



Energy for
generations

Electric Vehicles – A Sustainable Alternative

Irish Renewable Energy Summit
Dublin
Dec 13th 2016

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Chair of Eurelectric Electromobility WG
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Climate Change - Transport

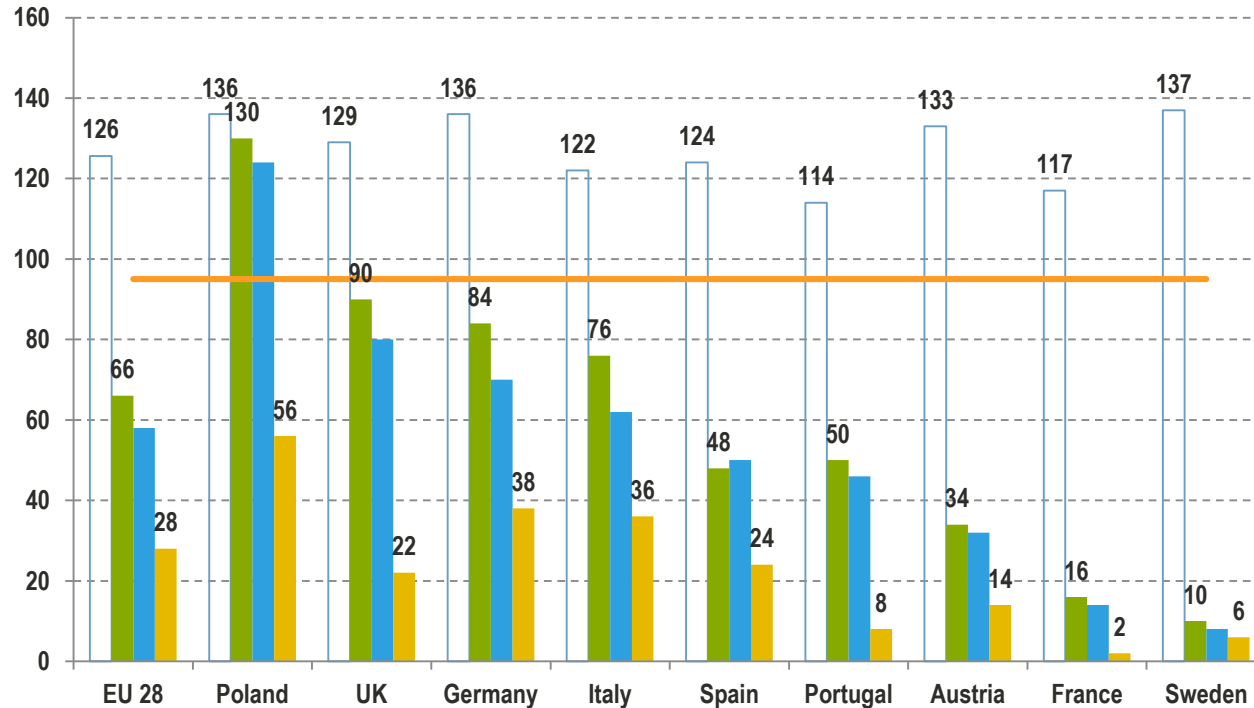
5 B) Electric Vehicles

“We want Ireland to become a leader in the take-up of electric vehicles. We will establish a dedicated taskforce involving relevant government departments, agencies, industry and representative groups, to work on this goal and to set ambitious and achievable targets. The taskforce will also investigate the potential role and use of other future fuels such as hydrogen.”

- **Fuel/ Energy**
 - Sustainable with zero carbon a realistic medium term goal
 - Improve air quality and reduce carcinogens in the air that citizens breathe
 - Economical to produce with a realistic land use requirement
- **Technical Performance**
 - Vehicle speed and acceleration
 - Vehicle handling
- **Customer Acceptability**
 - Choice of Models
 - Vehicle Capital cost
 - Vehicle Running Cost
 - Vehicle Range
 - Ease of Refuelling/ Recharging

- **Electricity usage for Average Driving (16,000 km/ year) = 2500/ 3000 kWh**
- **Equals average residential usage in Southern and 60% of Northern Europe**
- **Battery Size (kWh) and Charging Rates (kW) increasing even faster than anticipated only two years ago and costs reducing accordingly.**
- **Typically all cars everywhere are parked for over 90% of their lives**
- **Unique from a residential load management perspective as interruptions to supply (particularly short duration) acceptable subject to certain constraints**

