Conference « SHIFTING UP A GEAR »

# REAL-WORLD FUEL CONSUMPTION MEASUREMENTS OF GROUPE PSA VEHICLES


## Groupe PSA

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PSA GROUPE

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## THE GAP BETWEEN LABORATORY TEST RESULTS AND REAL DRIVING FUEL ECONOMY HAS GROWN SHARPLY OVER THE PAST 15 YEARS

- **Customers are losing confidence** in car emissions testing but their needs remain:


- to be able to compare the real world fuel economy of different vehicles
- to assess their individual fuel consumption depending on their own use
- to check their real world pollutant emissions

In the wake of the Diesel-gate scandal
Groupe PSA launched an initiative for more consumer transparency

# GROUPE PSA INITIATIVE : REAL FUEL CONSUMPTION TRANSPARENCY

- **NOVEMBER 2015 : COLLABORATION WITH 2 NGO AND A CERTIFICATION BODY**

| TRANSPORT & ENVIRONMENT<br>FRANCE NATURE ENVIRONNEMENT | PSA GROUPE | BUREAU VERITAS |
|---|---|---|
| *Validation of tests protocol and conditions* | *Measurement program* | *Protocol audit Results certification* |

OBJECTIVES

- Define a protocol able to determine real fuel economies and emissions through real driving and PEMS measurements close to the legislative RDE
- Assess the fuel economy of the Groupe PSA models and publish all the data on the brand's websites
- Extend the protocol to pollutant emissions starting second half 2017

# MILESTONES

**Nov. 2015**
Groupe PSA and T&E announced their cooperation
to publish real-world fuel economy data

**March 2016**
Official real-world fuel consumption measurements release
for 3 Peugeot, Citroën and DS vehicles

**July 2016**
Release of measurements for 30 models

**Oct. 2016**
Protocol publication by Groupe PSA, Transport & Environment,
France Nature Environnement & Bureau Veritas

**March 2017**
1000 vehicle versions published on the Peugeot, Citroën and DS websites
Release of a calculator to enable customers to estimate their own vehicle fuel consumption

# OVERVIEW OF THE PROTOCOL

## 1. MEASUREMENTS BASED ON GROUPE PSA AVERAGE CUSTOMER CHARACTERISTICS BY CATEGORY AND ENERGY

**REPRESENTATIVE MASS**

Empty vehicle
+ options
+ occupants
+ luggage

**DYNAMIC Conditions**

Speed
Acceleration

| Distance parcourue [%] & Accélération longi moyenne calculé en distance [m/s²] | | | Vitesse véhicule [km/h] | | |
|---|---|---|---|---|---|
| | | | 0 à 60 | 60 à 90 | 90 à 250 |
| Vitesse moyenne | | | Vitesse moyenne: 26.0 km/h | Vitesse moyenne: 75.0 km/h | Vitesse moyenne: 110.5 km/h |
| Accélération Longitudinale moyenne sur 2 secondes [m/s^2] | < | -0,1 | Distance : 12,43%<br>Accèl longi moyen : -0,54 | Distance : 9,91%<br>Accèl longi moyen : -0,37 | Distance : 6,86%<br>Accèl longi moyen : -0,30 |
| | -0,1 à | 0,1 | Distance : 6,50%<br>Accèl longi moyen : 0,00 | Distance : 10,47%<br>Accèl longi moyen : 0,00 | Distance : 24.32%<br>Accèl longi moyen : 0,00 |
| | > | 0,1 | Distance : 12,92%<br>Accèl longi moyen : 0,52 | Distance : 9,78%<br>Accèl longi moyen : 0,37 | Distance : 6,80%<br>Accèl longi moyen : 0,30 |

## 2. VEHICLE SOURCING AND VERIFICATION BY BUREAU VERITAS

### CHECK PRIOR TO TEST

Battery health
Oil level
Tire pressure
Maintenance book

### SEALS

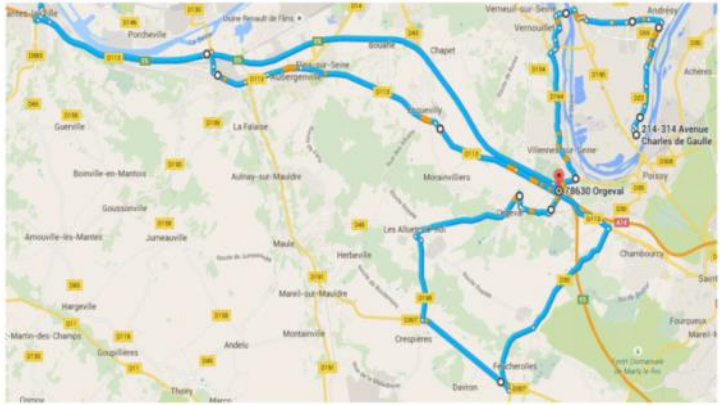
Engine calculator
Wheels
(valves + tires)

