SERVICE SYSTEMS, SYSTEM OF SYSTEMS, CYBER PHYSICAL SYSTEMS:

LESSONS LEARNED FROM ELECTRIC VEHICLES

TO ACHIEVE NEW MOBILITY CHALLENGES

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AGENDA

- **Introduction about new mobility**
- **Lessons learned from Electric Vehicles about :**
  - Service Systems
  - System of Systems
  - Cyber Physical Systems
- **Focus on autonomous driving**
- **Synthesis of new automotive challenges**
- **Illustration of one step in our learning process**

NEW MOBILITY : THE BIKE STORY

free-floating

Service with connected bikes

with stands

constituent of an integrated mobility service

mechanical product

mecatronic system

system of systems

socio-cyber-physical SoS

BATTERY AS A SERVICE : A SERVICE SYSTEM BASED ON A CONNECTED PRODUCT

automotive business as usual

EV business since 2012

customer

for sale

customer

for sale

battery to rent as a service

usage

batteries data lake

engineering

marketing

manufacturing

dealers

invoicing

Ownership kept by OEM
Guaranty for performance
Replacement if >25% capacity lost
Pricing personalization / usage

RENAULT

EV AND CHARGE INFRASTRUCTURE: A LARGE SCALE SYSTEM OF SYSTEMS

automotive business as usual

No question mark about fuel distribution infrastructure availability and interoperability.

EV business since 2012

- Standards to be applied, revised or initiated (IEC, SAE, GB/T, DIN, EN)

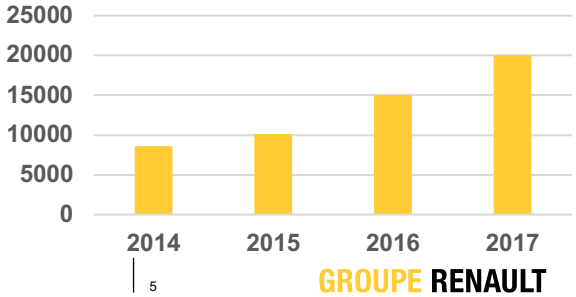
Standards for EVSE: 9

Standards for plugs: 7

Cable standards : 6 (communication) 3 (electric)

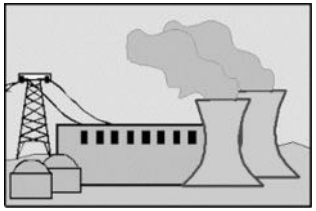
- Consortiums, certification labels
- National legacy, regulation and incentives
- Many decisions at local level in the end

Public charging spots available in France (Gireve data)



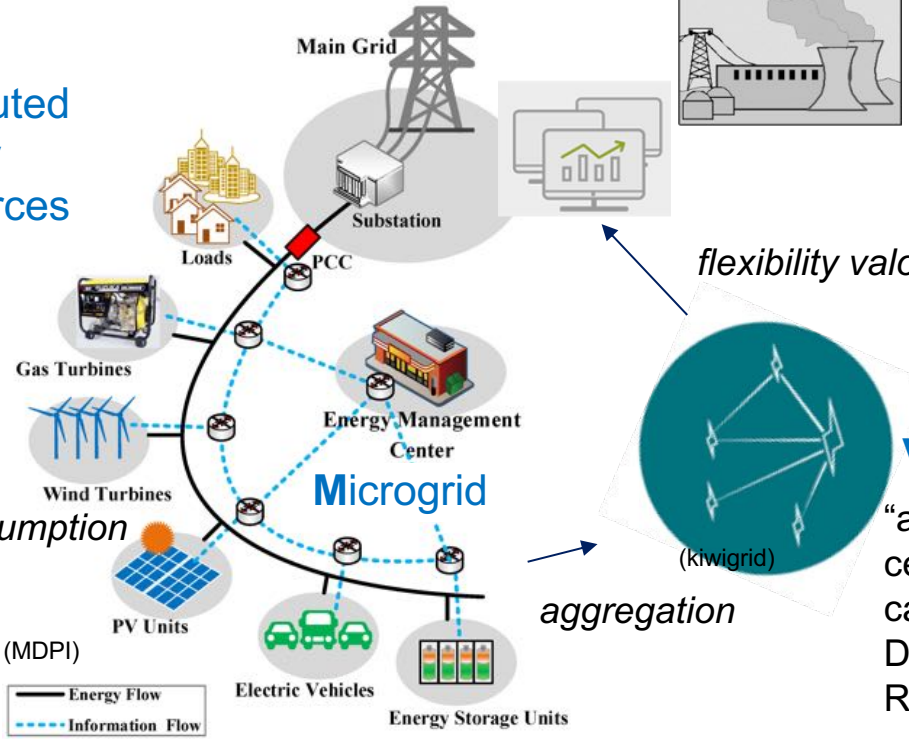
MICROGRID AND VIRTUAL POWER PLANT: A SOCIO-CYBER-PHYSICAL SOS

