

Is V2G a profitable Business?

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- What is the potential on revenue and profit in Denmark?
- What does it take to scale?
- Which other countries have a V2G potential?





- Calculations focus on one specific service – FCR-N
- Based on figures from 2017
- Shows full potential of V2G service
- Average fleet approach
- Calculations are only made on DK2

Domain	Categories	Service examples	
Region (Transmission) 	Power balancing	Synthetic inertia Frequency containment	Controlling power for balancing purposes.
	Energy Balancing	Regulation Marginal emission	Use batteries to consume, store and return energy.
	Grid contingencies	Loading issues Voltage issues	Support the operation of the distribution grid.
Neighborhood (Distribution) 	Energy Autonomy	Bilateral trading Self consumption maximization	Support local energy production and exchange.
	Islanded operation	Back-up power Fully off-grid	Support islanded operation.
Building (behind meter) 	Mobile load serving	Vehicle-to-tool Vehicle-to-Vehicle	Using the EV as a mobile power source.



- Grid related data
- Car related data
- Charger related data
- Market related data

Formula symbol	Variable	Unit	Single calculation
Sync	Synchronous area		DK2
Mept	Market entry power threshold	kW	300
EvFleet	EV fleet	units	10
CmxPw	Charger max power	kW/EV	10
BatCap	Battery capacity (usable)	kWh	21
EVmil	EV Mileage	km/month	250
EVee	EV Energy efficiency	kWh/100km	18
MxUdirEnEx	Max unidirectional energy exchange (% of Charger max power)	%	30%
ChEngPr	Charger energy production	kWh/EV/month	350
ChEngLos	Charger energy loss	%	30%
EIconPro	Electricity consumption price	DKK/kWh	1,00
EIProPro	Electricity production price	DKK/kWh	0,20
BatForW	Battery FCR-related wear	DKK/year	0
ChDeprec	Charger (bi-direc additional cost) depreciation	DKK/year	0
FcPC	FCR-N price change factor for sensitivity analysis	%/year	0,0%
SocOfsWd	SOC offset for sensitivity analysis, weekdays	%-points	0,0
SocOfsWe	SOC offset for sensitivity analysis, weekends	%-points	0,0



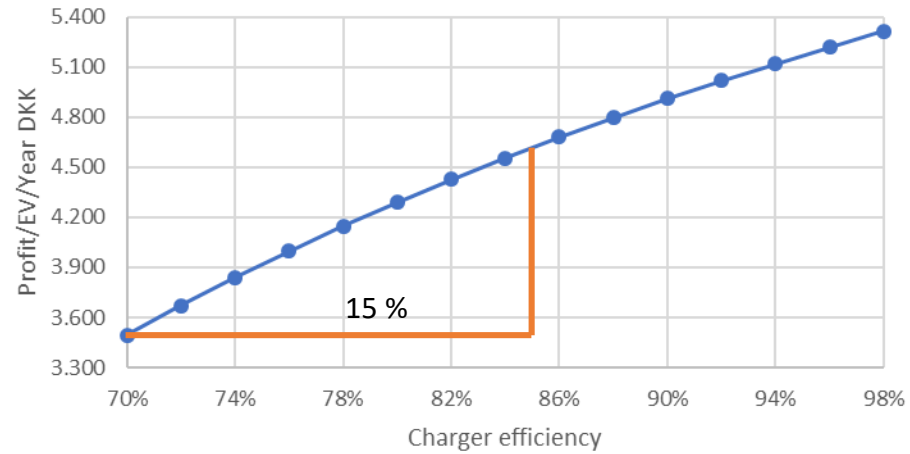
3 Scenarios have been developed

- Reference
 - The Frederiksberg Forsyning case
- Best Case
 - Larger batteries
 - More powerfull and efficient chargers
 - Net meetering allowed
 - No surplus cost to charger
 - Battery degradation non existing
- Worst Case
 - Frederiksberg Forsyning case, however
 - Electricity consumption price rises
 - Reduced charger power
 - Battery wear of 3% p.a.
 - Additional charger price of 2.500 €

