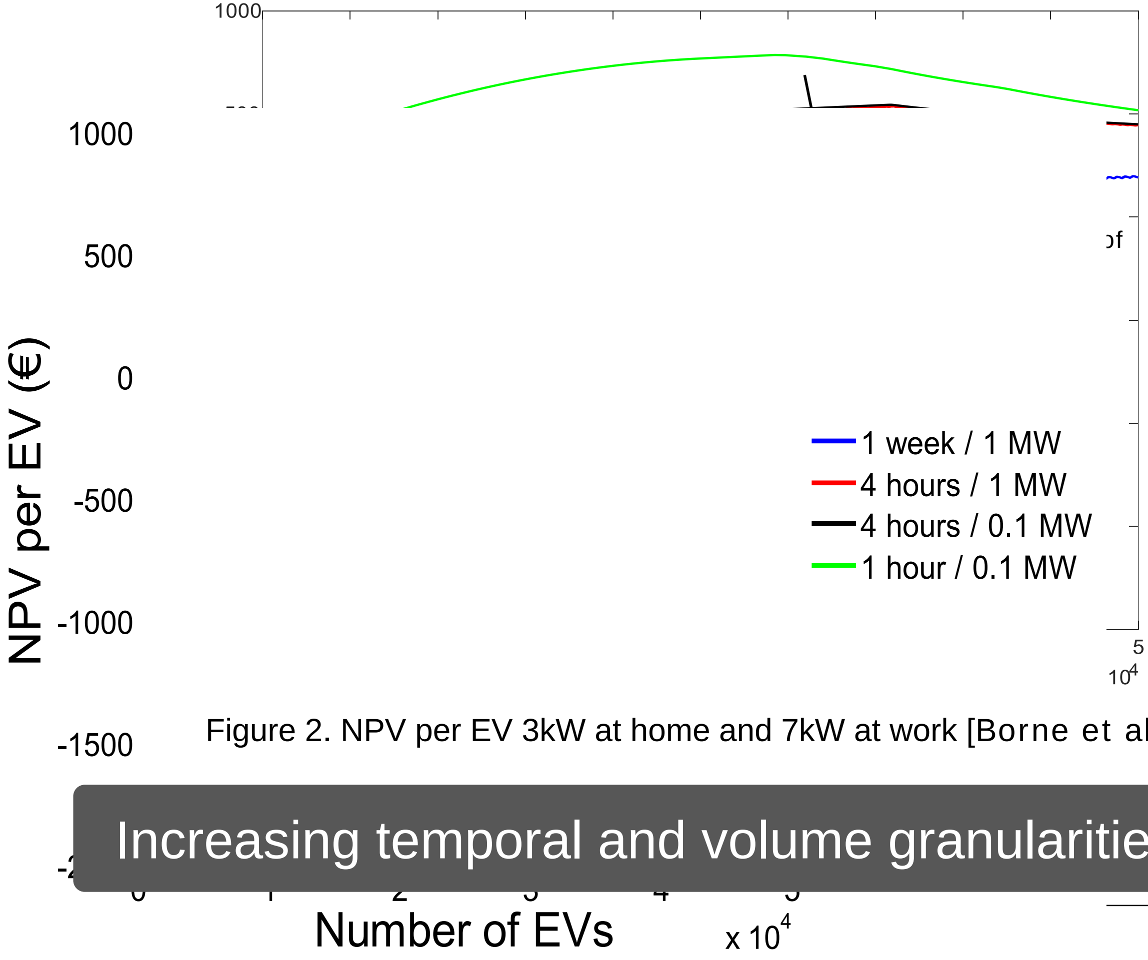
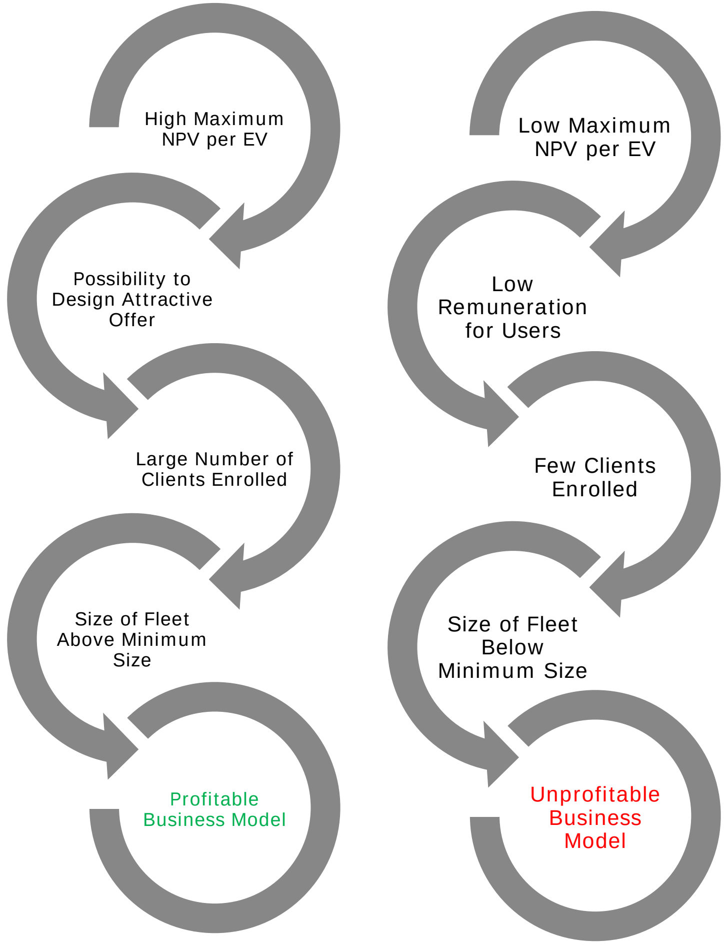



Figure 2. NPV per EV 3kW at home and 7kW at work [Borne et al. 2018]




**Increasing temporal and volume granularities reduce risks of unprofitable investments.**

# AGENDA

# 5 – CONCLUSION



## Technical Analysis

**Meter issues:**
- Standardization of already working meters.
- Can impact negatively the maximum revenue per EV.

**Cooperation between actors:**
- TSO-DSO optimal cooperation.
- DSO active grid management.

**Beyond technical barriers**:
- Aggregator-user transparent relation.
- Data privacy concerns.

## Profitability Analysis

**Need to take into account costs when assessing value of V2G:**
- Costs for implementing the function on the vehicle.
- Costs for operating the fleet.
- Economies of scale.

**Different scenarios studied**:
- Revenues ranging between 0 and ~1200€/EV/year.
- Rated EVSE power highly affects the maximum revenue/EV.
- High bid increment induce threshold effects, which might create risks for small fleets.
- Big fleets do not benefit from greater volume granularity.

**Sensitivity analysis on different parameters:**
- Increasing granularity of products reduces risks.
- High risks linked to price of reserve.

INSTITUT VEDECOM
DU VÉHICULE DÉCARBONÉ ET COMMUNICANT ET DE SA MOBILITÉ

# Thank you for your attention

## Together to accelerate the mobilities of tomorrow!

10:30 – 12:30 ***International Field Experiments and mobility projects***

- *Chair:* **Yannick Perez**, *University Paris-Saclay and Florence School of Regulation, RSCAS-EU*

## 6. Managing EVs as distributed energy resources with JuiceNet?

- **Vincent Schachter** *(ENEL X e-Mobility)*

# Managing EVs as distributed energy resources with JuiceNet

Vincent Schachter, Head of Global Energy Services, ENEL X e-Mobility

IAEE - EVER2019, Monaco, May 2019

# Enel today

Leader in the new Energy World

1st **network** operator[1]

World's largest private player[2] in **renewables**

Largest retail **customer** base worldwide[1]

73 mn end users

43 GW capacity[2]

46.5 GW capacity[3]

5.7 GW demand response

~ 64 mn customers[4]

# Enel X Portfolio of solutions

## 4 Global Product Lines

enel x

| e-Industries | e-City | e-Home | e-Mobility |
|---|---|---|---|
| Consulting and auditing service | Smart lighting | Installation, maintenance and repair services | Charging infrastructure (public & private) |
| Distributed generation on/off site | Fiber optic wholesale network | Automated home management | Maintenance and other services |
| Energy efficiency | Distributed generation & energy services | Financial services | OEM back-end integration |
| Demand response and storage solutions | Demand response and storage solutions | Home 2 Grid | Vehicle Grid Integration |

**Flexibility**

**Addressing new customer needs with innovative technologies**

# eMotorWerks timeline

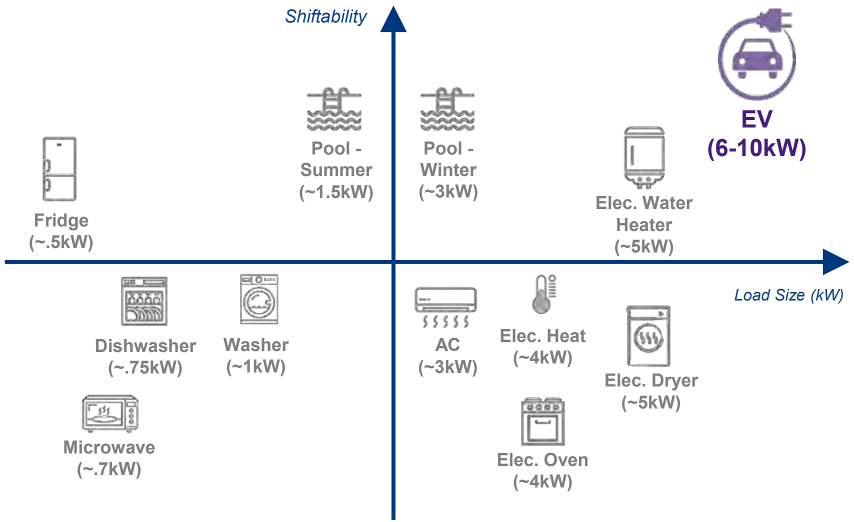
eMotorWerks
An Enel Group Company

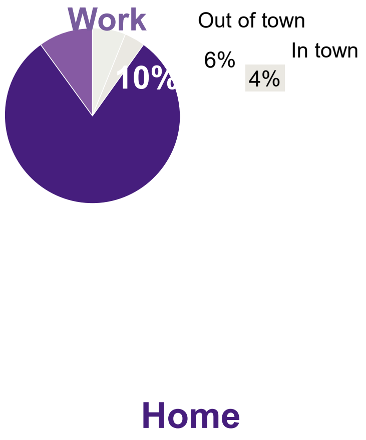
- **Jan 2014** – Launch of JuiceBox, the first smart-grid enabled charging station
- **Q4 2015** – Launch of JuiceNet IoT platform for EVSEs and JuiceNet Green, first CO2-minimizing charging solution
- **Q2 2016** – Launch of JuiceNet utility solution
- **Q3 2016** – Launch of JuiceNet OEM cloud-to-cloud platform
- **Q4 2017** – Acquisition of eMotorWerks by Enel
- **Q1 2018** – eMotorWerks' expansion to Europe
- Product line merge with ENEL

# EV charging – a highly flexible load

eMotorWerks
An Enel Group Company

## 90% of Re-Fueling is Flexible

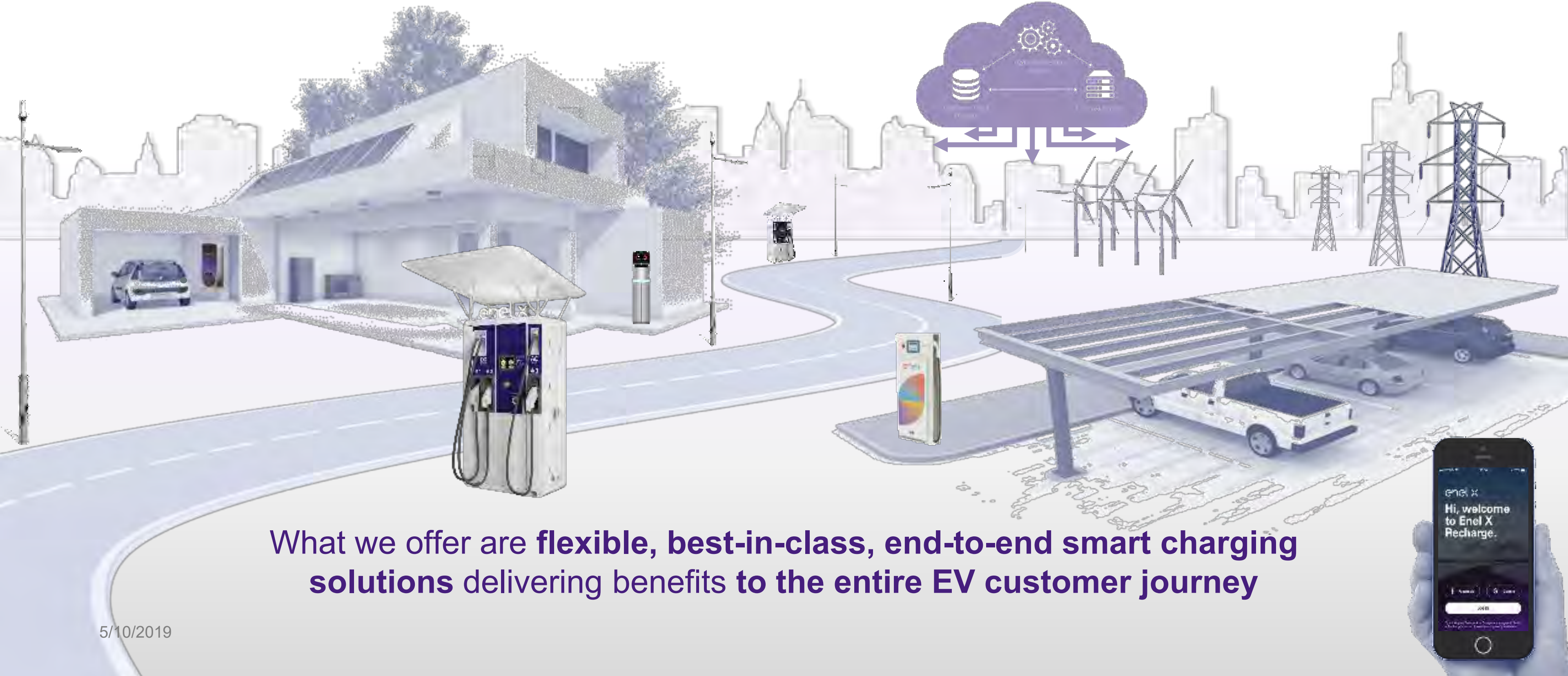



**30-40 mi. average daily commute requires 10-15 kWh energy per day with 1-2 h charge time**

Most long duration charging (over 6 hours) happens at home and work, but drivers usually need less than 2 hours of charging, creating many **opportunities to provide flexibility**

# Our offering: a flexible end-to-end charging ecosystem

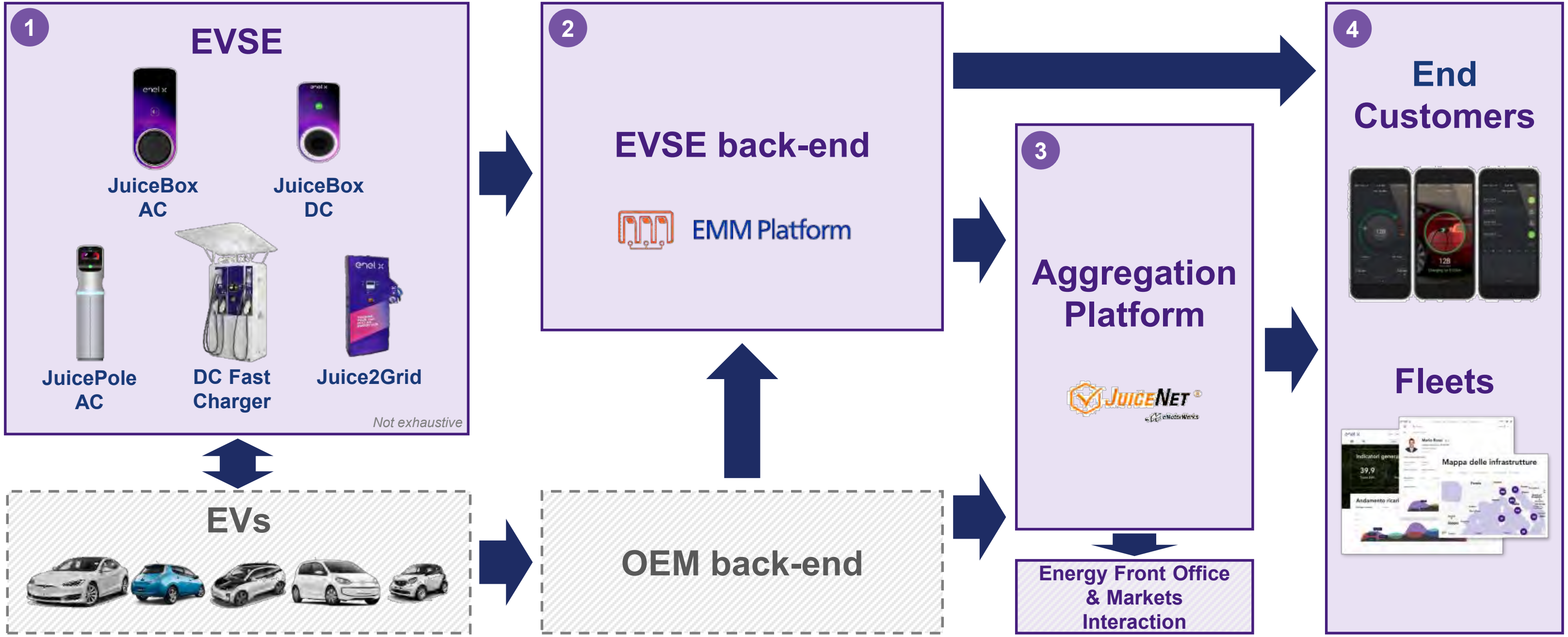



What we offer are **flexible, best-in-class, end-to-end smart charging solutions** delivering benefits **to the entire EV customer journey**

# e-Mobility product ecosystem

Enel can be a full stack technology provider or an aggregation technology provider

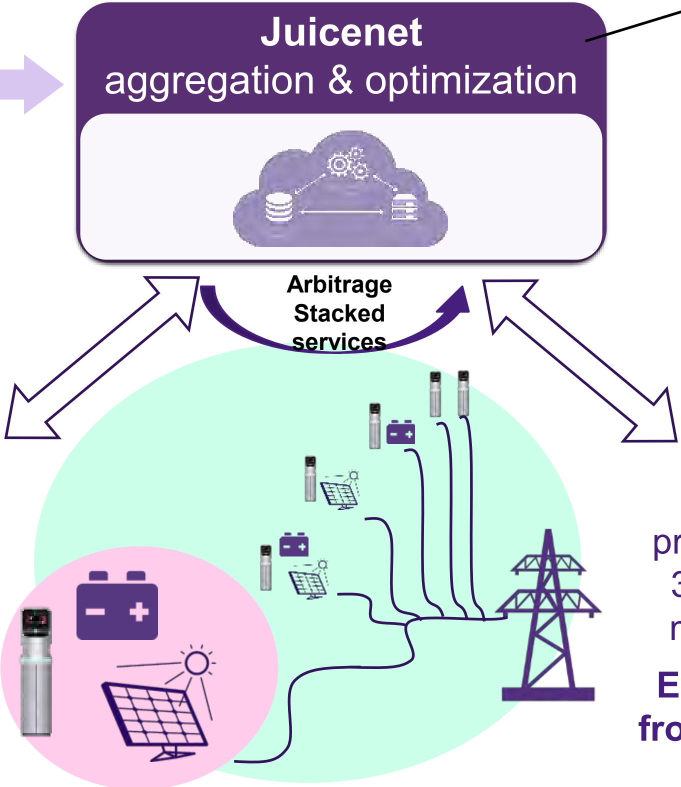
*An open system ensuring interoperability*



# The JuiceNet Platform

Aggregating flexibility from EVs and small DERs to deliver energy services

Telemetry
& control




- Aggregation & Optimization Engine
- Predictive Resource Models
- Predictive Value Models
- User Interfaces

BTM services
**Local optimization**
of EVs charging and Distributed Energy Resources
**Enabling customer savings on energy bill**

FTM services
**Aggregation** for providing services to 3rd parties (energy markets & trading)
**Enabling revenues from energy markets**

# CAISO Market Participation

- **CAISO:** responsible for balancing the grid. 3800 nodes. A variety of products. Market data freely available. Easy access for DR and DER aggregators. Strong renewables penetration.

- **Energy Markets Participation Models**
  - Direct Participation Rewards Program and/or EV OEMs (possibly via scheduling coordinator)
  - In partnership with utilities:
    - large « Investor Owned Utilities »
    - « Community Choice Aggregators »

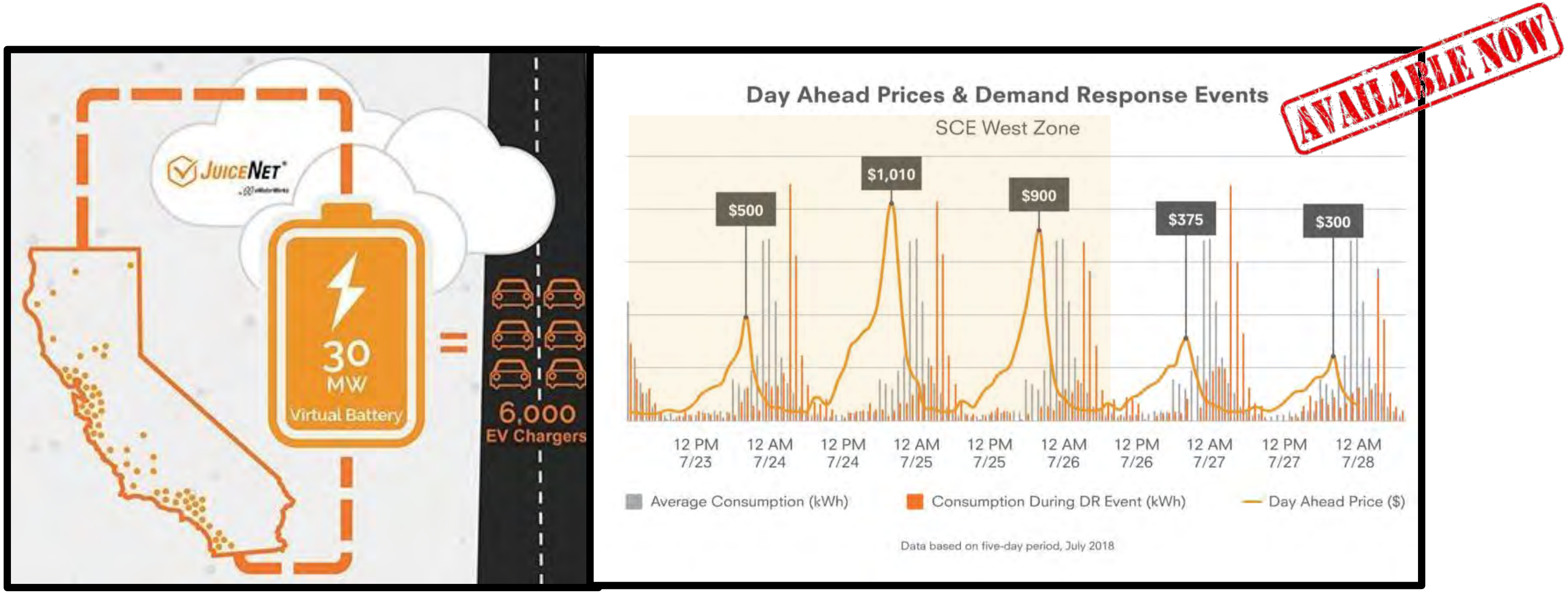
- Thousands of EVSEs currently signed up for smart charging programs directly with eMotorWerks or through partners (CCAs, OEMs)

- **Day-Ahead Market, DR Programs, Low Carbon Fuel Standard, Real-Time Market**
- **Regulation at pilot stage**

# California (CAISO) Wholesale Markets

First large-scale commercial participation of EV batteries in electricity markets

enel x

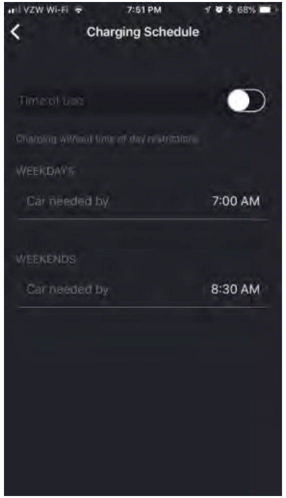



**Residential EVSEs / Aggregation / DR programs + Day-Ahead + Real-Time Market trading**

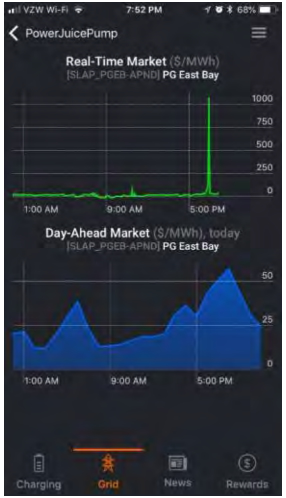
# JuiceNet Energy Markets participation

Earn from direct participation into energy and ancillary markets

**Customer Provides Mobility Preferences**




**Bid & Awards based on Market Prices**

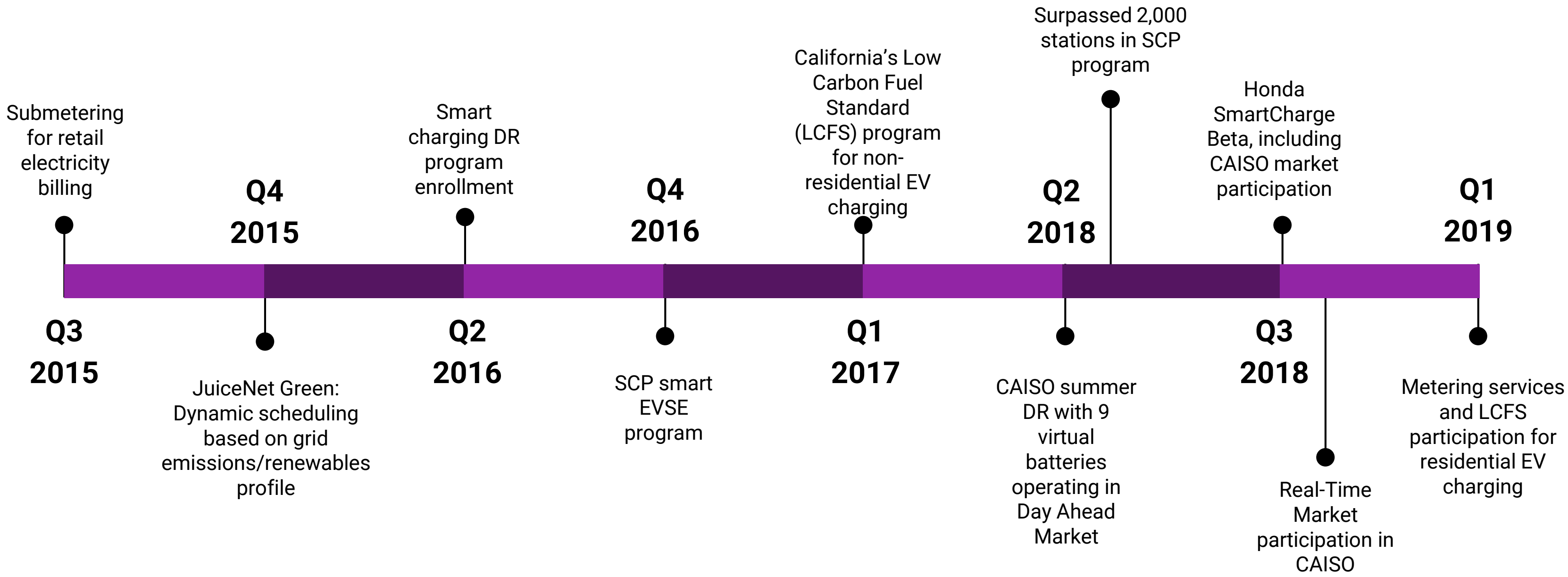



**Long Duration Curtailment**


**Fast Response Curtailment**


Our technology helps you **maximize your return on EVSE investment**, through **revenues** from grid services provision

# Smart Charging Milestones in CAISO



# JuiceNet for OEMs

Enabling OEMs to generate revenue streams to reduce EV Driver's TCO

**Find the best time to charge EVs according to electric grid conditions:**
**reduce customer costs and CO2 emissions;**
**Earn rewards through DR programs and wholesale market trading in California**

Honda SMART CHARGE powered by JUICENET®


Honda SmartCharge monitors wholesale electricity markets for when energy demands spike and inefficient peaker power plants need to pick up the slack.

In such events, we defer charging temporarily until the grid electricity load has dropped sufficiently to avoid needing these inefficient fossil fuel power plants. This happens automatically, while ensuring your car is at maximum charge when you need it.

By adjusting the time of charging of your Fit EV along with other Fit EVs in your area, Honda earns payments from its utility partners and is then able to share those profits with you.

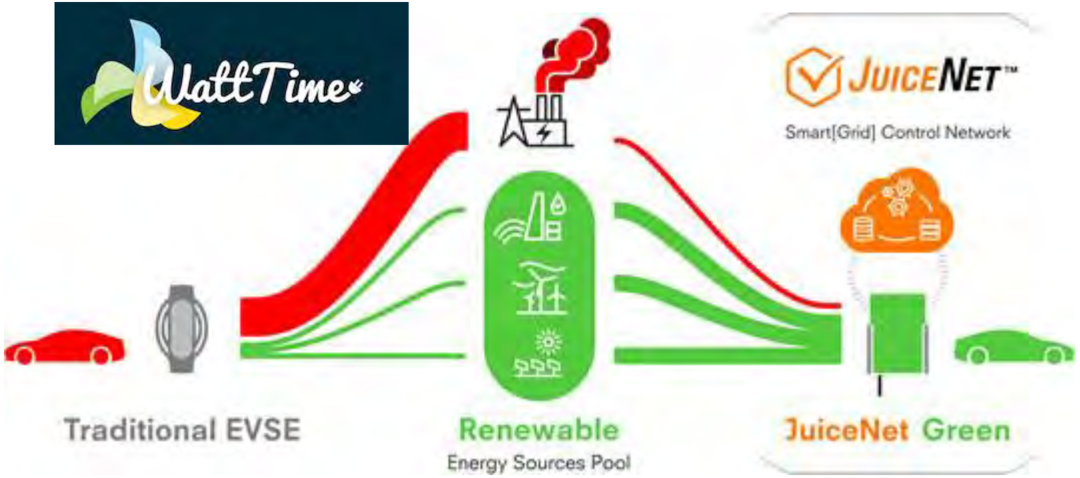
# JuiceNet Green

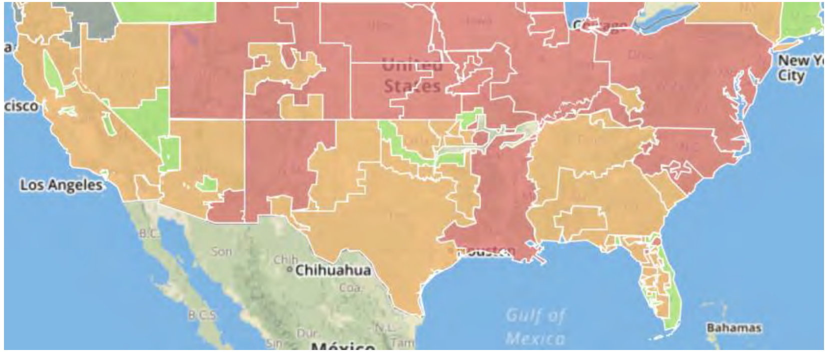
Uses industry leading emissions-prediction API from WattTime.org

Builds a charging schedule that optimizes CO2 emissions

Benefits:

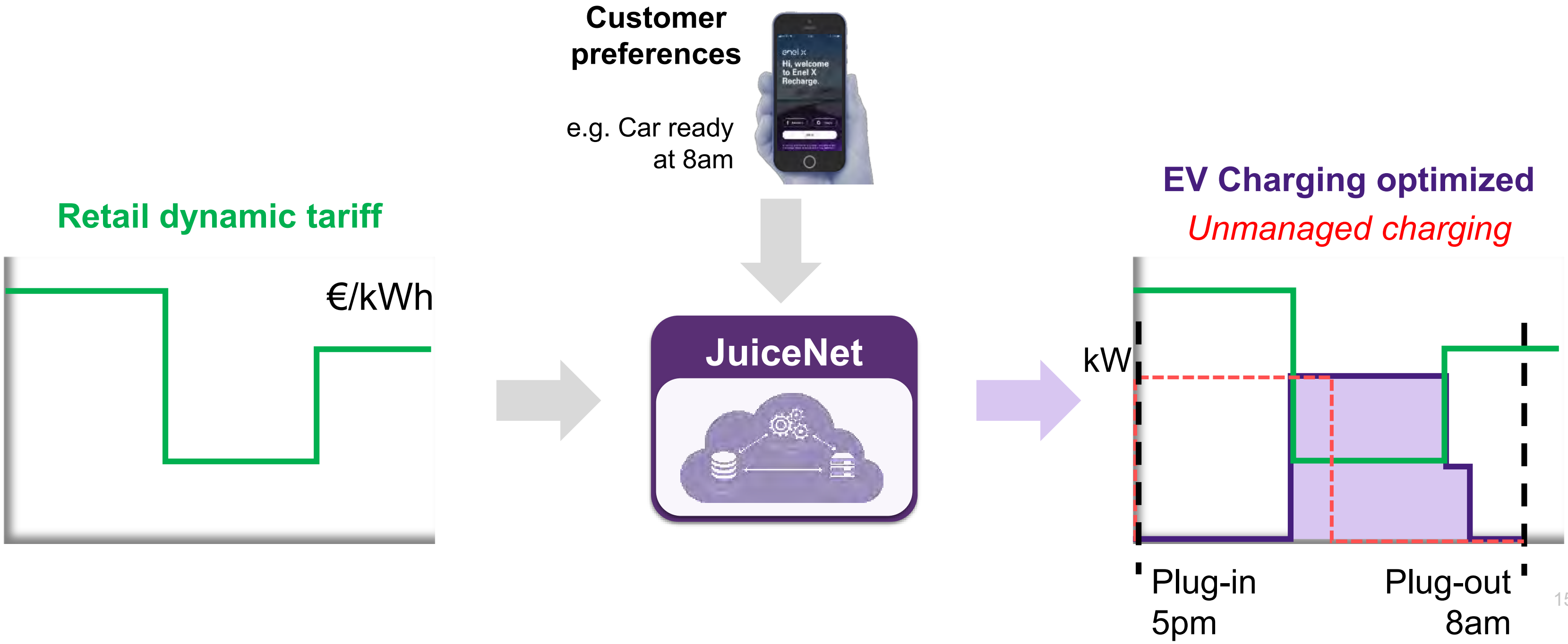
- **Charge your EV using cleanest energy**
- **Minimize EV's pollution footprint: reduce carbon emissions impact of EV charging**



# Tariff Optimization

The tariff Optimization functionality guarantees you to charge when your electricity price is lower, dynamic pricing retails tariffs are also integrated (tariffs indexed on Energy Markets).



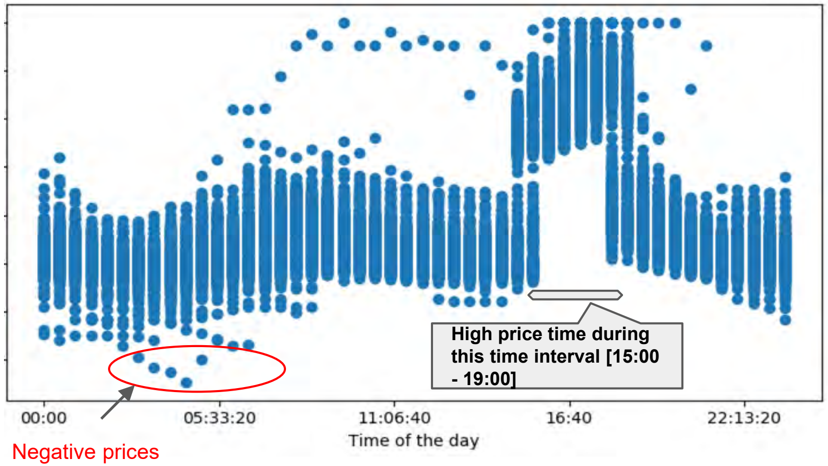
# Tariff Optimization

An example of savings for a Residential UK customer

**The EV driver will save 1/3 of the cost of charging its Electric Vehicle.**

Considering a retail dynamic tariff varying with UK wholesale day ahead market, versus a flat tariff

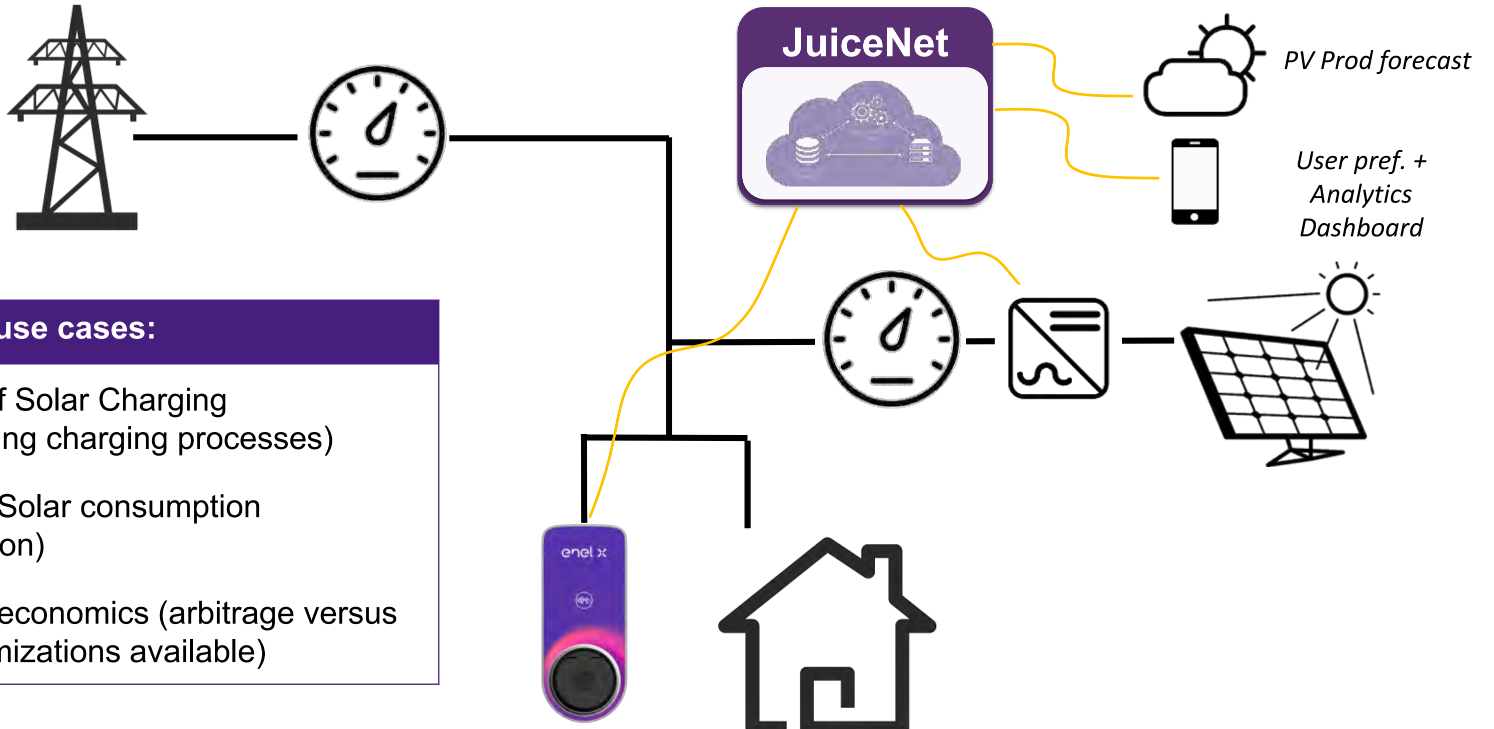
- Plug-in time: 7pm
- Plug-out time: 7am (D+1)






Additional assumptions: Energy need: 30 kWh (weekdays only); Schedules time resolution of the price signal: 30min

# Solar + Charging




**Example use cases:**

Show % of Solar Charging
(not affecting charging processes)

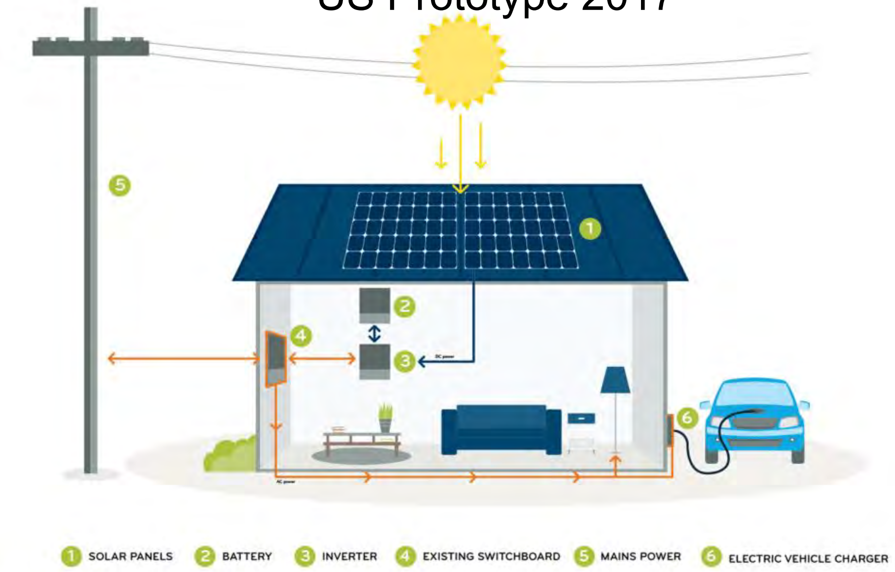
Maximize Solar consumption
(optimization)

Maximize economics (arbitrage versus
other optimizations available)

# Solar + Charging

## Co-optimize charging, PV and battery

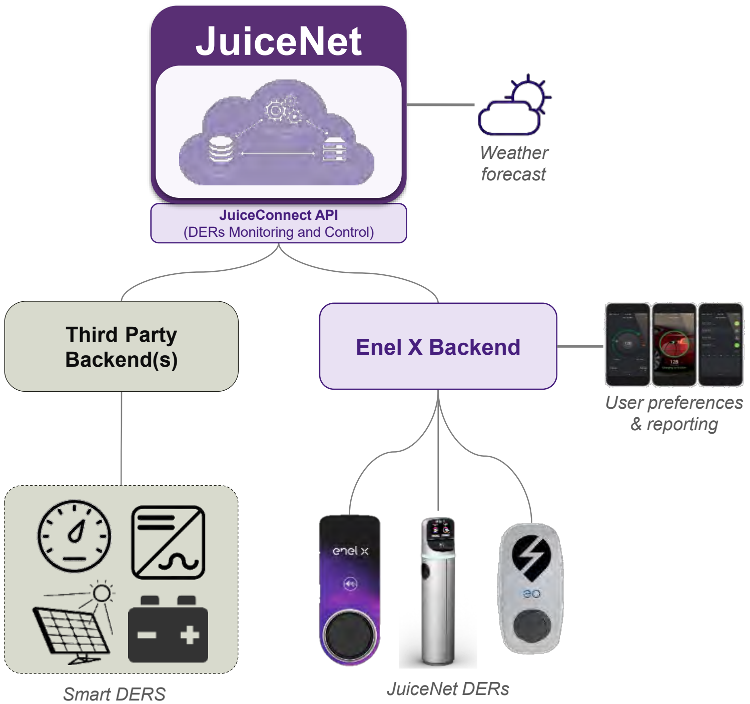
US Prototype 2017




[3] JuiceMeter on solar inverter measures real-time solar production
[6] EVSE modulates charging rate to match solar production

- US prototype: simple easy-to-install (JuiceMeter + EVSE), match charging to solar production
    - Generate customer savings by optimizing charging against FIT & NEM.
- EU “JuiceNet for Solar” product(s) under development:
    - JuiceNet controls Stationary Battery + EV Charging to maximize self-consumption
    - Solar prediction
    - Germany, UK, France, Italy
    - B2B vs B2C: different needs

# Solar + Charging: Integrating DERs beyond e-Mobility




1. Easy integration of Distributed Energy Resources (DERs) from Third Parties thanks to an **open architecture**:
   - Solar Systems
   - Batteries
   - Inverters
   - Energy Meters
   - Etc.