EVs emit less CO₂ than conventional cars



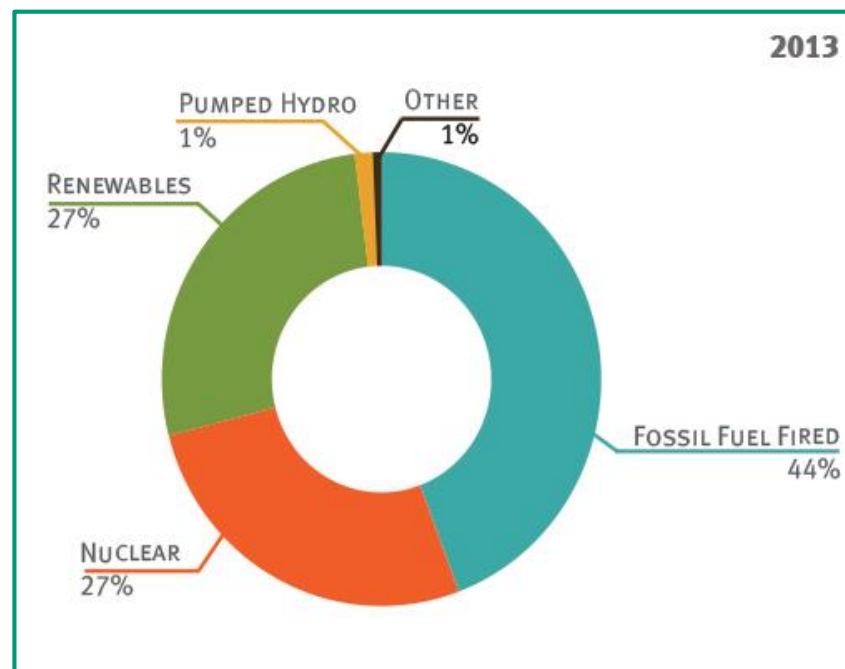
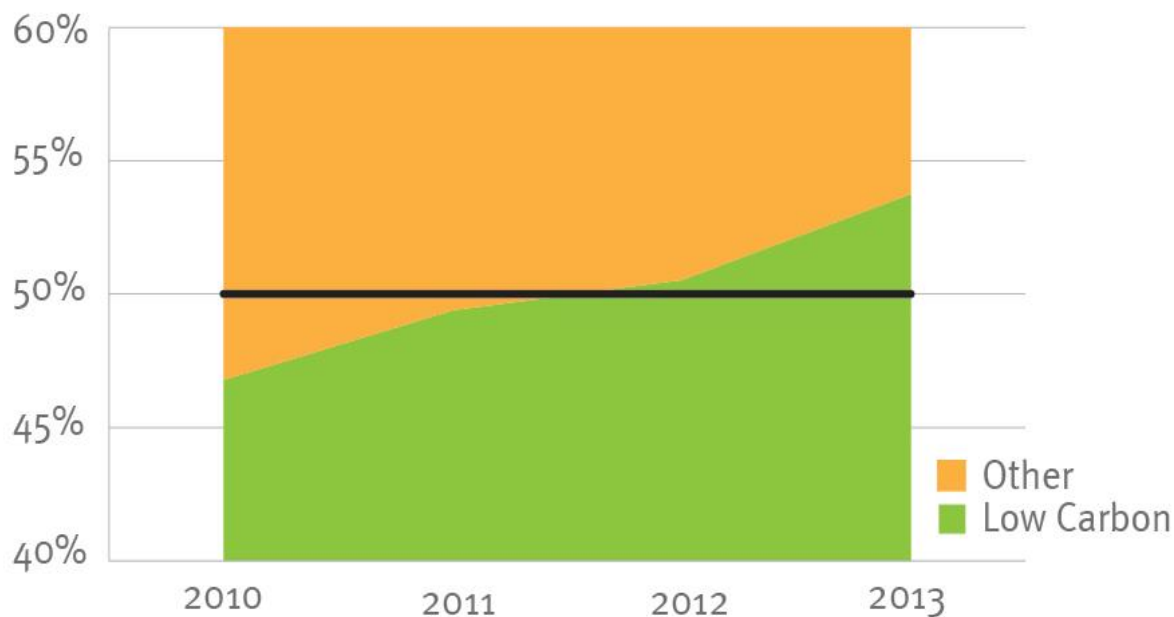
□ Average of CO2 of new cars
■ Average of CO2 EVs (2015)
— 2021 Goal 95 gr

