Informal Meeting of European Union Competitiveness Ministers

Chairman and CEO

Ignacio S. Galán

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IBERDROLA

Energy Policy & Transport

Electric Vehicle

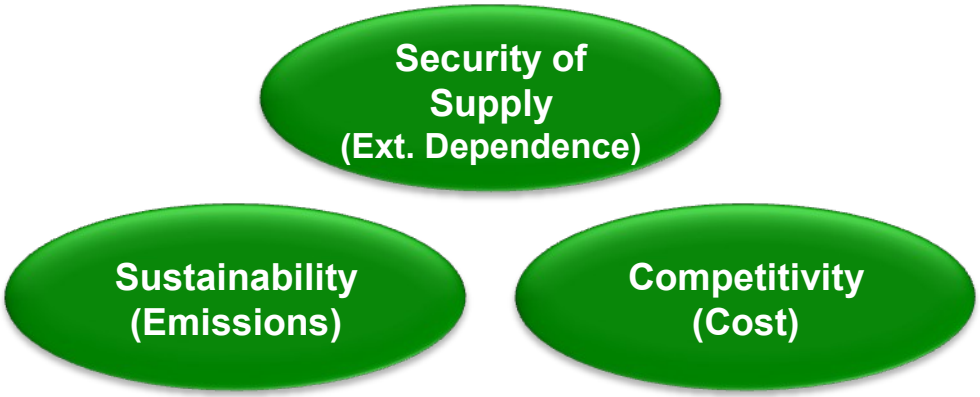
The role of electricity grids

Conclusions

Energy Policy & Transport

The decarbonisation of transport is a key element of the European Energy and Environmental Policy…

nergy Policy Objectives



uropean Commitments by 2020

- 20% emissions reduction
- 20% renewables in final consumption
- 20% of energy efficiency improvement

… and for the achievement of 20-20-20 commitments

Energy Policy & Transport

Transport is responsible for 30% of EU´s emissions, therefore a big change is needed

900 million vehicles on the road worldwide today

1,100 million by 2020

1,800 million by 2030

- 50% of oil extractions are currently consumed by transport
- 20% global emissions increase by conventional vehicles in 10 years
- Increasing oil prices

- Efficiency improvements in conventional vehicles are slow and not sufficient
- Hydrogen vehicle technology is still incipient and has no infrastructure available
- The Electric Vehicle (EV) has a relatively mature technology and most of needed infraestructure is already deployed

Energy Policy & Electric Vehicle

The Electric Vehicle is the essential step

Security of Supply (Ext. Dependence)

- Replace oil as a primary energy source
- Increase energy efficiency (75% vs. 20% of conventional vehicles)

Sustainability (Emissions)

- Reduce CO_2 emissions according to generation mix
  (3 kg CO_2/100 km vs. 16 kg CO_2/100 km of conventional vehicles)*
- Reduce noise and local pollution

Competitivity (Cost)

- Enable renewables penetration
- Optimise generation mix

EV is an innovative activity that can contribute to economic revitalisation

Efficient incentives and regulation can foster EV's implementation

* Considering 40% renewables and 60% combined cycles

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Electric Vehicle: evolution

Historically, EV has had barriers that nowadays have been partially overcome

Technology	**Electronic control systems**
New materials and design	**Weight reduction and aerodynamics**
	Higher energy efficient appliances