2. **Highly configurable optimization algorithm** to cover various hardware configurations:
   - AC or DC coupling
   - Net metering with various Feed In Tariff schemes
   - Islanding
   - V1G/V2G chargers
   - Etc.

# Preparing for commercial V2G


## Nissan And Enel Launches World's First Commercial V2G Hub In Denmark

Nissan together with Enel and Nuvve is laying the groundwork for future large application commercial V2G (vehicle-to-grid) systems in Denmark.

The country's utility – Frederiksberg Forsyning has installed **10 Enel V2G** charging units (10 kW each) and also purchased **10 Nissan e-NV200** for use at its headquarters.

## Nissan and Enel launch groundbreaking vehicle-to-grid project in the UK

- First ever vehicle-to-grid (V2G) trial in the UK
- Nissan electric vehicles become mobile energy hubs supplying the grid
- Trial comprises of 100 V2G units
- Nissan EV owners can sell stored energy in their vehicles back to the grid for a profit

## New V2G Pilot In Genoa Aims To Define Operating Standard For V2G In Italy

May 18th, 2017 by Kyle Field

Vehicle to Grid (V2G) vehicles have arrived in Italy as part of an agreement between Enel Energia, Nissan Italia, and the Italian Institute of Technology. The pilot project will kick off

## Enel and Italy's first vehicle-to-grid pilot

Enel Energia, Nissan Italy and the Italian Institute of Technology have teamed up on a corporate electric car sharing pilot with V2G charging.

Published: Wed 10 May 2017

# Thank You!

**Vincent Schachter**
Head of Global Energy Services
ENEL X e-Mobility
vincent@emotorwerks.com

1. Company Profile
2. Energy Services current use cases
3. EVs and beyond
4. Status of ongoing discussions

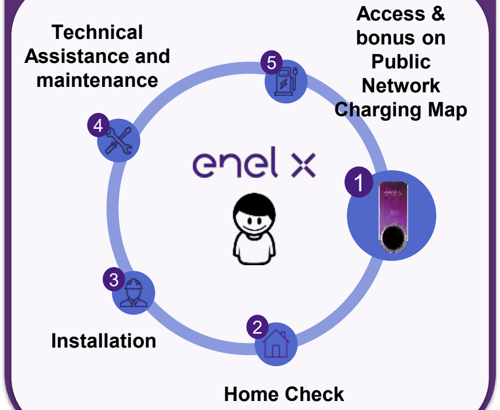
# Our offering: a flexible end-to-end charging ecosystem

## Energy Services

**Flexible, best-in-class, end-to-end smart charging solutions** delivering benefits to the entire EV Value Chain

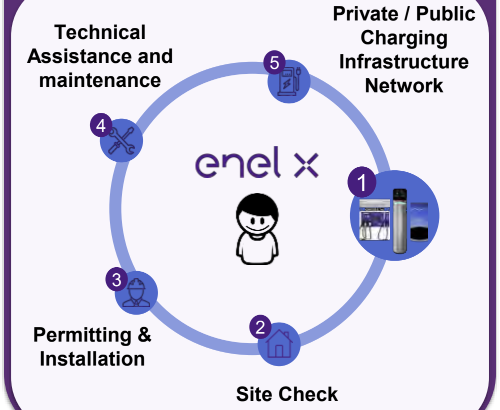
## B2C

**E2E Package for Private Customer**




## B2B2B/C

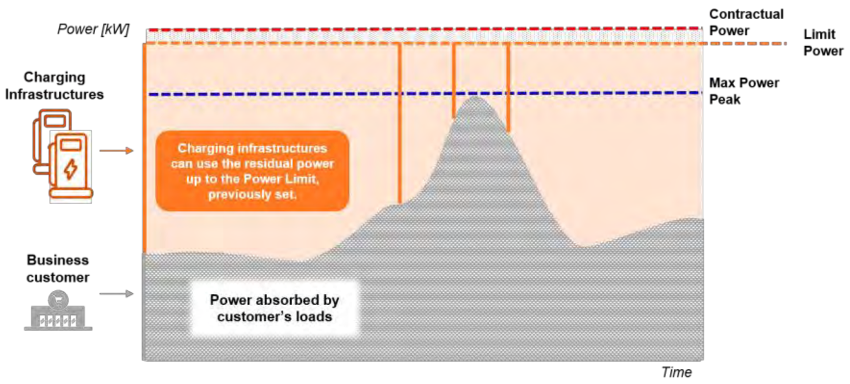
**Private estate / Private or Public charging**



# Demand Limitation at Commercial Facilities

Behind-the-meter functionality applied to Public & Private Charging domain

- The Cap Charging functionality guarantees that charging loads use only the building's residual power
  → EVs are dynamically managed, total customer load stays below the agreed-upon Cap.

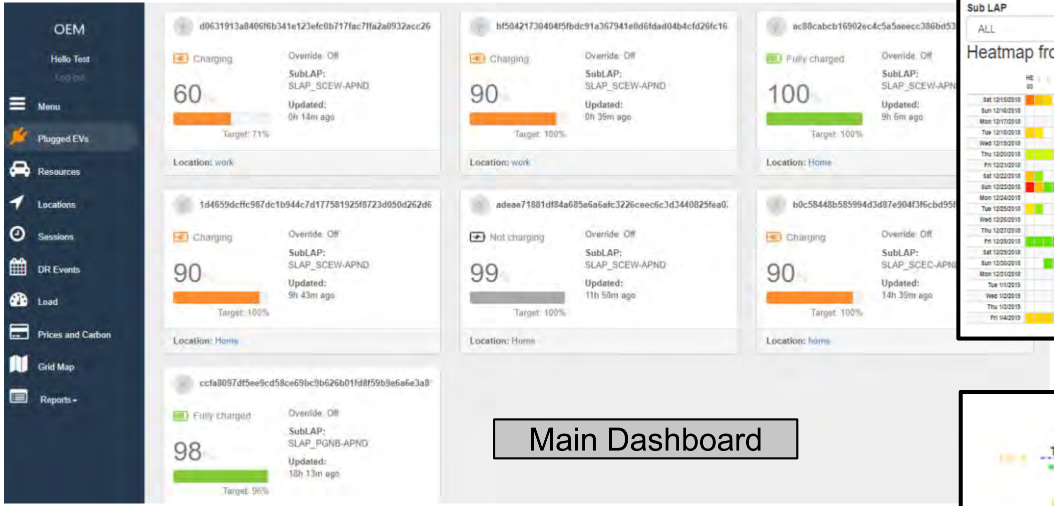




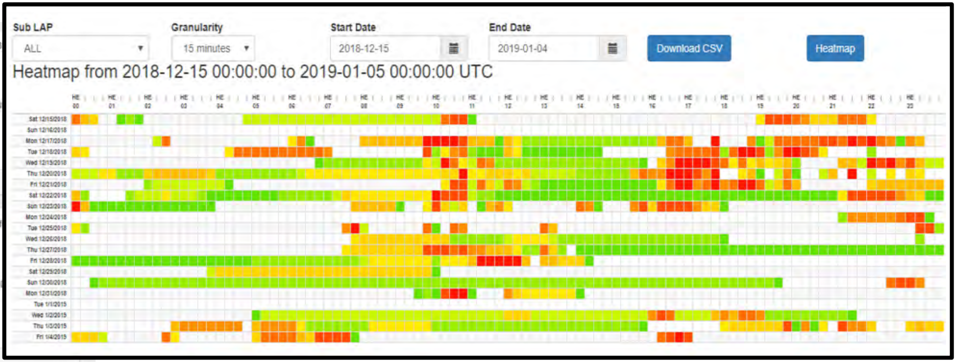
**Multiple EVSEs + other loads in a building / Local Optimization / Savings on energy bill + Peace of mind**

# JuiceNet for Honda: Smart Charging Direct to EV

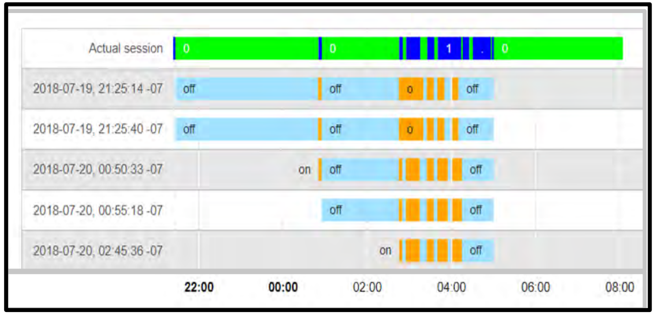
**Honda FITs + Clarity / Aggregation / DR Programs + Wholesale markets**



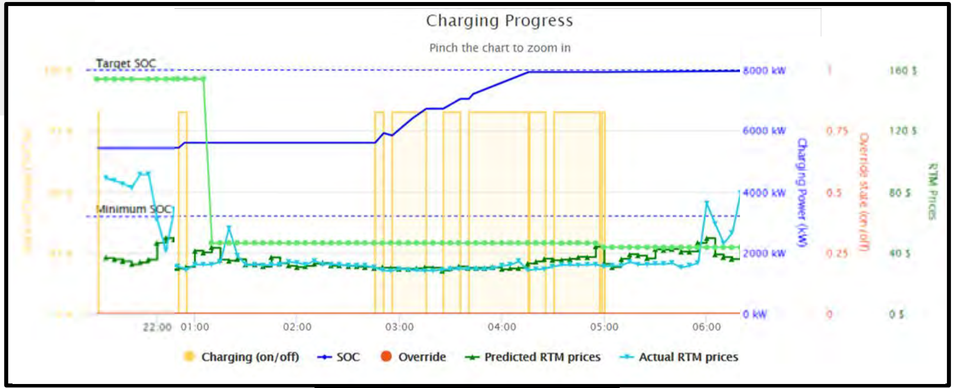

Main Dashboard




Heatmap



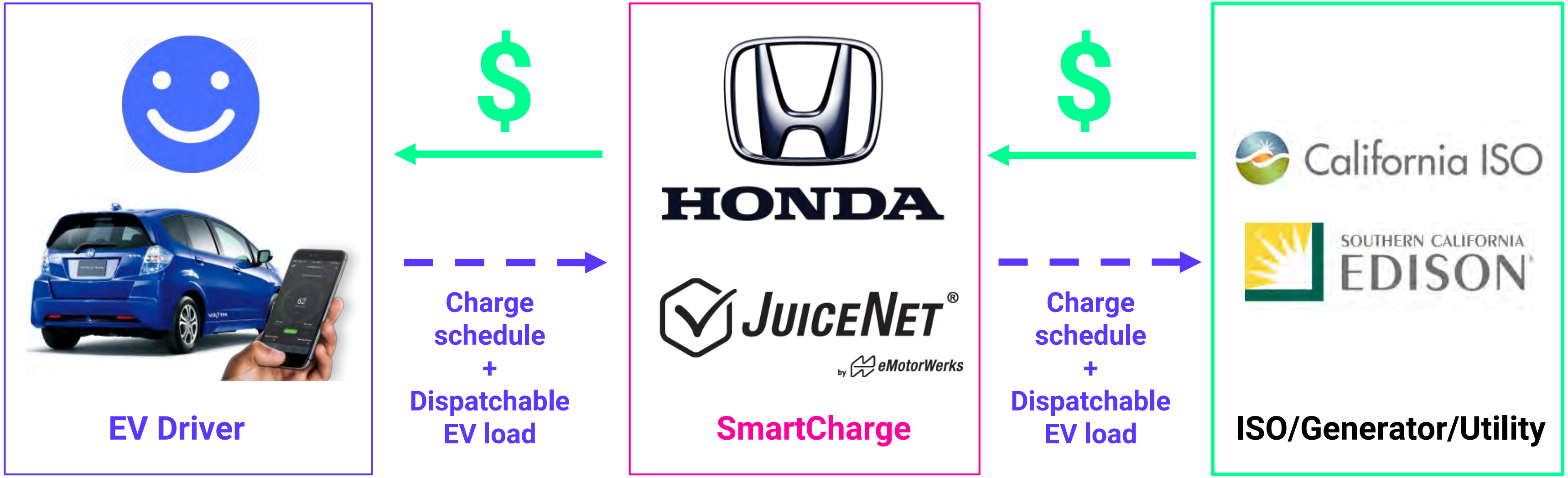

Schedule Updates




Session Chart

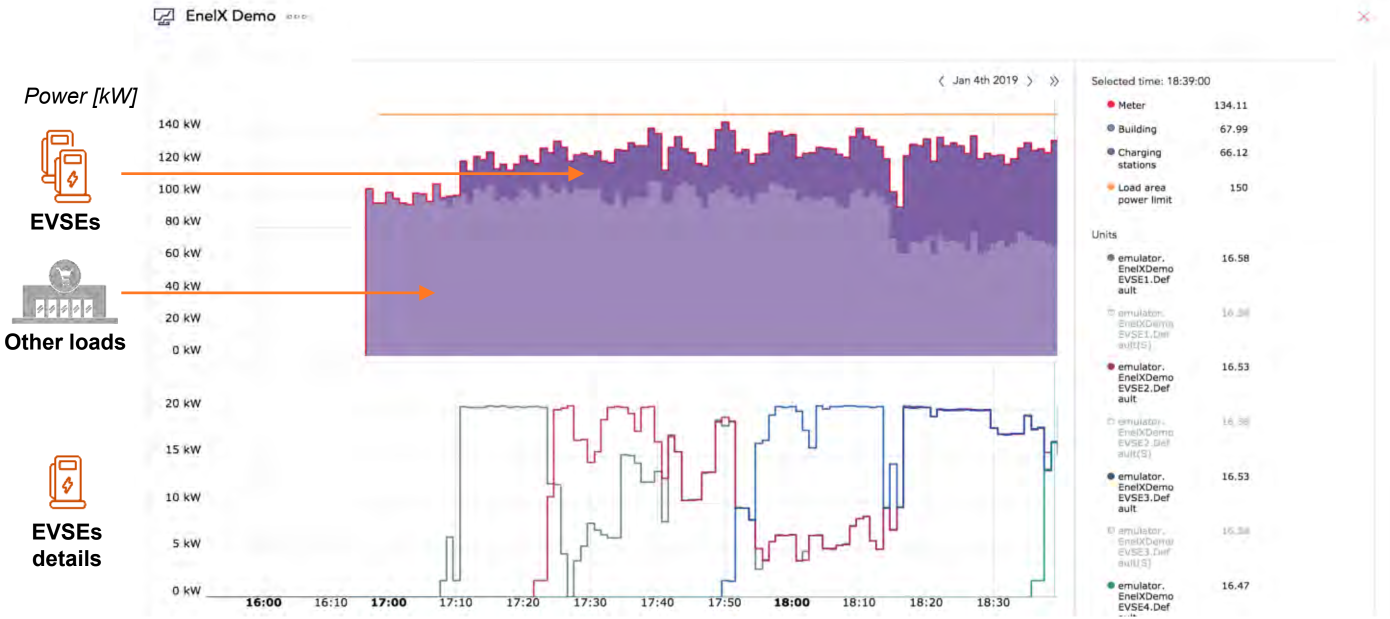
# Honda SmartCharge Program

eMotorWerks
An Enel Group Company



# Cap Charging

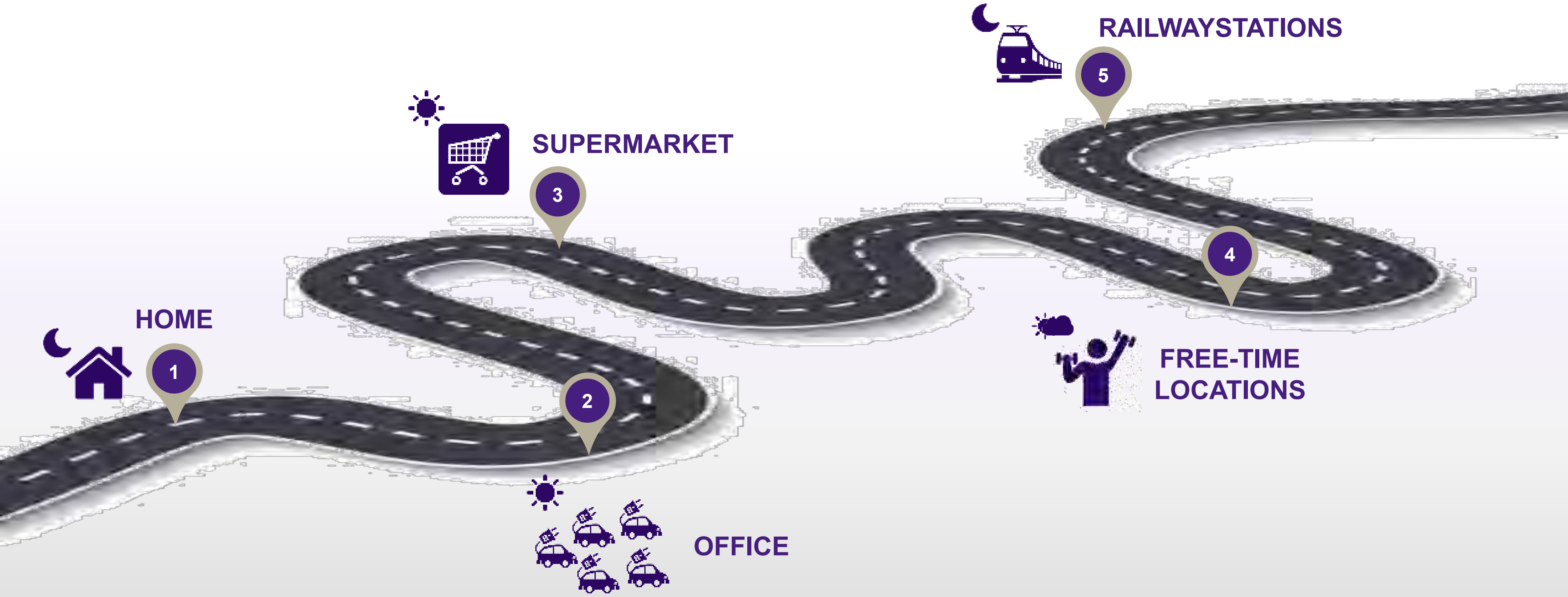
The Cap Charging functionality guarantees that charging loads use only the **building's residual power**. EVSEs are dynamically managed in order to have the customer total load below the agreed-upon Cap.



# Today’s Energy Services opportunity

| | Revenue streams | Relevance today | Relevance 2021 | Key drivers / enablers |
|---|---|---|---|---|
| Local energy optimization | **Grid charge avoidance** | High | Medium | • Network Use of System charges become increasingly unavoidable, but aggregated flexibility from EV corporate car fleet would still be valuable |
| | **DSO local programs** | Small | High | • Emerging markets for local flexibility (e.g. Piclo, Electron)<br>• Approach to value avoidance of local grid investments |
| | **Tariff optimization** | Small | High | • Retailers offering dynamic tariffs to reduce imbalances / to leverage energy arbitrage<br>• EVs + PV solar self-consumption business case |
| TSO services | **Balancing Mechanism** | None | High | • Allow settlement of aggregated EV units<br>• Reduce minimum settlement unit size<br>• Combined trading strategies with energy arbitrage from wholesale energy markets |
| | **Frequency regulation** | Small | High | • Lower minimum entry levels (from MWs to kWs), combine pool of EVs with pool of stationary Industrial & Commercial flexible capacity<br>• Auctions with more granular hourly products to align with predictable EV charging times<br>• Allow testing and ongoing metering of aggregated pools of EVs instead of each single EV unit<br>• Allow testing in specific time periods<br>• Lower metering accuracy requirements of individual units<br>• Establish baseline methodology to account for state-of-charge management of EVs |
| | **Capacity Market** | None | Medium | |

# EV usage and customers’ journey will be different from those of traditional ICE cars



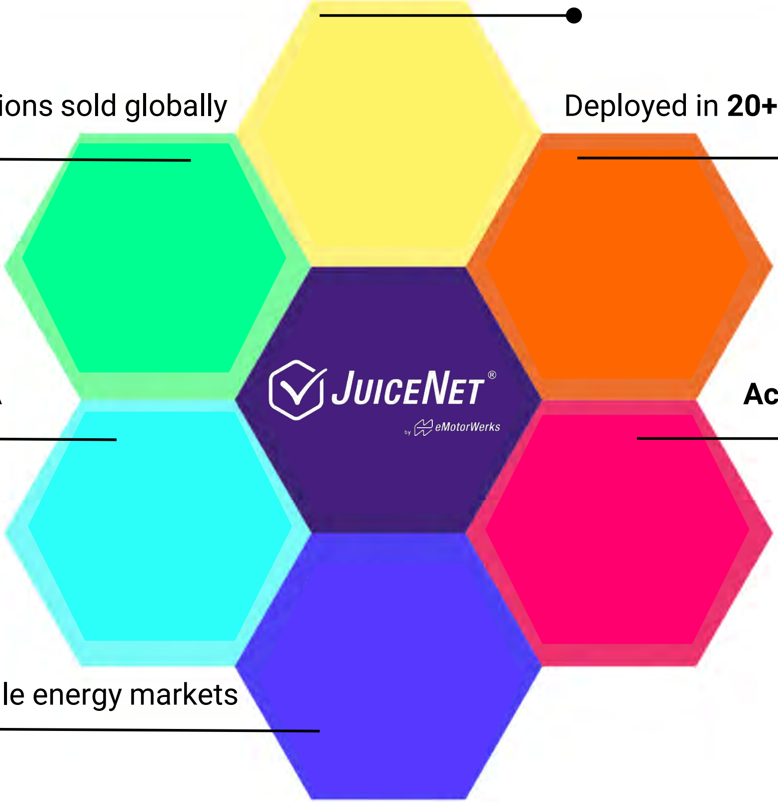
# A snapshot of today

eMotorWerks
An Enel Group Company

**#1 EVSE** on Amazon for 4 years

**40,000+** EV charging stations sold globally

Deployed in **20+ countries** around the world

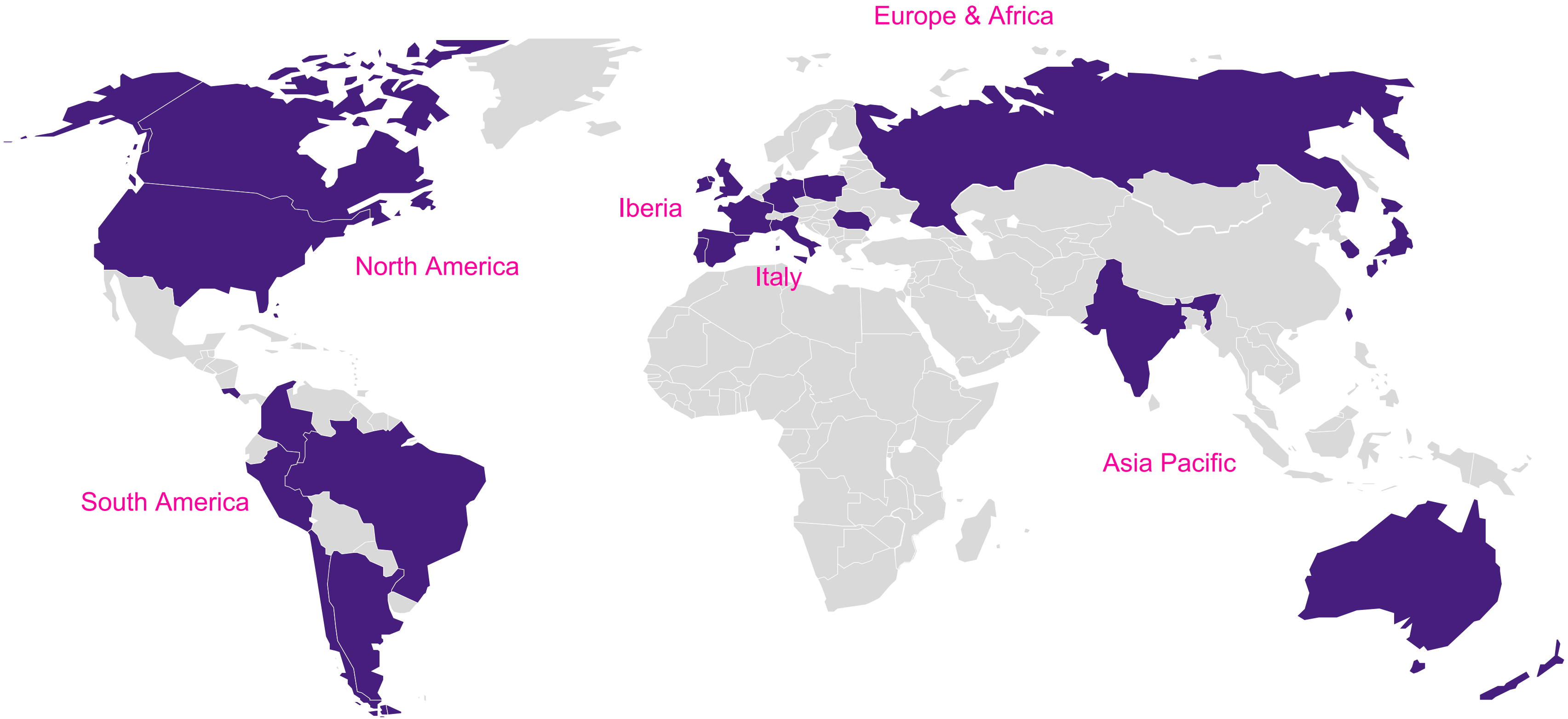



**30MW** Virtual Battery Capacity in CA

**Acquired by** Enel Group in October 2017

**Only EVSE** to participate in wholesale energy markets

# Enel X's presence

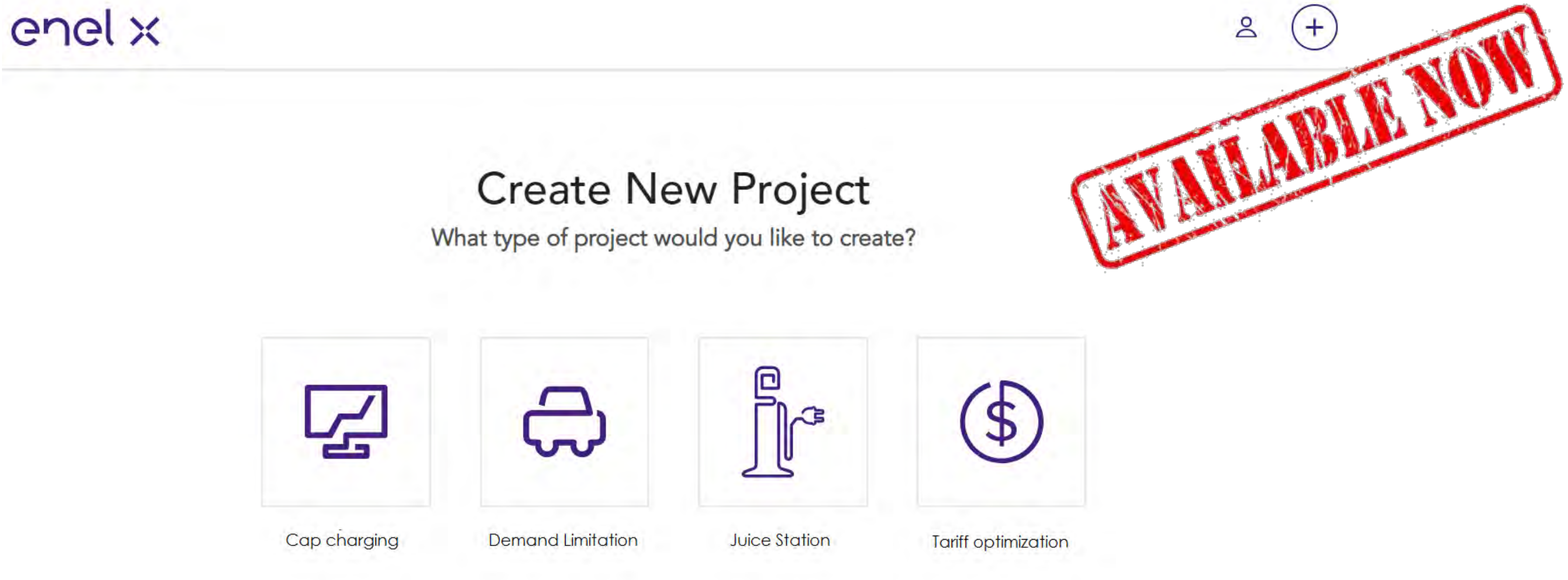


# Behind The Meter Services

| | Demand Limitation | Tariff Optimization | Sequential / Parallel Charging |
|---|---|---|---|
| Features | • Cap charging<br>• Peak shaving | • Static tariff schedule<br>• Dynamic tariff schedule | • Parallel<br>• Sequential - Without priority<br>• Sequential - Location based priority<br>• Sequential - User based priority<br>• Sequential - Request based priority |
| Main Targets | *MUD* *C&I* | *MUD* *C&I* *Residential* | *MUD* *C&I* |
| Benefits | *Savings on installation cost & Power bill* | *Savings on Power bill* | *User Experience* *Upselling opportunities* |

# JuiceNet Energy Services

One platform for local optimization, enabling customer savings on energy bill

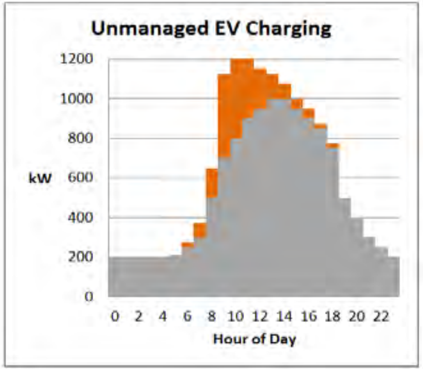


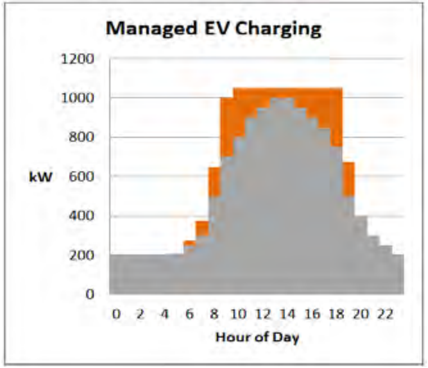

**Current local energy optimization services:**
optimizing the charging processes in order to
**reducing grid charges and exploiting the best tariff**

# Cap Charging

- **Avoiding high upfront connection costs**
  Upgrade of Power connection is usually required when adding EVs as an energy load
- **Reducing recurrent Power components costs**
  One Power peak in the whole year/month is sufficient for increasing the energy bill substantially and there is no reason for it
- **Maximize utilization**
  If a site has power constraints, the system will maximize utilization rates
- **Limiting impacts**
  Our experts in energy advisory can help in designing the best solution to your needs, adapting the solution to consumption levels before adding EV loads to each site.
- **Residential or commercial sites**

- No cons



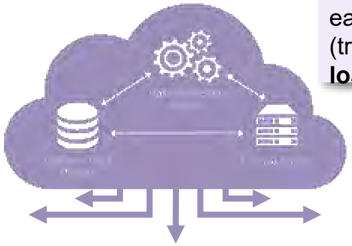



# Demand Response using EV in Italy

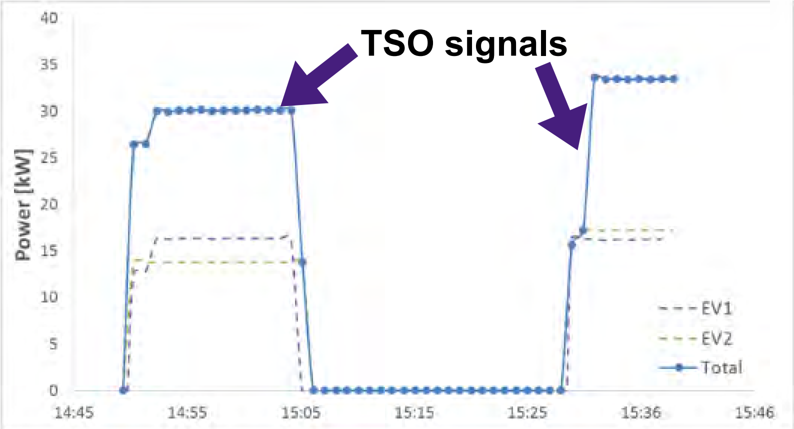
## Experimental project in Tor di Quinto - overview

Enel's intelligent infrastructures are connected to a management and monitoring **platform that allows the aggregation of resources** and the automatic variation of the power absorbed by each electric car in order to satisfy a **request by the TSO** (transmission system operator, Terna in Italy) **to reduce the load**.

The experimental project involves the participation of several models of electric vehicles, part of the internal **car sharing fleet of Enel X**, connected to the smart unidirectional charging infrastructures (V1G) of the Tor di Quinto car park.



**Recharging process modulation**




The platform therefore at the time required by the TSO **reduces the power absorbed during active charging processes** and at the end of the event restores the initial situation, responding to the needs of the TSO (in this case, to obtain the maximum possible power variation the recharges are totally suspended) – vehicle 1 grid service.

# Honda partnership:

Enabling OEMs to generate revenue streams to reduce EV Driver’s TCO

**Find the best time to charge electric vehicles according to electric grid conditions: reducing customer costs and CO2 emissions; earing rewards through DR programs participation in California**

powered by


Honda SmartCharge monitors wholesale electricity markets for when energy demands spike and inefficient peaker power plants need to pick up the slack.

In such events, we defer charging temporarily until the grid electricity load has dropped sufficiently to avoid needing these inefficient fossil fuel power plants. This happens automatically, while ensuring your car is at maximum charge when you need it.

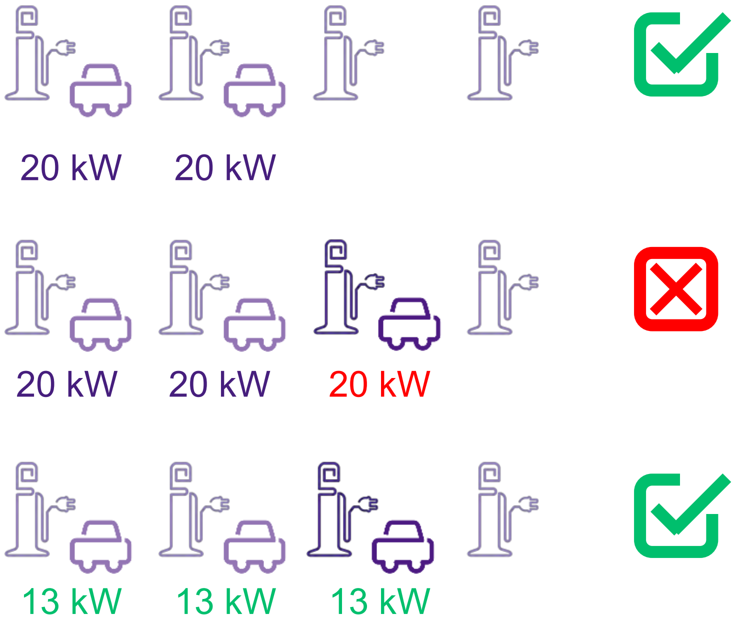
By adjusting the time of charging of your Fit EV along with other Fit EVs in your area, Honda earns payments from its utility partners and is then able to share those profits with you.

# Demand Limitation

Behind-the-meter functionality

The Demand Limitation functionality guarantees that a group of EVSEs is dynamically managed in order to not exceed a fixed threshold. The threshold can be set to different values in different periods.

Limit is 40kW



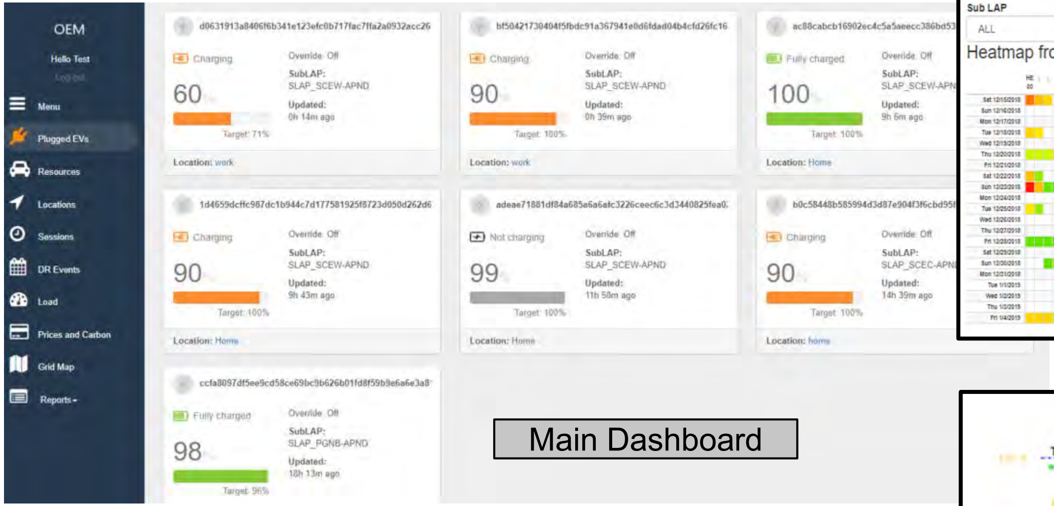

All cars are charging at their maximum available power, if possible.

When a new car plugs in, you could exceed the power constraints.

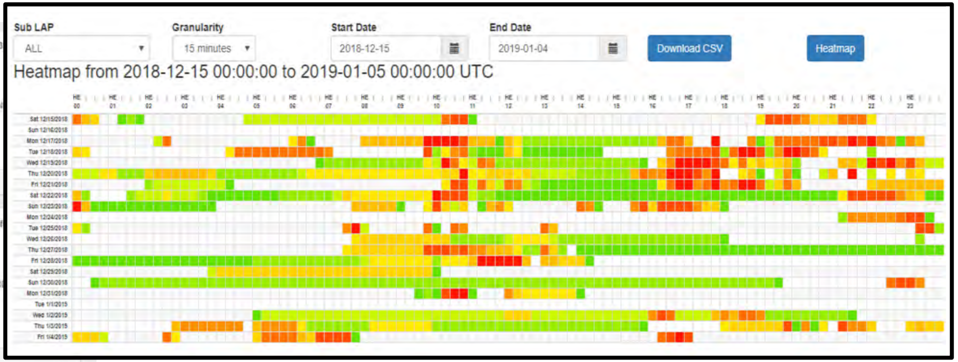
With this functionality the power will be automatically managed according to your needs.