■ Average of CO2 EVs (2010)
■ Average of CO2 EVs (2035) Ref Scenario 2013

- With the 2010 carbon intensity, a typical EV emits about 66g CO₂/km
- EVs will be even cleaner in the future as the power sector continues to decarbonise by 2050

EURELECTRIC smart charging paper, 2015

Latest trends: low-carbon generation is leading, capacity goes green

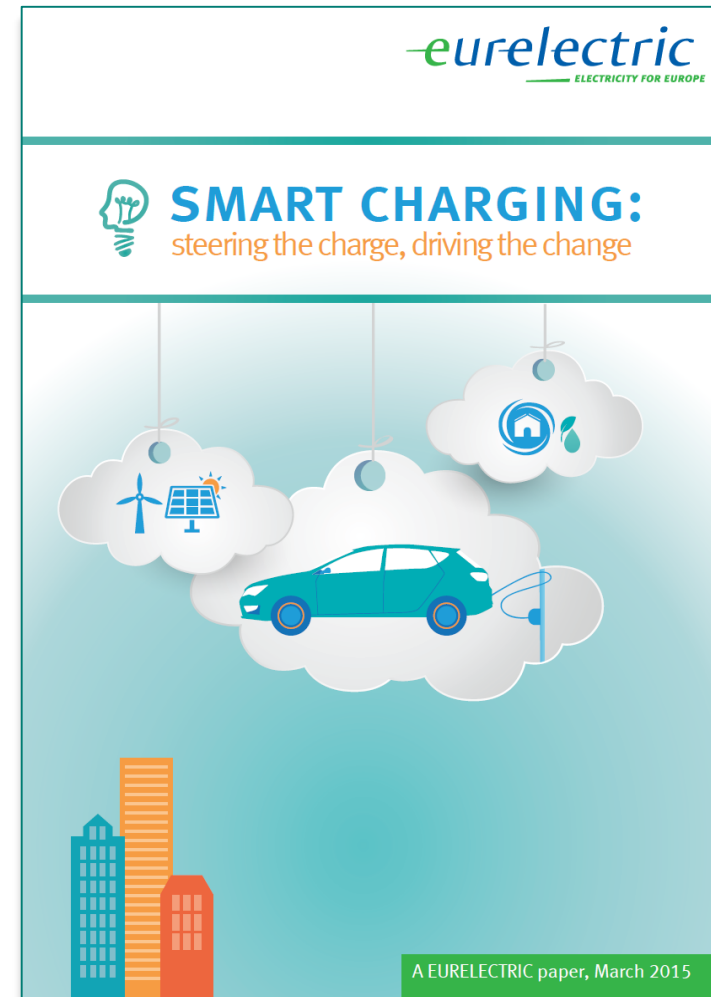


EURELECTRIC Power Statistics 2015

- For the second year in a row, more than half of the electricity generated in Europe in 2013 comes from low-carbon facilities
- More than 70% of the new capacity installed in 2013 was RES

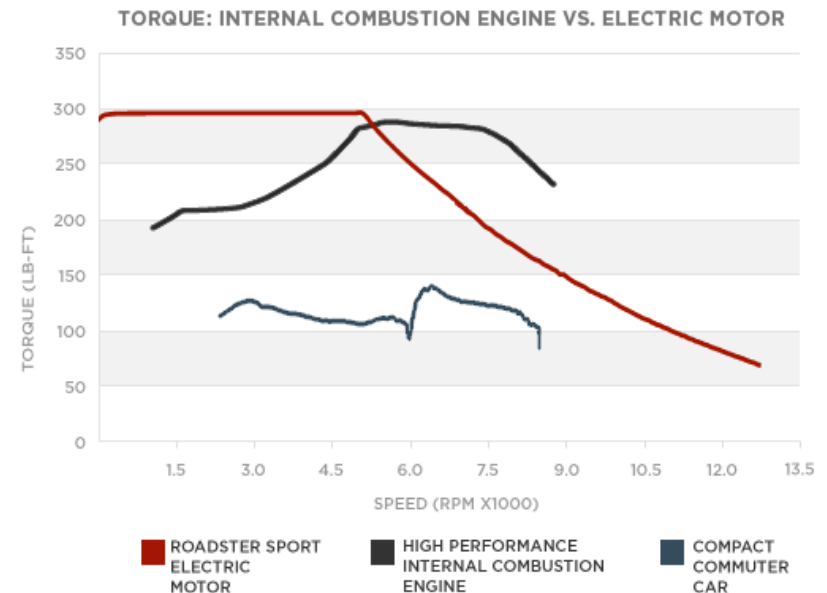
Can the European Electricity System Cope with EVs?

