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

ifP SCHOOL

CleanMob.eu

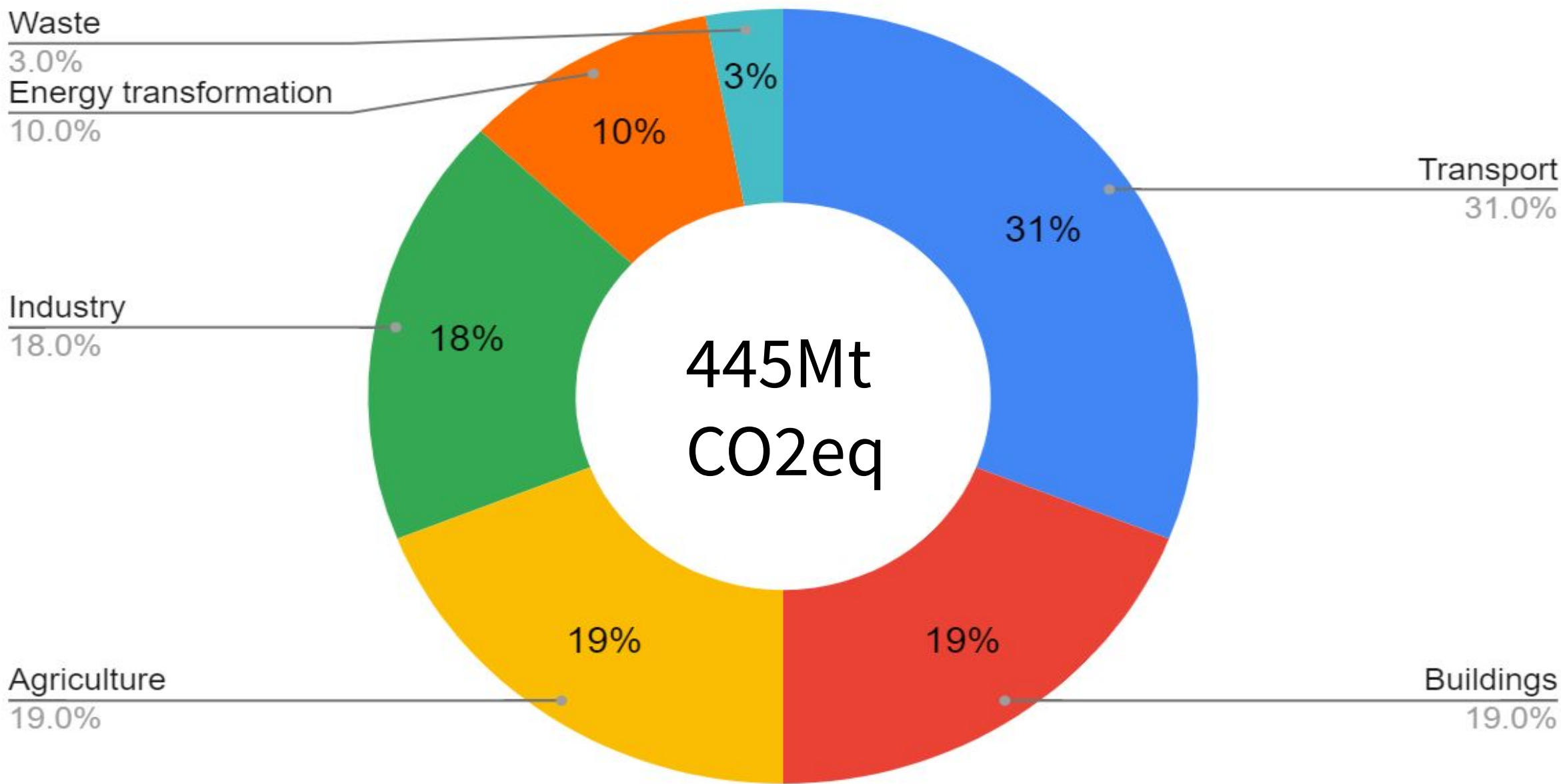CleanMob - Clean mobility enabler (B2B)
Agenda

Context of modern mobility

Transport is the major contributor

National GHG emissions - France (2018)

Waste
3.0%

Energy transformation
10.0%

3%

10%

31%

Transport
31.0%

Industry
18.0%

18%

445Mt
CO2eq

Agriculture
19.0%

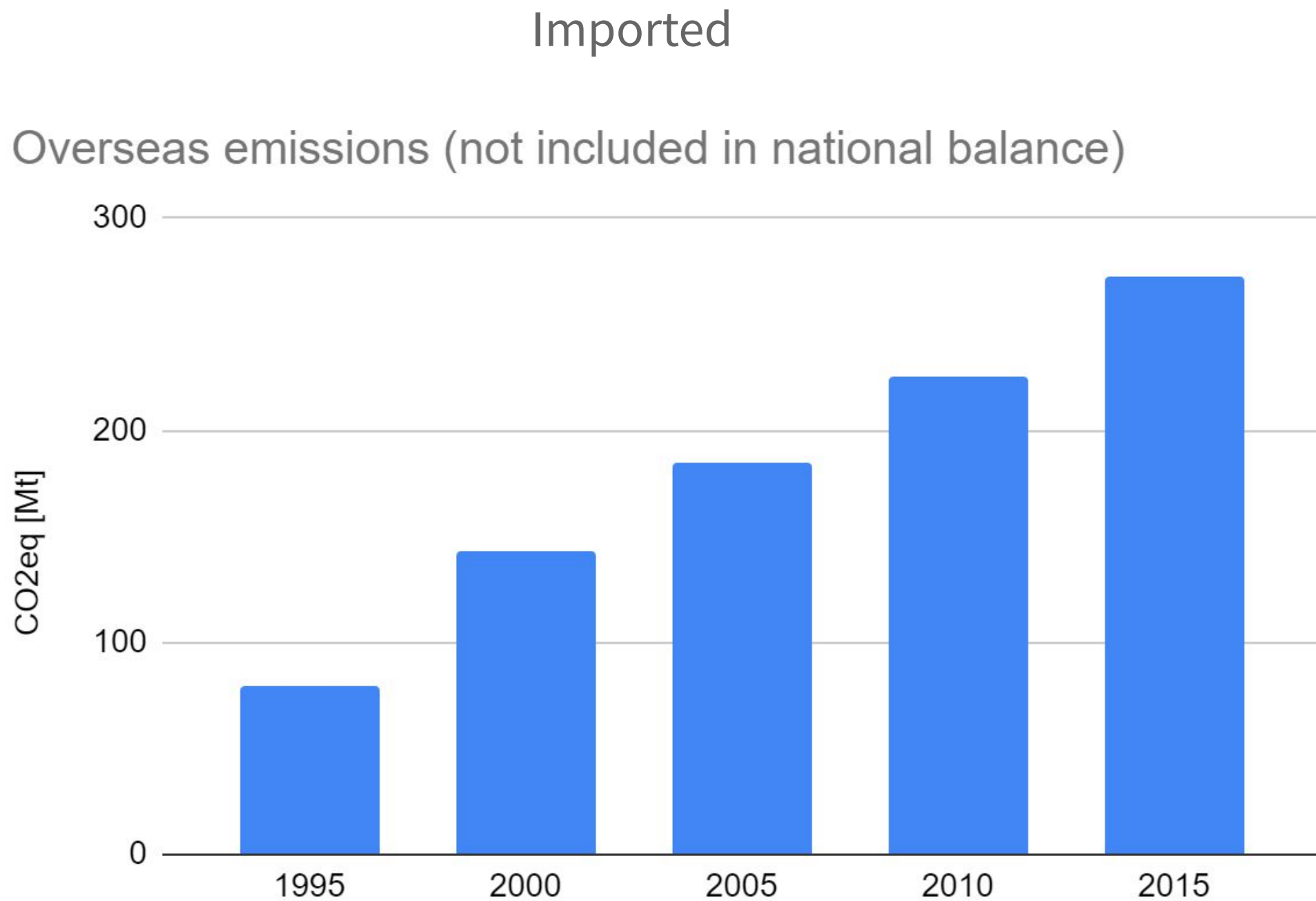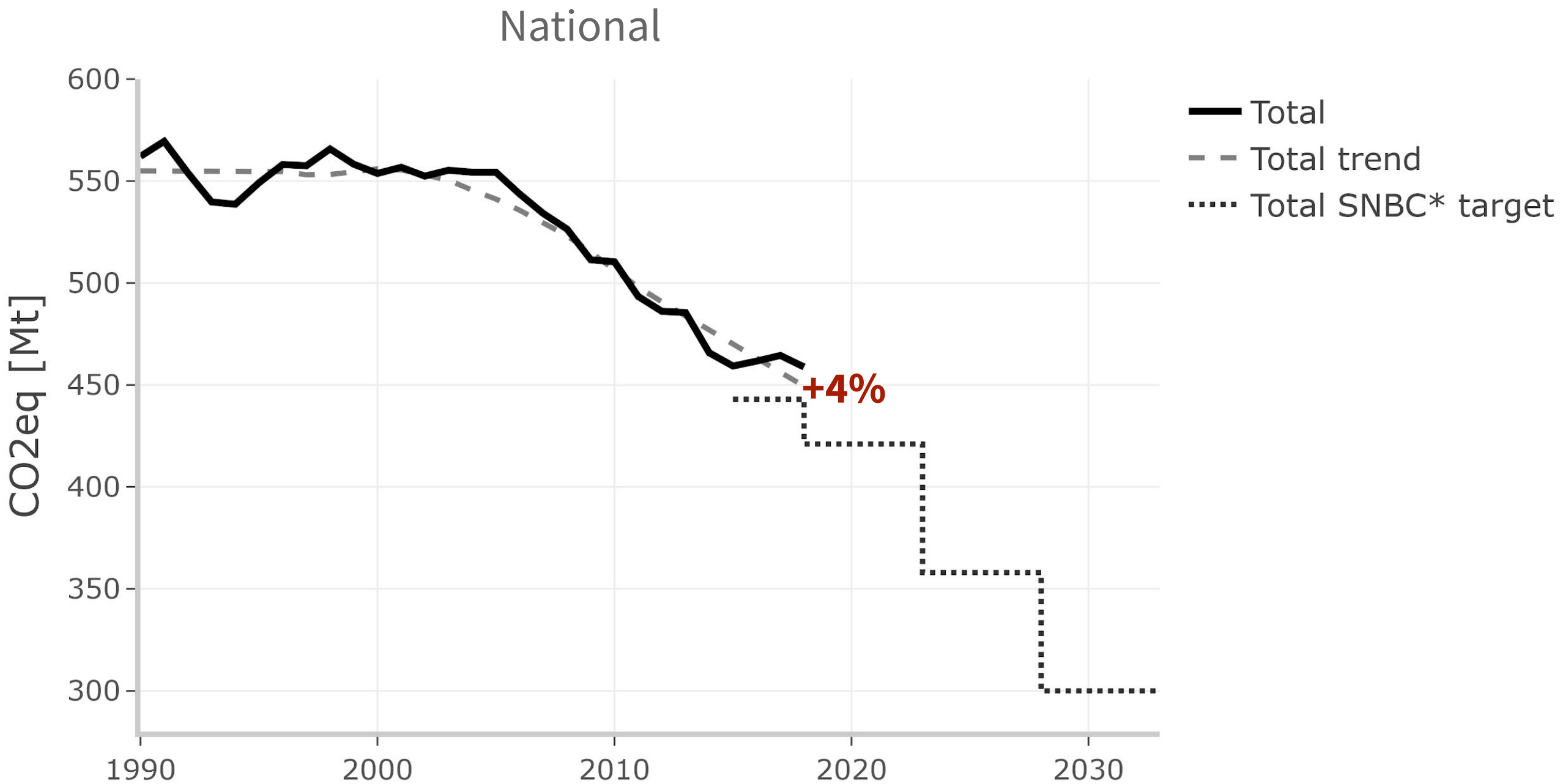19%

