



Using EVs to Provide Grid Electric Services: Regulatory Challenges

Yannick Perez

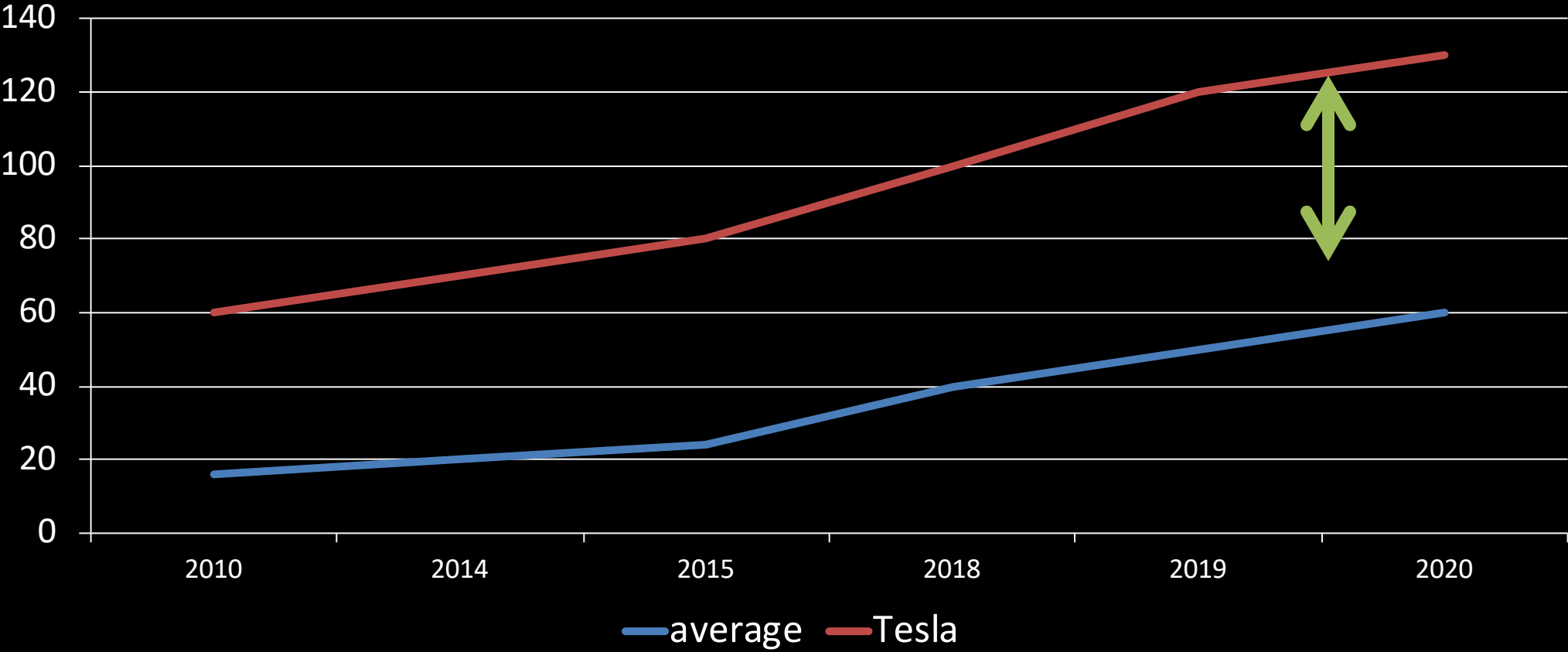
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Common strategy: more stored energy / car