Electric Vehicle: evolution

Batteries

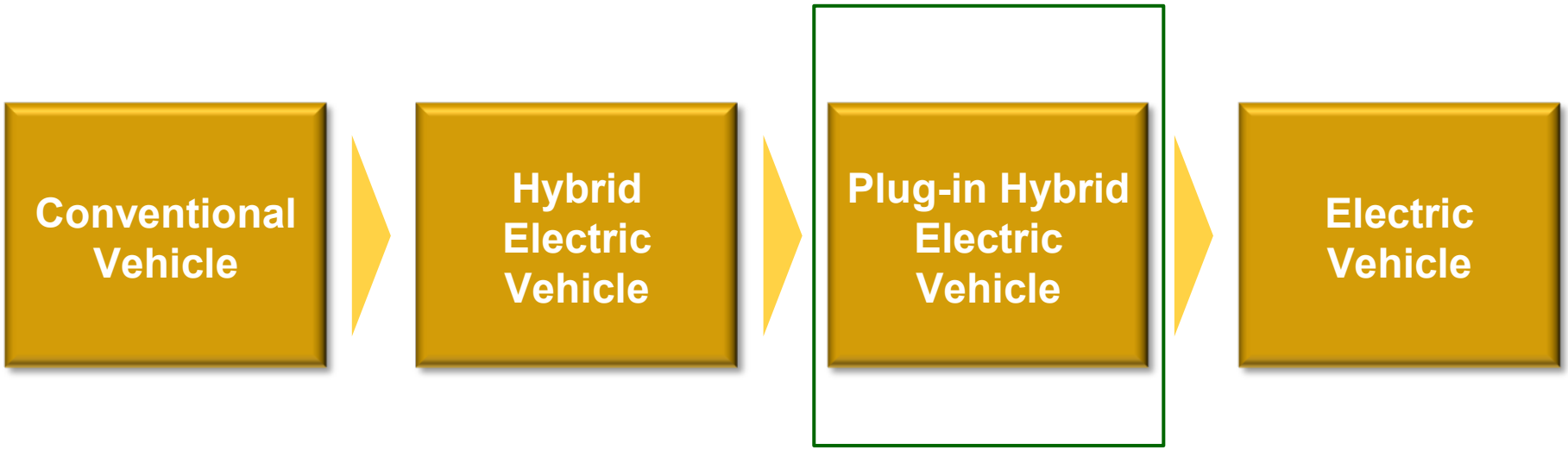
- Higher energy density and lighter batteries
- Recharging cycle and memory effect improvements

	Lead acid	Ni-Cd	Ni-MH	Zinc Air	Sodium sulphide	Zebra NaNiCl	Lithium technology
Power density W/Kg	180	150	250- 1000	80-140	150	150	250-1800
Energy density (Wh/kg)	30-50	45-80	60-120	220	110	100-120	90-300
Recharging time	>10 h	8 h	6 h	na	na	na	< 3 h
Life cycles	300-800	2000	1000	200	1000	> 1000	1200
Cost €/KWh	80	280-500	170	60	na	200	200-1000

Grid infrastructure has never been a problem and will help EV´s deployment

Electric Vehicle: implementation

Plug-in Hybrid Electric Vehicle (PHEV) can be the intermediate step to pure Electric Vehicle…



… whose first foreseen market segments are fleets, taxis and rental cars

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Electric Vehicle

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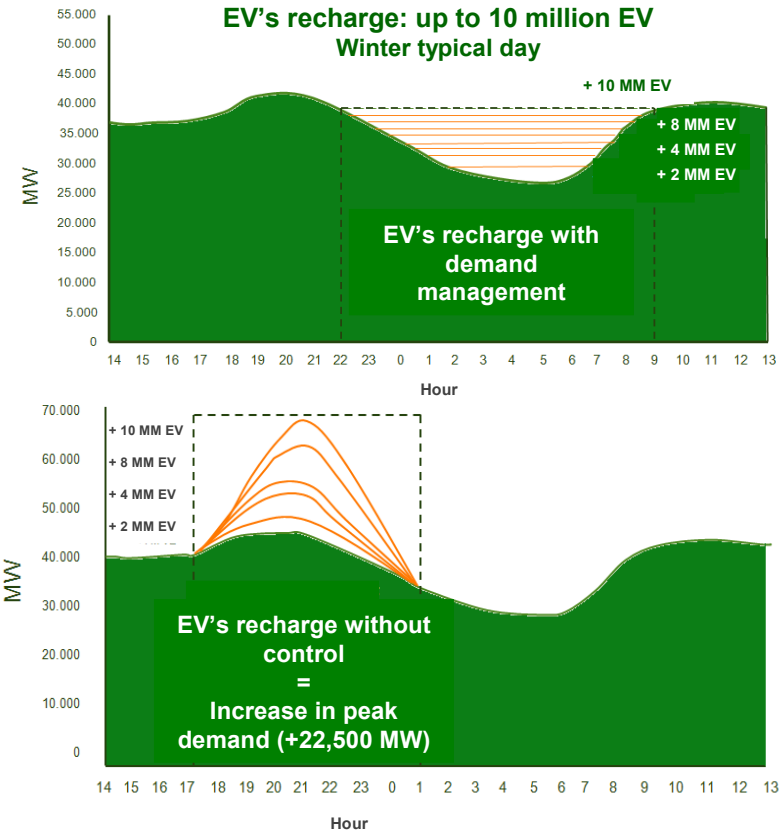
The role of electricity grids: impact on system

