

Challenges of E-mobility and the grids

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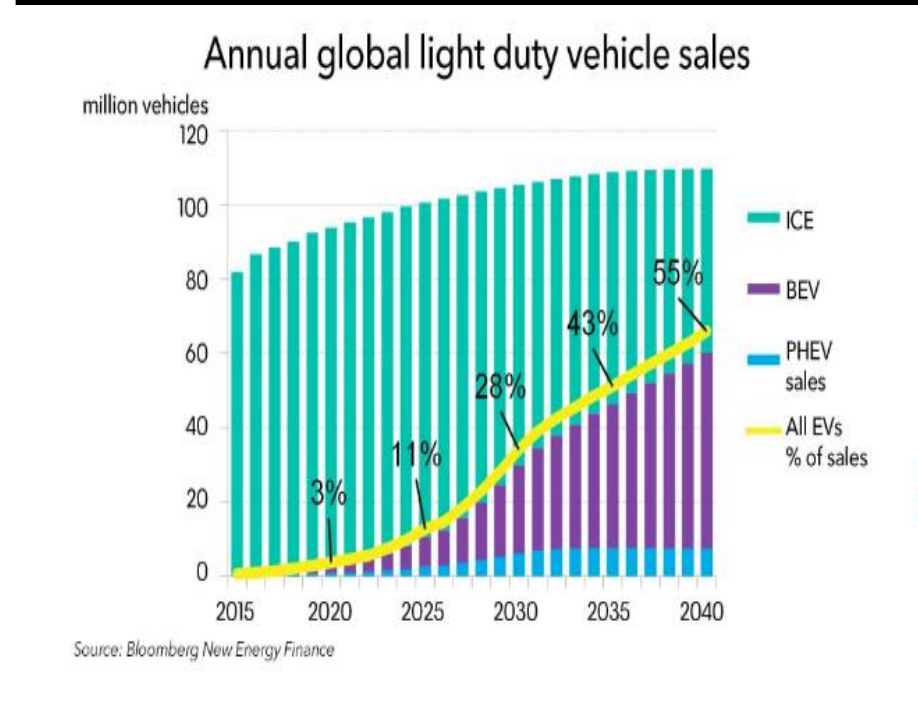
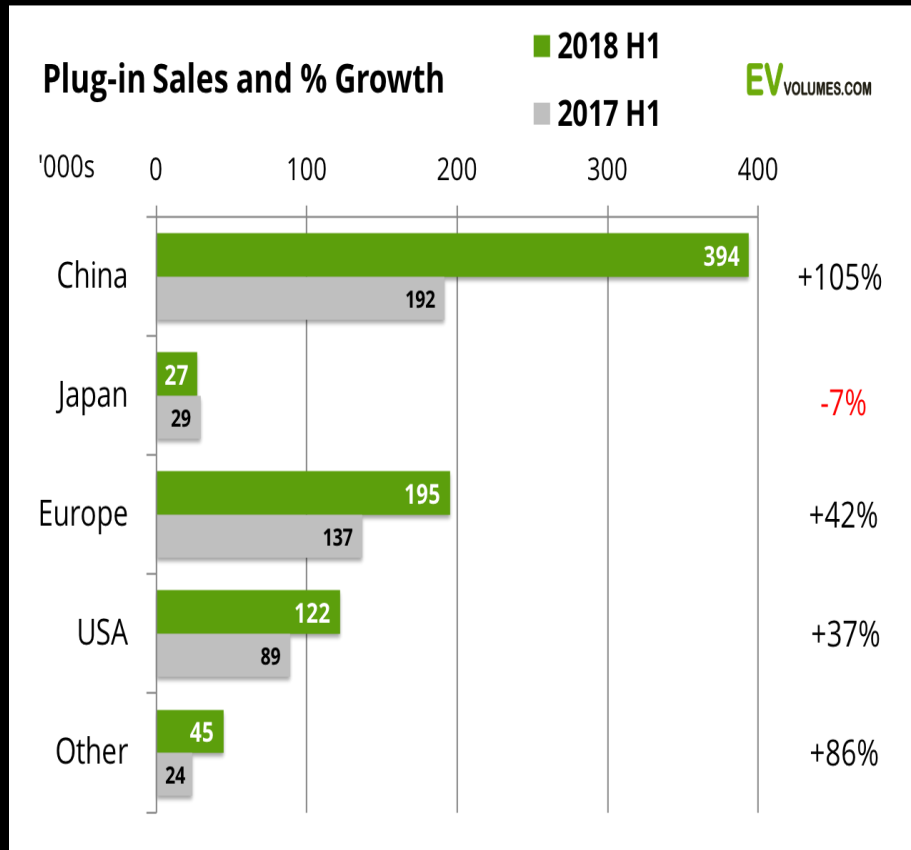
Outline of the presentation

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

Outline of the presentation

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

EV sales for personal cars + Electric buses



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

Why it is starting?

