WORLD MATERIALS FORUM

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EV

Smarter, longer, better use of materials, thanks to batteries

Gilles Normand

SVP, EV Business Unit, Groupe Renault

GROUPE RENAULT

Agenda

01 Renault: EV pionnier & leader in Europe

02 EV CO2 « cradle to the grave » balance

03 The WMF « Smarter, Less and Longer » toolkit

04 Improved battery performance

05 Battery 2nd life and recycling

06 Optimized battery utilization through faster chargeability

07 Carsharing maximizes EV usage

01. Renault: EV pionnier & leader in Europe

FIRST MOVER WITH A COMPLETE EV LINE UP

TECHNICAL EXCELLENCE

ZOE FLINS

e-Motor CLEON

Kangoo ZE
MAUBEUGE

Battery pack
TECHNOCENTRE

10 YEARS EV EXPERIENCE
>200K CUSTOMERS
4Bn e-KM RUN

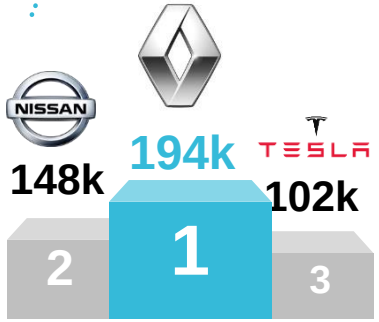
30 000
PEOPLE EV TRAINED

100%
TRAINED DEALERS

CUSTOMER SATISFACTION

- NEW ZOE: 300 km WLTP range
- >90% customer recommendations

EV LEADER IN EUROPE



Cumulated total EV sales
(@end 2018)

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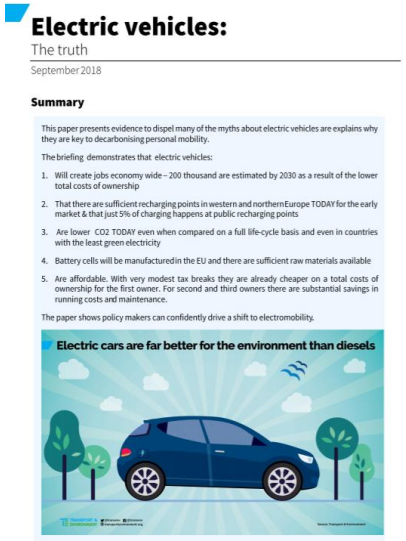
02. EV CO2 « cradle to the grave » balance


Electric vehicles:
The truth
September 2018

Summary

This paper presents evidence to dispel many of the myths about electric vehicles are explains why they are key to decarbonising personal mobility.

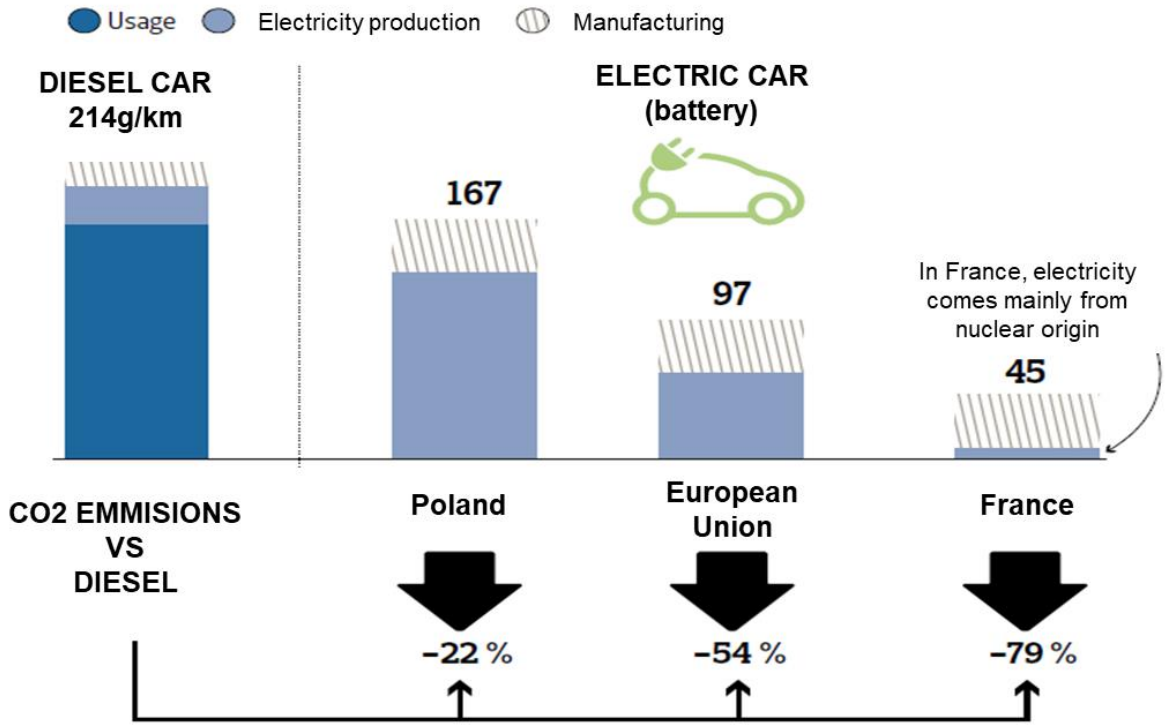
The briefing demonstrates that electric vehicles:

