



asociación iberoamericana de entidades  
reguladoras de la energía

associação iberoamericana da entidades  
reguladoras da energia

# LA MOVILIDAD ELECTRICA Y LAS REDES DE DISTRIBUCIÓN

Ing. Claudio Damiano

ENRE

ARGENTINA

Santa Cruz, Bolivia, oct 19

# Historia del automóvil eléctrico

Record mundial de velocidad,  
en 1899: 105 km/h

**American Electric Vehicle Co.**

MANUFACTURERS OF

**FINE ELECTRIC CARRIAGES.**

**1896**

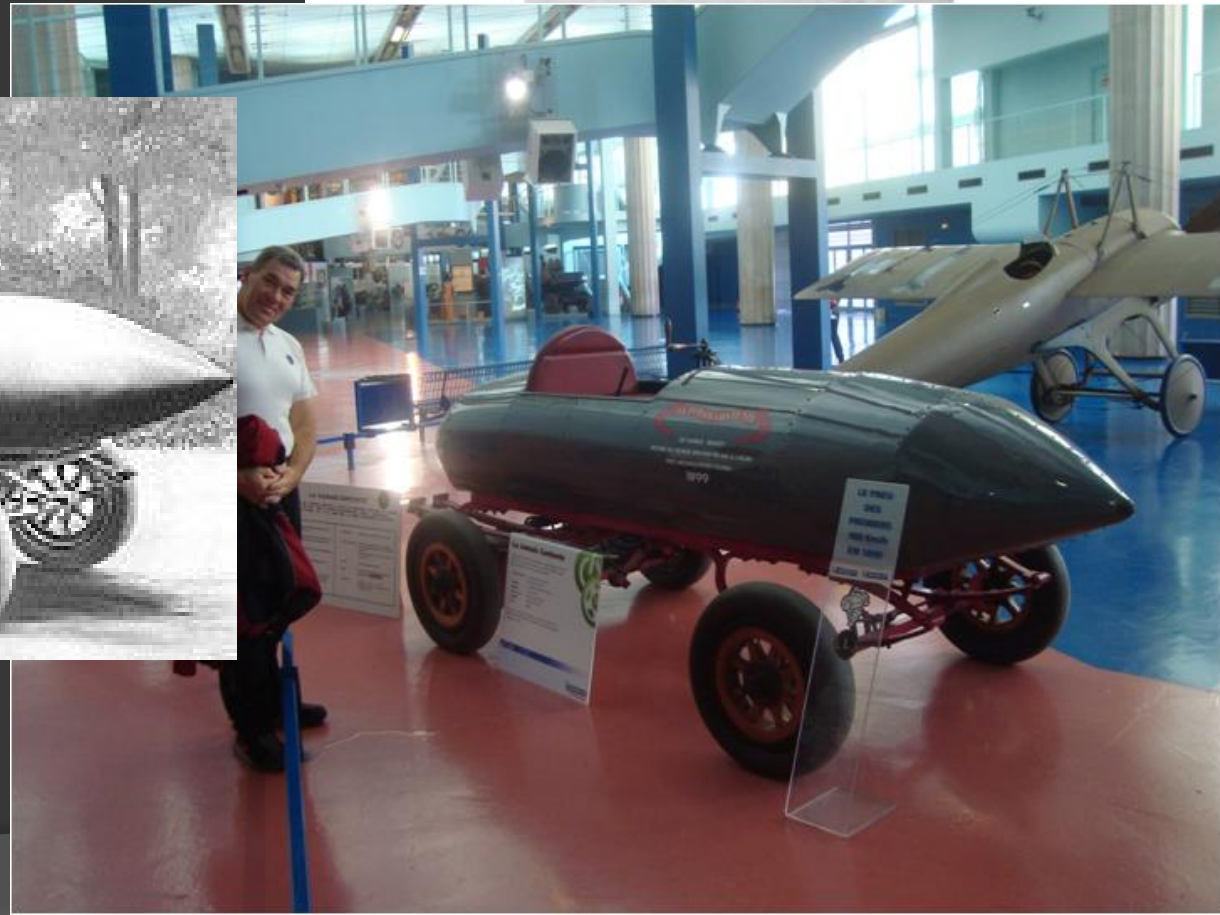
Maximum  
Speed,  
14 Miles  
per  
Hour.



Cost of  
Operation  
per Mile,  
**1**  
Cent.



**LE JAMAIS  
CONTENTE**





# Vehículos actuales

## Primera generación:

Con leves cambios en modelos existentes, se acomodan el motor y el almacenamiento energía.

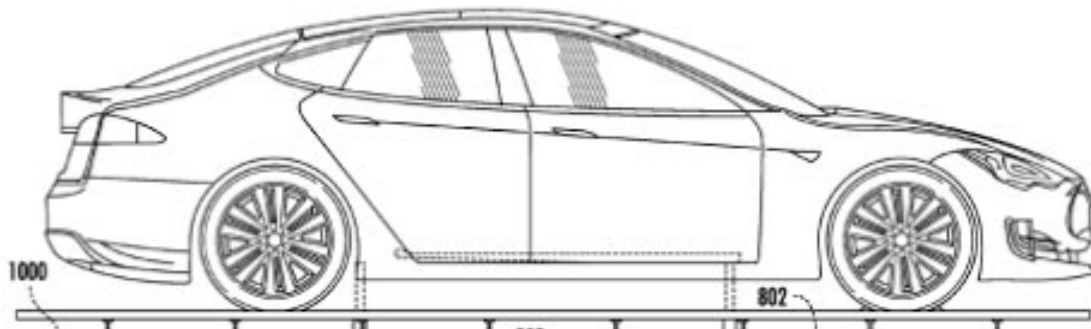
# Recargas fuera del vehículo: batería intercambiable



