



Using EVs... to do what?

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Electric cars save more energy than they daily use

- Size of the battery goes from 24 to 100 kWh
- EV consumes 15-20 kWh per 100 km
- Mean Drivers Daily trips/day is between 24 km -40 km
 - EVs are very flexible resources (to store or deliver electricity) if needed = **Distributed Storage Services (DSS)**
 - Arbitrage** between private use (house-building) or other flexibility buyers of DSS (Energy markets / grids)

Arbitrage

Between...

16 services

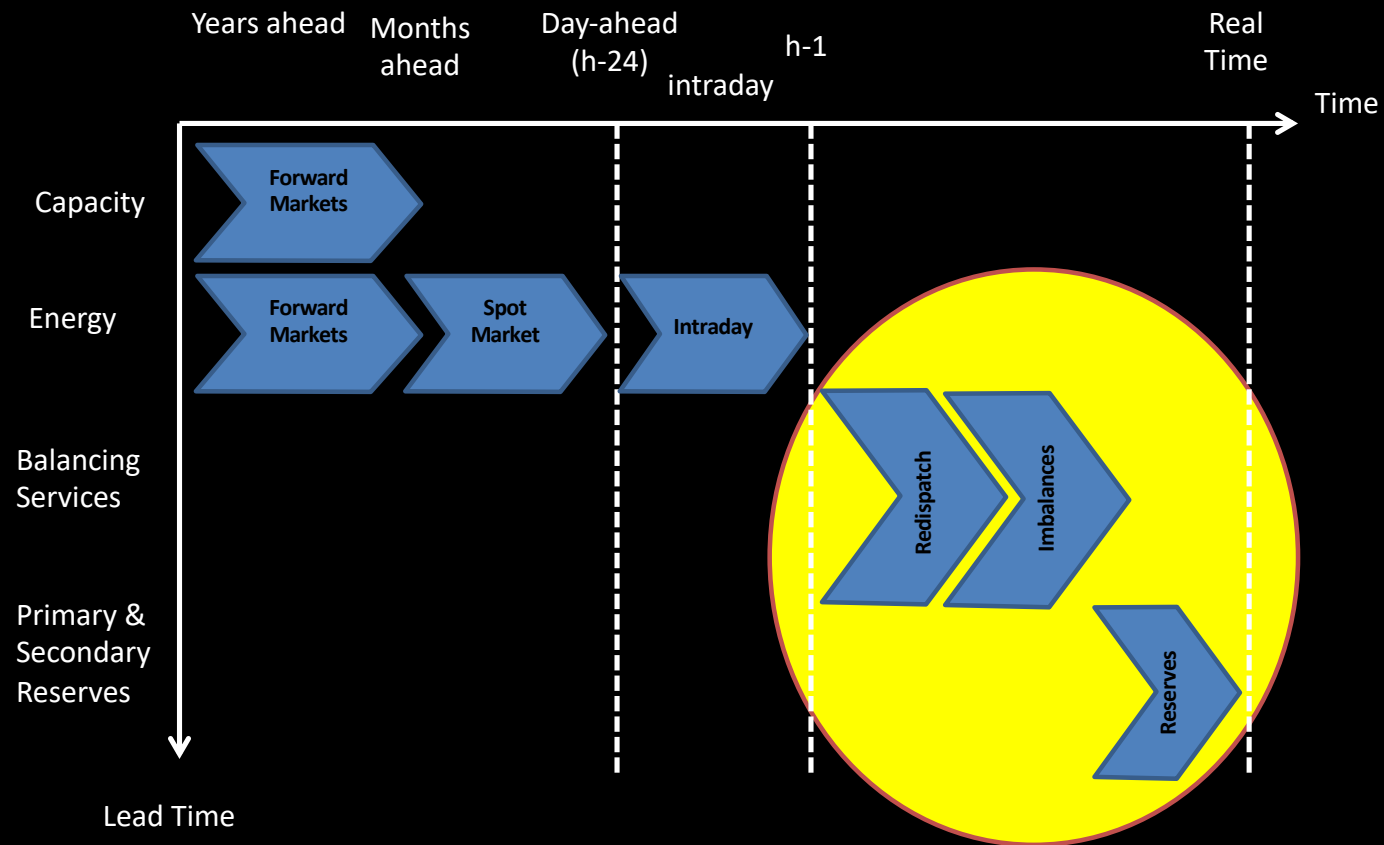
A	Wholesale	Demand Response—Wholesale	Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand
		Energy Arbitrage	Allows storage of inexpensive electricity to sell at a higher price later (includes only wholesale electricity purchase)
		Frequency Regulation	Provides immediate (4-second) power to maintain generation-load balance and prevent frequency fluctuations
		Resource Adequacy	Provides capacity to meet generation requirements at peak loading in a region with limited generation and/or transmission capacity
		Spinning/Non-Spinning Reserves	Maintains electricity output during unexpected contingency event (e.g., an outage) immediately (spinning reserve) or within a short period (non-spinning reserve)
B	Utility	Distribution Deferral	Provide extra capacity to meet projected load growth for the purpose of delaying, reducing or avoiding distribution system investment in a region
		Transmission Deferral	Provide extra capacity to meet projected load growth for the purpose of delaying, reducing or avoiding transmission system investment
		Demand Response—Utility	Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand
C	Customer	Bill Management	Allows reduction of demand charge using battery discharge and the daily storage of electricity for use when time of use rates are highest
		Backup Power	Supplies power reserve for use by Residential and Commercial users when the grid is down

