Foster clean and multimodal mobility using smartphone data
Symposium of the IFP School Chair on Electric, Connected, and Autonomous Vehicle for Smart Mobility
24/11/2020, by Salah EL HAJJI
CleanMob - Clean mobility enabler (B2B)

**Agenda**

1. Context of modern mobility
2. Mitigation options
3. Vision, ambition and solutions
4. CleanMob under the hood
5. Conclusion
Context of modern mobility

Transport is the major contributor

CO2 emissions by source
Source: HCC report 2019
An insufficient reduction...

National CO2 emissions evolution
Source: HCC report 2019
SNBC*: Stratégie nationale bas carbone

Imported CO2 emissions evolution
Source: HCC report 2019
Context of modern mobility

...especially in transport

CO2 emissions evolution by source 1990-2018
Source: HCC report 2019
Context of modern mobility

...especially in transport

**CO2 emissions - Transport evolution**

Source: HCC report 2019

SNBC*: Stratégie nationale bas carbone
Context of modern mobility

People transportation represents 60%

CO2 emissions - Transport
Source: AEE 2018
Context of modern mobility

Personal car, a habit that needs change

75% of the French population uses individual cars for trips of less than 8km (5km in cities)
INSEE 2014

Traffic congestion
Source: tomtom.com/congestionindex
Context of modern mobility

Today transport innovation is mainly focused on energy efficiency and personal car...

- Excessive energy demand
- High dependency on oil
- High CO2/km
- Noxious emissions
- High usage of public space
- BEVs will increase imported emissions

...But is personal car our only option?

Transport contribution to national CO2 emissions

Source: AEE 2018 / HCC report 2019
Context of modern mobility

A holistic view on the mobility problem

Primary energy demand /km/pers

Well-To-Wheel Life-cycle-assessment

Available stocks, consumption rate, geostrategic tensions, ethics

Energy

CO₂

Natural Resources

Mobility

Traffic Congestion

m²/pers

Frustration, anxiety

Local Pollution

Air-quality, noise pollution

Health

kCal/km

Sedentarity

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01  Context of modern mobility

02  Mitigation options

03  Vision, ambition and solutions

04  CleanMob under the hood

05  Conclusion
Mitigation options

**Do not put all our eggs in the same basket**

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Energy</th>
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### Mitigation options

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- Better
- Neutral
- Worse
## Mitigation options

### Do not put all our eggs in the same basket

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- = Worse  
+ = Neutral  
= = Improved  

Do not put all our eggs in the same basket. Do not put all our eggs in the same basket. Do not put all our eggs in the same basket. Do not put all our eggs in the same basket. Do not put all our eggs in the same basket.
### Mitigation options

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<td>Modal shifts (Public transport, micro and shared mobility, ...)</td>
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**Improved Mitigation options**

- Do not put all our eggs in the same basket
- Neutral
- Worse
Vision, ambition & solutions

- Context of modern mobility
- Mitigation options
- Vision, ambition and solutions
- CleanMob under the hood
- Conclusion
Vision, ambition and solutions

Our vision

Energy sobriety is our best leverage for a successful energy transition

- Resilient economy
- Less sensitivity to strategic resources
- Values CO2 reduction
Vision, ambition and solutions

Our mission

Promote sustainable mobility for **all employees**

Empower **individuals**
Vision, ambition and solutions

Ambition: Key levers to success!

Behavior changes with positive psychology
For a well adopted behavior and maintained for a long time

Tech for good
Leverage the phone sensors data, and couple it with AI and physics based models
Vision, ambition and solutions

Ambition: A complex system simplified, through cleanpoints

- Energy
- CO₂
- Traffic congestion
- Natural resources
- Local pollution
- Health
Vision, ambition and solutions

**Ambition: Tech for good**

- **Did someone mention smartphones?**

  **Why a smartphone?**
  - 77% of the French population have a smartphone (more than 85% for the 18-60 years)
  - No new device/extra sensors
  - With us all the time
  - Built-in sensors

  **Why a smartphone?**
  - 77% of the French population have a smartphone (more than 85% for the 18-60 years)

  **Source:** Baromètre numérique 2019 - Conseil général de l’économie

- **Goal**
  - Transform the smartphone to a CO2 virtual sensor

- **Connected in real time with our API**

- **Technology powered by AI and physics based models**

- **Smartphone sensors data**
  - GPS, Accelerometer, ...