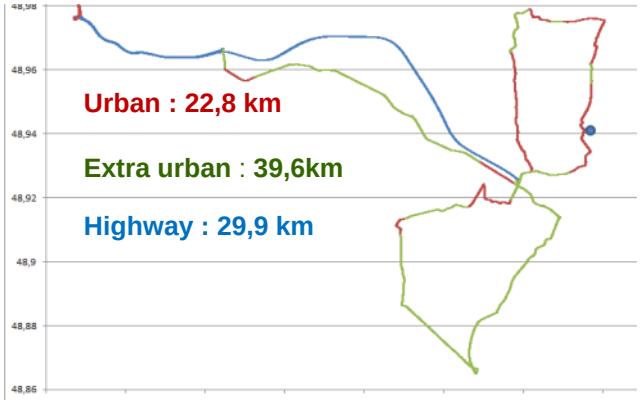
### VEHICLE PREPARATION

PEMS* installation
Recording of data
*(weight, tires pressure, km..)*

** Portable Emissions Monitoring System*

## 3. DRIVING REFLECTING THE REAL USE OF CUSTOMERS




*A minimum of 3 tests for each model are performed by two different drivers to ensure reliable results*

## 4. DATA PROCESSING

*Real consumption measurement is performed without communication between PEMS and vehicle*

**PEMS DATA**
**AFTER THE TEST**

GPS
*Position, speed, acceleration*

Weather Conditions

$CO_2$ emissions

**DATA PROCESSING**

Test validation
*Dynamic conditions*

Normalization
to the **middle customer**

*Objective mass*

*Weather conditions correction*
*Mix Urban, Extra urban Highway*

Consumption calculation

**CERTIFICATION**
**OF CONSUMPTION RESULT**
&
REMOVE SEALS

# STATUS

- Protocol fully developed for fuel consumption of conventional ICE (PC and LCV)
- Full protocol available on Groupe PSA Website
  https://www.groupe-psa.com/en/newsroom/responsibility/protocol-for-measuring-real-world-fuel-consumption/

- Tests performed from March 2016 to May 2017
  - 68 vehicles tested including 5 LCV,
    representing more than 80% of our European sales
  - On the road: 525 road tests ≈ 50 000 km
  - On the bench: 126 correlations on WLTC cycle

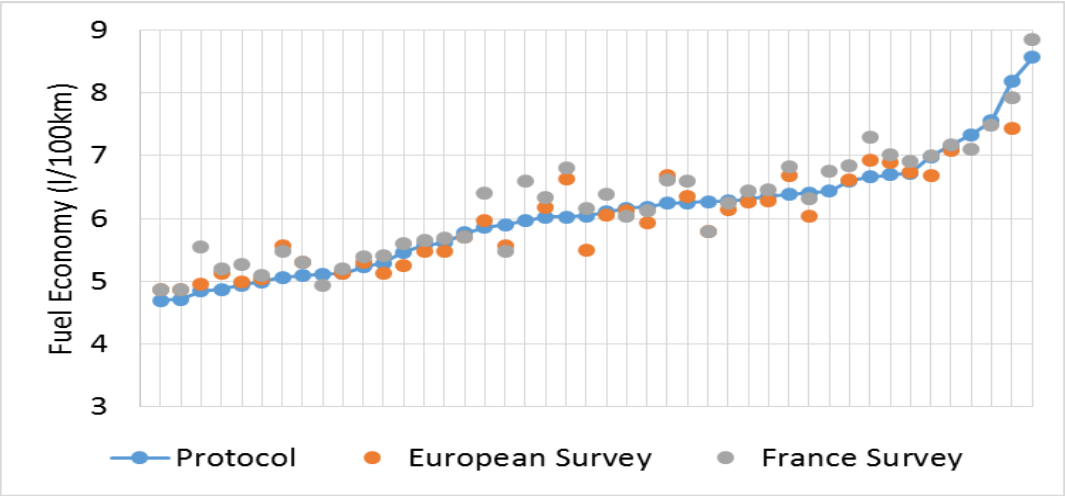
**More than 1000 fuel consumption values published**
on the Websites of our 3 brands in 12 countries