A large implementation of EVs could mean a significant electricity peak demand increase…



Peak demand control

Renewables integration

Slow and nightly charge: *Dominant*

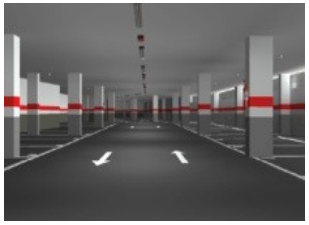
Quick charge: *Occasional*

… that may imply further peak generation & grid investments

The role of electricity grids: charging availability

Correct price signals will encourage proper habits in consumers (smart meters, hourly basis)

Private spots	Public spots
Slow and nightly charge	Quick charge
Low electricity cost	High electricity cost
Low investments	High investments
Secure (spot and payment)	Vandalism & fraud
Lowest cost = Dominant charge	**Highest cost = Occasional charge**



The role of electricity grids: model

Electricity companies can make the EV´s market model more efficient and simple

Maximum synergies minimise cost

Reasonable investment costs

No intermediaries are necessary to connect EV to the grid (only more cost)

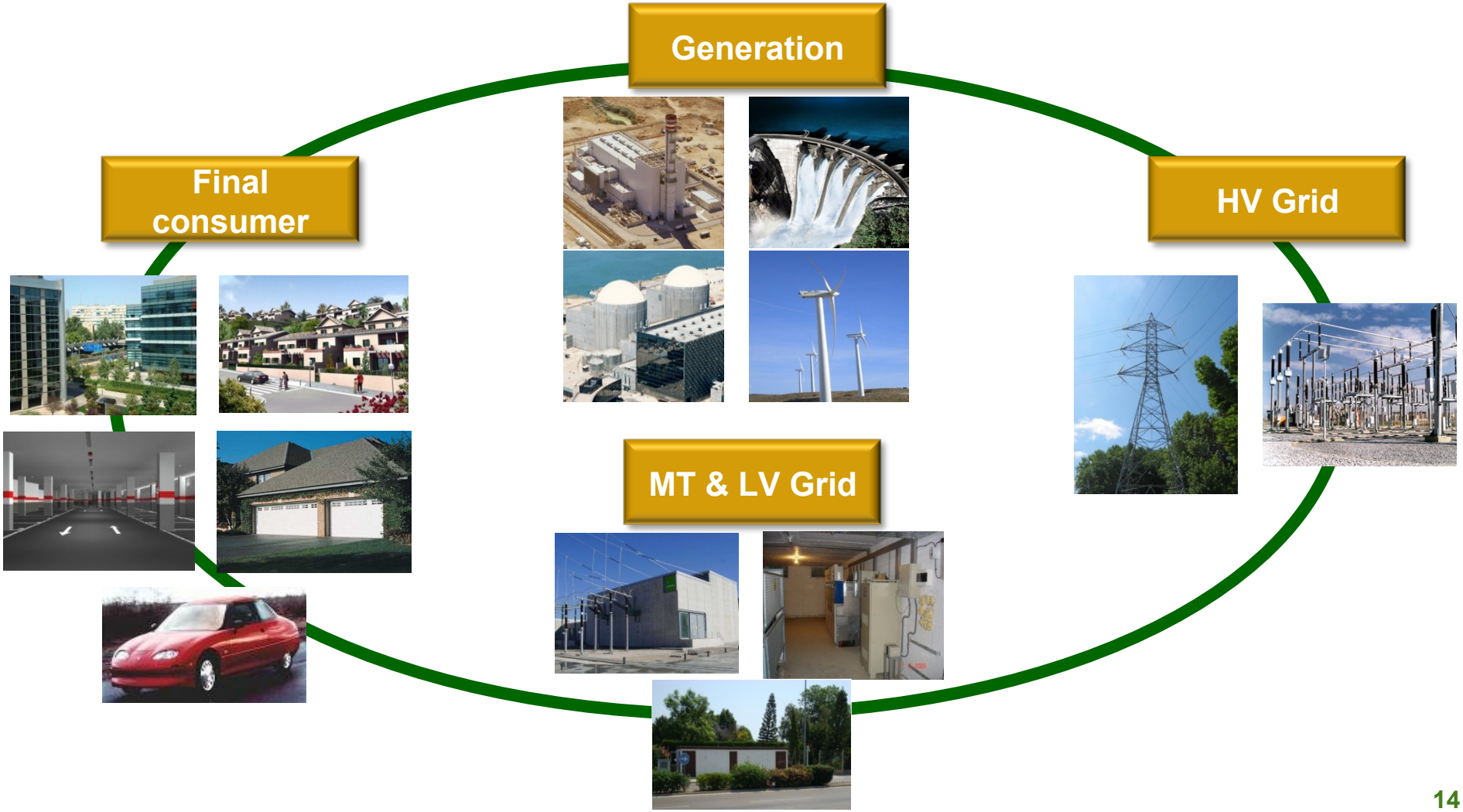
Grid Infrastructure ***(network operators)***