- **Secure data processing**

- **#Realtime**

- **#API**

- **#AI**

- **#PhysicsModel**

- **#Privacy**

- **#Inclusive**

- **#Empowerment**

- **#Privacy**

- **#Realtime**

- **#AI**

- **#PhysicsModel**

- **#Privacy**

- **#Realtime**

- **#AI**

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- **#PhysicsModel**

- **#Privacy**
Vision, ambition and solutions

Cleanmob mobile App for commuter

Daily commuting
Our incentive to reduce carbon footprint

1. Install the Cleanmob App
Vision, ambition and solutions

**Cleanmob mobile App for commuter**

- **#Privacy**
  - Geospatial data is commuter’s property and will never be shared with the employer under any circumstances.
Vision, ambition and solutions

Cleanmob Web App for CSR/HR manager

Steer efficiently your mobility plan
Thanks to our back office solution

1. Go to Cleanmob web app
Vision, ambition and solutions

Cleanmob Web App for CSR/HR manager

Mobility Report
General Summary

Get an overview of all the transport related metrics from users within your community
Filter by geographical preferences on the selected time range.

Select date range
- 
Transport Mode
- 
Trip Distance (km)
- 
Duration (min)
- 
Select a geographical granularity to update the table and charts below:

<table>
<thead>
<tr>
<th>Location Name</th>
<th>Number of Trips</th>
<th>Avg. Trip Distance (km)</th>
<th>Avg. Trip Duration (min)</th>
<th>Avg. Total Carbon (g)</th>
<th>Count of Unique Transport Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hongkong</td>
<td>1,400</td>
<td>1.19</td>
<td>7.97</td>
<td>32.41</td>
<td>3</td>
</tr>
<tr>
<td>2. Beijing</td>
<td>400</td>
<td>2.54</td>
<td>12.03</td>
<td>76.75</td>
<td>5</td>
</tr>
<tr>
<td>3. Jiuquan</td>
<td>421</td>
<td>0.81</td>
<td>9.42</td>
<td>15.75</td>
<td>5</td>
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<tr>
<td>4. Fuzhou</td>
<td>59</td>
<td>1.42</td>
<td>9.5</td>
<td>30.72</td>
<td>4</td>
</tr>
<tr>
<td>5. Tianjin</td>
<td>49</td>
<td>6.82</td>
<td>2.6</td>
<td>21.19</td>
<td>3</td>
</tr>
<tr>
<td>6. Qingheangde</td>
<td>20</td>
<td>8.26</td>
<td>11.53</td>
<td>313.87</td>
<td>3</td>
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<tr>
<td>7. Guangzhou</td>
<td>100</td>
<td>3.13</td>
<td>15.36</td>
<td>43.01</td>
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<tr>
<td>10. Nanjing</td>
<td>600</td>
<td>3.92</td>
<td>16.47</td>
<td>104.08</td>
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### Automated transport mode detection

#### Sensor name | Data collected | Dimensions | Unit
---|---|---|---
Accelerometer | Acceleration | x,y,z | m/s²
Gyroscope | Rotation rate | x,y,z | rad/s
Magnetometer | Magnetic field | x,y,z | μT
GPS | Geospatial data | lon,lat,speed | Degrees / m/s

**Figure 1.** Coordinate system (relative to a device) that’s used by the Sensor API.

*Source: Android developers*
CleanMob under the hood

Automated transport mode detection

1. Data acquisition
2. Classification algorithm
3. Detected transport mode

Source: Austrian Institute of Technology
CleanMob under the hood

Physical modeling & LCA

Physics based model by CleanMob

Transport mode

Energy data:
- Electricity production mix
- Carbon intensity

Market analysis:
- Reference scenario
- Market representative vehicles

Country

Life-Cycle-Assessment:
- Extraction
- Manufacturing
- Recycling

Speed & altitude

Vehicle parameters:
- Weight
- Rolling resistance f
- Aero Cx

Energy [Wh]

CO2eq [g]
CleanMob under the hood

Physical modeling & LCA

Use case #1

- direct CO2eq [g]
- indirect CO2eq [g]
Use case #2

Case 1 - flat road
Case 2 - hilly road

Traditional model: [https://ecolab.ademe.fr/transport](https://ecolab.ademe.fr/transport) (193g/km)

**Added value:**
Real driving conditions
High quality CO2 evaluation

CleanMob under the hood
**Physical modeling & LCA**

- **Speed [km/h]**
  - Case 1 - flat road
  - Case 2 - hilly road

- **Altitude [m]**
  - Case 1 - flat road
  - Case 2 - hilly road

- **Time [s]**
  - Case 1 - flat road
  - Case 2 - hilly road

- **CO2 emission comparison**
  - Traditional models
  - CleanMob model

- **-54%**
01  Context of modern mobility
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Conclusion

**Tomorrow’s mobility**

Personal car is not the only option

We propose a holistic framework to optimize our mobility

You can measure accurate climate impact of your mobility using our app

We shape tomorrow’s mobility today
Conclusion

Together we go further!

Beta-testing
Help us tailor our products to better fit your needs: join our beta-testing phase

Partnerships
We want to develop:
● Multi-modal routing
● Convert CleanPoints to public transport tickets
● Couple app with connected vehicles
● Many more features...

Let’s connect
Any other ideas or possible synergies let’s connect on LinkedIn or contact me:
salah.elhajji@cleanmob.eu