Challenges of E-mobility

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Outline of the presentation

- Why Electromobility is starting?
- Why is it promising for Grids ?
- Why is it promising for Users?

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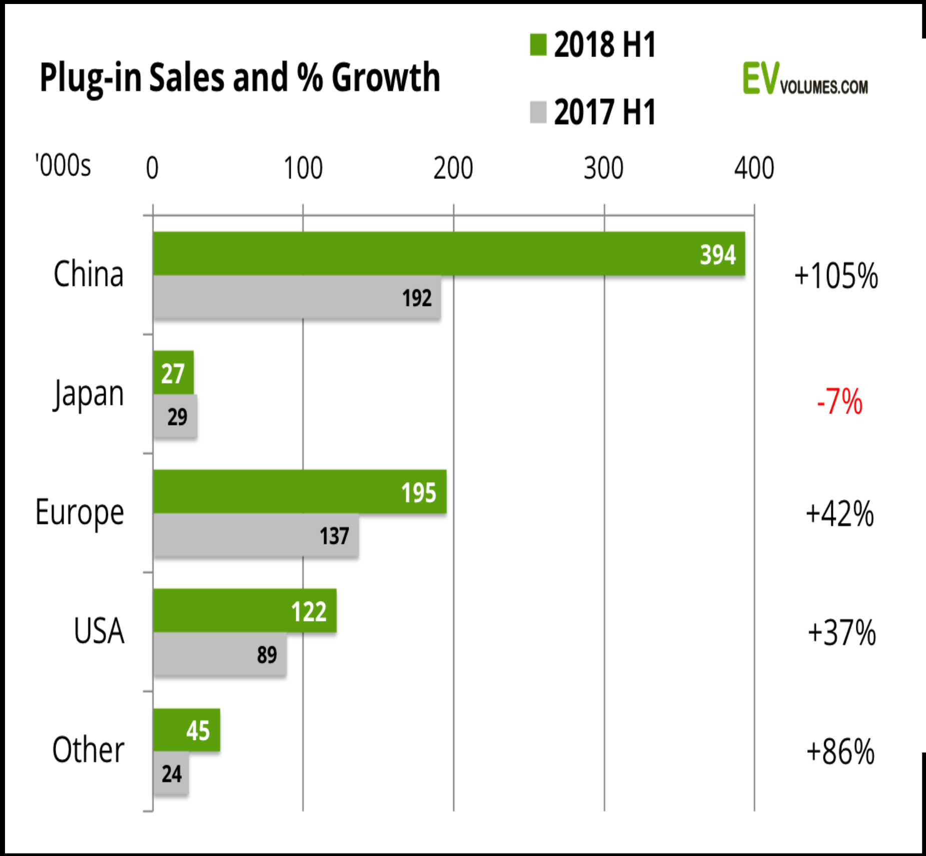
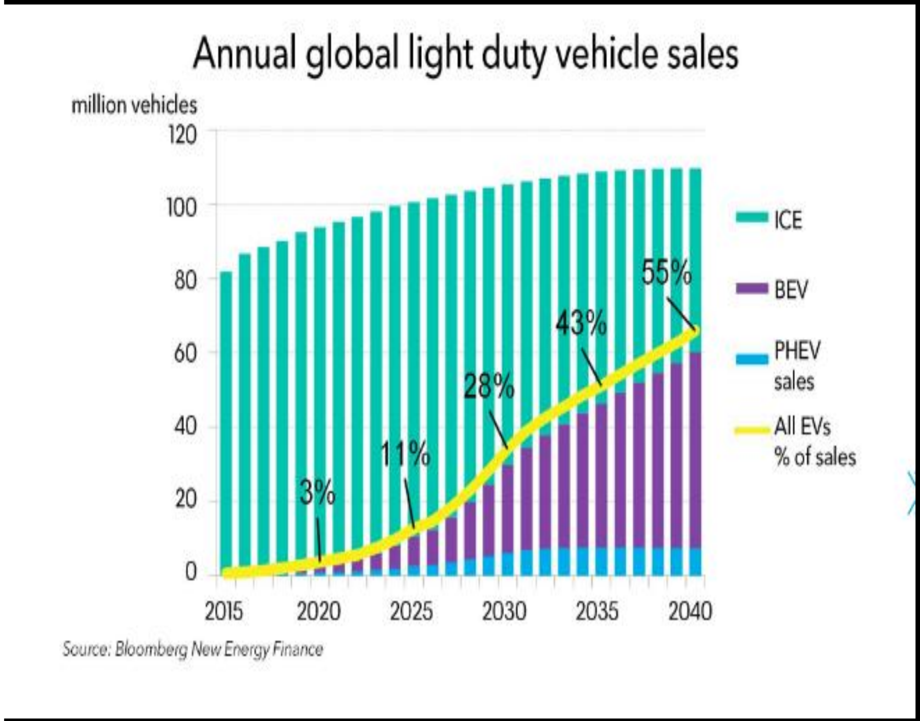
EV sales for personal cars + Electric buses





Source: http://www.ev-volumes.com/country/total-world-plug-in-vehicle-volumes/

Why it is starting?

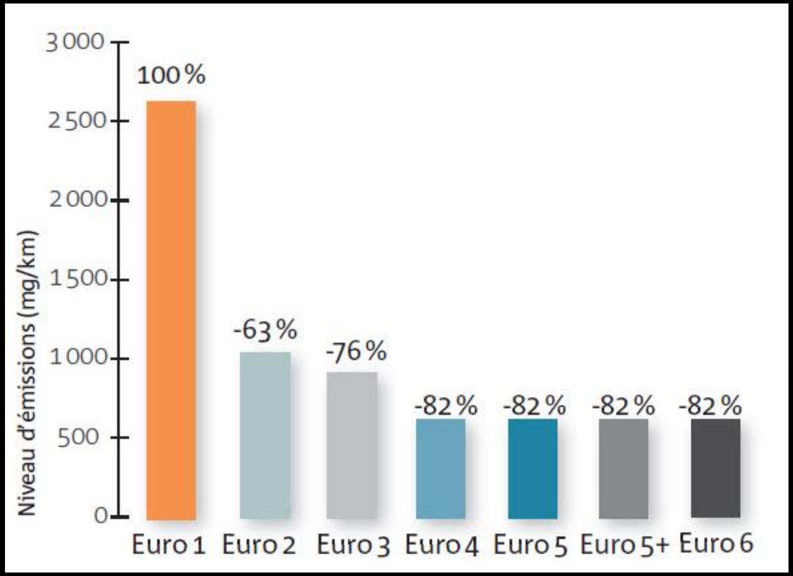
Public action: Sticks and Carrots

Range anxiety decrease

Basic infrastructures exist

Sticks and carrots

Sticks: Banning policies @ local level+ emission reductions for cars



Carrorts

- Public subsidies
  - EV PHEV selling subsidies (State level + local)
  - Charging infrastructure subsidies
  - R&D subsidies