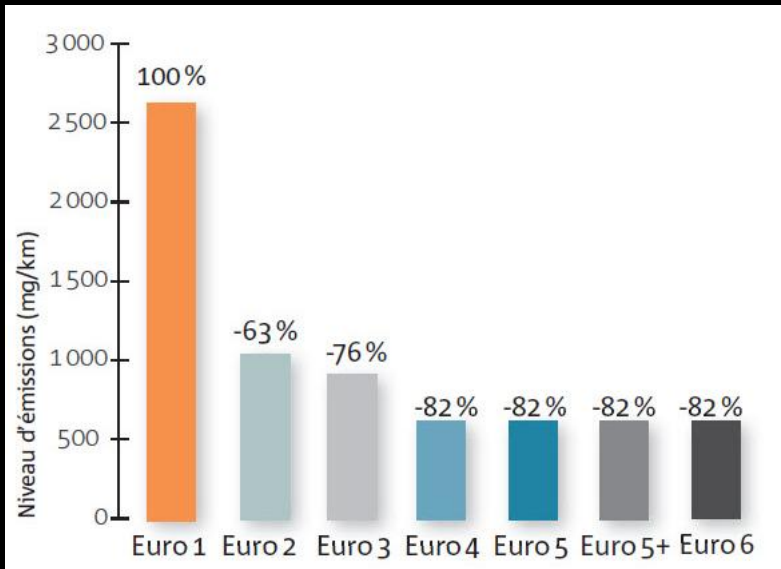
Public action: Sticks and Carrots

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

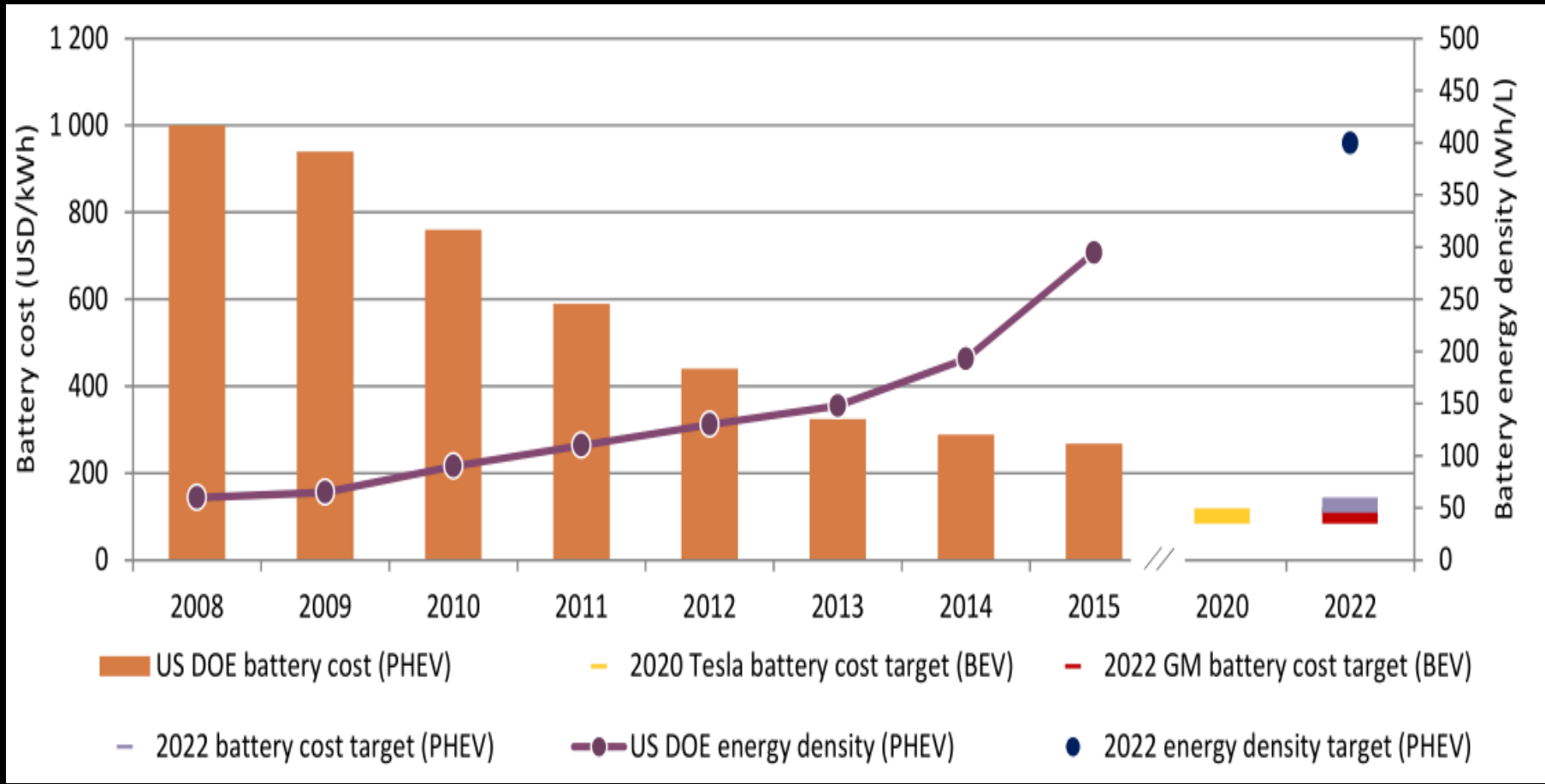
Why it is starting?

