



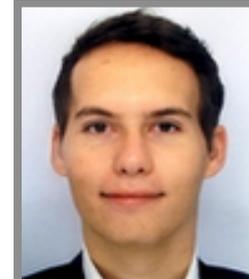
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# Business Case Study

Can the current legislation be more efficient to guarantee a green transition in the French car industry?

# Executive Summary

## Context

The French car industry still suffers from the economic crisis with a decrease by 14% in sales for 2012. European laws are enforced to lower gas emissions:

- An “optional” limit curve value concerning CO2 emissions.
- Euro norm 6: compulsory limitations concerning other gases.

## Problem

Yet, there are several ways for manufacturers to meet governments objectives:

- Compensating or not their fleet around the curve.
- Meeting compulsory requirements earlier or waiting for the last minute to change their production.

**Is the current legislation as efficient as it could be in reducing pollution and preventing a further decrease in sales?**

## Method

Using Ademe’s open source datasets:

- To check the progress in legal compliance for each manufacturer and to cast light upon their strategies towards these legislations.
- To map the various strategies and to put forward, if it exists, the balanced strategy between green expectations and profits.

## Results

- Legislations have proved to be efficient on the long run: CO2 emissions have decreased on average from 200 g/km to 140 g/km between 2003 and 2014.
- Constructors take advantage from the compensation margin given in the legislation: on average, each constructor keeps 50% of its fleet above the limit curve value.
- Despite fiscal incentives to anticipate the norms, constructors wait for the norms implementation to act and produce the necessary cars.
- Green strategies targeting either the least or the best selling market ends are both efficient..

## Recommendations Outcomes

- Foresaking the fiscal incentives.
- For the compensation options, target market ends rather than the global offer in the norms
- Improve legislations’ efficiency.
- Increase the consumer’s part in the green transition.

# Although the worrying economic context forces the industry to change strategy, the eco-friendly market gives room for improvement

## The economic crisis impacted negatively the French car market

- Decrease in personal car sales by 14% between 2011-2012.
- The number of private cars sunk under 1,9 million cars, the lowest level since 1997.

## Public authorities have decided to intervene and aim at changing the market structure

- Government announced a change of tax rate regulation and an increase of 4 cents per liter of diesel from 2015 on.
- Eco-friendly policies are toughening up:
  - An European law aims at reducing the CO2 emissions with 2015 and 2021 targets: fleet average of 130g of CO2 per km by 2015 and 95g of CO2 per km by 2021.
  - Euro 6 Norm implemented in September 2014 forces the constructors to lower emissions of polluting gazes (apart from CO2).

## Growth on the hybrid and electric car market:

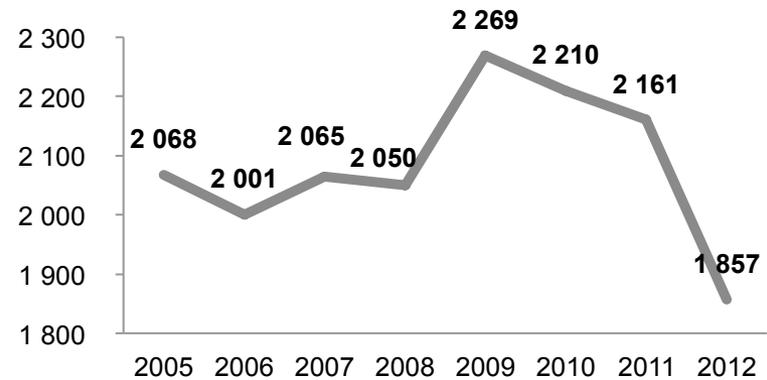
**Between 2011 and 2012:** sales in electric car increased by 54% (from 2630 to 5663 car registered) and sales in hybrid cars increased by 104% (from 13635 to 27889 registrations)

Most car brands already produce hybrid or electric car:

Audi: A6 Hybride, Citroën: DS5 Hybrid4, Opel: Ampera, Toyota: Prius, Volkswagen: Touareg II Hybride, Renault : Zoé