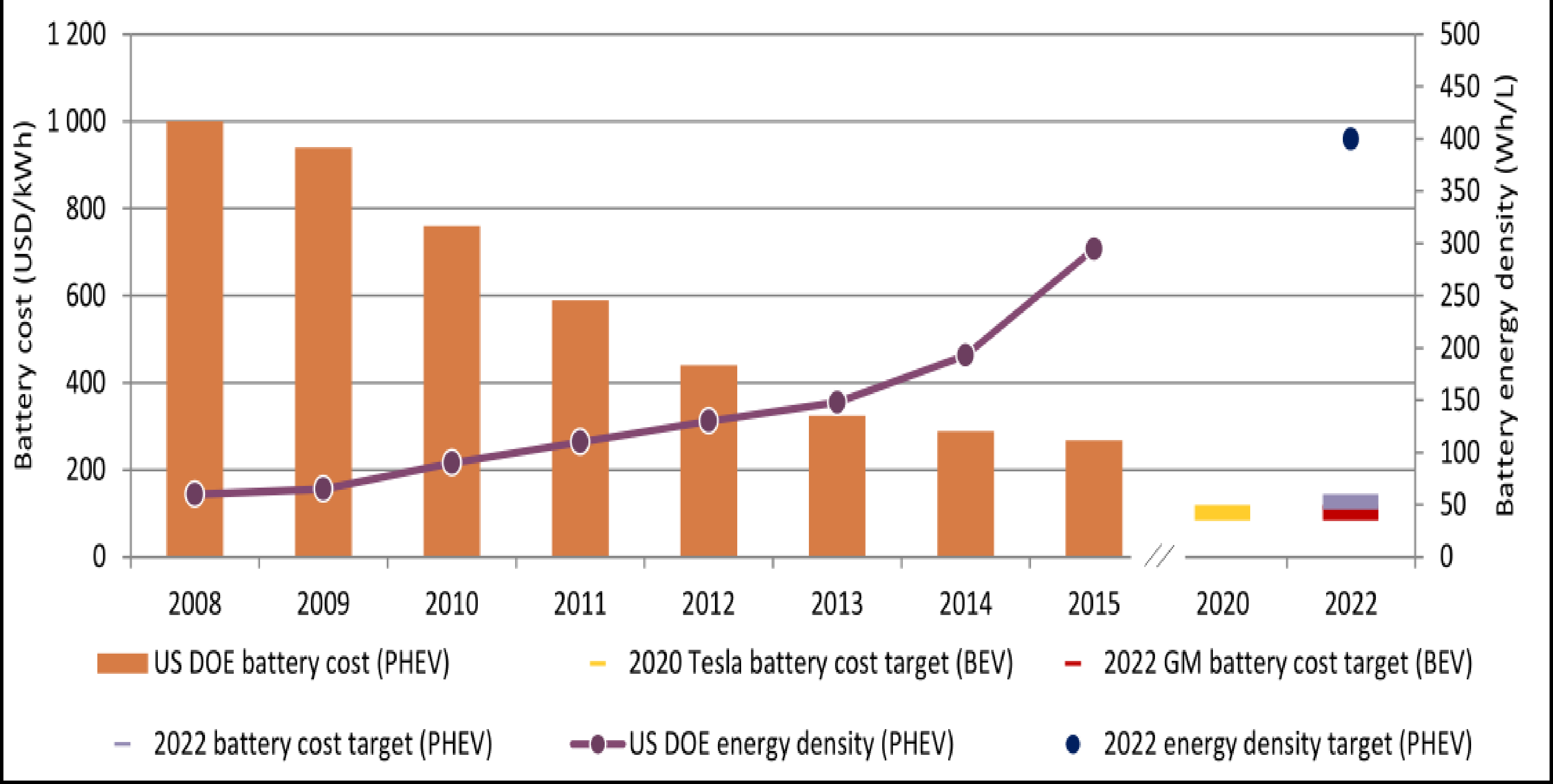
Why it is starting?