Who need flexible electricity storage?
Who would buy flexibility provision?
Who need to be decarbonized?

1. Electricity markets
2. Electricity grids (TSO or DSO)
3. Buildings/ Houses
4. Car manufacturers

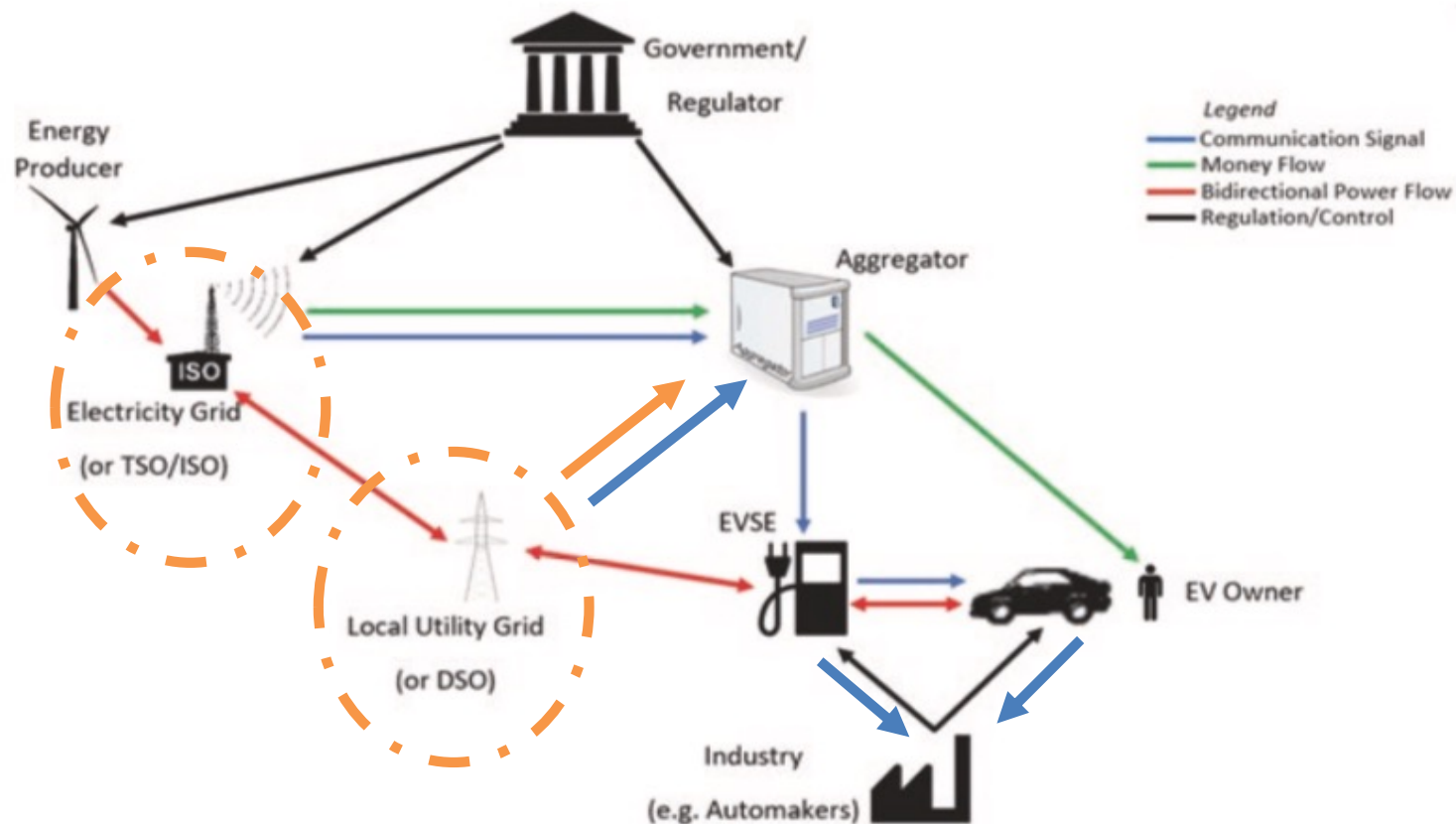
1. Electricity Markets

ELECTRICITY MARKETS ORGANIZATION and EV Fleet



And best adapted grid services for ev fleets

Reg : market friendly and transparent rules



But
Electricity wholesale market rules
are for existing technologies
Not for **Distributed Storage Services**

Market rules are not really ready for EVs

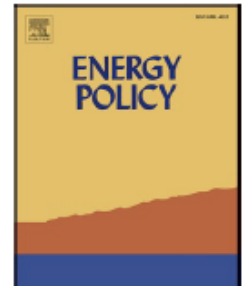
Energy Policy 137 (2020) 111136



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Vehicle-to-Everything (V2X) energy services, value streams, and regulatory policy implications

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2. For Electricity grids (TSO-DSO)

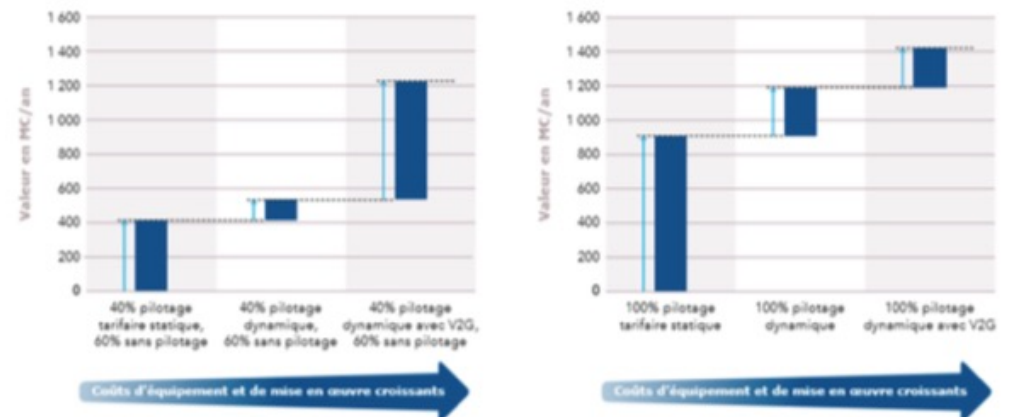
Example: TSO potential need for EV flexibility is large (manage Renewables)

V2G value could be worth £3.5Bn/year in UK by 2040
(source: Innovate UK)

Scenario		Energy system benefit (£bn/yr)	
		Smart Charger	V2G
	Burning platform (assumes 50% participating vehicles)	0.1	0.15
	Stepping stone (assumes 50% participating vehicles)	0.5	1.4
	Future survival (assumes 80% participating vehicles)	1.1	3.5

EV flexibility is > €1Bn/year market in France
(source: RTE)

Figure 18. Gisement de valeur associée au pilotage dans le scénario Crescendo haut (variantes sur le développement du pilotage de la recharge, comparées à une situation sans aucun pilotage de la recharge)



BUT

Need regulatory adaptations

TSO and EVs

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



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Same issues Distribution grids

DSS are potential local provision of flexibility
where and when it is needed

Evs and DSO: technical barriers to entry

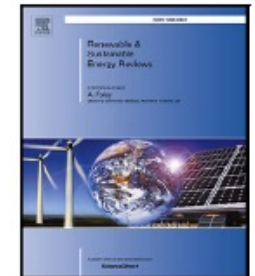
Renewable and Sustainable Energy Reviews 145 (2021) 111060