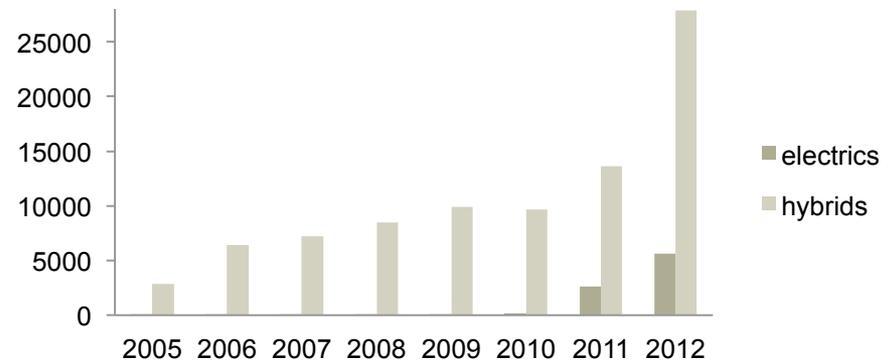
**These car constructors master the green technologies**

Registrations of personal cars in France  
(thousand units)



Source: Ministère (4)

Registrations of new private cars



Source: CCFA (2)



**Through these laws car manufacturers will have to adopt a greener strategy. With 1,8% of the car market and a growth of 106% (2011-2012), the eco-friendly market is strategic but under-estimated.**

# Benchmarking various constructors strategies will enable to draft a genuine win-win legislation for both the constructors and climate change

- Despite stagnation in the car market, the eco-friendly segment showcases high potential growth.
- European regulations encourage growth on this market.
- Moreover, most car constructors have sufficient capabilities to produce eco-friendly compliant cars.
- Yet, car constructors are still not opting for a development based on eco-friendly innovation.

*Is the current legislation as efficient as it could be in reducing pollution and preventing a further decrease in sales?*

## Analysis framework

### Cleansing the database:

- Merging the annual datasets
- Deleting typed-in mistakes
- Excluding small constructors who do not need to comply by the current and potential legislations
- Transforming the categorical variables into quantitative “dummy” variables
- => Dataset used: Ademe & CCFA
- => Variables: brand, hybrid vehicle, fuel type, market end, car body

### Observing the global trends to define a strong position towards green cars:

- Emphasizing trends by merging the annual datasets to cast light on eco-friendly car innovations
- => Dataset used: Ademe
- => Variables: CO2 emissions, hybrid vehicle
- Observing legal compliance, finding who abides by the green laws, and since when, and classifying the constraints by difficulty of implementation and by urgency of need
- => Dataset used: Ademe
- => Variables: hybrid vehicle, gas emission (6 variables), mass

### Focusing on the various strategies adopted:

- Mapping the strategic positioning of the competing brands on the French market
- Comparing green strategies by market end
- => Dataset used: Ademe
- => Variables: brand, market end, gas emissions, fuel consumption, hybrid vehicle, power, car body

### Creating economic and ecological value :

- Pointing out the most profitable strategies on the French market
- Suggesting adapted government’s policies to foster the most value-oriented strategies
- => Dataset used: Ademe & Argus & CCFA
- => Variables: brand, market end, commercial model, gas emissions, fuel consumption, hybrid vehicle, sales and market shares