Public Subsidies

Range anxiety decrease

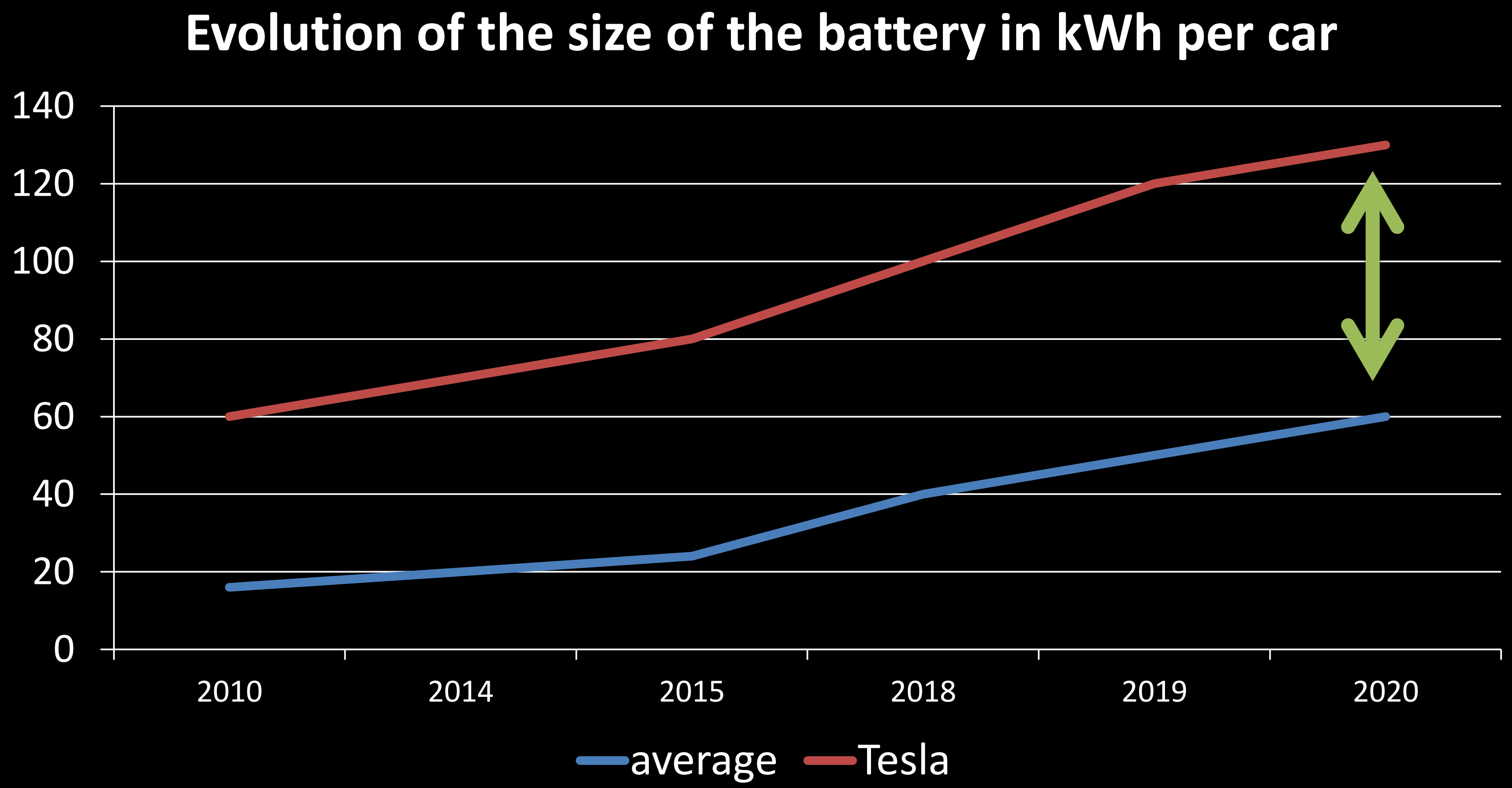
Basic charging infrastructures exist

EVs enjoy a Double dynamic:
Increase in ENERGY DENSITY & decrease of COST



Source: IEA Global EV Outlook 2016

Less costs => More capacity / car => less range anxiety

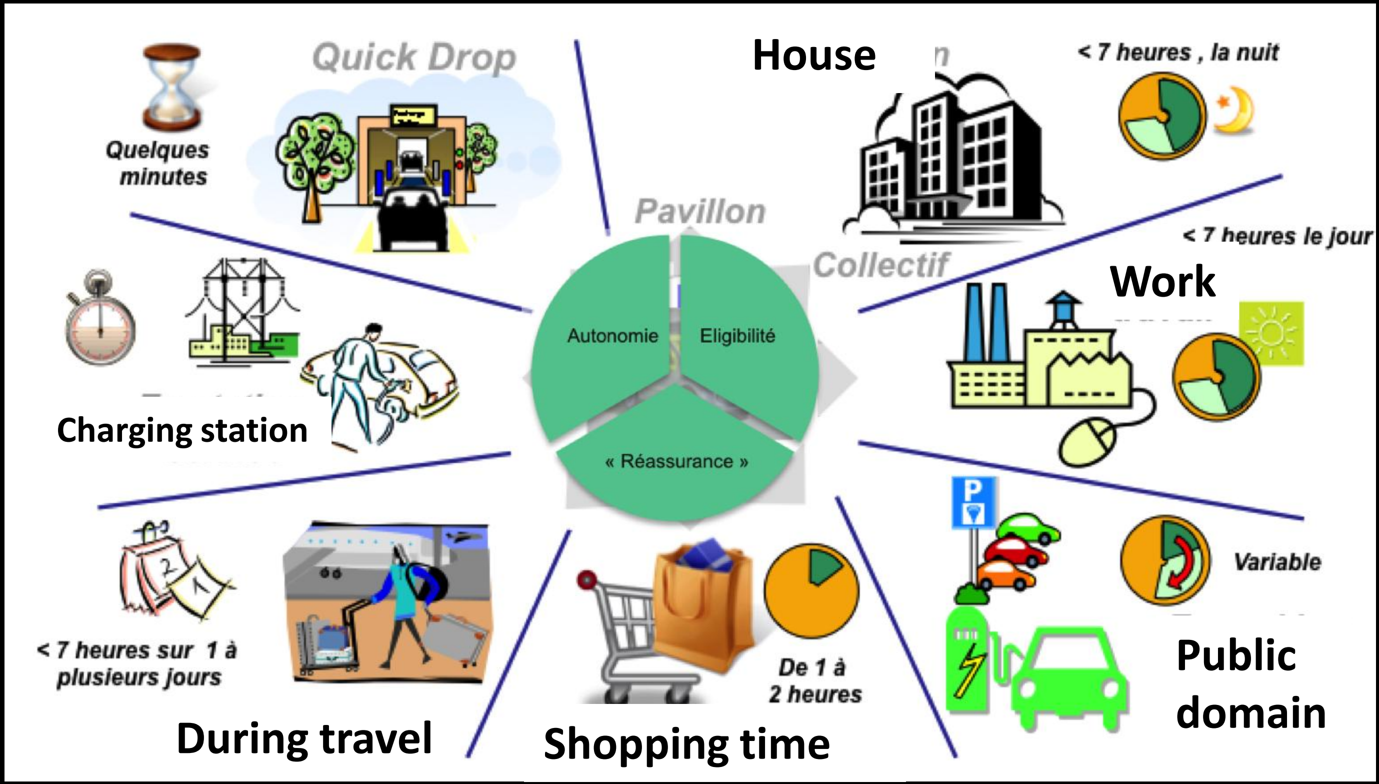


After 2020 = Cost reduction will normaly used to reduce the cost of the EVs

Switching from
« range anxiety »
to
« charging anxiety »

Where and when I can charge?