Recargas

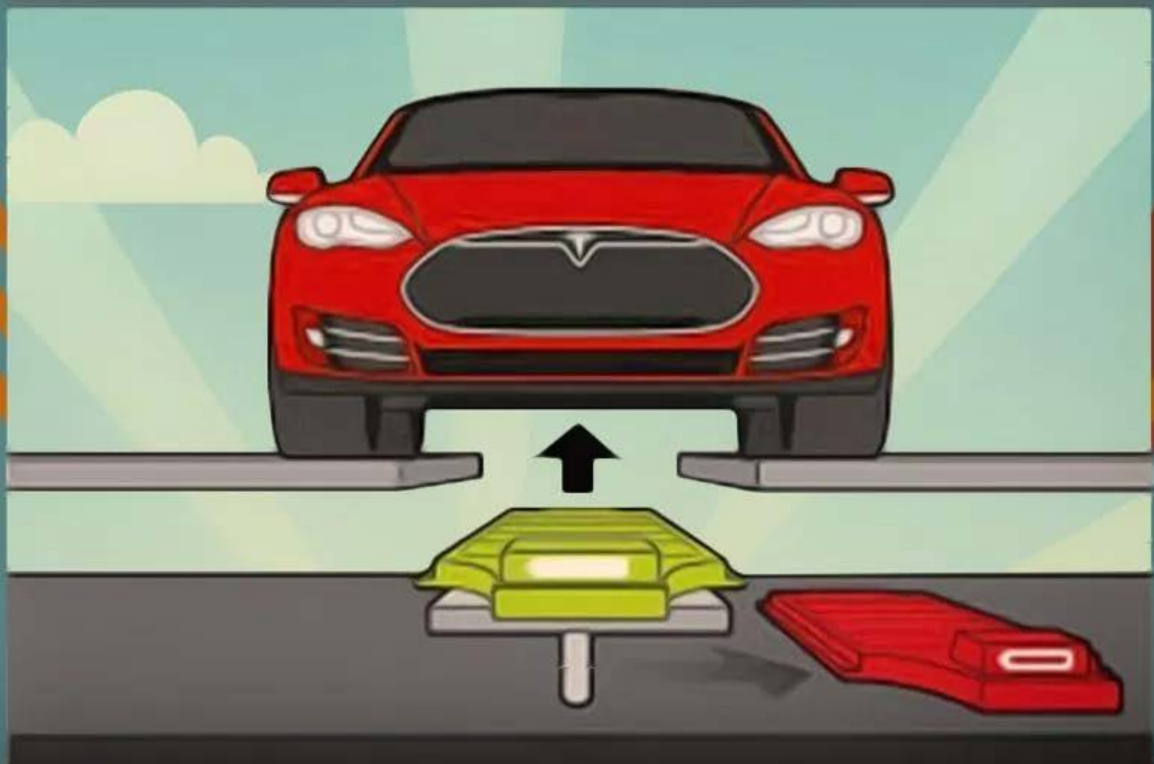
cambiable



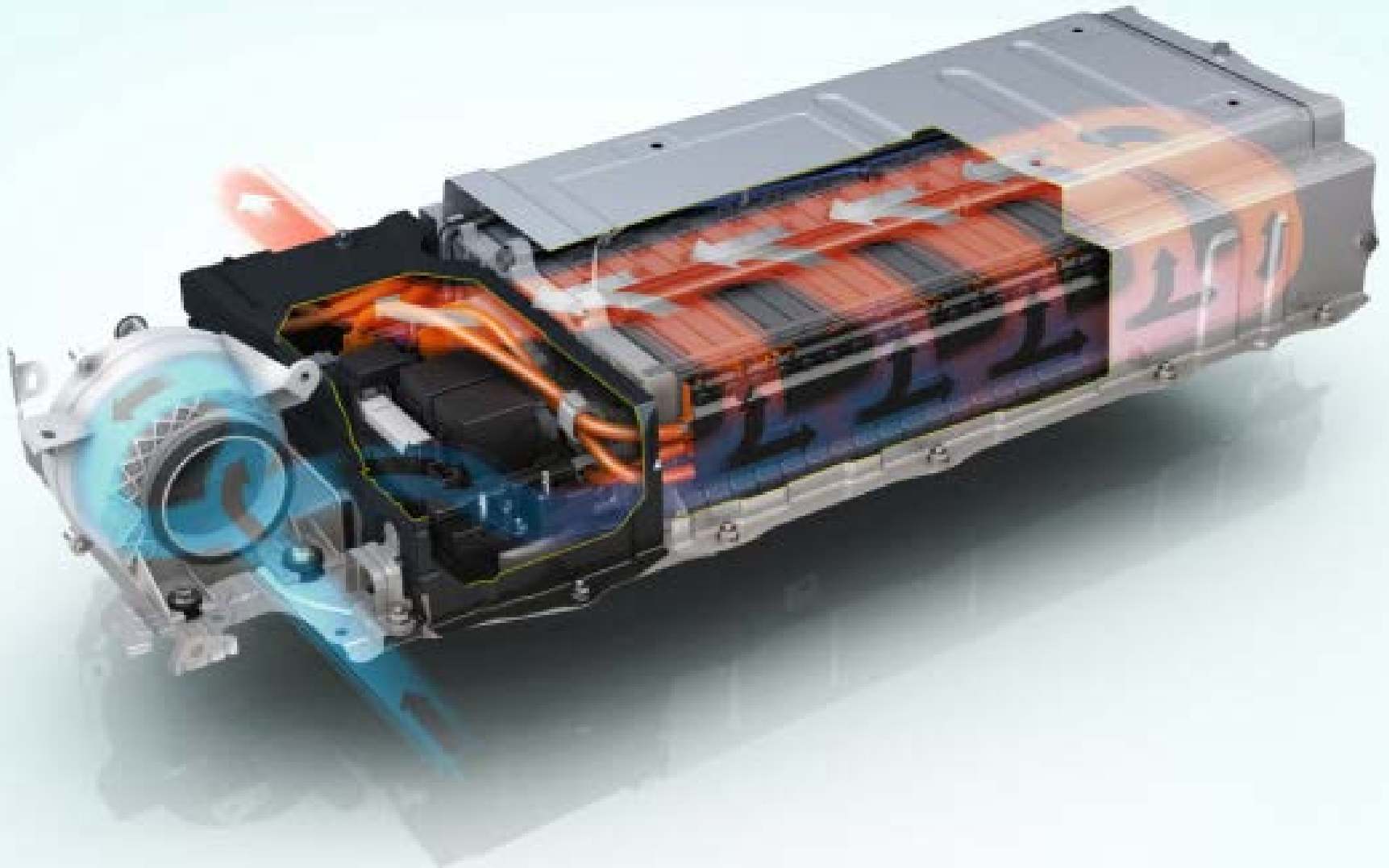


BIDNESS ETC

# Battery-Swap Station



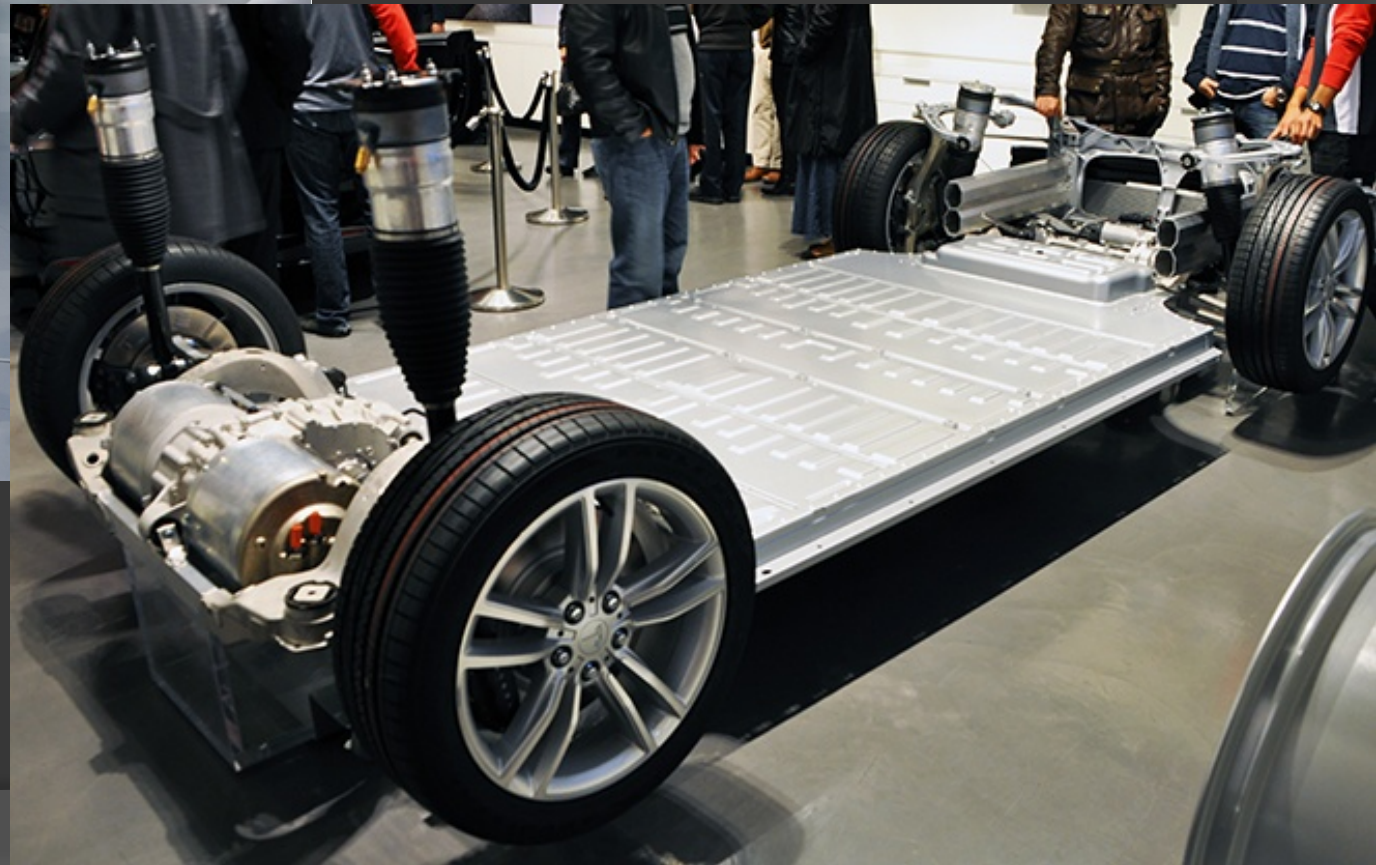
# Gerenciamiento térmico del pack de baterías:



# Vehículos actuales

## Segunda generación:

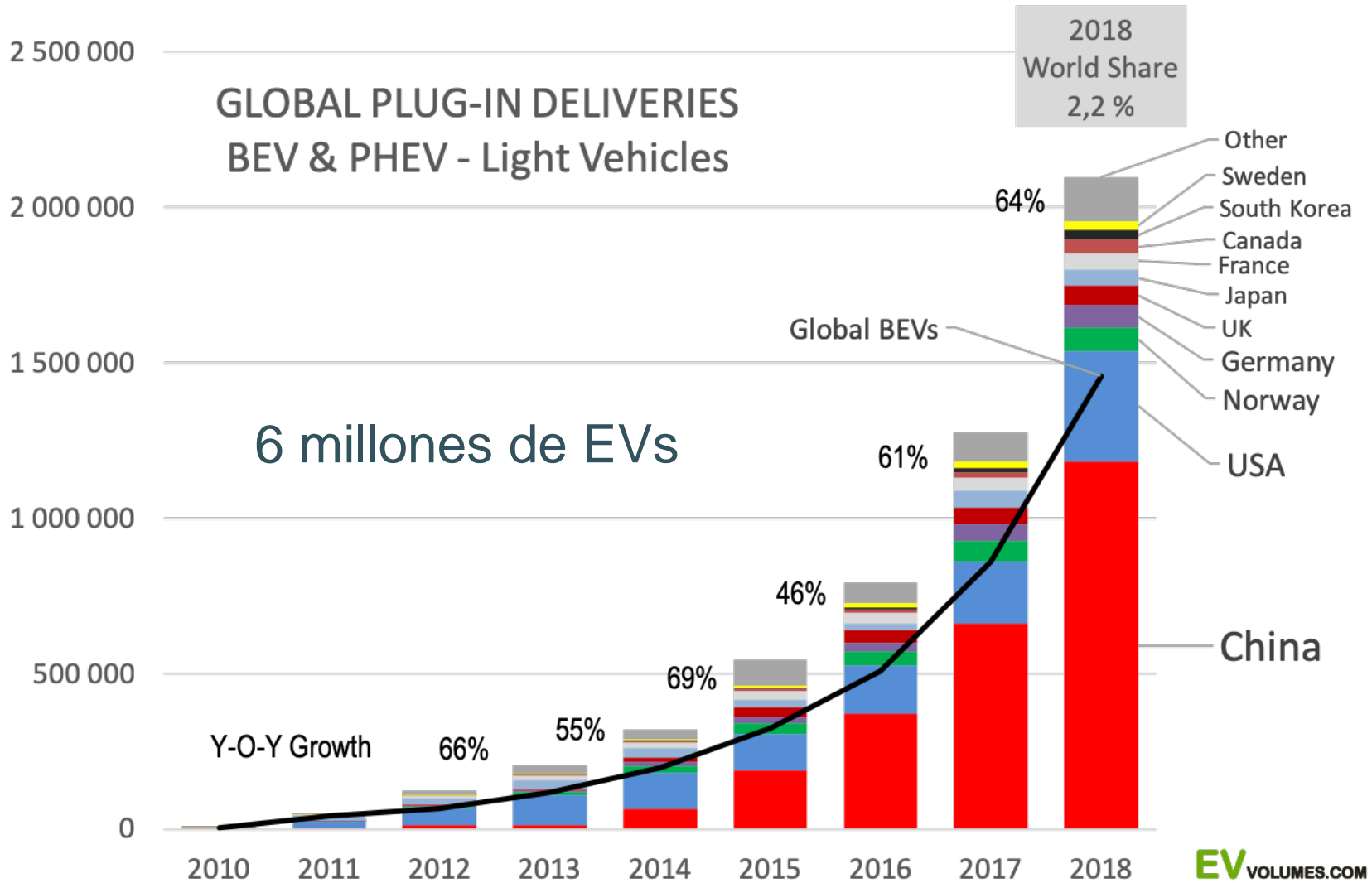
vehículos nacidos para el accionamiento a baterías





# Skate para carrozar





EVOLUCION DE VENTAS MUNDIALES

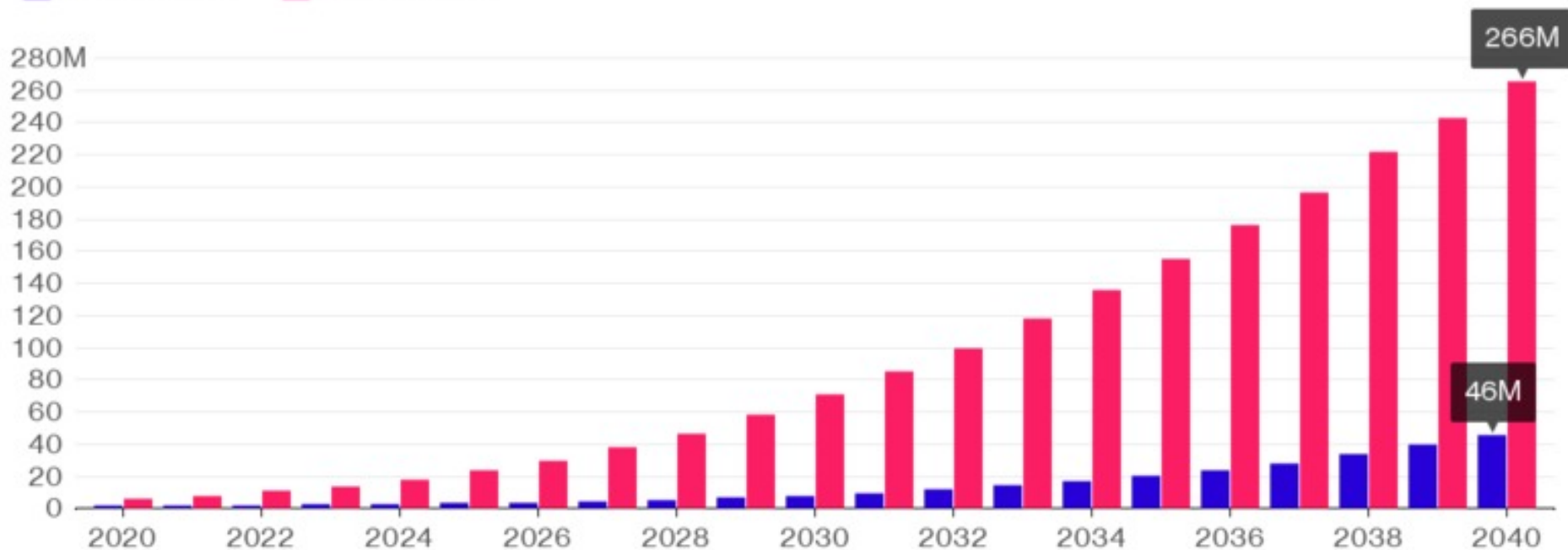
# Ventas mundiales de autos eléctricos

## Growing Expectations

OPEC's electric vehicle forecast grew by almost 500% last year

■ 2015 Forecast

■ 2016 Forecast



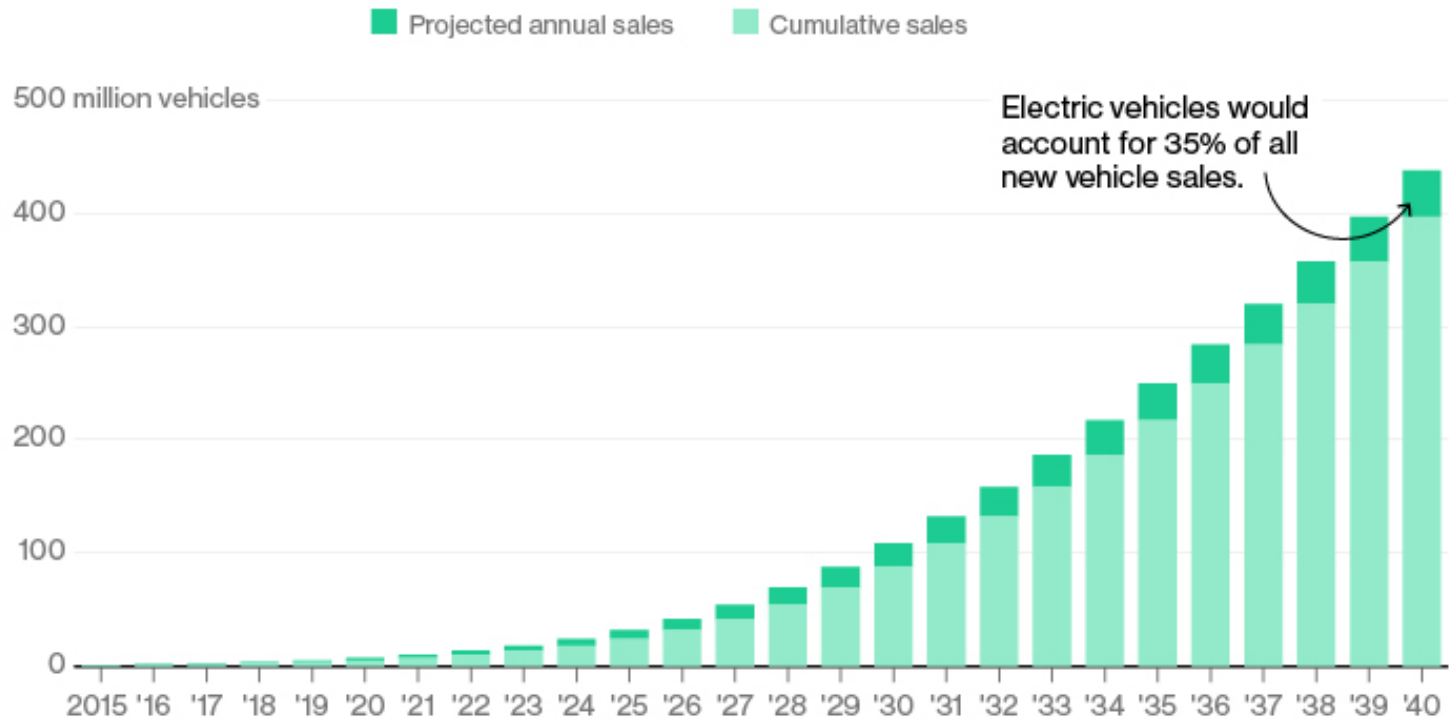
Source: Bloomberg New Energy Finance

Bloomberg 

# Ventas mundiales de autos eléctricos

## The Rise of Electric Cars

By 2022 electric vehicles will cost the same as their internal-combustion counterparts. That's the point of liftoff for sales.



