

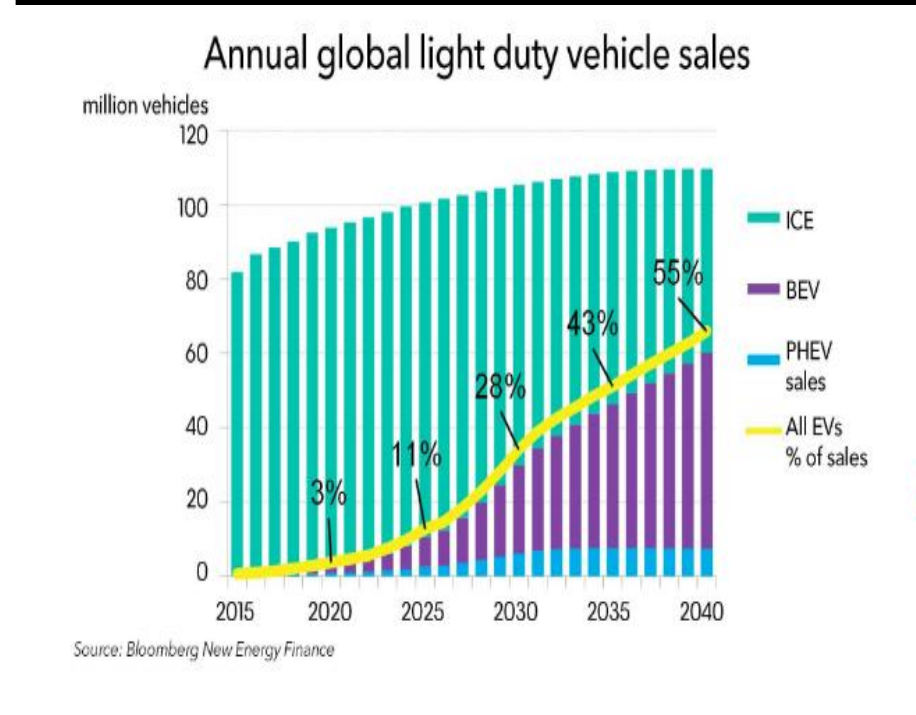
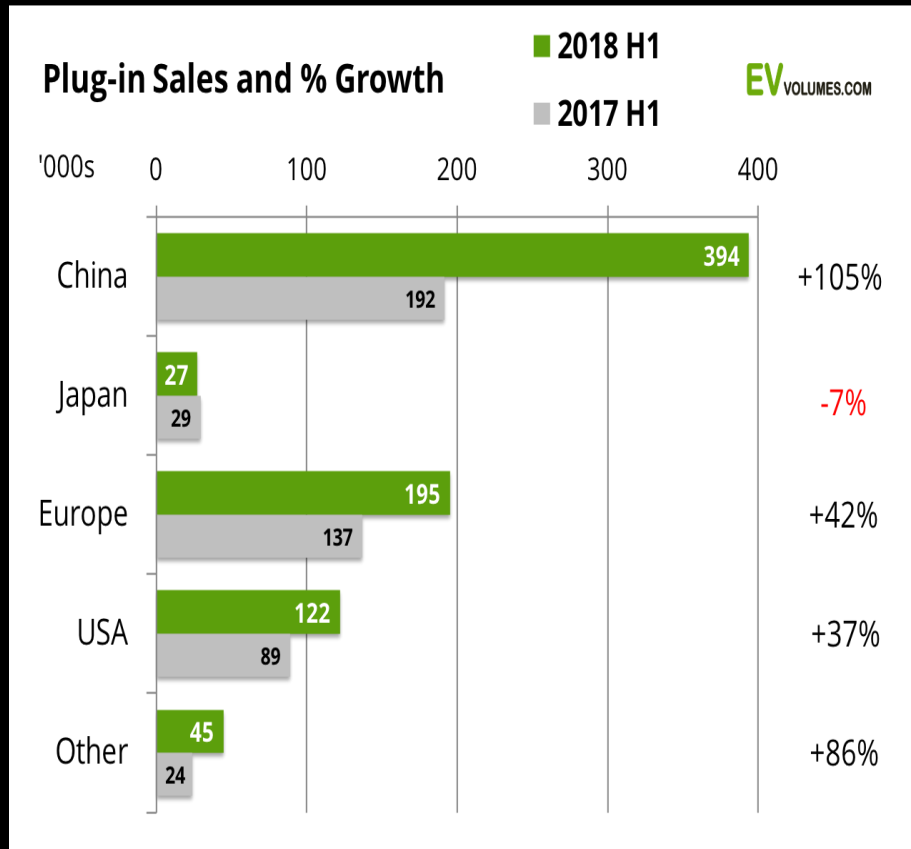
Electromobility challenges

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EV sales for personal cars



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

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

Why?