1. Will create jobs economy wide – 200 thousand are estimated by 2030 as a result of the lower total costs of ownership
2. That there are sufficient recharging points in western and northern Europe TODAY for the early market & that just 5% of charging happens at public recharging points
3. Are lower CO2 TODAY even when compared on a full life-cycle basis and even in countries with the least green electricity
4. Battery cells will be manufactured in the EU and there are sufficient raw materials available
5. Are affordable. With very modest tax breaks they are already cheaper on a total costs of ownership for the first owner. For second and third owners there are substantial savings in running costs and maintenance.

The paper shows policy makers can confidently drive a shift to electromobility.

Electric cars are far better for the environment than diesels

TRANSPORT & ENVIRONMENT



Source: LE FIGARO 7 November 2018, quoting Transport & Environnement September 2018 Report

EV CO2 “cradle to the grave” is already much better than ICE

+ It will get even better with WW decarbonisation of electricity production
- **T&E foresee -70 of the CO2/kWh produced by 2050**

+ EVs play an enabler role thanks to smart charging and V2G
+ EVs emit ZERO pollutants

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03. The WMF « Smarter, Less and Longer » toolkit

04. Improved battery performance

Smarter

ZOE 1st Gen.
Battery 22kWh

2012 - 2013

DRIVING RANGE INCREASE

150km → 300km

x2

+10%

280 kg → 305 kg

VERY LIMITED WEIGHT INCREASE

2016 - 2017

ZOE 2nd Gen.
Battery 41kWh

Active materials (cathode) increased in mass by only ~ 25%

CO_2 emissions for **batteries production** increased by only 15%

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05. Battery 2nd life and recycling