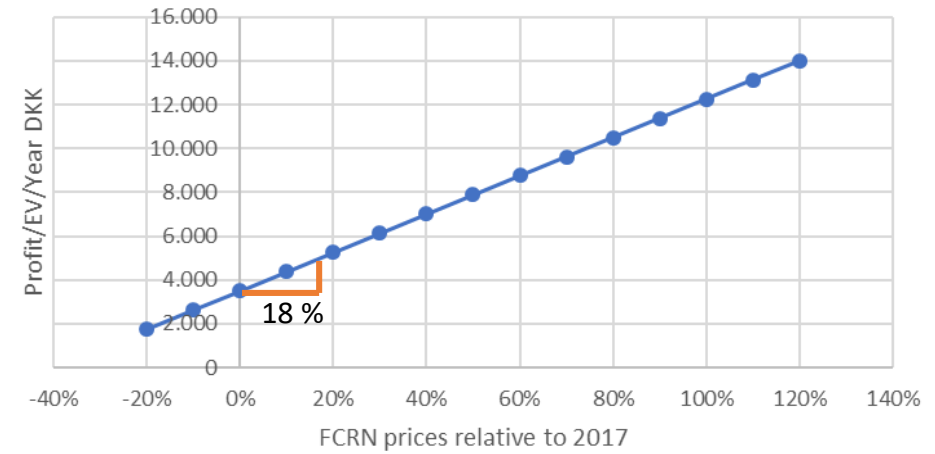
Variable	Unit	Reference Scenario	Best case	Worst case
EV fleet	units	10	10	10
Charger max power	kW/EV	10	20	6,6
Battery capacity (usable)	kWh	21	60	21
EV Mileage	km/month	250	250	250
EV Efficiency	kWh/100km	18	12,5	18
Max unidirectional energy exchange (% of Charger max power)	%	20%	10%	30%
Charger energy production	kWh/EV/month	350	350	350
Charger energy loss	%	30%	10%	30%
Electricity consumption price	DKK/kWh	1,00	0,70	1,40
Electricity production price	DKK/kWh	0,20	0,70	0,20
Battery FCR-related wear	DKK/kWhUp	0	0	1.200
Charger (bi-direc additional cost) depreciation	DKK/year	0	0	4.000
FCR-N price change factor for sensitivity analysis	%/year	0,0%	0	0
SOC offset for sensitivity analysis, weekdays	%-points	0,0	0,0	0,0
SOC offset for sensitivity analysis, weekends	%-points	0,0	0,0	0,0
Profit/EV/Year	DKK	3.495	17.187	-7.128
And in €		468	2,304	-955