Sources: Data compiled by Bloomberg New Energy Finance, Marklines

# Modelos representativos



50 GWh

100 kWh

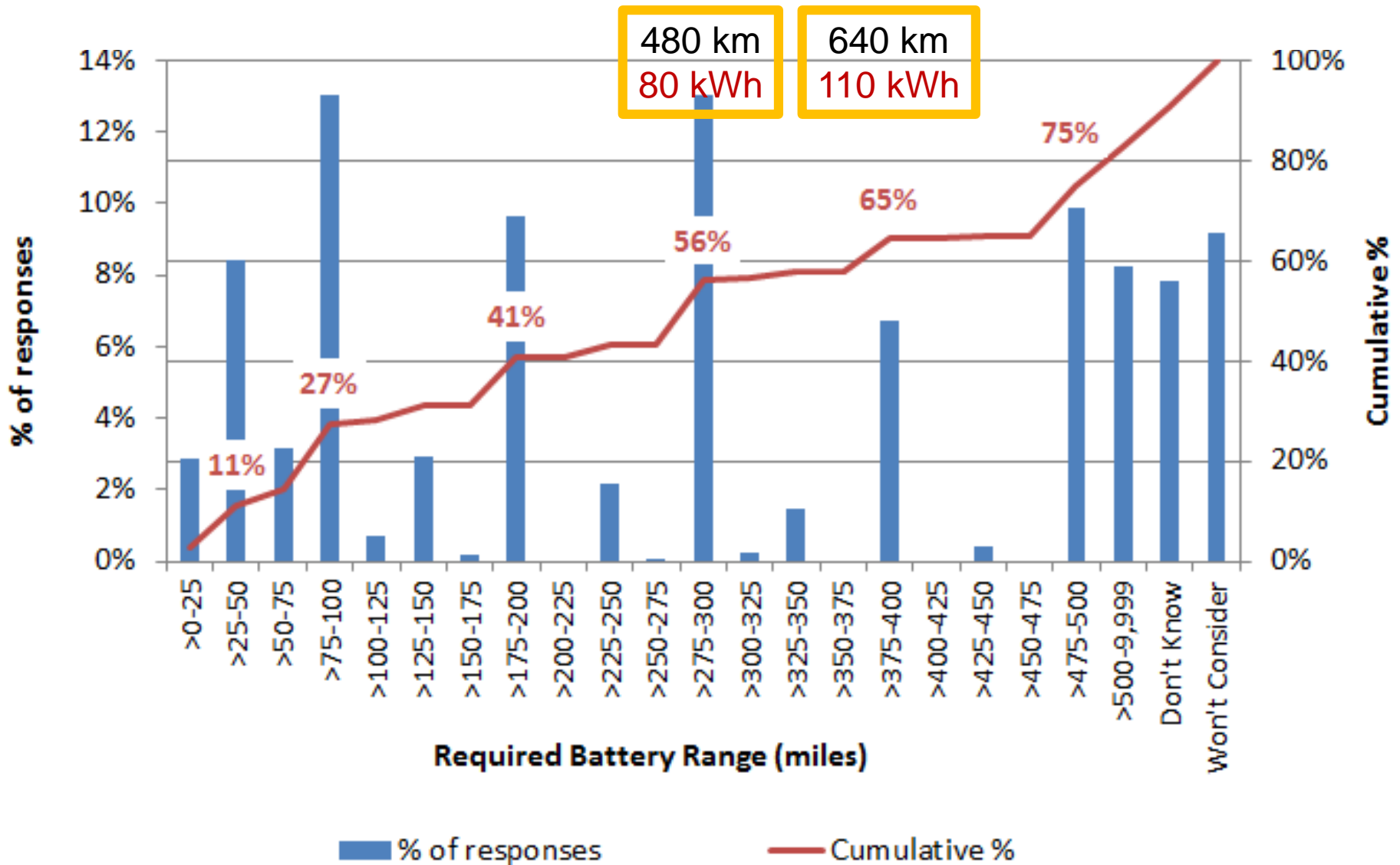


60 kWh

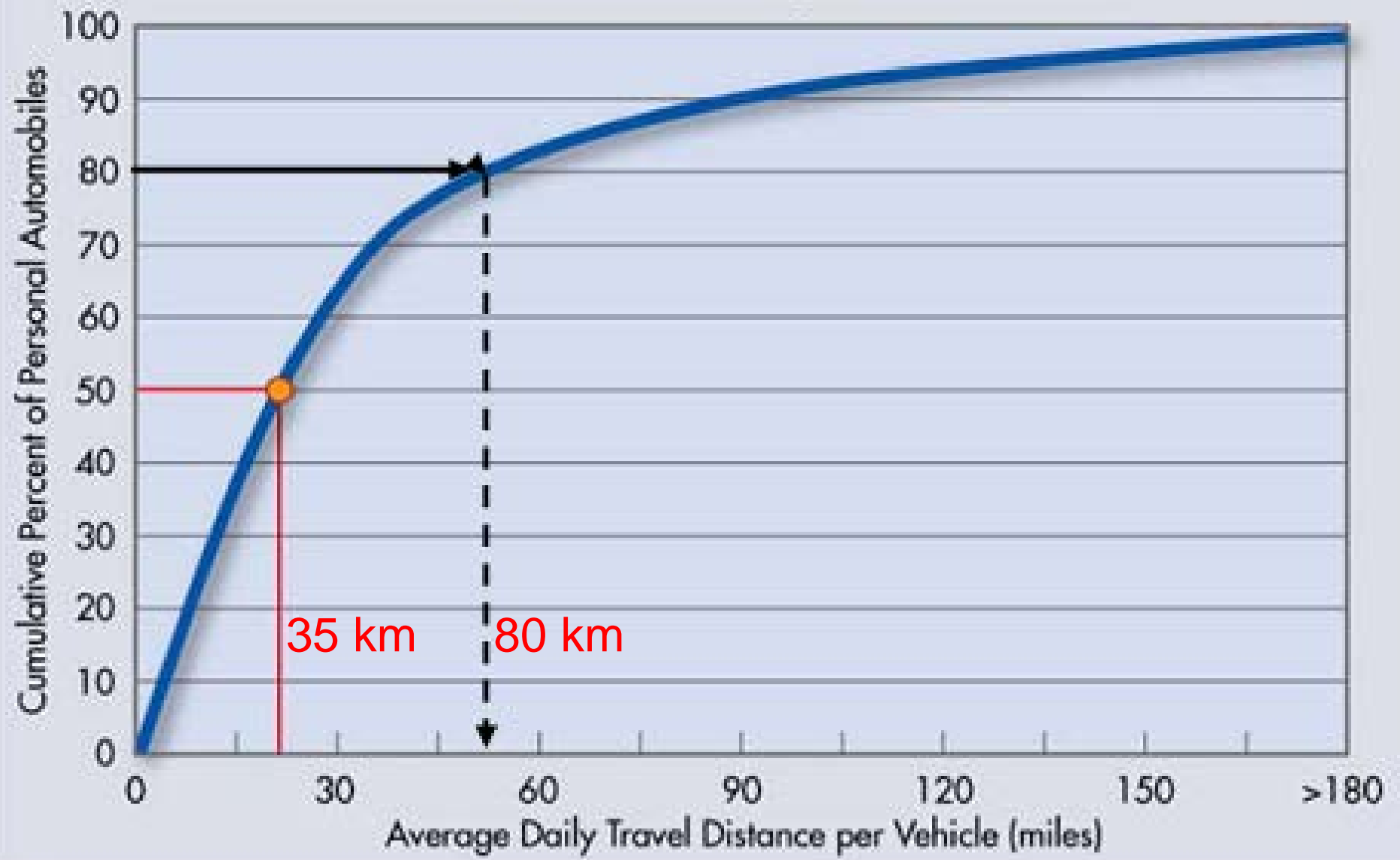


60 kWh

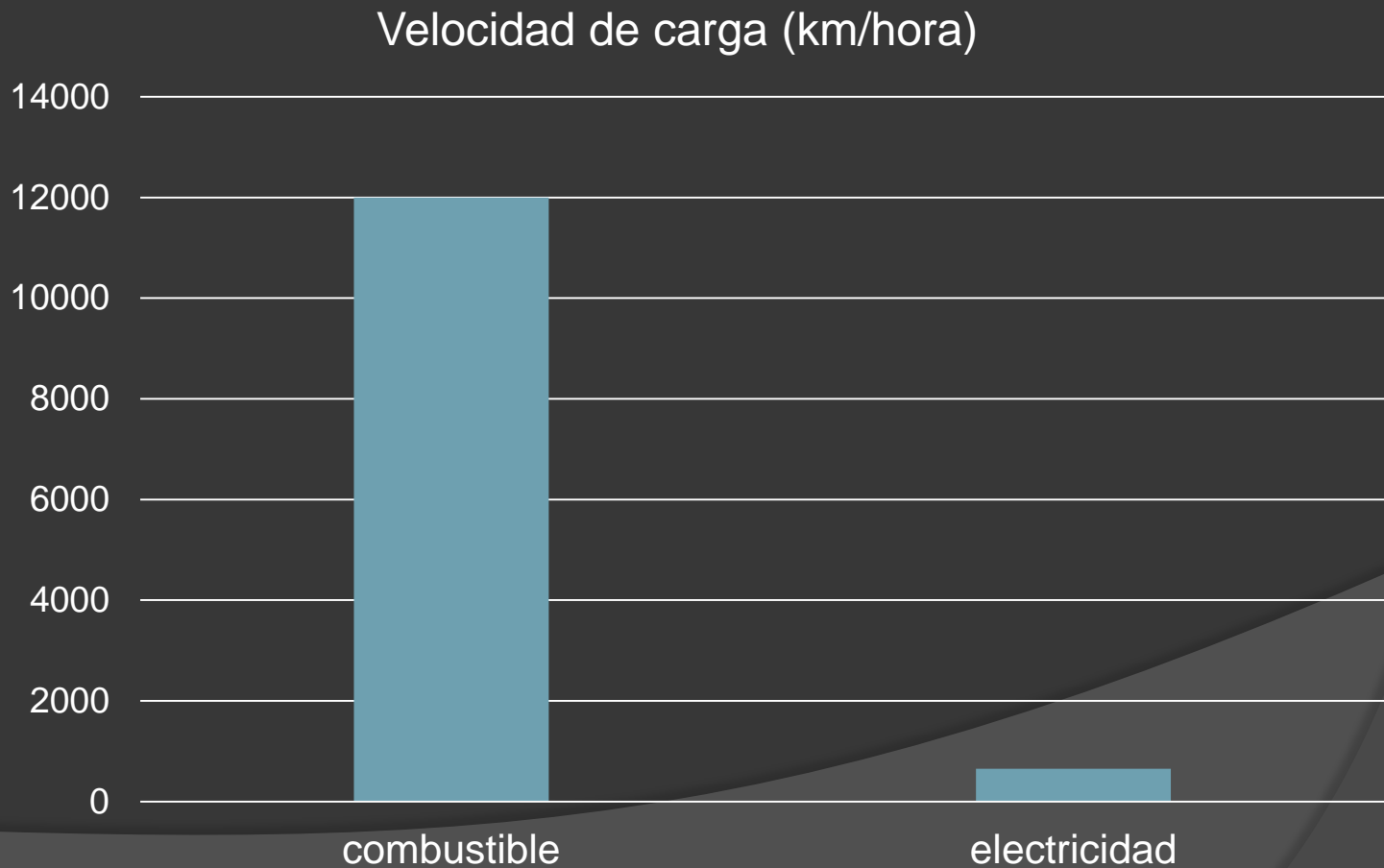
# Encuesta: cuántas millas debería recorrer un automóvil a baterías para que Ud. considere comprarlo?