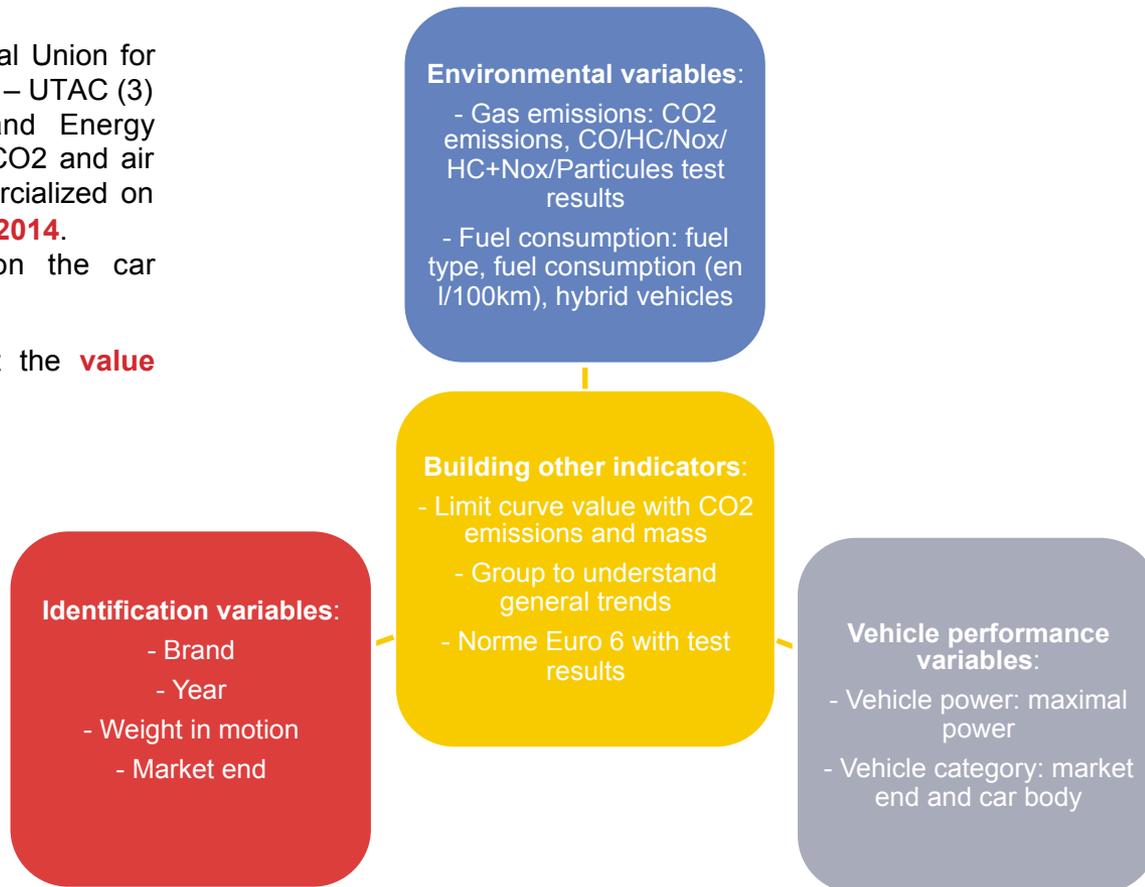
# A dataset of 44 840 observations and 26 variables about environmental tests gives clues about manufacturers' strategies for 2013

- Data is produced and provided by the Technical Union for the Automobile, Motorcycle and Cycle Industries – UTAC (3)
- Every year, the **ADEME** – Environment and Energy Supervision Agency – publishes data about CO2 and air pollutant emissions for each car model commercialized on the French market. We have data **from 2003 to 2014**.
- More precisely, each option combination on the car differentiates the observations.

These Ademe data do not take into account the **value created** (or not) when the car is eco-friendly.

## CCFA – Comité des Constructeurs Français d'Automobiles:

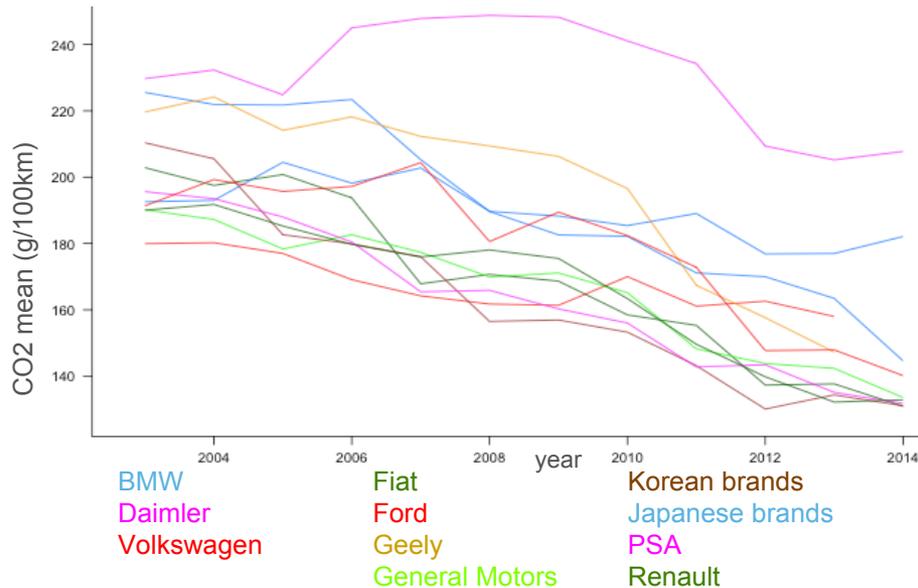
- Annual report on the global car industry, and more precisely in France, with information concerning: market shares of electric and hybrid vehicles in France, market shares per type of fuel, consumer habits.
- Monthly statistical reports on **private cars registrations** per brand in France between June 2013 and September 2014.