# JuiceNet for Honda: Smart Charging Direct to EV

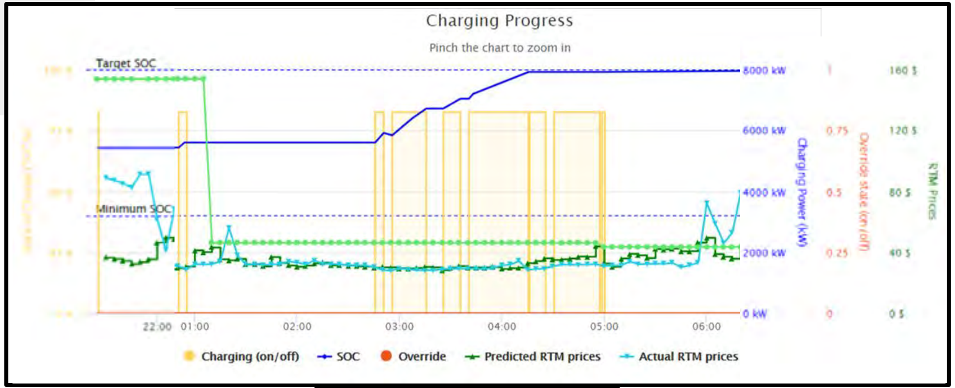
**Honda FITs + Clarity / Aggregation / DR Programs + Wholesale markets**



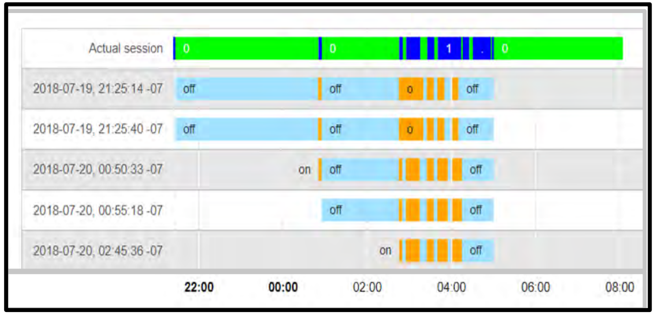

Main Dashboard




Heatmap




Session Chart




Schedule Updates

# EV Energy Services Outlook - California

eMotorWerks
An Enel Group Company

| | 2018 | 2019 | 2020 | 202X |
|---|---|---|---|---|
| Day Ahead Energy | | | | |
| Real Time Energy | | | | |
| Low Carbon Fuel | | | | |
| Regulation@Home | | | | |
| Whole-home DR | | | | |
| T&D Deferral Services | | | | |
| Regulation@Away | | | | |
| New CAISO Products - *Flex RA, FlexiRamp, Load Shift, Frequency Response* | | | | |

** Whole Home DR not shown above - ETA 2019*



eMotorWerks
SMART [GRID] EV CHARGING

# Delivering benefits to the entire EV value-chain

eMotorWerks
An Enel Group Company

## EV DRIVERS

Intelligent control, green charging, utility incentives

## BUSINESSES

Intelligent control & access to energy services

- Workplaces
- MUD
- Cities
- Destinations

## EVSE PARTNERS

IoT intelligence & demand flexibility incentives

ClipperCreek, Inc.
AeroVironment
VOLTA
NAYAX

## AUTO OEM

Connected EVs and smart grid integration

Multiple partnerships with international automotive OEMS

## UTILITIES

Charging load aggregation & control

Sonoma Clean Power
EDF
PG&E
Xcel Energy

Best-in-class smart charging solutions that support the needs of drivers and the grid



14:00 – 15:00

# *Keynote addresses*

- **Willett Kempton**, Professor University of Delaware
- **Thierry Plouvier**, Vice President Power Grids, ABB France Benelux
- **Hervé Rivoalen**, Vice President, EDF Mobility
- **Eric Lalliard**, Scientific Director, PSA Group

14:00 – 15:00

# *Keynote addresses*

- **Willett Kempton**, Professor University of Delaware

# Grid Integrated Vehicles for Grid Services

**Willett Kempton**
**Professor, University of Delaware**
**CTO, Nuvve Corp**

**Presented 8 May 2019 at**

**EV and Renewable Energies Interactions at the Local Level**

**EVER2019/IAEE Monaco Conference**

# How do EVs interact with the local Grid?

- The grid is the fuel source
  - A bargain! About € 0.25 per “liter” of EV driving (at € 0.16/kWh)
  - Environmental! Much cleaner than petrol or diesel (except if local grid is mostly coal)
- But the local grid? Full EV penetration could:
  - Overload the grid at peak times, OR
  - Be valuable by modulating charge rate, balancing renewables, or being active storage.

# Uncontrolled Charging versus Grid Services

- Charging can be:

  (A) Uncontrolled, “full power ASAP” (As Soon As Plugged-in)

  (B) Delayed start, full power charging after loads & rates drop

  (C) Modulated charge, e.g. charge at 1/2 power, increase or decrease depending on grid needs

  (D) V2G, e.g. go to desired charge level, then charge and discharge according to grid needs

- Quick Evaluation: (A) hurts grid. (B)(C)(D) are grid services that help the grid. (C) & (D) can generate revenue and/or reduce site bills. (D) can generate >> revenue than (C)

# Example 1, Grid Services—Local

- Example: In one neighborhood, many houses have rooftop solar and many others houses have EVs

- At noon, there can be too much power, voltages go too high. Late afternoon the solar drops off at the same time as cooking and other electric uses increase. Too much or too little electricity.

  - Solution: EVs in this neighborhood are controlled by the local utility, based on local power measurements, to charge during the solar peak and discharge late afternoon. This is a “Distribution grid service.”

  - Because the neighborhood EVs are pooled via the existing grid, it matters little who has solar, who has EVs, or when cars are on the road.

# Example 2, Grid Services-Regional

- Regionally, about 5% of power plants are set to respond when demand changes suddenly (up or down) or part of the electric supply unexpectedly fails.

- Transmission System Operators (TSOs) manage a regional market, controlling and paying generators to stand by and respond to power fluctuations, to keep the grid stable and reliable. (TSO markets are called, for example, “Primary regulation”, “Reserves”, etc.) These are “Transmission system grid services.”

  - EVs can participate in these markets with the controls mentioned before (although there are some barriers to entry).

  - EVs are doing this now in Denmark and the US—commercialized by Nuvve Corp with partners such as EDF, who are working to expand rapidly.

# Revenue from Grid Services

- For an EV with charging and discharging capability, and with controls installed to do these services…
  - For transmission system grid services, EVs have been shown able to earn € 500  to €1500/year.  When entry barriers are cleared, EVs typically underbid providing these same grid services from power plants.
  - Distribution grid services have fewer established markets, but calculations show that they can be worth from €50/year to €1000/year. Existing market mechanisms such as on-peak and off-peak rates allow EVs with controls to earn some income today with minimal barriers to entry.

# Cost to Provide EV Grid Services

- The **capital cost** of controlled charging requires communication, thus some additional controls in the charging station and/or EV.
  - Control equipment costs less than €200 in production.
  - For bidirectional services, the onboard internal charger (“AC Charger”) requires design changes, approximately an added €300.
- **Operating cost** increase are energy losses due to back and forth energy flow (only for bidirectional operation). However, revenue value of bidirectional is > energy loss operating cost.
- Adding both capital and operating cost, most transmission services are a good investment, and most distribution services would be. (Requires market analysis for each jurisdiction and service.)
- Alternative would be a 10 kW external bidirectional charger (“DC Charger”), intended to enable grid services, cost now is approximately €6,000; at higher production perhaps €3000.

# Approximate profit calculation

- One business model:   A grid services provider pays for all added equipment costs, navigates market barriers, and manages ongoing sales of grid services.  Grid service provider gets 2/3, customer gets 1/3 of revenue.  What is revenue / cost (“payback period”)?

- Best case (AC, used for transmission svcs)  500/1000= payback 1/2 year

- Mid case (AC for mid-value distribution services) 3000/500 = payback 6 years

- Worst case (DC charger, low-value services) — don’t do that!

# Improving the economics

- On-board AC charger, lower cost
- Bidirectional charger — 13x revenue vs controlled unidirectional charging
- Higher power per car (higher kW in/out) — revenue proportional to power.
- Driver plug-in consistently — when parked, bidirectional revenue is proportional to hours on-line.
- Drive more!  Unidirectional only — grid service is proportional to driving, only create value during battery refilling.

# Barriers to Entry

- TSO rules change slowly
  - Placing a storage resource behind a retail meter can generate double tariff, double taxation
  - Markets that were designed for slow thermal generation may not allocate full value to very fast-responding resources
- interconnection and paperwork requirements that are reasonable for a few 500 MW power plants are burdensome for 1,000’s of 10 kW resources.
- Fewer markets for distribution system services.

# Policy Barriers

- Each EVSE is a “power plant”; TSO registration and qualification now very clumsy
- Most EDC jurisdictions do not include EVs or batteries as qualifying resources for backflow and net metering
- Distribution system demand charges may count any time, should be only during TSO peak or local network maximum
- All solvable, but require work on the electric system regulatory, standards, and business aspects.

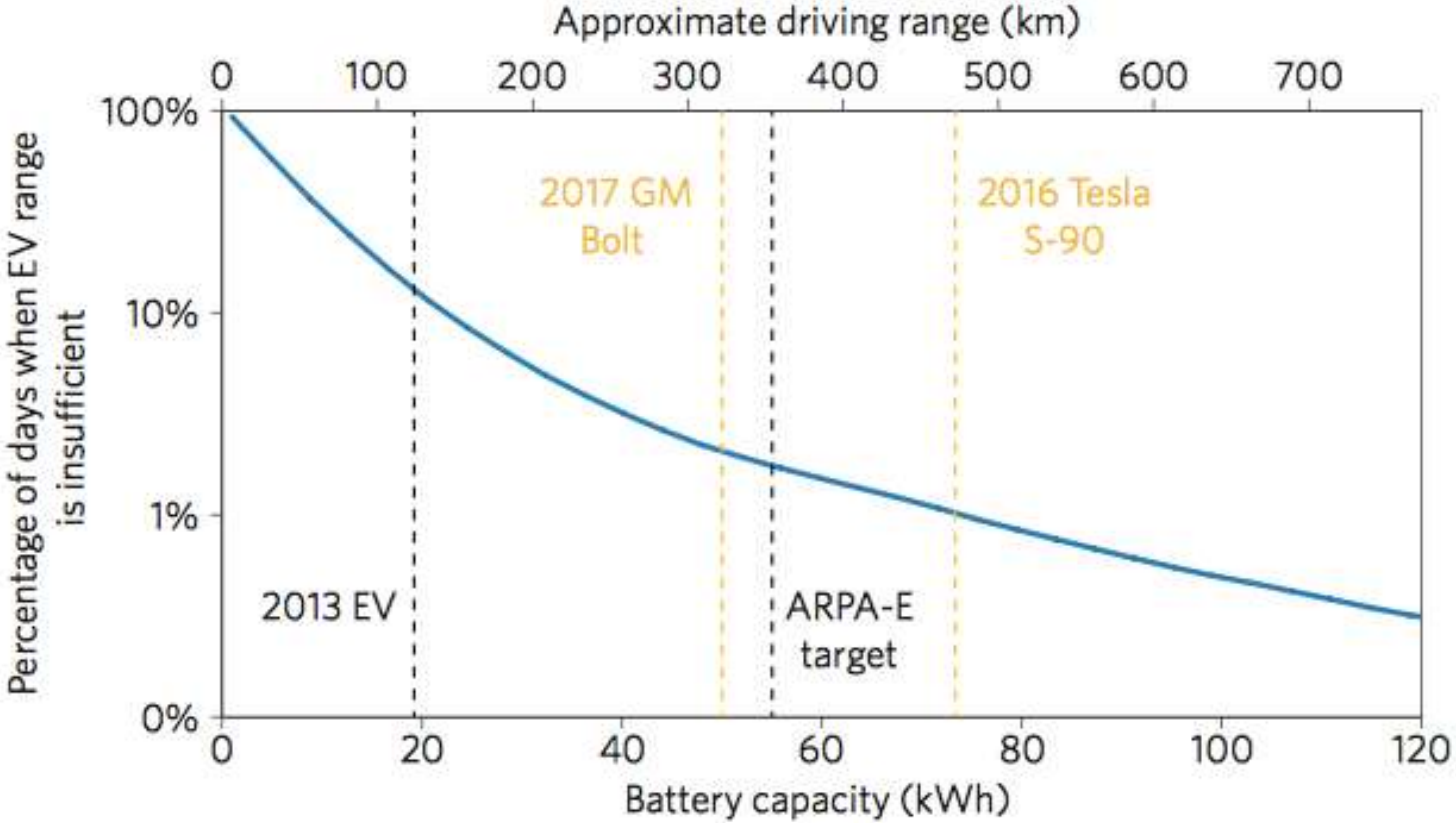
# END

www.nuvve.com
www.udel.edu/v2g

# EV Evolution (commercial sedan)

| | 2014 | 2018 | Kempton future (two models, bimodal split) |
|---|---|---|---|
| Battery (kWh) | 20 | 50 | 50/200 |
| Efficiency (km/kWh) | 5 | 7 | 8/7 |
| Autonomy (km) | 100 | 350 | 400/1400 |
| Charge rate (kW) | 7/50 | 7/80 | 12/50/120 |
| Cost premium | ++ | + | -/+ |
| GIV connector | J1772 | CHAdeMO | IEC 62196, J3068 |

# Evolution of battery size, 20➔50➔ ? kWh




**from: Kempton, 2016, "Electric vehicles: Driving range", Nature Energy, August 2016**

# Connectors for charging

| | ϕ | Typical / Max power (kW) | Typical comm | Typical application | Retail cost |
|---|---|---|---|---|---|
| SAE J1772 | 1 | 7/19 | Analog PWM | Overnight/destination | $600 - $1200 |
| IEC 62196 | 1 or 3 | 12/52 | Analog PWM + 15118, LIN Bus | Overnight/destination; some enroute | €3000 |
| SAE J3068 | 1 or 3 | 50/100 | LIN Bus + PWM | Heavy and large-battery EVs | $3,000 |
| CHAdeMO | DC | 50/150 | CAN | en-route | $50,000 |
| CCS = Combo | DC | 50/150* | 15118 | en-route | $50,000 - $100K |

*** Prototypes was built to do 350 kW with liquid cooling on the hose.**

14:00 – 15:00

# *Keynote addresses*

- **Thierry Plouvier**, Vice President Power Grids, ABB France Benelux


MAY 8TH, 2019

# EV Mobility & Infrastructure

EVER Monaco 2019

ABB

# A short overview of the ABB group

# A global leader in power and automation technologies

## Leading market positions in main businesses

**~147,000**
Employees (incl. GE IS)

**$ 35** billion
In revenue (excl. GE IS)

Present in **+100**
Countries

| | |
|---|---|
| Single “A” credit rating | HQ Zurich |

Formed in **1988**
Merger of Swiss (BBC, 1891) and Swedish (ASEA, 1883) engineering companies

# ABB : the pioneering technology leader

| | | | |
|---|---|---|---|
| **What** (Offering) | **Pioneering technology** | | |
| | Products | Systems | Services & software |
| **For whom** (Customers) | **Utilities** | **Industry** | **Transport & Infrastructure** |
| **Where** (Geographies) | **Globally** | | |
| | Asia, Middle East, Africa | Americas | Europe |

| | | |
|---|---|---|
| ~$34 bn revenue[1] | ~100 countries | ~147,000 employees |




[1]SOURCE: Q4 2017 published financial results; ABB analysis

# ABB : the pioneering technology leader

**What**
(Offering)

## Pioneering technology

### Products


Motors


Transformer


Robot


Flow meter


Breakers


EV charger

…

### Systems

Battery energy storage system


Rail traction system

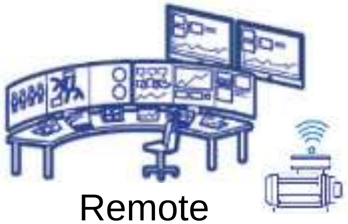

DCS

Azipod propulsion system


Robotic system


HVDC station

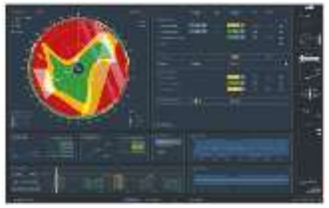
### Services & software


Remote diagnostics


Maintenance

Spare parts


Connected services


Advisory software

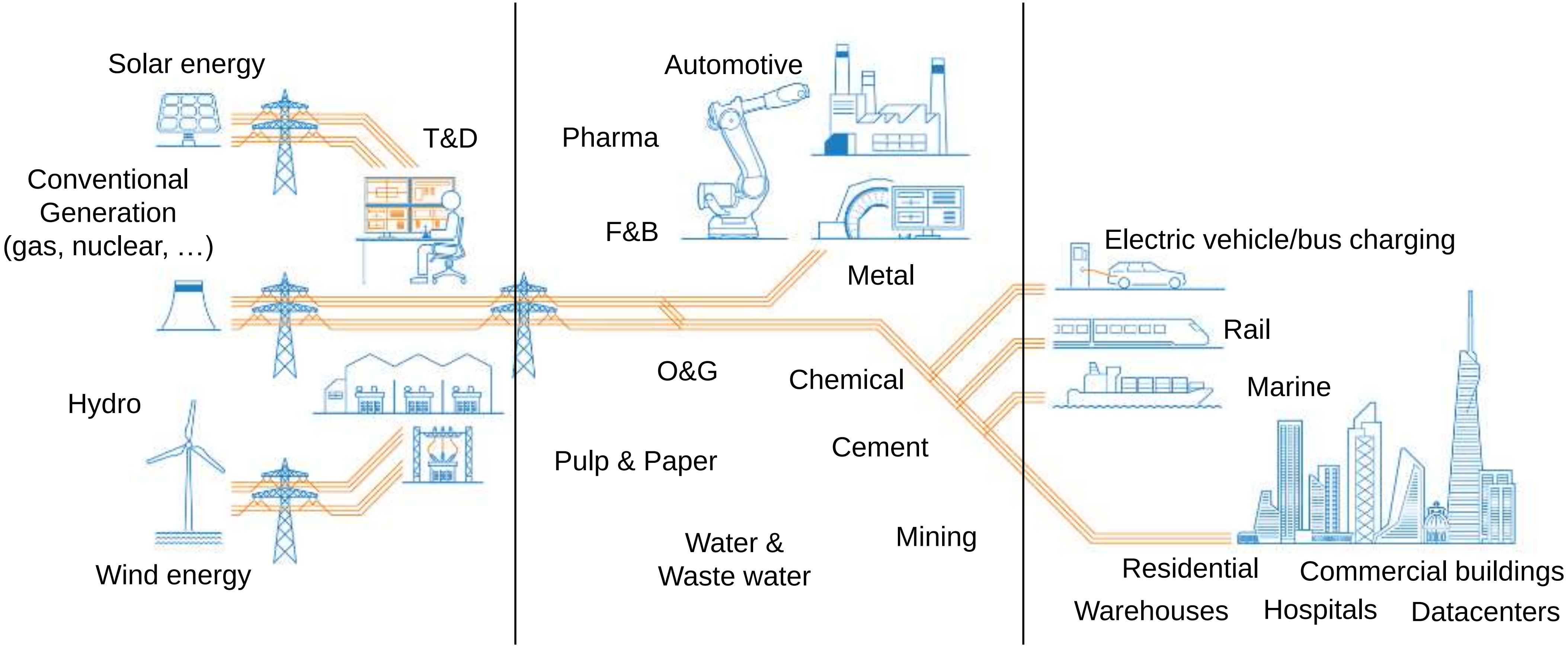


ABB

# ABB : the pioneering technology leader

**For whom**
(Customers)

| Utilities | Industry | Transport & Infrastructure |
|---|---|---|



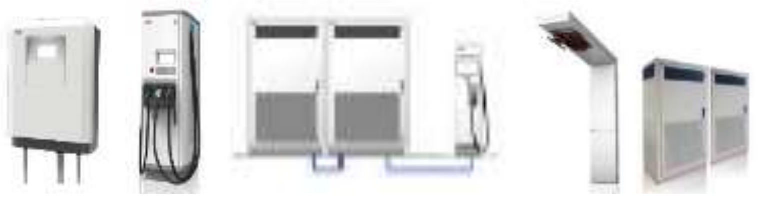
# What about eMobility

# ABB EV charging

Mission statement – EV Infrastructure team

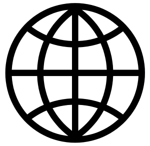
## We offer AC and DC charging solutions for Electric Vehicles…

### …from 3-600kW…



### …based on standards…

### …in all countries...



Present in
74 countries

### ..with cloud connectivity..

### …using ABB technology…

### and ABB manufacturing.

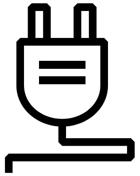
# EV fast charging and global standardization

ABB leading in major developments this decade

CHAdeMO

**2010**
**Founding of CHAdeMO**
ABB was involved from the start

**2010**
**Launch ABB Terra 51**
50 kW CHAdeMO charger



**2012**
**Founding of CCS alliance**
ABB was involved from the start, basis for IEC standard

**2013**
**Launch CCS & multi-standard Terra 53**
CCS + CHAdeMO + AC

**2013-2015**
**Launch global variants Terra 53**
China, USA, APAC

**2016**
**First eBus chargers in EU**
Global partnerships with bus OEMs

**2018**
**First eTruck chargers**
Global partnerships with OEMs

Pilots – CHAdeMO – First EV's – CCS alliance – IEC 61851-23 – Multi-standard – Global EV spread – E-bus – OppCharge – Higher power – DC home – Near future

**2010**
**First 50 kW charger in EU**
Based on proprietary standard, no consumer EV's available

**2010**
**First EV's with DC charging**
Nissan Leaf & Mitsubishi iMieV

**2012**
**First demo of CCS charging**
ABB & CCS alliance at EVS26 Los Angeles, USA

**2012 - 2013**
**First nationwide DC networks**
ABB in Estonia, Denmark, Netherlands

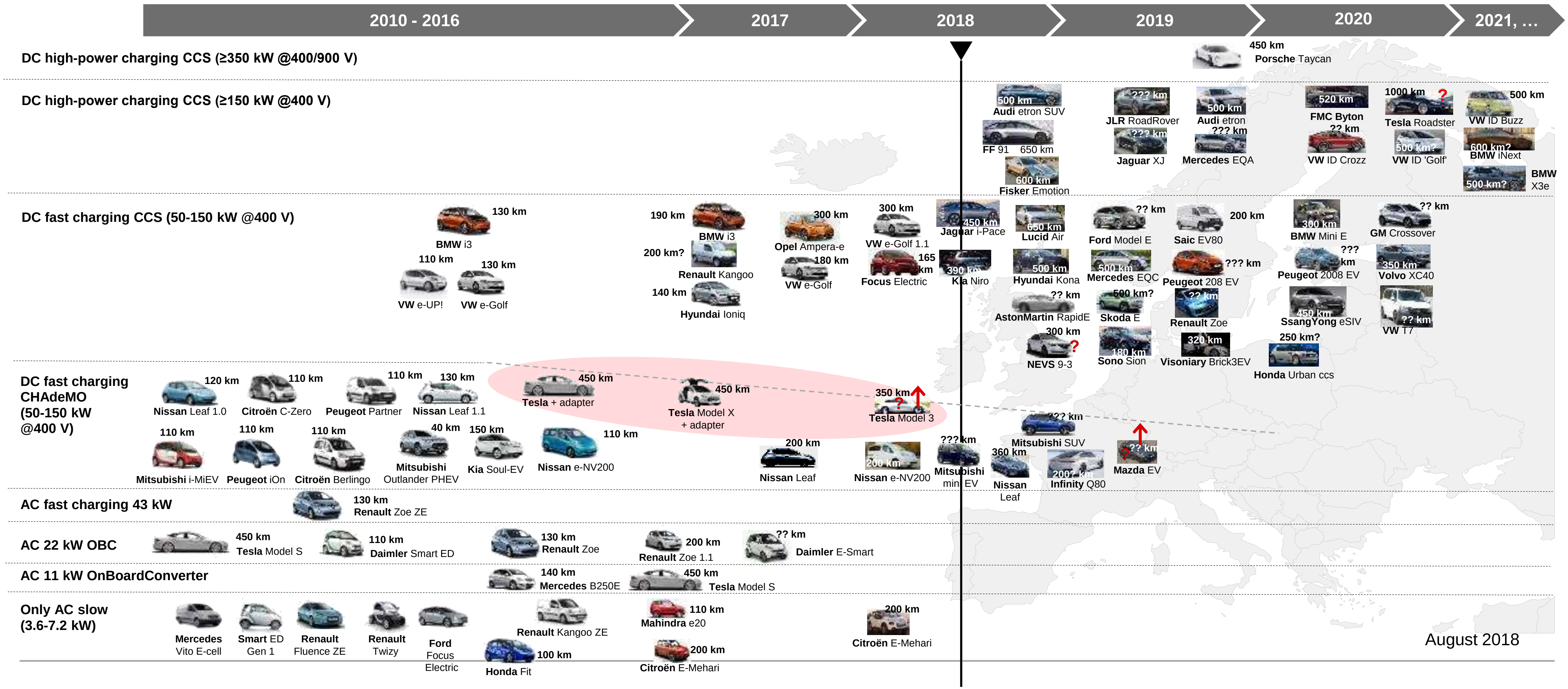
**2012, >**
**ABB leading Connectivity & uptime**
ABB has industry leading uptime by remote mnmnt

**2014 - >**
**DC networks spread globally**
Europe, USA, Asia

**2017**
**Launch of high power for cars**
150-350kW fast charging for next generation EV's

**2018**
**Gen2 charge post and Terra 54HV**
Next steps in High Voltage charging

# Follow the car through Europe, and open standard protocols



# ABB, eMobility and EV Charging

ABB’s focus and investments in eMobility are also recognized in the market place

## ABB and Formula E

Together, Formula-E and ABB are defining the roadmap for electric mobility through motor sports.

## Jaguar I-PACE eTROPHY Series

Jaguar I-PACE eTROPHY announces ABB as Official Charging Partner

ABB will provide custom-made, compact Terra fast chargers for the series


## Fortune Magazine's August 20th 2018

Recognizing ABB’s groundbreaking leadership in e-mobility, Fortune Magazine today selected ABB as #8 on its 2018 “Change the World” list, a global ranking of companies whose innovative work is making a significant, positive social impact around the world.

# Electric vehicles to buses… and services

# Electrical Mobility : cars but not only…

# 3 main ways of charging buses

ABB supports all standardized solutions supported by main Bus OEMs

## CCS 2 connector

## Pantograph Up (PU)

## Pantograph Down (PD) - OppCharge



ABB

# ABB is global charging partner for Car, Bus and Truck OEMs

## Strong presence in China, USA and Europe

# Connected services

## Connectivity is needed to

Monitor and operate a network of chargers

Get paid for a charge session

Help EV-drivers in case of questions

Maintain and service a charger at lowest cost

Interface with renewables for a smarter and greener recharge

**Reliable 24/7 connectivity is fundamental for a commercial operation of a network of chargers!**

# Positioning connected services

## Electric cars

Audi, BMW, DAIMLER, Ford, GM, MITSUBISHI, NISSAN, PEUGEOT, PORSCHE, RENAULT, TESLA, VW

## Charging infrastructure

CCS
CHAdeMO
GB
AC

ABB

Connected
Services

Microsoft Azure

ABB Ability™

## Solutions to run a charger network

MasterCard, VISA, NTT DATA, BOSCH, Fortum, GRIDPOINT, NOW! INNOVATIONS, CGI, has·to·be eMobility, chargecloud, pod POINT, GIANT LEAP TECHNOLOGIES, MOBI.E MOBILIDADE ELÉCTRICA, greenlots, VENTYX AN ABB COMPANY

ABB does not have exclusive cooperation with any of the solutions

# Network Operations Center (NOC)

Proactively monitoring status of chargers

## Advantages of ABB Connected Services Platform

Reliable connectivity

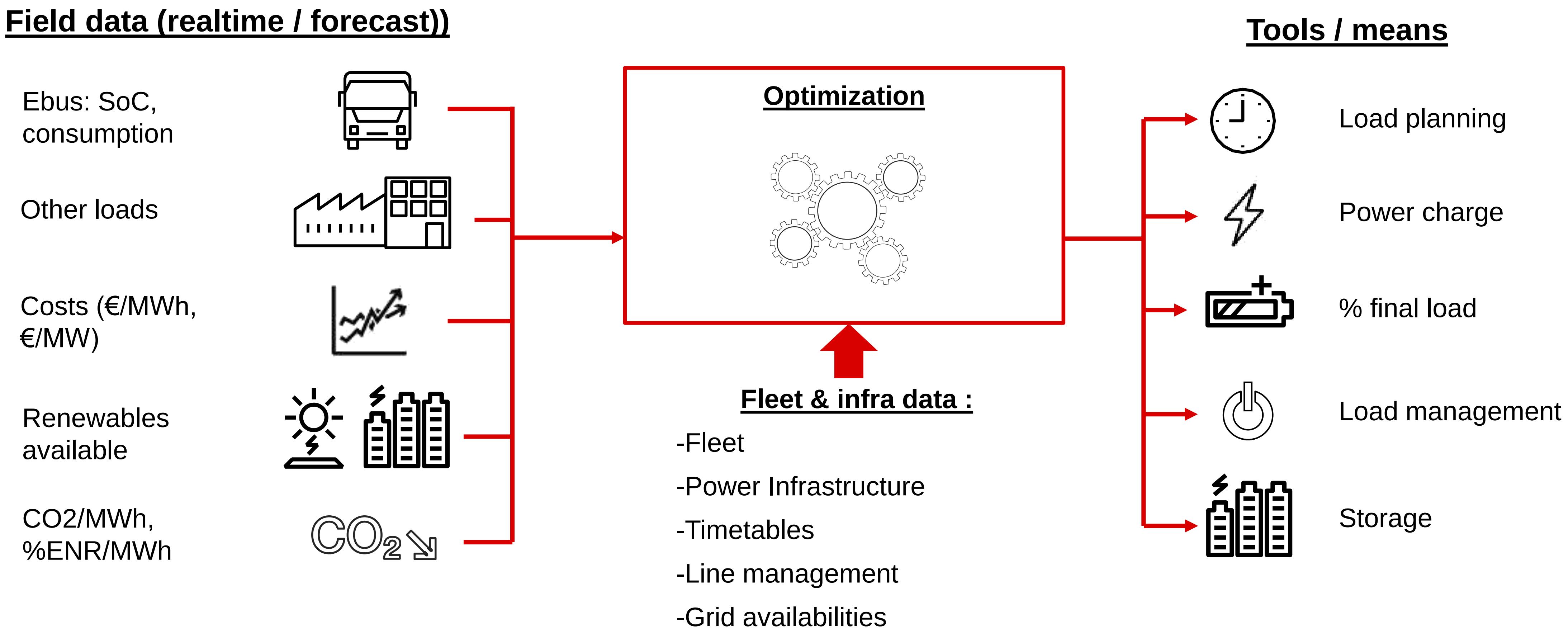
24/7 monitoring of network status

Remote software updates

Compliance with communication standards/ OCPP

# Optimization of a bus terminal

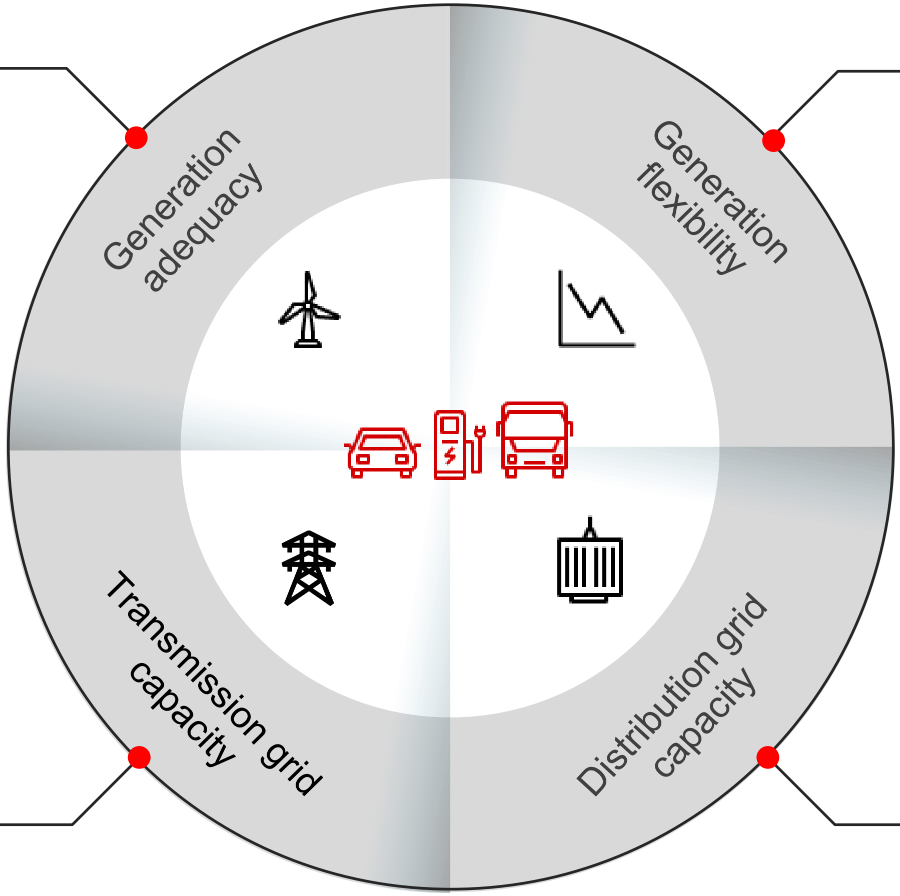
Various drivers



# Integration of electrical mobility into the grid

Can we produce enough **(green) energy annually and daily** to supply traditional and vehicle charging demand?

Do we have enough **energy sources** which may **quickly start ramp up and down and stop**?




Do we have enough **transmission capacity** to accommodate a regional vehicle charging demand?

Do we have enough **distribution grid hosting capacity** to accommodate a local vehicle charging demand?

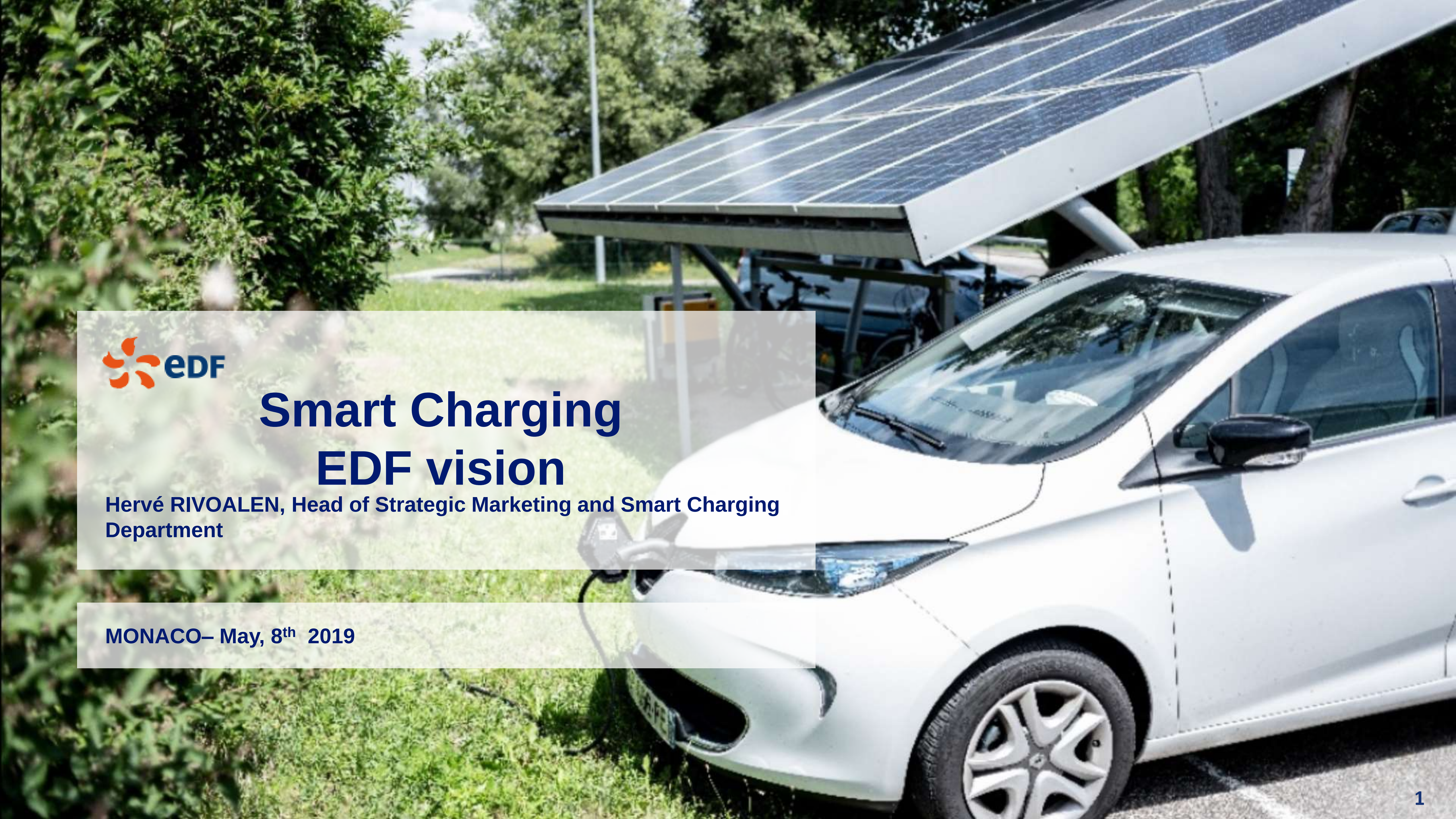
ABB

https://abbtv.inside.abb.com/2018/07/26/why-e-mobility-needs-the-digital-revolution-2

14:00 – 15:00

# *Keynote addresses*

- **Hervé Rivoalen**, Vice President, EDF Mobility



# Smart Charging
# EDF vision

Hervé RIVOALEN, Head of Strategic Marketing and Smart Charging Department

MONACO– May, 8th 2019

# IN EUROPE AND FRANCE, ELECTRIC MOBILITY IS COMING

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21-CMP11

Limit global warming and keep it under 2° by 2100

1/5

Greenhouse gas emissions in Europe come from the transport sector

EUROPE

**Reduction of CO2 emissions for new vehicles[1]**

**Average emissions in 2020 below 95g CO2 per km**

**Average emissions in 2030 below 60g CO2 per km**

EV 20% of sales in 2025
More than 1 vehicle out of 2 sold in 2030
This ambitious trajectory, if respected, should lead to the release of
50 millions electric vehicles in 10 years and 150 millions in 20 years in Europe [2]

# EDF LAUNCHES ITS ELECTRIC MOBILITY PLAN GROUP OCTOBER 10, 2018

LE PLAN
MOBILITÉ
ÉLECTRIQUE

**BEING THE LEADING ENERGY MANAGER OF ELECTRIC MOBILITY IN EUROPE AS 2022**

**on our 4 major markets :**
**France, United Kingdom, Italy, Belgium**

**3 pillars :**

**First electricity supplier for EV**

**First operator of EV charger infrastructure**

**European leader in smart charging**

EDF

# THE DEVELOPMENT OF ELECTRO MOBILITY : A CONSTRAINT ON THE ELECTRICAL SYSTEM ?

NO ! WE HAVE ENOUGH LOW-CARBON ENERGY TO POWER THE EUROPEAN EV FLEET

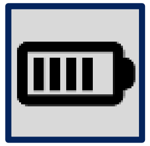
**Annual consumption remains very relative** (about 2 to 3 MWh), the equivalent of a electric water heater (350/400 euros / year in France for a vehicle traveling 15 000 km / year)

The electric vehicle is energy efficient compare to ICE

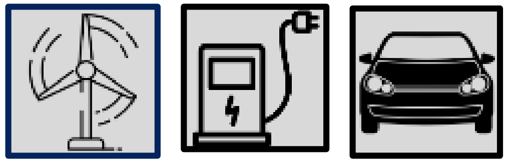
Overall, buildings will continue to gain in energy efficiency, no overall increase in energy consumption

Continuous development of renewable energy to cover the energy needs of this new use : doubling in the next 20 years 700 TWh, **equivalent of 300 Millions EV** (more than the current European park)

# THE DEVELOPMENT OF ELECTRO MOBILITY : AN OPPORTUNITY FOR THE ELECTRICAL SYSTEM ?



EV a great tool for electricity storage : 50 millions EV = 3500 GWh of storage or **2 to 3 times the hydraulic storage capacity present in Europe**

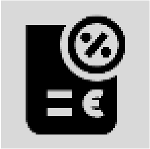


With the development of EV **the consumption adapts to the production :**

- Better integration of intermittent energy
- The load of an EV is planned "at the best" moment (low carbon, low prices, management of the electrical system)
- A battery is 70 KWh : 10 days of autonomy ( without heaters)

Strong focus of our electric mobility plan : The development of Smart Charging :
Develop all intelligent management solutions to exploit these flexibilities and to ensure the mobility needs of our customers at the best cost and the most virtuous way for the electrical system by maximizing the integration of renewable energy

# THE DIFFERENT SMART CHARGING SOLUTIONS



Smart tarif / pricing

Real-time dynamic control behing the meter (*Peak shaving, tariff optimisation, arbitrage, emergency back-up)*

Real-time dynamic control of the electrical system (energy re-injection) : availability of ENR production, constraint on other means of production, network constraints, etc.

