

Electromobility challenges for electricity regulators

Yannick Perez

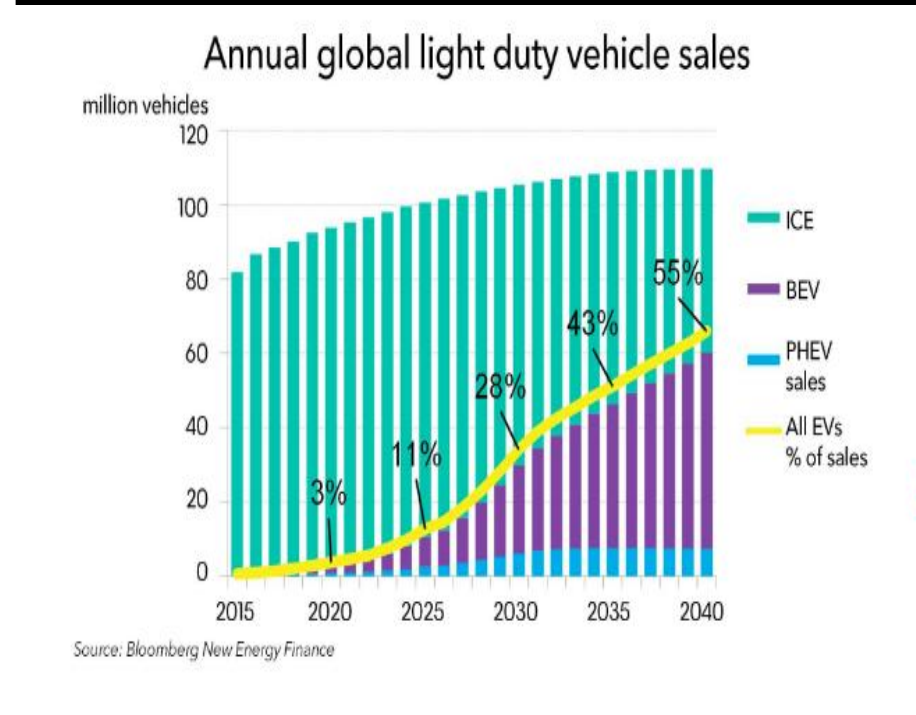
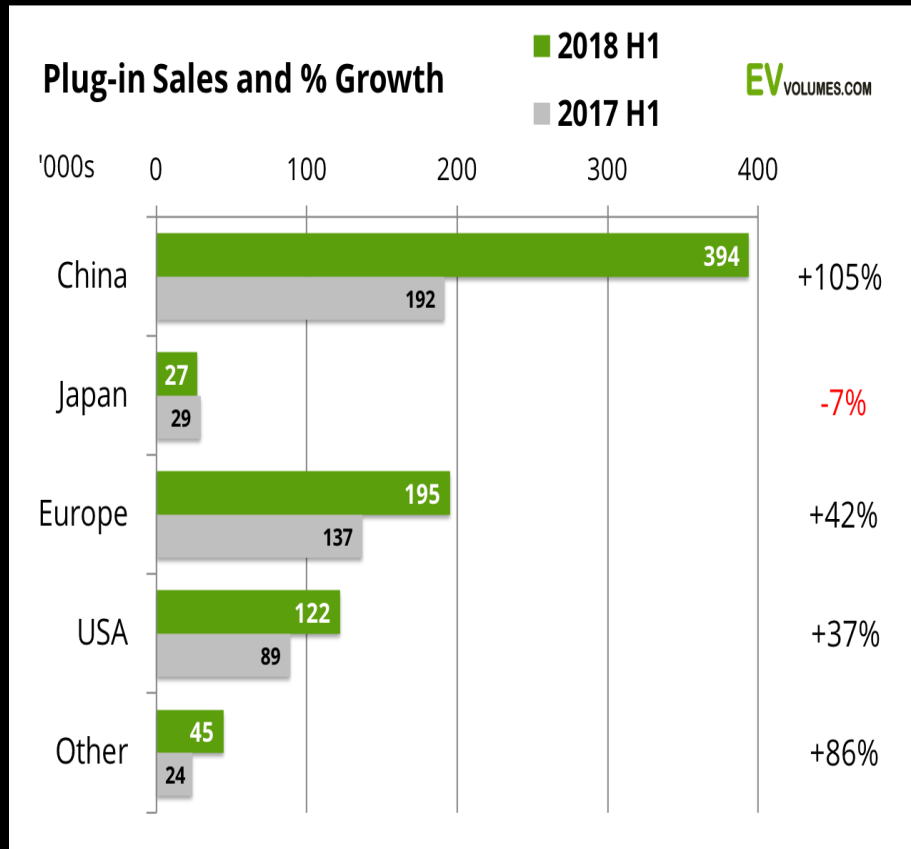
Electromobility chair holder

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EV sales for personal cars



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

Why it is starting?

Public Subsidies

Range anxiety decrease

Basic infrastructures exist

CO₂

EV and electricity eco-system problems

Why it is starting?