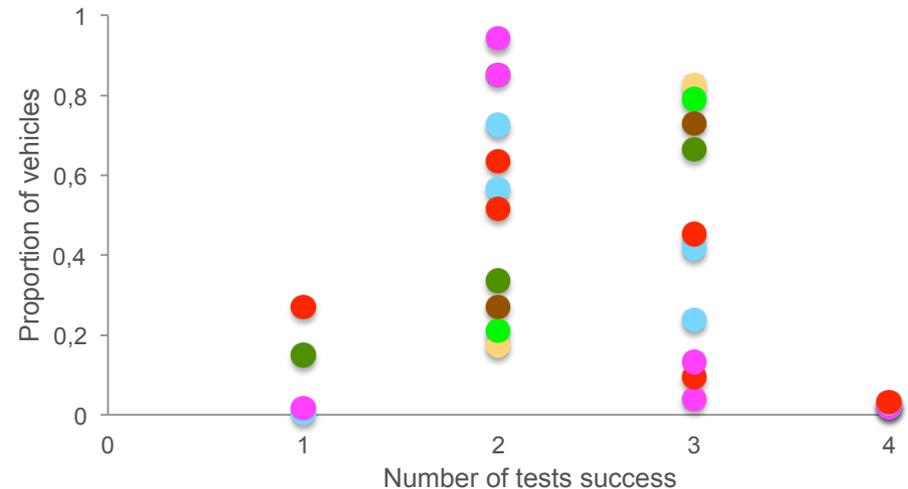
**Crossing the value-oriented data from the CCFA dataset with Ademe's dataset, we should be able to put forward green strategies that won't adversely impact sales.**

# Although constructors are putting efforts into reducing gas emissions they are not eco-proactive yet

CO2 emissions trend



Proportion of vehicles complying with Euro 6 tests



## General trends:

- Since 2003, manufacturers are reducing the CO2 emissions per km:
  - Daimler, the most polluting constructor: decrease on average from 230 g/100 km to 208 g/100 km between 2003 and 2014
  - GM, a less polluting constructor: decrease on average from 190g/100 km to 134g/100 km between 2003 and 2014
- These trends can be accounted for by a green transition in the European legislative norms.

- The Euro 6 Norm tests the 4 main polluting gases apart from CO2 and aims principally at Diesel cars.
- The Euro 6 norm was implemented in 2014: non-complying vehicles will not be tolerated on the market. Yet if the vehicles complied with this norm before its implementation in 2014, constructors would benefit from fiscal incentives.
- Here we analyze the **2013 test results for diesel vehicles**
  - Most vehicles failed at least one test
  - Only 632 out of 33124 commercialized vehicles passed the 4 tests



**Car manufacturers wait for the legal obligation to be implemented before complying with it. These fiscal incentives are not efficient enough to foster green strategies.**

# Furthermore, analyzing the constructors' behavior towards the limit curve value showcases discrepancies within their car portfolios

## Limit Curve Value:

- The constructors are still not opting for a “all-on-the-curve” vehicles development.
- Manufacturers prefer balancing both polluting and green vehicles to compensate their overall gas emission mean and comply by the law:
  - 37 151 commercialized vehicles above the curve in 2013
  - 5 714 below the curve in 2013
- As expected, this law enables the constructors to keep on producing heavier vehicles with higher gas emissions (hypothesis tested with a regression on the limit curve value and the maximal mass).