# BENEFITS OF V2G SMART CHARGING

*for the customer, the environment, and the community*

**Citizens :** they will be strengthened in their commitment to the environment with the acquisition of an Electric Vehicle and will help to decarbonize transport

A positive dynamic

**Ennery transition :** electric mobility will drastically reduce $CO_2$ emissions from the transport sector and promote the integration and growth of renewable energy in Energy sector

**Customers :** solution to lower the cost of the load and thus accelerate the development of the Electric Vehicle, while restoring purchasing power

# KEYS TO THE DEVELOPMENT OF SMART CHARGING

- Communication protocols between vehicles and EV chargers and more generally the electrical system
- **Adaptation of market rules to allow remuneration of vehicles for services offers to the electrical system**
- **Evolution of Grid rules**
- Cyber Security and RGPD
- **Pedagogy and communication towards the end users**
- Ambition and visibility for all the sectors concerned

Develop business models that put the customer at the heart of Smart Charging systems and restore mostly created value

# CONDITIONS OF SUCCESS : THE COMBINATION OF DIFFERENT AND COMPLEMENTARY SKILLS

An eco system to set up mobilizing actors from very different environments who must learn to work together and imagine the solutions of tomorrow

## EDF SKILLS

- EV charger
- Energy Markets Home Automation Solutions and the Internet of Things
- Expertise in energy optimization of buildings, local networks

## AUTOMOTIVE EXPERTISE SKILLS

- Development of electric vehicles
- Energy and Vehicle Load Management
- Communication between the vehicle and its environment
- Aging batteries and their recycling
- Client mobility needs

Energy producers/ suppliers and Automobile Manufacturers who have lived their development separately for more than two centuries, must work hand in hand to offer the best technical solutions and a rewarding customer

# CONCLUSIONS

- **The arrival of the Electric Vehicle is not a constraint but an opportunity**
- The more we all work together to optimize the charging / discharging of Electric Vehicles **thanks to Smart Charging solutions**
- the more we create a virtuous circle that will amplify the $CO_2$ decarbonization of the transport sector at the best cost by **reducing for the end user the cost per km**
- The more we will amplify the energy transition by helping **to insert even more $CO_2$-free intermittent energy into electrical systems**

# Thank You

14:00 – 15:00 **Keynote addresses**

- **Eric Lalliard**, Scientific Director, PSA Group

# GROUPE PSA ELECTRIFICATION’S STRATEGY

Eric LALLIARD – Groupe PSA Chief Scientific Officer

PSA
GROUPE

QUALITY AND ENGINEERING

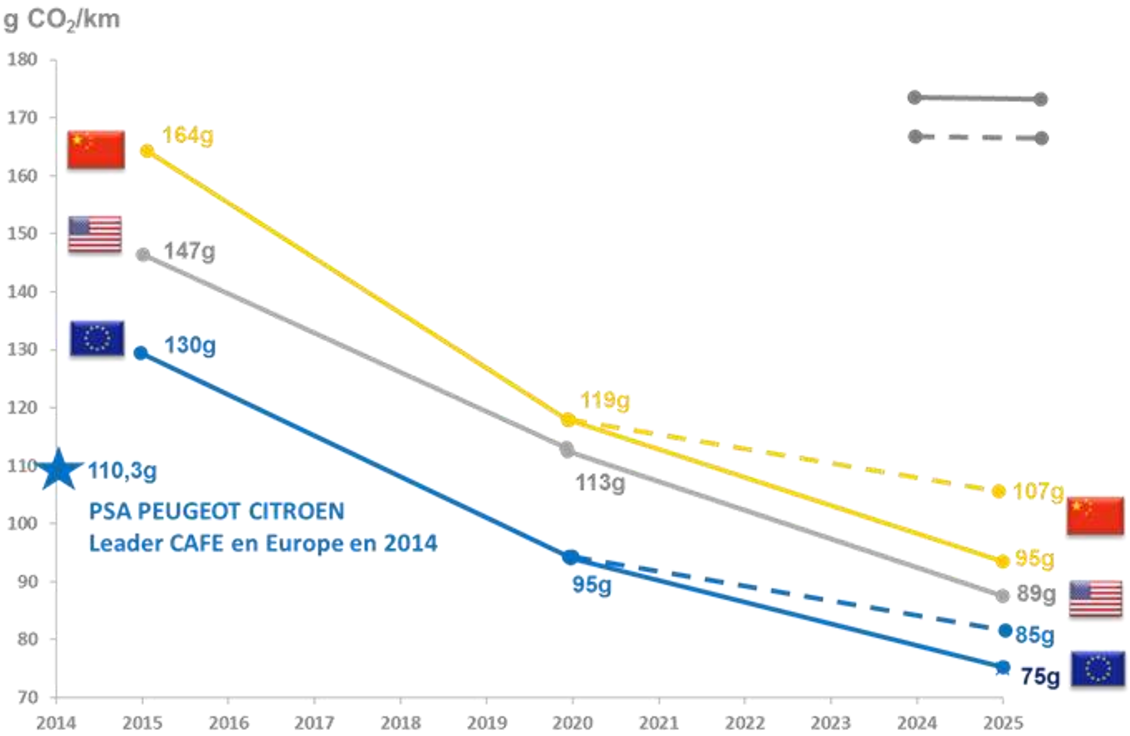
EVER 2019 – « Electric vehicle and renewable
energies integration at the local level » - Monaco – May 8, 2019

AUTOMOTIVE RESEARCH INNOVATION AND ADVANCED ENGINEERING DIRECTION
SCIENTIFIC AND FUTURE TECHNOLOGIE DEPARTMENT

# 7 MEGATRENDS

# REGULATION CONSTRAINTS

PSA Groupe European Leader for $CO_2$ emissions with only **104,7g.CO2/km** (by end of 2017)




**Major Driver = worldwide CO2 regulations**

**→ Need for deploying the electrification of powertrains to reach $CO_2$ emissions : 95g / km in 2020**

# REGULATION CONSTRAINTS

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# GROUPE PSA ELECTRIC VEHICLES BLITZ FROM 2019

*"100% OF OUR LINEUP WILL HAVE AN ELECTRIFIED VERSION BY 2025"*

# 2 MULTI-ENERGY PLATFORMS

*“CHOOSE THE MODEL YOU WANT WITH THE TECHNOLOGY YOU PREFER”*

**EMP2**

*ICE / PHEV*

D SEGMENT

C SEGMENT

B SEGMENT

**PHEV : PLUG-IN HYBRID**

STARTING 2019

IN EUROPE & IN CHINA


**CMP**

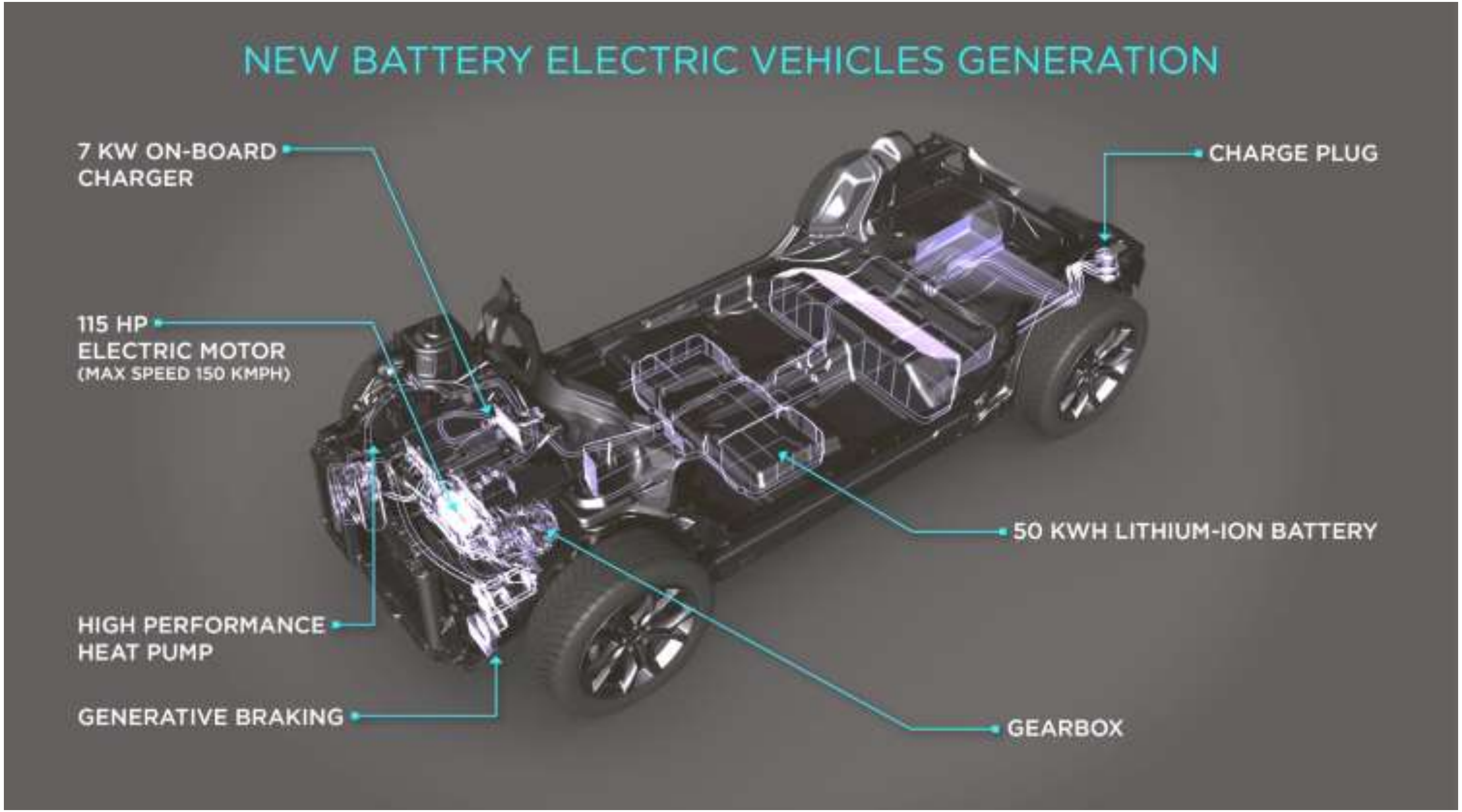
*ICE / BEV*

**BEV : ELECTRIC VEHICLES**

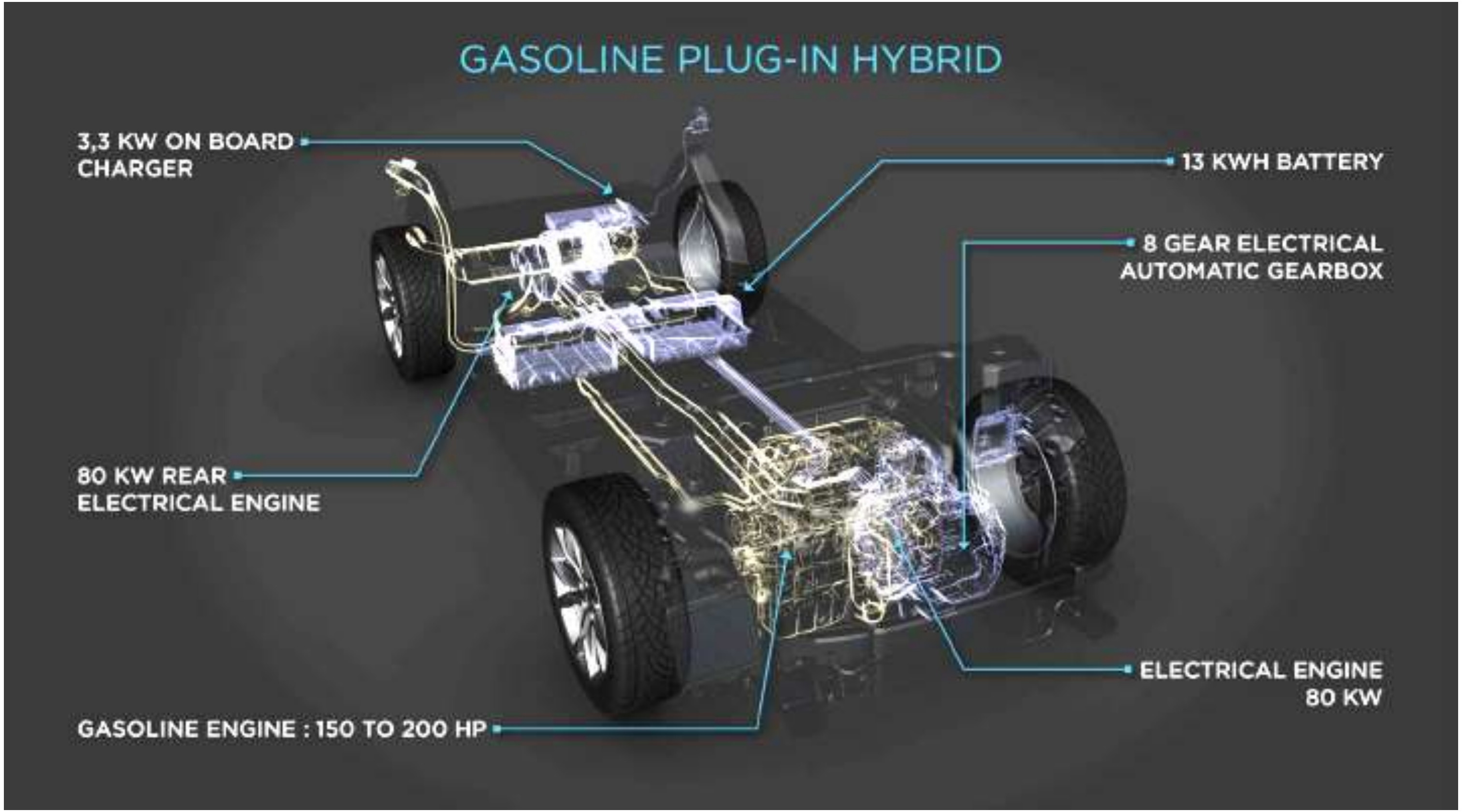
STARTING 2019

IN EUROPE & IN CHINA

# ELECTRIC POWRTRAIN



# PLUG-IN HYBRID POWERTRAIN



# GROUPE PSA ROADMAP FOR ELECTRIFICATION

*"WE ARE DEVELOPING A COMPLETE OFFER TO MEET OUR CUSTOMERS' NEEDS ON A WORLDWIDE SCALE"*

Currently → 2019 → 2020 → 2021 → 2022 → … → 2025


Citroën E-Mehari


Citroën C-ZERO


Peugeot ION


Citroën BERLINGO *PC & LCV*


Peugeot PARTNER *PC & LCV*


Opel e-AMPERA


**PHEV** on EMP2

**8 MODELS BEFORE 2021**


**BEV** on CMP

**7 MODELS BEFORE 2021**

**From 2022**
New Electrified Powertrains
&
e-components integration

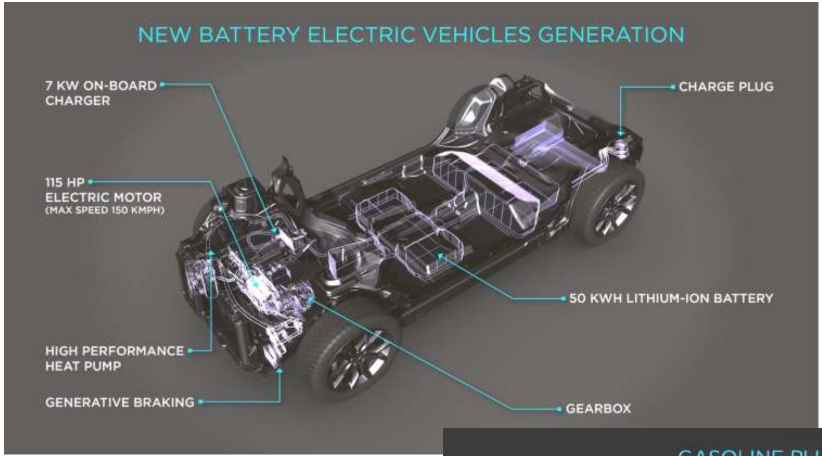
…

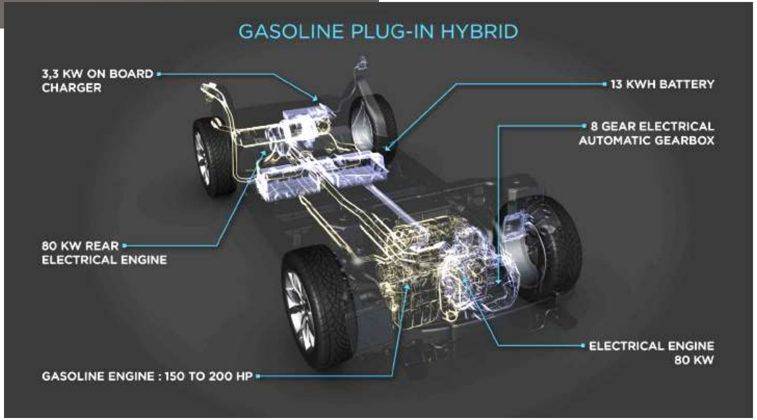
**40 MODELS OF THE 5 BRANDS**

# REMIND : E-POWERTRAINS COMPOSITION

The e-Powertrains are made with

- A Battery
- An e-Machine
- Reducer
- Power electronic parts
- Wires
- Control & Command laws

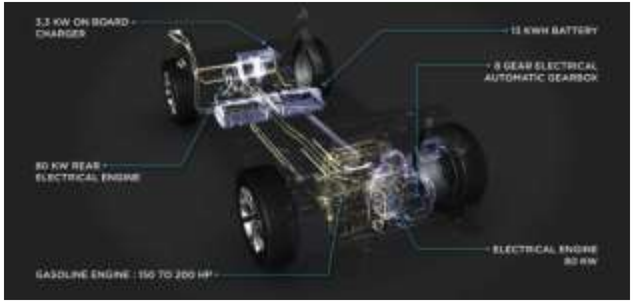


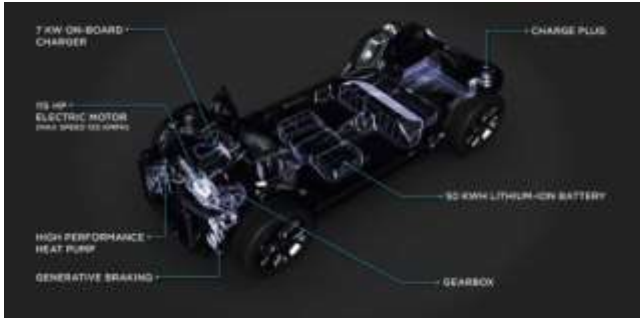
# ELECTRIFICATION STRATEGY: 2 PILLARS

## Multi-energies platforms

**PHEV: GASOLINE PLUG-IN HYBRID**




**BEV: NEW BATTERY ELECTRIC VEHICLES**




## E- Powertrain components

| Transmission | Reducer | e-machine | Battery |
|---|---|---|---|
|  |  |  |  |



**ANCHOR THE DESIGN AND PRODUCTION OF THE KEY COMPONENTS OF ELECTRIFIED POWERTRAINS**


*Design, development and manufacturing of electric motors in an optimized schedule and at best value*

**STARTING 2022: NEW E-PWT & E-COMPONENTS INTEGRATION**

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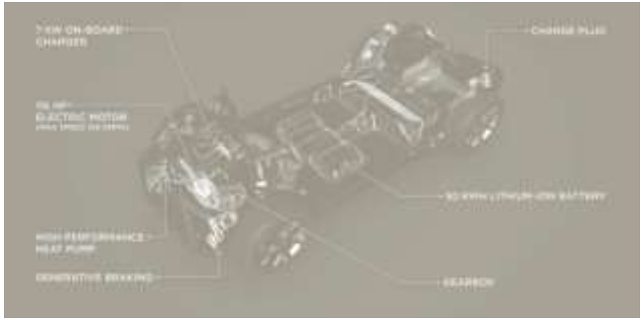


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|  |  |  |  |



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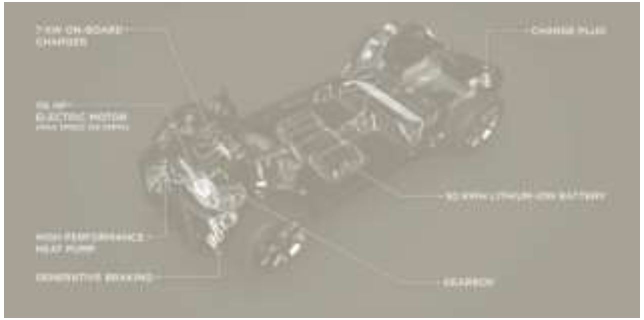

## E- Powertrain components

| Transmission | Reducer | e-machine | Battery |
|---|---|---|---|



E KEY COMPONENTS
NS

*cturing of electric motors*
*and at best value*

ONENTS INTEGRATION

# ELECTRIFICATION STRATEGY: 2 PILLARS

## Multi-energies platforms

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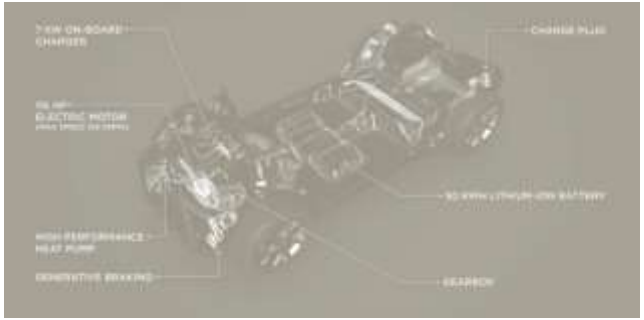
BEV: NEW BATTERY ELECTRIC VEHICLES

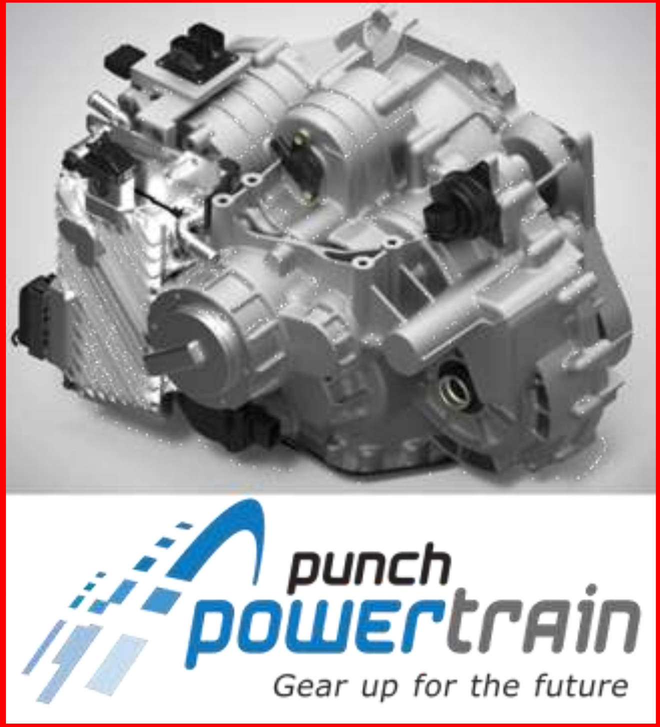


## E- Powertrain components

**Transmission**


ANCHOR THE DES


STARTING 2022: N



Thank you for your attention


Any questions ?

15-17 ***International feedbacks of local governance for EVs and Renewable deployment***

- *Chair:* **Gurkan Kumbaroglu**, *President of the Turkish association for electromobility*

1. **Electric vehicles and renewable energies interactions : case of Turkey**
   - **Gurkan Kumbaroglu**
2. **Electric vehicles, cornerstone of smart cities**
   - **Didier Chabaud** *(Sorbonne Business School)*
3. **Are energy regulators going to adapt the rules?**
   - **Didier Laffaille** *(Commission de Régulation de l'Energie)*
4. **Positive energy territories and electric vehicles**
   - **Cécile Goubet** *(AVERE)*
5. **What future room for sustainable mobility in urban and rural areas?**
   - **Alain Leboeuf** *(SyDEV , Vice-president, Department of Vendée Council)*

# International feedbacks of local governance for EVs and Renewable deployment: The Case of Turkey

Gürkan Kumbaroğlu

*Professor of Industrial Engineering*
*Chair, Energy Policy Research Center*
*Director, Energy Systems Modeling Laboratory*

*President, Turkish Association for Energy Economics*
*President, AVERE Turkey*
*President 2016, IAEE*

EVER Monaco IAEE Day
8 May 2019

# OVERVIEW

1. **Introduction**
   i. $CO_2$ Emissions in Turkey
   ii. EV Sales in Turkey
   iii. Charging Infrastructure in Turkey

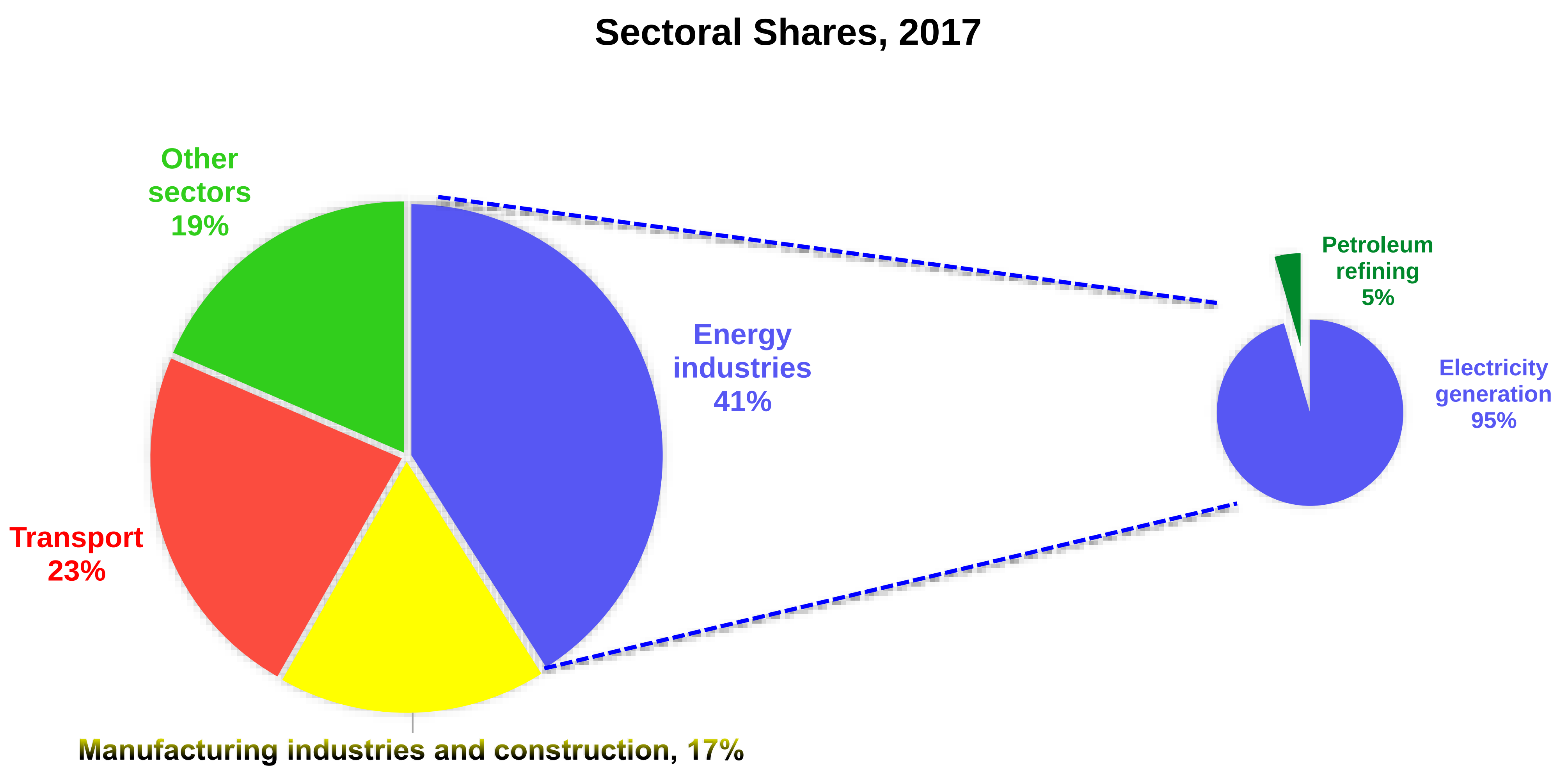
2. **Survey – EV Perception and Barriers for Diffusion**

3. **Modeling for EV Infrastructure and $CO_2$ Emissions**

4. **EV carsharing**

5. **Autonomous driving**

# **Introduction:** CO2 Emissions in Turkey

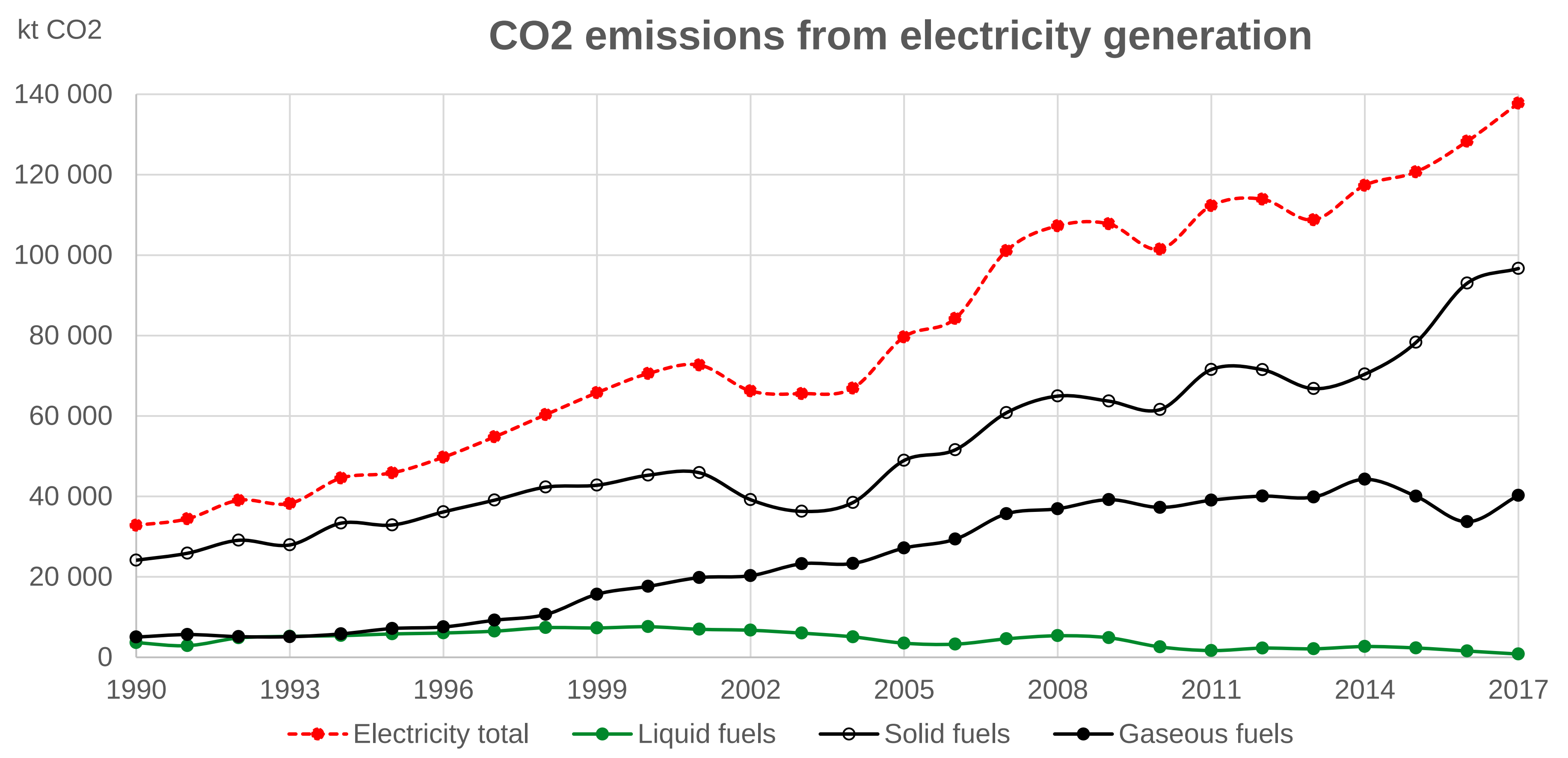


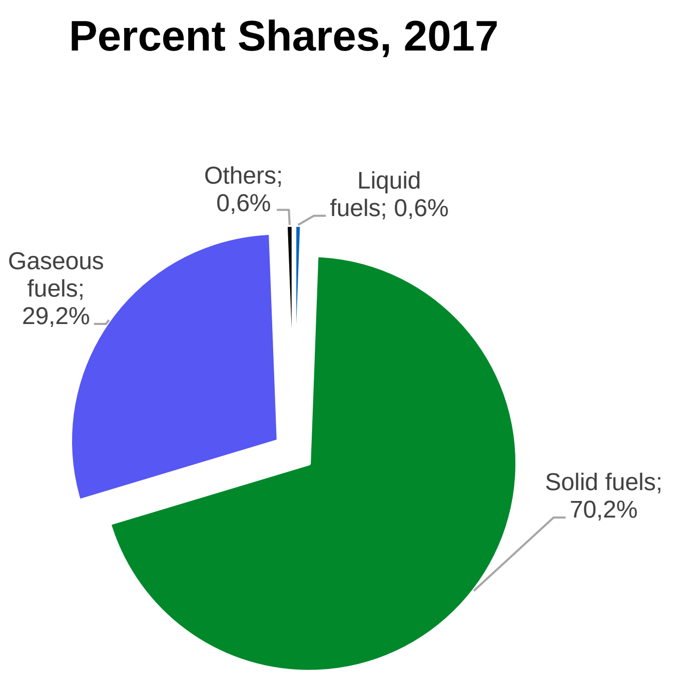

Data Source: UNFCCC National Inventory Submissions - Turkey 2019

INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
WWW.IAEE.ORG

TÜRKİYE ELEKTRO MOBİLİTE DERNEĞİ

# **Introduction:** CO2 Emissions in Turkey

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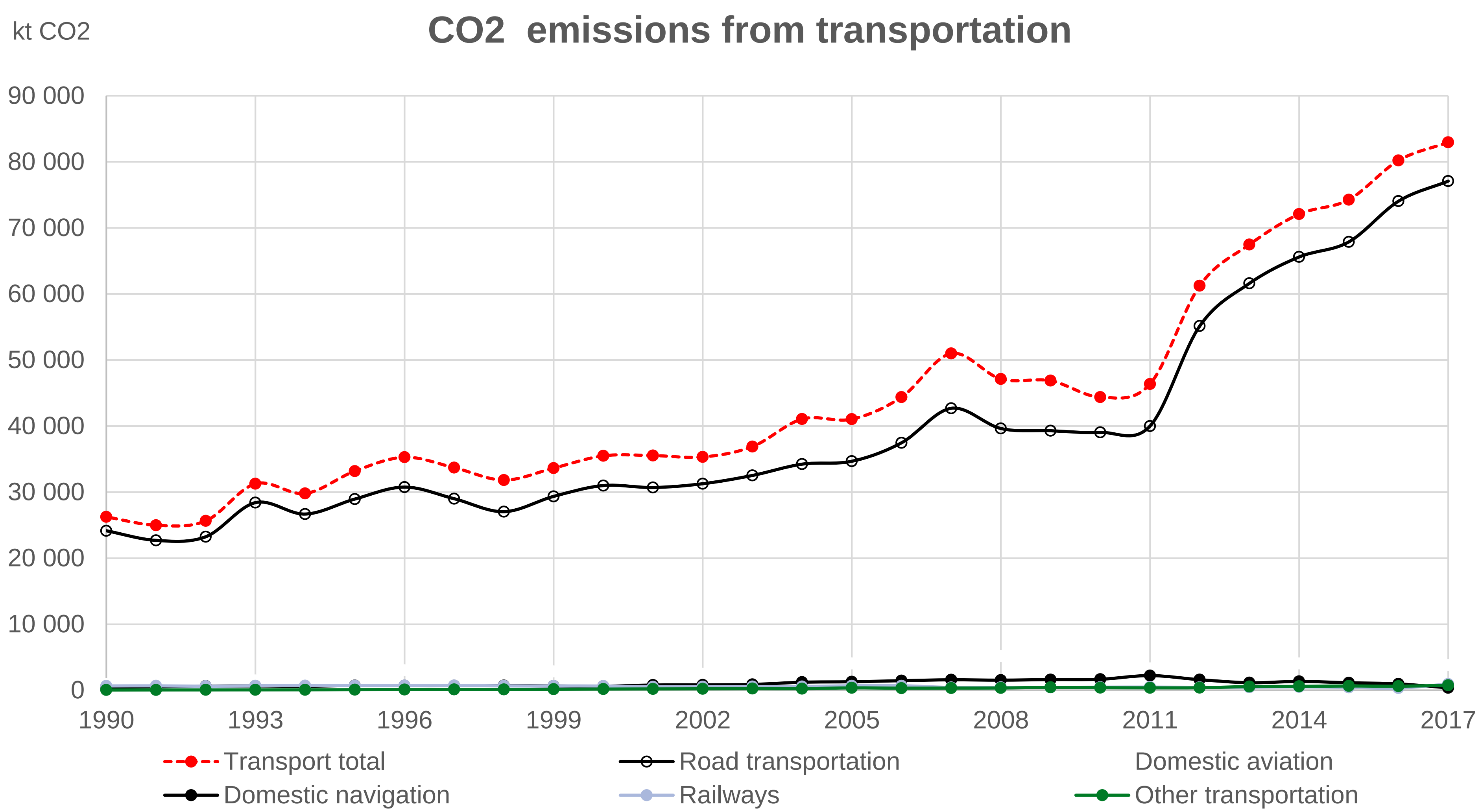


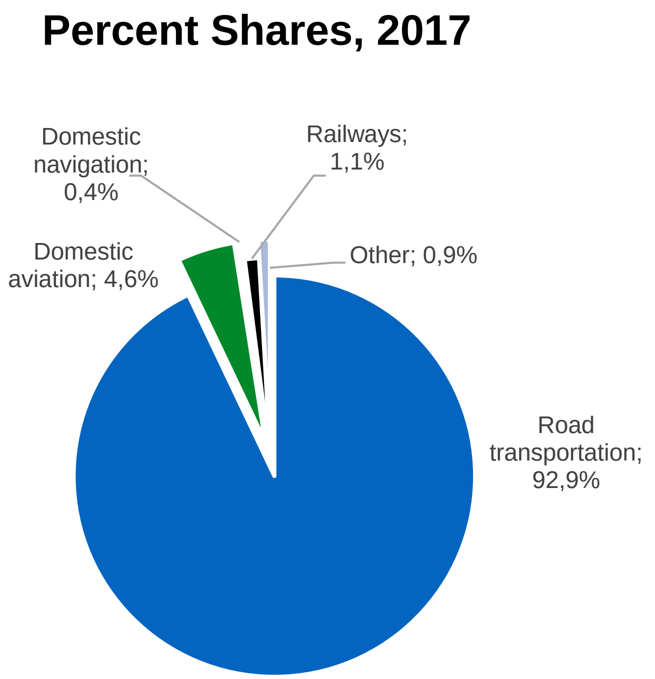


Data Source: UNFCCC National Inventory Submissions - Turkey 2019

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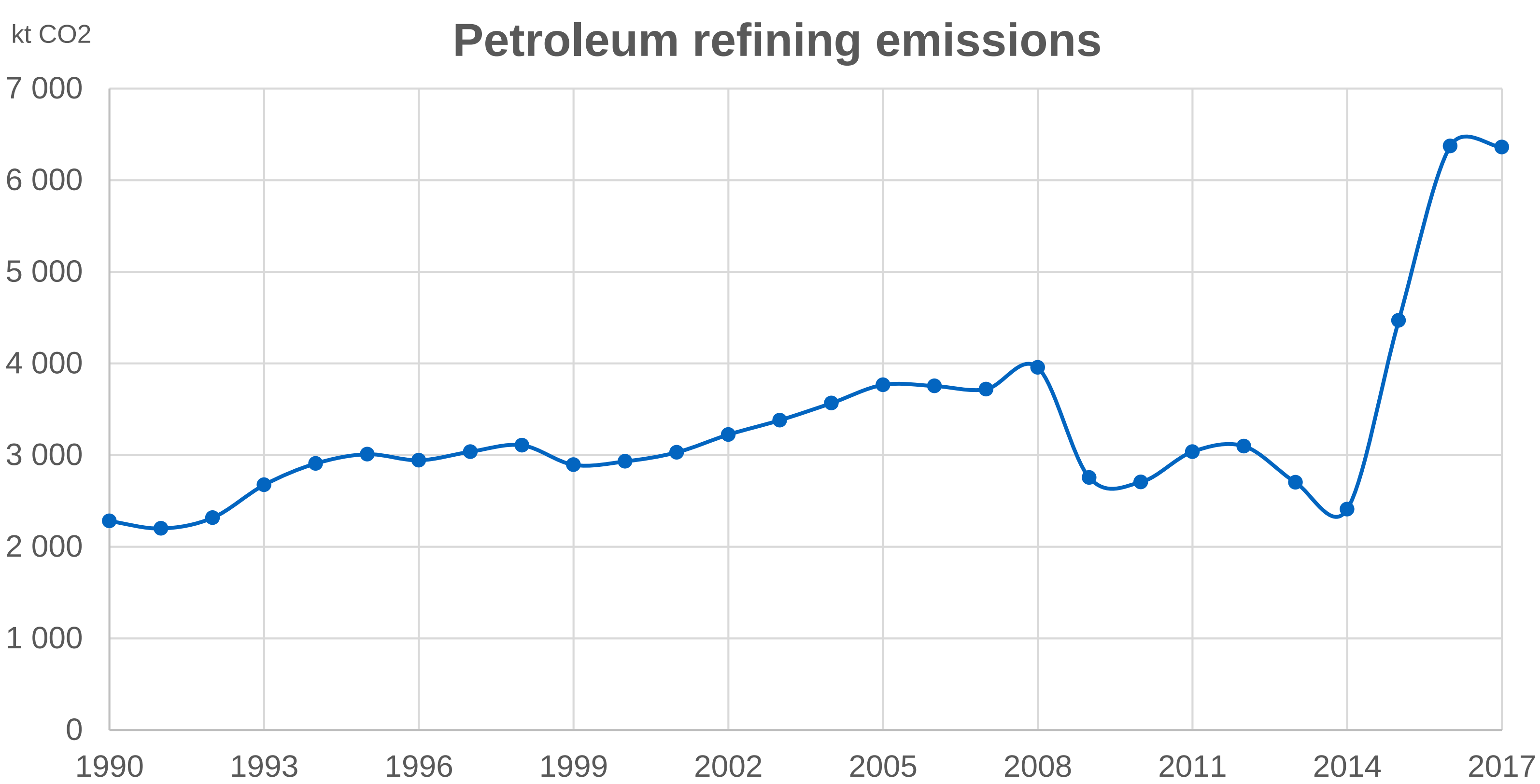
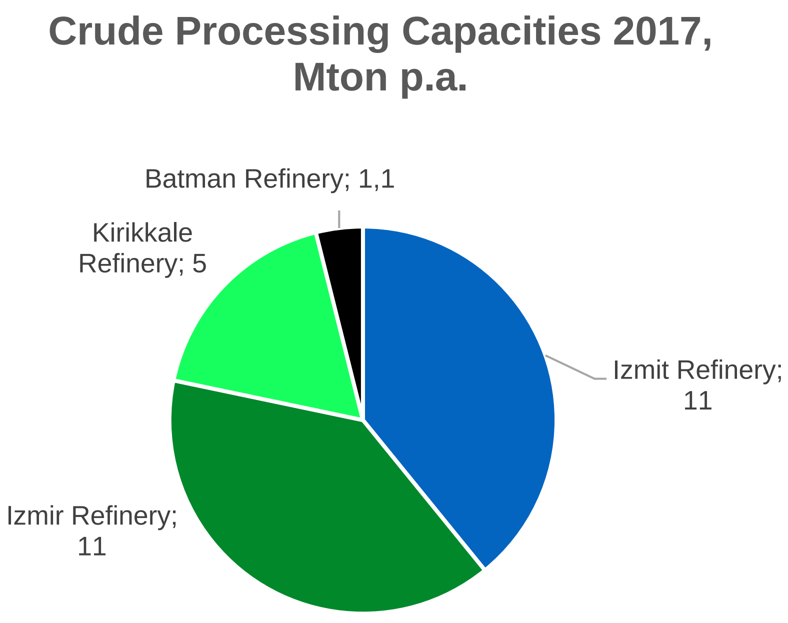



Data Source: UNFCCC National Inventory Submissions - Turkey 2019




**SOCAR Star Refinery, 2018**:
10 Mtons p.a.

# Introduction: EV Sales in Turkey

kaynak: TEHAD

**Türkiye**
Elektrikli ve Hibrid Araç Satışları

DÖNEM
OCAK ARALIK
2018

| MARKA - MODEL | 2018 | 2017 | 2016 | 2015 |
|---|---|---|---|---|
| BMW i3 (i3s dhl) Elektrikli | 37 | 35 | 24 | 83 |
| BMW i8 (Roadster dhl) Plug-in Hibrid *** | 5 | 16 | 51 | 106 |
| BMW 740Le xDrive Plug-in Hibrid *** | 10 | - | - | - |
| Hyundai IONIQ Hibrid | 220 | 166 | - | - |
| Honda NSX Hibrid | 3 | 1 | - | - |
| Infiniti Q50 Hibrid | 0 | - | 1 | - |
| Jaguar I-PACE Elektrikli | 38 | - | - | - |
| Kia NIRO Hibrid | 199 | 118 | - | - |
| Land Rover RR SPORT SE Hibrid *** | 0 | - | - | - |
| Land Rover RR Hibrid | 0 | - | - | - |
| Lexus LS500 Hibrid | 6 | 4 | 1 | - |
| Lexus GS300 Hibrid | 2 | 4 | - | - |
| Lexus CT200 Hibrid | 18 | 5 | - | - |
| Lexus IS300 Hibrid | 1 | 1 | - | - |
| Lexus ES Hibrid | 1 | - | - | - |
| Lexus NX300 Hibrid | 8 | 13 | - | - |
| Lexus RX450 Hibrid | 4 | 2 | 2 | - |
| MercedesBenz C200 Hibrid | 2 | - | - | - |
| MercedesBenz GLC350e Plug-in Hibrid *** | 13 | - | - | - |
| Porsche PANAMERA Plug-in Hibrid *** | - | - | - | - |
| Renault ZOE Elektrikli | 79 | 42 | 20 | 36 |
| Smart EQ Elektrikli | 1 | - | - | - |
| Toyota AURIS Hibrid | 364 | 314 | - | - |
| Toyota AURIS Touring Hibrid | 51 | - | - | - |
| Toyota C-HR Hibrid | 2576 | 3381 | 28 | - |
| Toyota PRIUS Hibrid | 2 | 4 | - | - |
| Toyota RAV4 Hibrid | 254 | 248 | - | - |
| Toyota YARIS Hibrid | 126 | 163 | 835 | - |
| Volvo S90 Plug-in Hibrid *** | 0 | | | - |
| Volvo XC60 T8 Plug-in Hibrid *** | 0 | | | - |
| Volvo XC90 T8 Plug-in Hibrid *** | 11 | 11 | 32 | - |
| Elektrikli | 155 ↑ | 77 | 44 | 119 |
| Hibrid | 3876 ↓ | 4451 | 950 | 106 |
| TOPLAM | 4031 ↓ | 4528 | 994 | 225 |

TEHAD, verilerinde yer alan bilgilerin doğruluğuna azami ölçüde hassasiyet göstermekle birlikte; bu verilerdeki hata, eksiklik veya yorum farklılıklarından ve/veya ticari amaçlı kullanımından doğabilecek zararlardan hiçbir şekilde sorumlu değildir.