19%

Buildings
19.0%

CO2 emissions by source

Source : HCC report 2019

Context of modern mobility
An insufficient reduction...

National

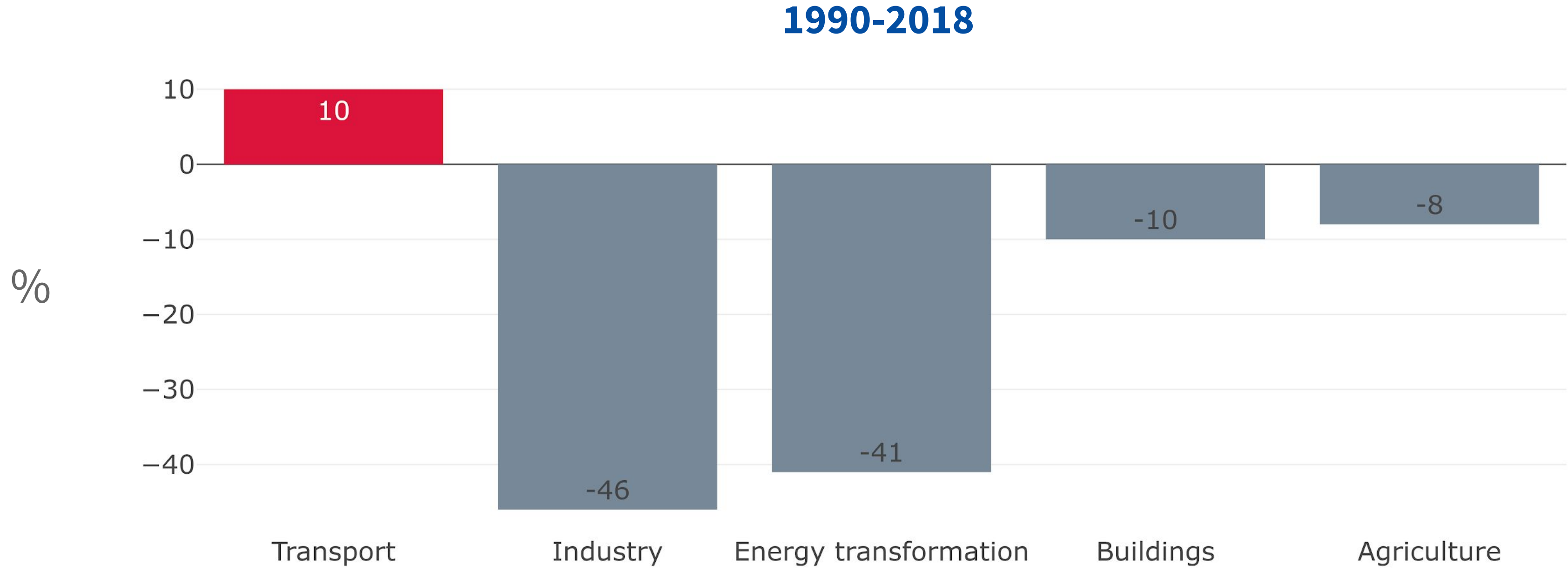**National CO2 emissions evolution**
Source : HCC report 2019
SNBC*: Stratégie nationale bas carbone

Imported

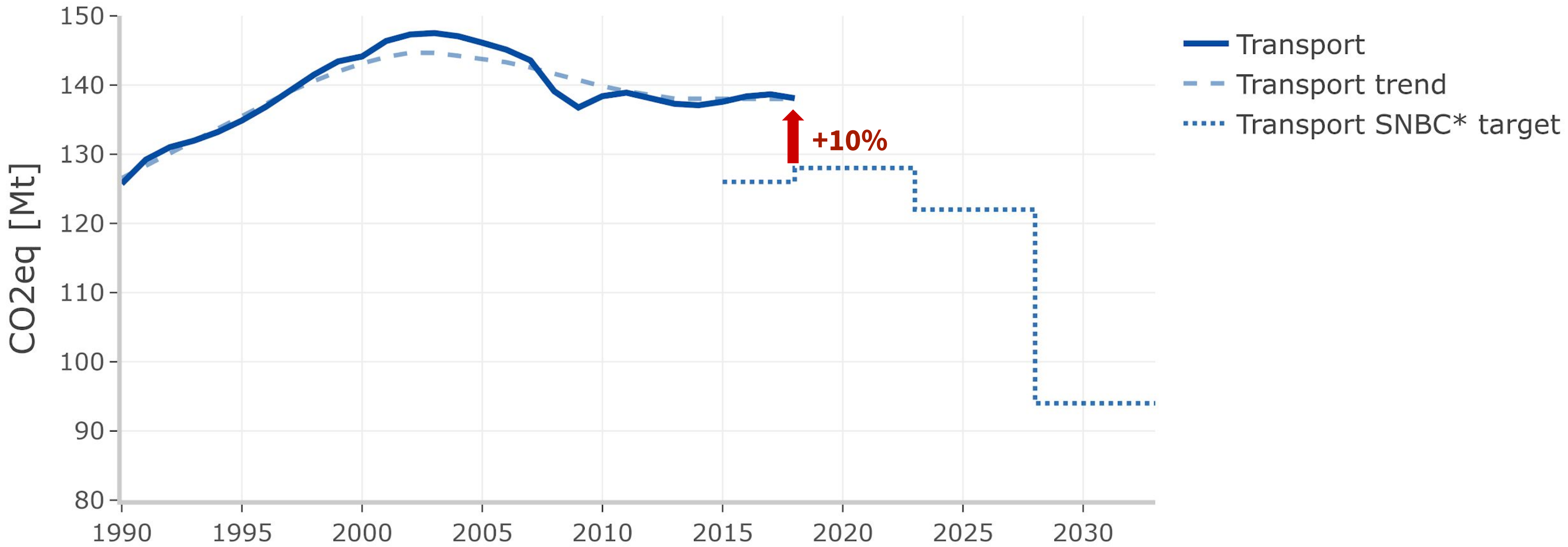**Imported CO2 emissions evolution**
Source : HCC report 2019

Context of modern mobility
...especially in transport

1990-2018

%

| | 10 |
| | |

Transport — 10
Industry — -46
Energy transformation — -41
Buildings — -10
Agriculture — -8