Public Subsidies

Range anxiety decrease

Basic infrastructures exist

CO₂

Complementarities with electricity grids

Why?

Public Subsidies

Range anxiety decrease

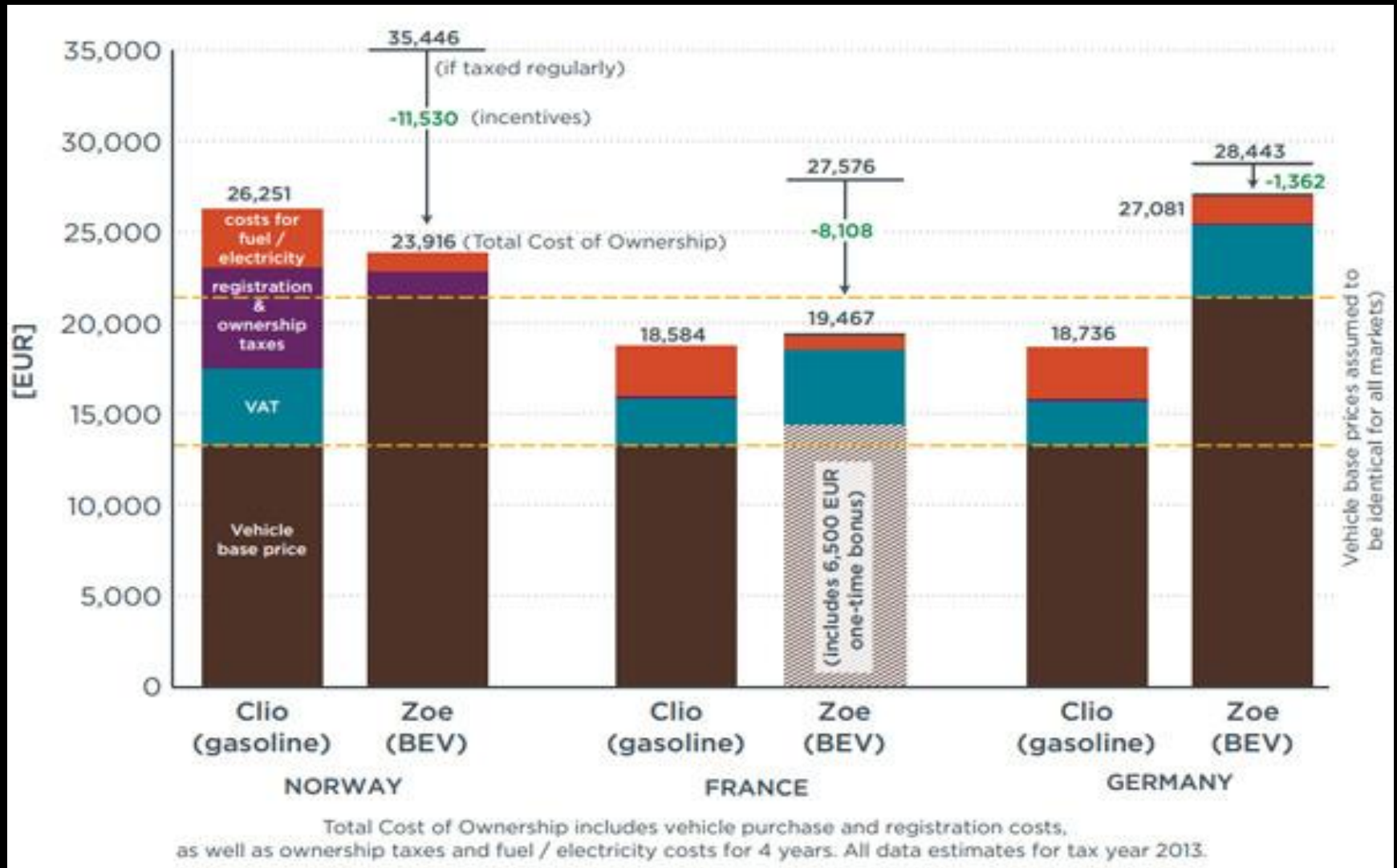
Basic infrastructures exist

CO₂

Complementarities with electricity grids

Public Subsidies

Norway France Germany



Why?