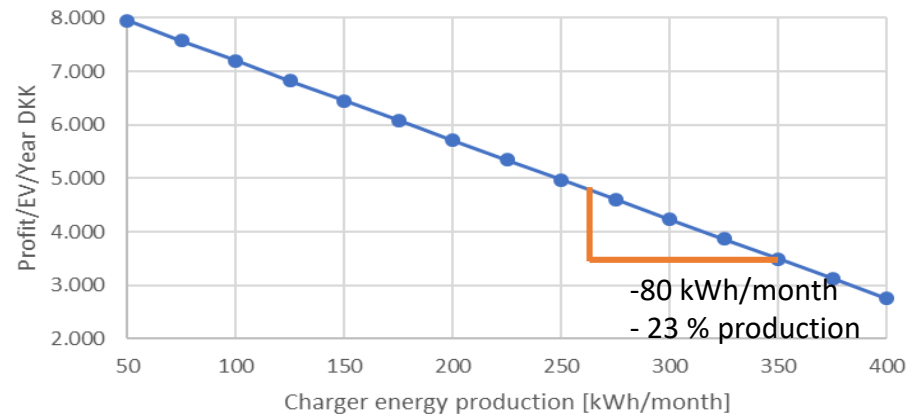
Charger efficiency



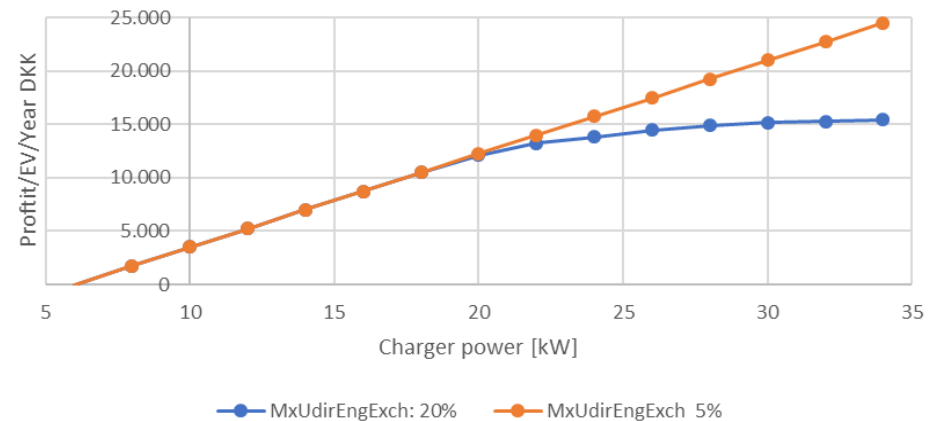
FCR-N prices