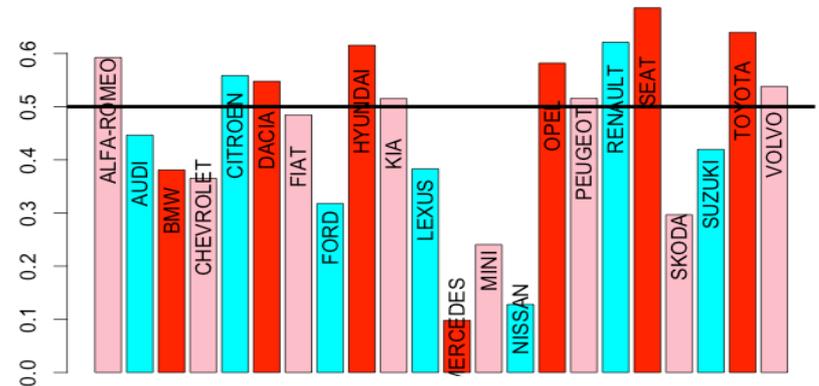
## Supercredits:

- The law enables to broaden the gap between heavy and light vehicles with supercredits. A vehicle producing less than 50g/km of CO<sub>2</sub> is worth 1,5 vehicles in 2015.
- Yet, the manufacturers are reluctant to use it (only 4 vehicles with CO<sub>2</sub> emissions <50g/km were commercialized in 2012).

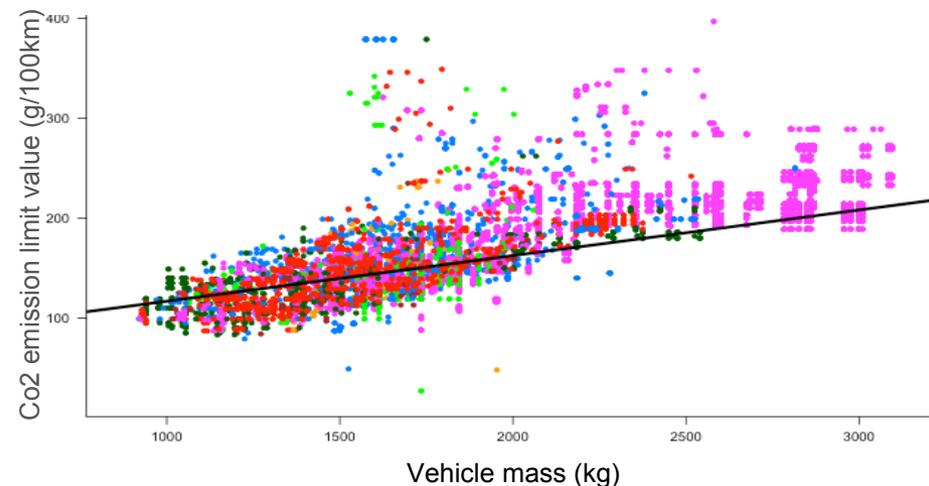


**Car constructors have chosen to use the compensation possibility: they combine green and polluting vehicles, rather than to lower the CO<sub>2</sub> emissions of all their models.**

Proportion of vehicles below the limit curve value (2013)