business as usual



EV integration perspective on behalf of energy transition

Distributed
Energy
Resources



(MDPI)

self-consumption

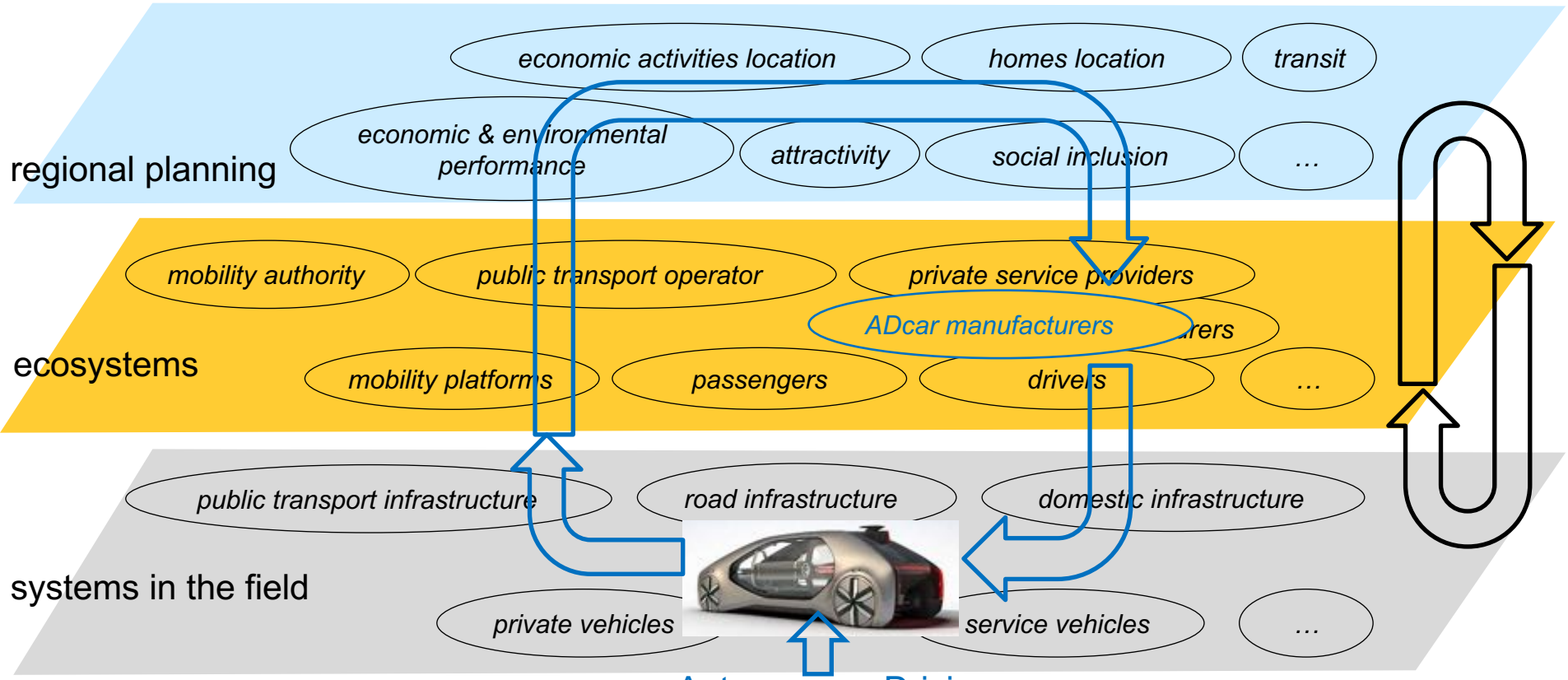
flexibility valorization

aggregation

Virtual **P**ower **P**lant

"a cloud-based control center that aggregates the capacity of heterogeneous Distributed Energy Resources" (*Wikipedia*)

AUTONOMOUS DRIVING ON BEHALF OF REGIONAL PLANNING



SYNTHESIS OF NEW AUTOMOTIVE CHALLENGES

System of Product and Service (PSS)

car manufacturer

service

car users

Service provided by other economical entity

system of systems

non exhaustive list of challenges:

Value proposition

Configuration management

Value sharing business model

Cultural shift

Lifecycles offsets and interlacing

Co-creation (incl users) Collaborative engineering

Governance

Safety Cybersecurity

FIELD OPERATIONAL TEST ON PUBLIC ROADS

"**Rouen Normandy Autonomous Lab**", Europe's first on-demand mobility experimental service using autonomous electric vehicles on public roads (10 km).

2 years of public experimentation from mid 2018