Public Subsidies

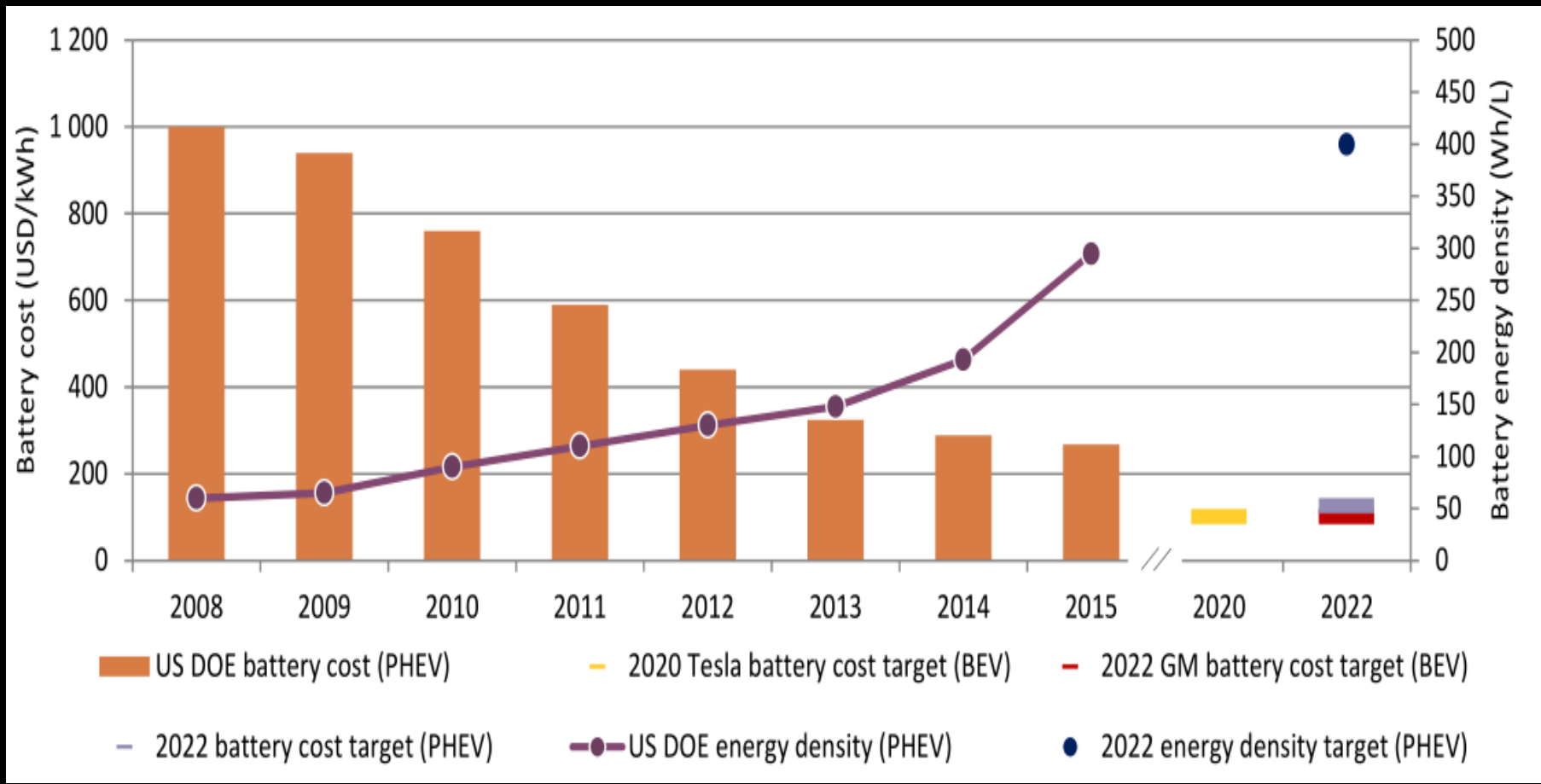
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CO₂

EV and electricity eco-system problems

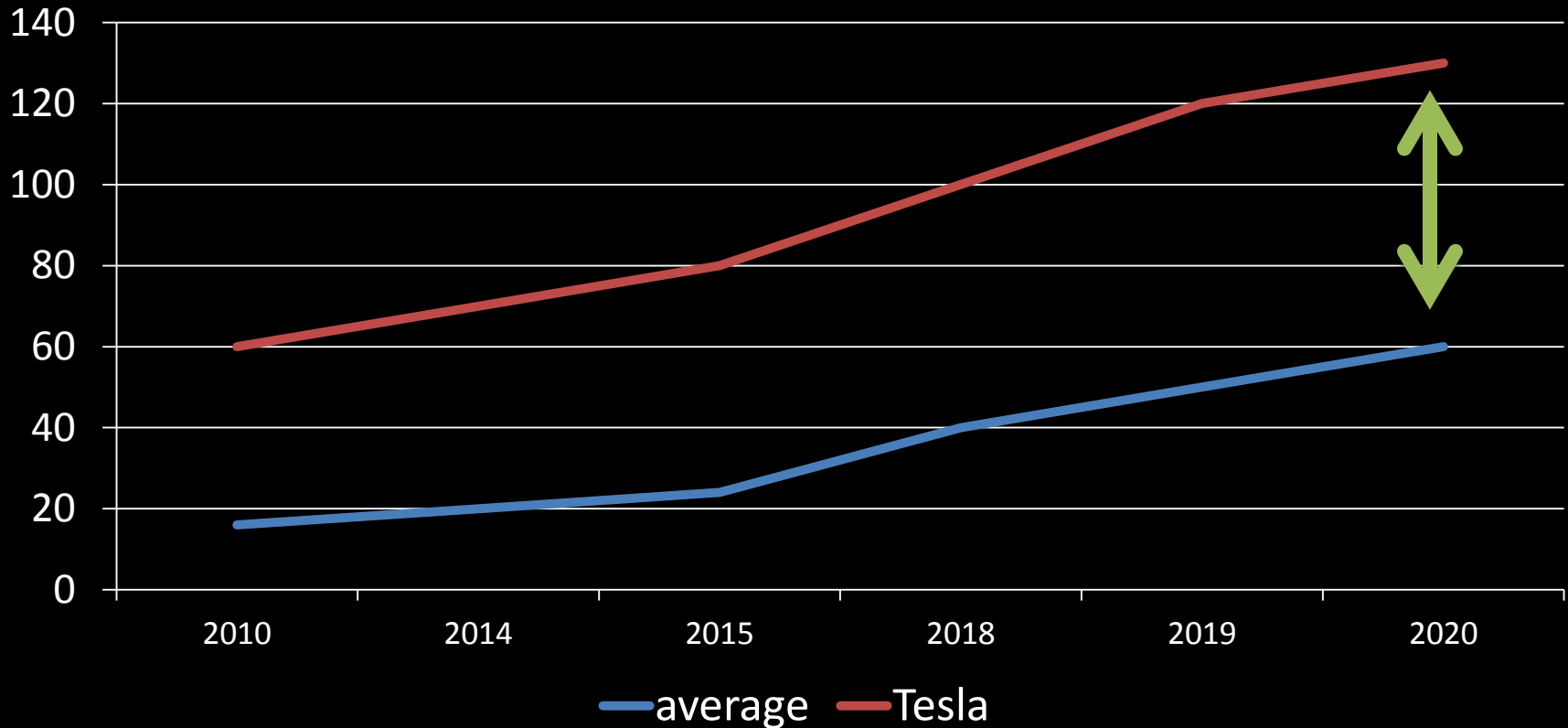
EVs enjoy a Double dynamic: Increase in ENERGY DENSITY & decrease of COST