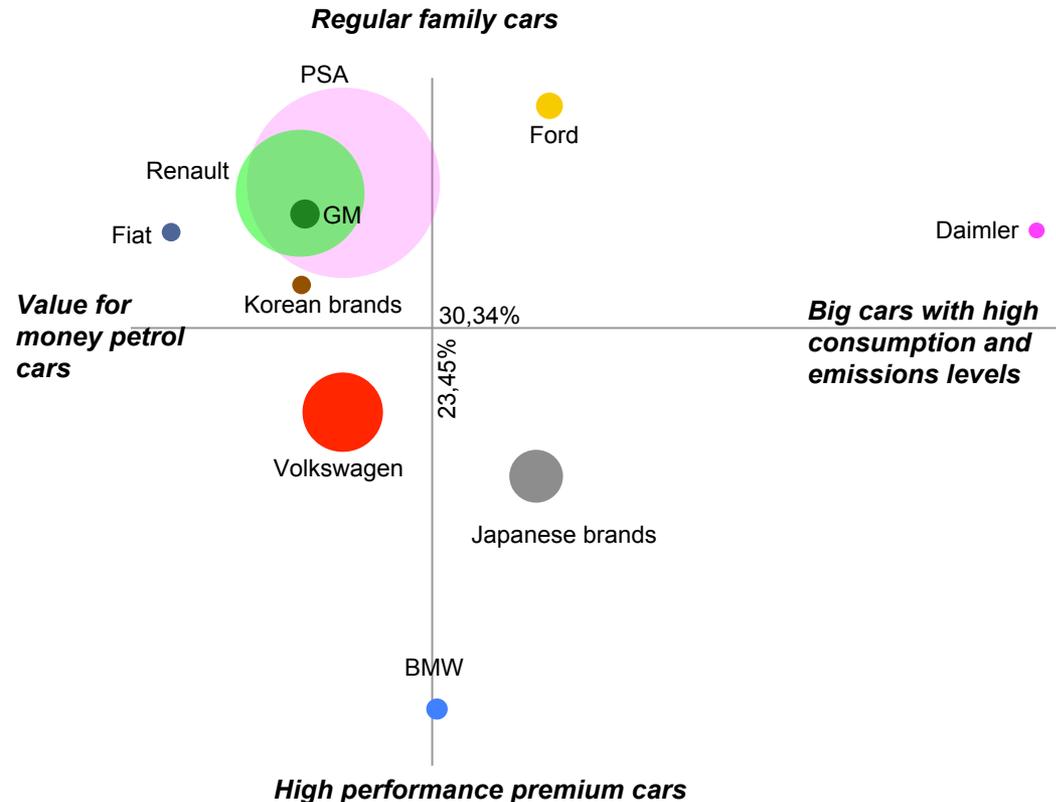


Vehicles compared with the limit curve value (2013)



# For a deeper analysis, i.e. of each constructor's green strategy, we first identify clusters on the French car market

Group positioning (size is proportionate to volume of sales)



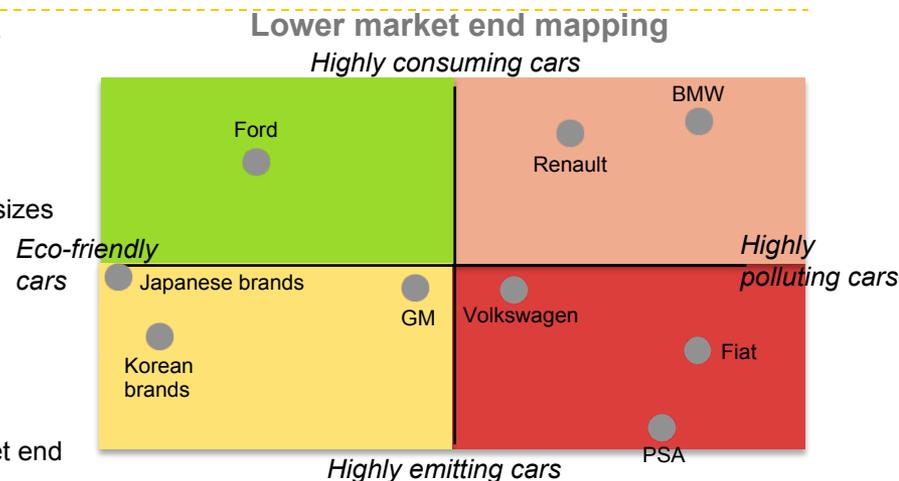
- We have seen the regular reaction of constructors towards the legislation, now we focus on each constructor's specific green strategy.
- We first computed a global **Principal Component Analysis** on all the car models on the market in 2012 with the Ademe dataset.
- The two dimensions account for **53% of the strategic choices**:
  - The horizontal dimension accounts for 30,34% of the variance, i.e. almost one third of all commercialized cars
    - Only BMW has a neutral position on this axis
  - The vertical dimension accounts for 23,45% of the variance, i.e. almost a quarter of all commercialized cars
    - All groups have a clear position on this axis
- The bubbles' sizes account for the 2012 sales volume given in the CCFA report.
  - 64,09% of market shares are concentrated in the North West corner: regular family cars/ value for money petrol car
- Several groups have **close positioning** strategies:
  - PSA and Renault are French groups so we will consider them in a separate cluster than GM, Fiat and Korean brands