CO2 emissions evolution by source 1990-2018
Source : HCC report 2019

Context of modern mobility

...especially in transport

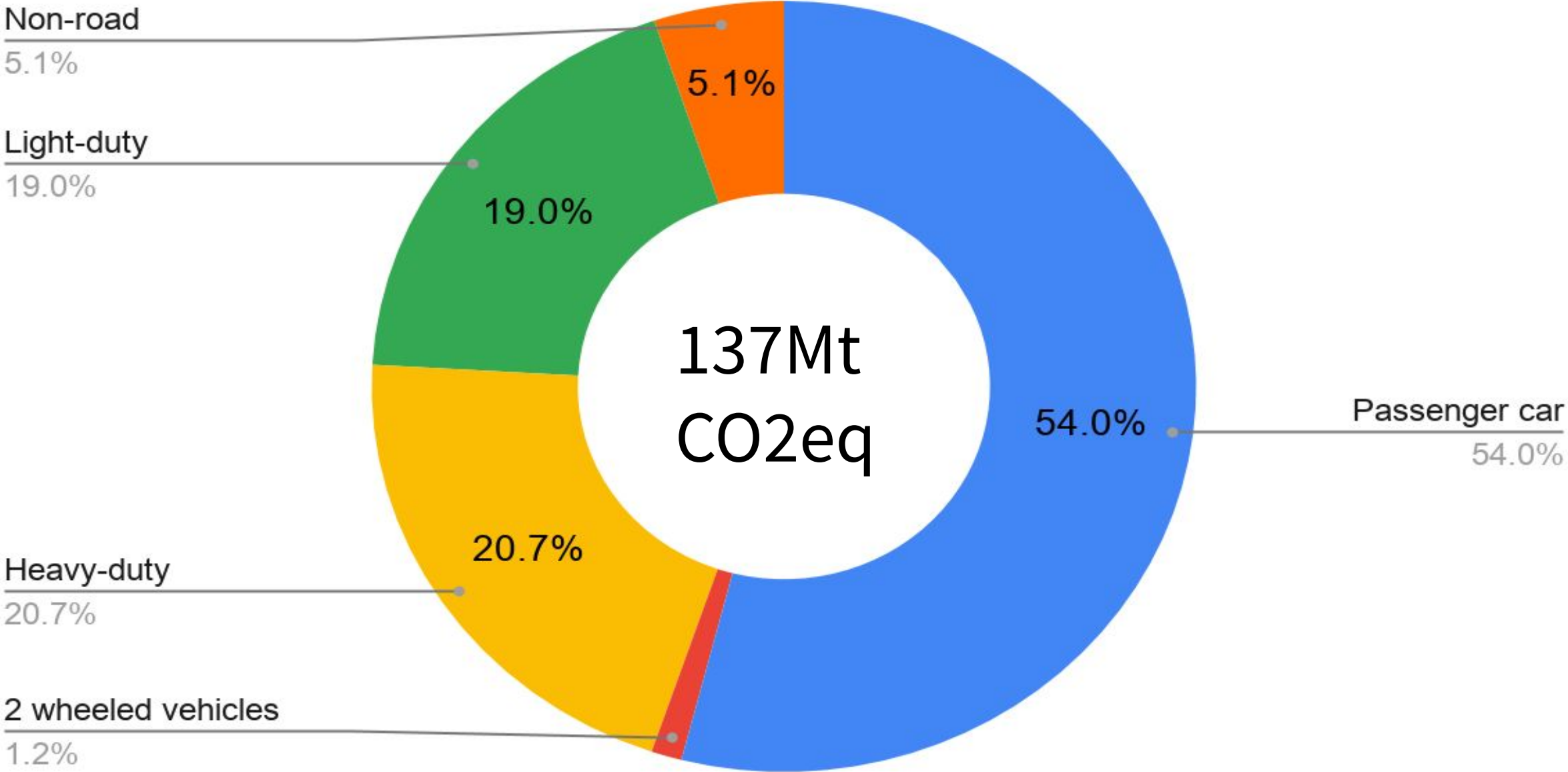**CO2 emissions - Transport evolution**

Source : HCC report 2019

SNBC*: Stratégie nationale bas carbone

Context of modern mobility

People transportation represents 60%

Transport GHG emissions - France (2018)

Non-road
5.1%

Light-duty
19.0%

5.1%

19.0%

137Mt
CO2eq

54.0%

Passenger car
54.0%

Heavy-duty
20.7%

20.7%

2 wheeled vehicles
1.2%
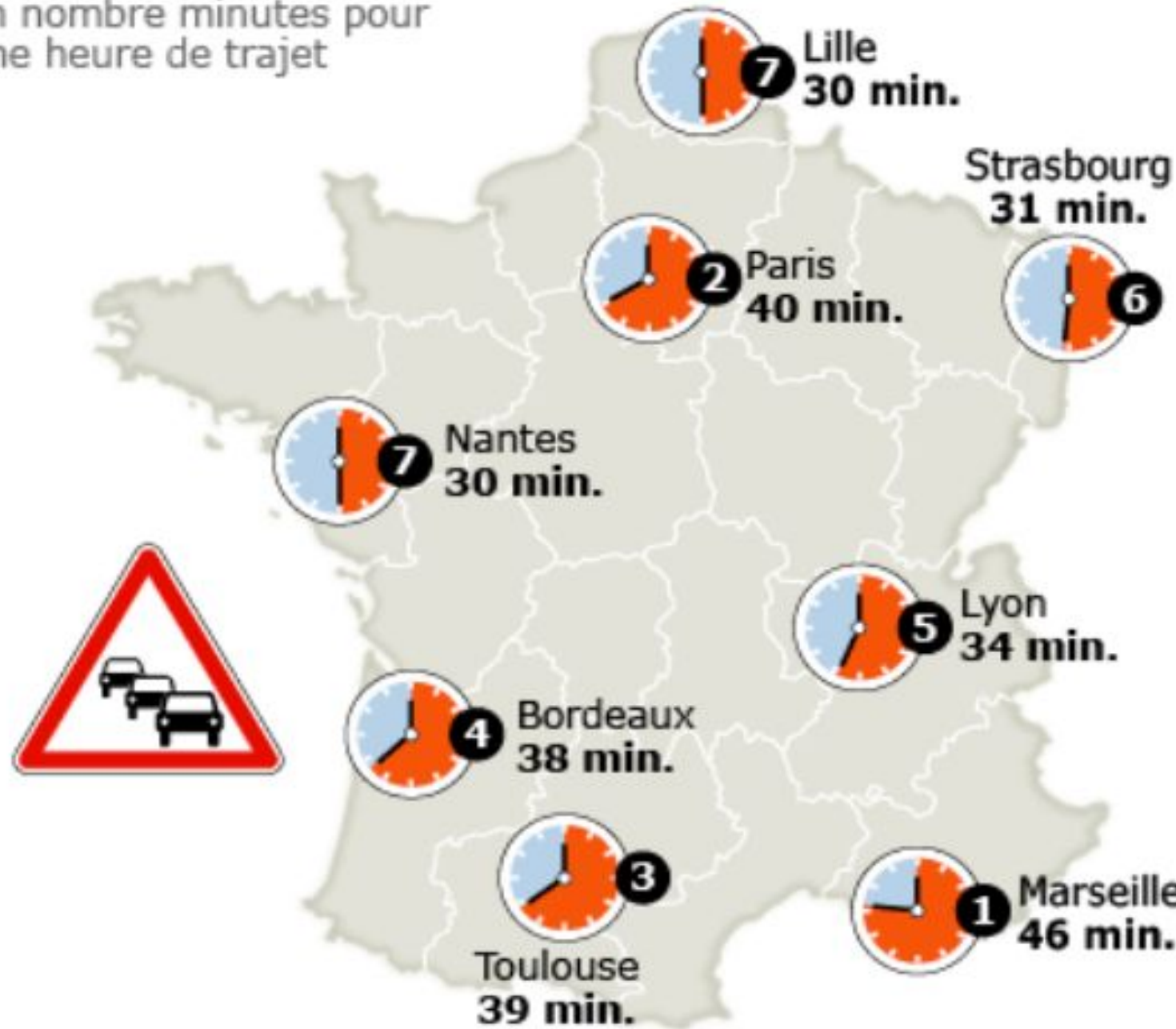
CO2 emissions - Transport

Source: AEE 2018

Context of modern mobility

Personal car, a habit that needs change

TEMPS PERDU DANS LES EMBOUTEILLAGES
EN PÉRIODE DE POINTE
en nombre minutes pour
une heure de trajet

7 Lille
30 min.

Strasbourg
31 min.

2 Paris
40 min.

6

7 Nantes
30 min.

Lyon
5 34 min.

4 Bordeaux
38 min.

3

Marseille
1 46 min.

Toulouse
39 min.