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

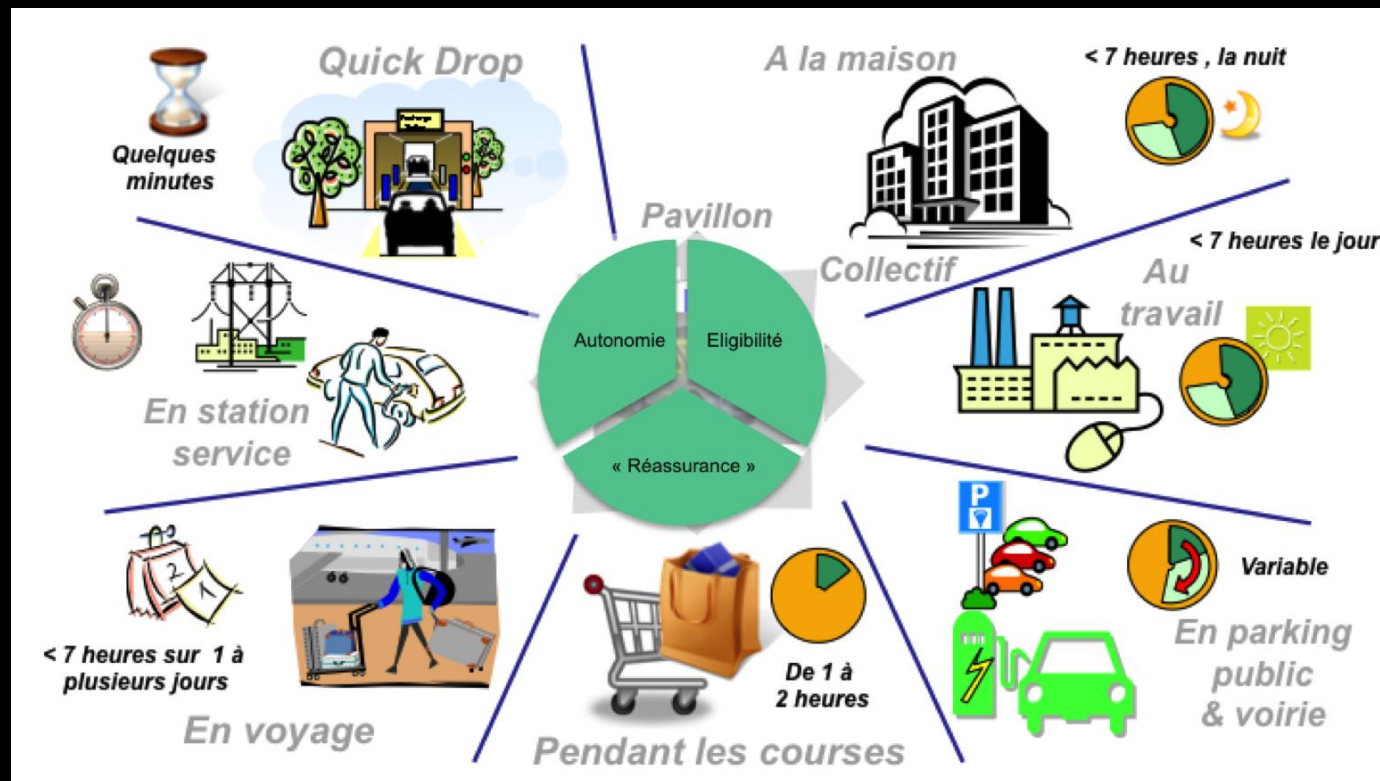


After 2020 = Cost reduction will normally used to reduce the cost of the EVs

Switching from
« range anxiety »
to
« charging anxiety »

Where I can charge?

Minimum charging infrastructures allows to start equipment



7 options to charge but 95% of the charging is made at home but a lot seems to be needed elsewhere to secure the buyer

Why it is starting?