Minimum charging infrastructures allows to start equipment



7 logical options to charge but 95% of the charging is made at home

but a lot seems to be needed elsewhere to secure the EV buyer

Business models and Data to “explore” for infrastructure charging deployment

Place / Characteristics	Home	Work	Fast charge	Tesla Supercharger Charging stations	Ionity Charging stations
Power	3-7 kW	3-22kW	22-50 kW	50-150 kW	350 kW
Time to charge	8-24h	1-3h	40 min 200km	30 min 400km	20 min 500 km
Usages	Commuting trips	Commuting trips	All usages	All usages	All usages
Investment cost per charger	200-500€	500-3k€	15k€-25k€	35-60k€	?
Cost of recharge	2-3€/ 100 km	4€	5 -7€	10-15€	50-80€

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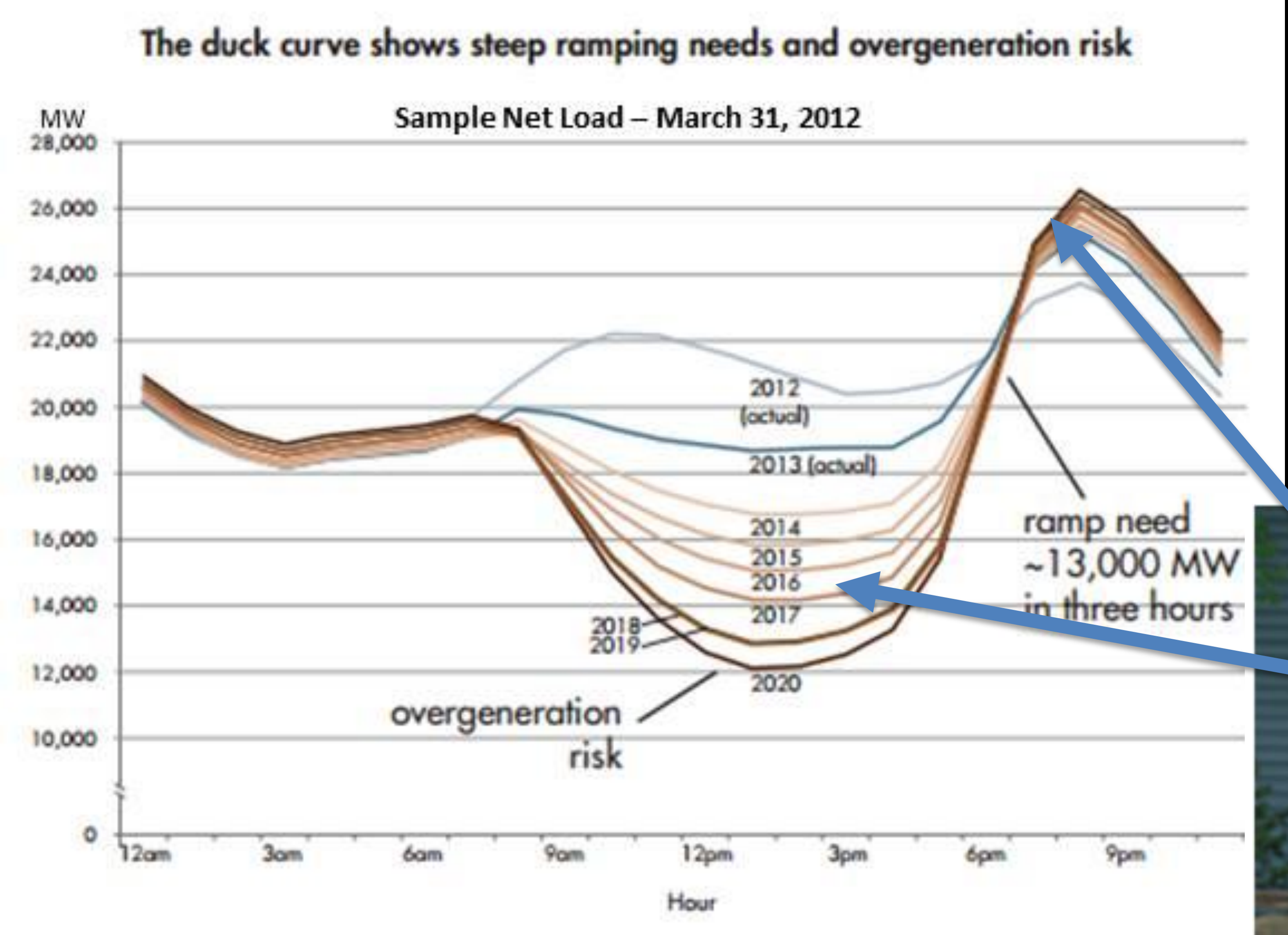
Why is it promising for TSO?

EV killing duck curve?



(from the California Independent System Operator)

Problem… Rules are inadapted

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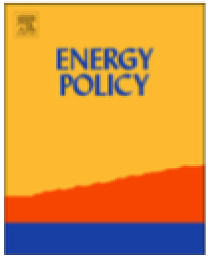

Market integration or bids granularity to enhance flexibility provision by batteries of electric vehicles

Olivier Borne[a,*], Yannick Perez[b], Marc Petit[a]

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Why is it promising for DSO?

EV solving « Death Spiral » for DSO revenues?