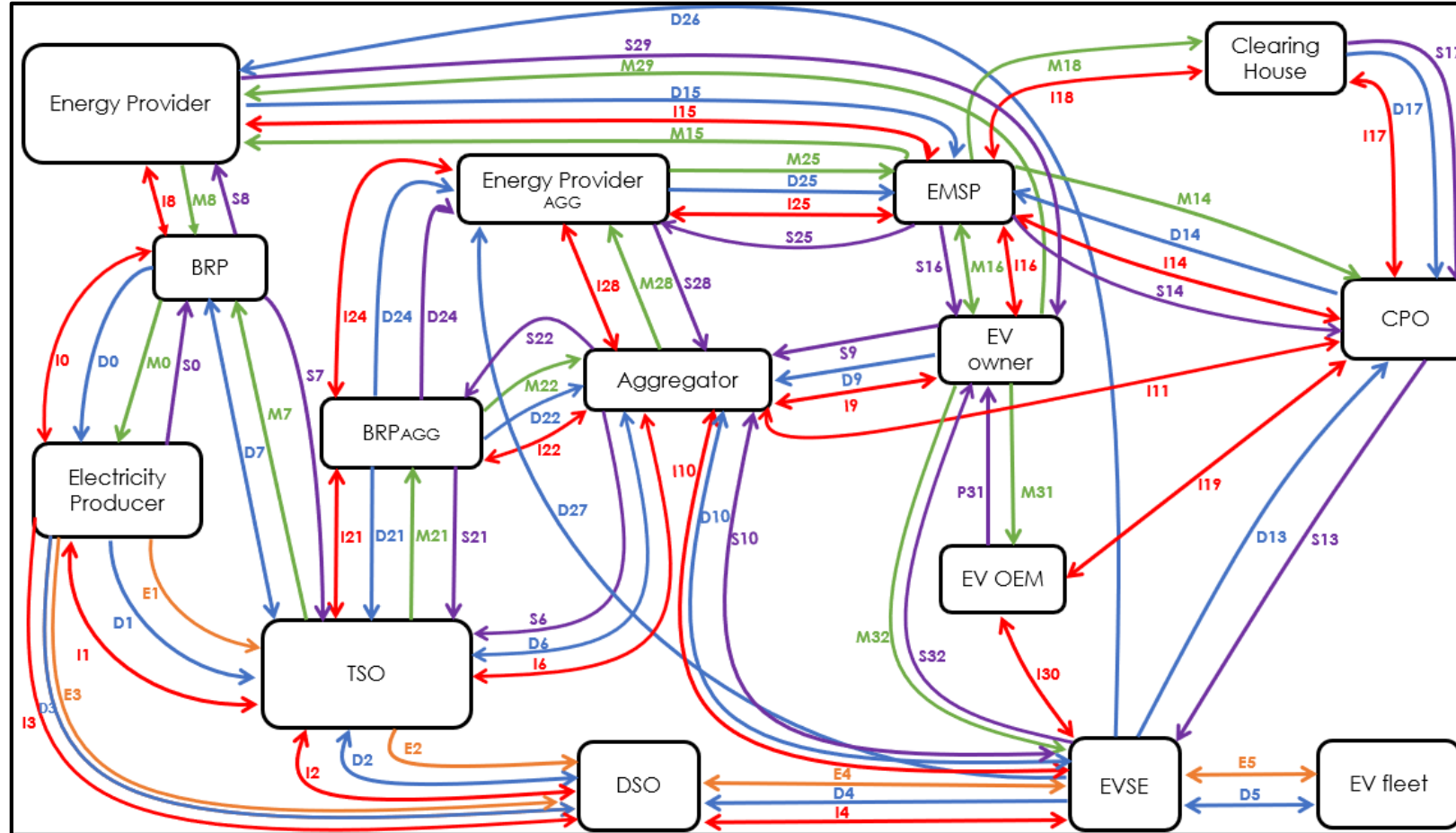
Charger energy exchange

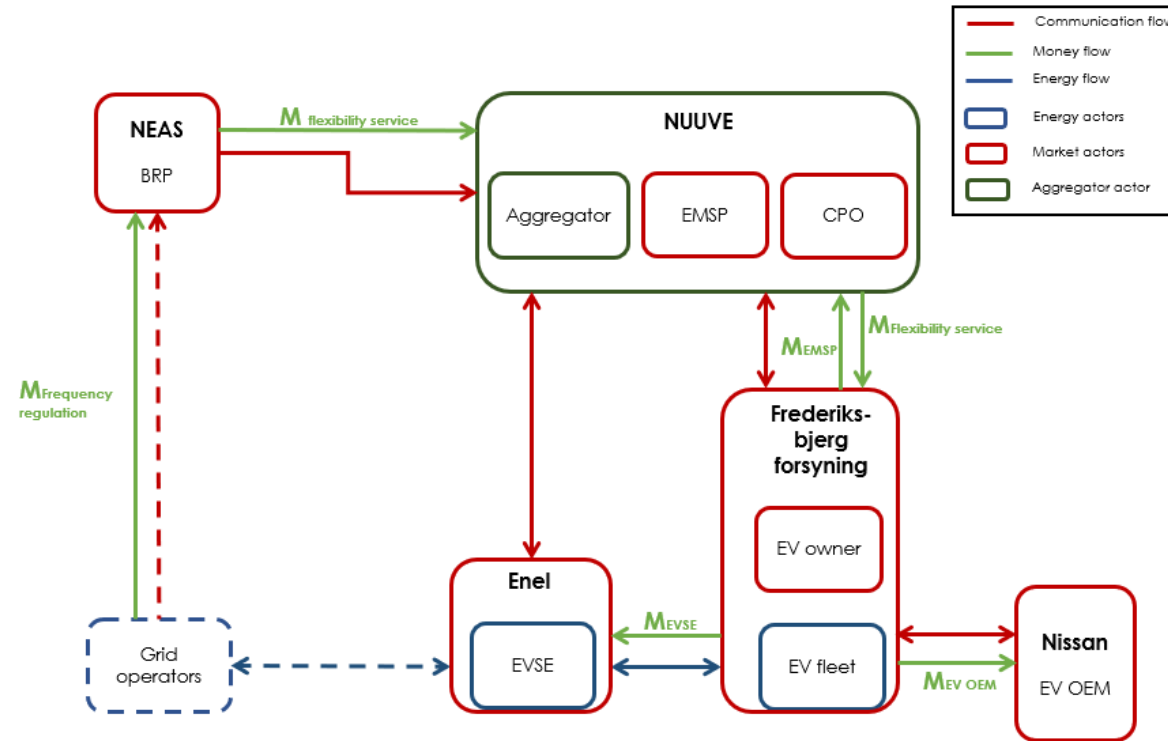


Max unidirectional energy-exchange