Public Subsidies

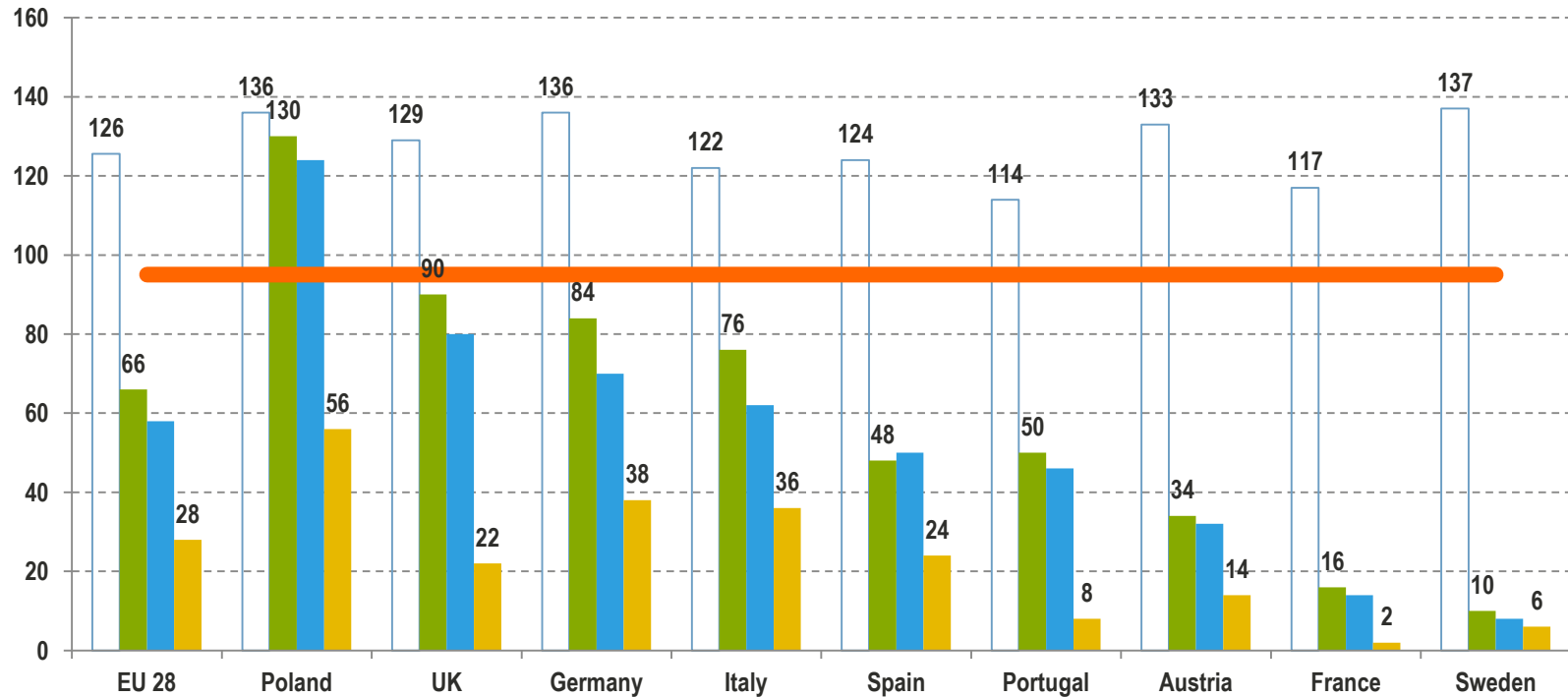
Range anxiety decrease

Basic infrastructures exist

CO2 regulation

EV and electricity eco-system problems

EVs emit less CO₂ than conventional cars fuel mix is not too CO₂ based...



□ Average of CO₂ of new cars

■ Average of CO₂ EVs (2015)

— 2021 Goal 95 gr

■ Average of CO₂ EVs (2010)

■ Average of CO₂ EVs (2035)Ref Scenario 2013

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EV and electricity eco-system problems