PV

Decrease revenues for DSO

Regulator increase tariffs

Incentive to install PV increase

Total costs of the system Increase = Efficiency issue

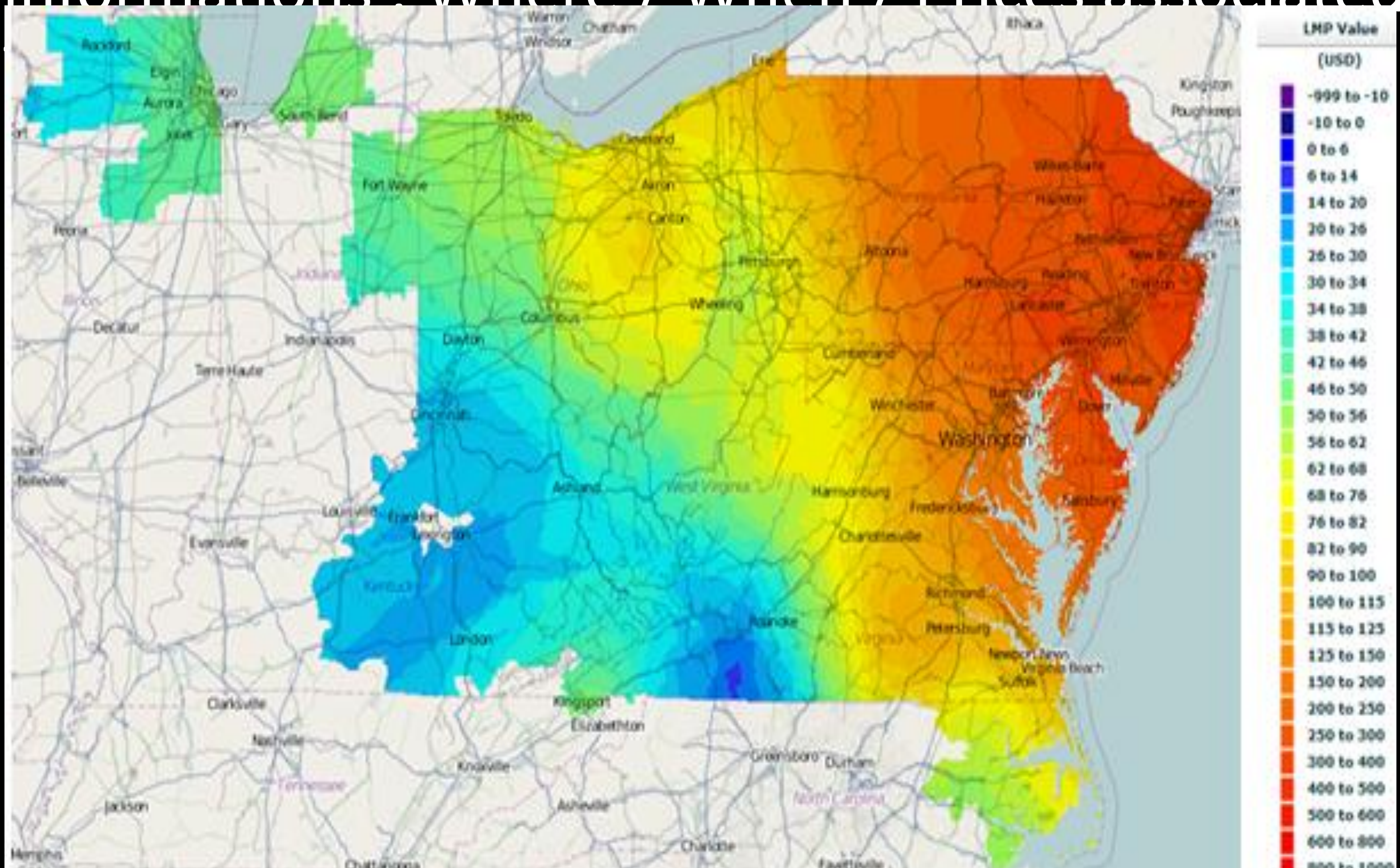
Non equiped consumers see a increase of the bill = Equity issue

Network tariffs need to be redesigned for **decentralised storage solutions**

But how?

Decentralised – time consistent- market based – transparent - solution for charging-discharging

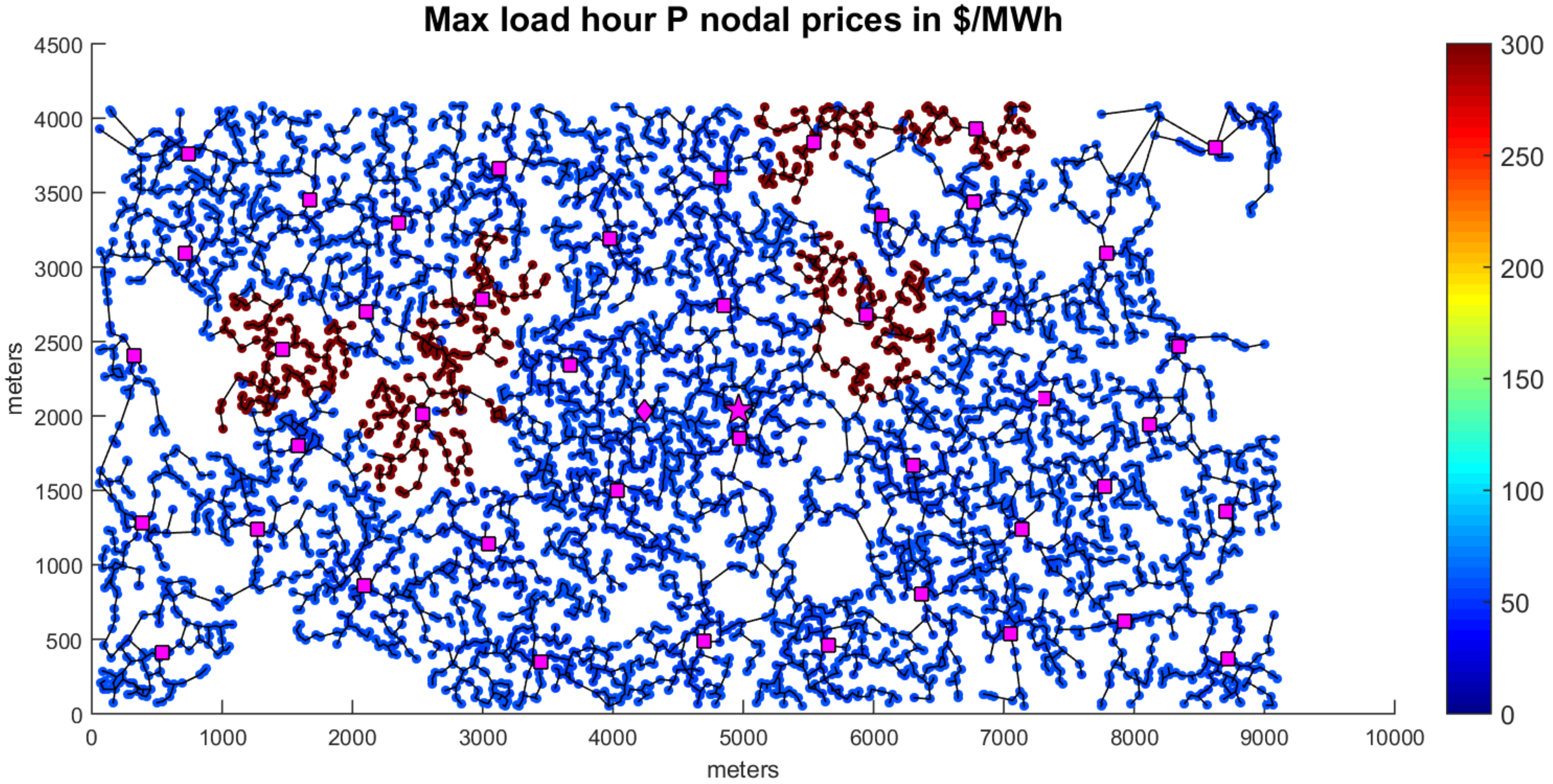
- Decentralized = price signals per node per time: 3 informations : Where / When / Prices associated