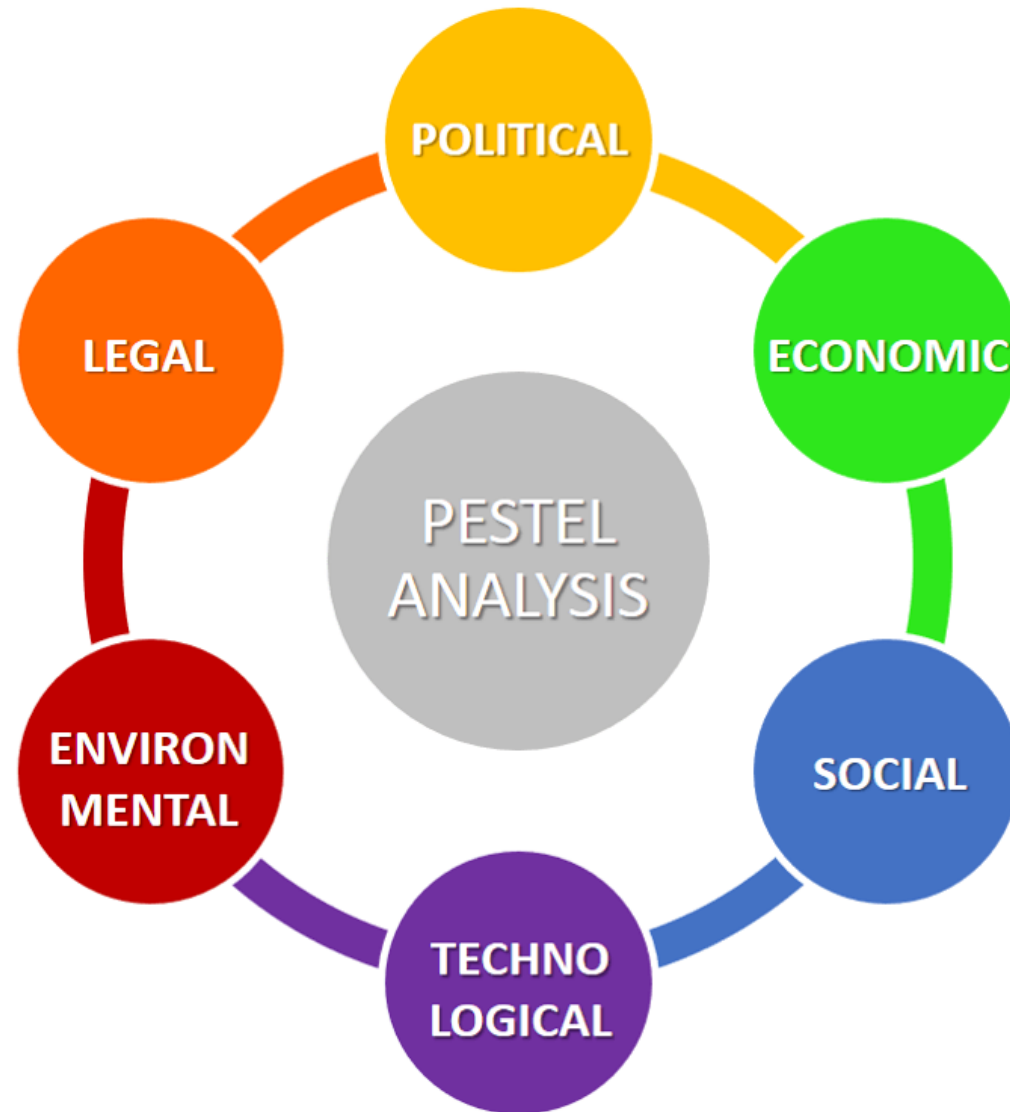


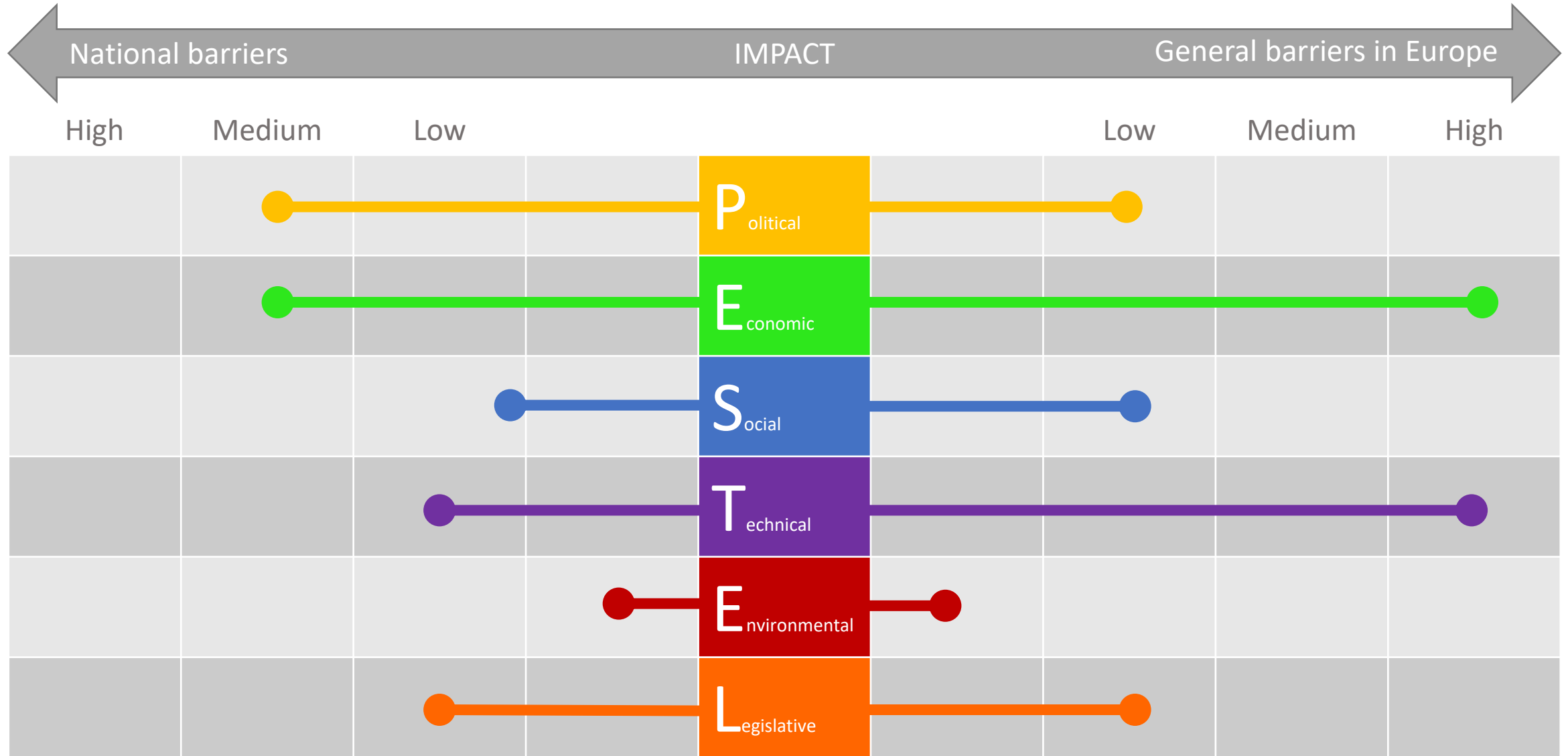


- Technically ready to scale
- Market place ready
- Value system in place
- Viable business case in place
- Customers ready
- Supply chain ready