Public Subsidies

Range anxiety decrease

Basic infrastructures exist

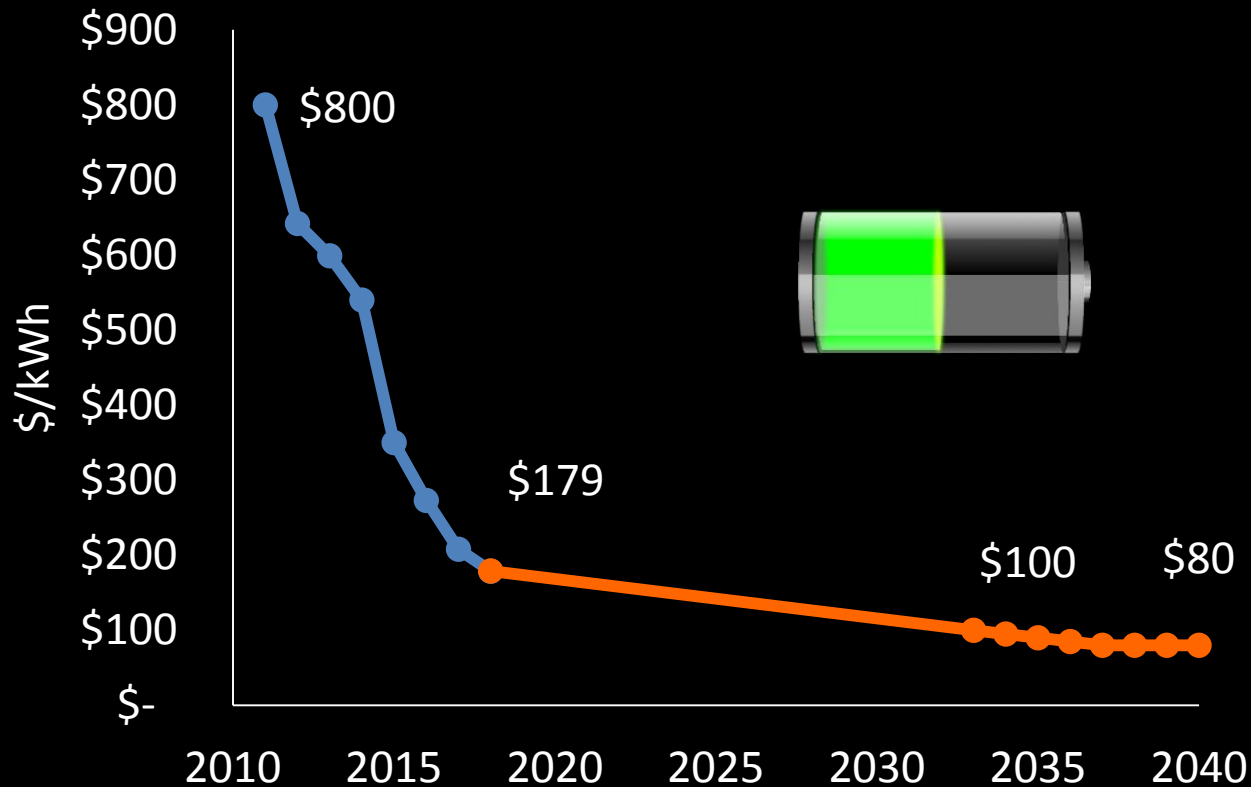
CO₂

Complementarities with electricity grids