TEHAD (Türkiye Elektrikli ve Hibrid Araçlar Platformu) verilerinde; marka ve model bazında yer alan sayısal satış bilgileri ilgili kuruluşların TEHAD'a yaptığı bildirimlerden oluşmaktadır. Bilgiler haksız rekabete yol açacak şekilde kullanılamaz.

TEHAD raporlarının telif hakkı TEHAD'a aittir. Fakat sadece ePosta ortamında yazılı bilgilendirme yapılarak, TEHAD izni olmaksızın rapor çoğaltılabilir, paylaşılabilir, yayınlanabilir veya dağıtılabilir.

* ilk 3 ay toplamı
** ilk 6 ay toplamı
*** Plug-in Hibrid : Kablo ile Şarj edilebilir
**** Marka satış bilgisi vermemiştir.

**Not:** TESLA'nın distribütör kanalı olmadığından, DMA ve Renault Fluence ZE üretimleri olmadığından satış rakamları mevcut değildir. Ülkemizde şu anda **24** adet **Model S** ve **13** adet **Model X**, satış ilanlarında görünmektedir. Bunların **14** adeti sıfır km, kalanları 2nci el ilanlardır. Bu ilanlar ile birlikte ülkemizde tahminen **200** adet Tesla marka otomobil vardır.

www.TEHAD.org
www.EHcars.net

Turkish EV market still in its infancy

INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
WWW.IAEE.ORG

AVERE
TÜRKİYE ELEKTRO MOBİLİTE DERNEĞİ

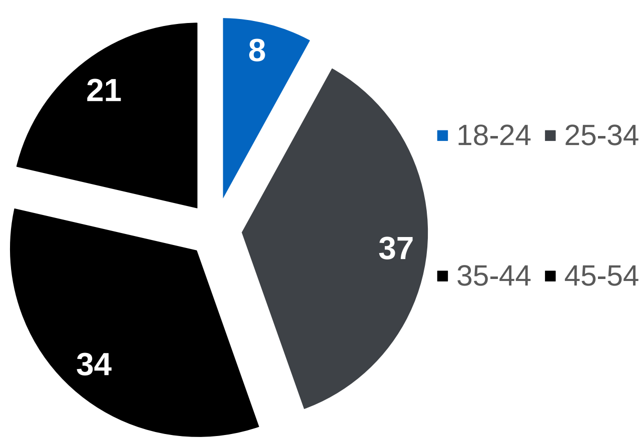
# Charging Infrastructure in Turkey

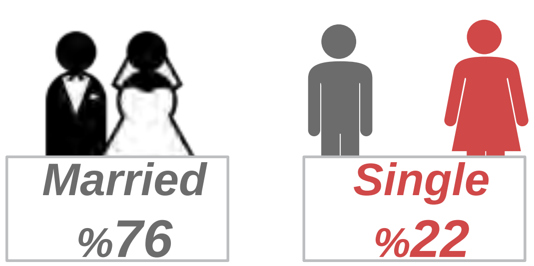

As of April 2019, a total of 582 charging stations (pre-dominantly Mode 3 chargers @ 32A, 380V AC, max 22 kW; 122 CHAdeMO standard with rapid charging DC connectors)

# **Survey:** EV Perception and Barriers for Diffusion

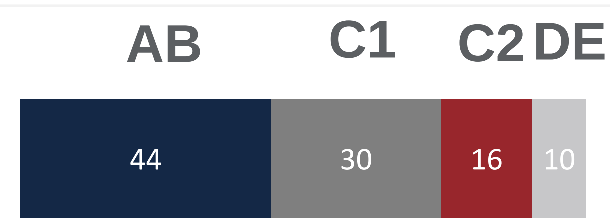
## Demographics

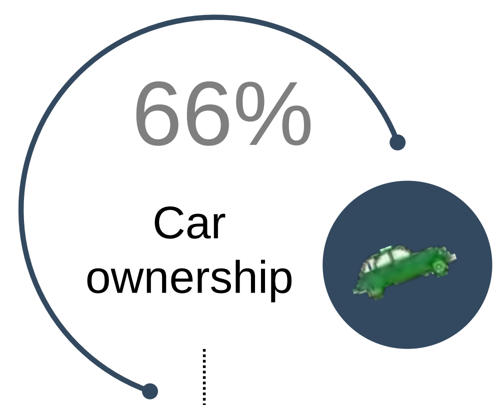

### Age



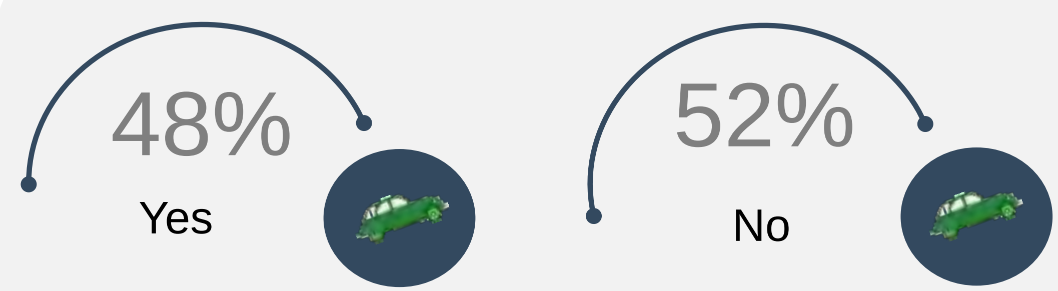




### Income group

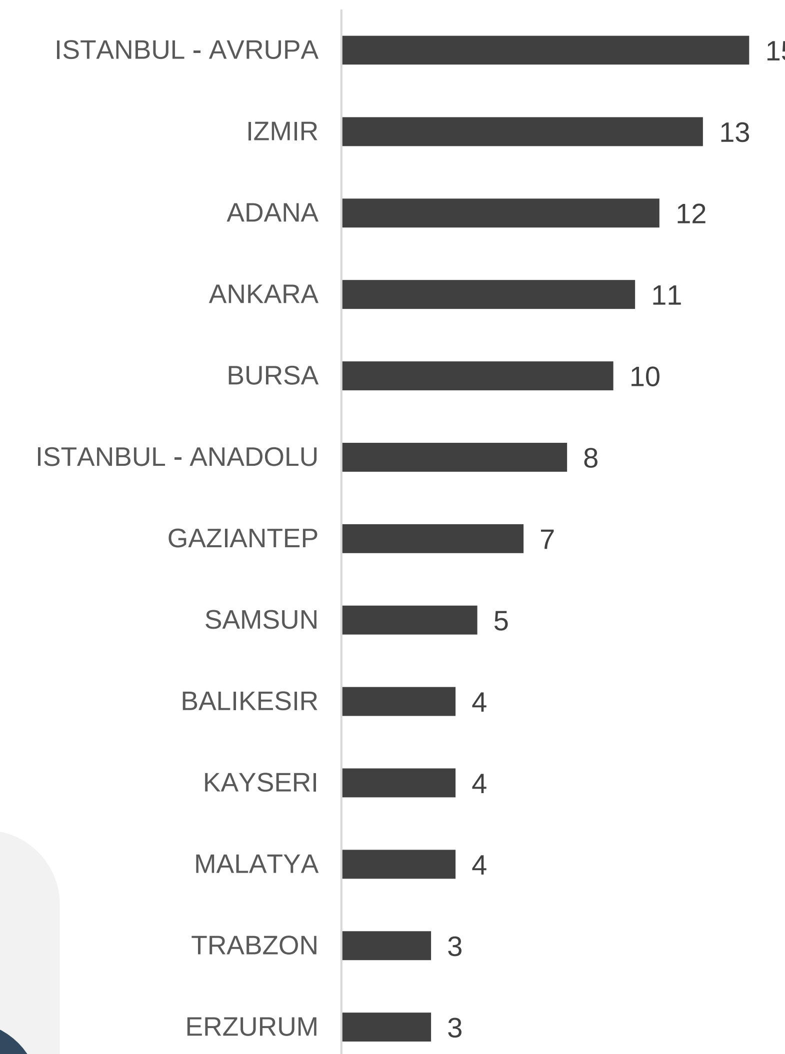



**Plan to change car within two years**

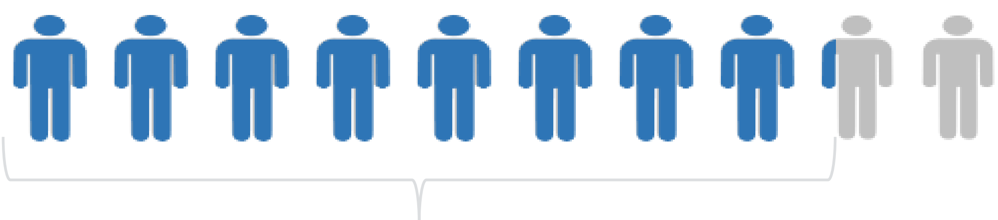



### Provincial distribution



# **Survey:** EV Perception and Barriers for Diffusion

Yes, I know electric vehicles



%83

**Only 54% knows the difference between plug-in EV and hybrid cars**

n:494
*(Women %30; Men %59)*

## What do you know about EV ?

| Technical | %81 |
|---|---|
| Uses electricity | %47 |
| Charged vehicles | %22 |
| Doesn't use fossil fuels | %13 |
| Has a battery | %12 |
| Hybrid vehicles | %10 |

| Environmental | %20 |
|---|---|
| Environment-friendly | %20 |

| Price | %12 |
|---|---|
| Low-cost and efficient | %11 |
| Expensive initial cost | %2 |

| Perception | %5 |
|---|---|
| No infrastructure | %3 |
| Everybody will use in future | %1 |
| Domestically produced | %1 |
| Reduces import dependence | %1 |
| Started getting widespread | %1 |
| Charging infrastructure incomplete | %1 |

| Others | %5 |
|---|---|
| New generation technology | %2 |
| Very useful | %1 |

n:494

*(Women %20; Men %51)*

**44% of all respondents knows the difference between plug-in EV and hybrid cars**

Total: 600
S|**S2**. Do you know what an EV is? Have you ever heard before? **S3.** What is an EV? What do you know about EV? **S4.**Did you know EV is different than hybrid car?

# **Survey:** EV Perception and Barriers for Diffusion

**Would you buy an EV ?**

| | *EV-aware* n:494 | *EV-unaware* n:106 |
|---|---|---|
| **Definitely Yes + Maybe** | %80 ▲ | %65 |
| **Definitely Not** | %20 | %35 ▲ |

▲▼ Statistically significant difference (higher/lower) between EV-aware and EV-unaware

S|S5. if you were to buy a new vehicle, would you buy an EV?

# **Survey:** EV Perception and Barriers for Diffusion

## Potential EV buyers: What is your motivation to buy an EV?

**80% of EV-aware would like to buy an EV because/if**

| | n:408 *EV-aware* | n:69 *EV-unaware* |
|---|---|---|
| **Economic** | **72%** ▲ | **58%** ▼ |
| because it's low-cost and efficient | %56 ▲ | %40 ▼ |
| because it saves fuel | %14 | %20 |
| because it saves maintenance cost | %3 | %1 |
| because it's advantageous | %2 | %0 |
| because it has no excise tax/less tax payment | %1 | %0 |
| **Environmental** | **%46** ▲ | **%29** ▼ |
| because it generates no emissions | %46 | %29 |
| **Technical** | **%15** | **%7** |
| because it's silent | %5 | %3 |
| because it does not use fossil fuels | %3 | %3 |
| because it has an electric motor | %3 | %1 |
| because it's chargeable | %2 | %1 |
| because its maintenance is easy | %1 | %0 |
| because it has limited speed – less accidents | %1 | %0 |
| because it leads to less breakdown | %1 | %0 |
| if range gets extended | %1 | %0 |
| if battery replacement cycle gets extended | %1 | %0 |

**65% of EV-unaware would like to buy an EV because/if**

| | n:408 *EV-aware* | n:69 *EV-unaware* |
|---|---|---|
| **Awareness** | **%13** | **%11** |
| because it's trendy/everybody will use e-car in future | %4 | %0 |
| because it reduces oil/import dependence | %3 | %0 |
| if there are sufficient charging stations | %2 | %0 |
| if it is easier/automated to use | %2 | %6 |
| because electricity is everywhere | %1 | %2 |
| if service network is widespread | %1 | %0 |
| because it is domestically produced | %0 | %2 |
| because it will be obligatory | %0 | %1 |
| **Other** | **%10** | **%12** |
| because it's new technology/new generation | %2 | %1 |
| because of catching up with developments | %2 | %1 |
| because of curiosity | %1 | %3 |
| because it's ideal for innercity transport | %1 | %2 |

▲▼ Statistically significant difference (higher/lower) between EV-aware and EV-unaware

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# Survey: EV Perception and Barriers for Diffusion

## EV opposed group: What is your reason not to buy an EV?

### 20% of EV-aware would NOT buy an EV because/if

| Technical | 52% (n:86 EV-aware) | 28% (n:37 EV-unaware) |
|---|---|---|
| it has limited range | 12% | %4 |
| intercity travel is a challenge | %10 | %6 |
| it requires frequent charging | %9 | %6 |
| gasoline is convenient | %9 | %2 |
| it has limited speed | %6 | %0 |
| charging requires too much time | %5 | %4 |
| it is less powerful | %4 | %2 |
| maintenance and spare part availability is limited | %3 | %2 |
| gasoline-fueled vehicles will be available | %2 | %0 |
| it's not suited for carrying freight | %1 | %0 |
| There may be an electricity shortage | %0 | %8 |
| it is silent | %0 | %2 |
| Electricity is dangerous | %0 | %3 |

| Economic | %14 | %8 |
|---|---|---|
| sales price is too high | %8 | %8 |
| Electricity prices are too high | %3 | %0 |
| I don't have sufficient funds | %1 | %0 |

### 35% of EV-unaware would NOT buy an EV because/if

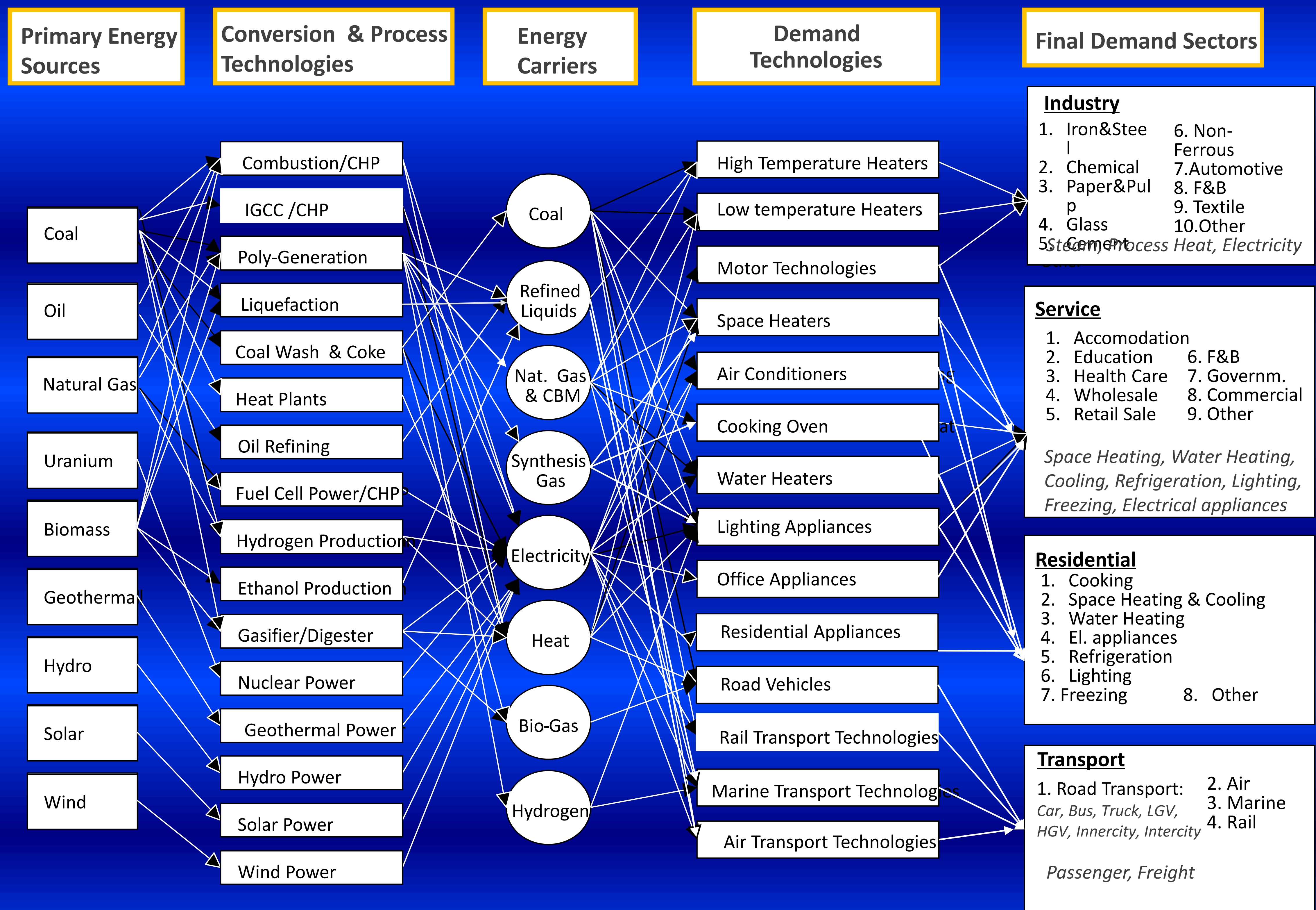
| Perception | 50% (n:86 EV-aware) | 40% (n:37 EV-unaware) |
|---|---|---|
| usage is not not widespread | %24 | %5 |
| I don't have enough knowledge | %13 | %33 |
| there are too few charging stations | %11 | %3 |
| there is a high breakdown risk | %8 | %5 |
| there is no second-hand market | %3 | %0 |
| it's not suited for regular use | %1 | %0 |
| it has no key | %0 | %4 |

| Other | %17 | %20 |
|---|---|---|
| it's still under development | %4 | %0 |
| I don't like it | %3 | %0 |
| it's not practical | %3 | %8 |
| It doesn't make any sense | %2 | %0 |
| I don't need it | %2 | %5 |
| It does not appear safe | %2 | %4 |
| I can think about it in future | %1 | %0 |
| of weather conditions | %1 | %0 |
| there is too much traffic | %0 | %3 |

Statistically significant difference (higher/lower) between EV-aware and EV-unaware

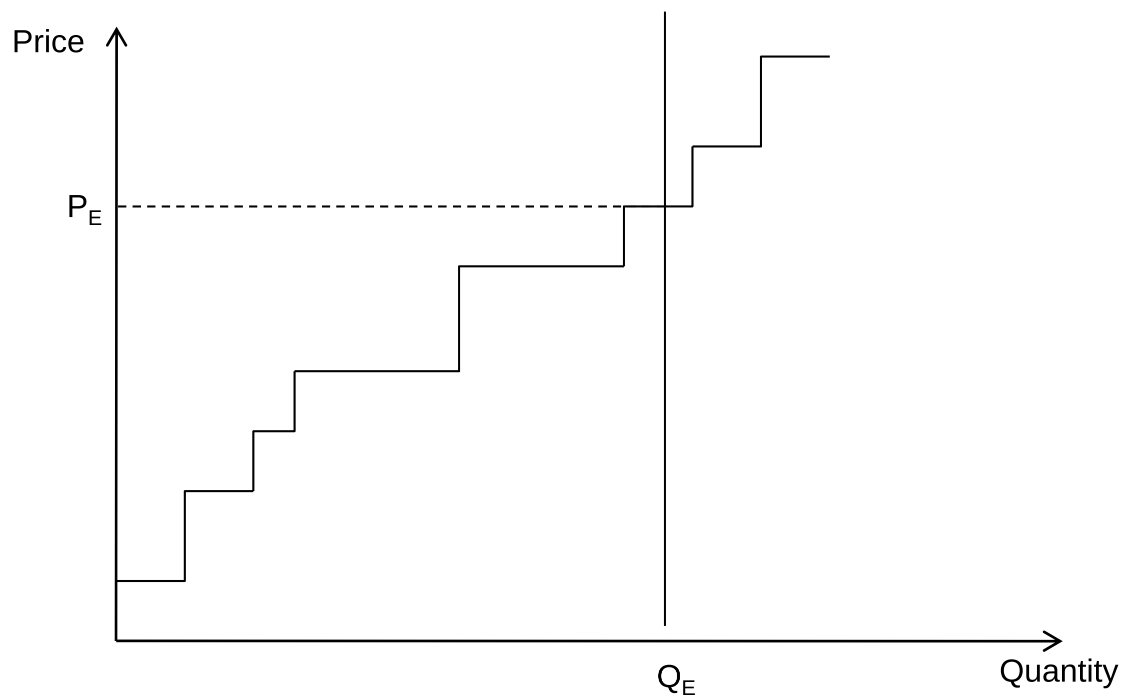
# Modeling for EV Infrastructure and CO2 Emissions

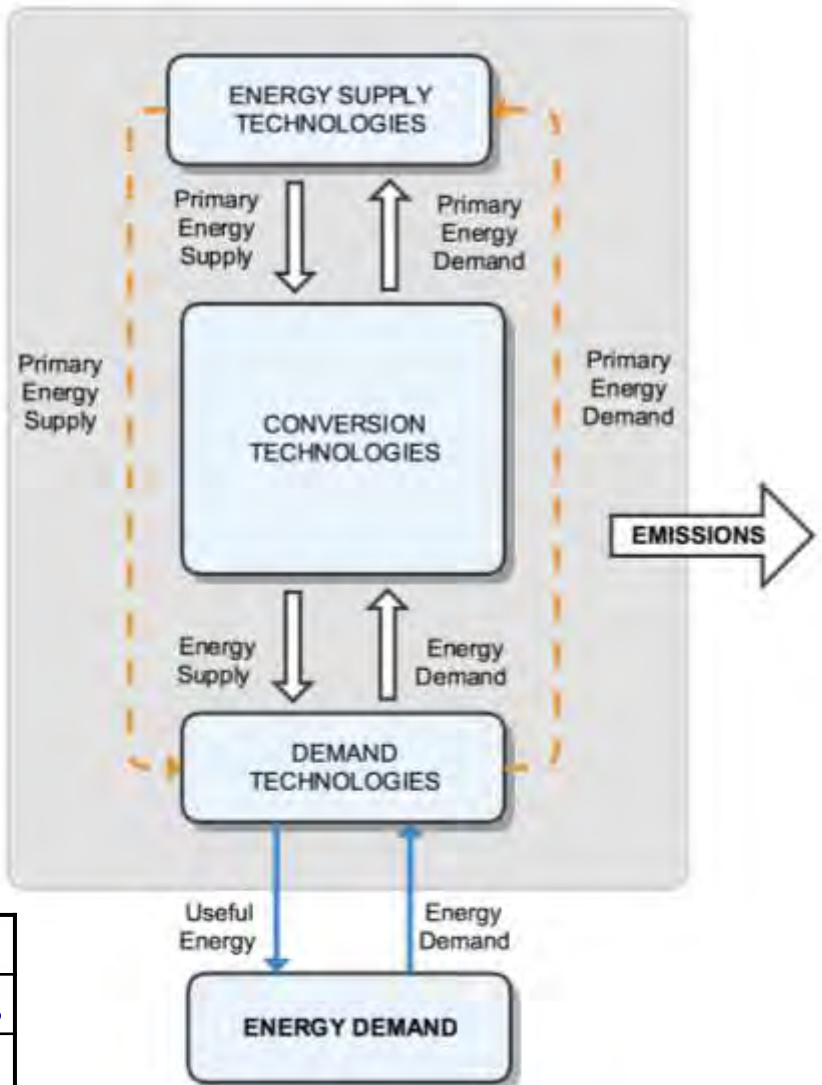
## BUEMS Model Structure



# Modeling for EV Infrastructure and CO2 Emissions

## BUEMS Technology Overview




| Sector | Demand Technologies |
|---|---|
| Transport | 53 vehicle technologies in 7 size classes. Total of 933 technologies |
| Service | 138 heating, cooling, insulation, ventilation, lighting, and refrigeration technologies |
| Residential | 87 heating, cooling, insulation, lighting, and refrigeration technologies |
| Industry | 8 most energy-extensive sectors (automobile, cement, chemical, food & beverage, glass, iron & steel, non-ferrous metals, pulp & paper and other industry) comprising 213 technologies |

**Technology Database**
- ✓108 Supply Technologies
- ✓481 Conversion Technologies
- ✓1371 Demand Technologies

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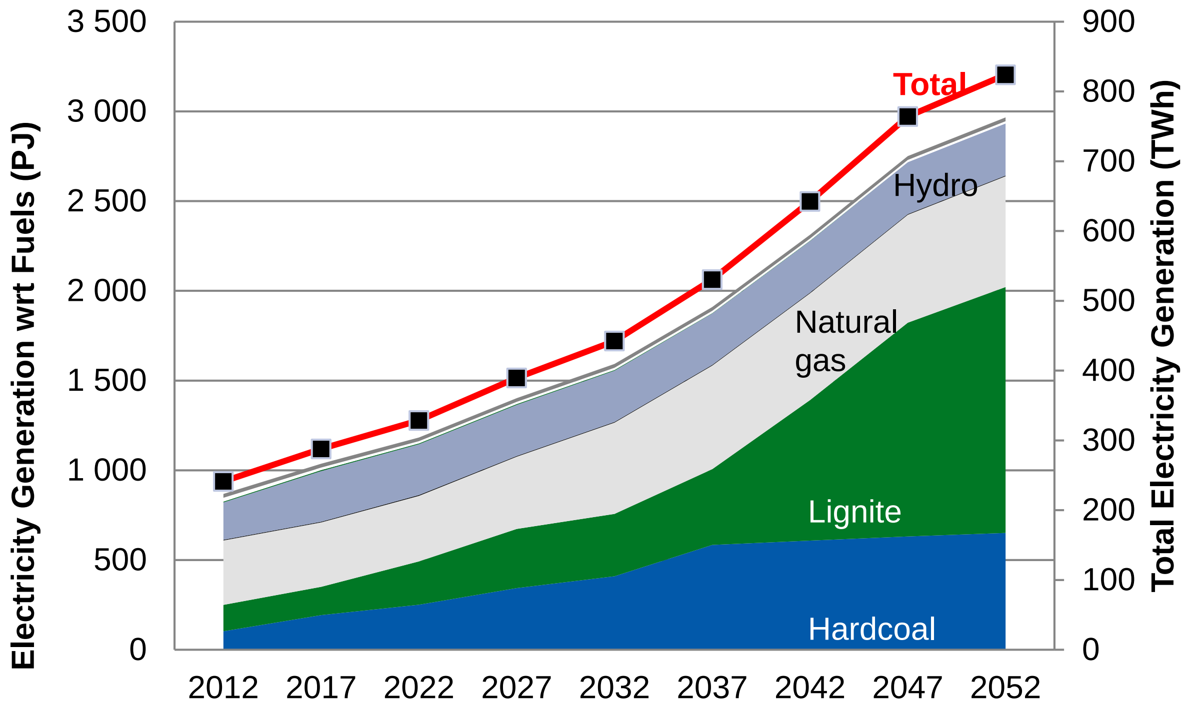
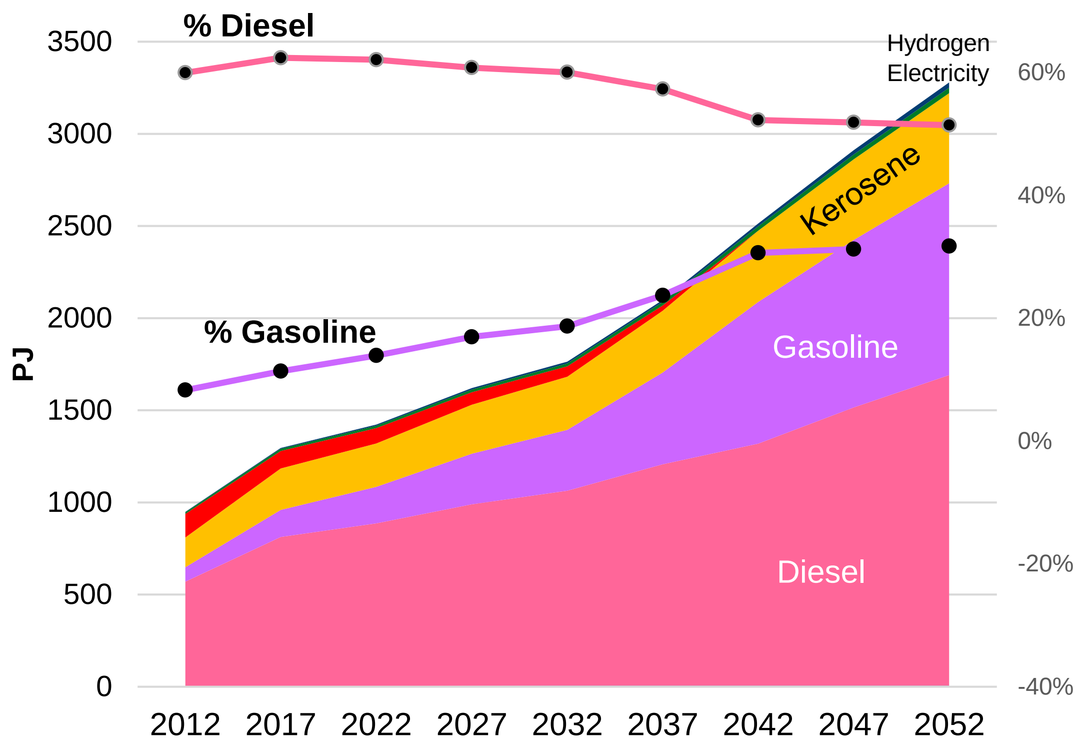
# Modeling for EV Infrastructure and CO2 Emissions

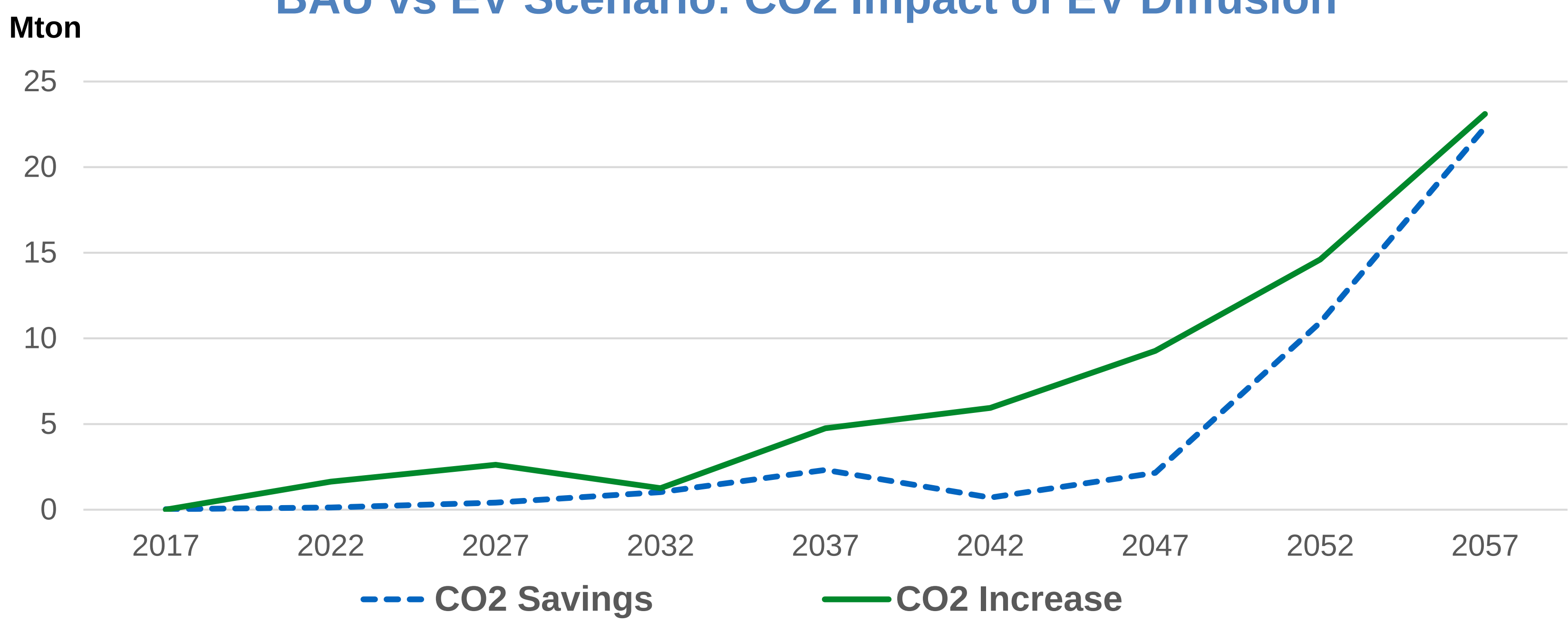
## BAU Scenario Electricity Generation



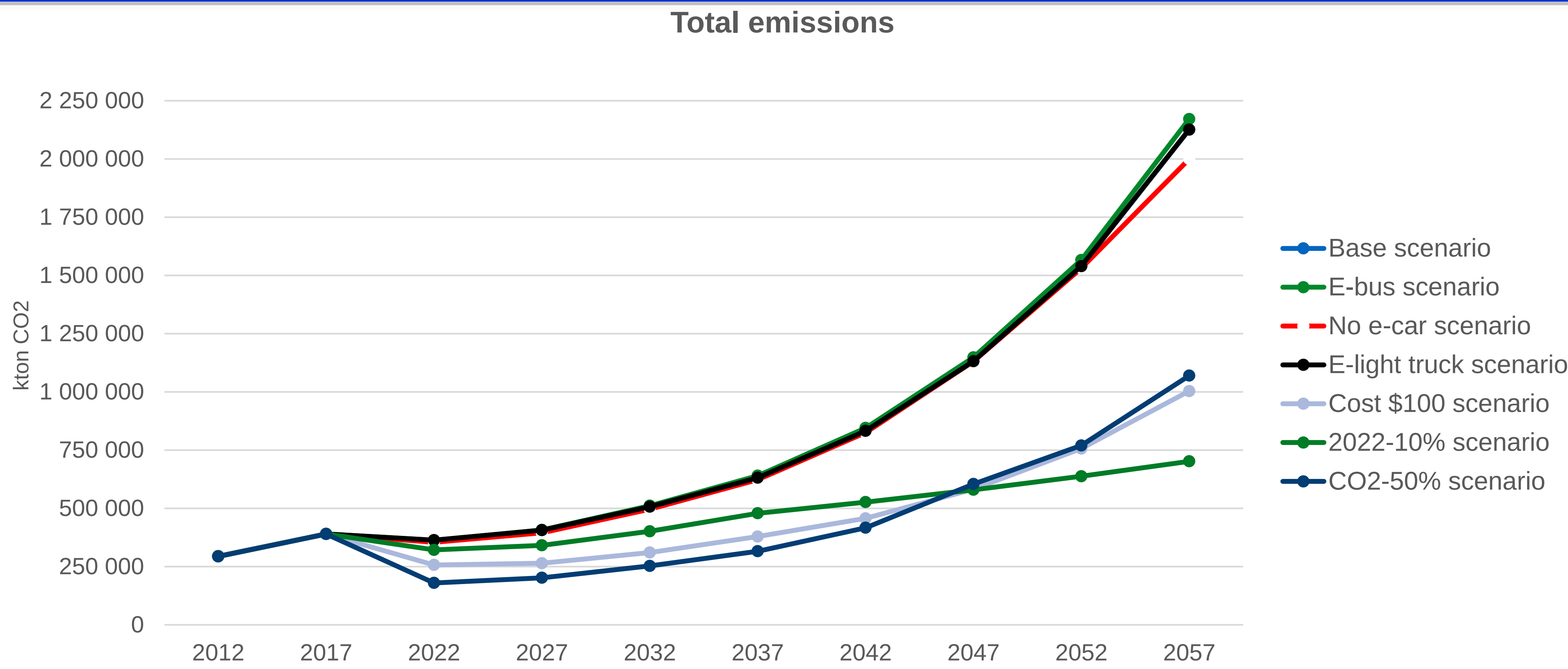

## BAU Scenario Transport Energy Use

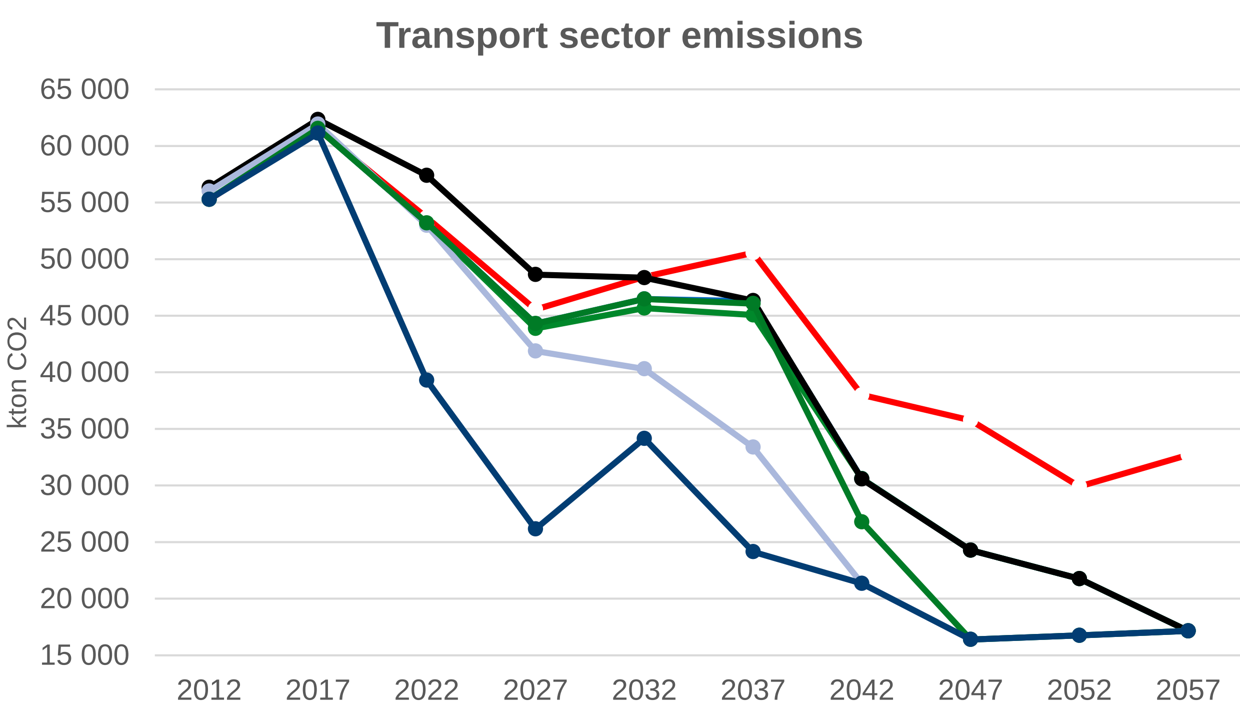


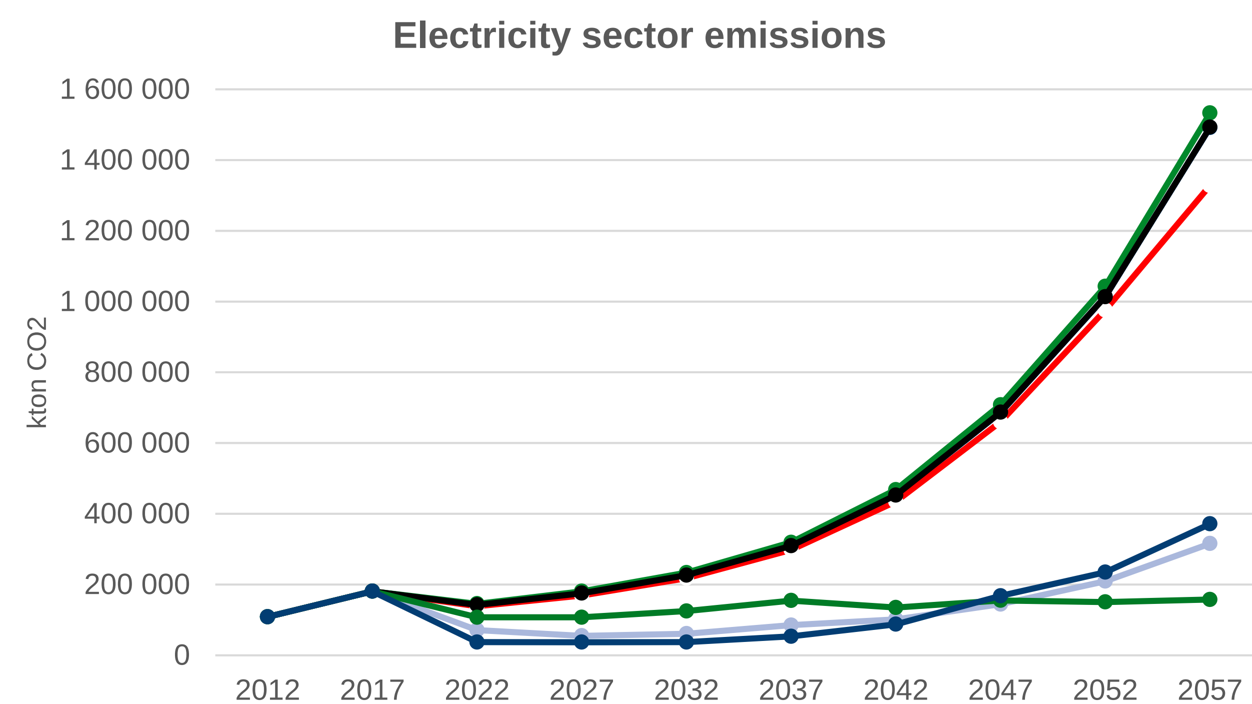

## BAU vs EV Scenario: CO2 Impact of EV Diffusion



# Modeling for EV Infrastructure and CO2 Emissions



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# EV Carsharing

## Sharing economy is changing our lives

### "Use per need, share the rest"

airbnb

- Home/room sharing
- ~35 million users, operations in 190 countries
- ~$31B market cap