# American Driving Patterns



Y también piden cargas más rápidas  
=  
MAS BATERÍA Y MAS POTENCIA DE CARGA





# Razones del éxito de los VEs

## Costo operativo en Argentina

**Cnafta = 5 \* Celect.**

- ✓ NO ACEITE
- ✓ NO FILTROS
- ✓ NO BUJIAS
- ✓ NO CORREAS
- ✓ NO EMBRAGUE
- ✓ NO FRENOS
- ✓ NO SILENCIADOR

# Reciclado – Segunda vida



# Almacenaje residencial

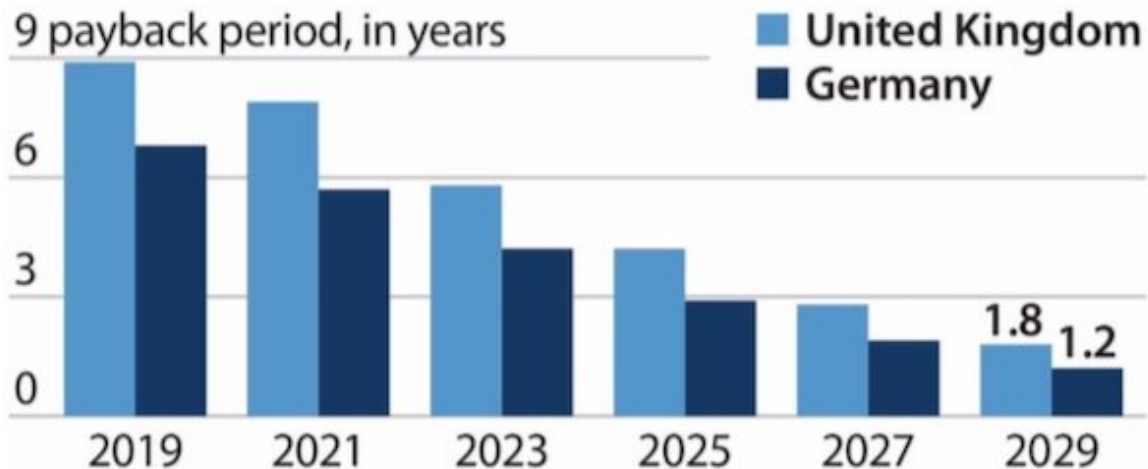


Baterías de segunda vida

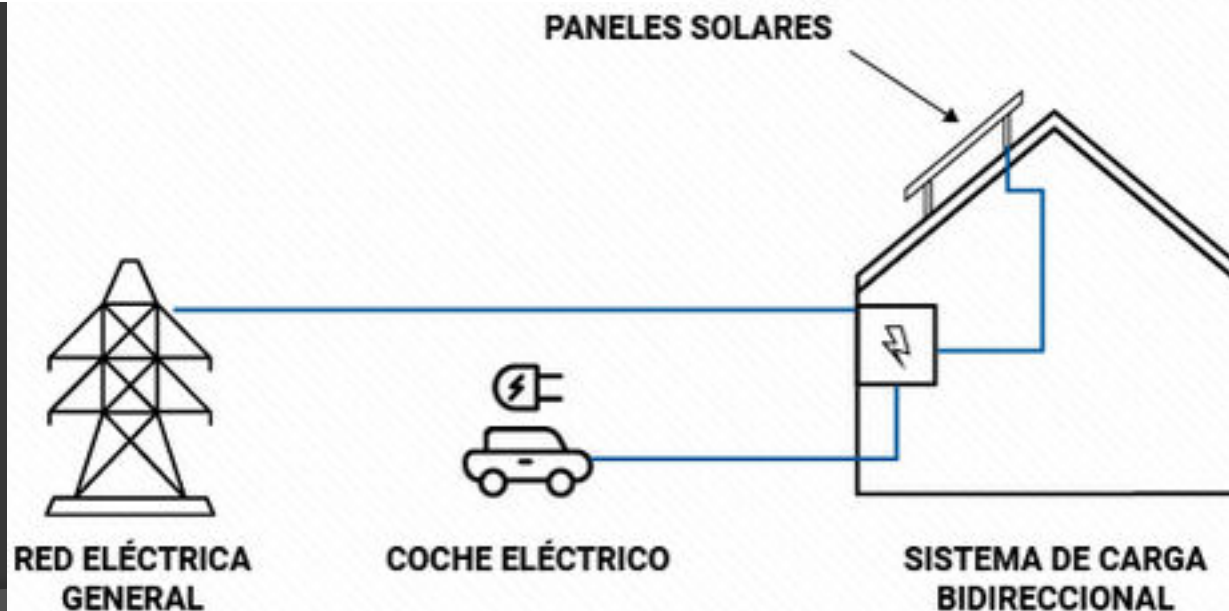


## Solar + Battery + EV Accelerates Payback Time

As costs fall, payback will be shorter in UK and Germany.



Source: IEEFA



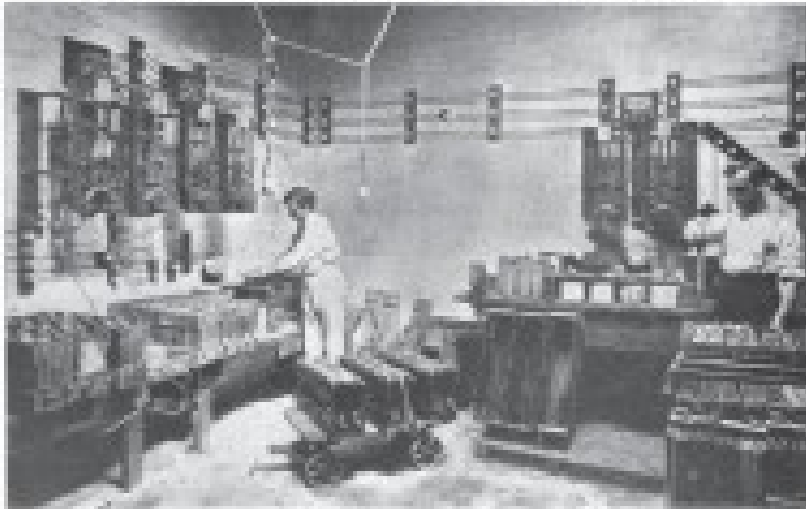
# Almacenaje residencial



# LA RECARGA DEL AUTOMOVIL ELECTRICO.

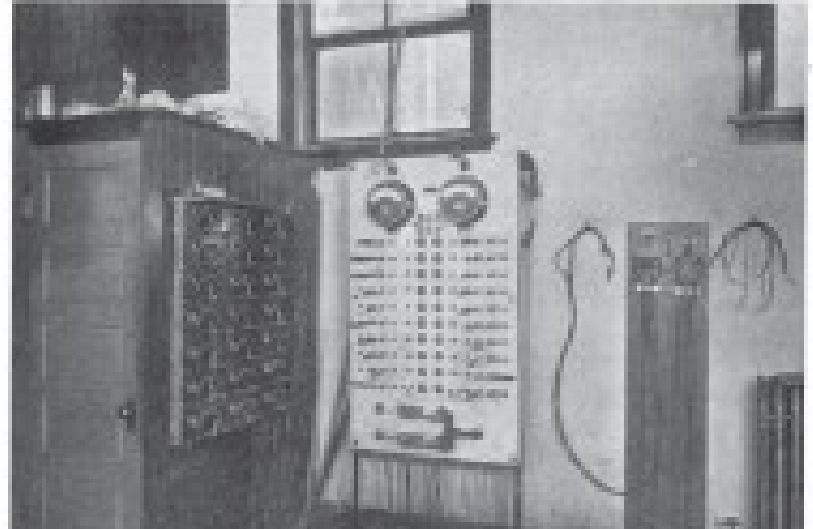
The Power Magazine, Dec 15, 1901

## Features of an Electric Stable



The Power Magazine, Dec 15, 1901

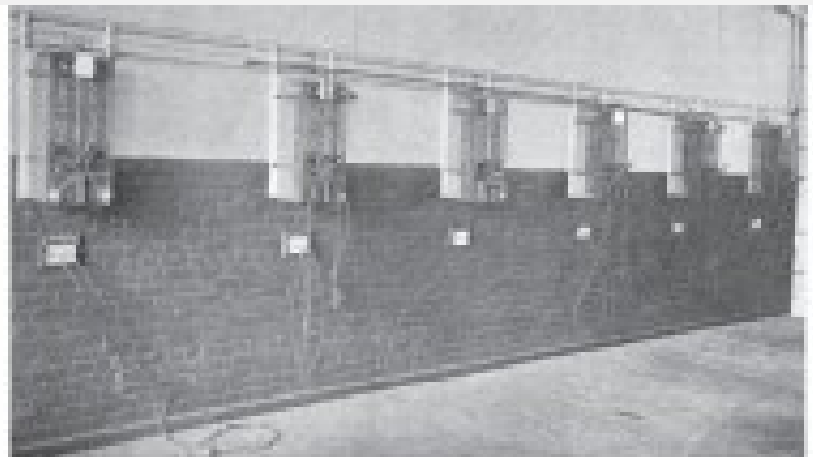
## Features of an Electric Stable



Battery swapping ... o recarga en el auto?



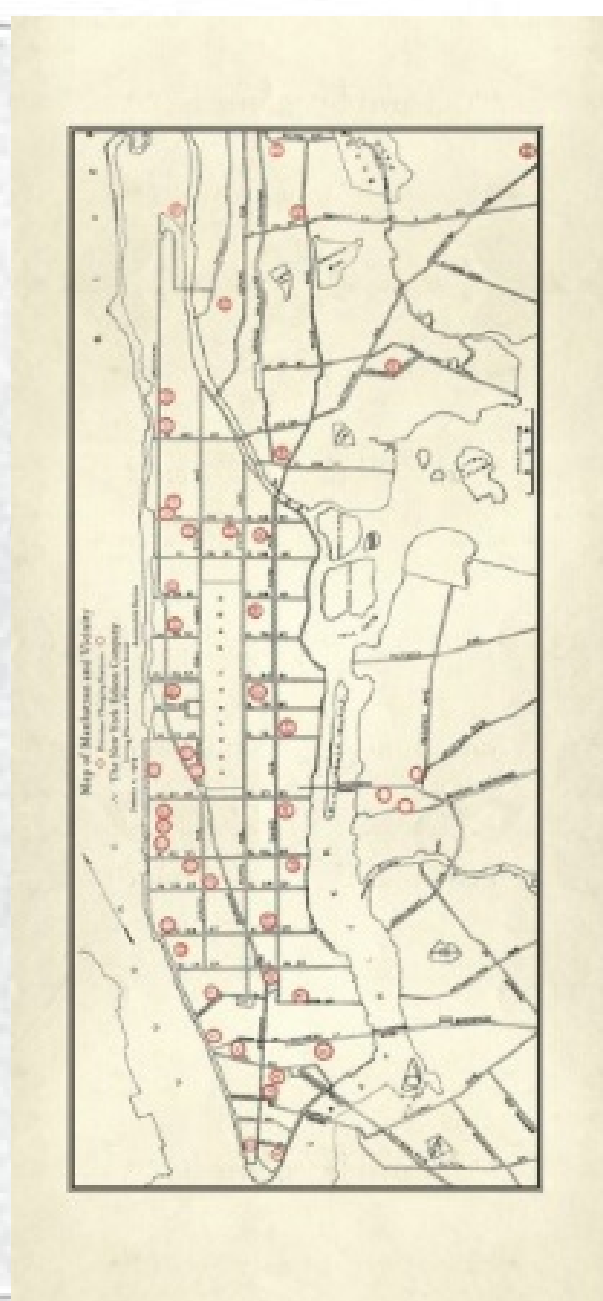
APPROXIMATE BATTERY ROOM



CHARGING ROOM - A READY TO GO BATTERY



207418



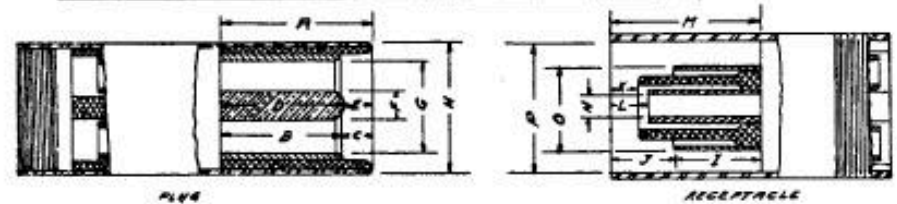
**FIGS. 1 AND 2—CURB CHARGING STATION FOR ELECTRIC AUTOMOBILES**

# Electric Vehicle Association of America



124 W. 42ND ST.  
NEW YORK

## Standard Charging Plugs and Receptacles.



contacts must be accurately concentric to insure interchangeability.