Public Subsidies

Range anxiety decrease

Basic charging infrastructures exist

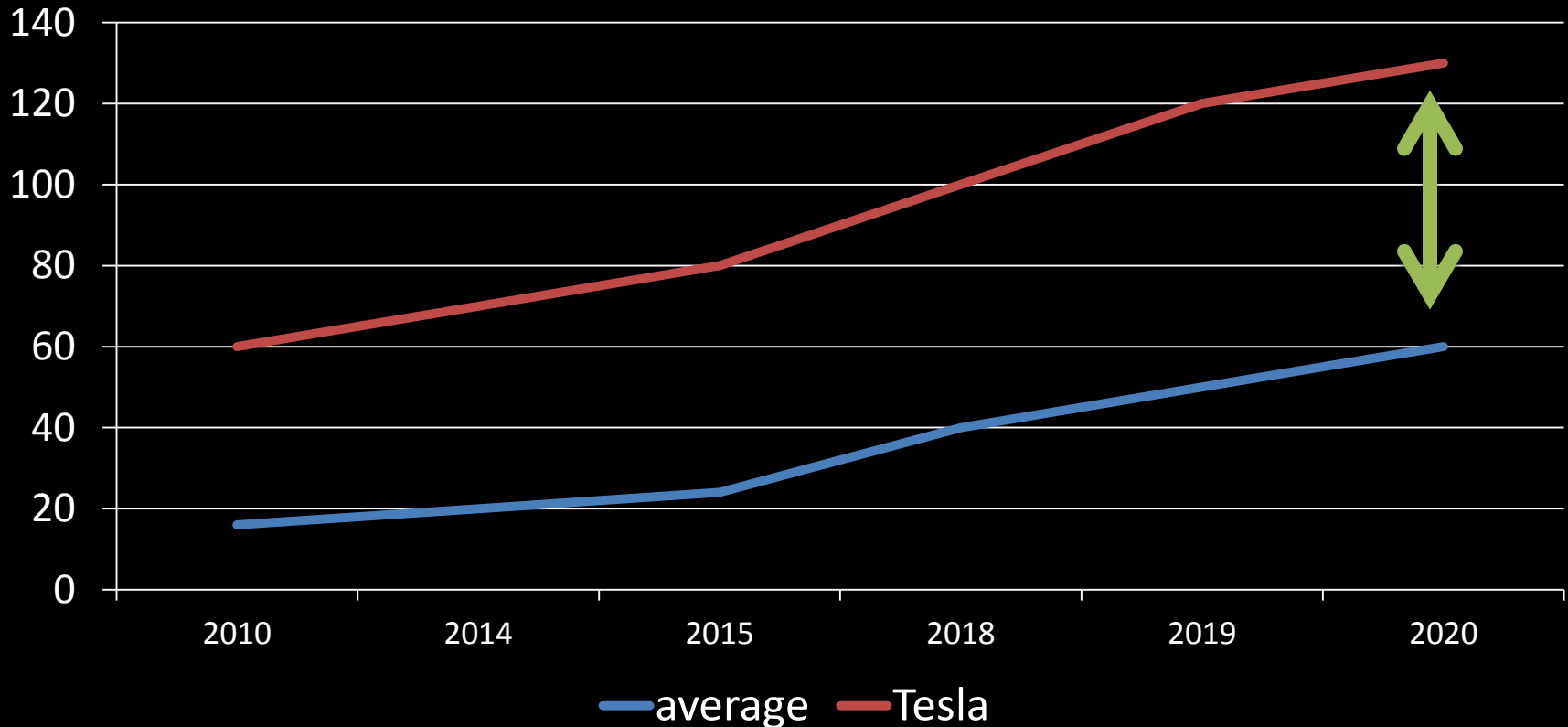
EVs enjoy a Double dynamic: Increase in ENERGY DENSITY & decrease of COST



Source: IEA Global EV Outlook 2016

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

Evolution of the size of the battery in kWh per car

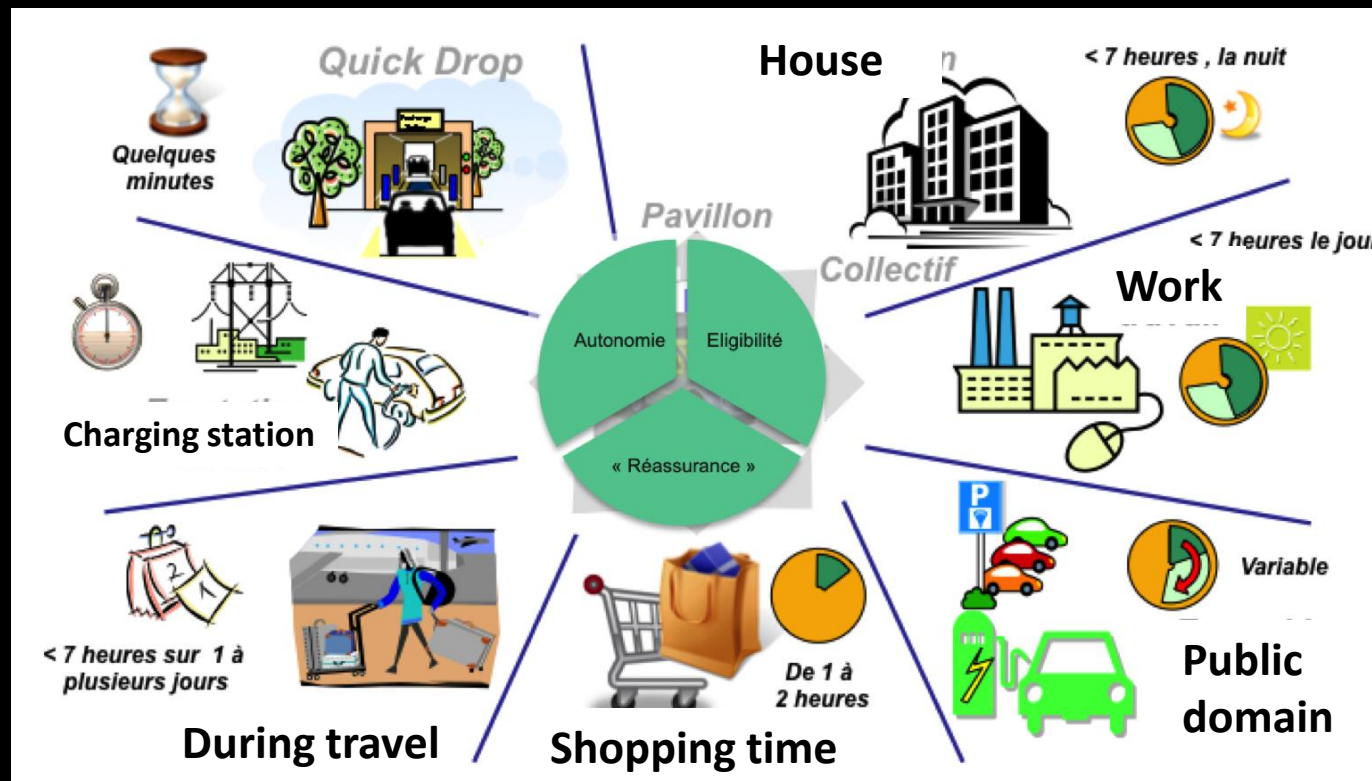


After 2020 = Cost reduction will normally used to reduce the cost of the EVs

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	Home	Work	Fast charge	Tesla Supercharger Charging stations	Ionity Charging stations
Characteristics					
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€