**On the global market two clusters account for 64,09% of the global sales. Now we can thoroughly compare green strategies between constructors closely positioned on the French market.**

# Focusing thoroughly on each market end, every constructor has its own green strategy on its market end portfolio, even within a same cluster

- To analyze each constructor's green strategy, we computed PCAs by market end.
- We scaled how green were every groups for each market end.
- Here is an illustration for the lower market end:
  - Groups on the left side of the horizontal axis are greener.
  - Concerning the vertical axis, the logic of the current legislations emphasizes on limiting gas emissions.
- As a result of this reasoning, we filled this global matrix



Legend: Eco-friendly Best-selling market end

Group		FIAT	BMW	DAIMLER	FORD	GENERAL MOTORS	KOREAN BRANDS	JAPANESE BRANDS	PSA	RENAULT	VOLKSWAGEN
Registration in 2012 in France (thousand u.)		63	70	53	92	96	62	175	572	424	267
Market end	Value for money	Fiat	NA	NA	NA	Opel	Hyundai	Nissan Suzuki Toyota	Peugeot & Citroën	Renault	Seat, Skoda
	Lower	Fiat, Alpha Romeo	Mini	NA	Ford	Opel & Chevrolet	Hyundai Kia	Nissan Suzuki Toyota	Peugeot Citroën	Renault Dacia	Audi, Seat, Skoda
	Lower middle	Fiat	BMW	Mercedes	Ford	Opel & Chevrolet	Hyundai Kia	Lexus Nissan Toyota	Peugeot Citroën	Renault Dacia	Audi, Seat, Skoda
	Upper middle	Fiat, Alpha Romeo	BMW	Mercedes	Ford	Opel & Chevrolet	Hyundai Kia	Nissan Suzuki Toyota	Peugeot Citroën	Renault	Audi, Seat, Skoda
	Premium	Alpha Romeo	BMW	Mercedes	Ford	NA	Hyundai Kia	Lexus Nissan	Peugeot Citroën	Renault	Audi, Seat, Skoda
	Luxury	Alpha Romeo	BMW	Mercedes	NA	Chevrolet	Hyundai	Lexus Nissan Toyota	NA	NA	Audi

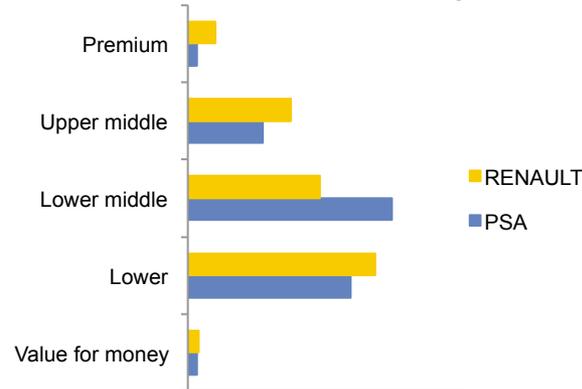
This analysis by market end puts forward the heterogeneity of the green strategies adopted by the constructors on the market

# Having a closer look: PSA and Renault, both French constructors, closely positioned and leading the market, have opposite green strategies

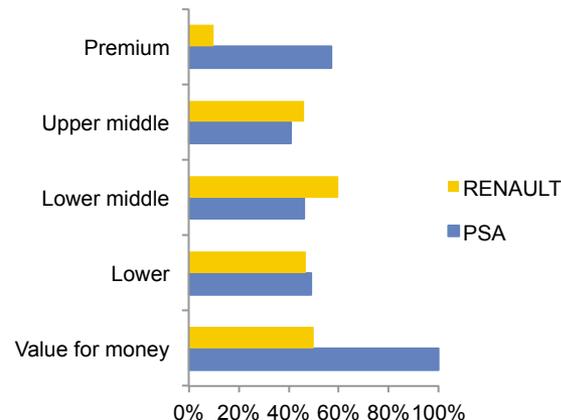
## RENAULT

- Identical positioning on the market with a focus on regular family cars and value for money special cars.
- Producing 5 market ends with more models commercialized on the lower middle and lower market ends.
- Compared to PSA, **Renault is greener on its best selling market ends**
  - Lower cars
  - Upper middle cars
- Focus on a best-seller lower middle model in 2012 on the French market:
  - 2<sup>nd</sup> with 6,2% of total sales: Megane: 64% of the models below the limit curve value, CO2 emissions: mean of 127 g/km, consumption: mean of 5,31L/100 km