Longer

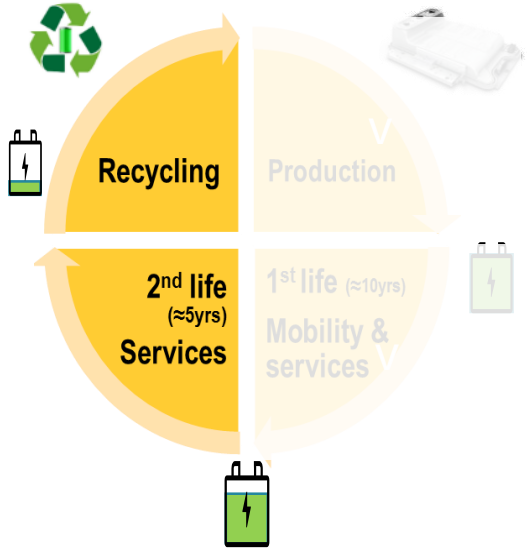
Less

BATTERY 2ND LIFE = LONGER

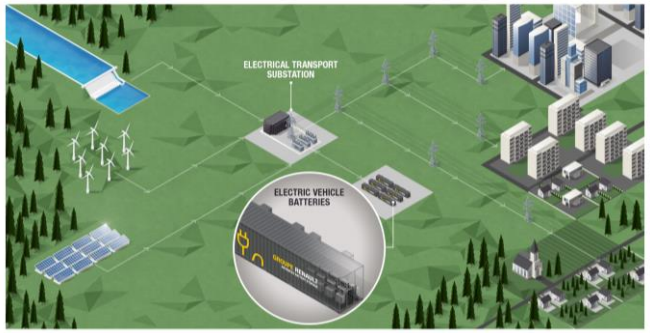
Connect clean energy to grid and buildings

CONNECTED ENERGY

Battery pack @high power charging station with Connected Energy in Europe

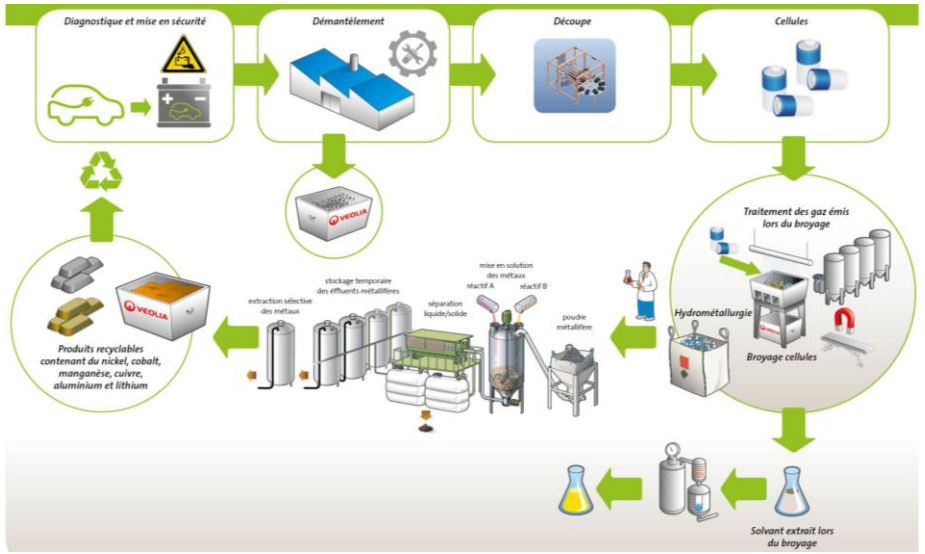


"Advanced Battery Storage"



Biggest energy stationary storage system from EV batteries in Europe: 60 MWh

BATTERY RECYCLING = LESS



- **100% of the batteries** are collected by Renault to be reused or recycled
- **Renault goes beyond the regulation** which imposes to recycle at least 50% of the batteries' materials (in weight)
- **Cobalt, Copper and Nickel are recycled** with an 80% efficiency

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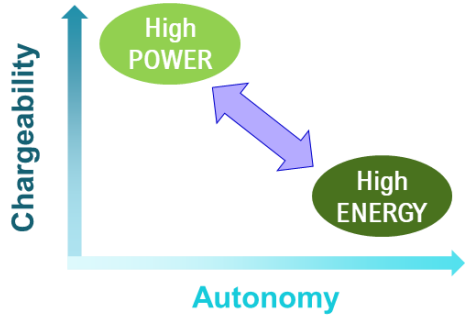
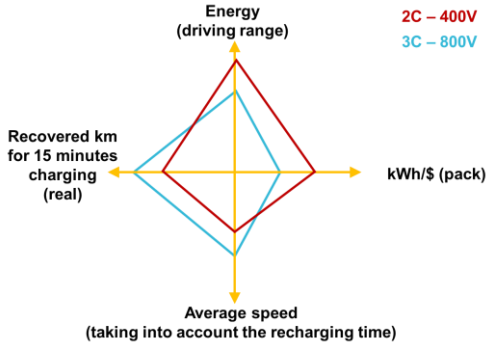
06. Optimized battery utilization through faster chargeability