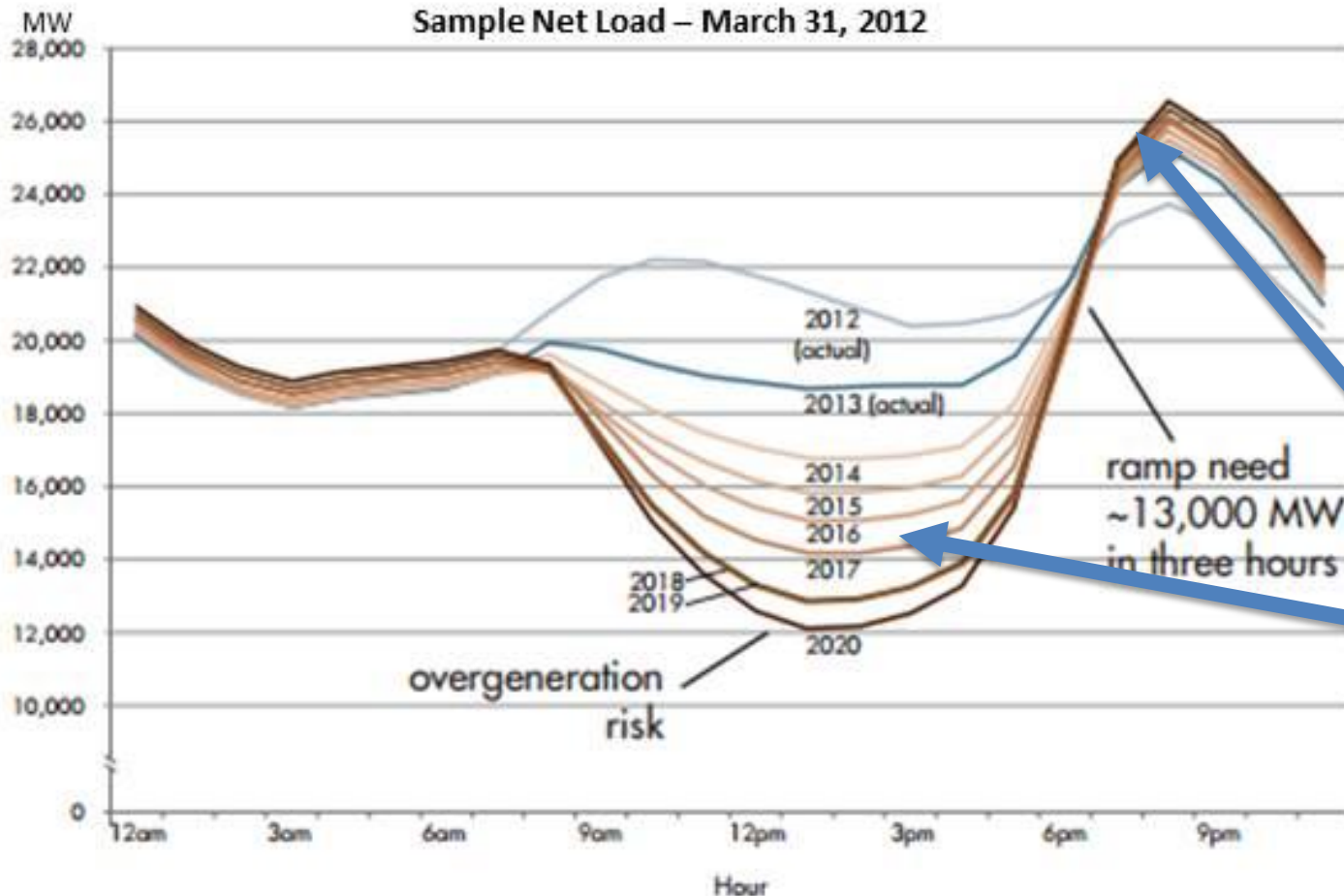
Electricity eco-system problems

TSO
DSO
Buildings
Homes



EV for I-(T) SO problems ?

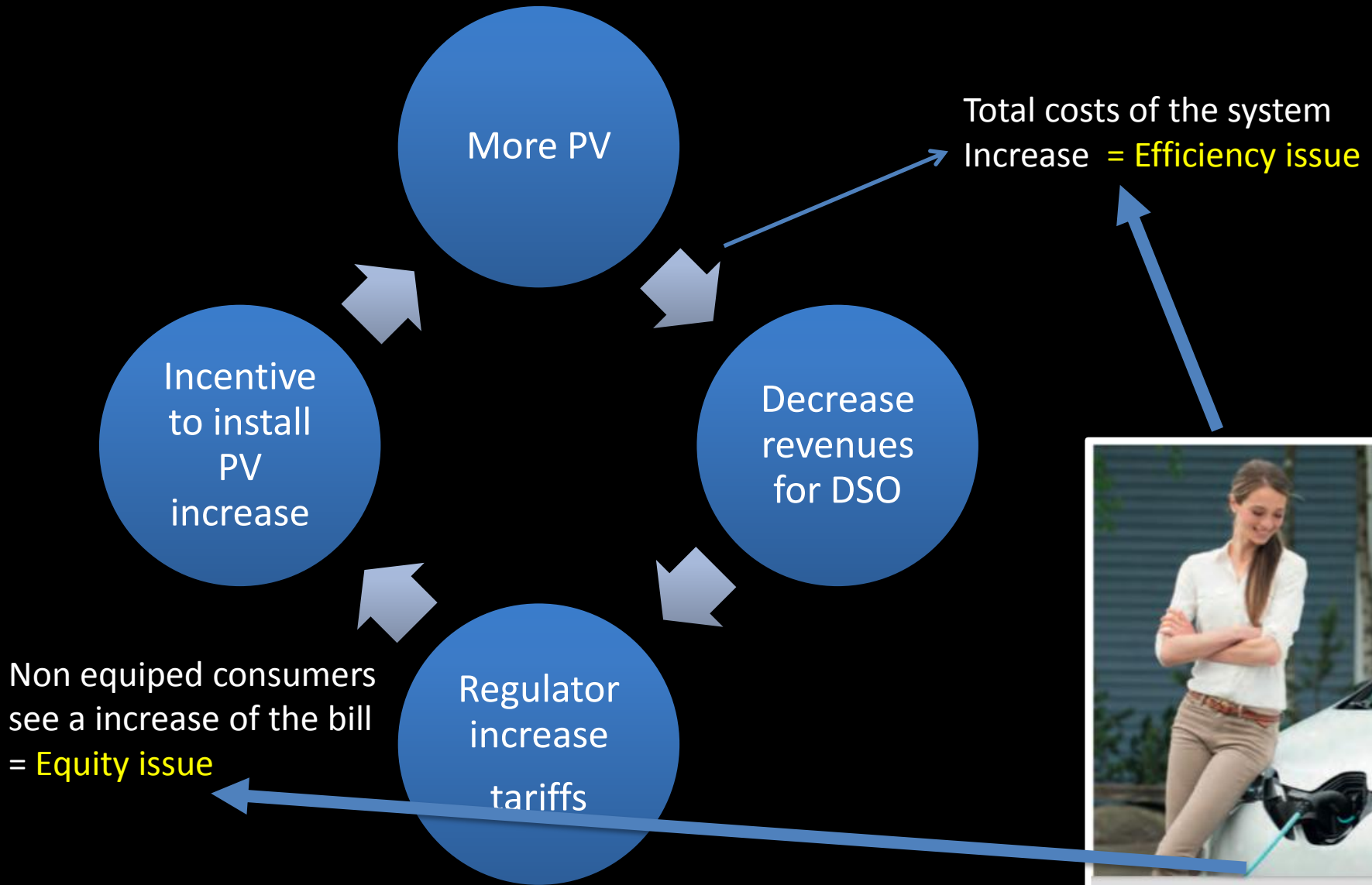
The duck curve shows steep ramping needs and overgeneration risk