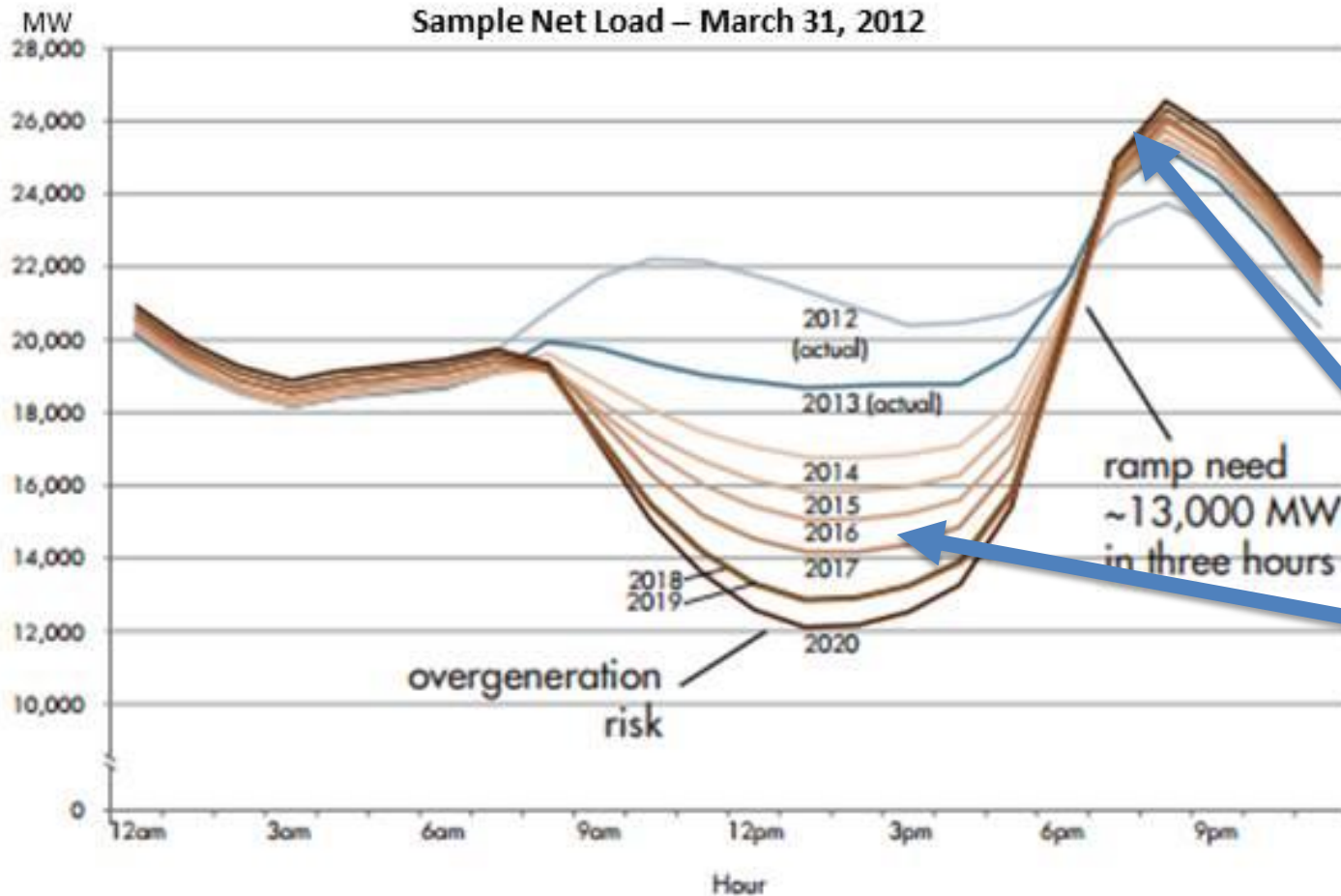
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Why is it promising for TSO?

EV killing duck curve?

The duck curve shows steep ramping needs and overgeneration risk



(from the California Independent System Operator)



Problem... Rules are inadapted



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Barriers to entry in frequency-regulation services markets: Review of the status quo and options for improvements



Olivier Borne^{a,1}, Klaas Korte^b, Yannick Perez^{c,d,*,1}, Marc Petit^{a,1}, Alexandra Purkus^b

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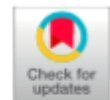
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Market integration or bids granularity to enhance flexibility provision by batteries of electric vehicles