- If 100% of cars in EU were electric it would add 24% to total electricity
- Sufficient spare capacity to cope with this without any G&T Investment (in theory)
- Clustering may result in investment in Distribution system but can be limited with smart charging
- Improved asset utilisation will tend to reduce electricity prices for all
- EV charging can take place to coincide with available RES capacity (overnight)



Electric Traction is much superior to ICE

- Electric motors are 4 to 5 times more efficient than petrol/ diesel engines
- Electric Motors have maximum torque at start unlike petrol or diesel engines which have zero torque and require a starter motor powered by a battery to get going
- The Tesla Model S (cost €150k) takes 2.6 seconds to get from 0-60mph. Fastest production car in the world – only Ferrari or Porsche costing over €1M can compete
- Electricity flows are much faster than liquid fuel so response is better
- Batteries under the floor lower the vehicle centre of gravity which leads to better road handling



Maintenance & Reliability

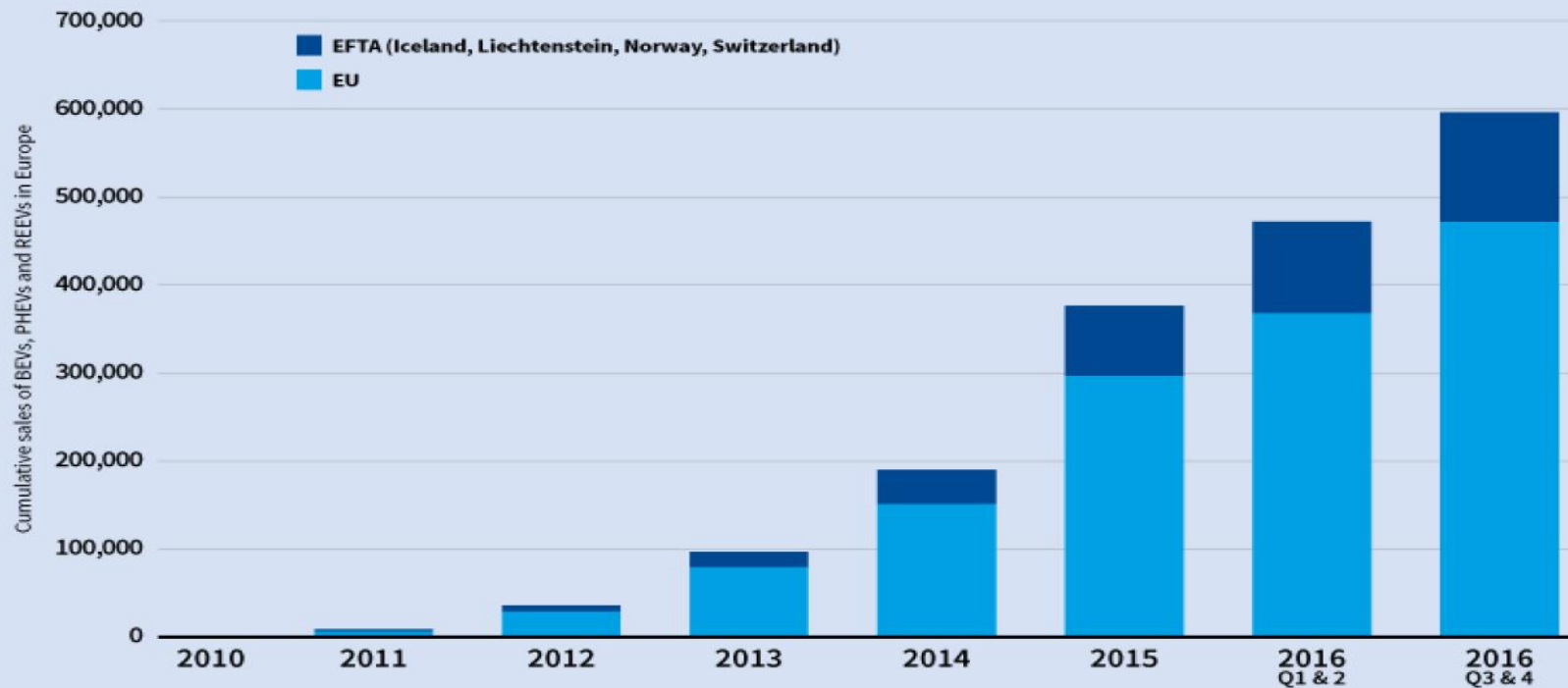
- ICE vehicle has 2000+ moving parts
- EV has > 20 moving parts
- ICE Car requires 48 person hours of assembly
- EV requires 10 person hours of assembly (for sme level of robotics)
