Range anxiety decrease

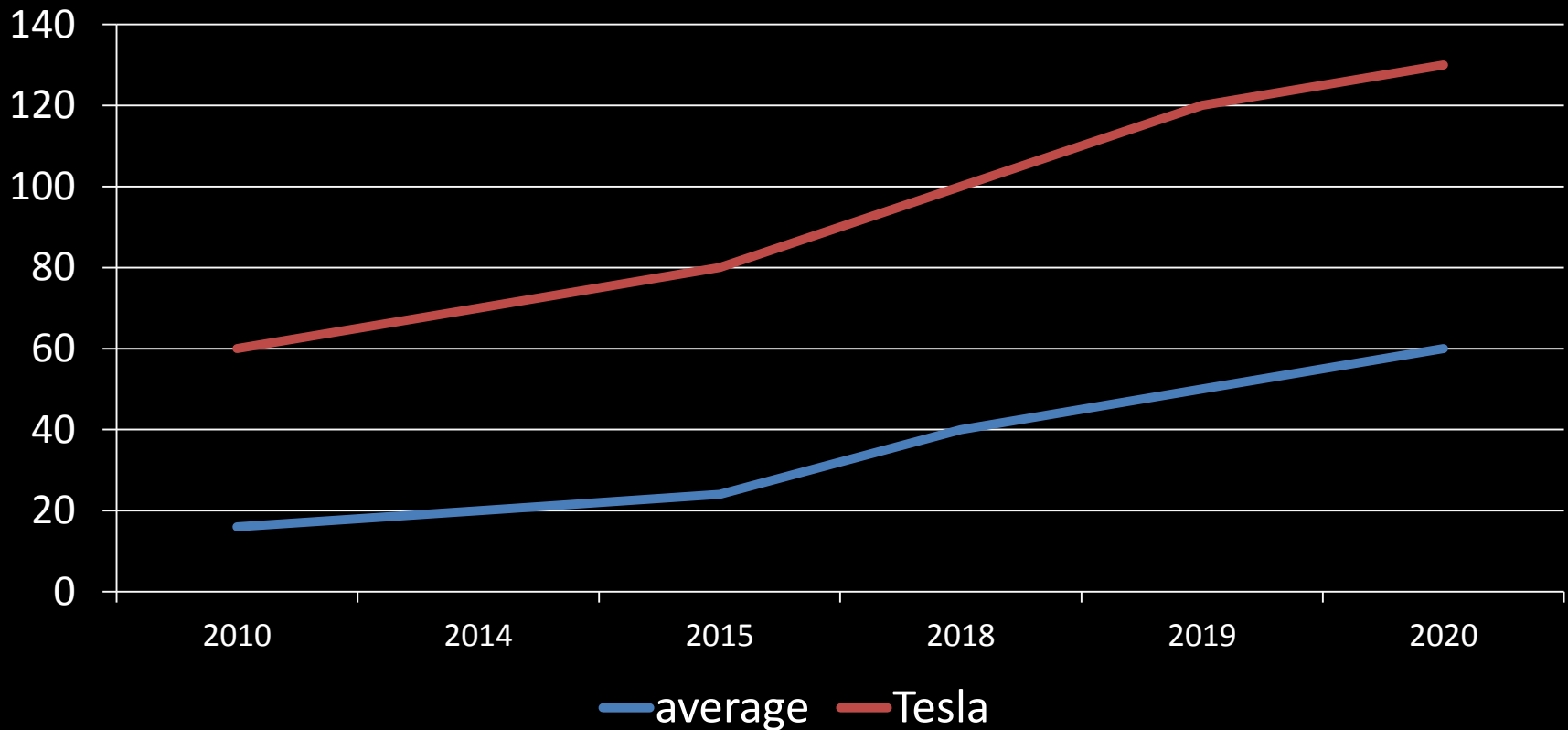
Plug-in Vehicle Battery Costs reduction

● BNEF (Historical) ● NREL (Projection)