BlaBlaCar

- Ride sharing
- ~40 million users, operations in 22 countries
- ~$1.6B market cap

fon

- Internet/connection sharing
- More than 20 million access points

LendingClub

- Money/credit sharing, peer-to-peer credit
- +1.5 million users
- ~$28B total volume

**Cars are parked In %95 of the time**

**&**

**Cost of ownership is rising.**

**Carsharing services are rising**

Car2Go, 2.5M users, 14K vehicles

Zipcar, 1.1M users, 13K vehicles

DriveNow, 700K users, 5K vehicles

Source: Navigant Research, RAC Foundation Report (UK- 2012), company websites

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# EV Carsharing

## EV carsharing services around the world

evo
1,250 vehicles
Vancouver, Canada
Launched March 2015

Communauto
650 vehicles
Montreal, Canada
Launched June 2013


GreenMobility
YOUR CITY CAR
450 vehicles
Copenhagen, Denmark
Launched October 2016


zipcar
250 vehicles
Bruxelles, Belgium
Launched September 2016

emov
500 vehicles
Madrid, Spain
Launched December 2016

panek
300 vehicles
Warsow, Poland
Launch June 2017

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# EV Carsharing

## Electrip: EV Carsharing Service by Zorlu Energy

**Targets**

- To show that EV's are practical and usable for lots of use cases
- To create a leverage in the EV market in Turkey
- To decrease carbon emission in Turkey

- **Fleet**: 40 BEVs
- **Location**: Starting from Istanbul Levent 199 and Zorlu Center
- **Launch Date**: Q4 2018


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# EV Carsharing

electrip
ŞEHRİN ELEKTRİĞİNİ KEŞFET

## Carsharing

Google play
Available on the App Store

electrip
ŞEHRİN ELEKTRİĞİNİ KEŞFET

## Corporate Carsharing

electrip
ŞEHRİN ELEKTRİĞİNİ KEŞFET

## Premium

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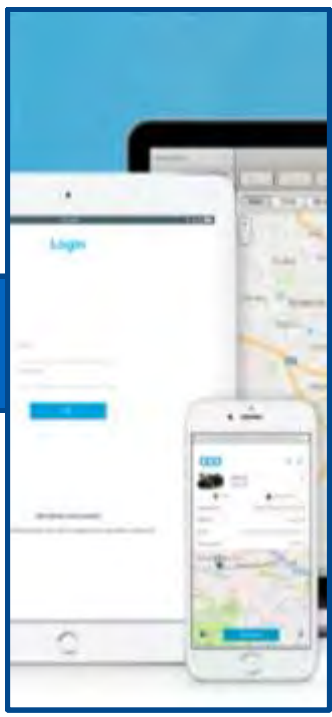
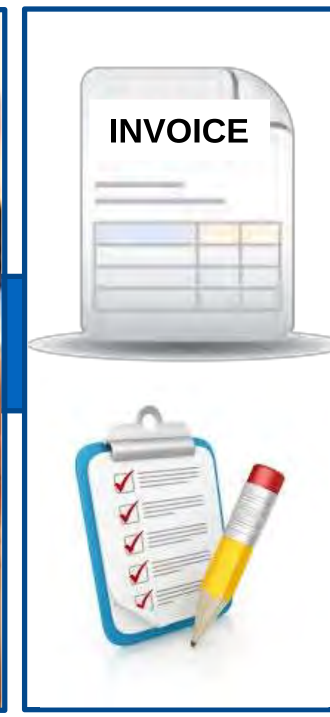
# EV Carsharing

## Simple and Totally Digital Customer Experience

1. Sign up through Web and Mobile App
2. Nearest car can be found through Web or Mobile App
3. Car can be unlocked using Mobile App
4. PoI's can be accessed via Mobile App
5. Car is locked through Mobile App after usage
6. Billing, trip statistics and scoring after the trip
7. Instant messages, polls and information through mobile app

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# EV Carsharing

## ZES: Fastest EV Charging Network in Turkey

# EV Carsharing

Zorlu Energy Solutions

- To create the fastest and widest coverage charging network in Turkey and be the **leader** with **min %50 market share**
- **1.000 charging points** in 2020
- **End to end Public and Private** charging solutions
- To be an **international e-mobility provider in the region** in the mid-long term

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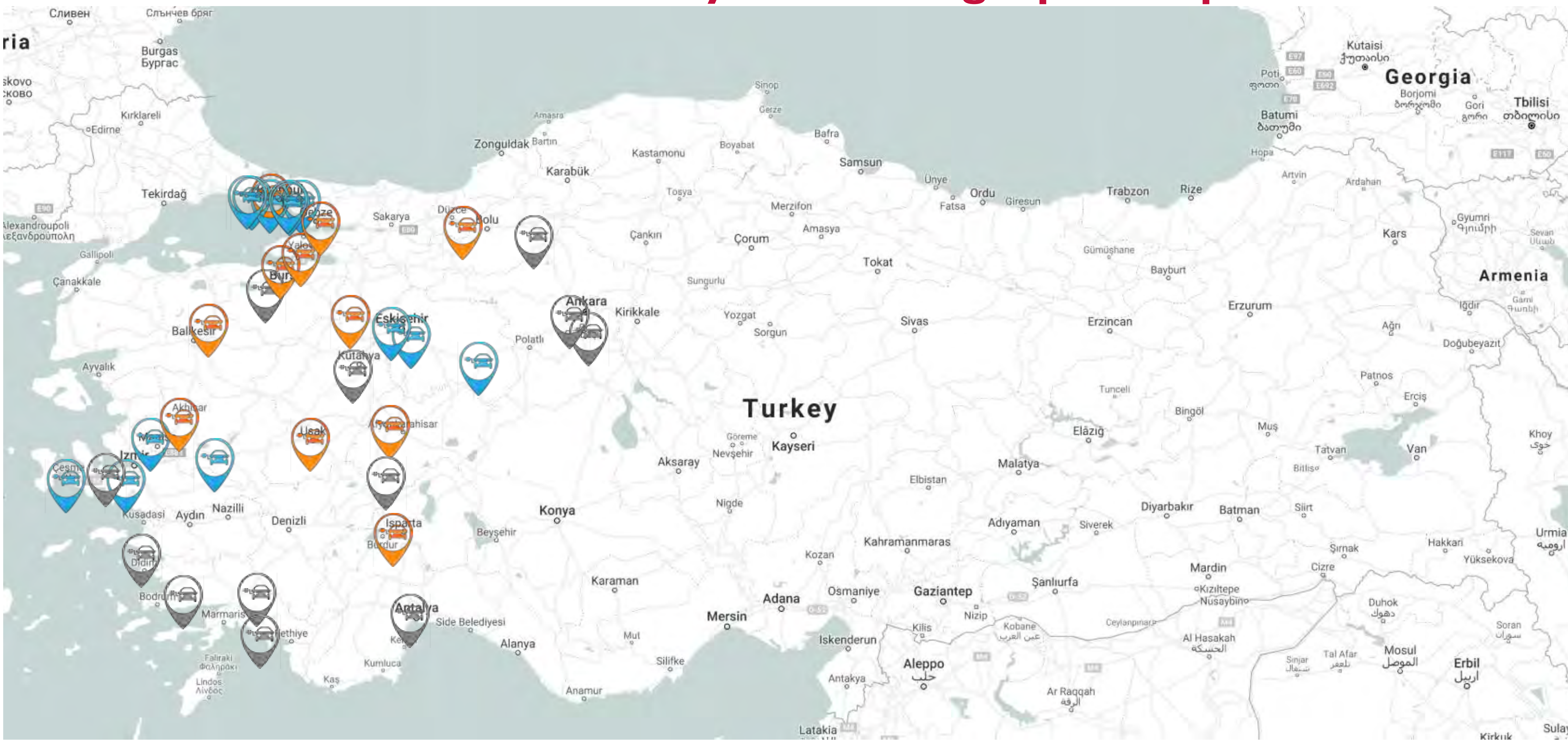
# EV Carsharing

Ultra Fast   Fast   In progress

## We make the EV's in Turkey move using a phased plan…



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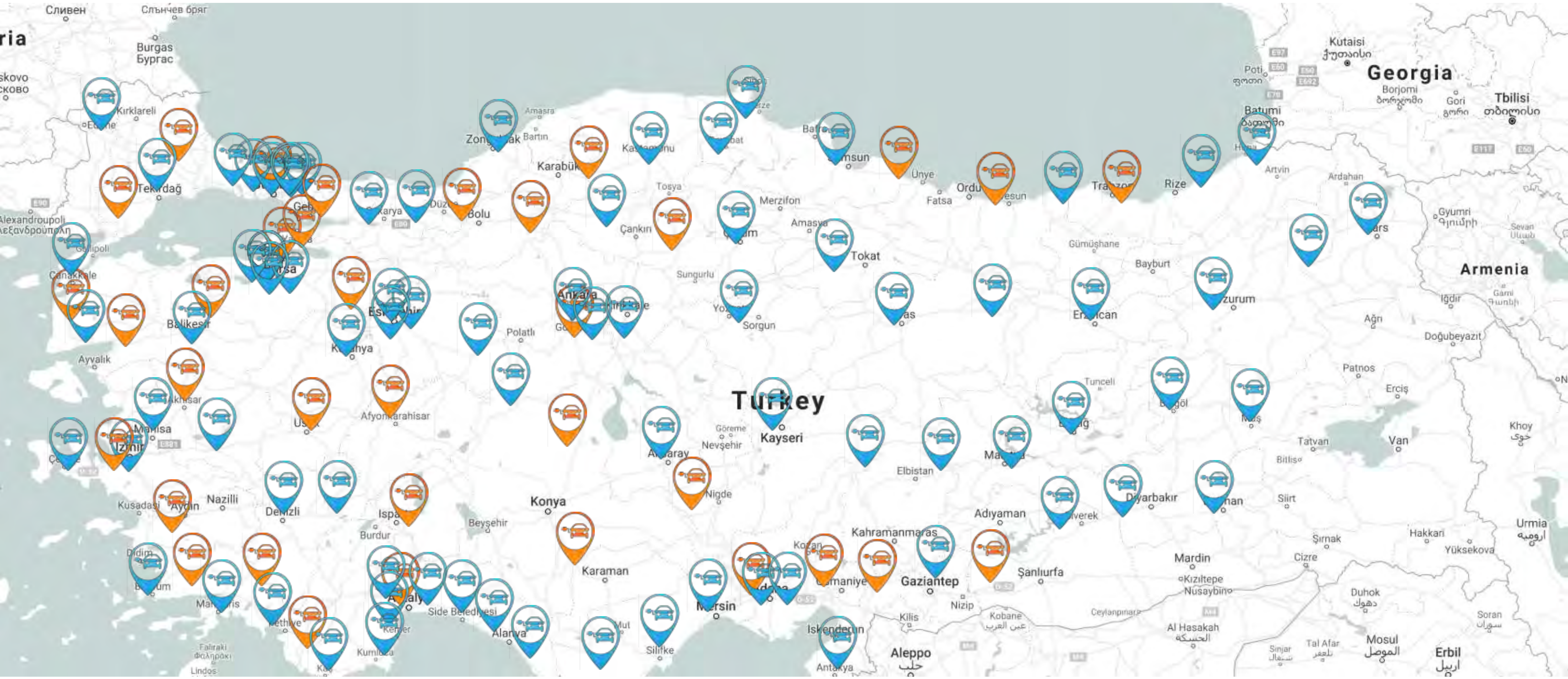
# EV Carsharing

Ultra Fast | Fast | In progress

## … and will cover Turkey with fast Chargers in 2020



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# EV Carsharing

## Cooperation with Car Manufacturers

JAGUAR RENAULT NISSAN KIA

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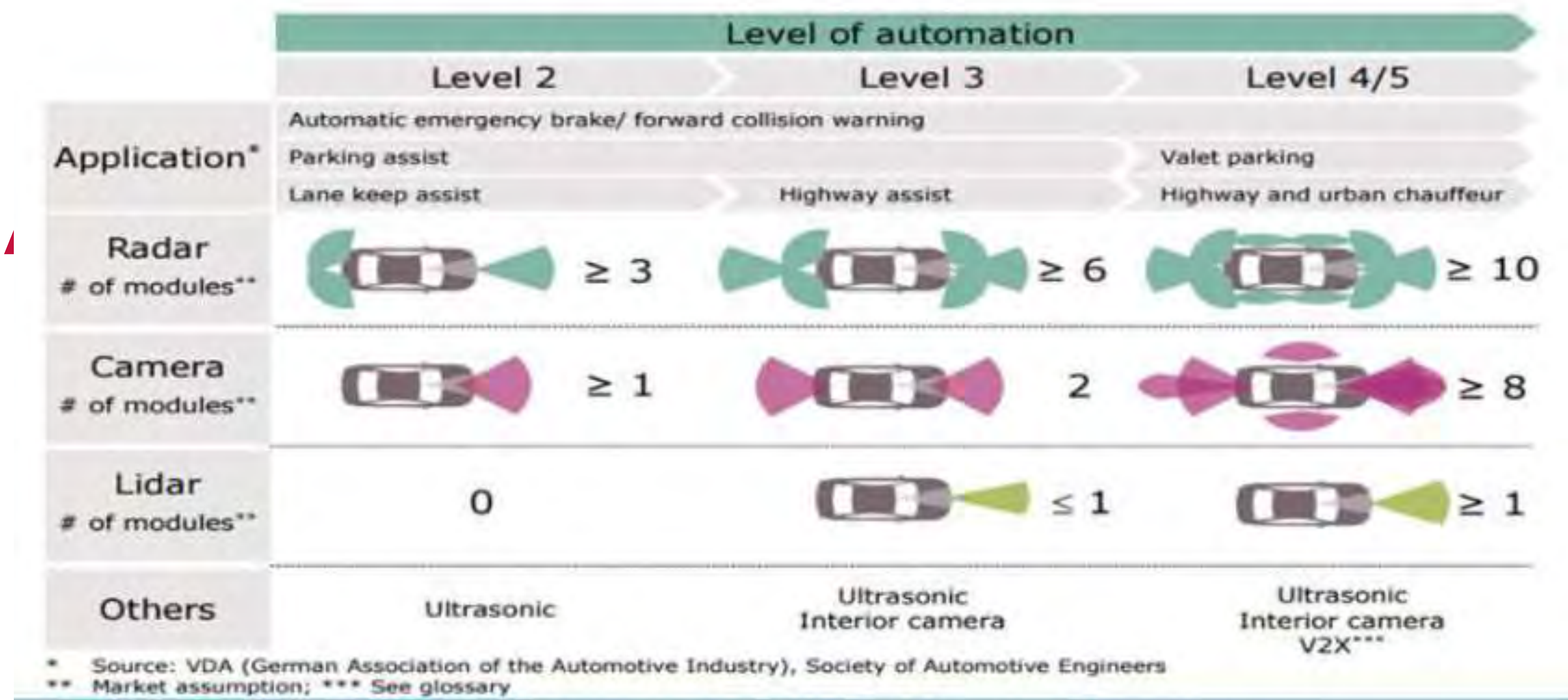
# Autonomous driving

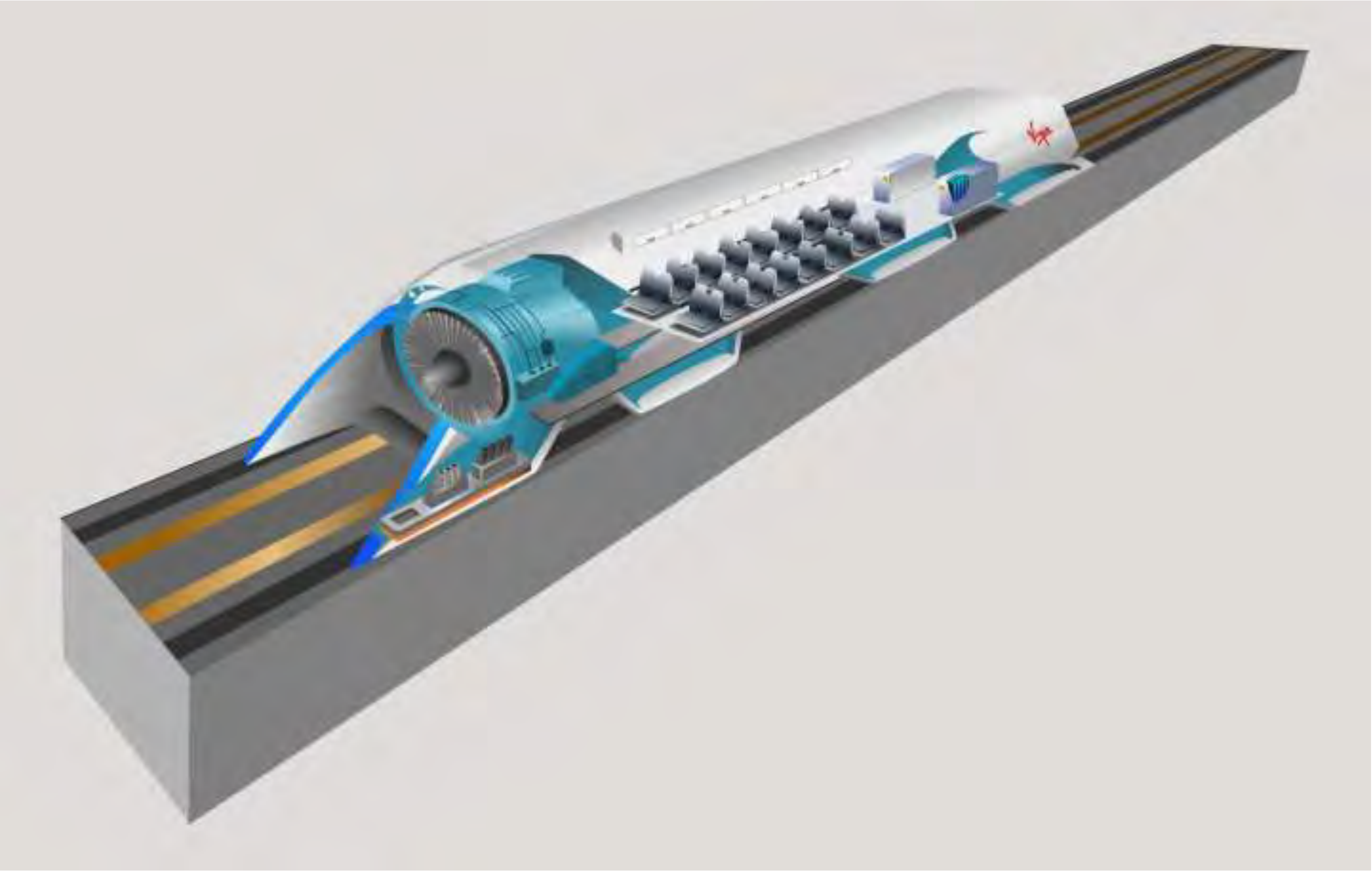
# Autonomous driving




Source: http://www.infineon.com/dgdl?fileId=5546d461579365280157b3707fa500f8&redirId=57324

# Autonomous driving

Hyperloop in Abu Dhabi to cost up to Dh1.4 billion, to be ready by 2020



https://www.youtube.com/watch?v=EQFYedsXg7M

# Thank You

## For More Information

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15-17 ***International feedbacks of local governance for EVs and Renewable deployment***

- *Chair:* **Gurkan Kumbaroglu**, *President of the Turkish association for electromobility*

## 1. Electric vehicles, cornerstone of smart cities

- **Didier Chabaud** *(Sorbonne Business School)*

# Electric vehicles, cornerstone of smart cities

## *Some issues regarding Autonomous Vehicles and business models*

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# Introduction

- A Paradox?
- Autolib economic collapse
- A central trend: Mobility in (smart) cities
- Addressing BM / system effects regarding the Autonomous Electric Vehicle

# A central concern: Mobility in (smart) cities

- A urban century

## World's population by size class of settlement, 2016 and 2030

| | 2016 | | | 2030 | | |
|---|---|---|---|---|---|---|
| | Number of settlements | Population (millions) | Percentage of world population | Number of settlements | Population (millions) | Percentage of world population |
| Urban | .. | 4 034 | 54.5 | .. | 5 058 | 60.0 |
| 10 million or more | 31 | 500 | 6.8 | 41 | 730 | 8.7 |
| 5 to 10 million | 45 | 308 | 4.2 | 63 | 434 | 5.2 |
| 1 to 5 million | 436 | 861 | 11.6 | 558 | 1 128 | 13.4 |
| 500 000 to 1 million | 551 | 380 | 5.1 | 731 | 509 | 6.0 |
| Fewer than 500 000 | .. | 1 985 | 26.8 | .. | 2 257 | 26.8 |
| Rural | .. | 3 371 | 45.5 | .. | 3 367 | 40.0 |

| Rank | City, Country | Population in 2016 (thousands) | City, Country | Population in 2030 (thousands) |
|---|---|---|---|---|
| 1 | Tokyo, Japan | 38 140 | Tokyo, Japan | 37 190 |
| 2 | Delhi, India | 26 454 | Delhi, India | 36 060 |
| 3 | Shanghai, China | 24 484 | Shanghai, China | 30 751 |
| 4 | Mumbai (Bombay), India | 21 357 | Mumbai (Bombay), India | 27 797 |
| 5 | São Paulo, Brazil | 21 297 | Beijing, China | 27 706 |
| 6 | Beijing, China | 21 240 | Dhaka, Bangladesh | 27 374 |
| 7 | Ciudad de México (Mexico City), Mexico | 21 157 | Karachi, Pakistan | 24 838 |
| 8 | Kinki M.M.A. (Osaka), Japan | 20 337 | Al-Qahirah (Cairo), Egypt | 24 502 |
| 9 | Al-Qahirah (Cairo), Egypt | 19 128 | Lagos, Nigeria | 24 239 |
| 10 | New York-Newark, USA | 18 604 | Ciudad de México (Mexico City), Mexico | 23 865 |
| 11 | Dhaka, Bangladesh | 18 237 | São Paulo, Brazil | 23 444 |
| 12 | Karachi, Pakistan | 17 121 | Kinshasa, Democratic Republic of the Congo | 19 996 |
| 13 | Buenos Aires, Argentina | 15 334 | Kinki M.M.A. (Osaka), Japan | 19 976 |
| 14 | Kolkata (Calcutta), India | 14 980 | New York-Newark, USA | 19 885 |
| 15 | Istanbul, Turkey | 14 365 | Kolkata (Calcutta), India | 19 092 |
| 16 | Chongqing, China | 13 744 | Guangzhou, Guangdong, China | 17 574 |
| 17 | Lagos, Nigeria | 13 661 | Chongqing, China | 17 380 |
| 18 | Manila, Philippines | 13 131 | Buenos Aires, Argentina | 16 956 |
| 19 | Guangzhou, Guangdong, China | 13 070 | Manila, Philippines | 16 756 |
| 20 | Rio de Janeiro, Brazil | 12 981 | Istanbul, Turkey | 16 694 |
| 21 | Los Angeles-Long Beach-Santa Ana, USA | 12 317 | Bangalore, India | 14 762 |
| 22 | Moskva (Moscow), Russian Federation | 12 260 | Tianjin, China | 14 655 |
| 23 | Kinshasa, Democratic Republic of the Congo | 12 071 | Rio de Janeiro, Brazil | 14 174 |
| 24 | Tianjin, China | 11 558 | Chennai (Madras), India | 13 921 |
| 25 | Paris, France | 10 925 | Jakarta, Indonesia | 13 812 |
| 26 | Shenzhen, China | 10 828 | Los Angeles-Long Beach-Santa Ana, USA | 13 257 |
| 27 | Jakarta, Indonesia | 10 483 | Lahore, Pakistan | 13 033 |
| 28 | Bangalore, India | 10 456 | Hyderabad, India | 12 774 |
| 29 | London, United Kingdom | 10 434 | Shenzhen, China | 12 673 |
| 30 | Chennai (Madras), India | 10 163 | Lima, Peru | 12 221 |

# A central concern: Mobility in (smart) cities

- A urban century
  - 54% of world population => 60% (2030)
  - 77% in Europe
  - A metropolis one
  - Cities: an important stakeholder (/Nation state)
- Mobility : A crucial issue


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# A central concern: Mobility in (smart) cities

- A urban century
- Mobility : A crucial issue
  - In an Anthropocene era
  - >70% of the world's greenhouse gas (GHG) emissions in Cities (UN-HABITAT, 2011)
  - Transportation  = 23% of total global energy-related GHG emissions (2010, IPCC 2014)

# Mobility issues today

- A context of private car ownership
  - One of the most underutilized asset (4%)
- Polluting sources of various emissions
- Raised urban congestion issues / “Traffic jam”
- Noise pollution
- Killed or injured drivers, passengers and pedestrians

$\Rightarrow$ Actual business model is clear: Mainly Private with no internalisation of main negatives externalities

# 3 innovations can provide solutions

- Electric car (whatever the kind)
  - Noise reduction
  - Local emission reduction
  - Global emission reduction if Electricity comes from renewable energy systems (RES)
- Shared Economy / Mobility as a Service (MaaS)
  - Reduction of urban congestion (4-15 cars for 1 shared)
  - Higher Utilization of asset
  - Cost reduction per Km
- Autonomous cars
  - Running all the time (- refulling time)
  - Less accidents (human error=90% of accidents)
  - but unclear liability rule in case of problem

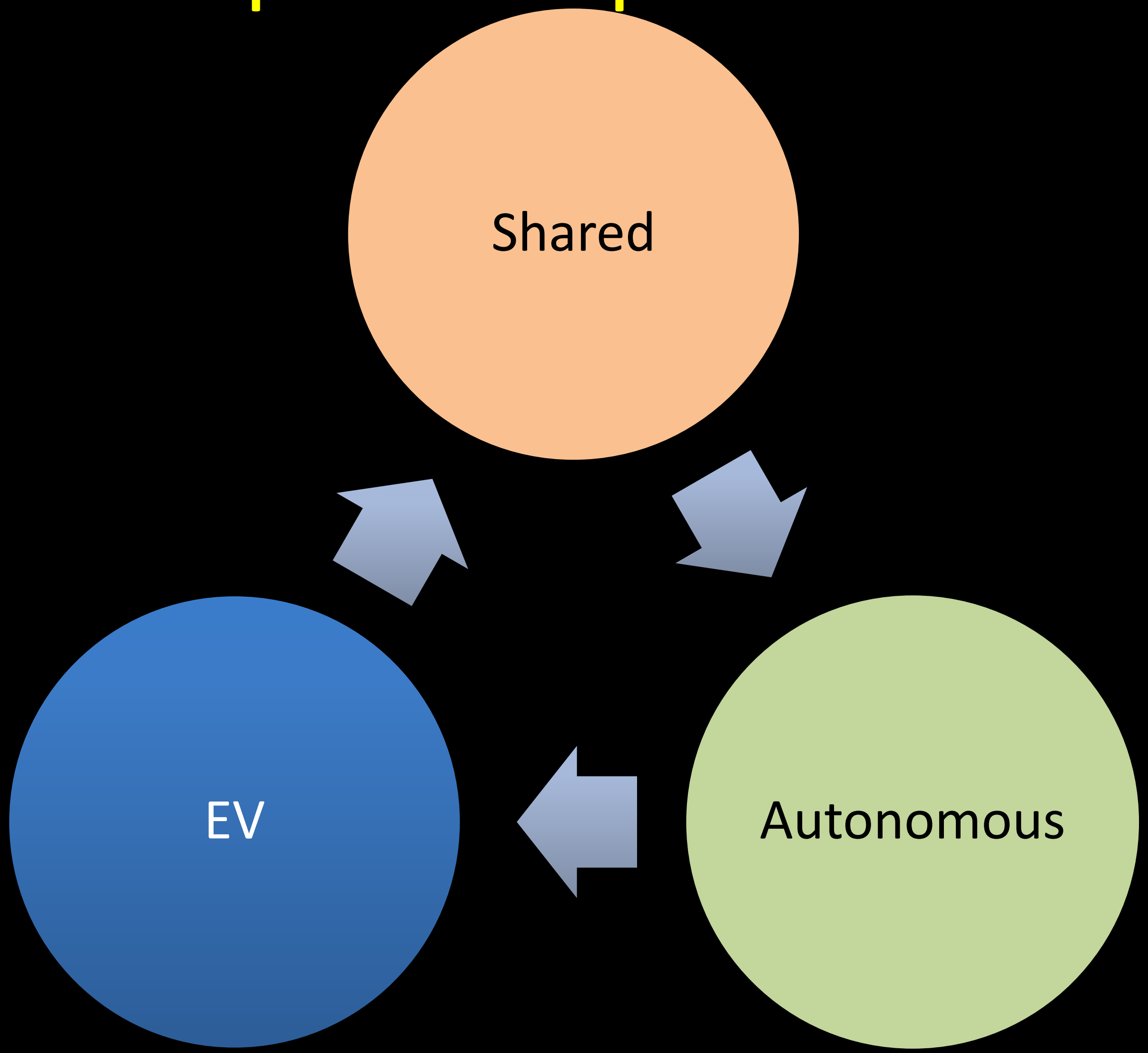
From Privatly owned Internal Combustion Engine

POICE

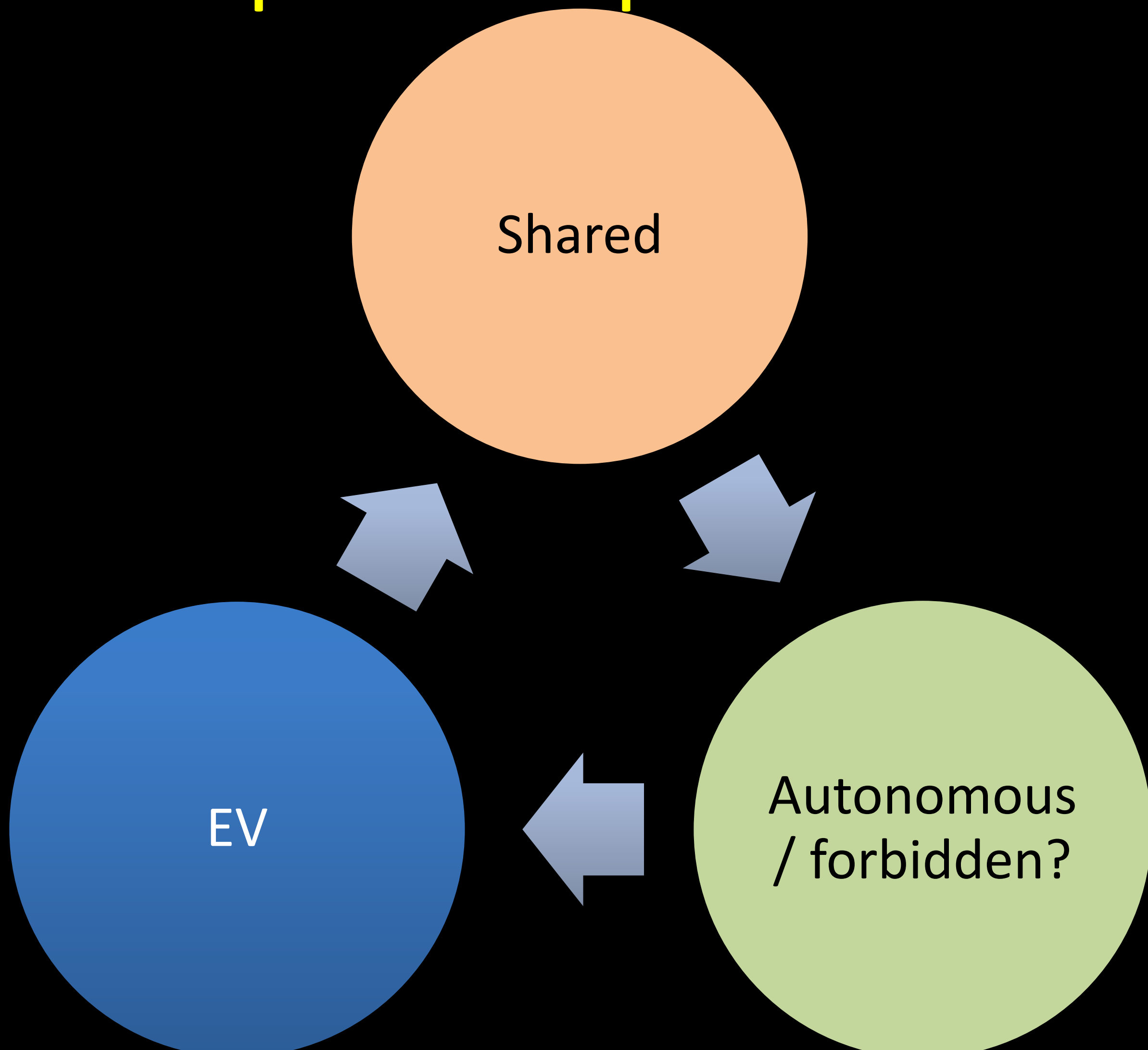
Shared Autonomous Electric Vehicle

SA-EV

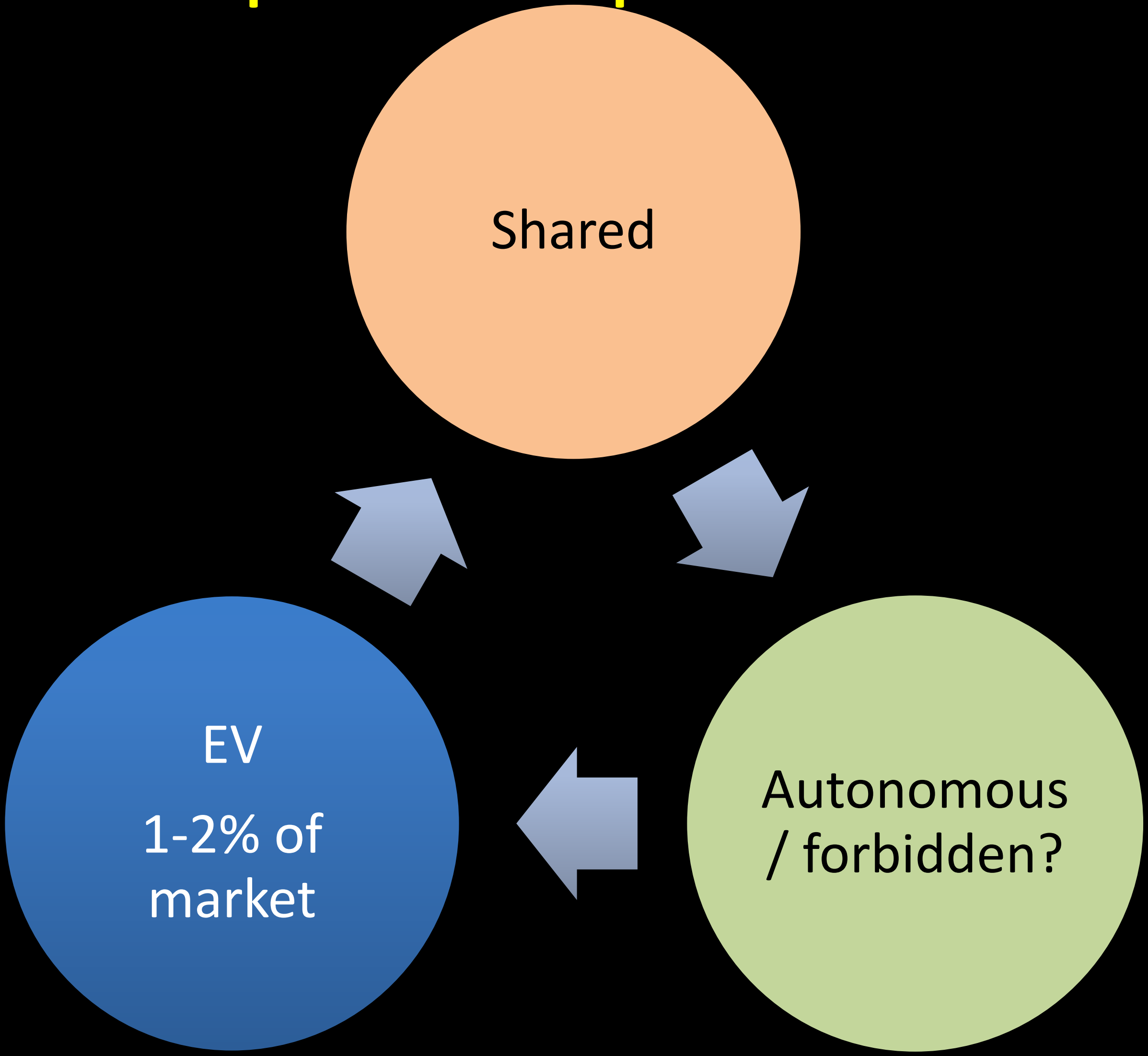
# Potential new ecosystem: will it be so simple to implement?