Traffic congestion
Source: tomtom.com/congestionindex

75%

of the french population uses

individual cars for trips of less

than 8km (5km in cities)

INSEE 2014

Context of modern mobility

Today transport innovation is mainly focused on energy efficiency and personal car...
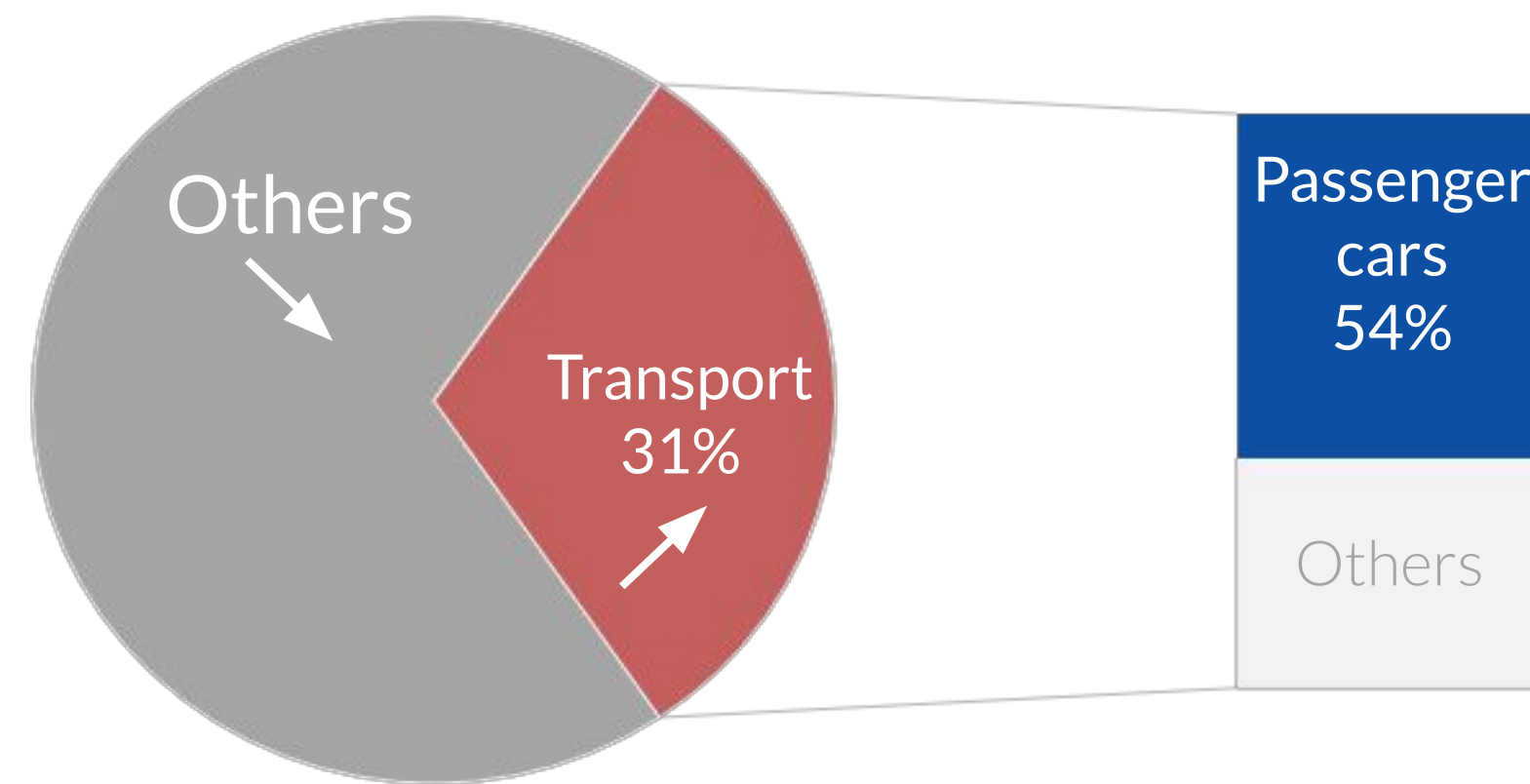
- Excessive energy demand
- High dependency on oil
- High CO_2/km
- Noxious emissions
- High usage of public space
- BEVs will increase imported emissions

...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

ENERGY

Well-To-Wheel
Life-cycle-assessment

CO₂

Available stocks,
consumption
rate, geostrategic
tesions, ethics

**NATURAL
RESOURCES**

MOBILITY

m2/pers
Frustration,
anxiety

**TRAFFIC
CONGESTION**

Air-quality,
noise
pollution

LOCAL POLLUTION

kCal/km
Sedentarity

HEALTH

Mitigation options

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

| Worse | Neutral | Improved |

Scenarios	⚡ ENERGY	☁ CO₂	🚗 TRAFFIC CONGESTION	🍃 NATURAL RESOURCES	🏠 LOCAL POLLUTION	👥 HEALTH
Business as usual (Fossil fuels, individual car)	–	–	–	–	–	–

Mitigation options

Do not put all our eggs in the same basket

| Worse | Neutral | Improved |

Scenarios	**E**NERGY	**CO$_2$**	**T**RAFFIC **CONGESTION**	**N**ATURAL **RESOURCES**	**L**OCAL **POLLUTION**	**H**EALTH
Business as usual (Fossil fuels,individual car)	-	-	-	-	-	-
Fossil free fuels (Bio-fuels,E-fuels,…)	-	+	-	=	-	-

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

| Worse | Neutral | Improved |

Scenarios	ENERGY	CO$_2$	TRAFFIC CONGESTION	NATURAL RESOURCES	LOCAL POLLUTION	HEALTH
Business as usual (Fossil fuels, individual car)	-	-	-	-	-	-
Fossil free fuels (Bio-fuels, E-fuels,…)	-	+	-	=	-	-
Vehicle technologies (EVs, Hybrids,…)	=	+	-	-	=	=

Mitigation options

Do not put all our eggs in the same basket

| | Worse | Neutral | Improved |

Scenarios	⚡ ENERGY	☁ CO₂	🚗 TRAFFIC CONGESTION	🍃 NATURAL RESOURCES	🏠 LOCAL POLLUTION	👥 HEALTH
Business as usual (Fossil fuels, individual car)	-	-	-	-	-	-
Fossil free fuels (Bio-fuels, E-fuels,…)	-	+	-	=	-	-
Vehicle technologies (EVs, Hybrids,…)	=	+	-	-	=	=
Modal shifts (Public transport, micro and shared mobility,…)	+	+	+	=	+	+
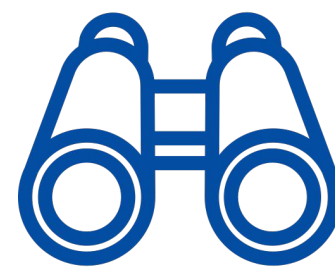
Vision, ambition & solutions

Vision, ambition and solutions

Our vision
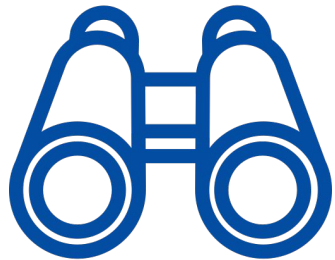
Energy sobriety is our best leverage for a successful energy transition

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

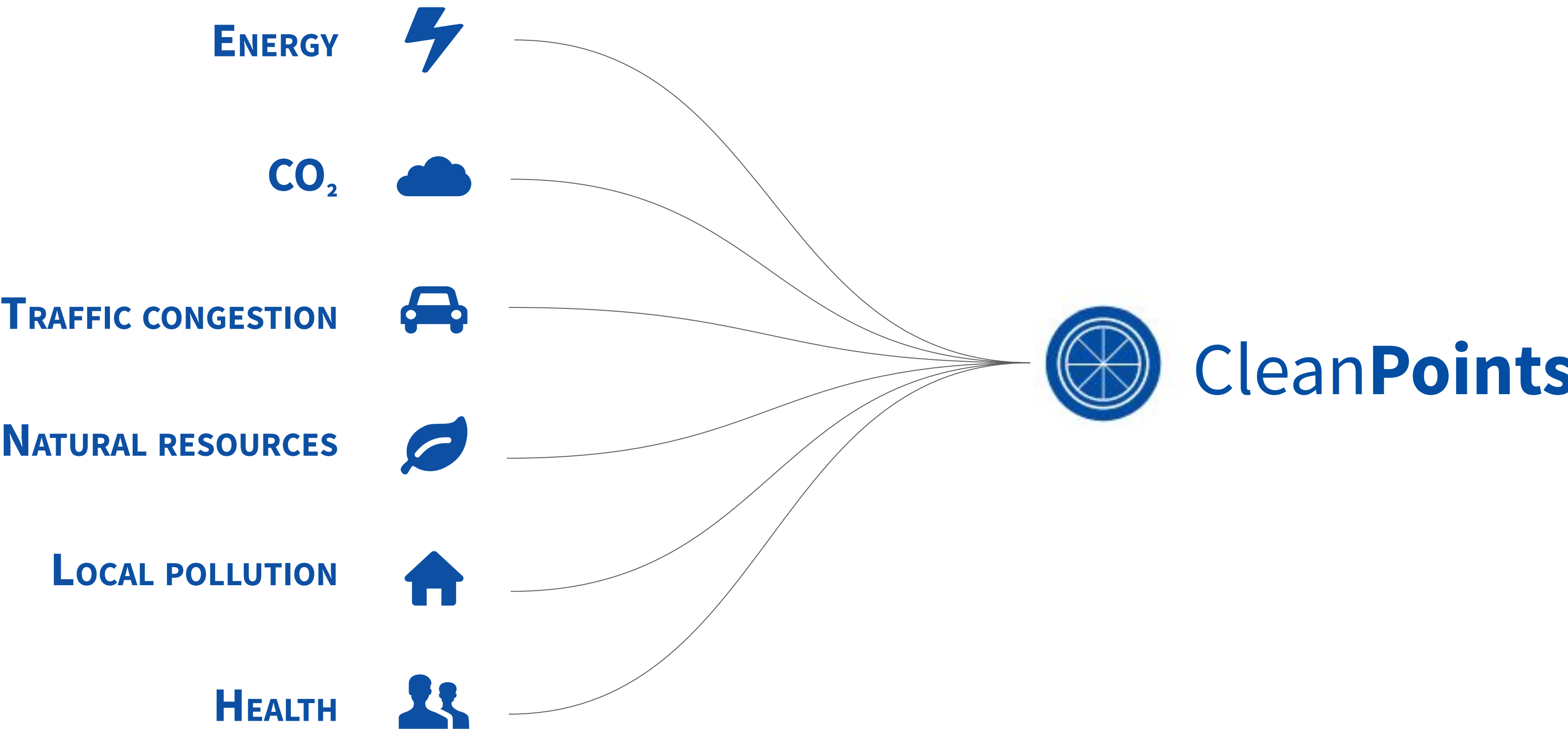For a well adopted behavior and maintained for a long time