Image Source: © Todd McLellan Source: (1) Baron Funds

Europe Passes 0.5 Million EV in 2016

More than 500,000 electric vehicles on Europe's roads



Plug-in Vehicles Registered New Ireland 2016

Marque - 13 (35)	Model No – 22 (266) + 2 Comm	EV	PHEV
Nissan 	1 + 1	Leaf, e-NV 200	
Tesla 	1	Model S	
Citroen 	1	C-Zero	
Peugeot 	1	Ion	
Renault 	2 + 1	Zoe, Twizy, Kangoo	
BMW 	5	i3	i3, i8, Series 2, 3, X5
Volkswagen 	2		Golf, Passat Saloon
Volvo 	2		V60, XC90
Mitsubishi 	1		Outlander
Porsche 	2		Cayenne, Panamera
Mercedes 	1		S Class
Audi 	2		A3, Q7
Hyundai 	1	Ionic	

Views of German Auto CEOs

- “Efficient combustion engines by themselves cannot achieve these [EU emission] CO₂ targets. That’s why we have to electrify our fleet more extensively. We will launch a new plug-in hybrid model every 4 months on average until 2017.”
- “BMW will systematically electrify all brands and model series”
- Major electrification initiative planned: more than 30 new e-vehicles by 2025, annual unit sales target of two to three million. These will account for 25% of all global VW sales.
 - Battery technology, digitalization and autonomous driving to be developed into new Group competencies