(from the California Independent System Operator)



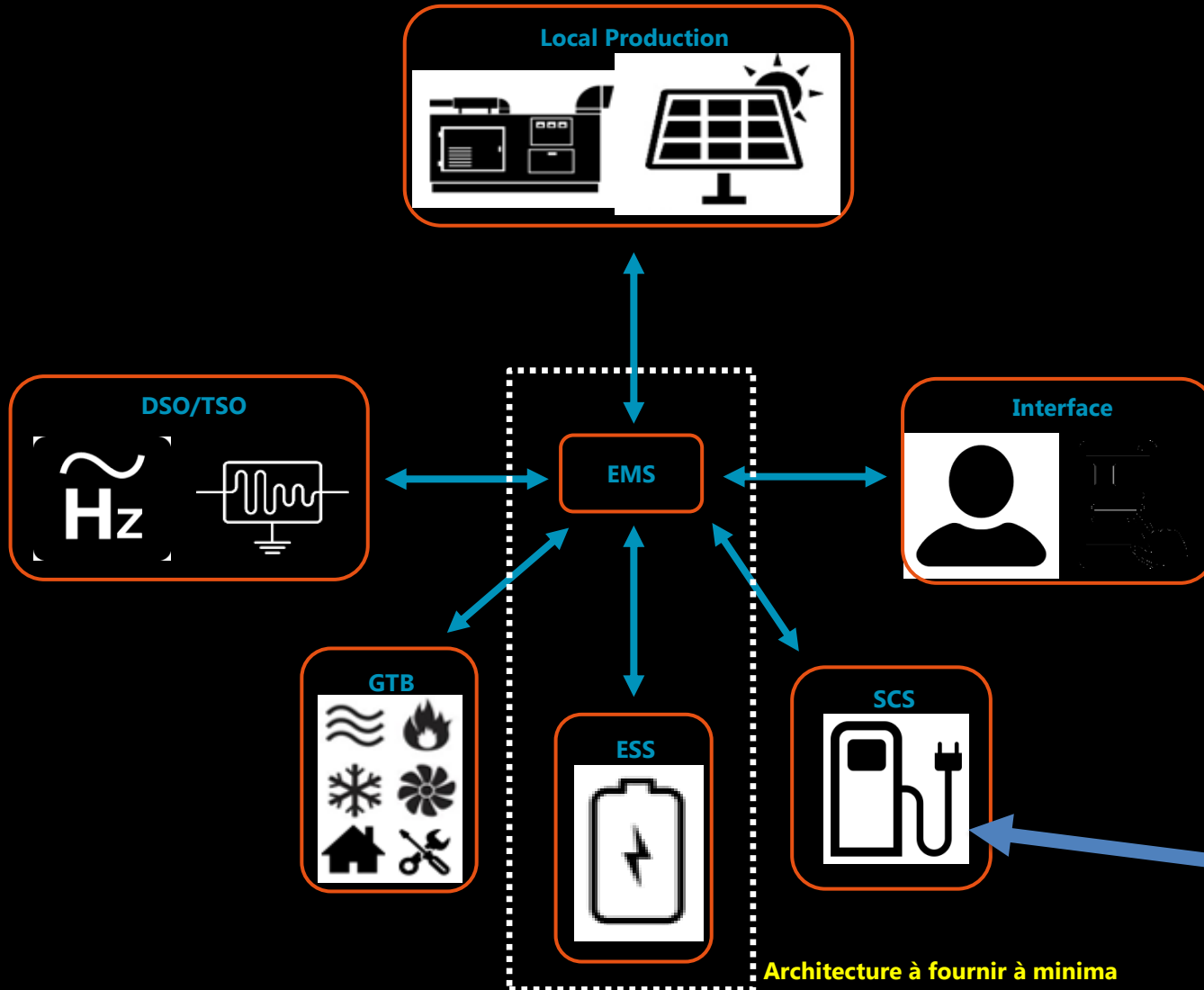
EV Reducing « Death Spiral » problem for DSO?



EV reduces cost of Building/house by potential savings in W and Wh



Require an « Energy management system »



Architecture à fournir à minima



Future Tesla house not connected to the grid

Solar Roof

The sun provides more than enough energy in just one hour to supply our planet's energy needs for an entire year. Your home can capture this free, abundant energy source through rooftop solar tiles, turning sunlight into electricity for immediate use or storage in a Powerwall battery.

STAY UPDATED



Who EVs are going to help?