CAPACITY	A	B	C	D	E	F	G	H	I	J	K	L	M	Standard		Alternate	
														N	N	O	O
50 AMP	1 1/2	1 1/8	3/8	1 1/8	5/16	.875	1.125	1.725	1 1/8	7/8	3/8	1/8	2	.375	.360	.423	.408
150 AMP	2 1/2	1 3/8	1 1/8	2 1/8	5/8	.935	1.406	2.100	1 5/8	1 1/2	3/4	7/16	2 3/8	.547	.432	1.404	1.416

The National Board of Fire Underwriters have approved plugs of the above dimensions for these ratings with an allowable overload of 50%.

**Polarity**— Outside contact positive, inside contact negative.

**Terminals**— Should be large enough to receive cable having a rating, according to the Underwriters Code "Table B," at least equal to the normal rating of plug.

Terminals are to be marked + and - to correspond to polarity of contacts as above.

COMMITTEE ON STANDARDS  
E.R. Whitney, Chairman.  
Alexander Churchward.  
J.R.C. Armstrong  
H.H. Rice.  
W.E. Holland.  
E.J. Ross Jr.  
E. Gruentli.  
Charles Blizgard.  
J.H. Hertner.  
Louis Burr

Dec 10<sup>th</sup> 1913

Recommended by Standardization Committee and accepted by E.V.A.A. Oct 1912 and Oct 1913.



Figure 3.25: 150 A charging plug with handle<sup>100</sup>

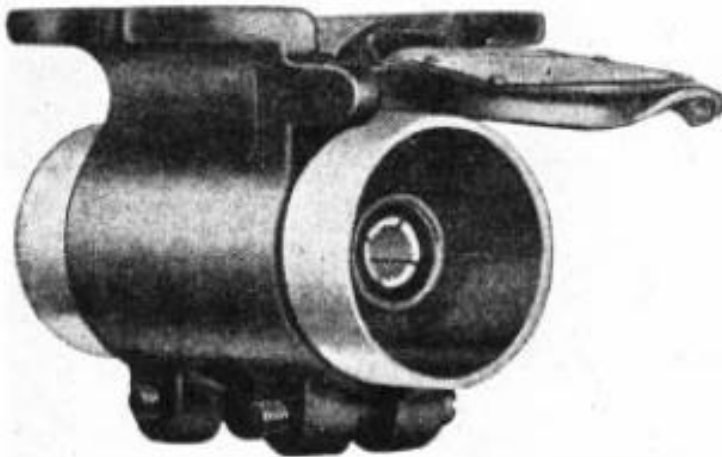


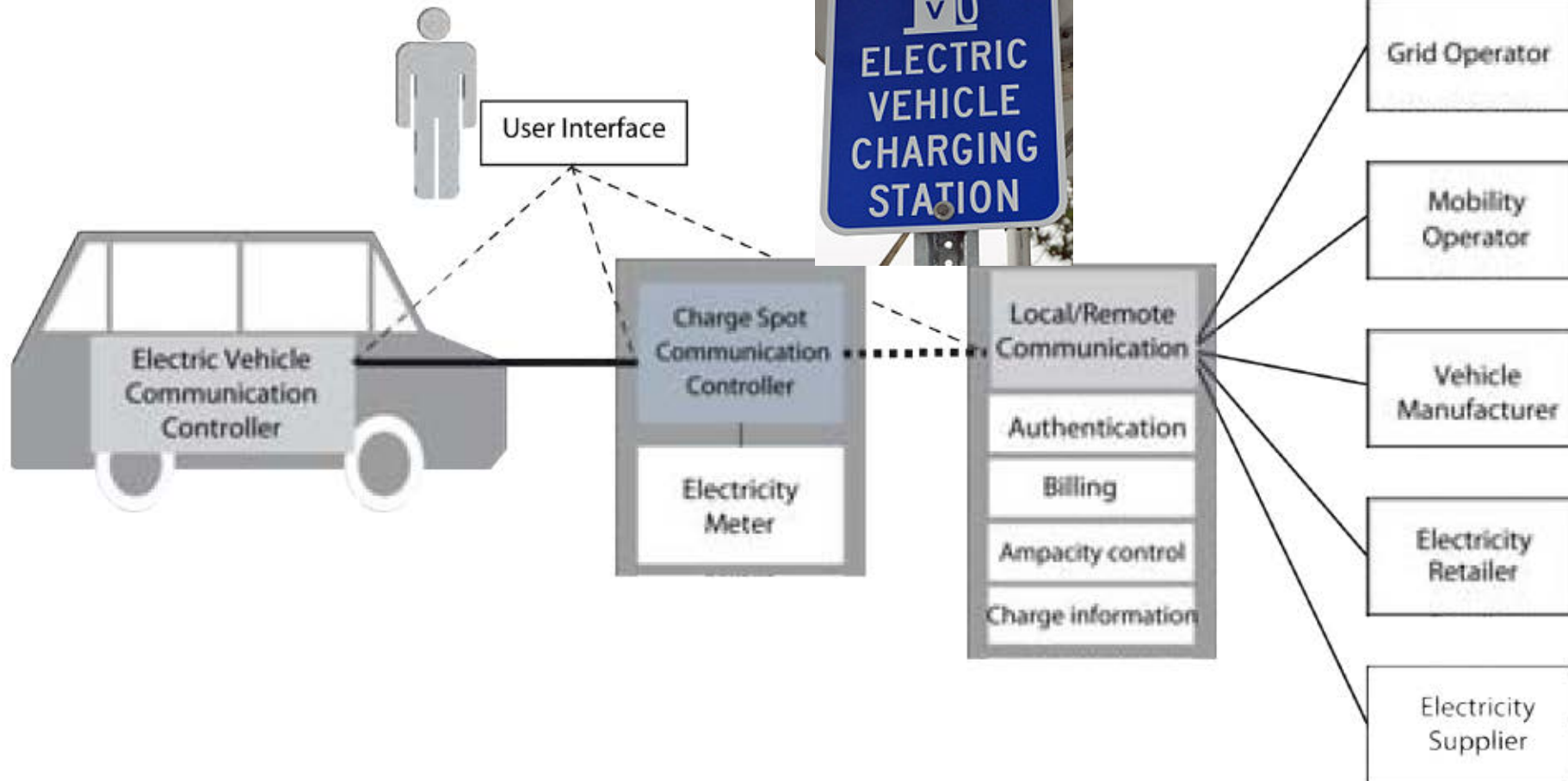
Figure 3.26: 150 ampere-hour (sic) charging receptacle<sup>100</sup>

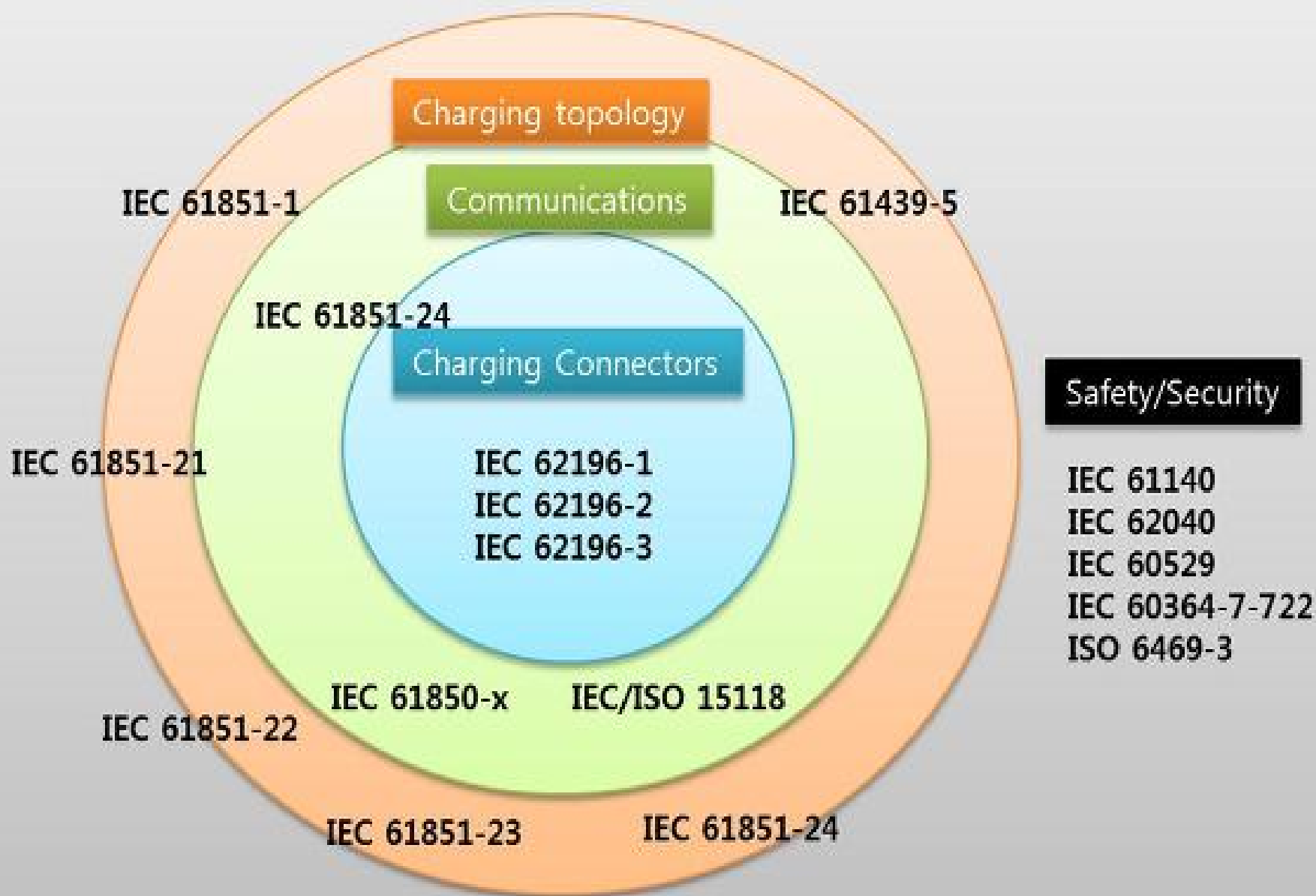




**INTEROPERABILIDAD  
Y SEGURIDAD  
IEC 61851**

# Interoperabilidad Recarga en vía pública Actores involucrados





# Interoperabilidad - Conectores

	US	EU	CHINA	JAPAN	
<p><b>AC Charging</b></p> 	<p>Single-Phase</p> 				
<p>Japón y Dinamarca con mas cargadores que gasolineras</p> <p>Con interoperabilidad limitada</p>					
<p><b>DC Charging</b></p> 	 <p>SAE J1772™ 'Hybrid'</p>	 <p>IEC 62196-2 Type 2 'Hybrid'</p>	<p>SAE and IEC working toward harmonization of DC 'Hybrid' charge couplers</p>	 <p>Mode 3</p>	 <p>JEVS G105-1993 (ChADeMO)</p>