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

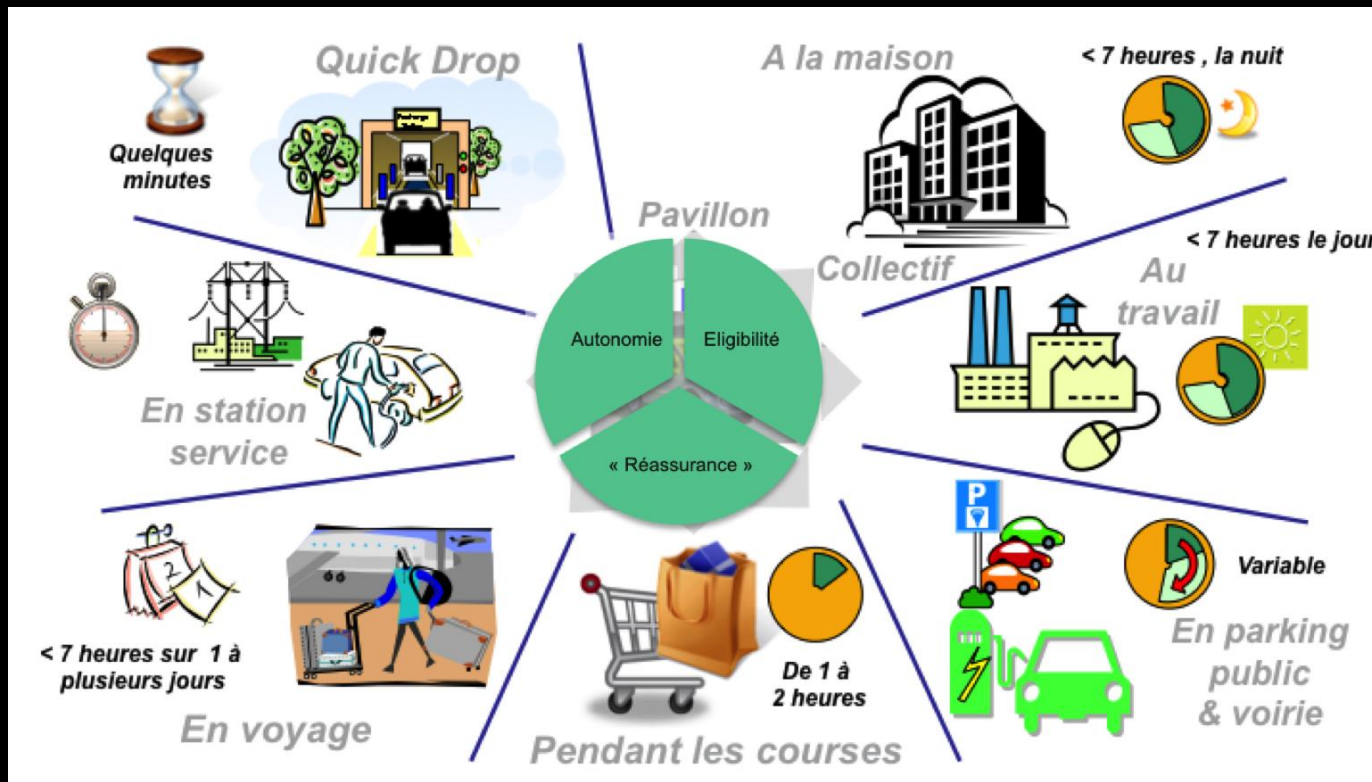
Evolution of the size of the battery in kWh per car



Less « range anxiety »
but
more « charging anxiety »

Where I can charge?

Minimum charging infrastructures allows to start equipment



Today 95% of the charging is made at home

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

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€

Why?