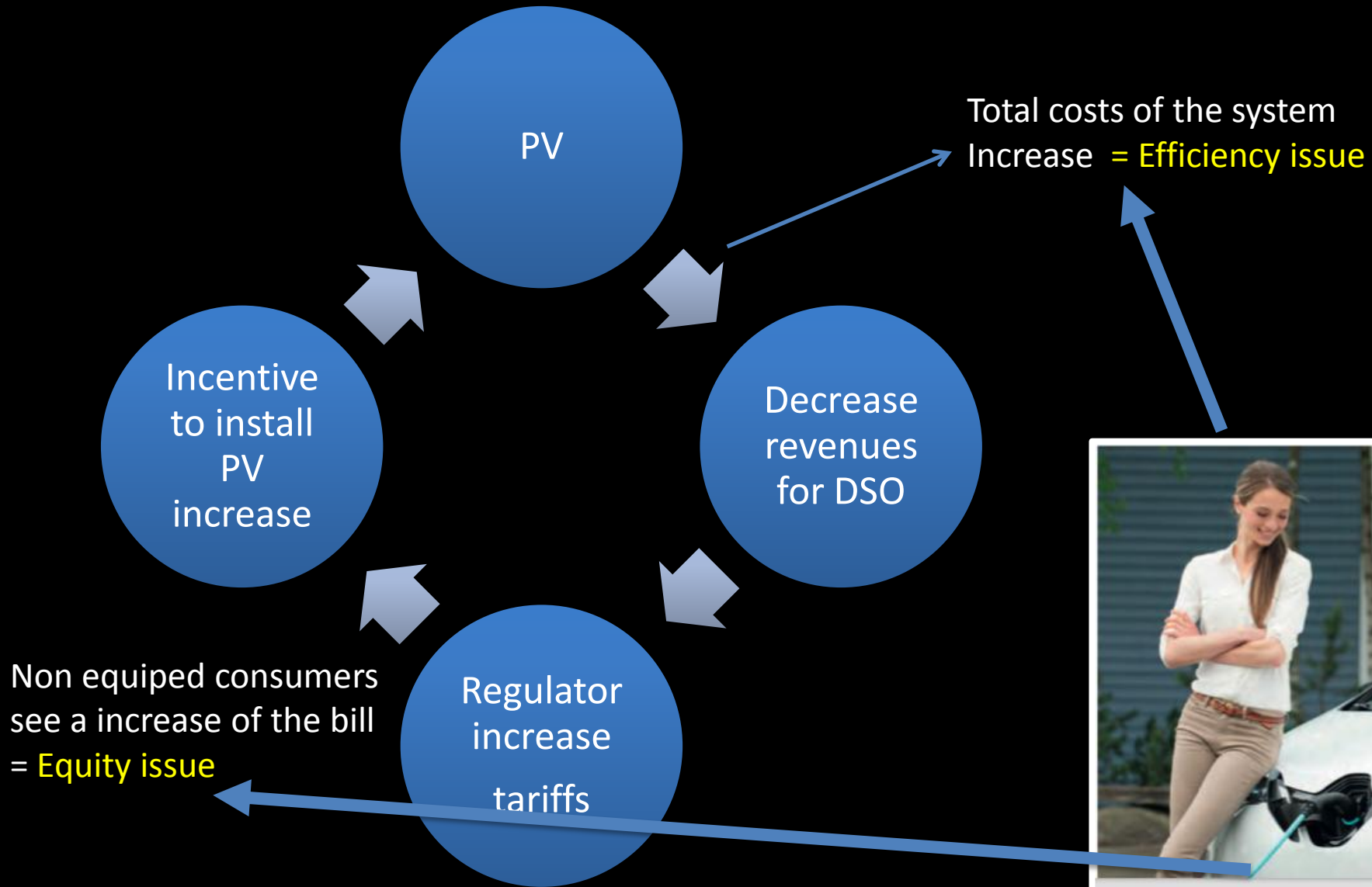
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Why is it promising for DSO?

EV solving « Death Spiral » for DSO revenues?

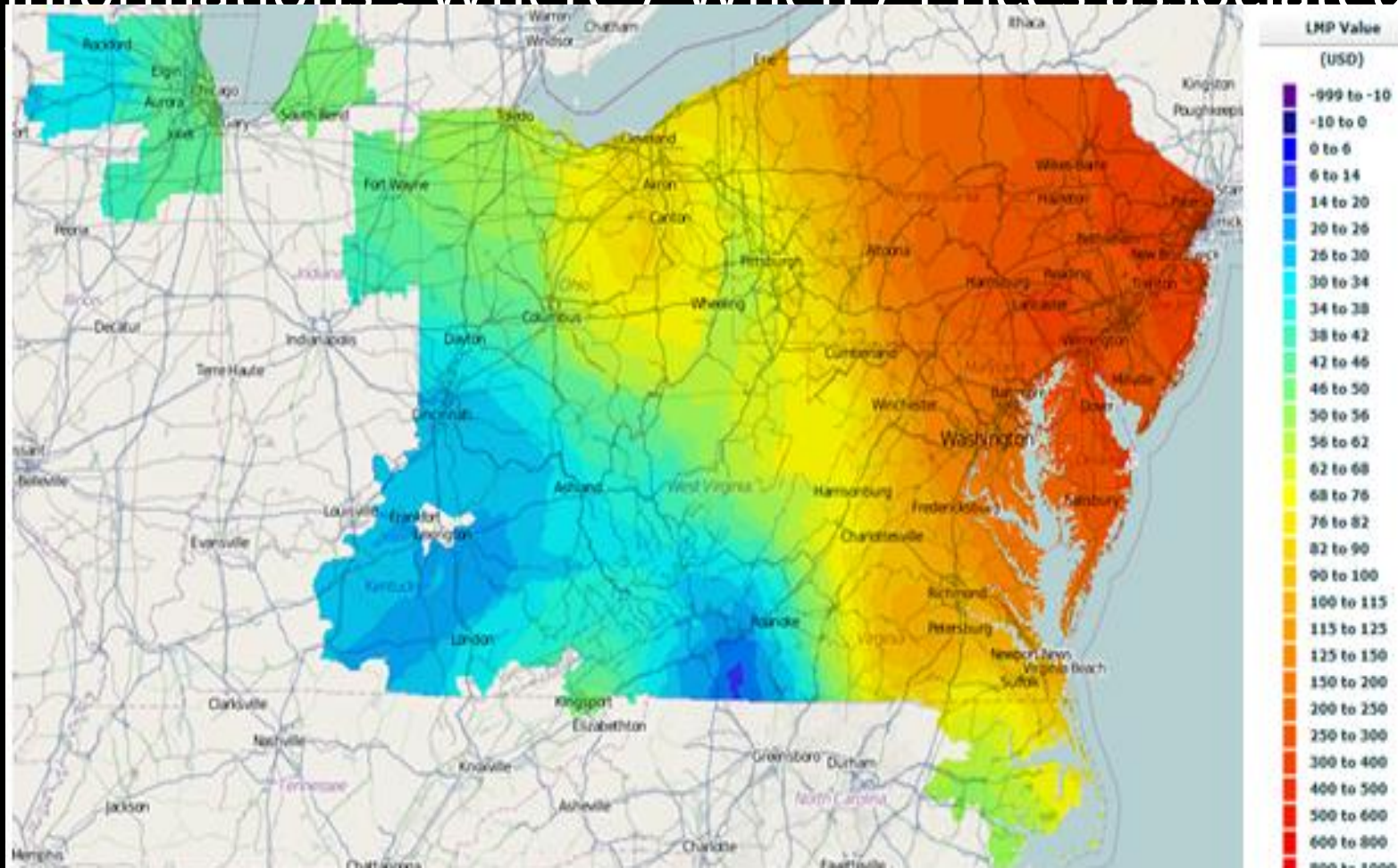


Network tariffs need to be
redesigned for
decentralised storage solutions

But how?