Tech for good

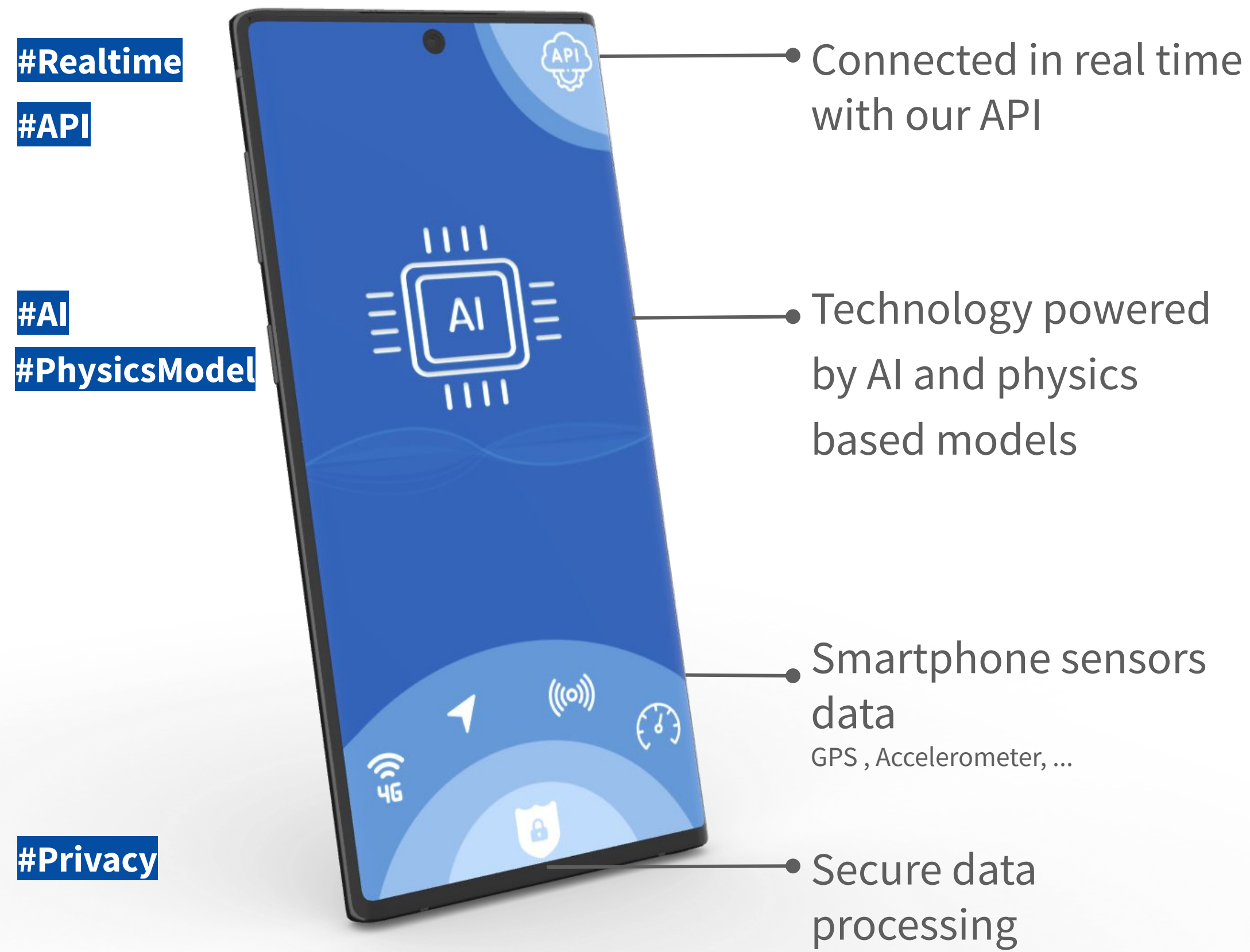Leverage the **phone sensors data**, and couple it with **AI and physics based models**

Vision, ambition and solutions

Ambition : A complex system simplified, through cleanpoints

ENERGY

CO_2

TRAFFIC CONGESTION

NATURAL RESOURCES

LOCAL POLLUTION

HEALTH

CleanPoints

Vision, ambition and solutions
Ambition : Tech for good

#Realtime

#API

Connected in real time with our API

#AI

#PhysicsModel

Technology powered by AI and physics based models

Smartphone sensors data
GPS , Accelerometer, …

#Privacy

Secure data processing

Did someone mention smartphones ?

Why a smartphone ?

- 77% of the french population have a smartphone (more than 85% for the 18 - 60 years)
  Source : barometre numerique 2019 - Conseil general de l'économie
- No new device / extra sensors
- With us all the time
- Built-in sensors

#Inclusive

#Empowerment

Goal

Transform the smartphone to a CO2 virtual sensor

Vision, ambition and solutions
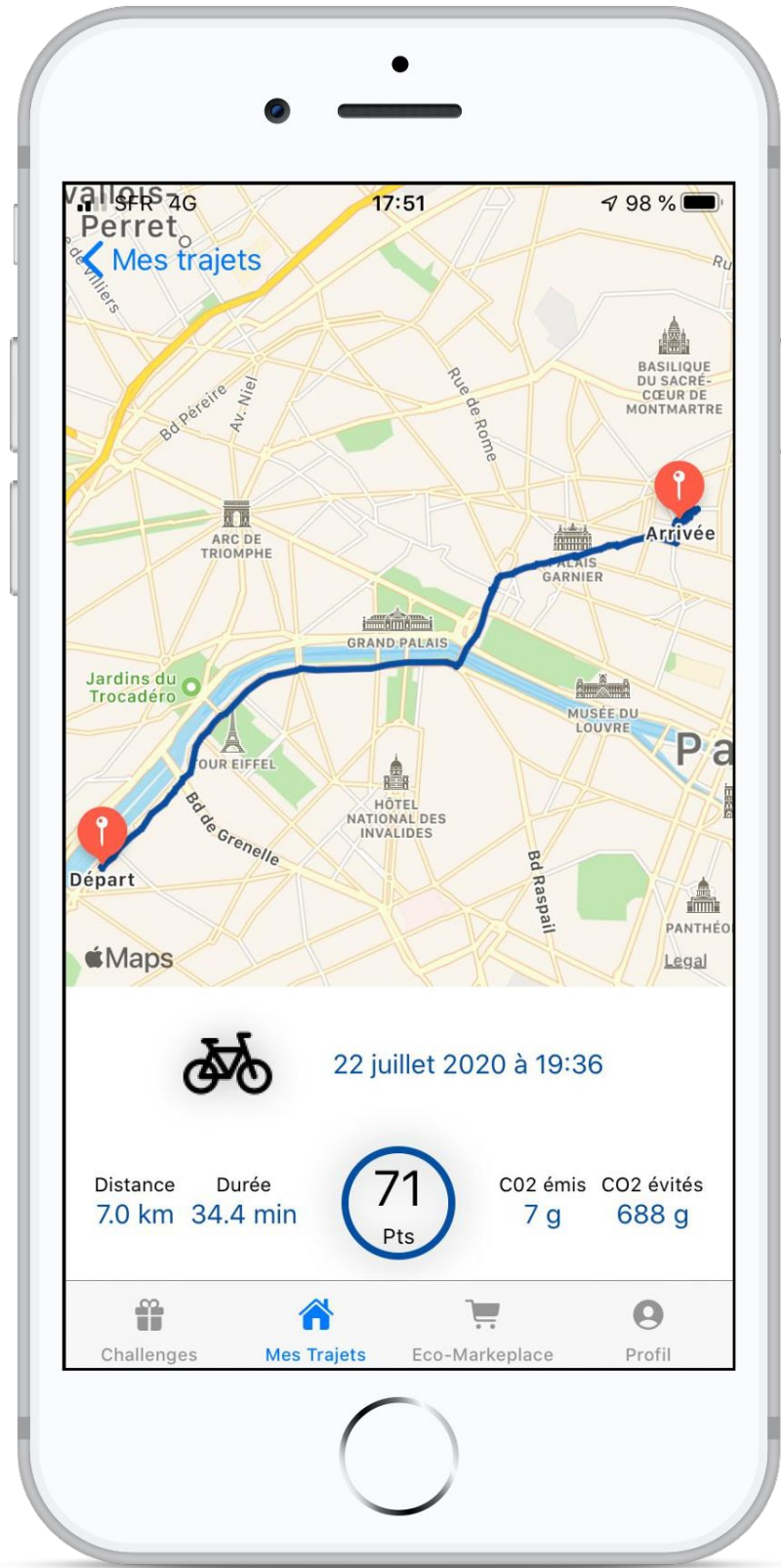
Cleanmob mobile App for commuter