Depends on regulators decisions

1. Vehicle to Transmission grid : **Need to change the rule**
 2. Vehicle to Distribution grid : **Need to change the rule**
-
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

Conclusions

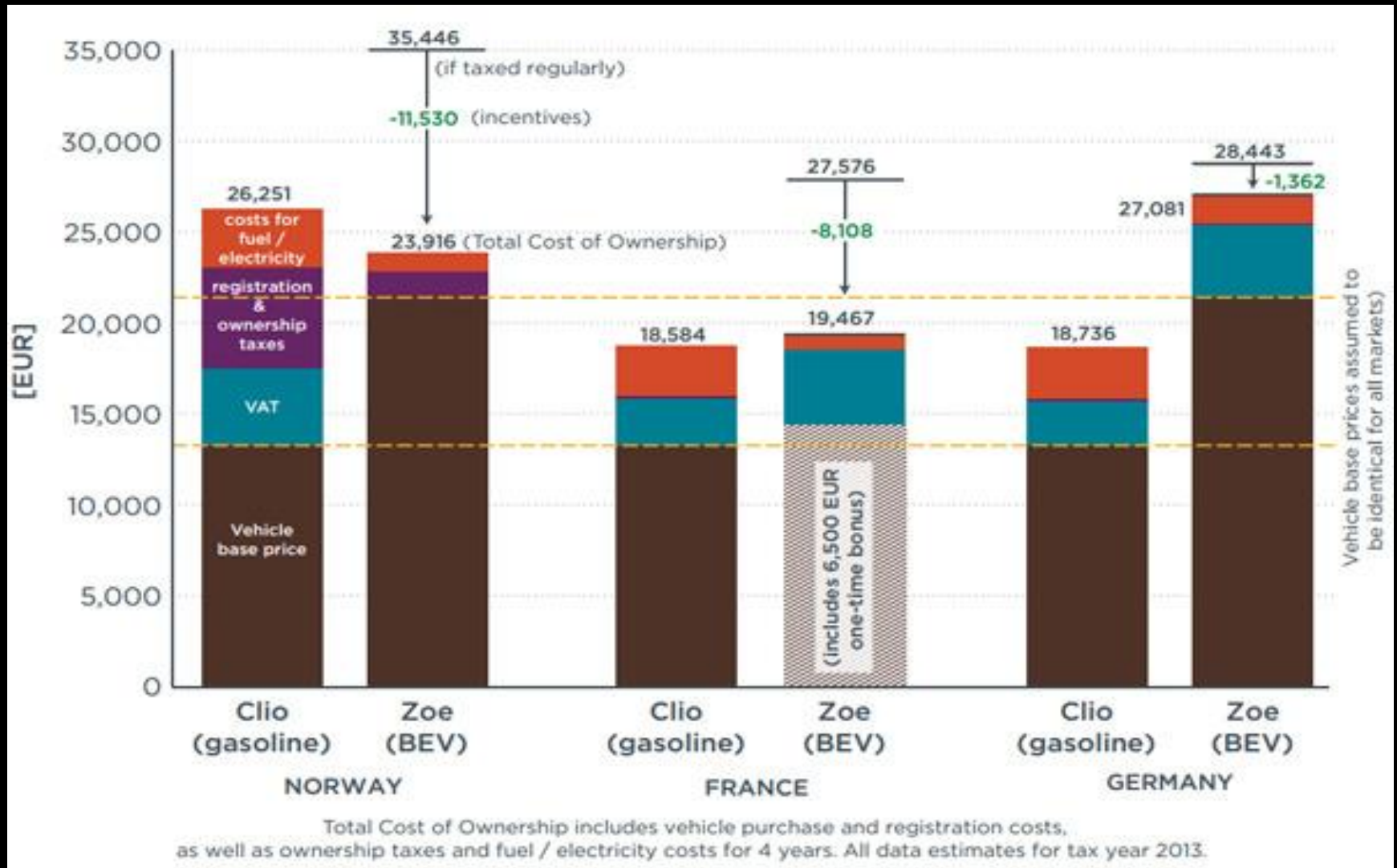
Selected Literature

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- Hoarau Quentin and Perez Yannick, 2018, *Interactions Between Electric Mobility And Photovoltaic Generation: A Review*, **RSER 94** (2018) 510–522.
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- Borne Olivier, Yannick Perez and Marc Petit 2018, *Market integration or bids granularity to enhance flexibility provision by batteries of Electric Vehicles*, **Energy Policy**, Volume 119, August 2018, Pages 140–148.
- Borne Olivier, Korte Klaas, Perez Yannick, Petit Marc and Purkus Alexandra 2018, *Barriers to entry in Frequency-Regulation Services Markets: Review of the status quo and options for improvements*, **RSER**. Volume 81, Part 1, January 2018, Pages 605–614.
- Codani Paul, Perez Yannick and Petit Marc 2016, *Financial Shortfall for Electric Vehicles: economic impacts of Transmission System Operators market designs*, **Energy**, Volume 113, pp 422-431.
- Eid Cherrelle, Codani Paul, Perez Yannick, Reneses Javier, Hakvoort Rudi, 2016, *Managing electric flexibility from Distributed Energy Resources: A review of incentives for market design*, **RSER**, Volume 64, pp 237–247.

addings

Public Subsidies

Norway France Germany



EV is efficient for

Kilométrage quotidien

Daily km too high
(more than 200 = 125 miles)

Daily km too low
Less than 40
(25 miles)