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

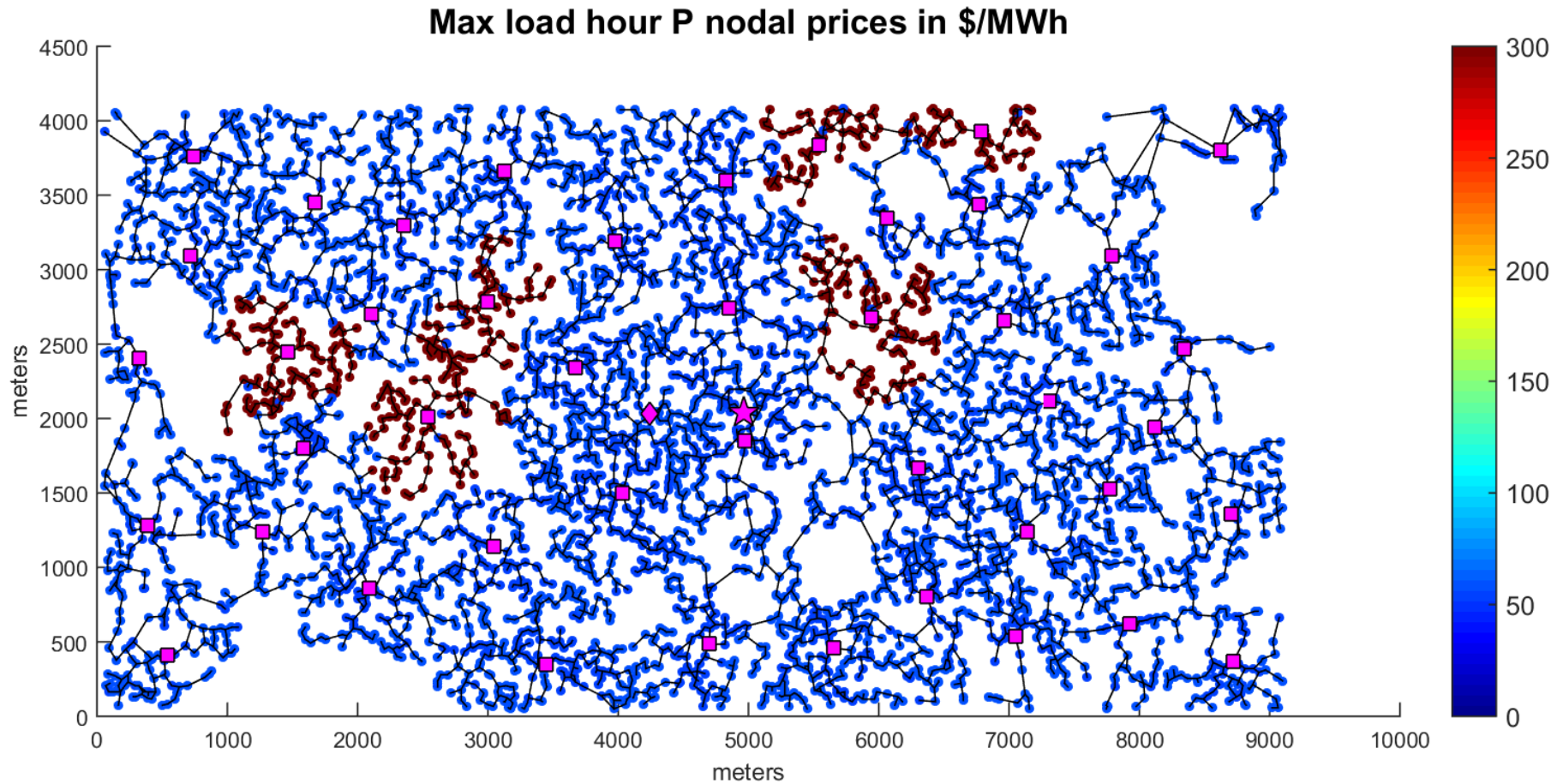
- Decentralized = price signals per node per time: 3 informations : Where / When / Prices associated