Daily commuting

Our incentive to reduce carbon footprint
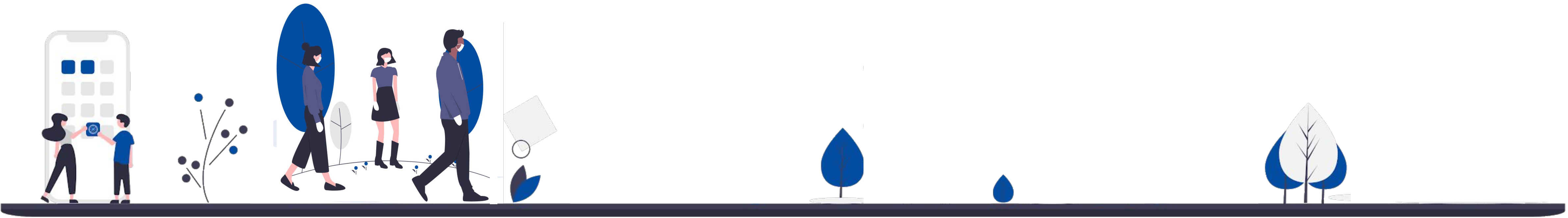
1 **Install the Cleanmob App**

Vision, ambition and solutions
Cleanmob mobile App for commuter

#Privacy
Geospatial data is commuter's proprety 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

CleanMob under the hood

CleanMob under the hood
Automated transport mode detection

Figure 1. Coordinate system (relative to a device) that's used by the Sensor API.
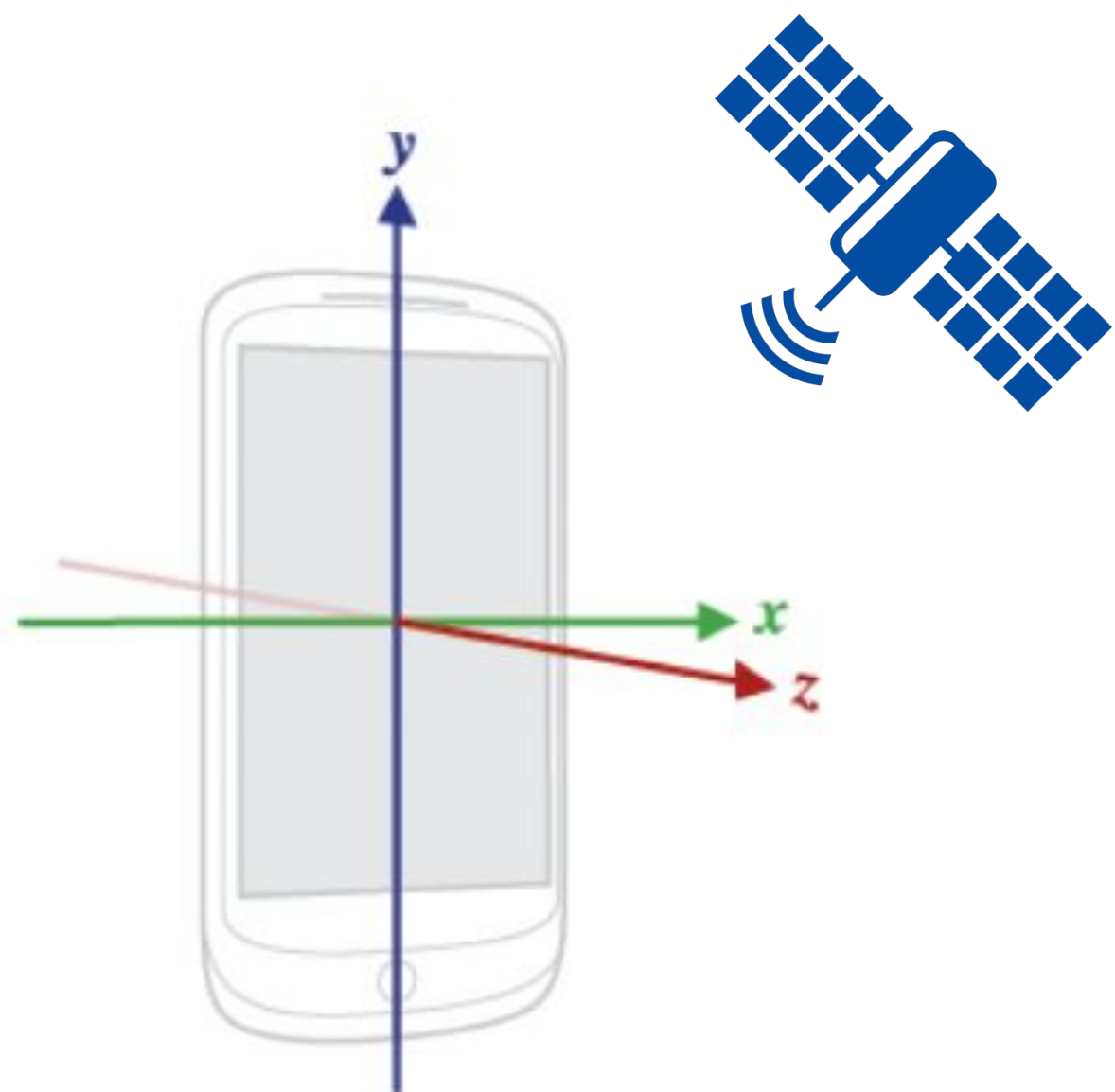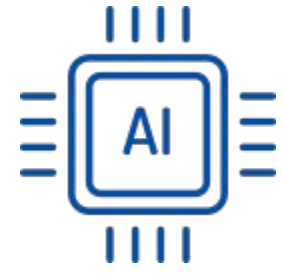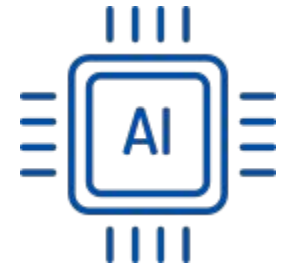
Source: Android developers

Sensor name	Data collected	Dimensions	Unit
Accelerometer	Acceleration	x,y,z	m/s^2
Gyroscope	Rotation rate	x,y,z	rad/s
Magnetometer	Magnetic field	x,y,z	μT
GPS	Geospatial data	lon,lat,speed	Degrees / m/s

CleanMob under the hood
Automated transport mode detection
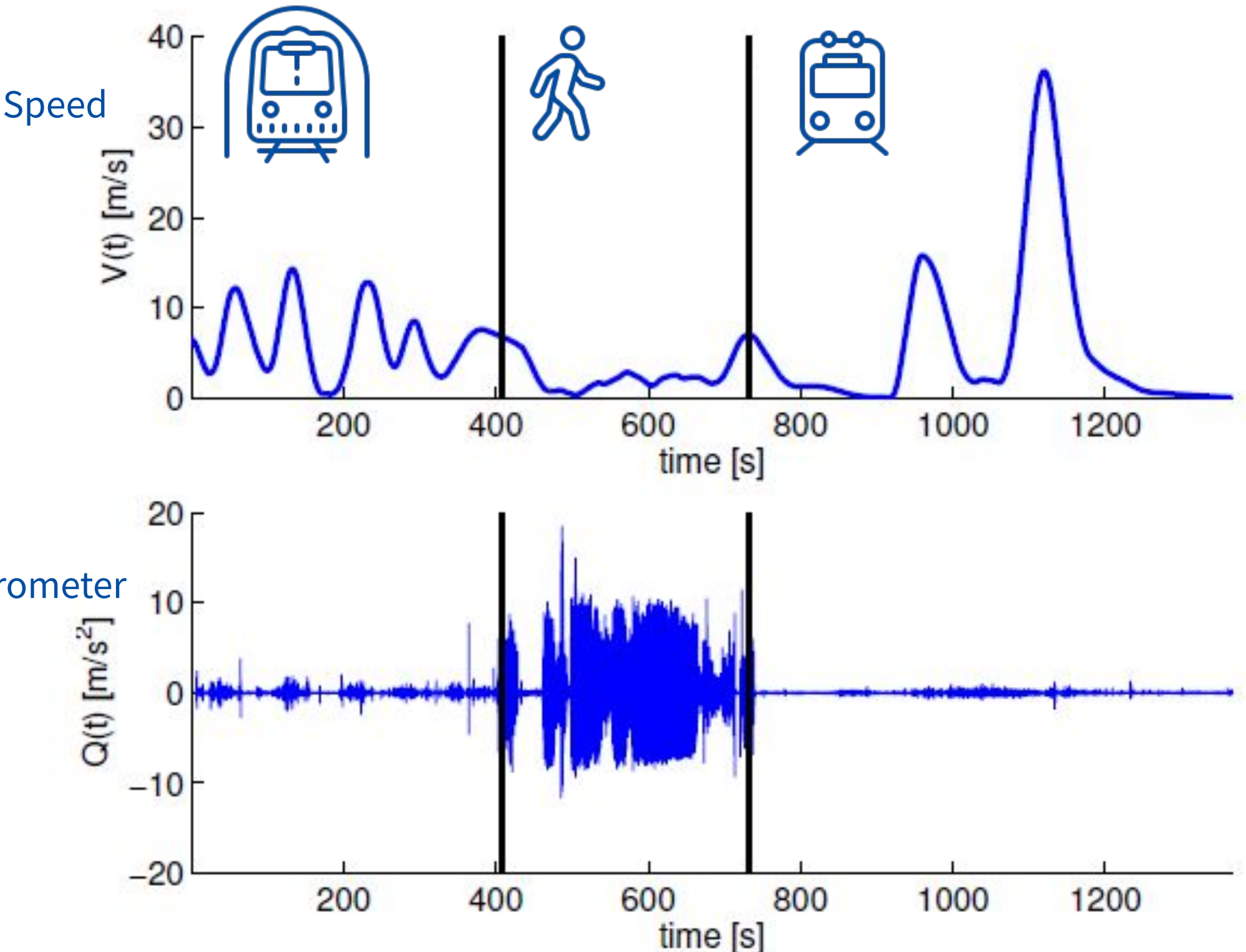
1 **Data acquisition**   **2** **Classification algorithm**   **3** **Detected transport mode**