Public Subsidies

Range anxiety decrease

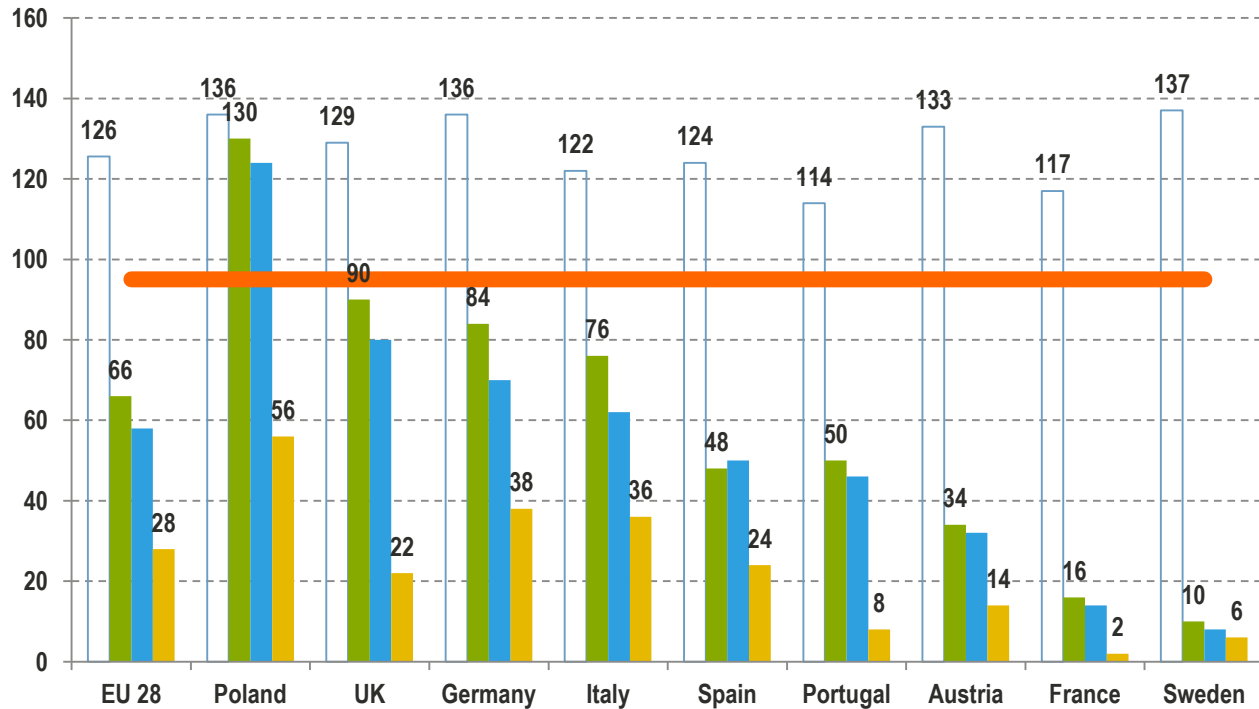
Basic infrastructures exist

CO₂

Complementarities with electricity grids

EV and CO2

EVs emit less CO₂ than conventional cars if...



□ 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

- With the 2010 carbon intensity, a typical EV emits about 66g CO₂/km
- EVs will be even cleaner in the future as the power sector continues to decarbonise by 2050

RES and EV are complements ?



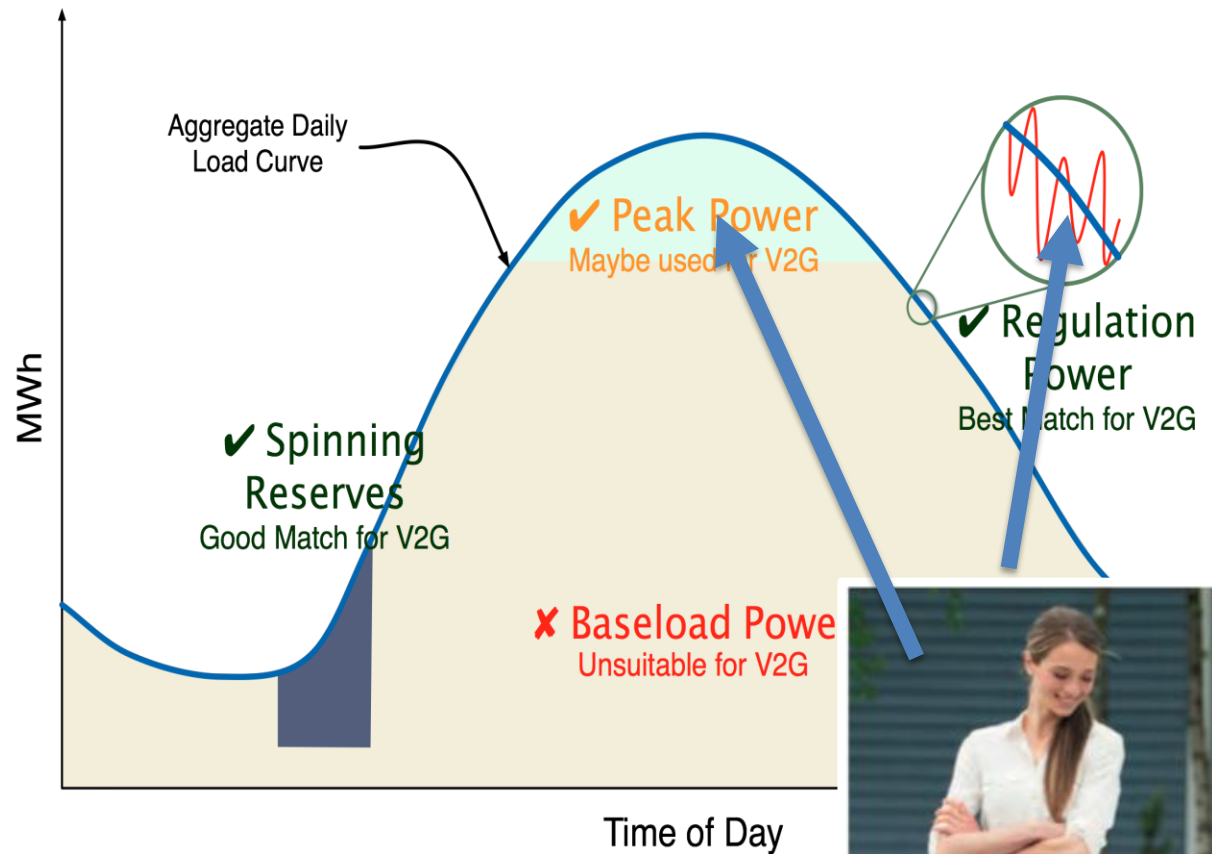
Potentially yes

And EV and electricity market?