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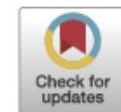
Active integration of electric vehicles into distribution grids: Barriers and frameworks for flexibility services

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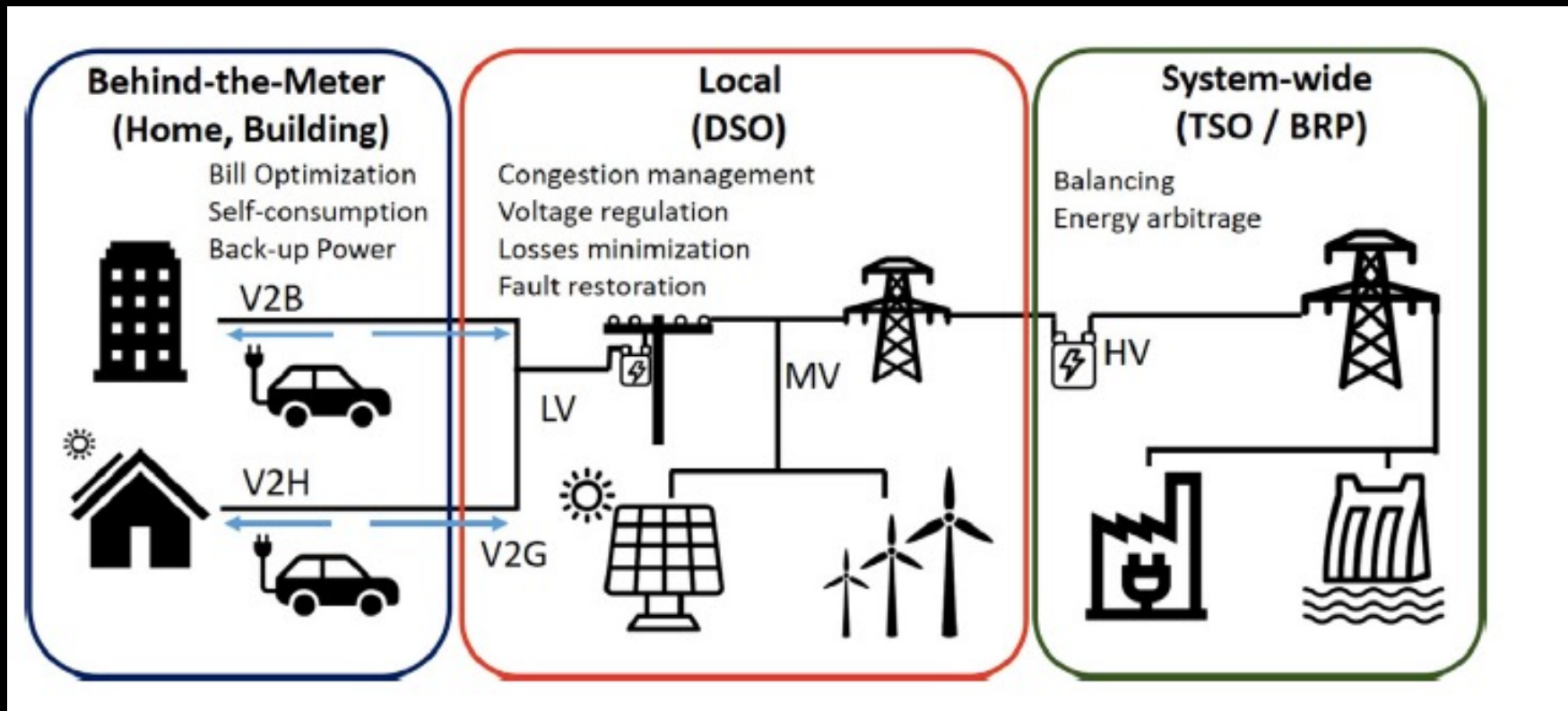
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3. For behind the meter services