Speed

Accelerometer

Classifier

Source: Austrian Institute of Technology

CleanMob under the hood

Physical modeling & LCA

Energy data:
Electricity
production mix
Carbon intensity
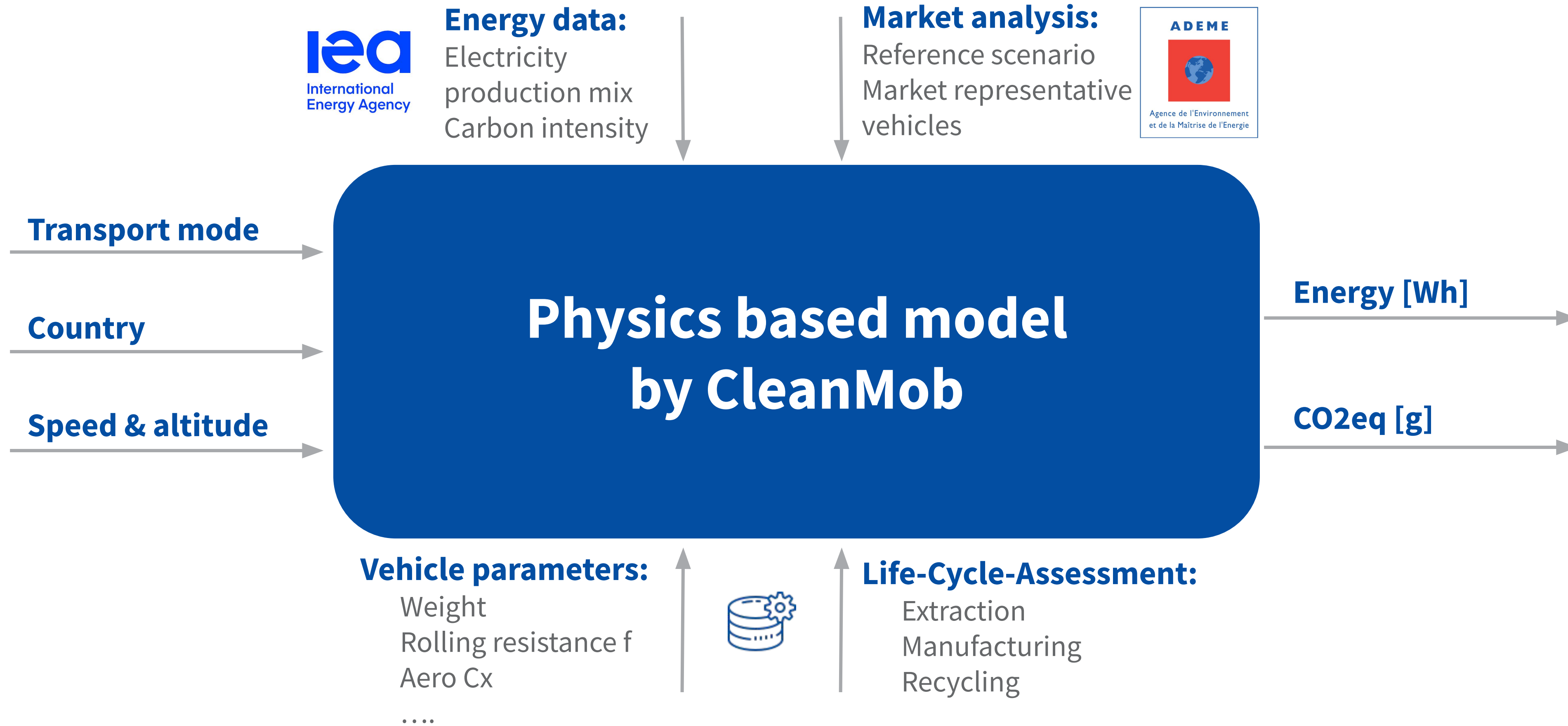
Market analysis:
Reference scenario
Market representative
vehicles

Transport mode

Country

Speed & altitude

Physics based model by CleanMob

Energy [Wh]

CO2eq [g]

Vehicle parameters:
Weight
Rolling resistance f
Aero Cx
….

Life-Cycle-Assessment:
Extraction
Manufacturing
Recycling

CleanMob under the hood
Physical modeling & LCA

Use case #1

direct CO2eq [g]
indirect CO2eq [g]
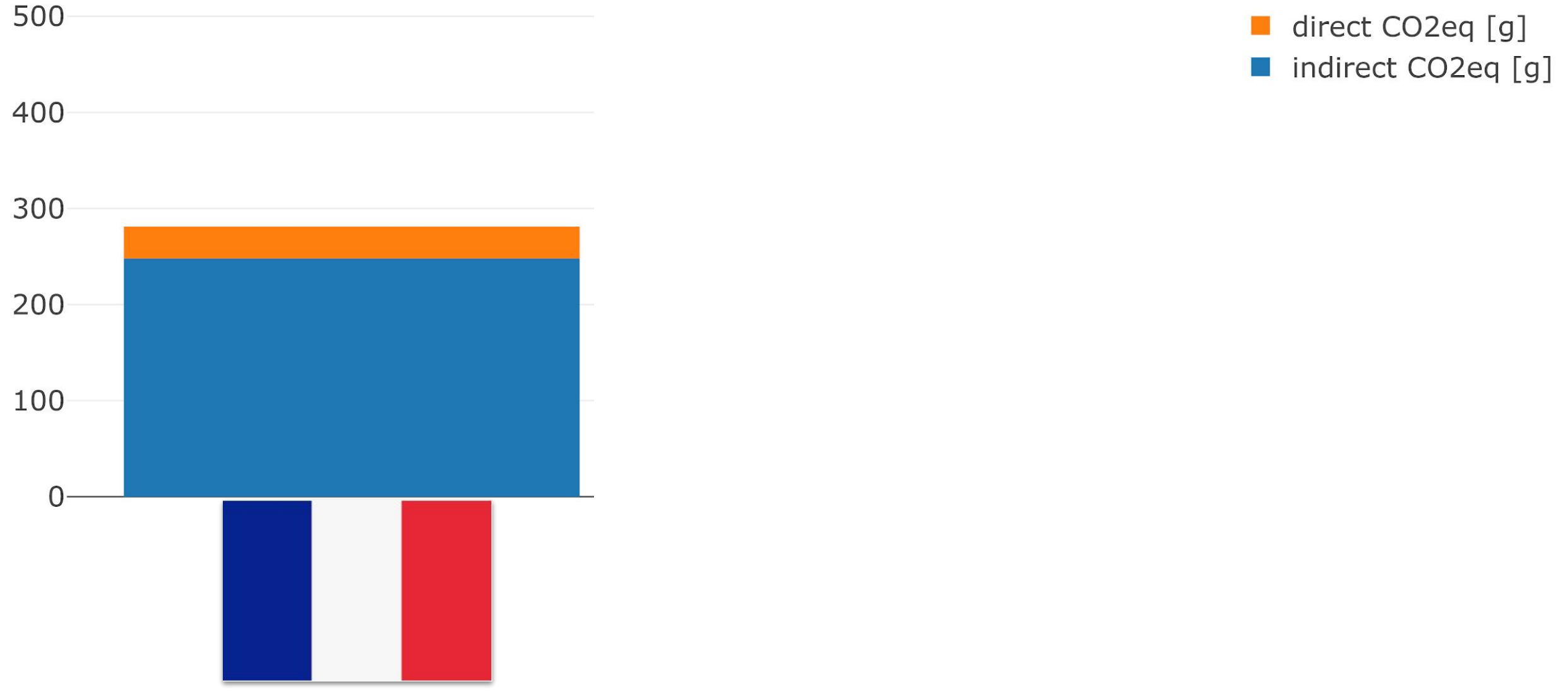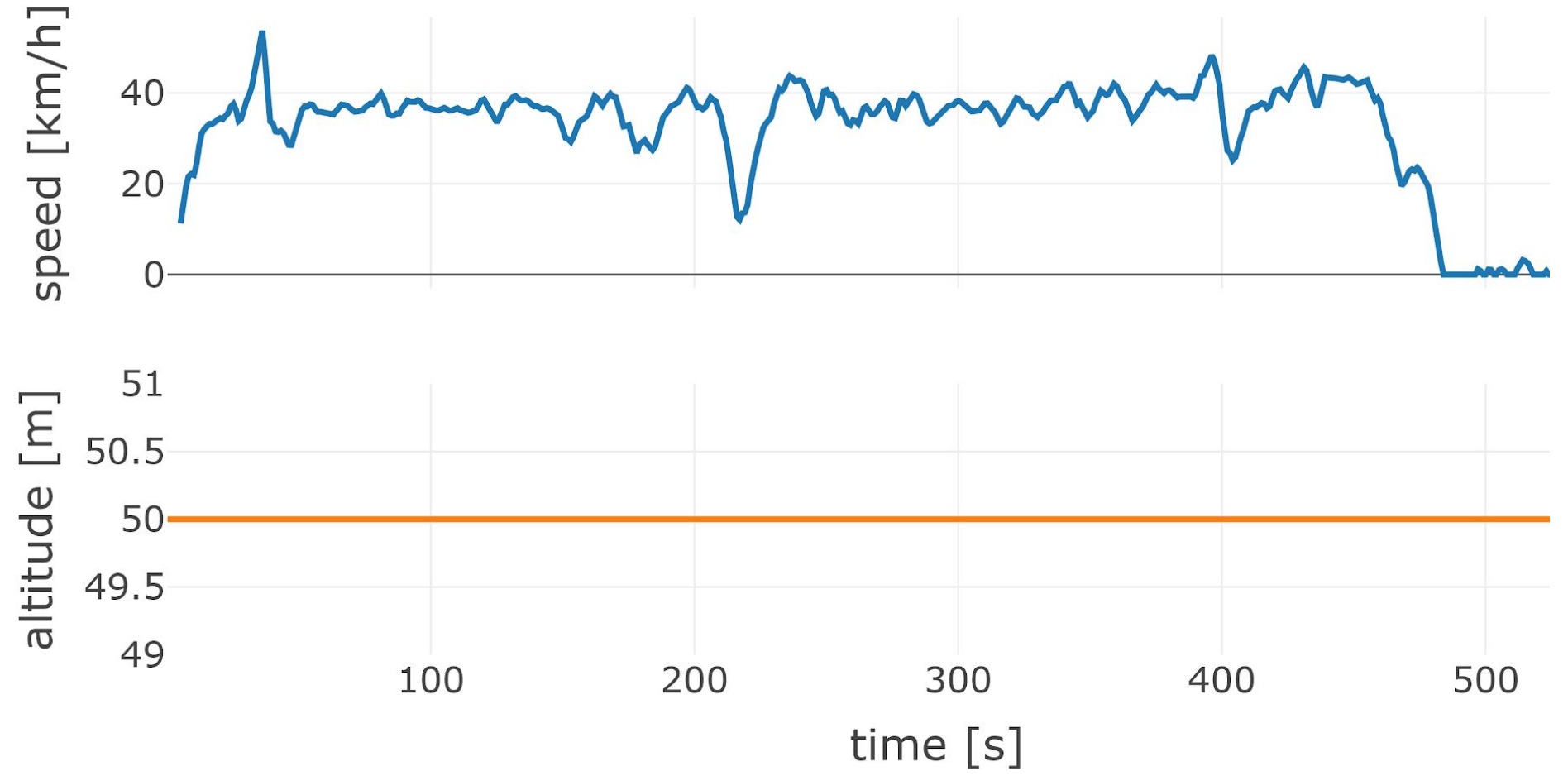
CleanMob under the hood
Physical modeling & LCA