# KEY FINDINGS

## PROTOCOL ACCURACY AND REPEATABILITY

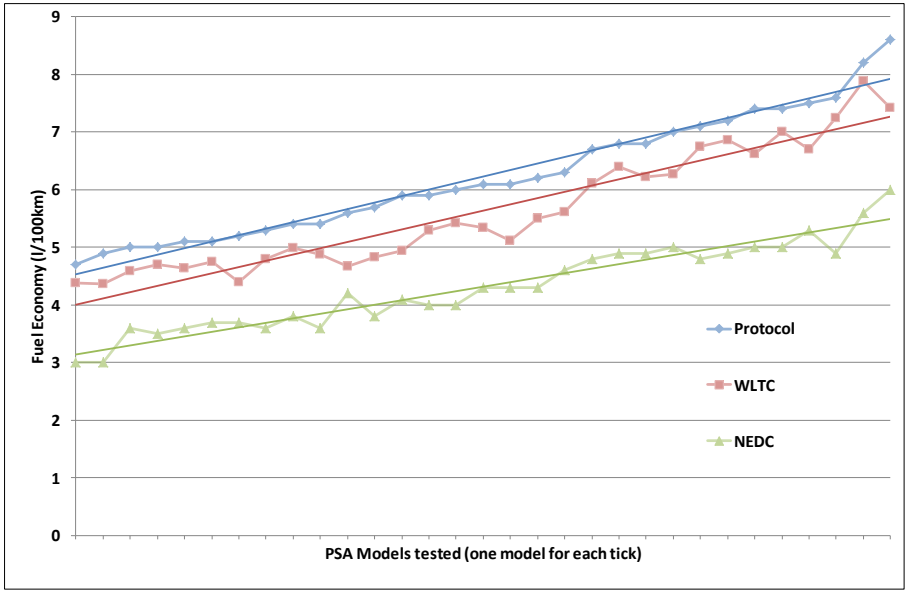
- The protocol results are accurate to within +/-0.3 l/100km
- This protocol has a high level of repeatability +/- 3 %

- The protocol closely matches the average customer fuel economy coming from our internal PSA surveys



# KEY FINDINGS

## PROTOCOL RESULTS VS HOMOLOGATION TESTS




- NEDC test values are particularly unrepresentative for larger vehicles and for MPV/SUV
- WLTC test cycle is making significant progress to close the gap between existing certification and real-life fuel economy
- To be closer to real-life fuel economy, WLTC would need to have a urban, rural and motorway mix with a higher proportion of urban driving