Dr Dieter Zetsche

Chairman of Board of Management Daimler AG and Head of Mercedes-Benz Cars

*Daimler AG
April 1st 2015 Berlin*



Harald Krueger, CEO BMW



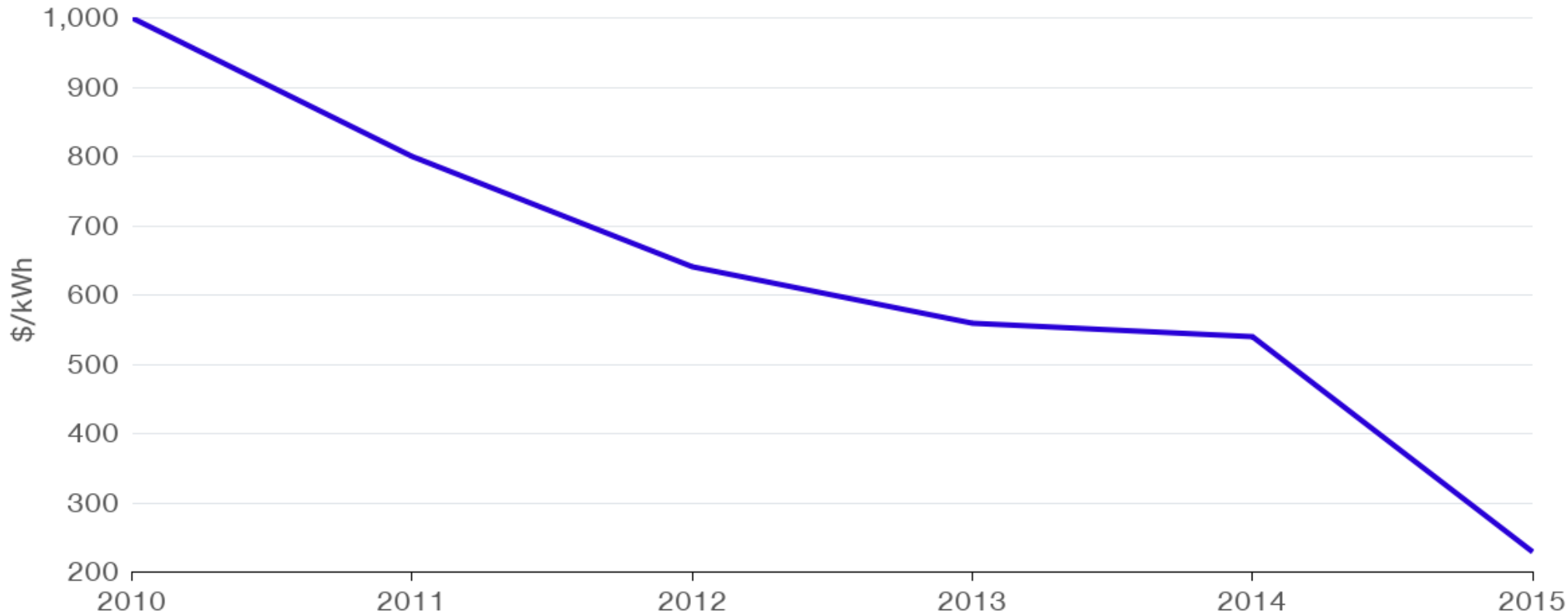
Matthias Mueller, CEO Volkswagen Group

Together – Strategy 2025



Battery prices are falling faster than forecast

Average Battery Pack Price

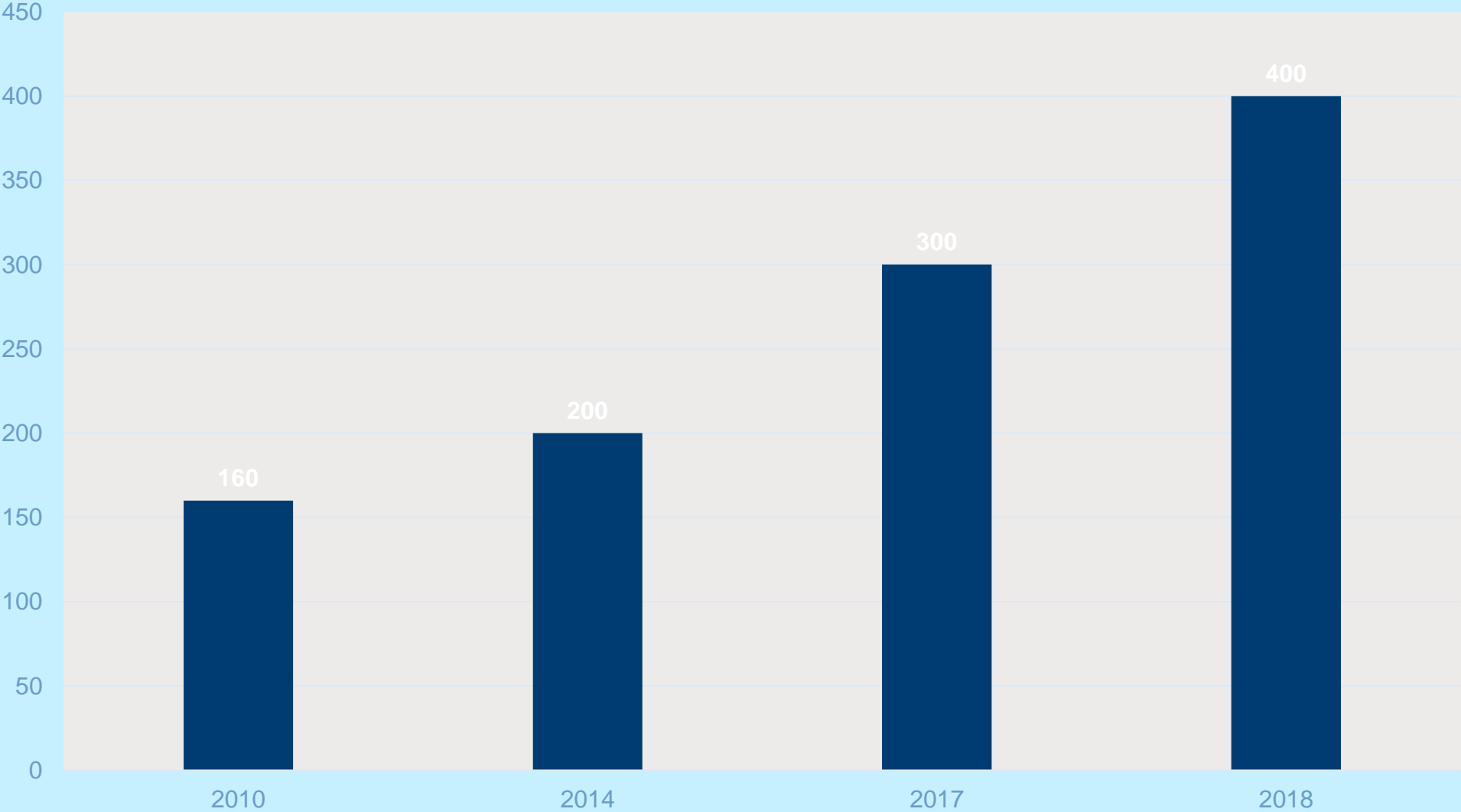


Source: Bloomberg New Energy Finance