Which possible markets?

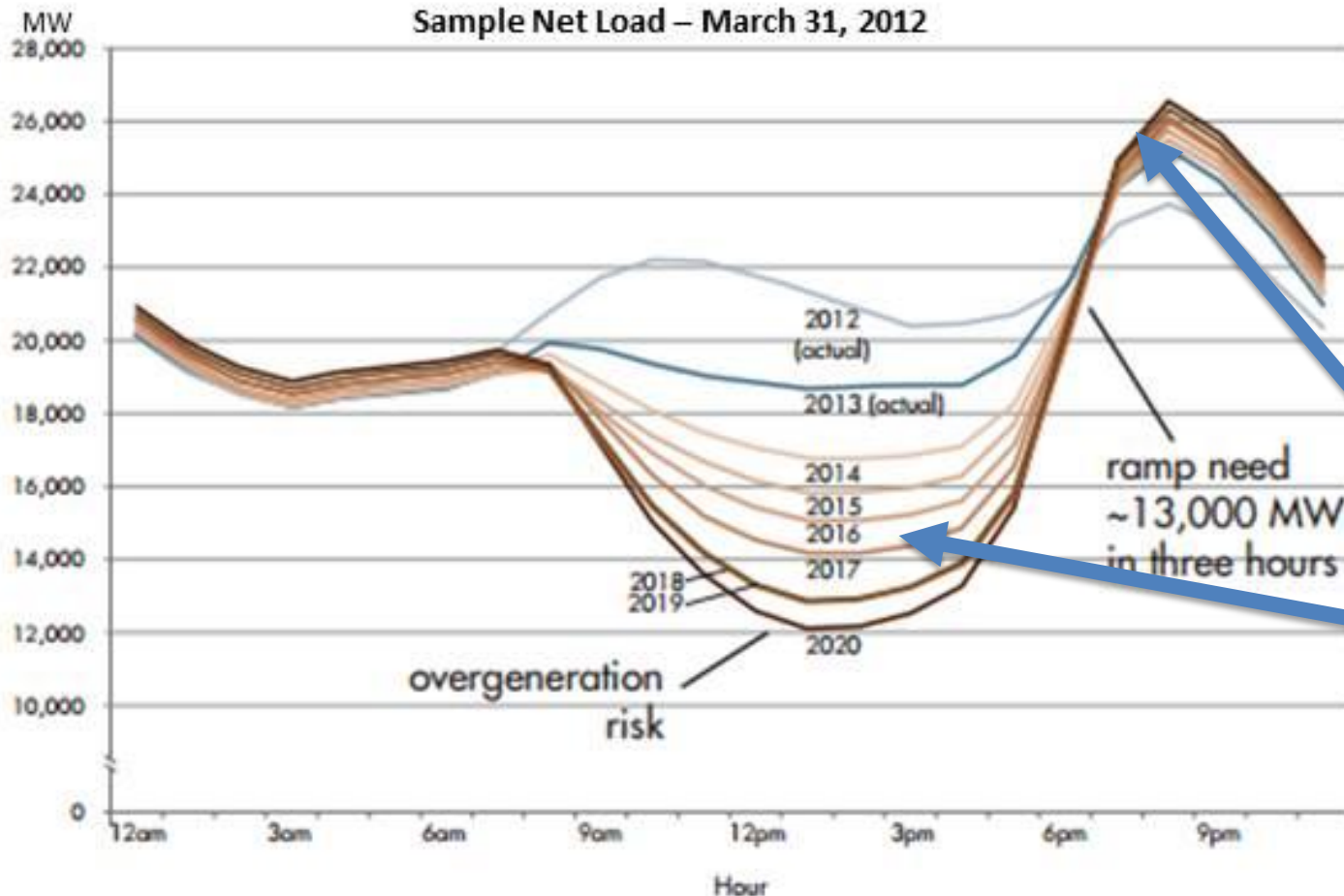
Profitable markets for EVs:

