Development of an experimental methodology to estimate real air pollutants emission and fuel consumption from rolling vehicle fleet in Algeria

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Outline

• Background
• Methodology
• Results
• Conclusions
Data Issues

• Vehicle fleet data: compiled by Office National des Statistiques (vehicle licence, registration)
  • Data base updating
  • Old vehicles are not removed
• Vehicle use parameters not determined (none is in charge):
  • Use of default values: not representative, source of uncertainty (Emissions factors and mileage)
Emission Inventories

• UNFCCC: Initial national communication 1994 (GHG)
  • Based on Fuel sales in Algeria
  • All fuel is not used by road vehicles (gasoil): agriculture, construction, heating, etc.
  • Illegal export (black market) of fuel

• COPERT & ARTEMIS: Air pollutants and GHG
  • Need of desagregated data of vehicle fleet composition
  • Vehicle use parameters & traffic (EF, age, annual mileage, etc.)
Fuel consumption: 1990-2011

Consommation de carburant (t)

- gazoil
- essence
- GPLc
Need for representative data

• To avoid over or under estimation (consumption & emission)
• To estimate future fuel demand (Projections) ?
  • Investment in new refineries ?
  • Fuel switch to gas fuel ?
  • Fuel Import ?
• What New Policies  
  • Road transport infrastructure
  • Traffic management
  • Emission regulations
  • Public road transportation
  • Other transport modes
Vehicle fleet data?

ONS
4 Millions Veh.

High Uncertainty?

Ministry of Energy
4,5 Millions Veh.

Ministry of Transport
5 Millions Veh.
Issues?

• Lack of effective vehicle emissions regulations
• Share of gasoil used by road vehicles unknown (one gasoil type for all uses)
• Old vehicles import (no more occurring)
• Default values used (pollutant emission, fuel consumption, mileage, etc.)
Methodology: Bottom-up

- Based on observation of real car fleet used (measurements, surveys, )
- Double check with insurance companies, customs, Police & Gendarmerie, control & maintenance agency, etc.
- Pollutant emissions measurement (vehicle sample)
- Fuel consumption calculation (copert, artemis)
Assumption

Only active/rolling vehicles are consuming fuel and polluting

• Real vehicle fleet (composition): active or rolling
• Use of vehicles
• Emission unit
• Consumption unit
Vehicle licence plate in Algeria

- **Sequential number:** 00639
- **Veh. Category:** 108
- **Region (Wilaya):** 22

**Year (age):** 
Age distribution

Three surveys on different road types: Urban, Rural, Road, Highway

a) April - June 1998
   Blida
   Sample: 67,600 veh.

b) March - July 2001
   Alger, Blida, Batna, El Oued, Tamanrasset, Oran
   Échantillon: 168,321 veh.

c) 27 June - 5 July 2005
   Alger, Blida
   Echantillon: 134,763 veh.
Survey, data collection of annual mileage

- Direct observation (once): roads, parkings, fuel stations
- Cohorte (one, two years): compagnies, parkings
- Interview (once): drivers
- Form (two times): schools
Sample composition

Catégorie de véhicule

<table>
<thead>
<tr>
<th>VP</th>
<th>PL</th>
<th>VUL</th>
<th>VTC</th>
<th>TR</th>
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<tbody>
<tr>
<td>63</td>
<td>11</td>
<td>23</td>
<td>1</td>
<td>2</td>
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<td>67</td>
<td>6</td>
<td>20</td>
<td>6</td>
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</table>

Parc ONS, 1999
Parc observé, 2001
Instrument de mesure GPS

GPS RBT-2300 Bluetooth

1: Interrupteur
2: Port pour Antenne
3: Prise d’alimentation
4: Etat Bluetooth
5: Etat de la mémoire
6: Etat de la batterie
Exemple de projection de trajet parcouru d’un véhicule
## Sample Size

<table>
<thead>
<tr>
<th></th>
<th>1994</th>
<th>1998</th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
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<tbody>
<tr>
<td>Years</td>
<td>1994</td>
<td>1998</td>
<td>2001</td>
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<tr>
<td>Samples</td>
<td></td>
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<tr>
<td>Veh. Age</td>
<td>67 600</td>
<td>168 321</td>
<td></td>
<td></td>
<td>134 763</td>
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<tr>
<td>Veh. Mileage</td>
<td>723</td>
<td>356</td>
<td>996</td>
<td>935</td>
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</table>