Charging Infrastructure ***(open system)***

Retail

The role of electricity grids: additional synergies

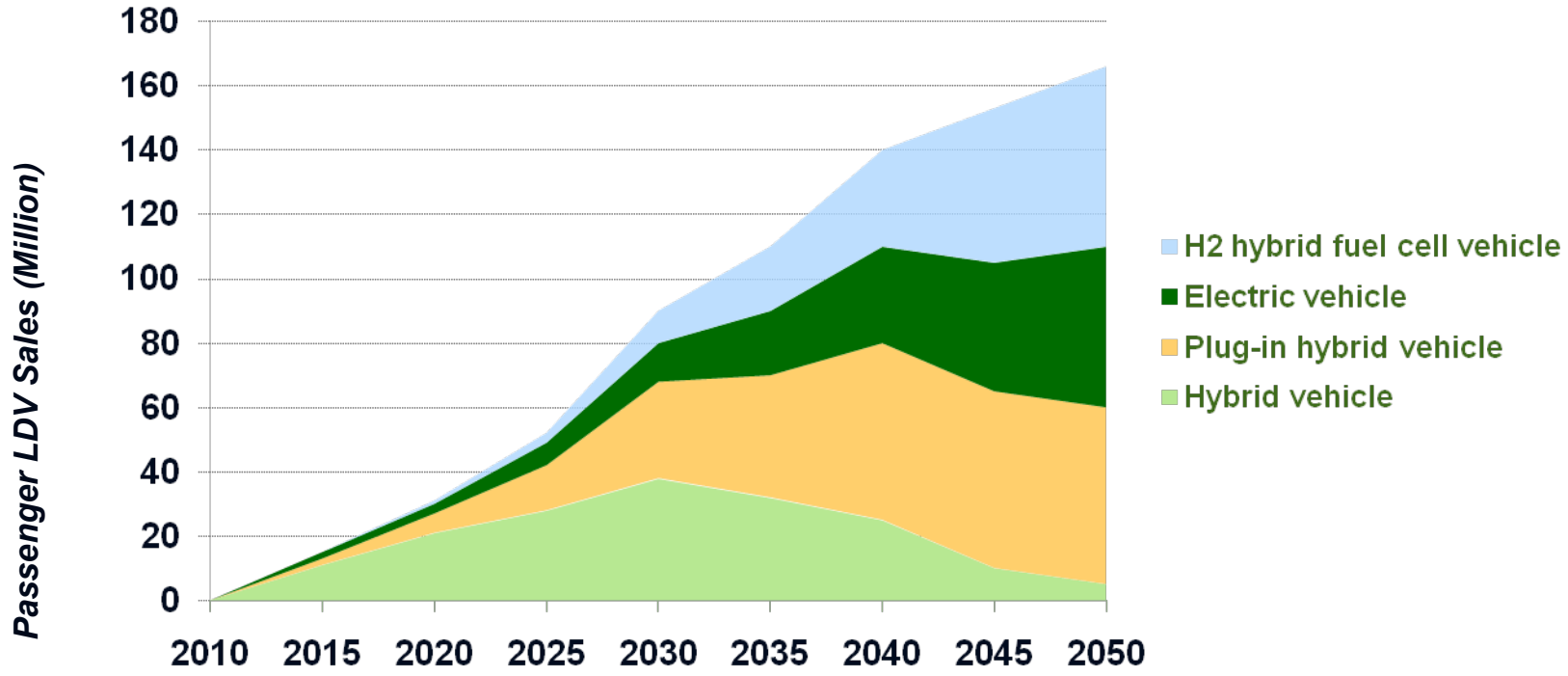
Thanks to smart grids development, EV's charge will contribute to optimise electricty system operation