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



PV => Duck issues for TSO

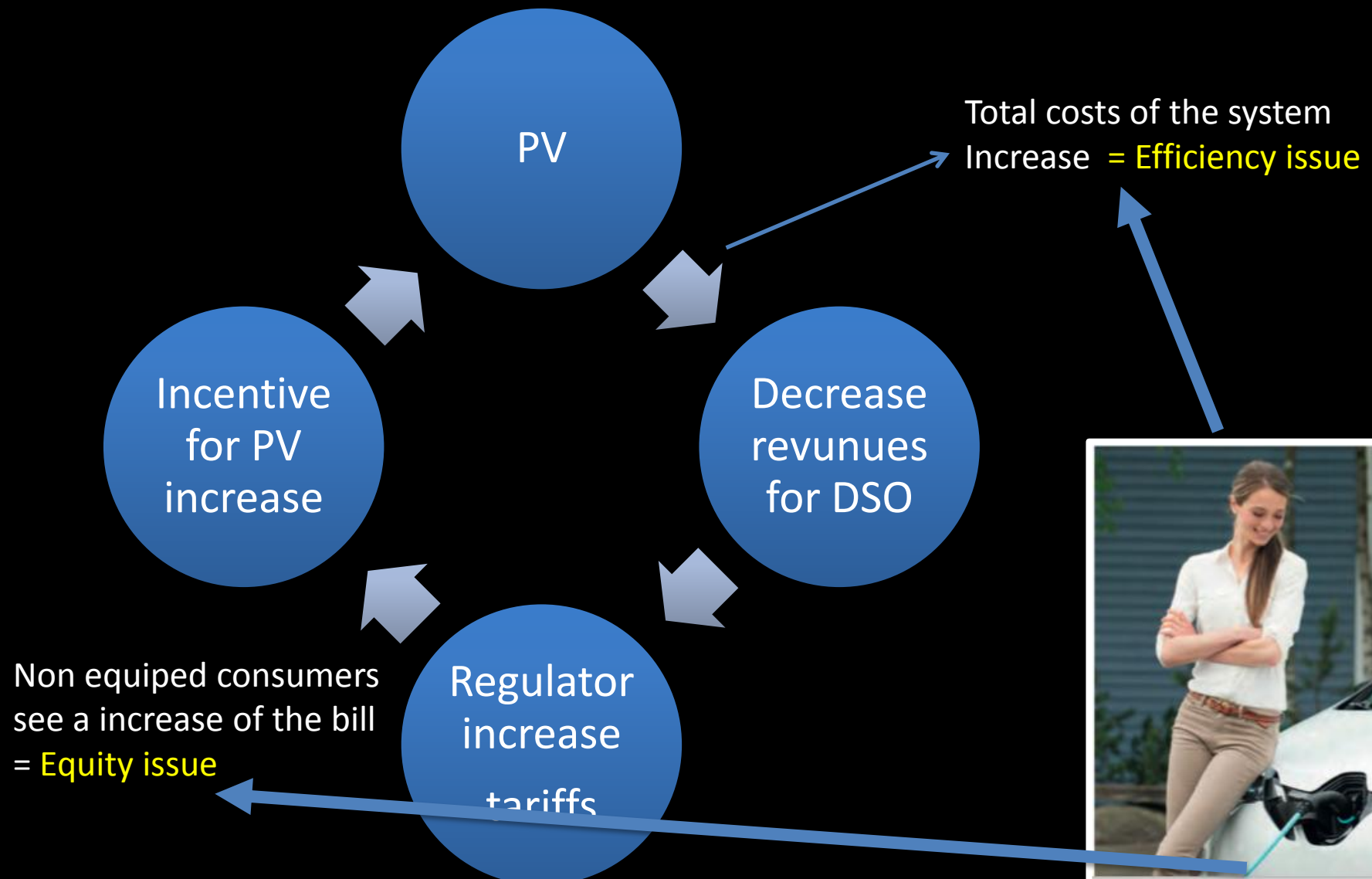
The duck curve shows steep ramping needs and overgeneration risk



(from the California Independent System Operator)



PV's « Death Spiral » for DSO



One EV powering one home : Japan or US style?

9OCT2012 press-released
27APR2012 sales-stared

1.5kW V2L
PowerBox



30MAY2012 press-released
**SEP2012 sales-stared

6kW V2H
EV power station



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

A modern house with a solar roof and a red car in the garage. The house has large windows and a covered porch. The car is parked in a two-car garage.

But

Market Rules and Grid regulations have been created for previous (polluting) technologies

=>

they **act as barrier to entry** for new tech

See Borne et al. (2018 a and b)

Conclusions

Electric vehicles are challenging

1. Vehicle to Transmission grid : if rule change
2. Vehicle to Distribution grid : if rule change
3. Vehicle to buildings = VtoB : Possible
4. Vehicle to Home = VtoH : Possible
5. Vehicle to Load = VtoL: Possible

Selected Literature

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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.
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