NOTE: Battery prices are an average of BEV and PHEV battery packs

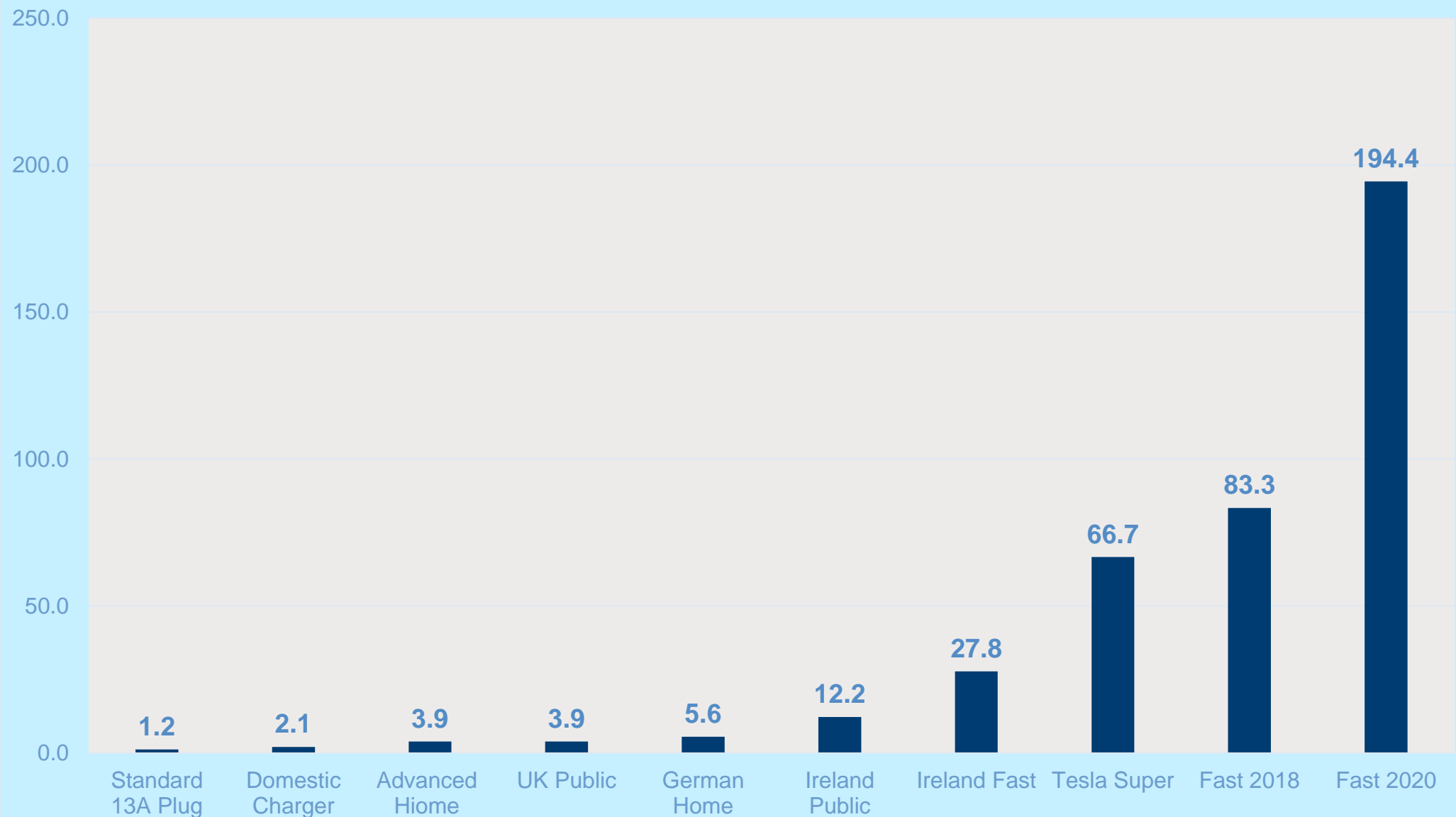
Small EV - Range Improvements

Nissan Leaf/ Renault Zoe Range (km)



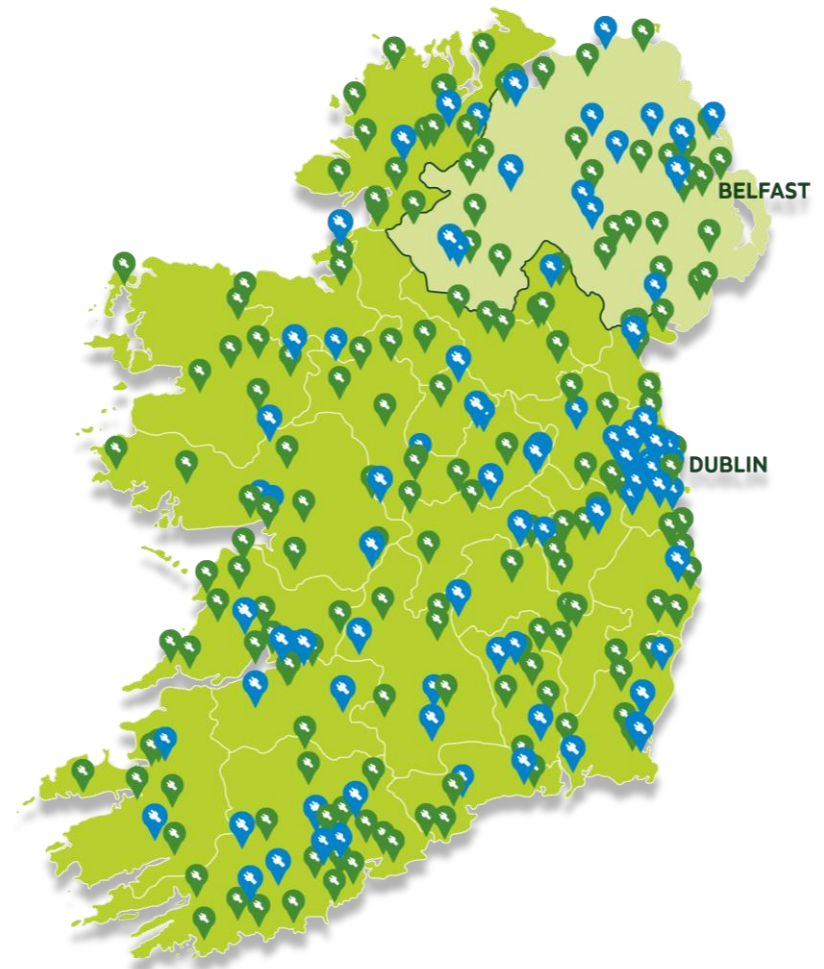
Developments in Charging Systems

Max km/ 5 min for Different Charging Systems



Ireland – ready for take-off

- **EV charge point infrastructure in place in Ireland**
 - AC 22kW in every town of 1500+ people
 - DC 50kW every 50km on all major inter-urban routes (initially Japanese Chademo only; latterly also with German Combo2)
 - Full interoperability across the whole island
- **Numbers of EV Models increasing steadily although some importers still not participating**
- **Leading Countries (Norway, Netherlands, UK) have centrally managed national organisation co-ordinating if not driving uptake.**



thank you!

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