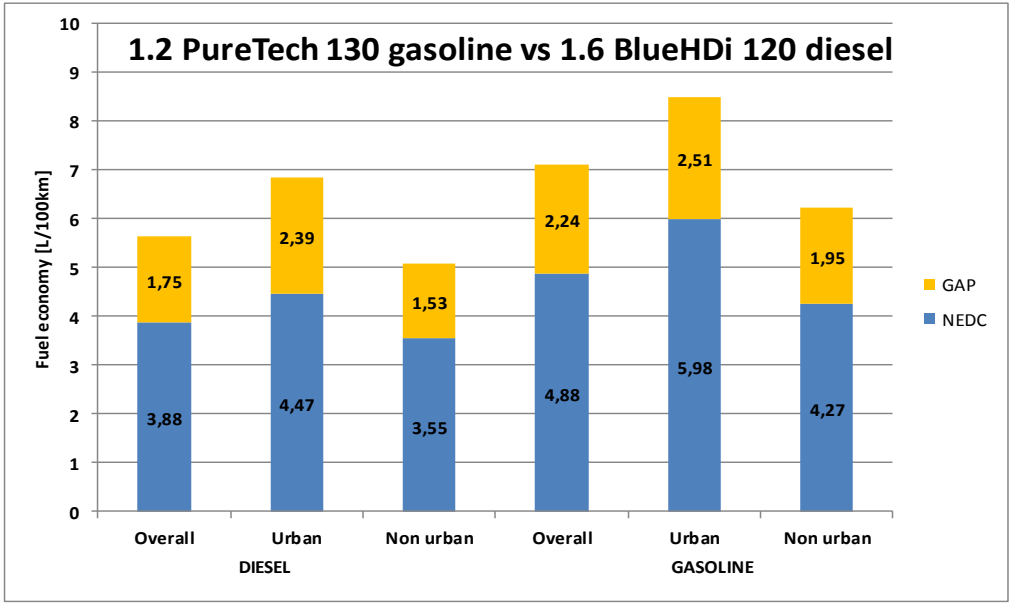
# KEY FINDINGS

- **AVERAGE FUEL CONSUMPTION GAPS**

| | |
|---|---|
| **AVERAGE FUEL CONSUMPTION**<br>weighted by the sales of the 68 vehicles tested | **6,0 l/100km** |
| **AVERAGE GAP BETWEEN THE PROTOCOL AND TYPE APPROVAL**<br>weighted by sales on 68 vehicles tested | **1,8 l/100km** |
| **MIN. GAP** BETWEEN THE PROTOCOL AND TYPE APPROVAL | **1,2 l/100 km**<br>Peugeot 208 - 1,6L BlueHDi 100 – MT5 |
| **MAX. GAP** BETWEEN THE PROTOCOL AND TYPE APPROVAL | **2,6 l/100 km**<br>Peugeot 308 GTi - 1,6L THP 270 S&S – MT6 |
| **STT (STOP & START) IN URBAN DRIVING**<br>for a given energy and similar cars | **- 0,3 l/100 km** |
| **AUTOMATIC VS MANUAL TRANSMISSIONS**<br>for a given energy and similar car | **+ 0,4 l/100 km** |

# KEY FINDINGS

- **PAIR-WISE COMPARISON OF A SIMILAR DISPLACEMENT AND POWER GASOLINE AND DIESEL ENGINE** (AVERAGE OF 4 CAR)



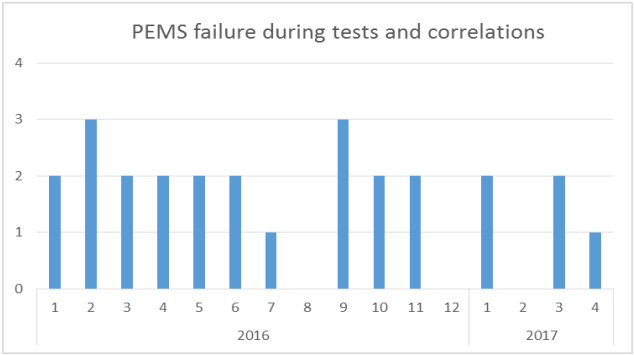

- Diesel engines have a 1.5 l/100 km lower fuel consumption
  - *1,65 l/100 km in urban conditions*
  - *1,15 l/100 km in non-urban conditions*
- In urban conditions, the gap between the certification and real world is equal for diesel and gasoline
  - *Respectively 2,4 l/100 and 2,5 l/100 km*
- Diesel engine efficiency tends to be less sensitive to driving style than gasoline models

# KEY FINDINGS

## PEMS RELIABILITY AND ACCURACY

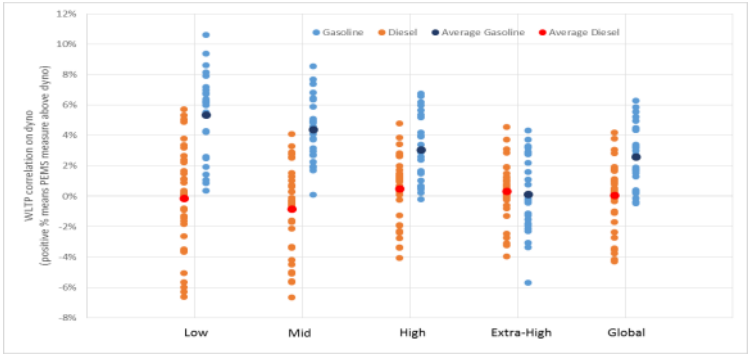
*More than 430 tests on the road performed with PEMS on 60 vehicles*