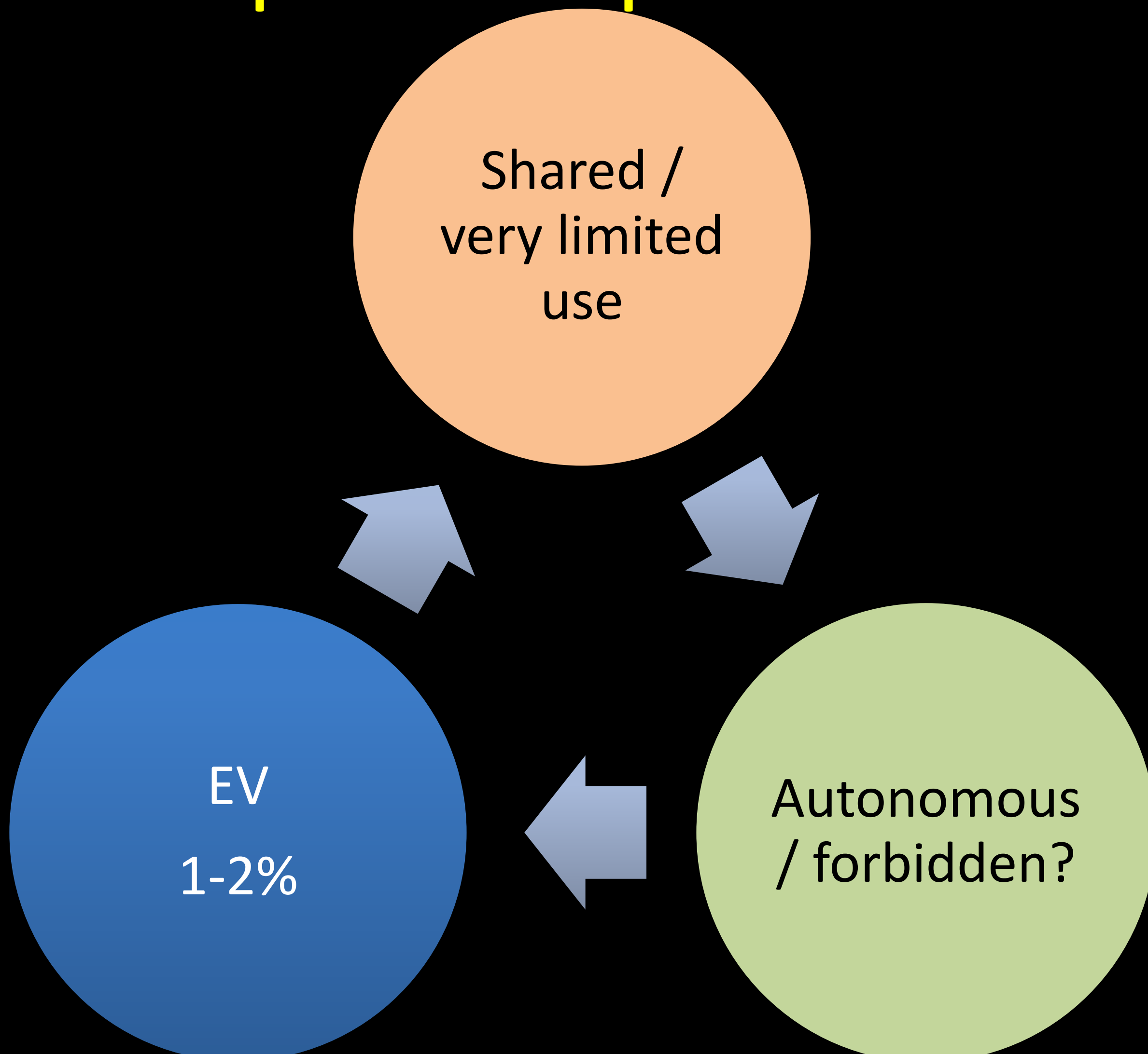
# Potential new ecosystem: will it be so simple to implement?



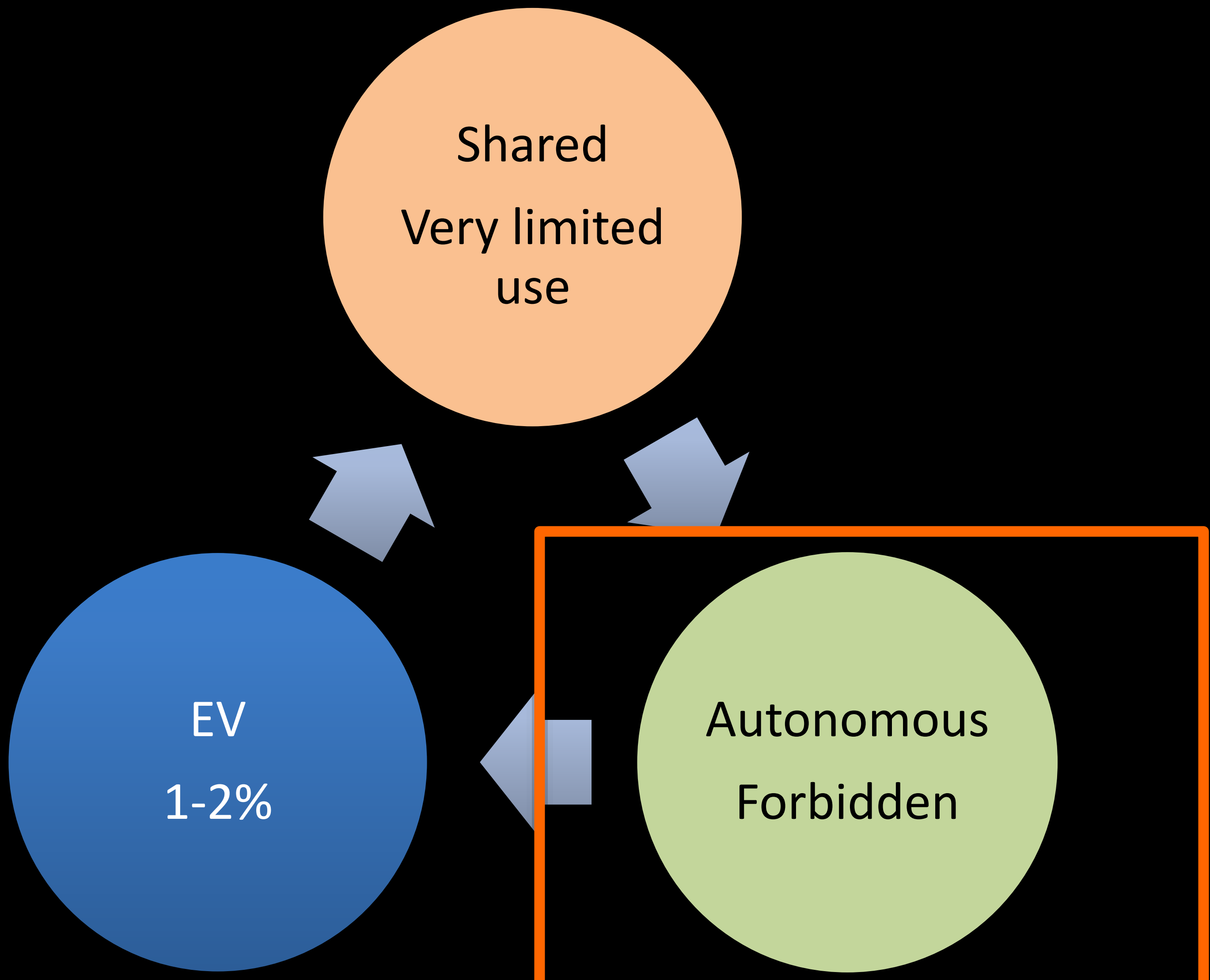
# Potential new ecosystem: will it be so simple to implement?



# Potential new ecosystem: will it be so simple to implement?



# Today SA-EV main challenges



# Autonomous cars are expensive R&D projects

# Buisson (2018)

- 119 experiments complete, ongoing or announced between 2011 and 2021
- 81 % of shuttle and 15% of cars
- Type of place : city-center: 26 %, campus : 12 %
- Iniated by public entities : 34%, by computer company : 13% and by public transport operator :  13 %
- Experimental services provided : internal service : 29 %, regular line : 24 %, last mile : 17% and taxis : 10 %

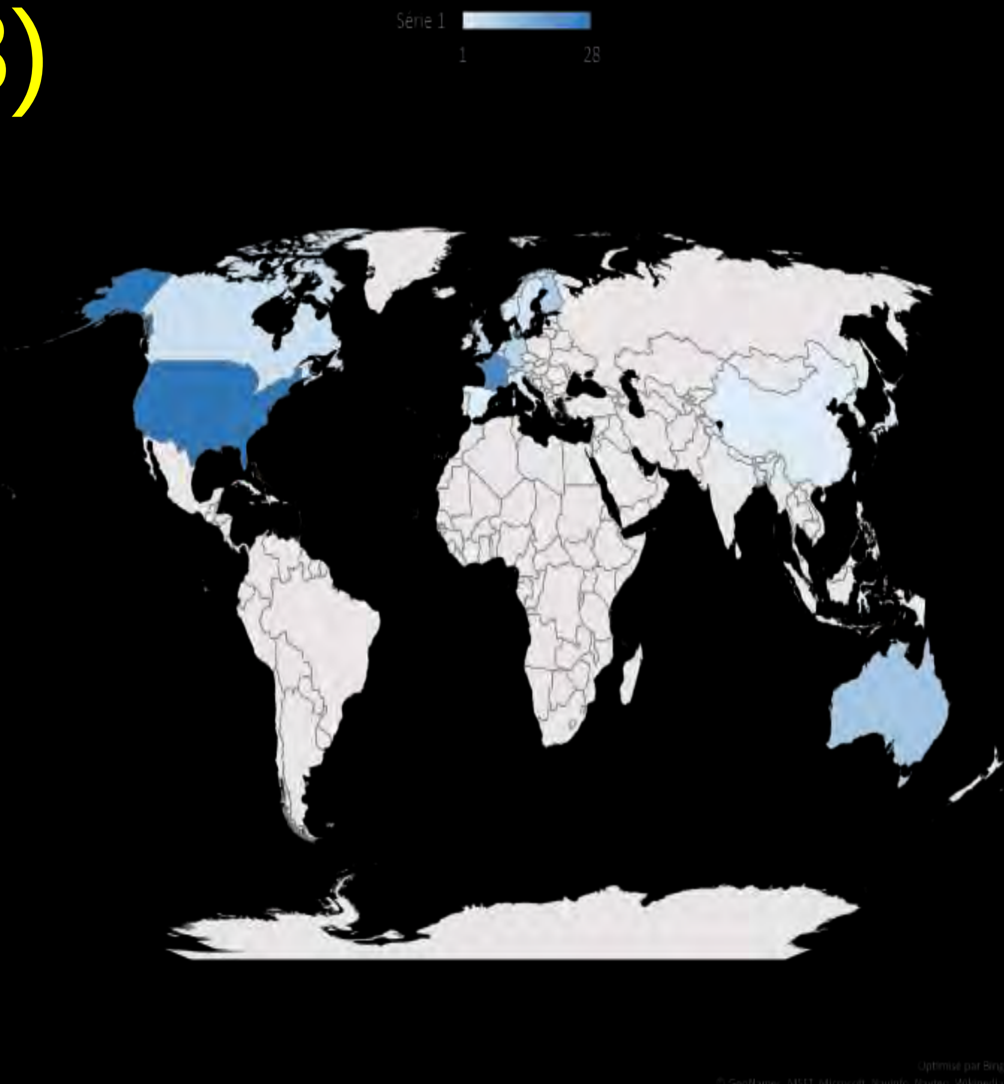
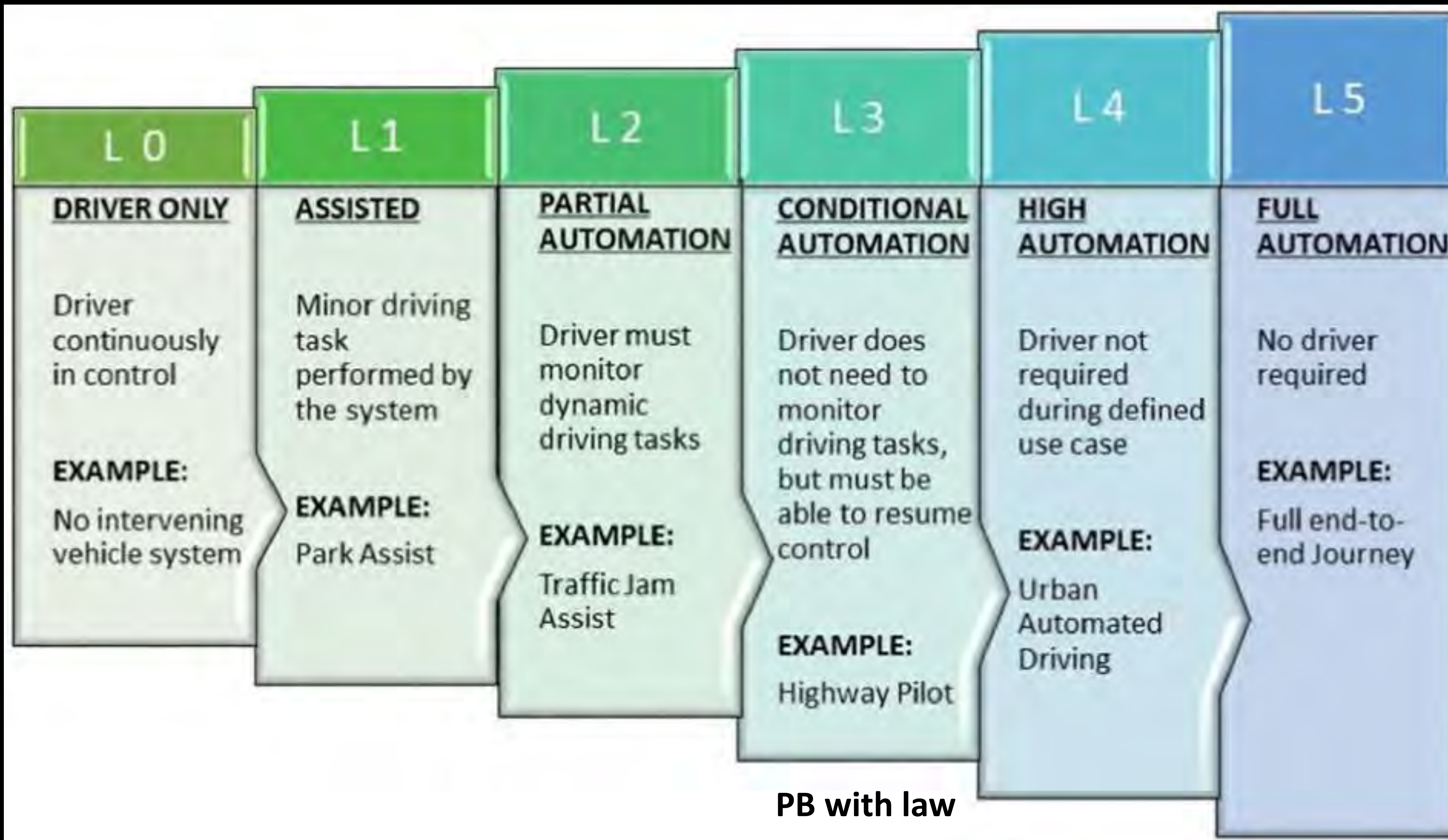



**Image 3 :** Number of experiments at country level (September 2018)

# Autonomous cars are R&D projects



# No level 5 cars / taxi/ bus do exist

Experiments regarding level 4

A lot of issues to go to level 5

Data management

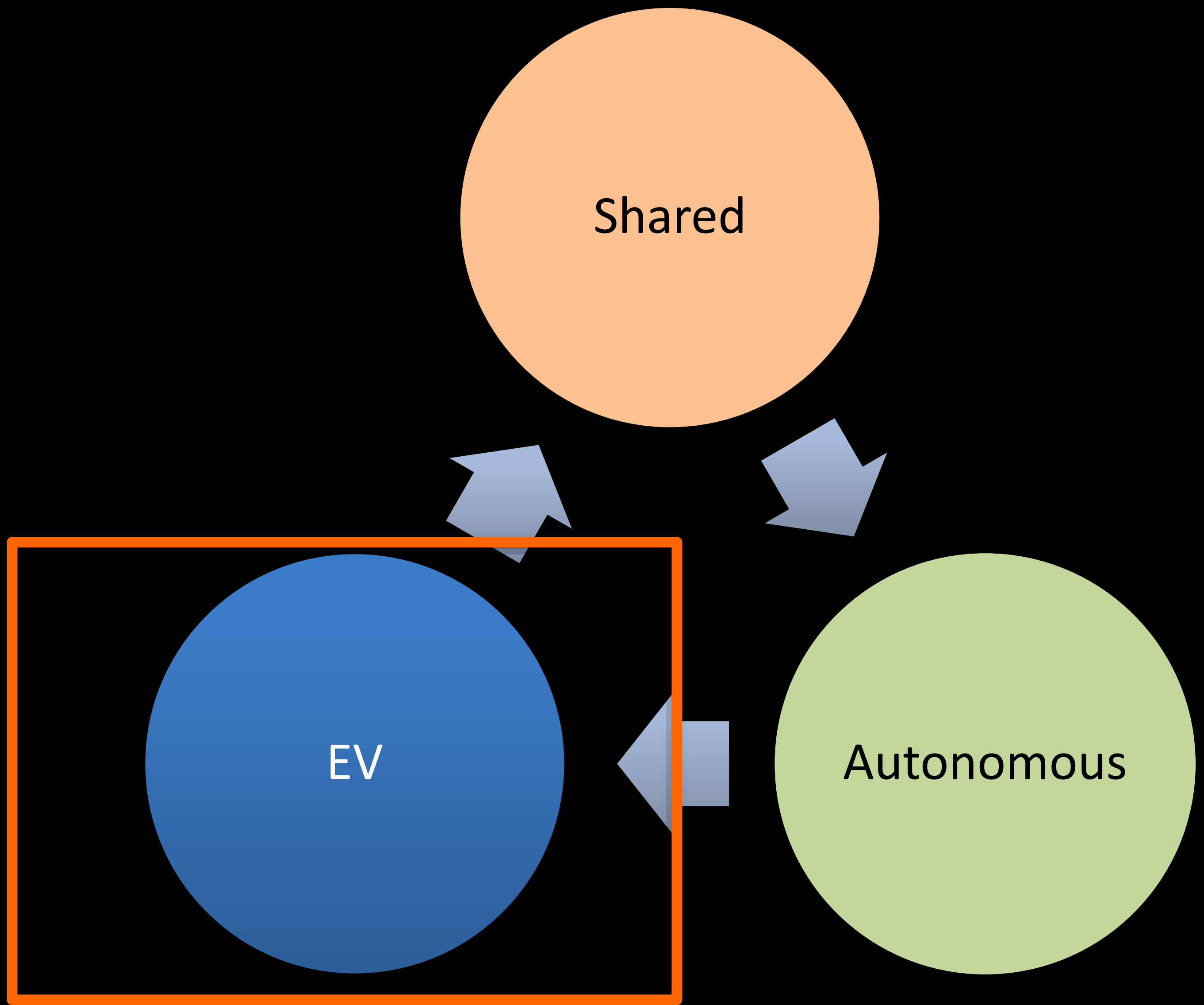
Algorithms architectures

Certification process…

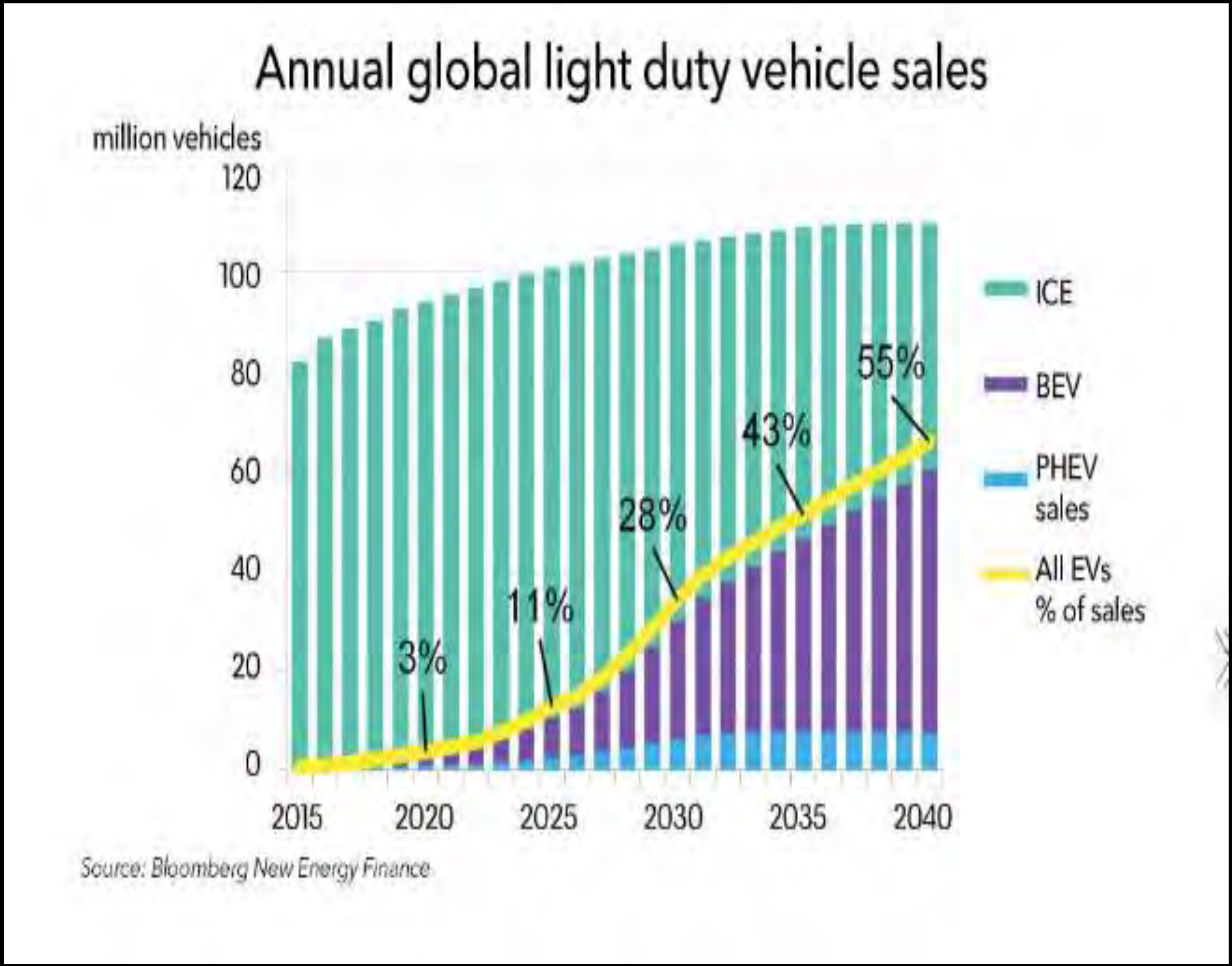
# Some unsolved Puzzles for Autonomous Cars…


Algorithms challenges !

# SA-EV ecosystem to build



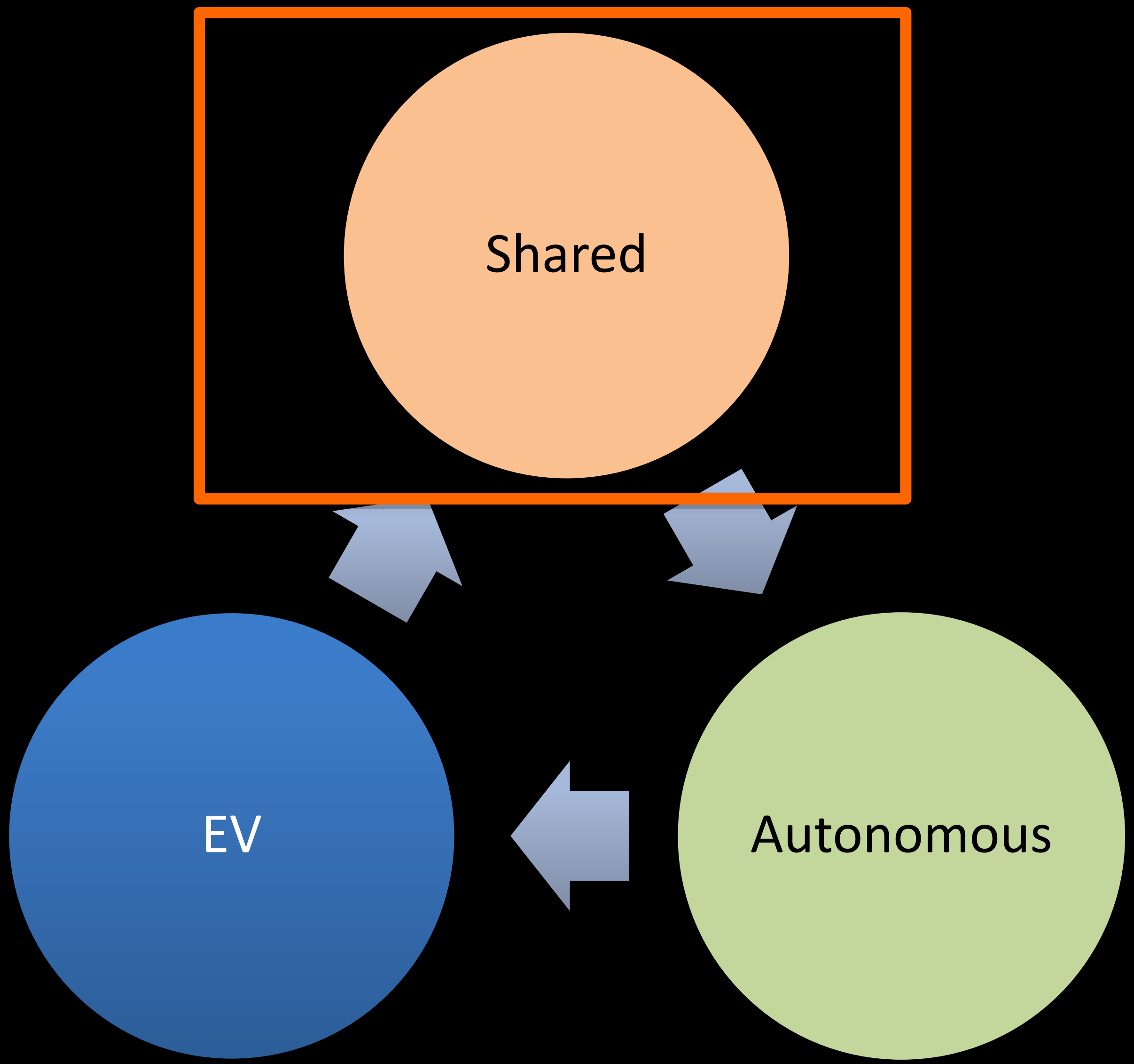
# EVs seem to start a S shape curve



# But

- EVs are still mainly privatly owned
- No garanty on the charging issue
  - Consumption peaks
  - Green, blue  or black electron?
- VtoX markets are not existing yet
- …

# SA-EV ecosystem to build



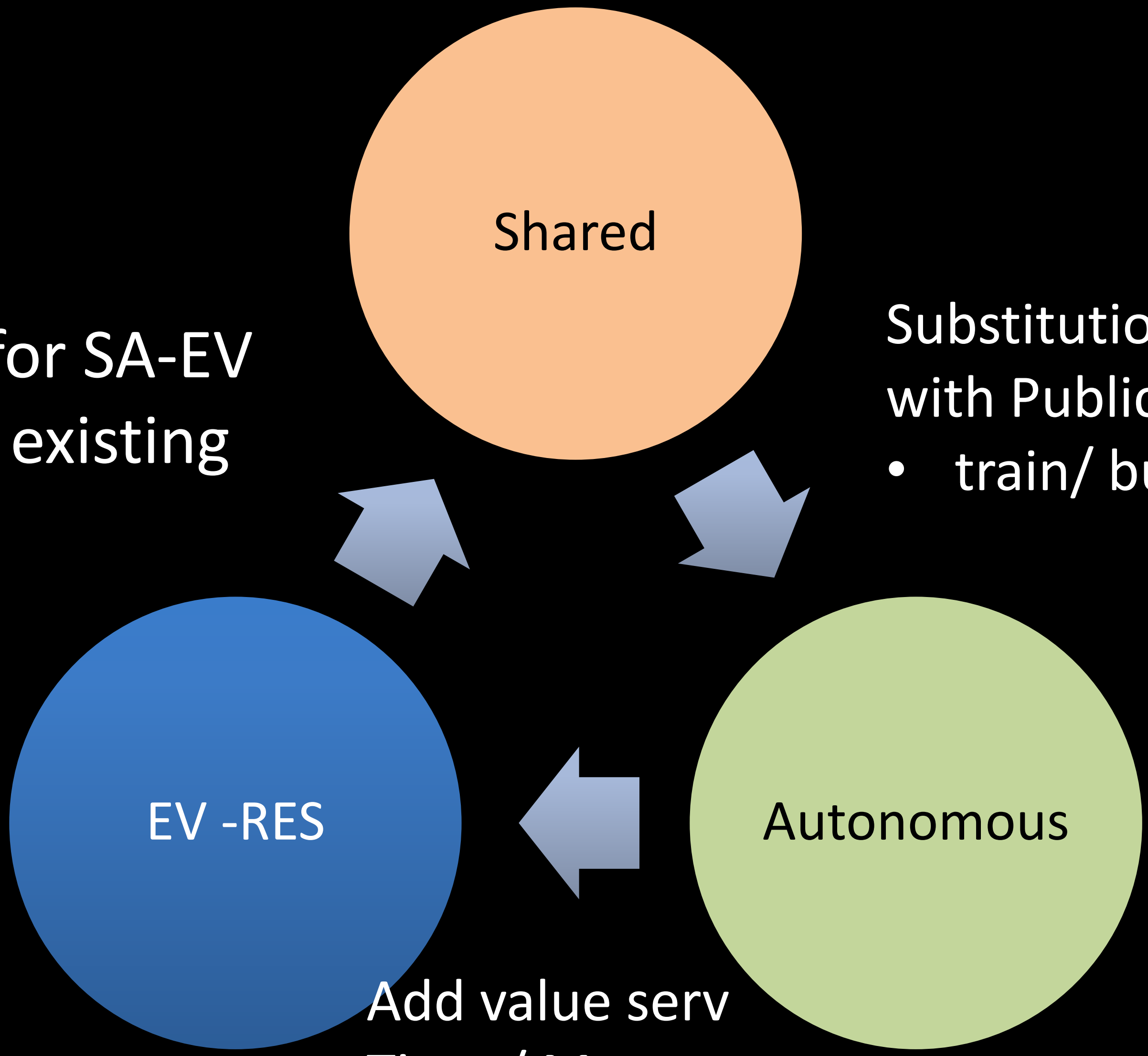
# Carsharing plateforms exist

- Use of “Uber Pool” is less than 15% of the Trips sales
- Blablacar :
  - 6 billions Passengers/KM in 2015 in France.
  - Makes money since september 2018

- But no Evs and no VtoX or RES dimensions in their app
- Autonomous data management
- How to combine it with public transport? With other transportation modes (Bikes, scooter…)

# Some gaps and who will benefit from?

Plateforms for SA-EV
Are  yet not existing




Substitution effect
with Public services

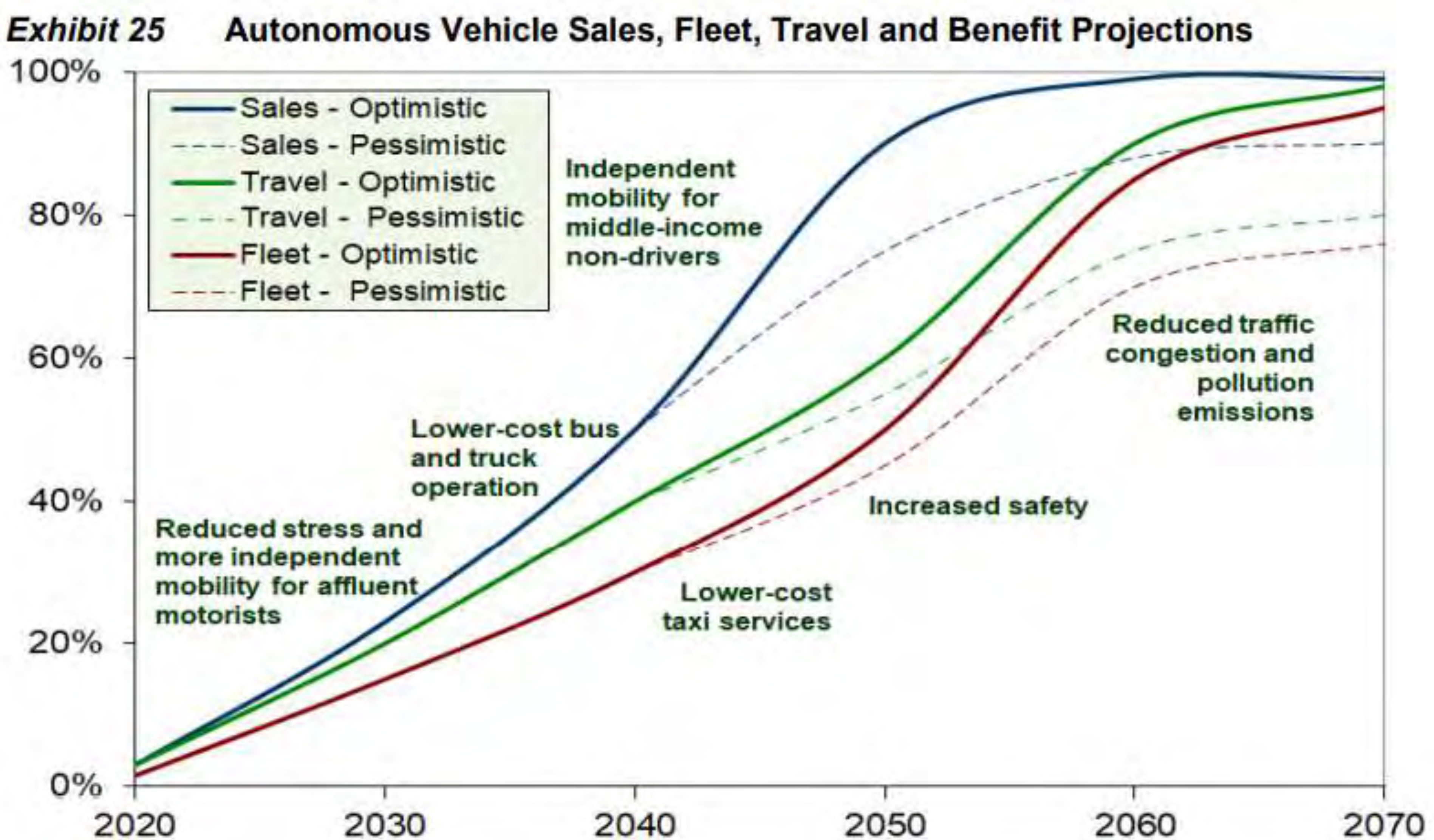
- train/ buses

Add value serv
Time / Money…

# Conclusions

# An ideal?

# Which trajectory? (Litman, 2019)



# Some actions taken so far

**Public policy driven changes**

- CO2 regulation => EV
- Subsidies for EV purchase
- Congestion tolls=> shared
- Park tolls => shared
- Consistency isssues
  - Autonomous cars are illegal
  - Shared mobility/Public service provision
  - Specific lanes

**Business driven changes**

- OEMs push for Autonomous cars technologies and R&D
  - AI
  - Cameras / algo/
  - Rules and algorythms
- Plateforms
  - Carsharing (Blablacar / Uber)
  - Car = one element of MaaS

# A lot of services / business models to explore

- Which stakeholders/actors
  - Cities?
  - OEMs / new players
  - Fleet management?
  - Platforms?
- Exploring synergies
  - Free time in the car for what? Eating ? Sleeping ? Meetings ?

# Diverse BM

| **Vehicle ownership** | (1) Business (B2C) | **(2) Individuals (P2P)** | **Hybrid Business / Individuals** |
|---|---|---|---|
| Network operations (who controls the network operations ) | (a) Same entity owns and operates (Private or public)<br>(b) Different entity owns than operates | (a) Third-party entity operates<br>(b) Decentralized peer-to-peer operations | (a) Same entity that owns (some) vehicles operates<br>(b) Third-party entity operates |

THANKS A LOT!

Electric vehicles, cornerstone of smart cities

*Some issues regarding Autonomous Vehicles and business models*

Chabaud.iae@univ-paris1.fr
Yannick.perez@centralesupelec.fr

15-17 ***International feedbacks of local governance for EVs and Renewable deployment***

- *Chair:* **Gurkan Kumbaroglu**, *President of the Turkish association for electromobility*

## 2. Are energy regulators going to adapt the rules?

- **Didier Laffaille** *(Commission de Régulation de l'Energie)*

Comité
de prospective
de la CRE

ÉCLAIRER
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# Conférence internationale EVER Monaco

Mercredi 8 mai 2019

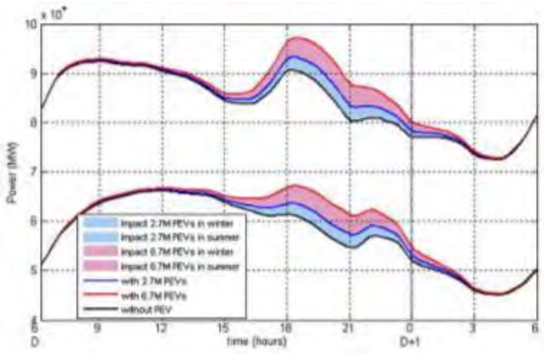
## Les recommandations de la CRE pour accompagner le développement du véhicule électrique

***Didier LAFFAILLE***
***Conseiller du Président***
***Secrétaire général du Comité de prospective***

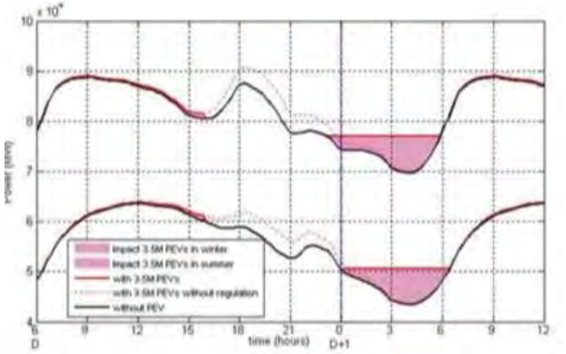
# Les enjeux de la recharge du véhicule électrique

- Quel que soit le rythme de développement futur de la mobilité électrique, les quantités d’énergie mises en jeu resteront limitées en volume à moyen terme.
- Cependant, les raccordements aux réseaux des infrastructures de recharge publiques et privées pourraient générer des besoins de **renforcement de réseaux** et d’augmentation des puissances souscrites (d’où la nécessité de piloter la recharge).
- La recharge du véhicule électrique pourrait avoir des **impacts conséquents sur le système électrique**.

Exemple de courbe de consommation (en 2025)



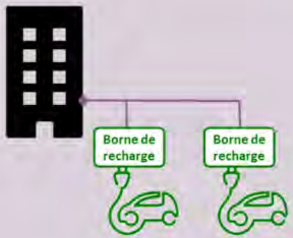
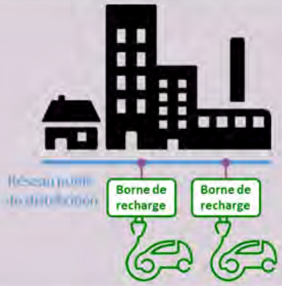

Courbe de consommation intégrant « *idéalement* » la charge des VE





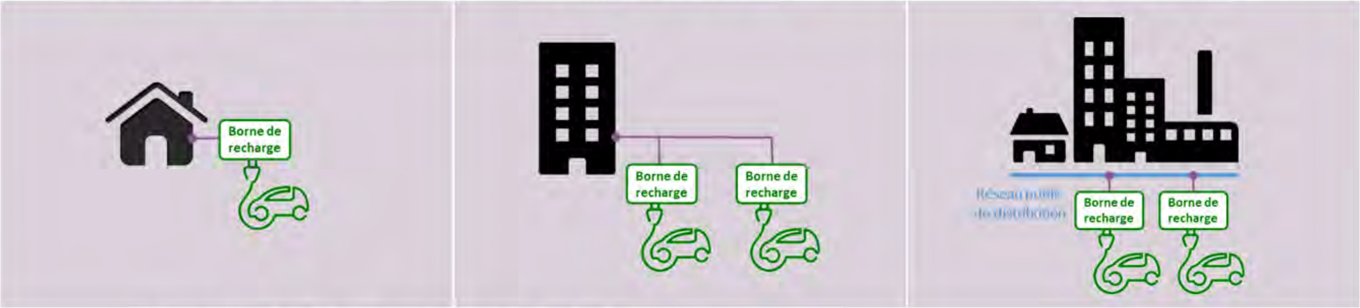

*Source :* courbes RTE

# Les principaux cas d'usage étudiés par la CRE (1/2)

| Raccordement du VE dans une « *résidence individuelle* » | Raccordement du VE dans un « *immeuble collectif* » | Raccordement du VE dans l'« *espace public* » |
| --- | --- | --- |
|   |   |   |
| • Alimentation de secours (V2L)<br>• Optimisation de la demande (V2H)<br>• Autoconsommation individuelle (V2H)<br>• Fournisseur spécifique pour la recharge du VE<br>• Prestation de décompte<br>• Pilotage aval compteur | • Droit à la prise<br>• Schémas de raccordement interne au bâtiment<br>• Regroupement PdL en BT<br>• Autoconsommation collective (V2B)<br>• Stockage<br>• Flexibilité (V2G) | • Itinérance de la recharge<br>• Déploiement des IRVE et conditions de financement<br>• Déploiement des stations de GNV<br>• Utilisation du réseau d'EP<br>• Impact sur le profilage de l'EP<br>• Services système et Flexibilité (V2G)<br>• Réserve de capacité |

# Les principaux cas d’usage étudiés par la CRE (2/2)

| Raccordement du VE dans une « *résidence individuelle* » | Raccordement du VE dans un « *immeuble collectif* » | Raccordement du VE dans l’« *espace public* » |
|---|---|---|




- Coûts de raccordement des IRVE
- Pilotage de la recharge (*Smart charging*) (V1G)
- Qualification juridique de l’activité de recharge des VE
- Certification du comptage embarqué dans le véhicule (MID)
- Interfaces dynamiques de présentation des capacités d’accueil des IRVE
- Recharge à partir de la production d’EnR
- Impact sur le réseau de la croissance du VE
- *Open data* ICA

# Les principales recommandations de la CRE

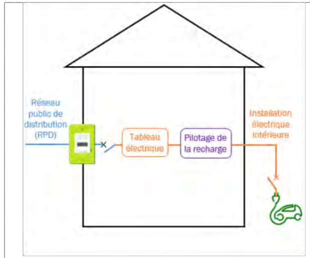

- **Faciliter et anticiper les opérations de raccordement des infrastructures de recharge**, pour mettre en œuvre différents schémas de raccordement et encourager les expérimentations visant à raccourcir les délais et les coûts de ces raccordement.