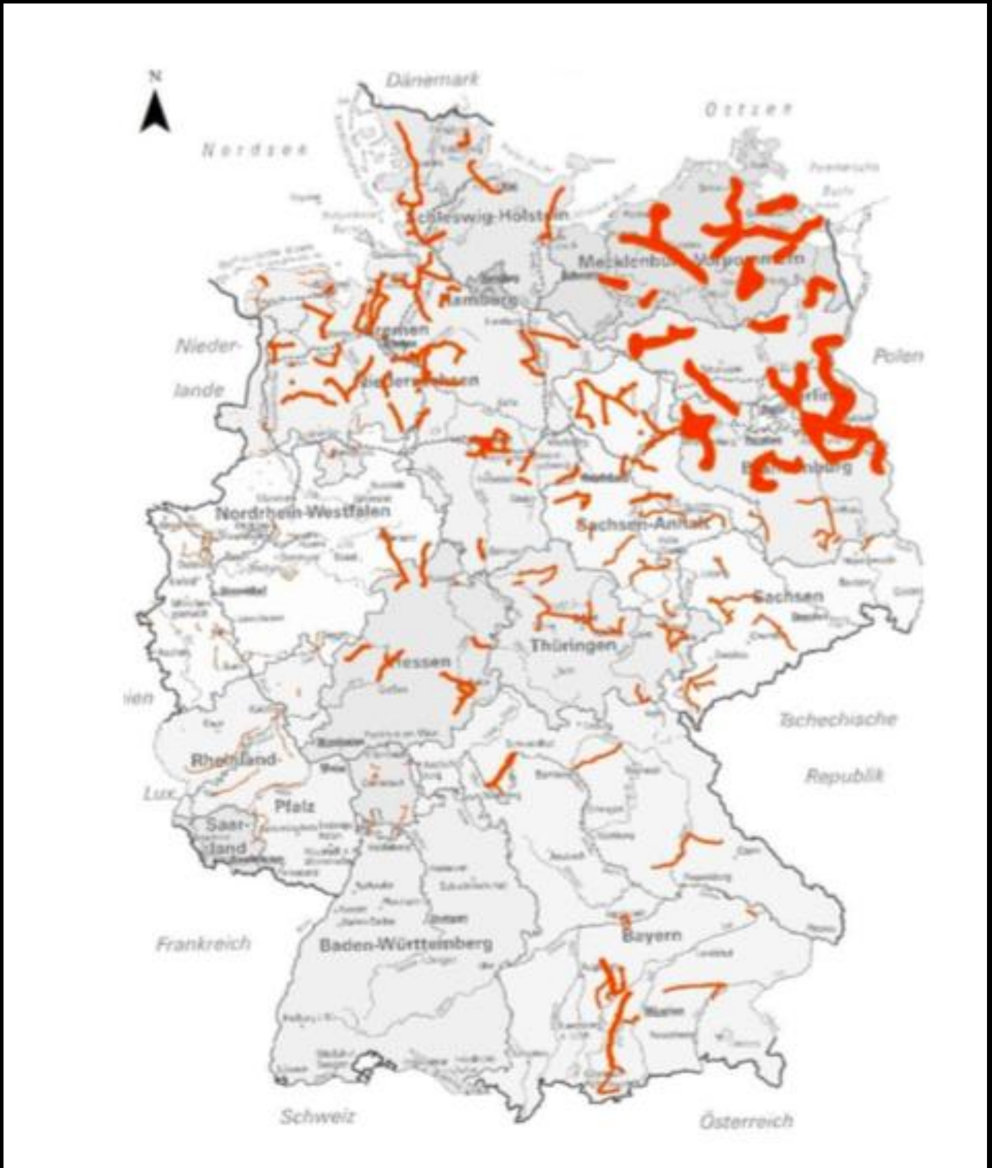
Decentralised – time consistent- market based – transparent solution for charging-discharging