Smarter



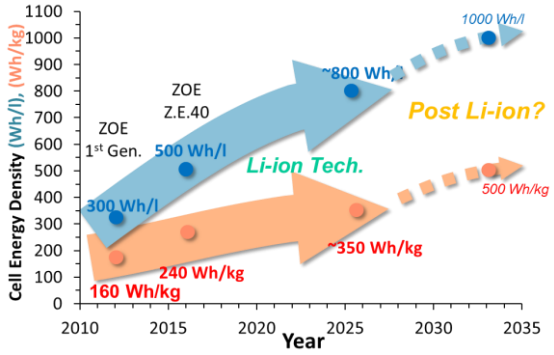
1

- Current technology is limited to 2C: Energy and Power trade-off is necessary (50kWh / max. 100KW)



3

- Increasing charging power allows to decrease traveling time but requires to switch to 3C+ / 800V
- It has a positive materials & CO2 impact by containing battery size



2

- Energy density is continuously increasing, improving autonomy
- Breakthrough expected with ASSB

RENAULT : ALLIANCE VENTURES INVESTIT DANS LA START-UP ENEVATE

PUBLIÉ LE 13/11/2018 À 17H30

ENEVATE Innovating Energy Storage

Ultrafast Charging Technology

4

- Application: investment and collaboration with ENEVATE

2C to 4C: 150km in 15' to 300km in 15'

Depending on chemistry / requires 800V

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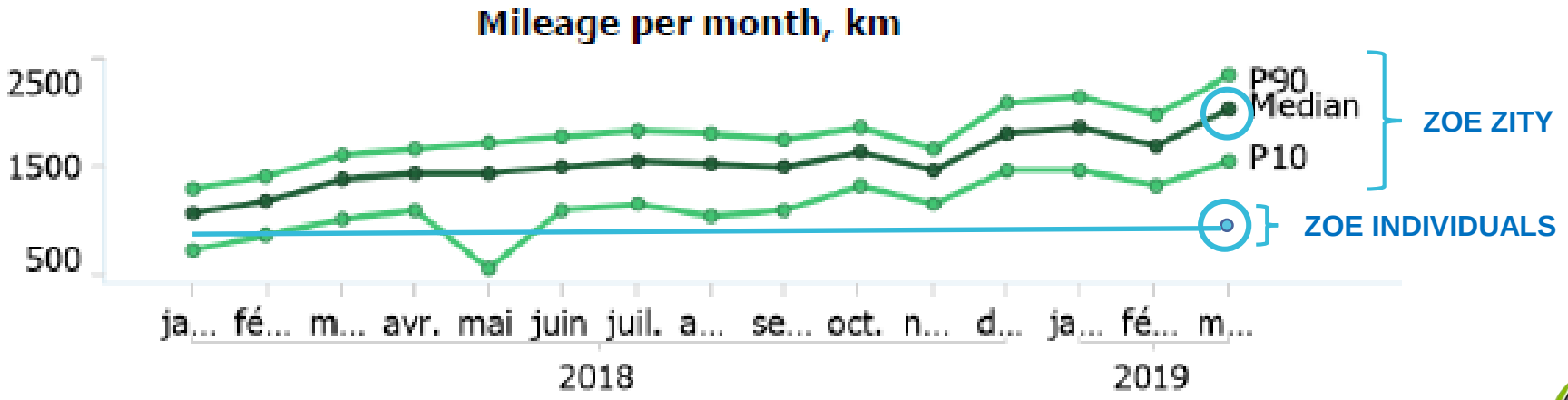
Smarter

07. Carsharing maximizes EV usage

- The **ZOE driven by particular clients** run **1 000km/month** on an average[1]
- The **ZOE Zity fleet** (Madrid carsharing / 650 cars) run **2 000km/month** on an average[2]



ZOE car sharing usage

=

ZOE individual usage x2

[1] *Renault study based on over 4200 clients*

[2] *2000km/month = median value / 1st decile ~+2 300km/month / 9th decile ~+1 500km/month*

THANK YOU