- **Simplifier l'acte de la recharge**, à savoir la clarification du statut juridique de la recharge.

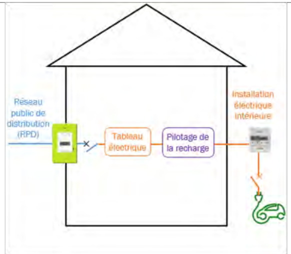
- **Inciter les différents acteurs à adopter les bons comportements**, permettant aux réseaux d'absorber facilement l'appel de puissance due à la recharge des véhicules électriques, limitant les investissements inutilement coûteux pour la collectivité.

# De nombreux schémas de raccordement ont été identifiés (1/2)

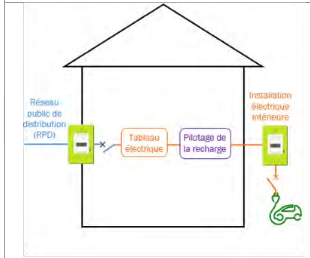
- Les principaux schémas de raccordement dans l'**habitat individuel**, dans les **immeubles collectifs**, conformes à la directive 2014/94/UE et au code de la construction et de l'habitation, sur les **réseaux d'éclairages publics**, *etc*. identifiés par la CRE.



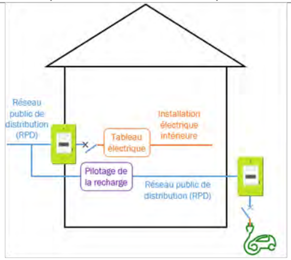
1. Raccordement de la borne de recharge à l'installation électrique intérieure du logement.



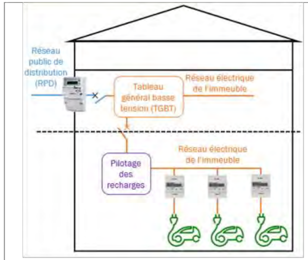
2. Raccordement de la borne de recharge à l'installation électrique intérieure du logement et mise en place d'un point de mesure au niveau de la prise.



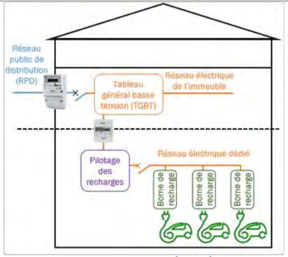
3. Raccordement de la borne de recharge à l'installation électrique intérieure du logement et mise en place d'un dispositif de décompte. Le comptage associé à ce décompte est nécessairement assuré par le gestionnaire de réseaux de distribution.



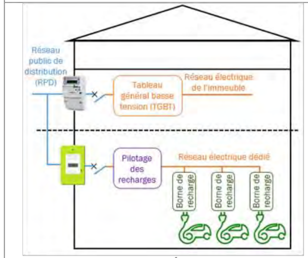
4. Raccordement de la borne de recharge au réseau public de distribution avec un point de livraison distinct.



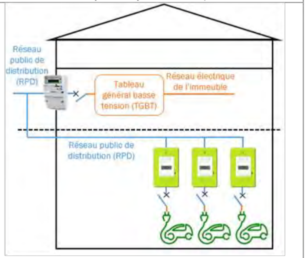
1. Raccordement de l'IRVE au réseau électrique de l'immeuble et mise en place d'un système de mesure privé permettant une facturation individuelle des recharges.



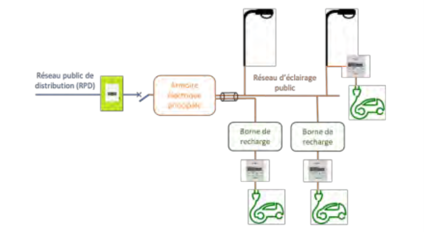
2. Raccordement de l'IRVE au réseau électrique de l'immeuble et mise en place d'un système de mesure privé commun à toutes les bornes (la facturation des recharges est faite ensuite selon des clés de répartition par le syndic ou par un opérateur tiers).

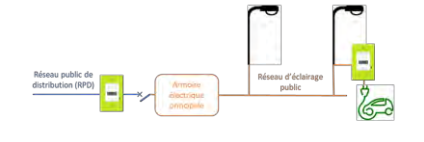


3. Raccordement de l'IRVE au réseau public de distribution et création d'un point de livraison commun à toutes les bornes.



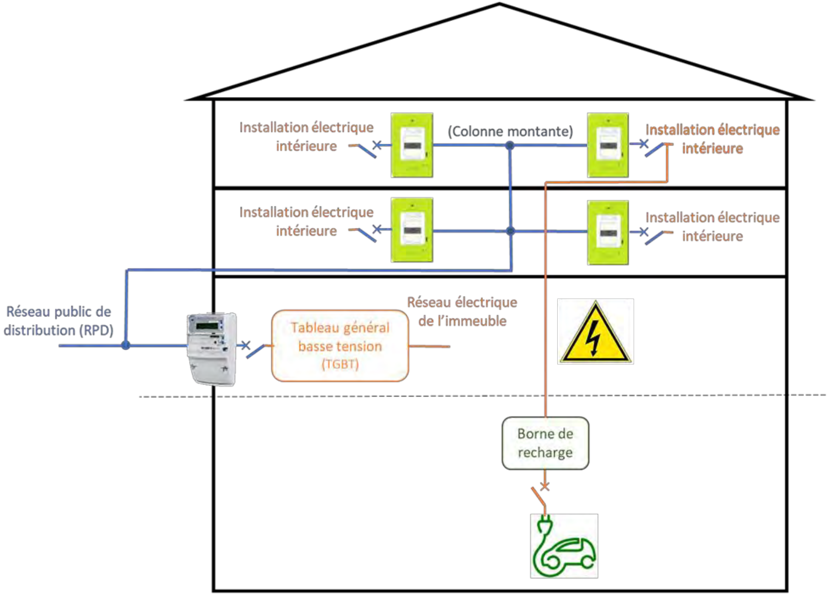
4. Raccordement individuel de chaque borne de recharge au réseau public de distribution.



# De nombreux schémas de raccordement ont été identifiés (2/2)

- Le raccordement de la borne de recharge **en aval du point de livraison individuel du logement** ne doit pas être autorisé, pour éviter une rupture de l'étanchéité électrique avec les parties communes du bâtiment.




# Le statut de l’activité de recharge

- Il est plus que jamais indispensable que le **statut juridique de la recharge** soit clarifié afin d’apporter la visibilité nécessaire au développement du marché. La CRE renouvelle sa recommandation au législateur d’une qualification juridique de contrat de prestation de service.

**Chapitre II - Développer des infrastructures pour le déploiement des véhicules propres**

**Article 23**

I. - Le code de l'énergie est ainsi modifié :

1° Le chapitre IV du titre III du livre III est complété par une section 3 ainsi rédigée :

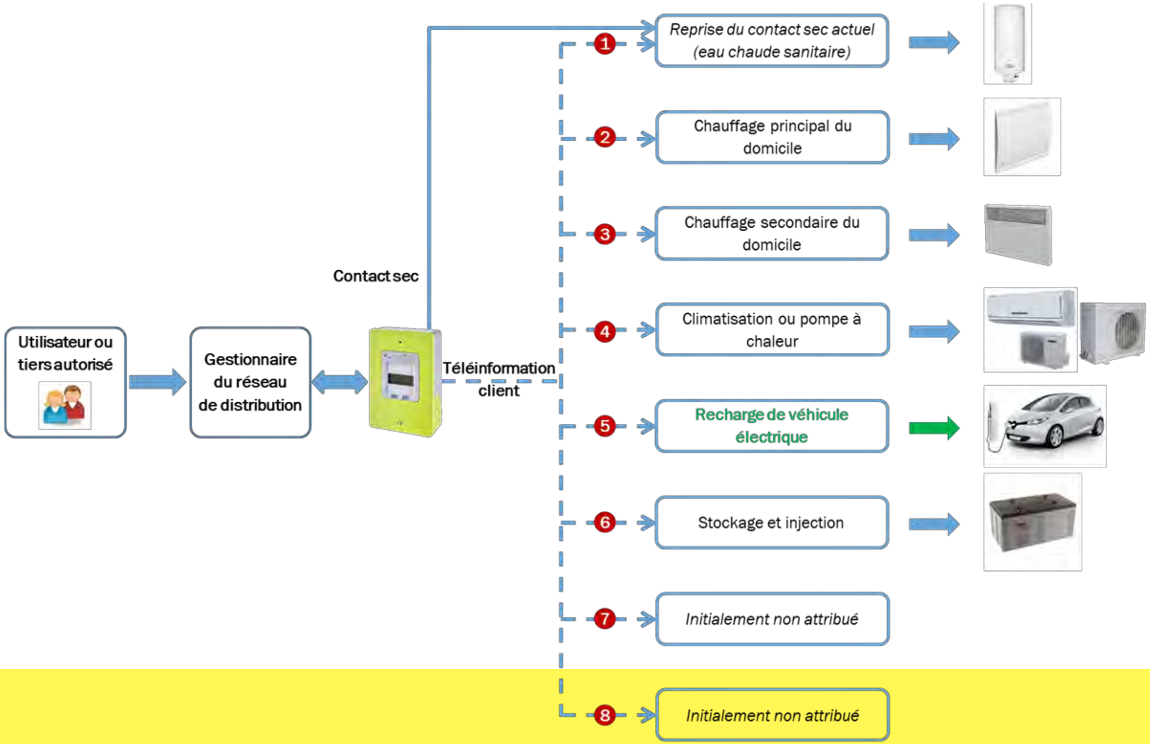
*« Section 3*

*« Les opérateurs de recharge de véhicules électriques ou hybrides*

« *Art. L. 334-4.* - Les opérateurs de recharge de véhicules électriques ou hybrides, qui s'approvisionnent en totalité, pour les besoins de leur activité, auprès d'un fournisseur de leur choix titulaire de l'autorisation prévue à l'article L. 333-1, n'exercent pas une activité d'achat d'électricité pour revente aux consommateurs finals au sens de cet article, mais une activité de prestation de service » ;

# Le pilotage de la recharge et la flexibilité

- La recommandation de la CRE d'association des **contacts secs et virtuels** du compteur évolué de type *Linky* à des usages types, dont la recharge du VE.



# La bidirectionnalité des flux d'énergie : *vehicle-to-anything* (V2X)

- Le niveau des **différents services** sera fonction de l'intégration du véhicule électrique dans l'infrastructure du réseau. La complexité et le potentiel sont aujourd'hui en cours d'intégration.

**→ *Vehicle-to-load* (V2L)**
Système d'alimentation de secours


**→ *Vehicle-to-home* (V2H)**
Optimisation de la demande, Autoconsommation individuelle, *Smart charging*


**→ *Vehicle-to-building* (V2B)**
Autoconsommation collective

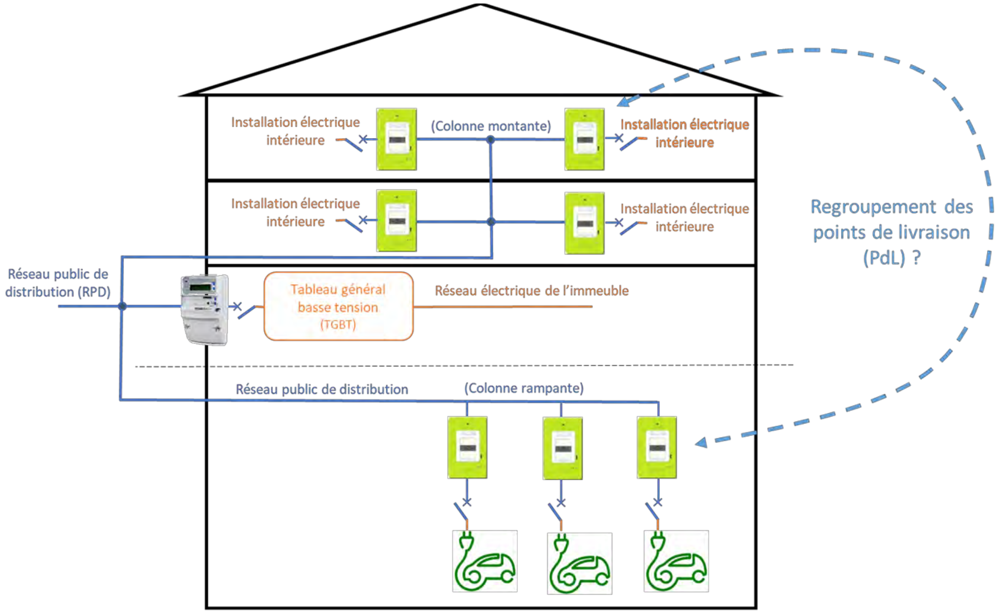

**→ *Vehicle-to-grid* (V2G)**
Services système, flexibilité, réserve de capacité



*Source :* schémas AVERE France

# Les expérimentations

- La CRE recommande de mener des **expérimentations**, sur le V1G, le V2X, le regroupement des points de livraison, *etc*.



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# Merci de votre attention

www.cre.fr
www.smartgrids-cre.fr
www.eclairerlavenir.fr

YouTube

15-17 ***International feedbacks of local governance for EVs and Renewable deployment***

- *Chair:* **Gurkan Kumbaroglu**, *President of the Turkish association for electromobility*

# 3. Positive energy territories and electric vehicles

- **Cécile Goubet** *(AVERE)*

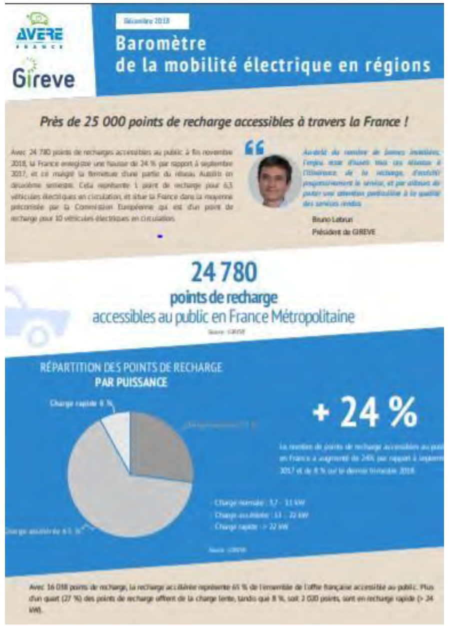
IAEE – Interactions VE &ENR au niveau local
Retour d'expérience

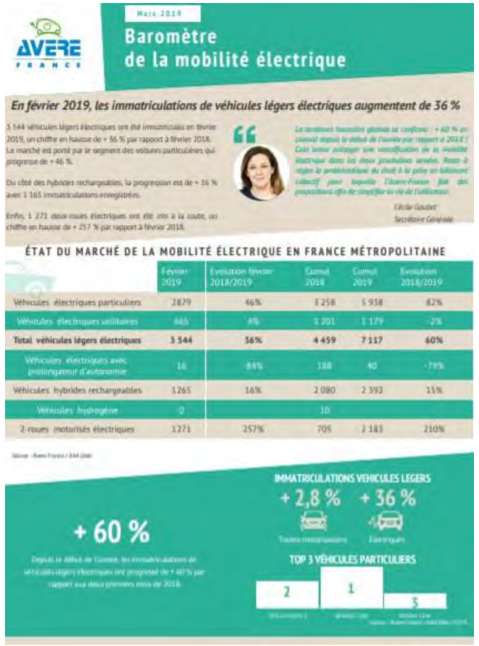
# A propos de l'AVERE France

- Tiers de confiance sur la mobilité électrique
- Association fondée en 1978
- Promotion de la mobilité électrique
  - Fédération de l'écosystème
  - Lobbying / analyse / expertise
  - Financement : gestion du programme ADVENIR
  - Lien et actions avec les territoires (via les associations régionales) et l'Europe (via l'Avere Europe)
  - Communication / sensibilisation (sites, publications réseaux sociaux, presse, télé etc.)
  - Organisation d'évènements sur la mobilité électrique (trophées des territoires, petits déjeuners thématiques, EVS32 etc.)


# A propos de l'AVERE France

- **Informations accessibles à tous**
  - Mensuel : immatriculations
  - Trimestriel : régions et IRVE
  - Dossiers : type stop aux idées reçues
- **Portail du véhicule électrique**
  - En partenariat avec le MTES et toute la filière
  - Lancement  à l'été
- **EVS32**





Véhicules électriques
ACCÉLÉRONS LE FUTUR

# Etat des lieux et perspectives

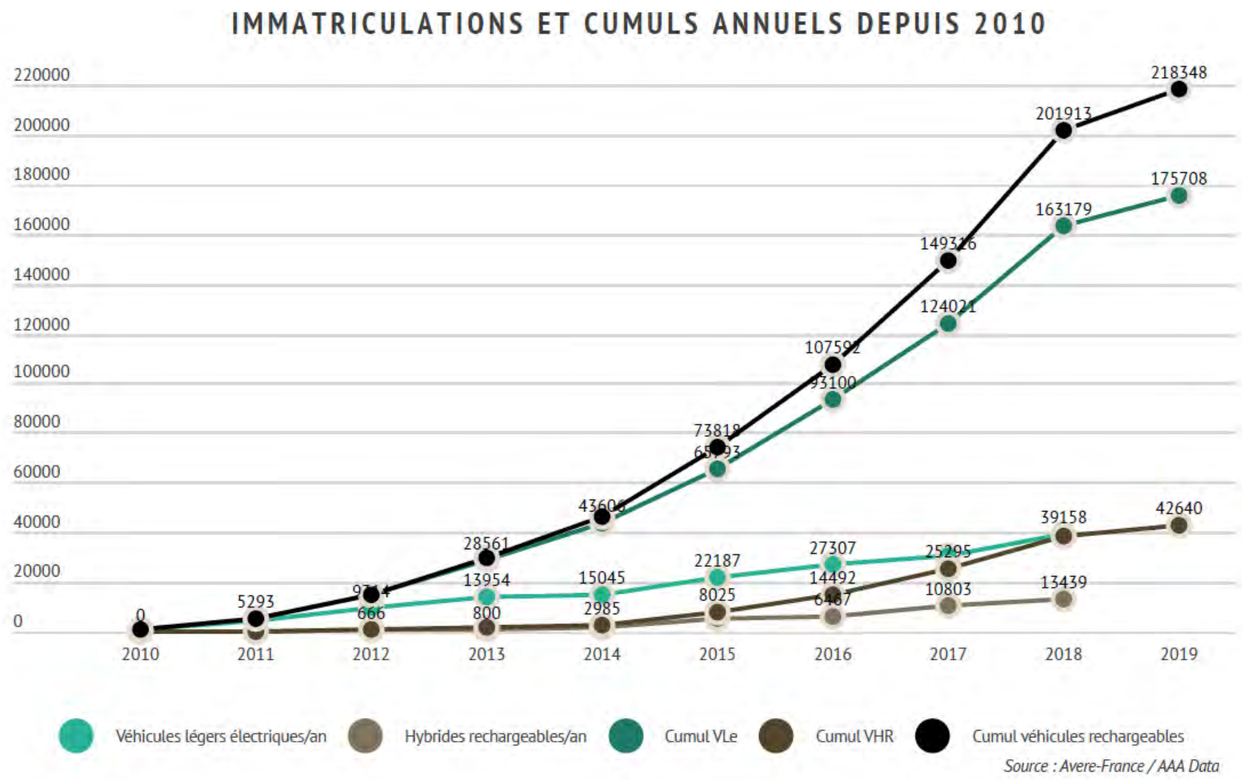
+29 %
IRVE

+35%
VE /
2018

+138%
pour les 2
roues

1 point de
charge
pour 6,9
véhicules

Source : Avere France d'après Gireve etAAA




**175 000** BEV & **de 42 000**PHEV
entre 2010 et 2019 (au 31/03)

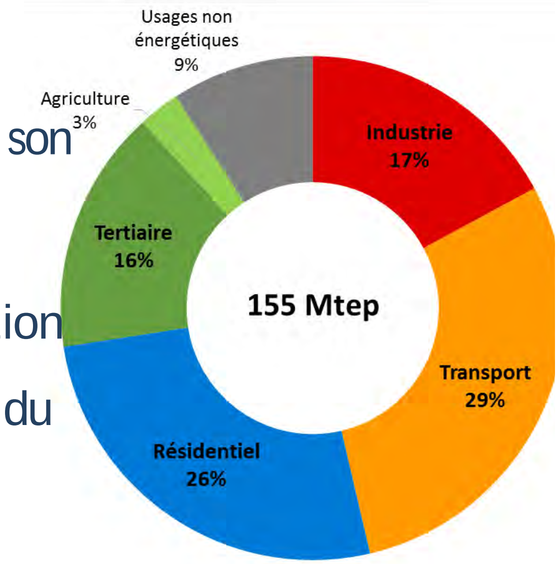
**25 880** points de charge
= 10 000 stations accessibles au
public (au 31/03/2019)

## Un développement massif de la mobilité électrique pour répondre aux enjeux environnementaux posés par les transports routiers

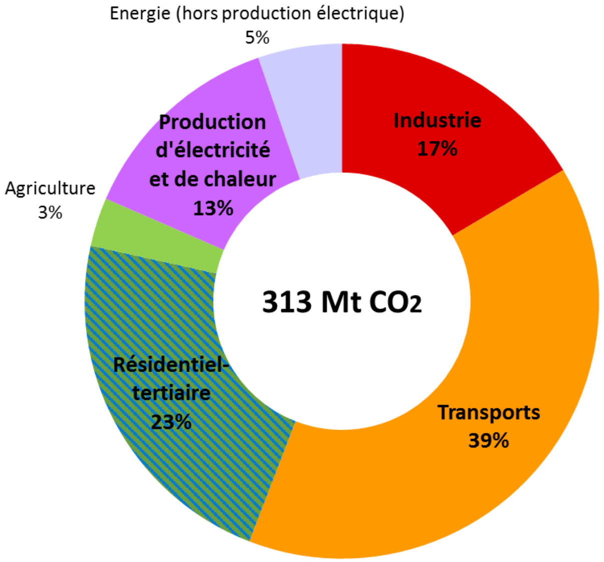
- Le secteur des transport représente une consommation énergétique importante, essentiellement carbonée. Les émissions « directes » **(au pot d'échappement) du transport routier représentent ~120 MtCO2/an, de l'ordre de 40% des émissions liées à la consommation d'énergie en** France

- Pour atteindre ses objectifs de décarbonation (neutralité carbone en 2050, ~ division par 8 des émissions), le transport routier doit évoluer et réduire son empreinte carbone.

- La mobilité électrique constitue la principale solution envisagée pour répondre aux défis environnementaux du transport routier




Consommation énergétique finale française

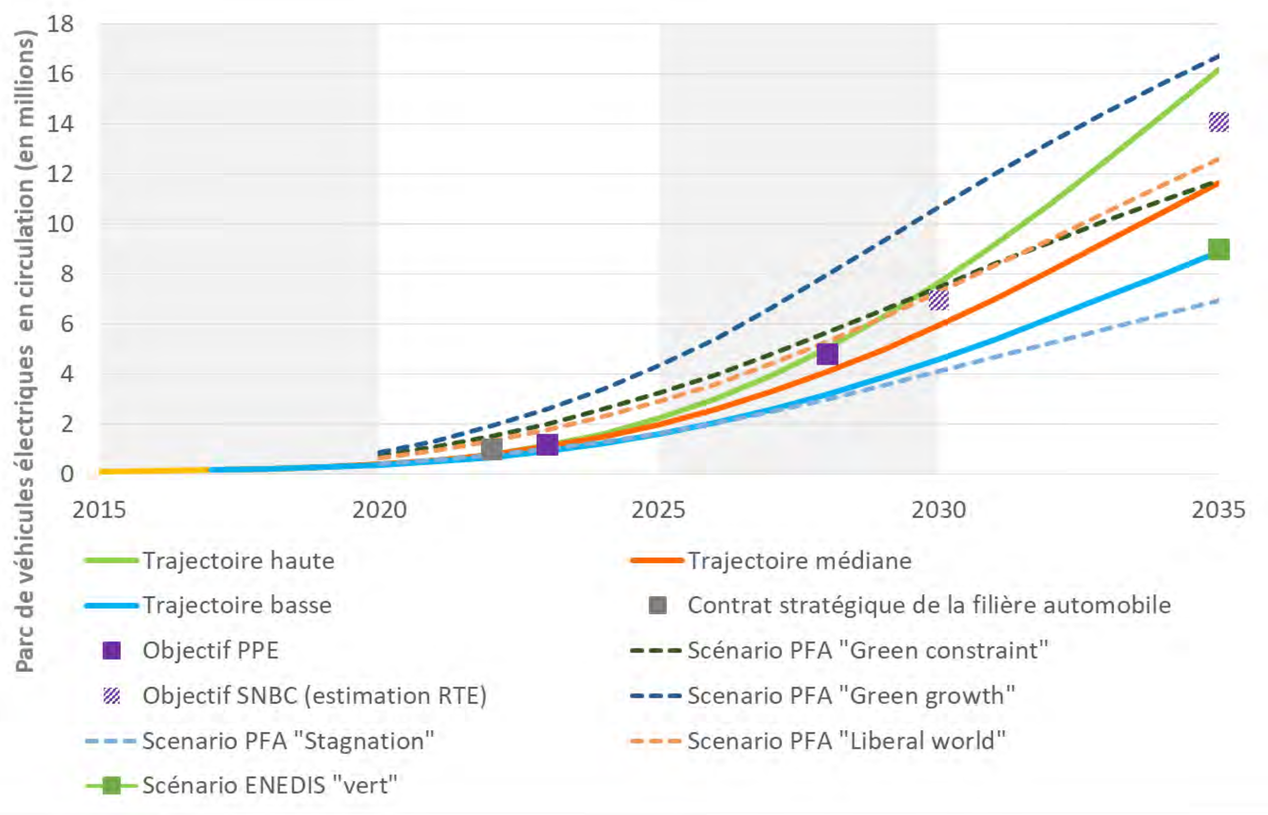



Emissions de CO2 liées à la consommation d'énergie en France

# Des ambitions de développement du VE qui se renforcent

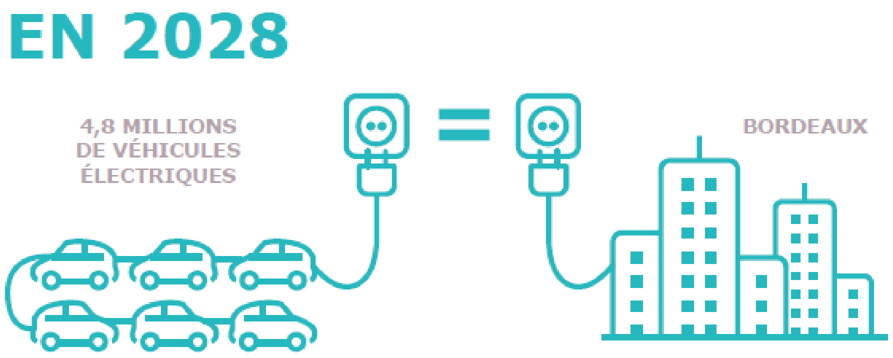
- Les ambitions publiques et projections des constructeurs ont été revues à la hausse ces derniers mois:
  - Le contrat stratégique de la filière automobile prévoit à **l'horizon 2022 de multiplier par 5 les ventes de VEB et un** parc de 1M de VEB + VHR en circulation.
  - Les objectifs de la PPE à 2028-2030 sont revus à la hausse: 4,8 millions en 2028 (vs 4,4 millions en 2030 dans la PPE actuelle)
  - La SNBC repose sur un recours massif au véhicule électrique qui correspond à ~ 14 millions en 2035 (estimation RTE)
  - Les scénarios de constructeurs automobiles ont été revus **à la hausse (entre 7M et 17,7M) à l'horizon2035**

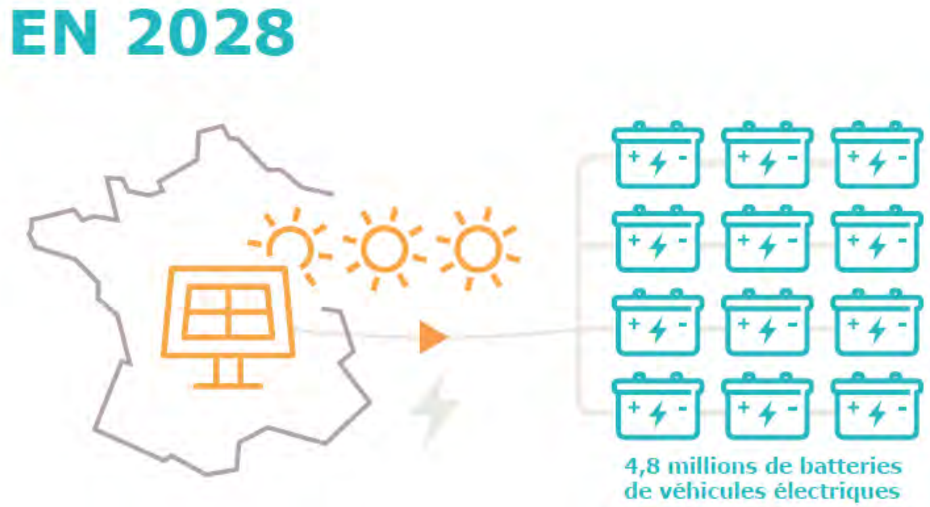
*Trajectoires de développement du VE et comparaison avec des objectifs publics ou sources externes*




Source : RTE

- Horizon 2028 - 4,8 M de VE
  - Equivaut à la consommation électrique d’une ville comme Bordeaux
  - Batteries permettent le stockage de l’equivalent de 3 jours de production photovoltaïque
- Pas de problème d’integration au niveau national avec un pilotage de la recharge
- Bénéfices encore accentués avec du V2G
- Les territoires acteurs de la transition et des interactions entre secteurs



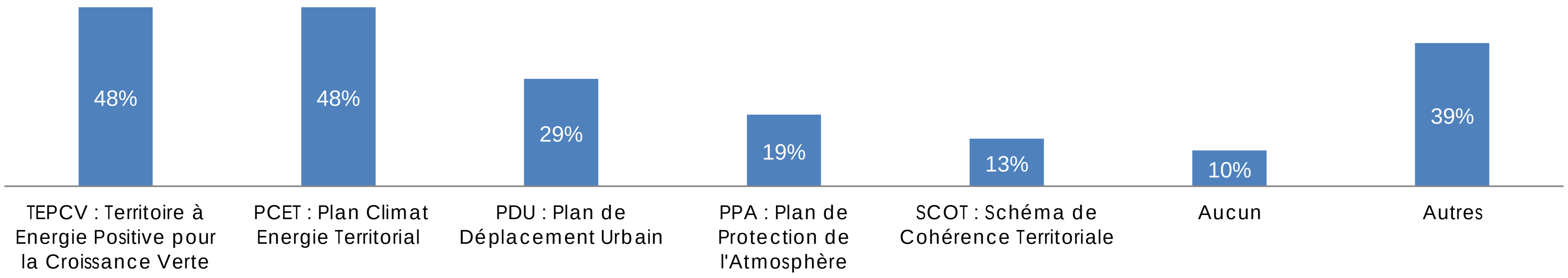




Source : RTE

# Territoires électromobiles - Une réflexion globale sur la mobilité entreprise dans le cadre de dispositifs nationaux

- 48% des répondants déclarent mener une réflexion globale sur la mobilité dans le cadre du dispositif « Territoire à Energie Positive pour la Croissance Verte » ou « Plan Climat Energie Territorial "
- 39% des répondants ont choisi la proposition « Autres ».
  - Ces réponses citaient notamment : « Loi Grenelle 2 », «  Réponse à l'Appel à Manifestation d'Intérêt de l'ADEME », « Programme des Investissements d'Avenir de l'Etat »

Dans quel cadre s'inscrit votre réflexion sur la mobilité / l'électromobilité ?

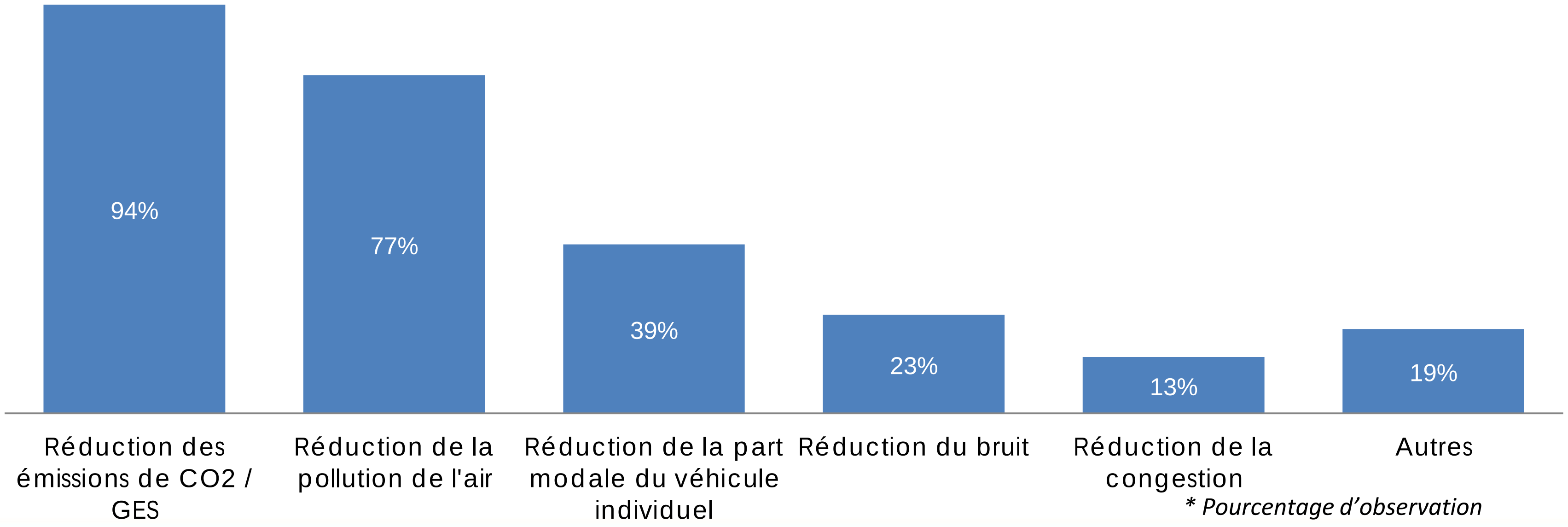



** Pourcentage d'observation*

## Territoires électromobiles - La réduction des émissions de $CO_2$ et de la pollution de l'air comme principaux enjeux des démarches menées

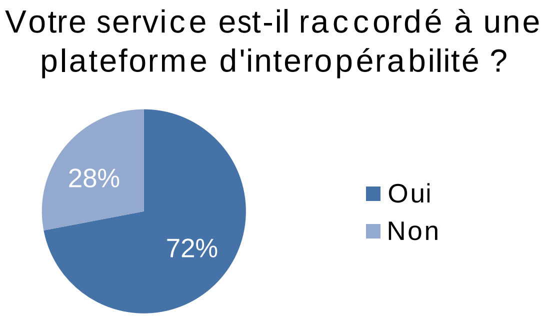
- La réduction des émissions de GES et de la pollution de l'air restent les principaux piliers de réflexion sur la mobilité : respectivement 84%* et 53%* en 2018
- Augmentation de la part du report modal depuis la 7e édition des trophées de 29%* à 39%*
- Parmi les propositions « Autres », les répondants citent : « Souhait de rester un territoire novateur et exemplaire », « Préparer le territoire à zéro émission CO2 », « Expérimentation de nouveaux services de mobilité en territoires peu denses », « covoiturage courte distance »

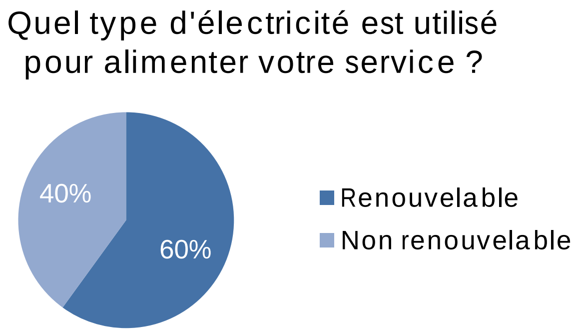
Quels sont les éléments essentiels de votre réflexion sur la mobilité ?

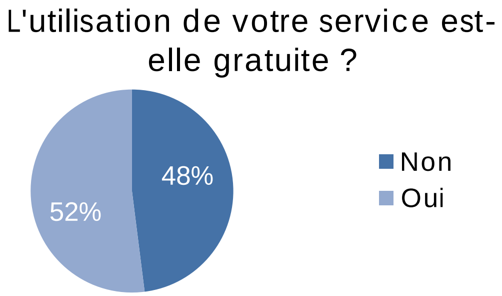



** Pourcentage d'observation*

## *Un service majoritairement raccordé à une plateforme d'interopérabilité fonctionnant avec des énergies renouvelables*




A retenir :

- 72% des bornes des répondants sont raccordées à **une plateforme d'interopérabilité**
- 60% des répondants utilisent des énergies **renouvelables pour l'alimentation de leurs bornes**
- 52% de ces bornes sont gratuites

En moyenne, les services comptent:

- 127 abonnés
- 11 recharges par jour

Aujourd'hui, nombreux projets de couplages ENR / stockage recharge via BEVs ou H2

# Mobilité électrique et territoires – quelles actions?

Déploiement d'un réseau de recharge sur le territoire avec une réflexion sur l'alimentation en ENR

Réflexion sur l'autopartage / free floating électrique

Passage des flottes à l'électrique

De plus en plus de projets couplage ENR locales / Stockage / recharge

15-17 ***International feedbacks of local governance for EVs and Renewable deployment***

- *Chair:* **Gurkan Kumbaroglu**, *President of the Turkish association for electromobility*

## 5. What future room for sustainable mobility in urban and rural areas?

- **Alain Leboeuf** *(SyDEV , Vice-president, Department of Vendée Council)*

Intervention du SyDEV par :

# M. Alain LEBOEUF

## Président du SyDEV
## Président de Vendée Energie

*08-10/05/2019*

# Sommaire

# Etat de déploiement des IRVE et des stations d'avitaillement GNV/Bio-GNV en Vendée au 02/05/2019

# Sommaire

# Chiffres clés IRVE 2018

## Retours 2018 sur l'utilisation des bornes de recharge publiques en Vendée

- 86 bornes normales et 9 bornes rapides en service en 2018

**7311**
Transactions

**237 min**
**Durée** moyenne par session **normale**

**32 min**
**Durée** moyenne par session **rapide**

**491** Abonnés SyDEV

**561** Badges distribués

**19%** d'abonnés actif

**4,5** Transactions / mois / abonné actif

**13 kWh**
**Consommation** moyenne **d'une session** sur borne **normale**

**9,5 kWh**
**Consommation** moyenne **d'une session** sur borne **rapide**

**6,9 €**
**Revenus** moyen **d'une session** sur borne **normale**

**5,3 €**
**Revenus** moyen **d'une session** sur borne **rapide**

SyDEV

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# Mob'Île'Yon : Un projet de mobilité durable innovant


✓ **Objectifs :**
Réduire l'auto-solisme et la précarité de mobilité en proposant des services innovants autour du véhicule partagé

➢ **2 Territoires d'expérimentation**, sur 3 ans

➢ **Projet SyDEV – Ile d'Yeu – La Roche-sur-Yon Agglomération : Lauréat** dans le cadre de l'Appel à Manifestation d'intérêt (AMI) France Mobilités fin janvier 2019

➢ Le **SyDEV est le coordonnateur technique** du projet

# Sommaire

La conversion des véhicules thermiques en véhicules électriques

Un enjeu pour l'économie artisanale en zone rurale

Une approche innovante du développement durable : redonner vie plutôt que détruire

Un cadre législatif en création : la loi mobilité

Un acteur Vendéen très impliqué : Brouzils auto

SyDEV
Service public des énergies vendéennes

# MERCI POUR VOTRE ATTENTION

# Electric vehicles and renewable energies interactions at the local level

## CONCLUSION

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ECOLOGIC VEHICLES RENEWABLE ENERGIES EVER MONACO

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ABB

Electric vehicles and renewable energies interactions at the local level

THANK YOU

*Congrats to Hubert Plateaux !*

**More information: www.iaee.org or www.faee.fr**

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