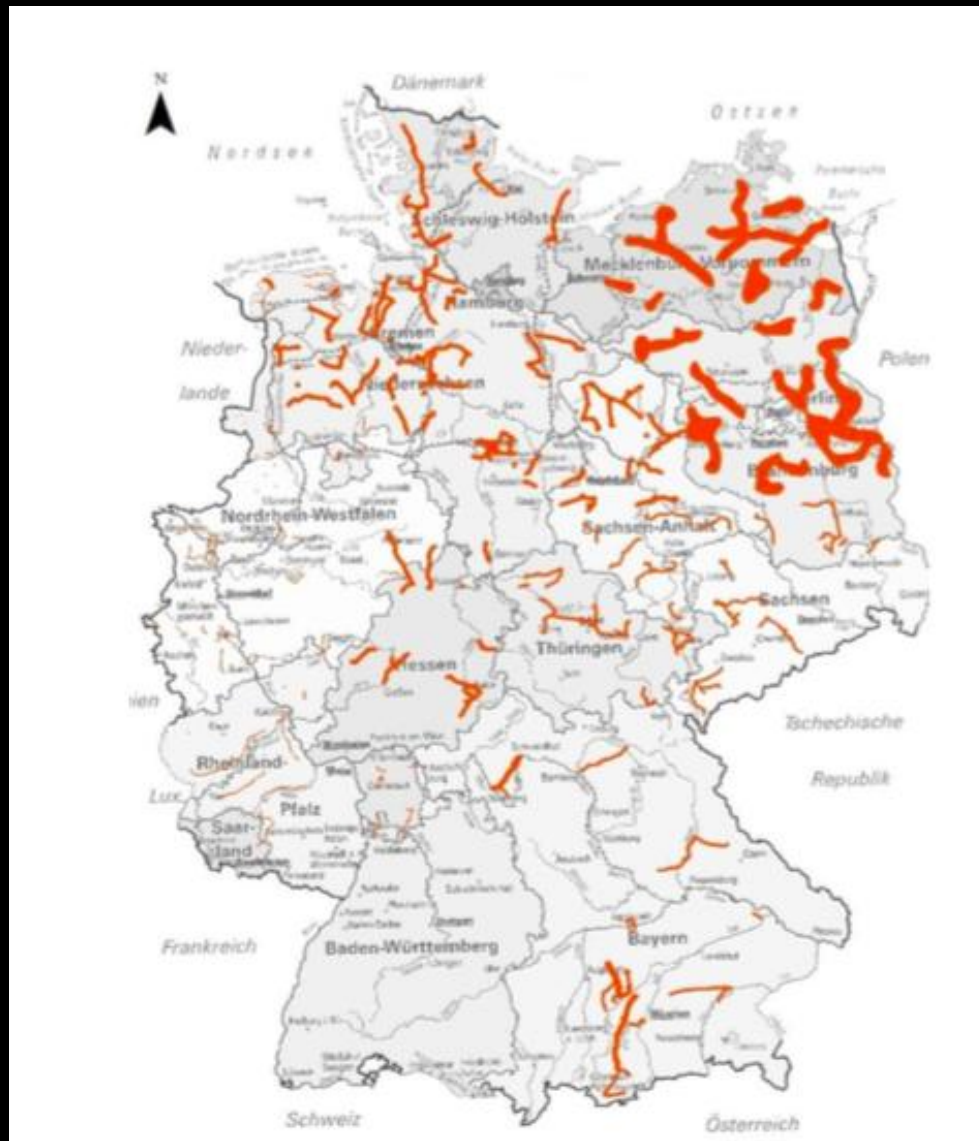
Decentralised – time consistent- market based – transparent solution for charging-discharging

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

Simulation results for PJM



German example of DSO's issues





MITEi
MIT Energy Initiative

UTILITY OF THE FUTURE

An MIT Energy Initiative response
to an industry in transition

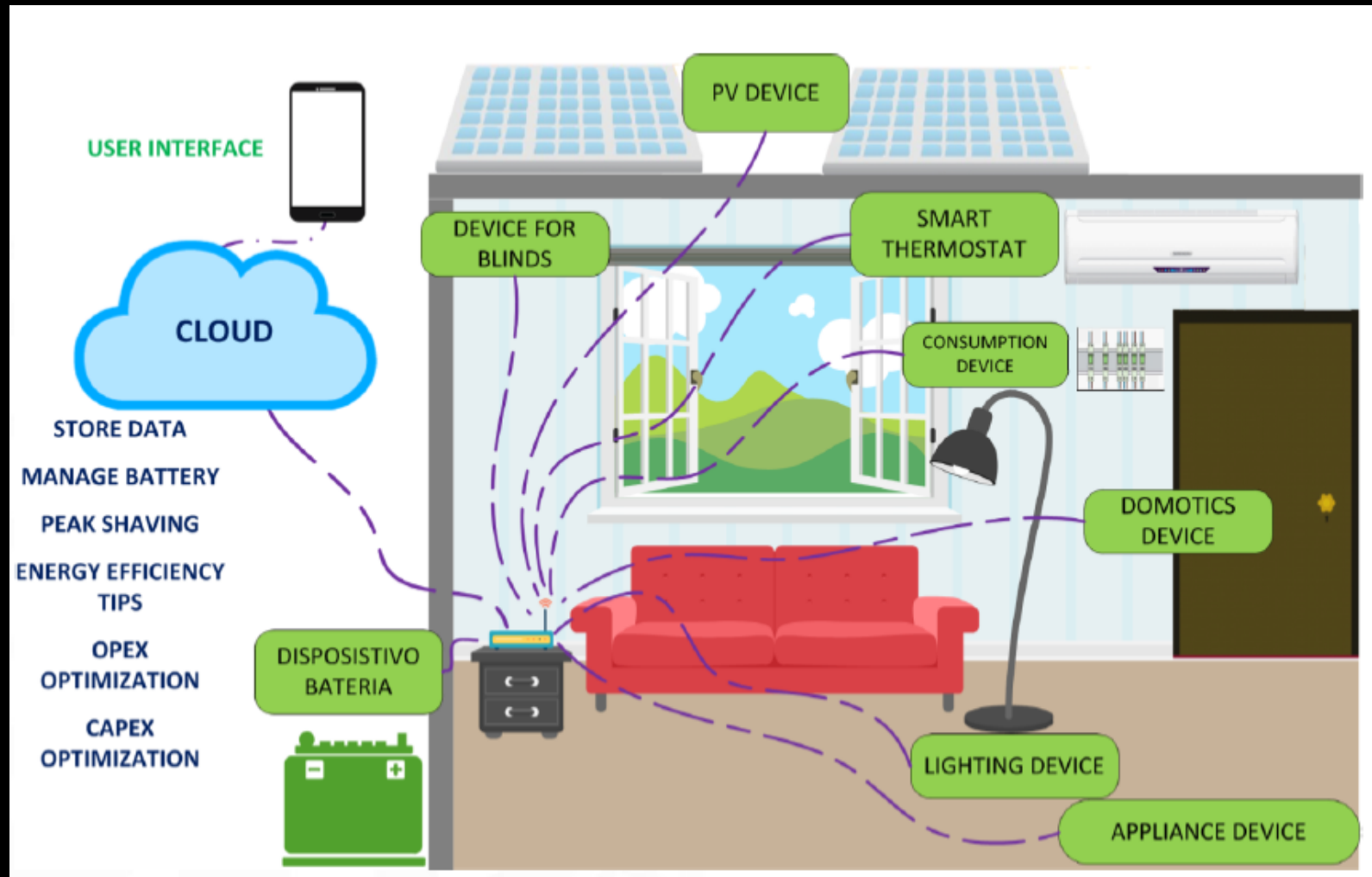
In collaboration with IIT-Comillas



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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-started