Number of commercialized cars by market end



Percentage of commercialized cars below the Limit Curve Value



## PSA

- Identical positioning on the market with a focus on regular family cars and value for money special cars.
- Producing 5 market ends with more models commercialized on the lower middle and lower market ends.
- Compared to Renault, **PSA is greener on its least selling market ends**
  - Value for money cars
  - Premium cars
- Focus on a best-seller lower middle model in 2012 on the French market:
  - 4<sup>th</sup> with 3,9% of total sales: C4: 50% of the models below the limit curve value, CO2 emissions: mean of 132 g/km, consumption: mean of 5,43 L/100km



**Choosing to be greener on the best selling or least selling market end consists in two opposite strategies, yet both are profitable: Renault and PSA are leaders on the French market.**

# Improvements can be implemented to enhance the green transition on the French car industry

## Conclusion

- Car constructors are **reluctant to prioritize green legislations**:
  - They are not eco-proactive: they wait until the last minute to comply with green legislations.
  - They are not eco-responsible: they prefer compensating highly polluting vehicles with greener cars rather than having all models complying with the norms.
- There are **different ways to organize a market end portfolio** including green cars:
  - As Renault : giving priority to the best selling market ends to implement green innovation.
  - As PSA: giving priority to the least selling market ends to implement green innovation.
- Both these strategies are not adverse to the sales. They are both positively accepted by the consumers.

## Recommendations

- **Stop relying on proactive fiscal incentives**: to have a norm effective as soon as possible the EU should implement it straight ahead instead of waiting for proactive behaviours.
- **Redefine the norms so as to aim at all market ends**: the legislation should authorize compensation only within market ends rather than on all models.

## Expected Results

- **Increasing the pace and homogeneity of the green transition** without jeopardizing the industry
- **The consumer will have a broader choice**: for each car constructor and every market end he will have an offer of both polluting and green vehicles
- **The decision of a greener car industry in France will further rely on the consumer**:
  - This is positive news because consumers are an easier target to communicate to and affect through with incentives

## Limits

- We only have global data concerning sales. A **sales variable** on the car models would have enabled us to draw a more profit-oriented analysis.
- Moreover, the compensation around the limit curve value is done based on sales and not commercialized models. With this sales variable we could have calculated the impact of our recommendations.
- We chose an analysis focused on market ends, it could have also been interesting to take into account the **car body variable**, especially to look at the strategies concerning the vehicle weight.

## Appendix – Details on sources

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- (1) Monthly data from the website of the Comité des Constructeurs Français d'Automobiles  
<http://www.ccfa.fr/Voitures-particulieres-en-France>
- (2) Annual report of the Comité des Constructeurs Français d'Automobiles  
<http://www.ccfa.fr/Edition-2013>
- (3) Ademe datasets collect the test results for various polluting gas emissions  
<https://www.data.gouv.fr/fr/datasets/emissions-de-co2-et-de-polluants-des-vehicules-commercialises-en-france/>
- (4) Ministère de l'Ecologie, du Développement Durable et de l'Energie, Excel: *véhicules neufs par genre de véhicules 1990-2012*  
[http://www.statistiques.developpement-durable.gouv.fr/transports/r/immatriculations.html?tx\\_ttnews%5Btt\\_news%5D=23388&cHash=dba439ca0c990d713bbfbbd716c06395](http://www.statistiques.developpement-durable.gouv.fr/transports/r/immatriculations.html?tx_ttnews%5Btt_news%5D=23388&cHash=dba439ca0c990d713bbfbbd716c06395)