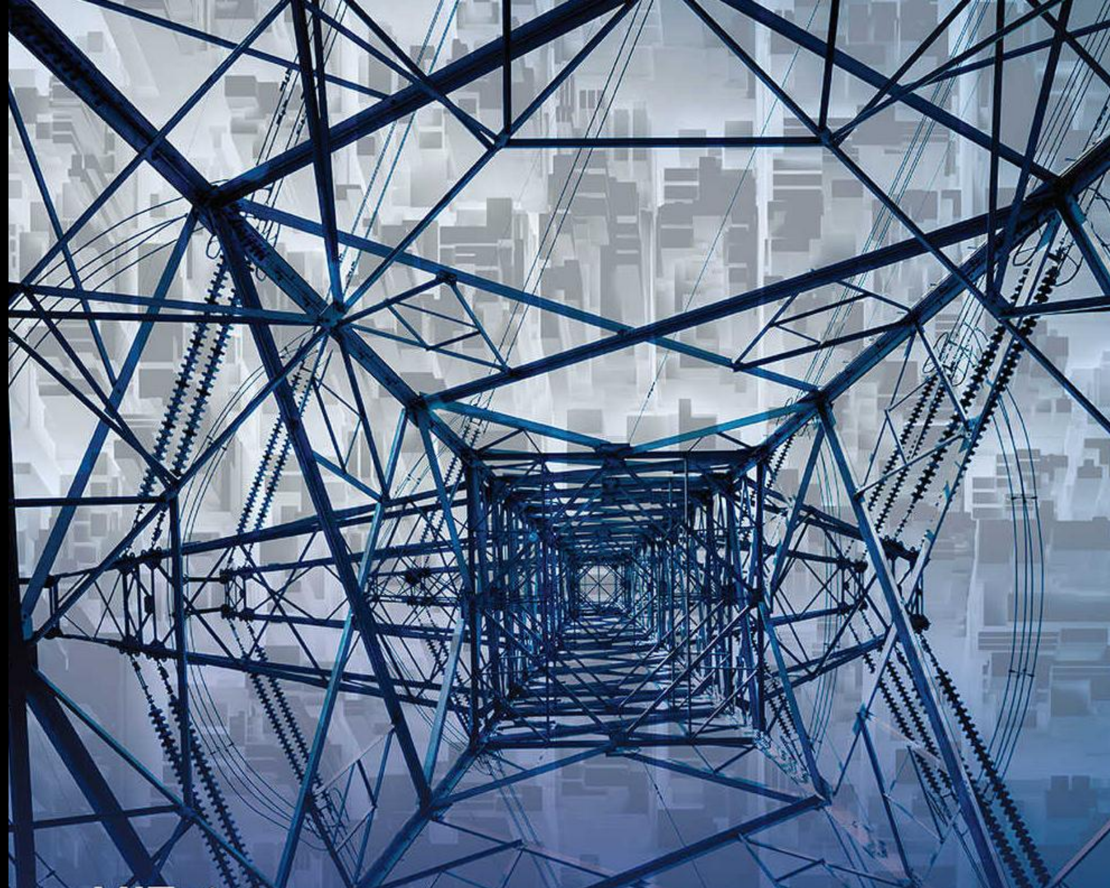
- Decentralized = price signals per node :
  - 3 informations :
    - Where
    - When
    - Prices associated for
      - Charging
      - Discharging
      - Per services offered

Simulation results for PJM



German exemple of DSO’s issues





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An MIT Energy Initiative response
to an industry in transition

In collaboration with IIT-Comillas

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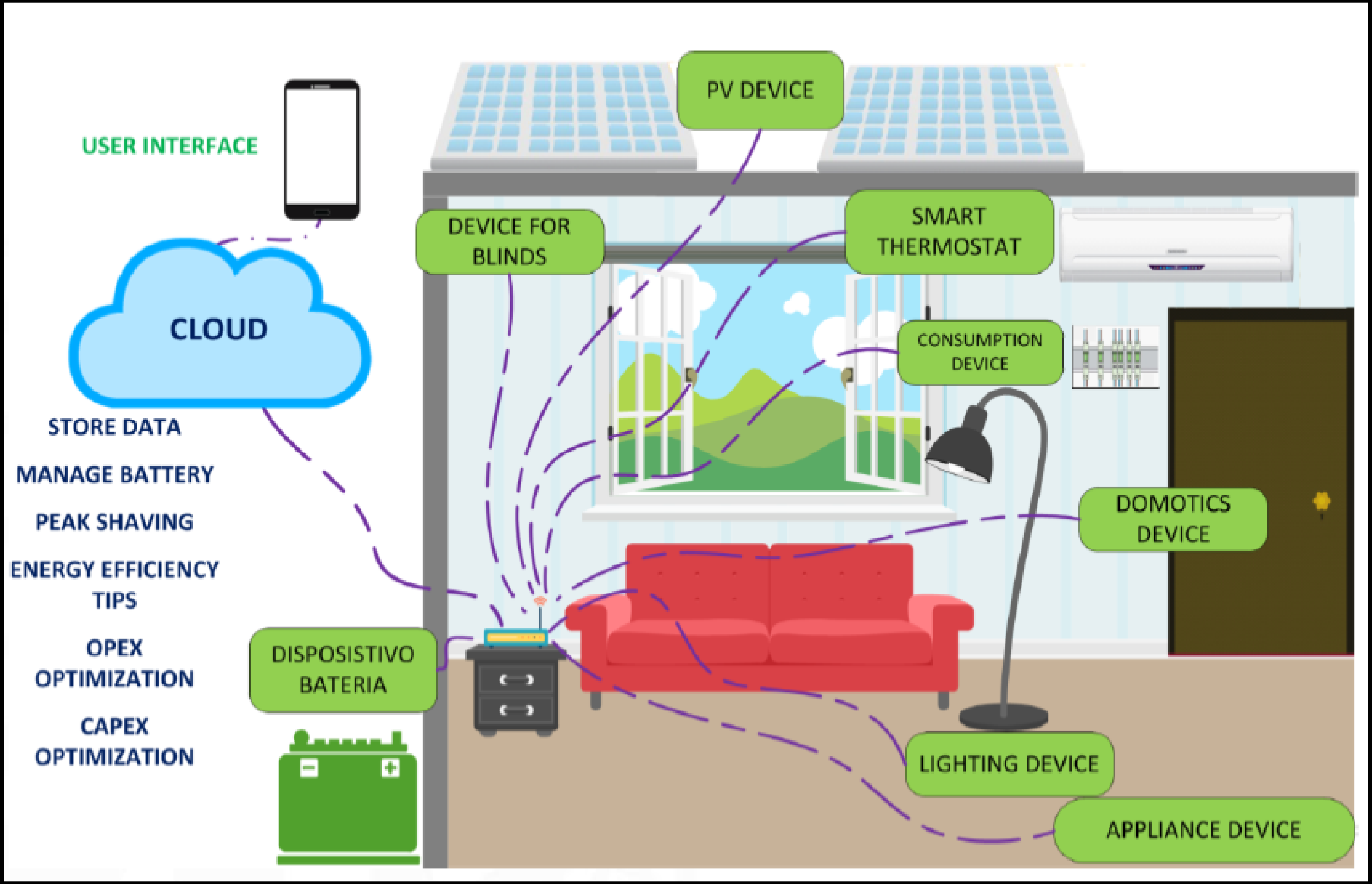
EVs reduce opex of Building / house by savings