Use case #2

Case 1 - flat road

Case 2 - hilly road

- Traditional models
- CleanMob model

-54%
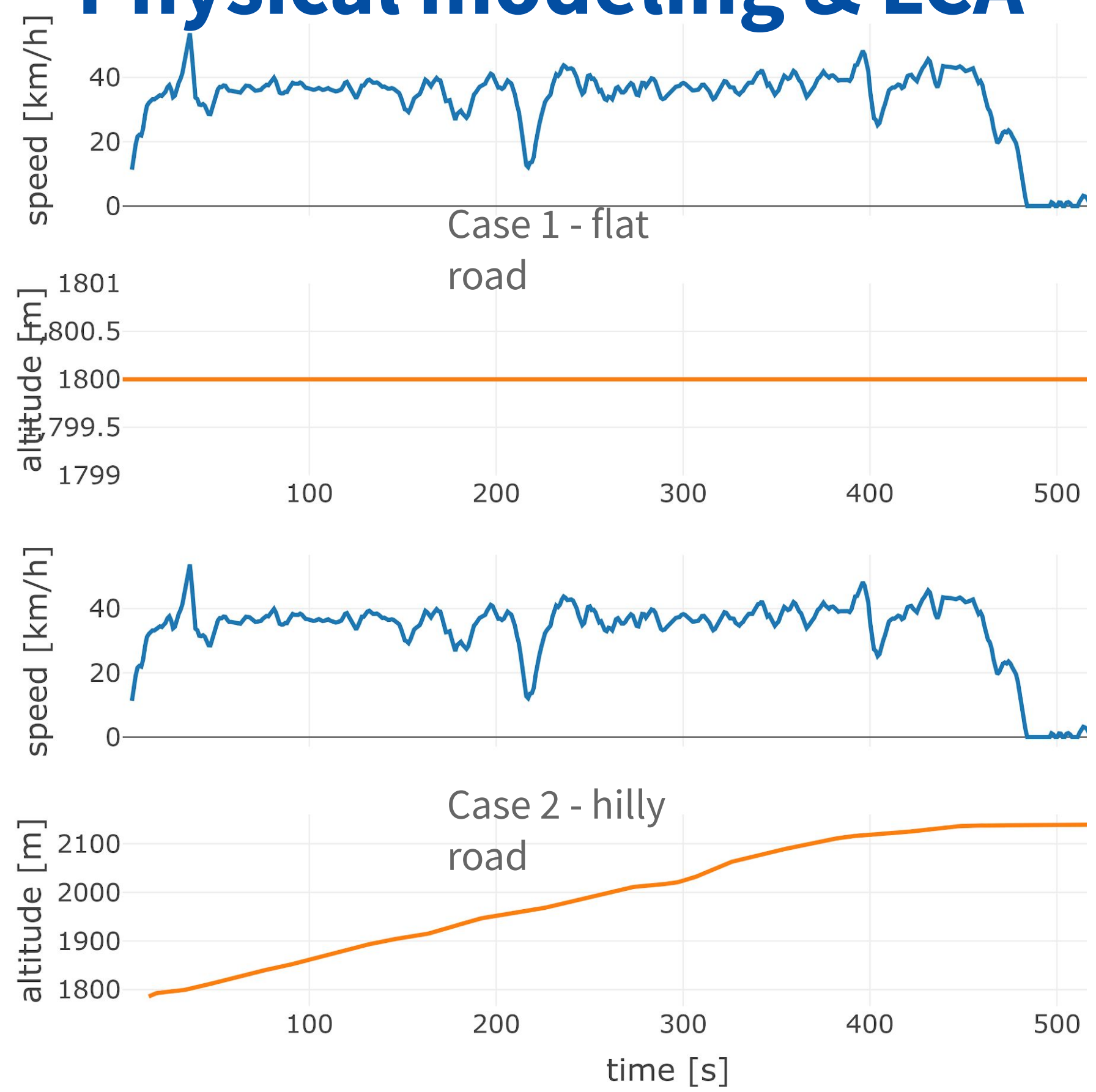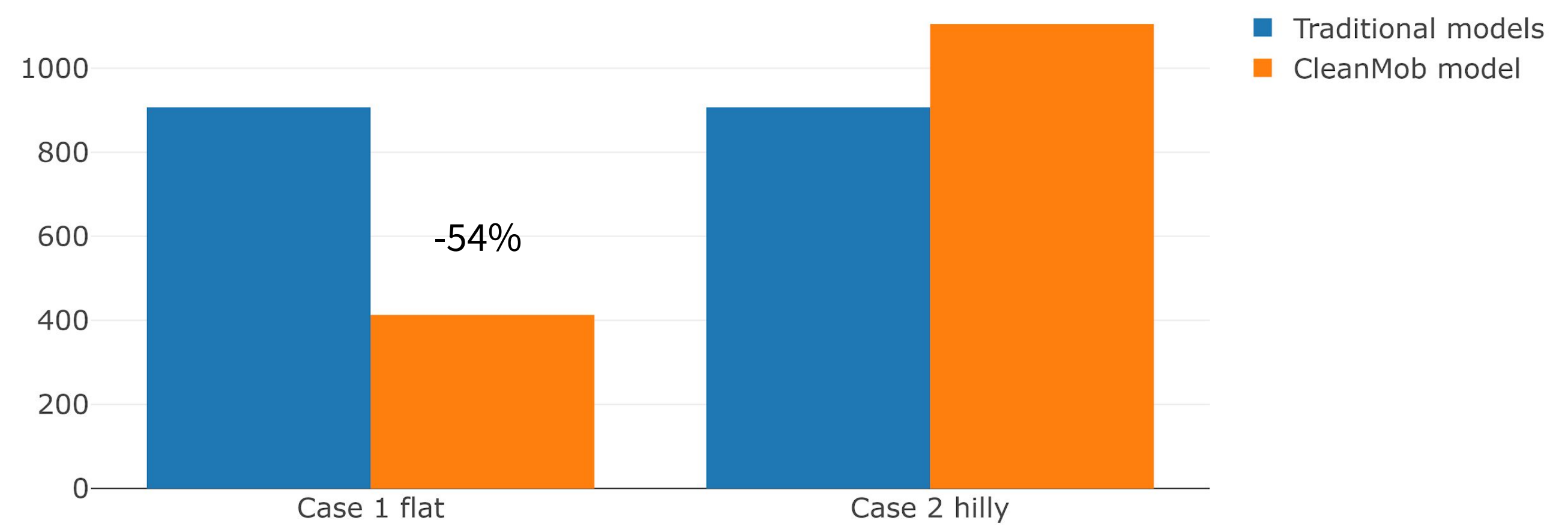
Added value:
Real driving conditions
High quality CO2 evaluation

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

Conclusion

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 !

Salah EL HAJJI
CEO & co-founder
Cleanmob.eu

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 LinkendIn or contact me : salah.elhajji@cleanmob.eu