*In addition, 116 tests conducted on the chassis dynamometer to correlate the results*

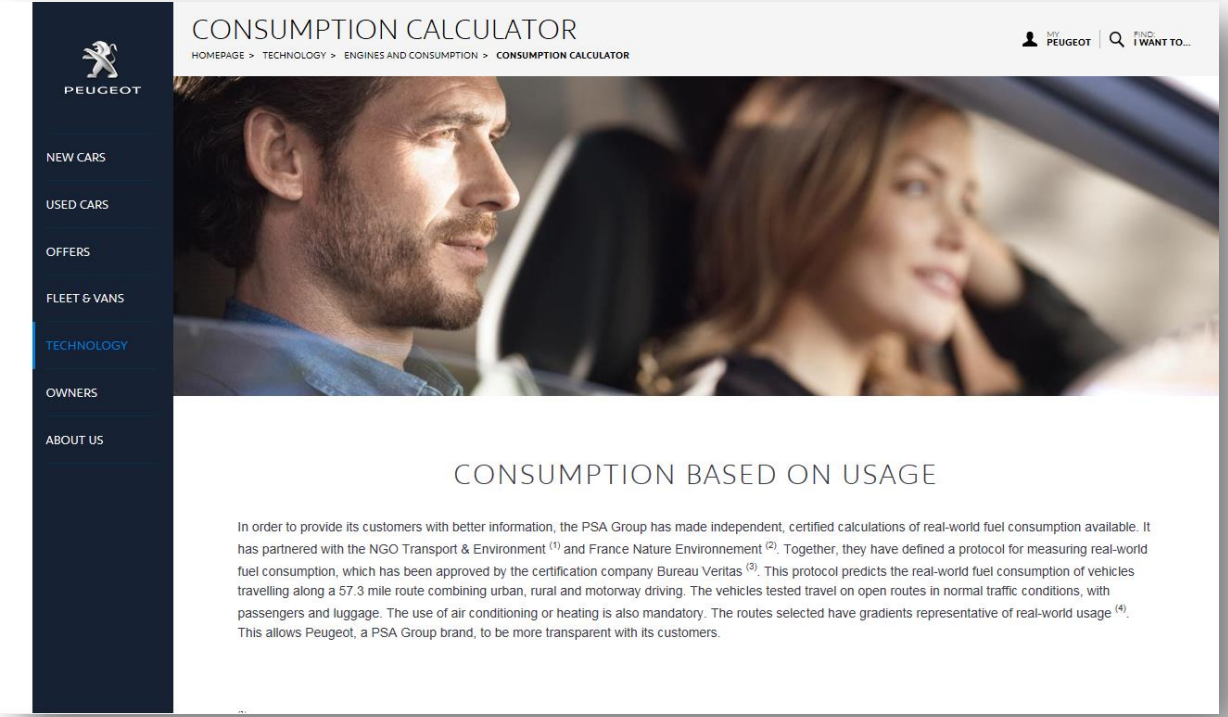



- PEMS performed properly, nevertheless:
  - Reliability issues occur with 28 tests lost because of a PEMS failure
  - Bad correlation test with chassis dyno for 18 tests lead to rework
  - Accuracy needs to be improved for gasoline engines particularly for low mass flow

In the protocol, measurements are made by the PEMS and the bench in order to detect abnormal values



# EXAMPLE OF DATA AVAILABLE ON BRANDS WEBSITES




http://www.peugeot.co.uk/consumption-calculator/

# NEXT STEPS

- ENLARGING THE PROTOCOL

| | |
|---|---|
| end 2017 | Development ongoing for NOx and Particle Number (PN) |
| 2018 | Adaptation for hybrid vehicles |

# CONCLUSION

- Successful collaboration between NGO and an OEM for providing customers with robust information about fuel consumption representative of the typical driver of the vehicle model
- Development of  a protocol close to legislative RDE in order to ensure robust, repeatable and representative measurement
- Portable Emissions Monitoring System (PEMS) gives satisfactory results but reliability and accuracy still need to be improved
- The procedure has now been used to conduct more than 500 tests on 68 PSA vehicles. Real consumption values are available for more than 1000 model variants.
- All results are available on PSA Brands websites together with a calculator that can refine the estimate based on each customer's usage.
- Extension of the protocol for NOx and Particulate Number (PN) is planned.