1.5kW V2L
PowerBox

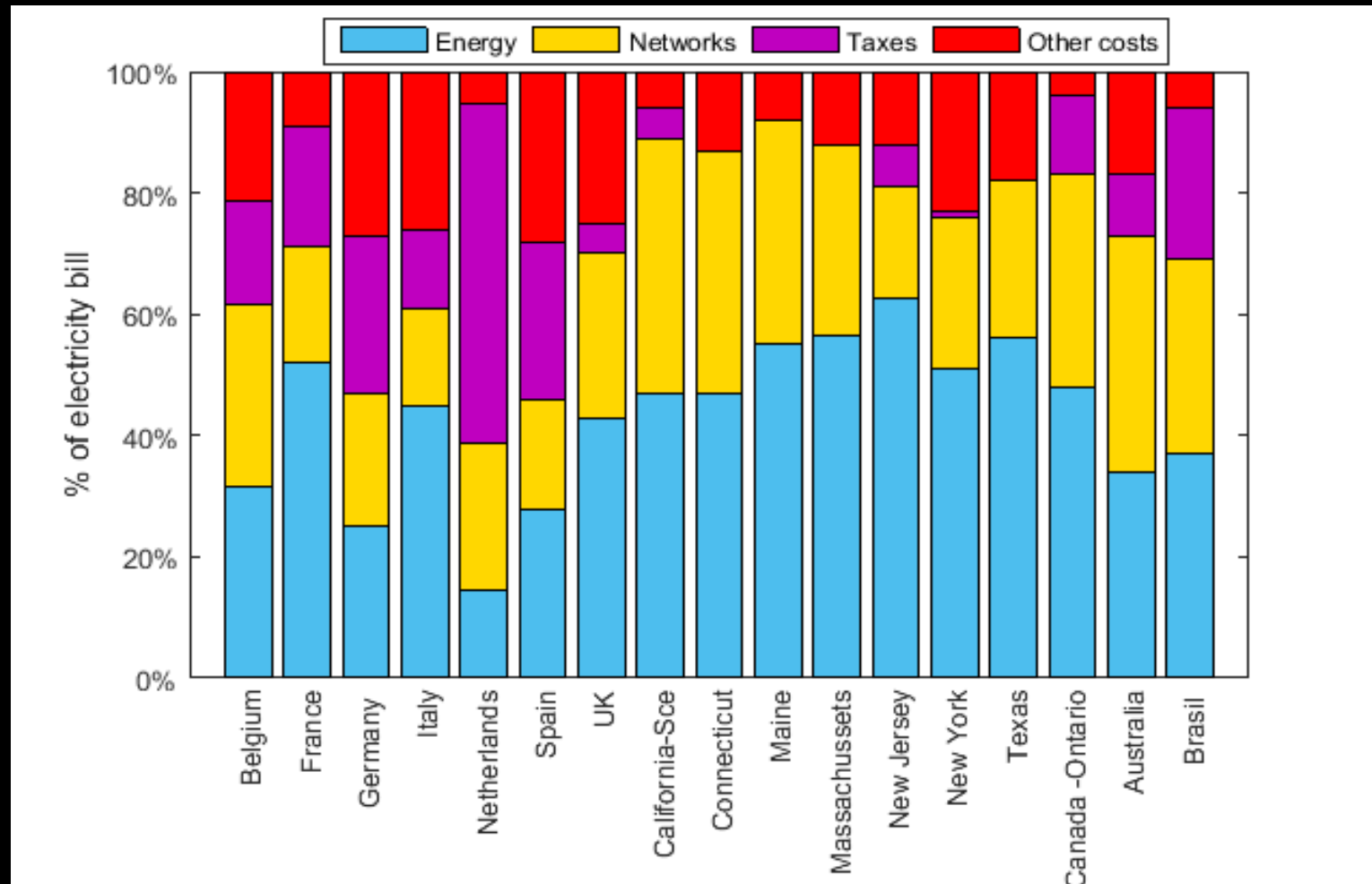


30MAY2012 press-released
**SEP2012 sales-started

6kW V2H
EV power station



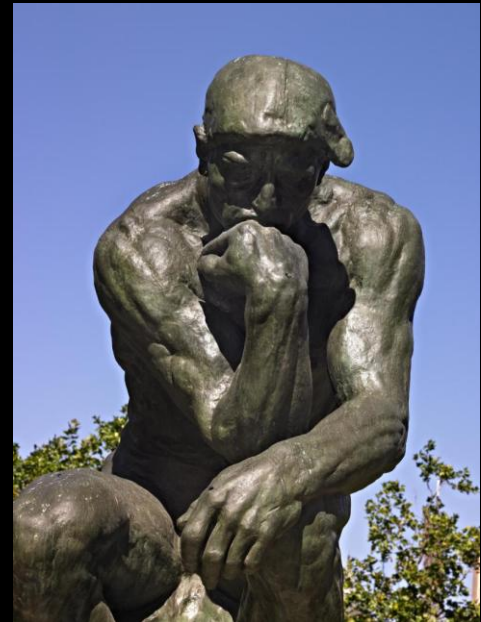
Energy-Networks-taxes-other “costs” => looking for savings with “Behind the meter solutions”



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



Selected Literature

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