Total vehicles over 500 000 using GPS, Video Camera
Age distribution of real vehicle fleet

- Green triangles: Observed 1998
- Pink triangles: Observed 2001
- Blue triangles: Observed 2005
Age distribution of the ONS vehicle fleet

- ONS 1998
- ONS 2001
- ONS 2005
Survival factor: Personal cars

Probabilité de survie

VP Essence cc<1.4 l
VP Essence 1.4<cc<2 l
VP Essence cc> 2 l
VP Diesel cc<2 l
VP Diesel cc> 2 l

Age (ans)
Survival factor: Light Duty Vehicle

- VUL Ess
- VUL Dies
Annual mileage for all vehicle categories

![Diagram showing annual mileage for different vehicle categories and years.

- **BEDAT 1990**
- **Enquête 1994**
- **Enquête 1998**
- **Enquête 2001**

- **VP**
- **Taxi**
- **VUL**
- **VL**
- **Bus**

The chart compares the annual mileage (in kilometers) for various vehicle categories across different survey years.]
Annual mileage vs time of PC and LDV

- VP Ess < 1,4 l
- VP Ess 1,4 l - 2 l
- VP Ess >2 l
- VP Dies < 2 l
- VP Dies >2 l
- VUL Ess
- VUL Dies

Années
Kilométrage annuel (km/an)
Annual mileage of buses, Lorries, Heavy vehicles

Kilométrage annuel (km/an)

Années

Autocars

Autobus

Camions

Tracteurs
On-board emission measurement in real traffic
Vehicle equipped with mini CVS & gas analysers on board
Emission of Gasoline LDV pseudo Euro 0
Emissions of Gasoil LDV pseudo Euro I
Emissions of Gasoil LDV pseudo Euro II
## Inventory comparison (1994)

<table>
<thead>
<tr>
<th>Pollutants (kt)</th>
<th>UNFCCC Tier 1</th>
<th>COPERT III</th>
<th>Deviation (%) (UNFCCC/ COPERT III)</th>
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<tbody>
<tr>
<td>CO2</td>
<td>13 911</td>
<td>13 450</td>
<td>+3</td>
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<tr>
<td>NO\textsubscript{x}</td>
<td>133</td>
<td>154</td>
<td>-14</td>
</tr>
<tr>
<td>CO</td>
<td>884</td>
<td>742</td>
<td>+19</td>
</tr>
<tr>
<td>COV</td>
<td>167</td>
<td>119</td>
<td>+40</td>
</tr>
</tbody>
</table>
Mileage Share per road type

Type de route

Part km (%)

AUTO
Urbain
RN
CW
Mileage share for different road types vs speed
Mileage on Highway

[Graph showing mileage distribution based on speed classes.]
Mileage on road
Mileage on urban road
### Comparison with European countries

<table>
<thead>
<tr>
<th>Road Types</th>
<th>Algeria (%)</th>
<th>France (%)</th>
<th>Belgique (%)</th>
<th>Allemagne (%)</th>
<th>Autriche (%)</th>
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</thead>
<tbody>
<tr>
<td>Highway</td>
<td>39</td>
<td>16,5</td>
<td>24,1</td>
<td>24,4</td>
<td>25,5</td>
</tr>
<tr>
<td>Urban</td>
<td>37</td>
<td>36,7</td>
<td>27,1</td>
<td><strong>37,2</strong></td>
<td><strong>31</strong></td>
</tr>
<tr>
<td>Others</td>
<td>24</td>
<td>46,8</td>
<td>48,7</td>
<td>38,4</td>
<td>43,5</td>
</tr>
</tbody>
</table>
Conclusions

• Deviation between real vehicle fleet and official data (cumulative fleet and not destructive)
• High uncertainty due to lack of real data
• Country specific data: EFs, Activity Data
• Moving towards tier 2 (emission inventory improvement)
• Air quality modeling & traffic management
• Tool development for better estimate of fuel demand and pollutant emissions
Regional Workshop on Raising Awareness about Transport and CO2 emissions

Thank You

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