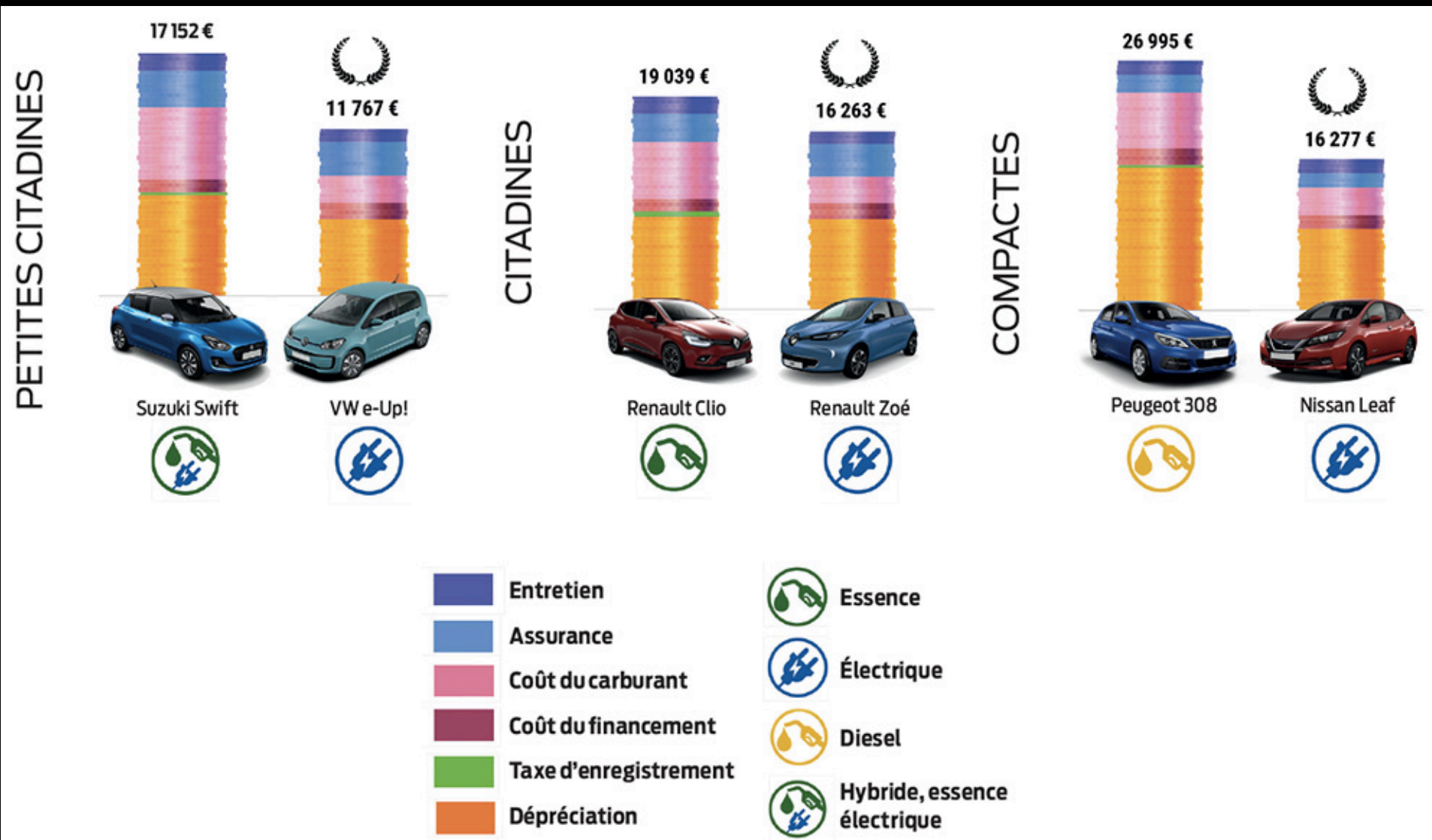
Evolution of the battery size in kWh per car



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 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)

First Goal : To make EV cheaper than ICE...



Who need flexible electricity storage?

Electricity markets

Electricity grids (TSO or DSO)

Buildings

Houses

Each (segment / service) need a specific analysis...

3 main sources

And Up to 16 services

A	Wholesale	Demand Response–Wholesale	<ul style="list-style-type: none">Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand
		Energy Arbitrage	<ul style="list-style-type: none">Allows storage of inexpensive electricity to sell at a higher price later (includes only wholesale electricity purchase)
		Frequency Regulation	<ul style="list-style-type: none">Provides immediate (4-second) power to maintain generation-load balance and prevent frequency fluctuations
		Resource Adequacy	<ul style="list-style-type: none">Provides capacity to meet generation requirements at peak loading in a region with limited generation and/or transmission capacity
		Spinning/ Non-Spinning Reserves	<ul style="list-style-type: none">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	<ul style="list-style-type: none">Provide extra capacity to meet projected load growth for the purpose of delaying, reducing or avoiding distribution system investment in a region
		Transmission Deferral	<ul style="list-style-type: none">Provide extra capacity to meet projected load growth for the purpose of delaying, reducing or avoiding transmission system investment
		Demand Response–Utility	<ul style="list-style-type: none">Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand
C	Customer	Bill Management	<ul style="list-style-type: none">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	<ul style="list-style-type: none">Supplies power reserve for use by Residential and Commercial users when the grid is down

Rules on the Electricity wholesale market
are for existing technologies

Not for **Distributed Storage Services**

Electricity markets and Evs

Energy Policy 119 (2018) 140–148



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Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol



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

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For the Utility (TSO-DSO)