Connexion charge (W) and Consumption (Wh)



Empowering consumers
Off grid, cutting taxes, networks charges…

9OCT2012 press-released
27APR2012 sales-stared

1.5kW V2L

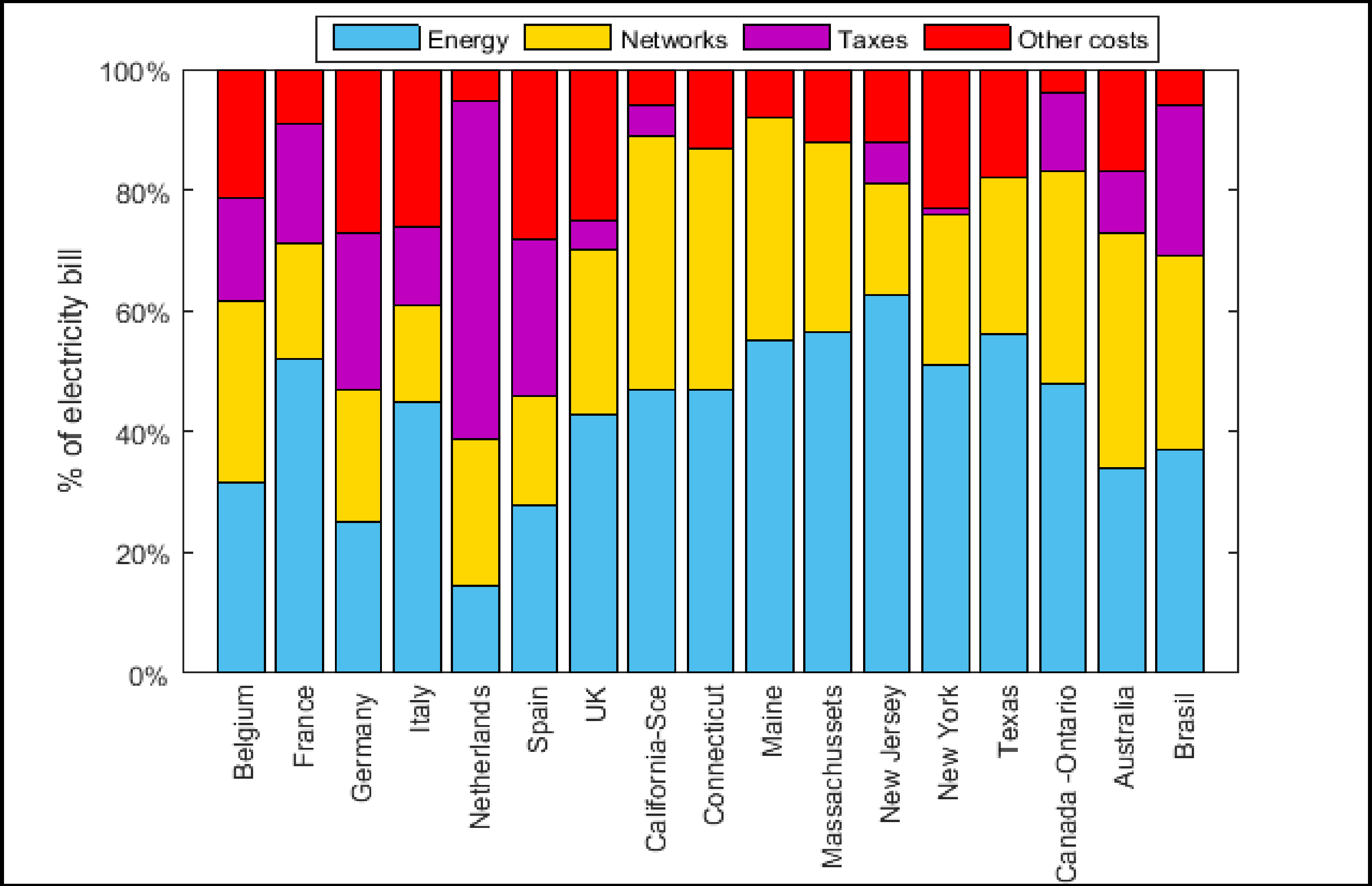
PowerBox

30MAY2012 press-released
**SEP2012 sales-stared

6kW V2H

EV power station

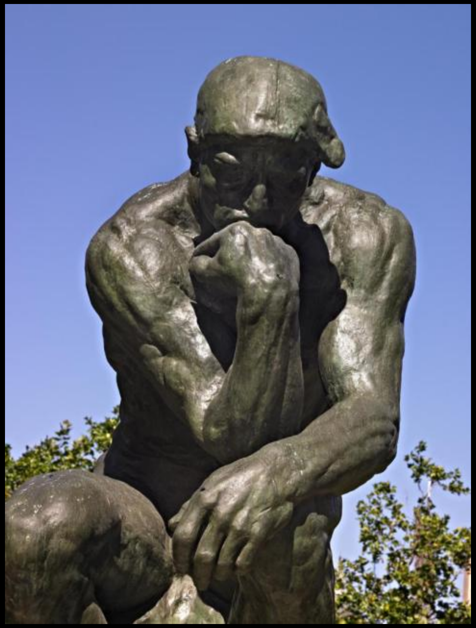
Energy-Networks-taxes-other “costs” => looking for savings with “Behind the meter solutions”



Breakdown of residential electricity bills in different jurisdictions in 2014-2015

Conclusions

Who EVs are going to help?



Energy Markets / grids / Behind the meter uses?

Depends on regulators decisions…

1. Energy market for EV: Need to change the rules
2. Vehicle to Transmission grid : Need to change the rules
3. Vehicle to Distribution grid : Need to change the rules

1. Vehicle to buildings = VtoB : Out of regulators scope
2. Vehicle to Home = VtoH : Out of regulators scope
3. Vehicle to Load = VtoL: Out of regulators scope

To help this process Florence School of Regulation will open soon an Electromobility Area

European University Institute

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Selected Literature

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