TCO of EV is lower than conventional



Kilométrage annuel

Data to “explore” for nation base charging deployment

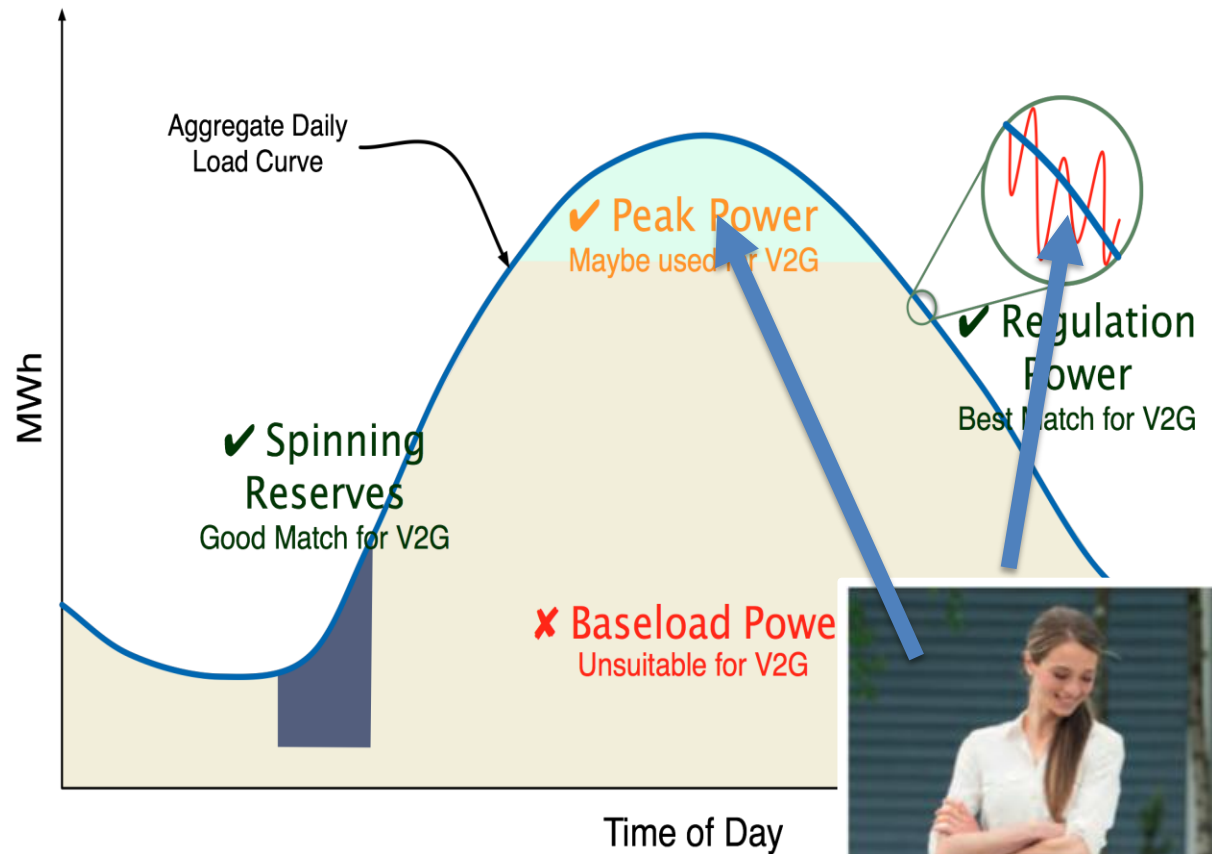
Place	Home	Work	Fast charge	Tesla Supercharger Charging stations	Ionity Charging stations
Characteristics					
Power	3-7 kW	3-22kW	22-50 kW	50-150 kW	350 kW
Time to charge	8-24h	1-3h	40 min 200km	30 min 400km	20 min 500 km
Usages	Commuting trips	Commuting trips	All usages	All usages	All usages
Investment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

And EV and electricity market?

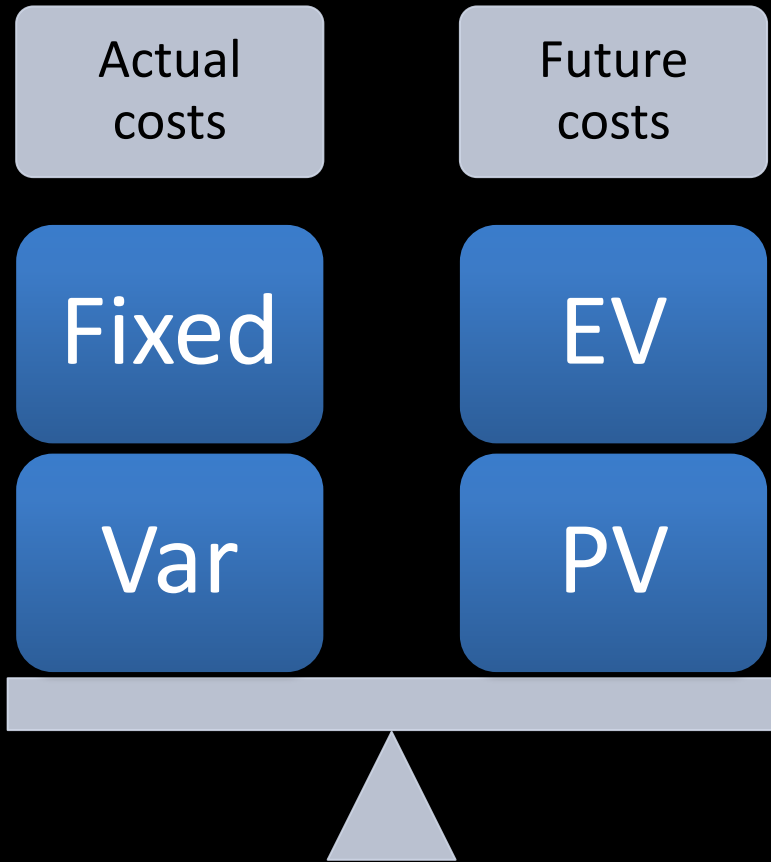
Which possible markets?

Profitable markets for EVs:

- little amount of energy, quick responsiveness
- remuneration based on availability and not utilization unless high number of EVs



Death Spiral => Who will win the race?



● BNEF (Historical) ● NREL (Projection)