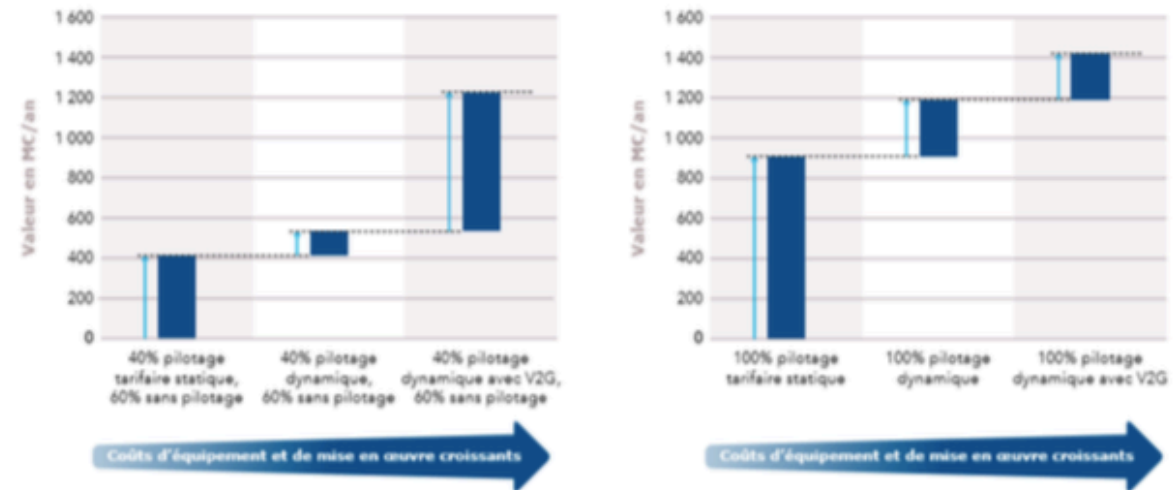
Example 1: TSO potential need for EV flexibility is large to manage Renewables

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 (1)

Energy 113 (2016) 422–431



Contents lists available at [ScienceDirect](#)

Energy

journal homepage: www.elsevier.com/locate/energy



Financial shortfall for electric vehicles: Economic impacts of Transmission System Operators market designs

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TSO and EVs (2)

Renewable and Sustainable Energy Reviews 81 (2018) 605–614



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Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser



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

But Tariff design issue

EVs and DSO

Energy Economics 83 (2019) 26–39

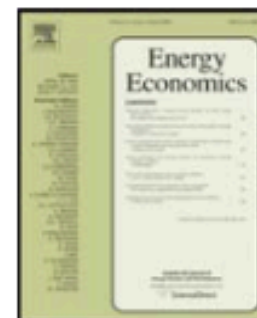


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Energy Economics

journal homepage: www.elsevier.com/locate/eneco



Network tariff design with prosumers and electromobility: Who wins, who loses?

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Regulation for DSS seems to be needed

1. We did not cover all the potential services...
2. But we think that we have evidence for Economics and technical rules adaptation on a case by case

Public policy for

1. Standardisation

2. Regulation

3. DSS definition

Communication standards

- Goal: « Plug and play »
 - “Meter war”
 - Standards are not adopted yet

Data collection and usages

- Who is doing what with the data (EV / EVSE / Networks / OEMs...)?
- EU to decide data protection / use?

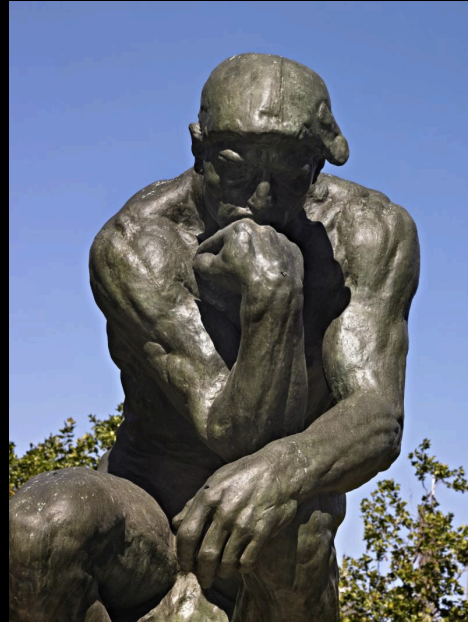
Reg : Rooming rules for charging

- Local level
- National level
- European Level
- Moving with an EV and charge it is an IT/ legal/ Economic challenge

Reg : Barriers to entry

Most Flex markets are today built for large players
Most revenues streams are still untapped
=> Network codes and market rules for Distributed Storage Solutions

Who EVs are going to help?



Energy Markets / grids / Behind the meter uses /
Electrification of rural areas?

Depends on Regulatory decisions and Economic evaluation country / country

1. EV and Energy market: **Need to change the rules**
 2. EV and Transmission grid : **Need to change the rules**
 3. EV and 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 (electrification) = VtoL: Out of regulators scope



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