\* SAE J1772™ AC connector has also been adopted by Korea and Australia

# Multi-standard charger solution

AC



RENAULT

DAIMLER

TESLA

CHAdeMO



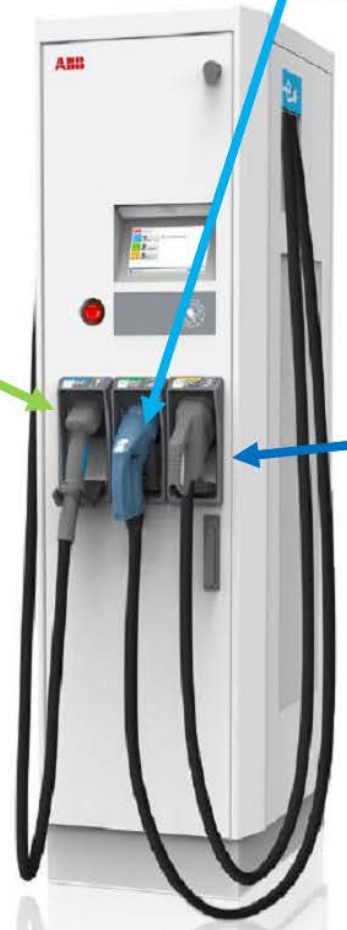
NISSAN

mitsubishi

KIA

PEUGEOT

CITROËN



CCS



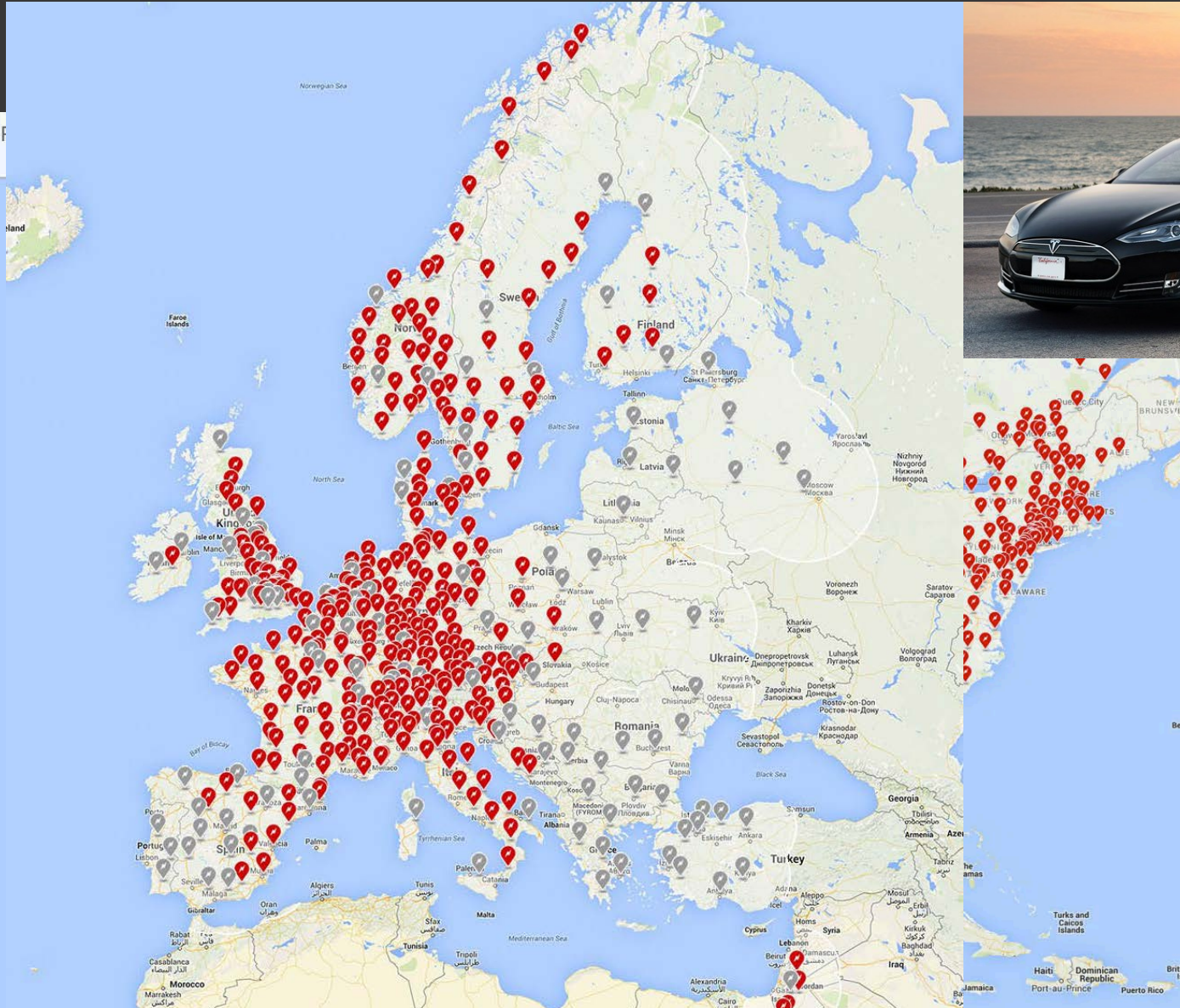
BMW

VW

GM

# **DISTINTAS TECNOLOGIAS DE RECARGA**

# Recarga rápida (y gratis!) – 13000 chargers en USA



# Recarga rápida a 350 kW



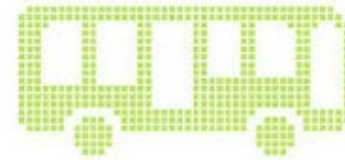


# RECARGA EN VEHICULOS PESADOS Gotemburgo (Volvo)

10 minutes  
fast charge



Long-life  
battery



Fast Charging  
Pure Electric  
Buses

Intelligent  
traffic  
management



Thermal  
Management  
System



RECARGA EN  
CARRETERA

PANTOGRAFO

SIEMENS' eHIGHWAY  
TEST TRACK  
GERMANY



# RECARGA EN CARRETERA

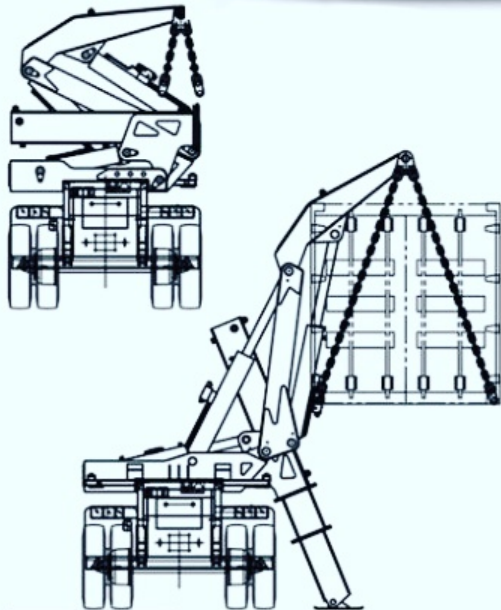


# Cargadores a baterías



# Cargadores a baterías

**E-TRUCK**  
SIDELIFTER



# Carga de emergencia



# Otros sistemas de Recarga: sin cables. (IEC 61980)



Qualcomm Halo  
3.3kW - 6.6kW



3 Wireless power & data transfer

4 Vehicle pad

5 On board controller

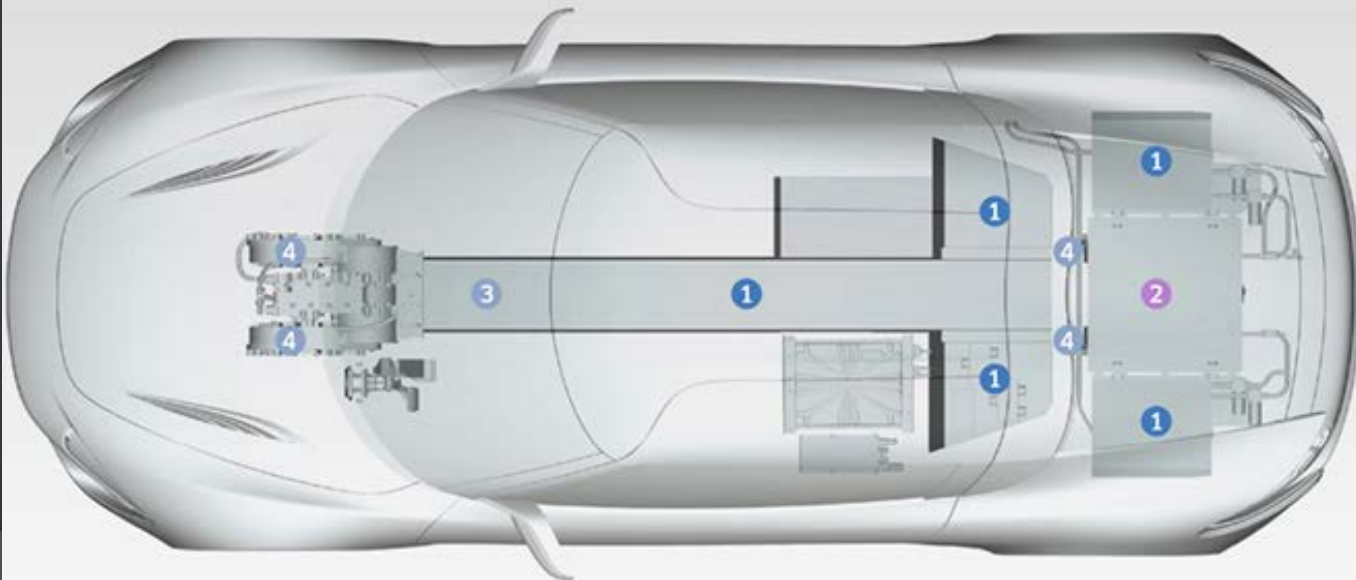
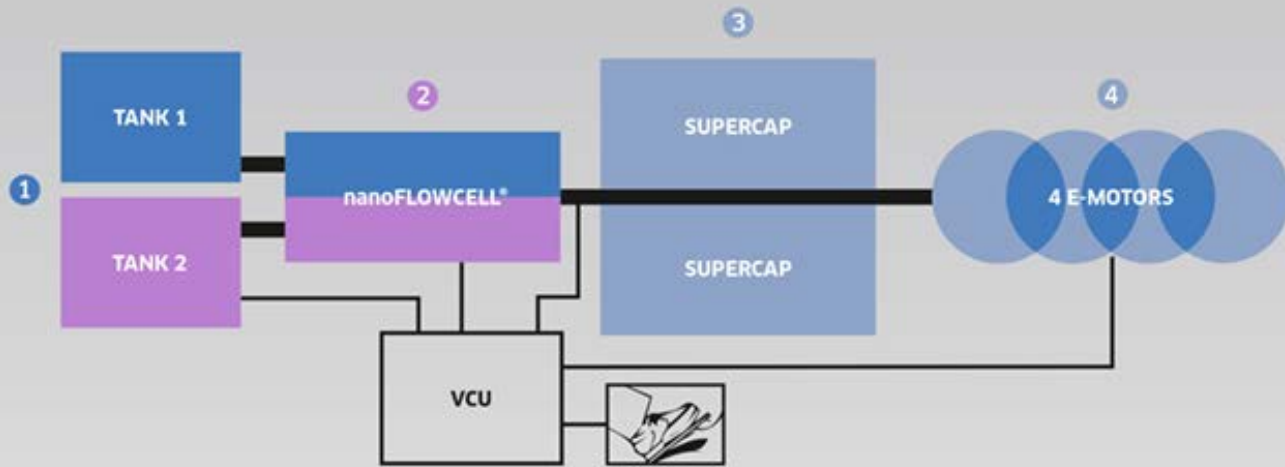
6 Battery