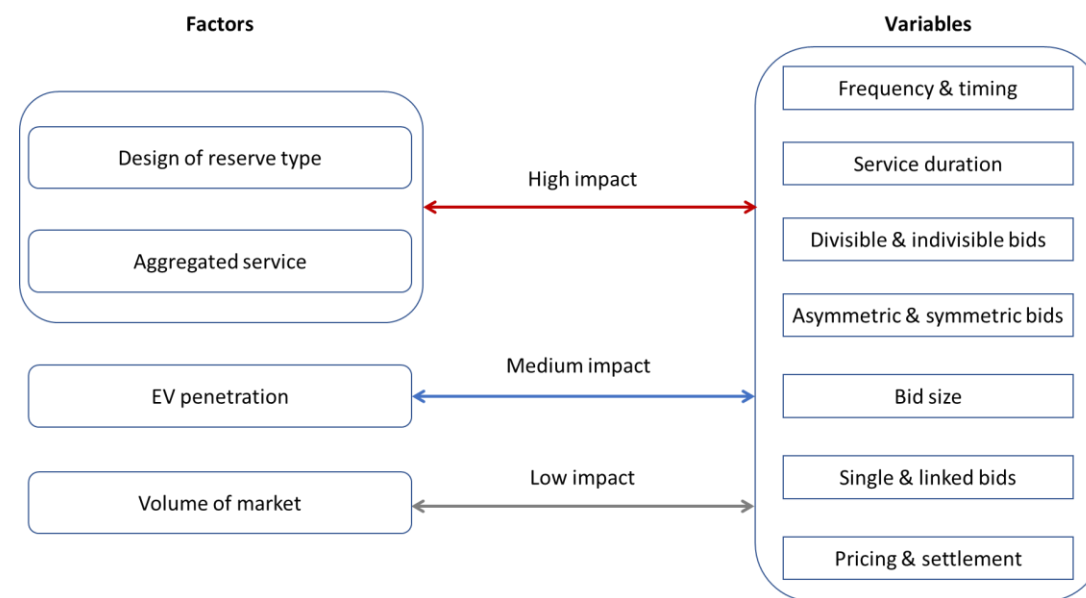


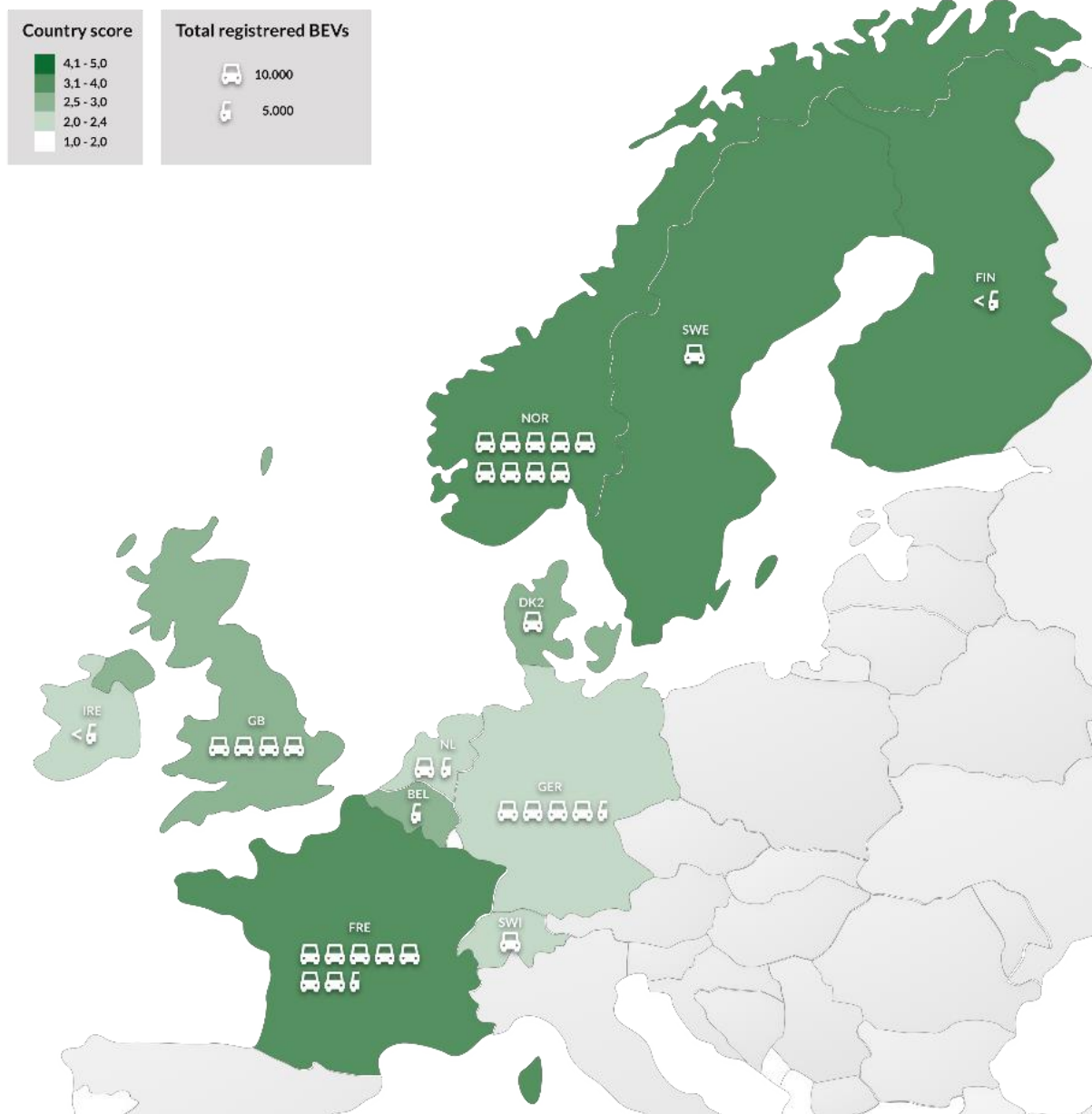






- The market structure is defined by 7 variables
- These impact 4 main factors
- Evaluation of these can point to the most interesting markets to approach
- In general, most countries are harmonizing their market structure
 - Central Europe is one zone
 - Nordic is another zone
 - Great Britain is a third zone
- Primary differentiation point is the EV penetration
- Other parameters to take into consideration
 - Electricity prices – buying and selling
 - Availability payment level
 - Energy need/Power availability







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