Behind the meter and EVs



And the off-grid « solution » VtoL

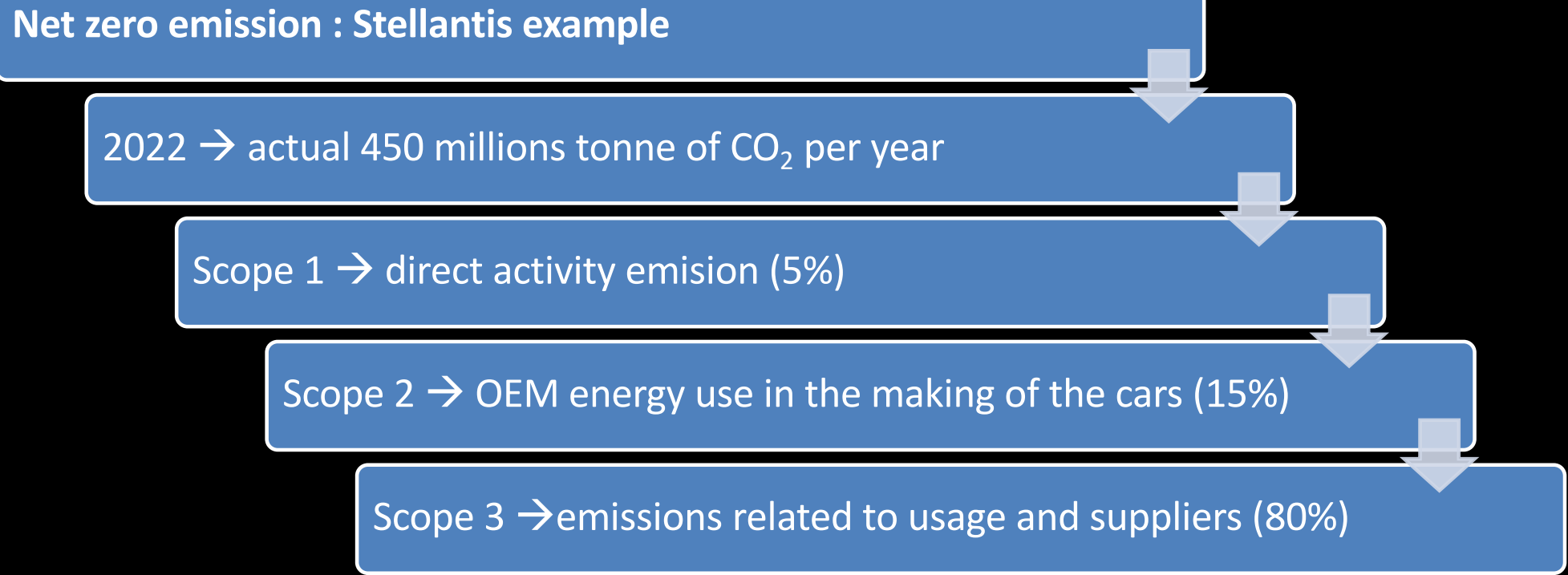
- New companies propose “off grid green” solution
 - Home Storage + Solar Roof + EV (100kWh) < Energy + networks + taxes + sunkcosts



4. And Net zero for OEMs?

OEMs Deep decarbonization = huge challenges

Net zero emission : Stellantis example



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graph TD; A[Net zero emission : Stellantis example] --> B[2022 → actual 450 millions tonne of CO2 per year]; B --> C[Scope 1 → direct activity emission (5%)]; C --> D[Scope 2 → OEM energy use in the making of the cars (15%)]; D --> E[Scope 3 → emissions related to usage and suppliers (80%)];
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2022 → actual 450 millions tonne of CO₂ per year

Scope 1 → direct activity emission (5%)

Scope 2 → OEM energy use in the making of the cars (15%)

Scope 3 → emissions related to usage and suppliers (80%)

Who EVs are going to help?



DRIVERS and
Energy Markets / grids / Behind the meter uses / car manufacturers?

Depends on Regulatory decisions and Economic evaluation country / country

OEM net zero compatibility

- 
1. EV and Energy market: **Need to change the market rules**
 2. EV and Transmission grid : **Need to change the transmission rules**
 3. EV and Distribution grid : **Need to change the distribution rules**
 1. Vehicle to buildings = VtoB : Out of regulators scope
 2. Vehicle to Home = VtoH : Out of regulators scope
 3. Vehicle to Load (electrification) = VtoL: Out of regulators scope



Using EVs to Provide Grid electric Services: Regulatory challenges

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