# Otros sistemas de Recarga: sin cables (IEC 61980)





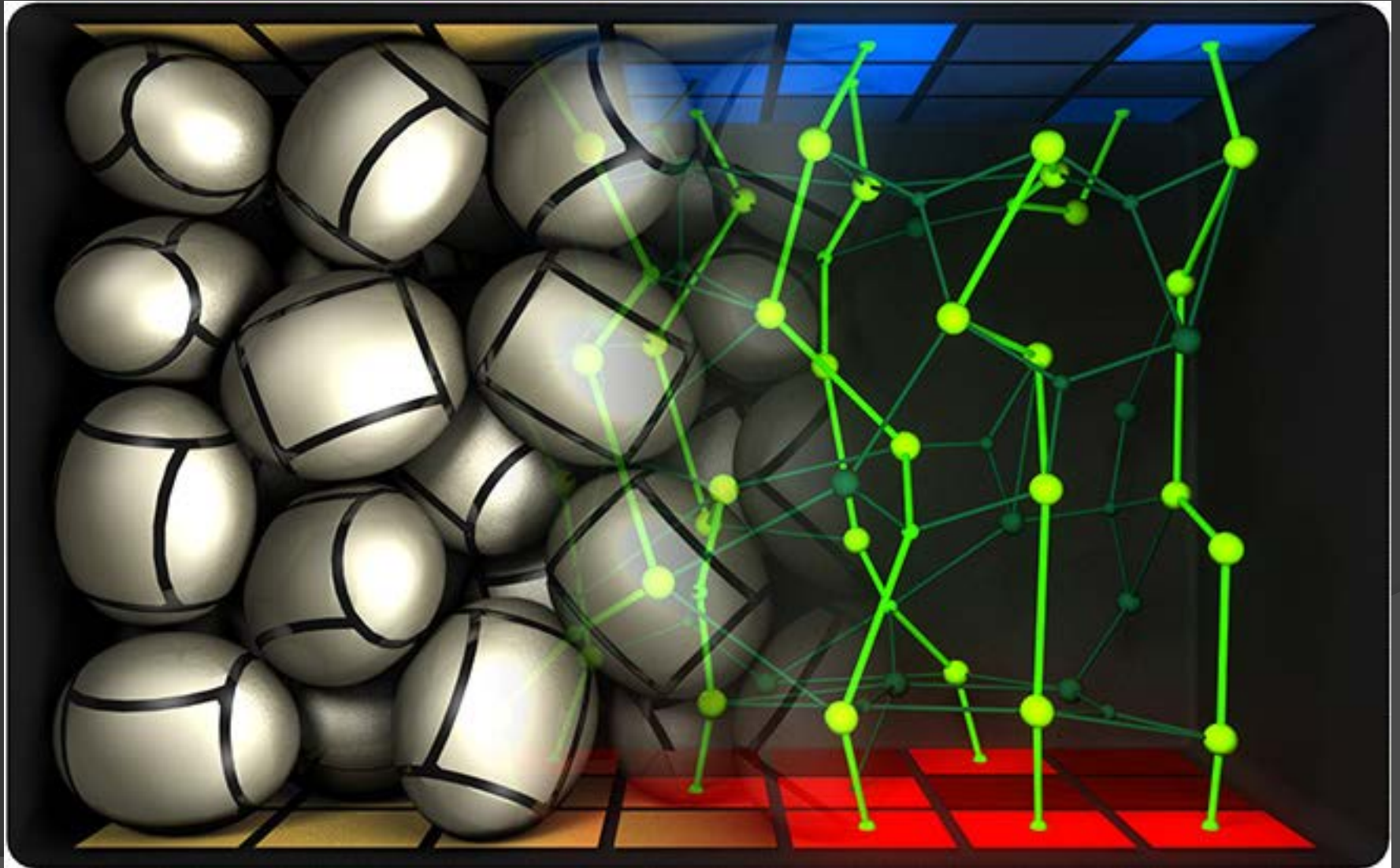
# Otra clase de recargas rápidas: cambio de electrolito



# Otra clase de recargas rápidas: String cell



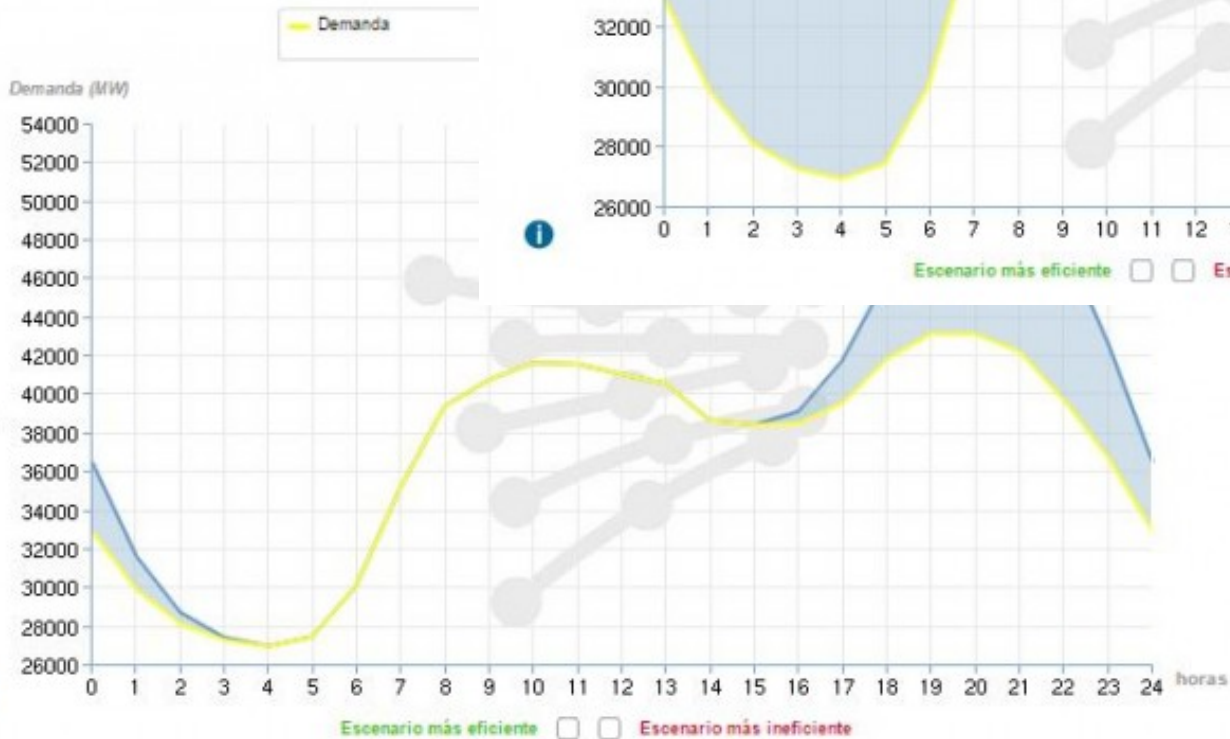
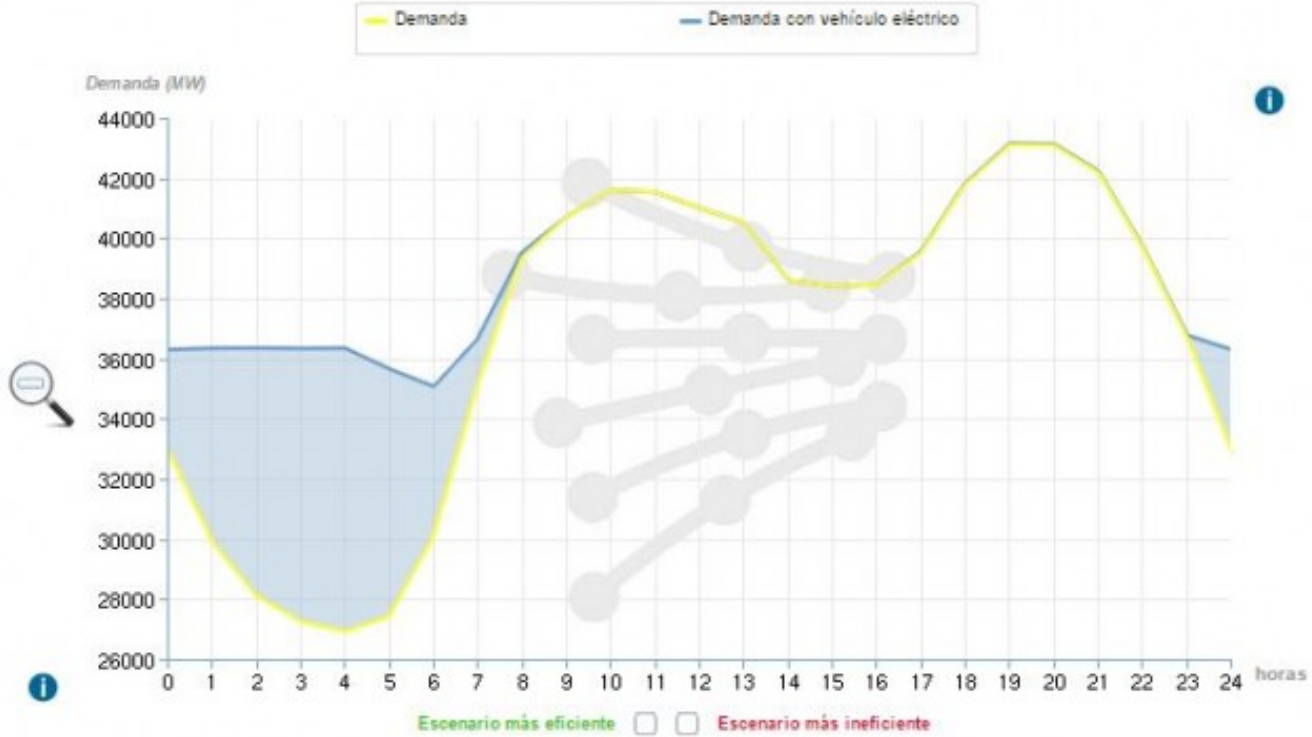
# Otra clase de recargas rápidas: String cell



# Vehículo eléctrico sin baterías (y autónomo)



# Impacto en los sistemas eléctricos





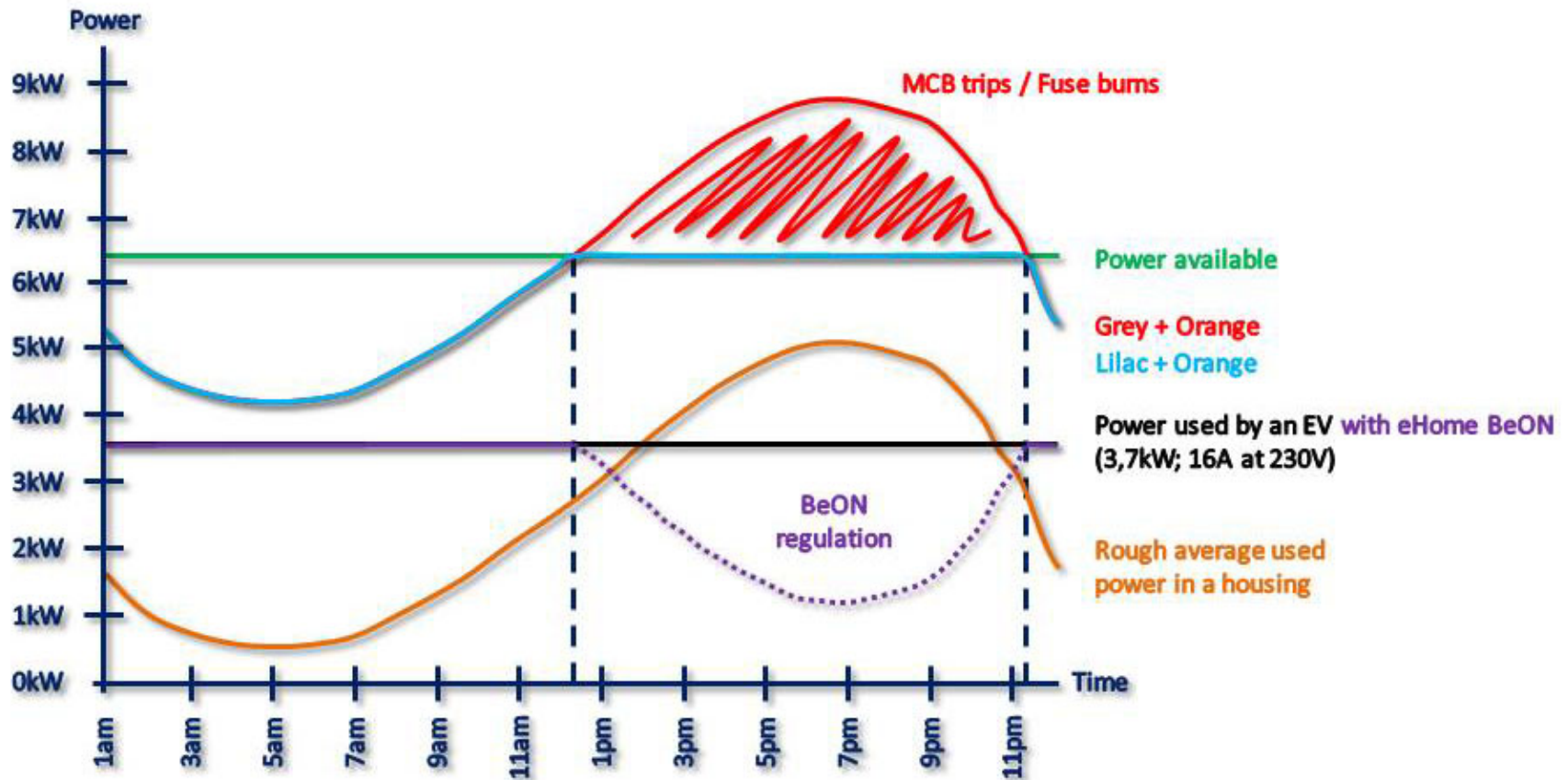
# Workplace Charging Challenge

U.S. DEPARTMENT OF ENERGY



# La recarga en Tarifa 1

## Intelligent sensor eHome BeON; principle of operation





**FILED**  
3-13-15  
04:59 PM

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF CALIFORNIA**

In the Matter of the Application of Pacific Gas  
And Electric Company (U 39 E) for Approval of  
its Electric Vehicle Infrastructure and Education  
Program.