The role of electricity grids: deployment

Progressive transition to EV:
no significant impact on grid infrastructure development…

Light-duty vehicle sales by technology type to 2050



Source: IEA. EV Roadmap

… but requires sufficient, transparent and stable remuneration

The role of electricity grids: infrastructure

Grid infrastructure will be ready when EV is available for a large scale retail

- Enough charging spots to avoid “range anxiety”
- Standard charging sockets to allow interoperability and consumer identification
- Smart meters for right price signals: Slow and nightly charge at private spots as dominant
- Smart grids for active demand management
- More investments to power lines and substations

Other measures

Examples of measures that can boost EV's implementation

Standardisation	Standard charging socket throughout Europe: slow or fast charge, all EV, all countries
	Standard security and commercial operation
Regulation	Mandatory charging spots at new buildings
Incentives	Incentives to wire existing garages and parkings
	No toll payments: highways, congestion charges
	Preferential use: bus lane, fast lane…

Energy Policy & Transport

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Conclusions

Conclusions

The decarbonisation of transport is essential to achieve 20-20-20 commitments

- **Increase security of supply (replace oil, more efficiency)**
- **Increase sustainability (less emissions, pollution and noise)**
- **Increase competitivity (optimise generation mix)**

Today EV is a feasible alternative (technology and infrastructure)

Conclusions

EV's success will mostly depend on the overall cost

Availability of EV at a reasonable cost

- **Battery's performance:** weight, charge cycle, energy density
- **Recharging time**
- **EV's weight**
- **Cost**

Charging infrastructure at a competitive cost

- **Standard & simple**
- **Enough & convenient**
- **Secure**
- **Cost**
- **Impact on system**

Therefore, efficient regulation and incentives are key for EV's implementation

Conclusions

Utilities will play an important role on EV's implementation

Generation	Outcome adjusted to meet total demand
	Possible need of new peak investments
Distribution	Smart meters and smart grids (management and control)
	Grid development (lines, ST, access points…)
Retail	New products and services
	Management and control (secure payments)

Conclusions

Iberdrola is one of the largest utilities in the world and the number 1 wind producer…

- Present in over 40 countries worldwide
- Market capitalization of Eur 32,000 MM
- Installed capacity of 47,000 MW (21,000 MW renewables)
- 28 million customers
- 900,000 km of lines

Conclusions

… and is firmly committed to foster EV's implementation

Public Authorities Agreements	• Spain: Autonomous Regions (Valencia, Castilla y León, Madrid, País Vasco, La Rioja) and City Halls (Madrid, Logroño) • United Kingdom: Glasgow town hall
Vehicles manufacturers	• Agreements with GME, Renault, SEAT • Contacts with Toyota, Subaru, Nissan
Standardisation	• Europe: Standardisation EV charge group, ISO/IEC JWG V2G CI • USA: EPRI
R + D projects	• Europe: MERGE, Green e-Motion, CAPIRE, Glasgow Pilot • Spain: Electric Powered Vehicles, VERDE, CONSOLIDER • USA: Truck electrification