Application 15-02-009  
(Filed February 9, 2015)

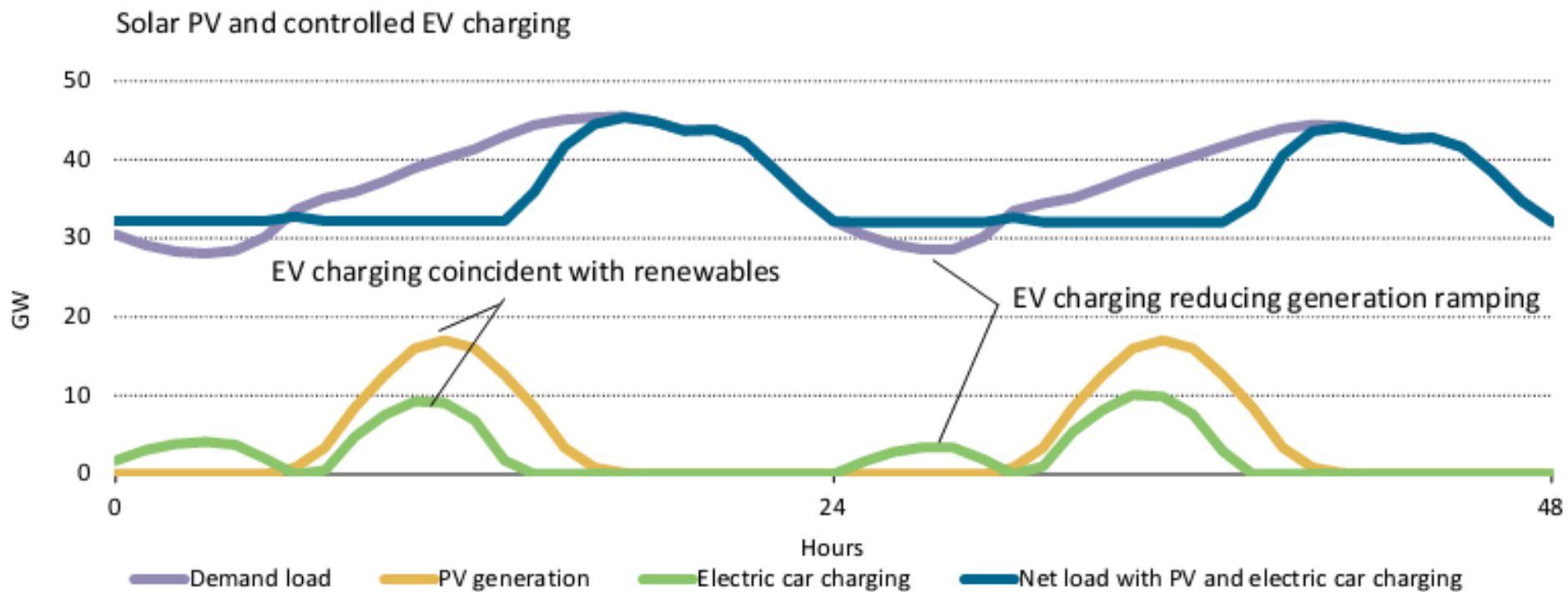
25.000 puntos de carga  
a U\$S 26.000 cada uno  
Total U\$S 638 millones

**PROTEST OF CONSUMER WATCHDOG TO  
PACIFIC GAS AND ELECTRIC COMPANY'S (U 39 E) ELECTRIC VEHICLE  
INFRASTRUCTURE AND EDUCATION PROGRAM APPLICATION**



# Recarga de baterías

## La interconexión con la red eléctrica y las renovables



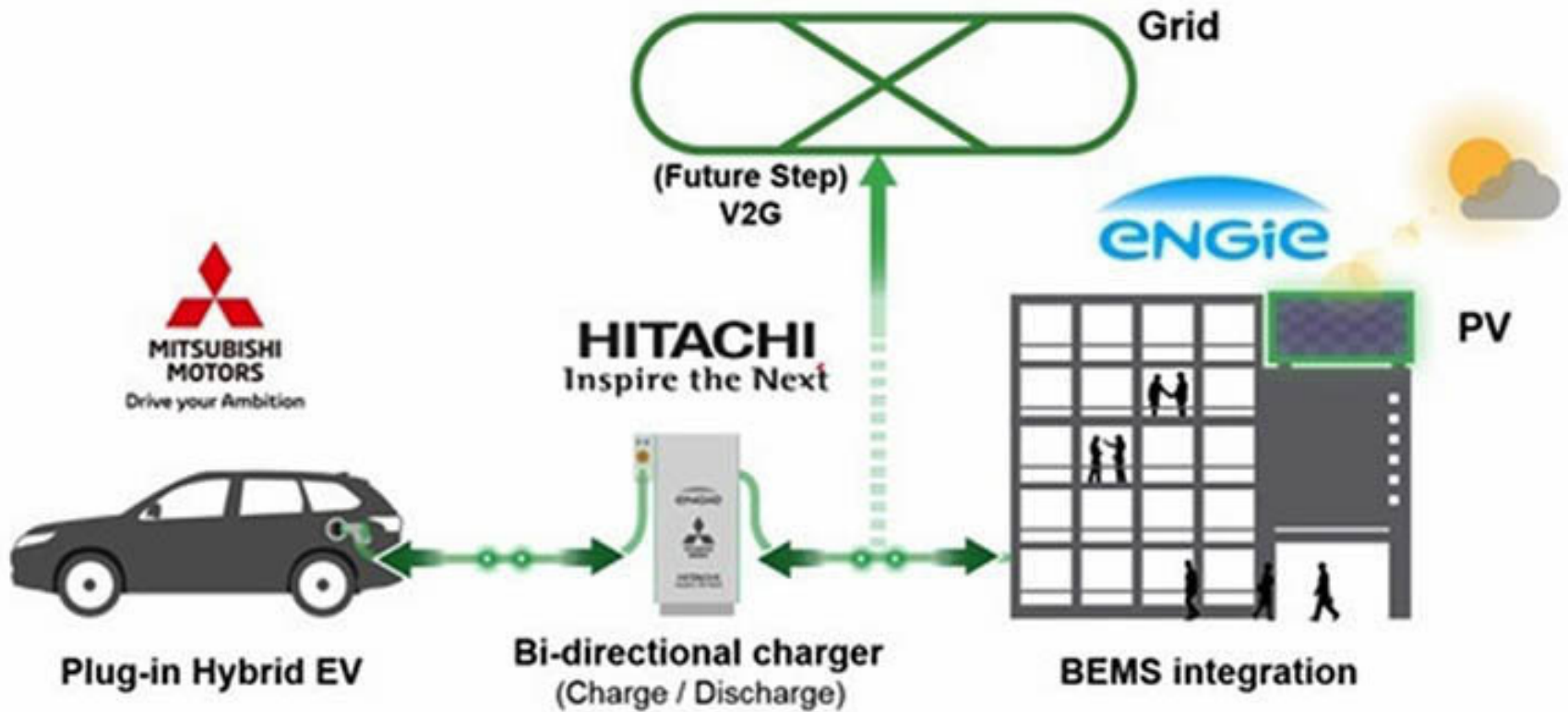
Sources: IEA (2017b).

# Recarga de baterías

## La interconexión con la red eléctrica y las renovables



# V2G



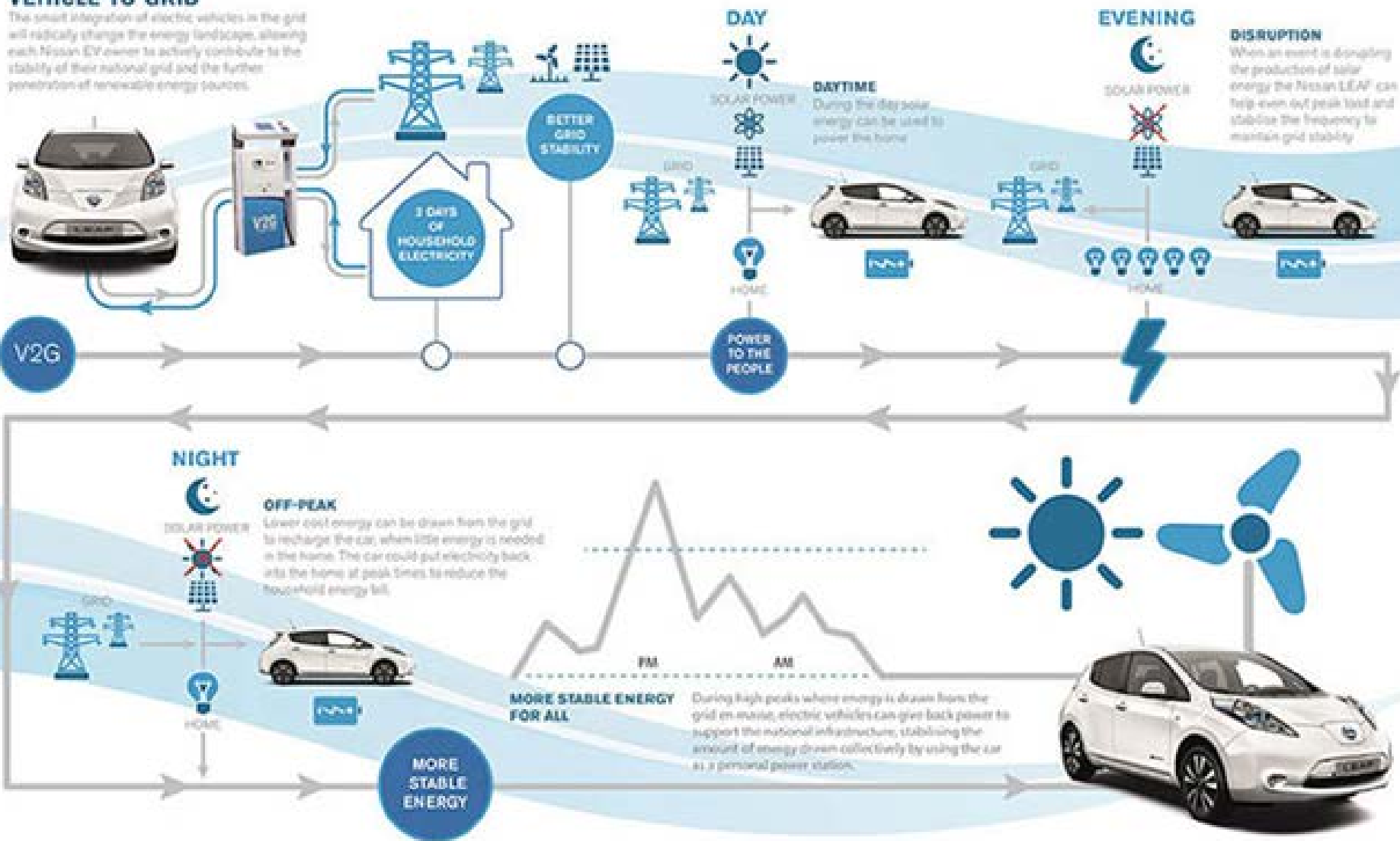


# POWER TO THE PEOPLE

## NISSAN'S VISION FOR THE ENERGY GRID PUTS THE POWER IN YOUR HANDS

### VEHICLE-TO-GRID

The smart integration of electric vehicles in the grid will radically change the energy landscape, allowing each Nissan EV owner to actively contribute to the stability of their national grid and the further penetration of renewable energy sources.



# Costos de Recarga

## Conceptos

- La domiciliaria puede ser la de menor costo.
- Problemas en propiedad horizontal.
- Carga de oportunidad: Membresías, Redes de carga, cuotas fijas.
- Roaming entre redes y entre países.
- 85% de las recargas públicas no se cobran. Ni se miden.

Muchas gracias!

Ing. Claudio Damiano  
cdamiano@enre.gov.ar