Daily Mobility in Medium Density Areas

how to reduce carbon emissions and connect people

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THE SHIFT PROJECT
THE CARBON TRANSITION THINK TANK

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www.theshiftproject.org

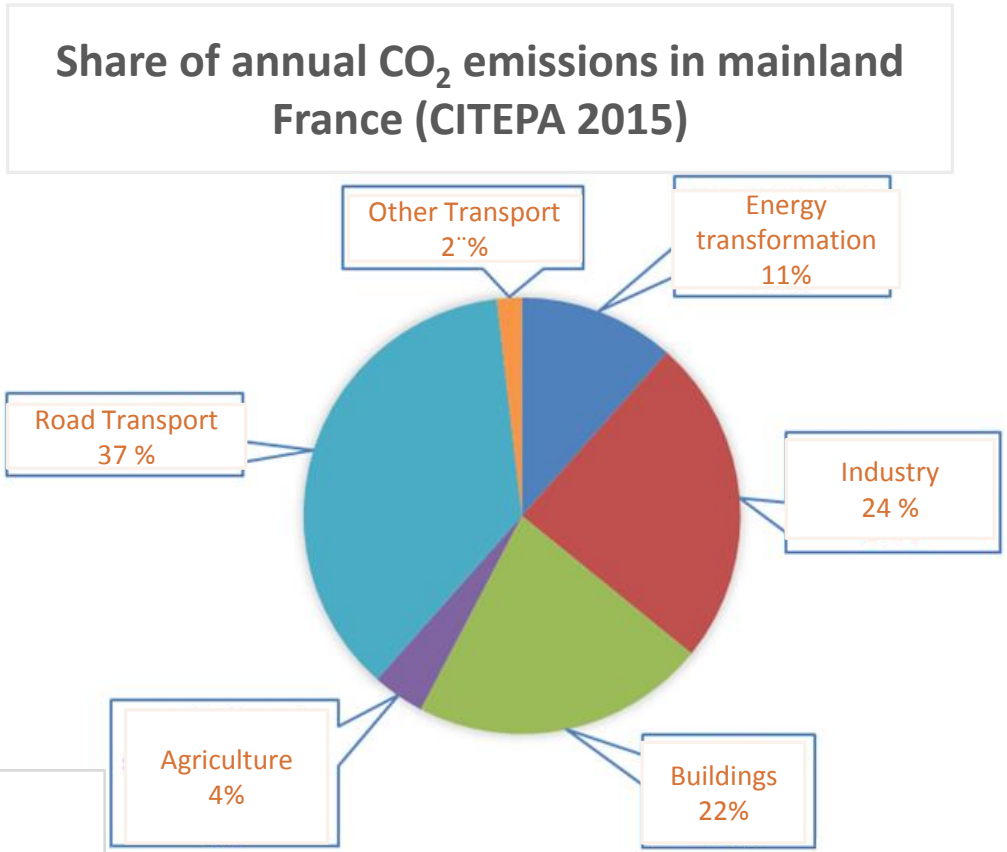
Transport

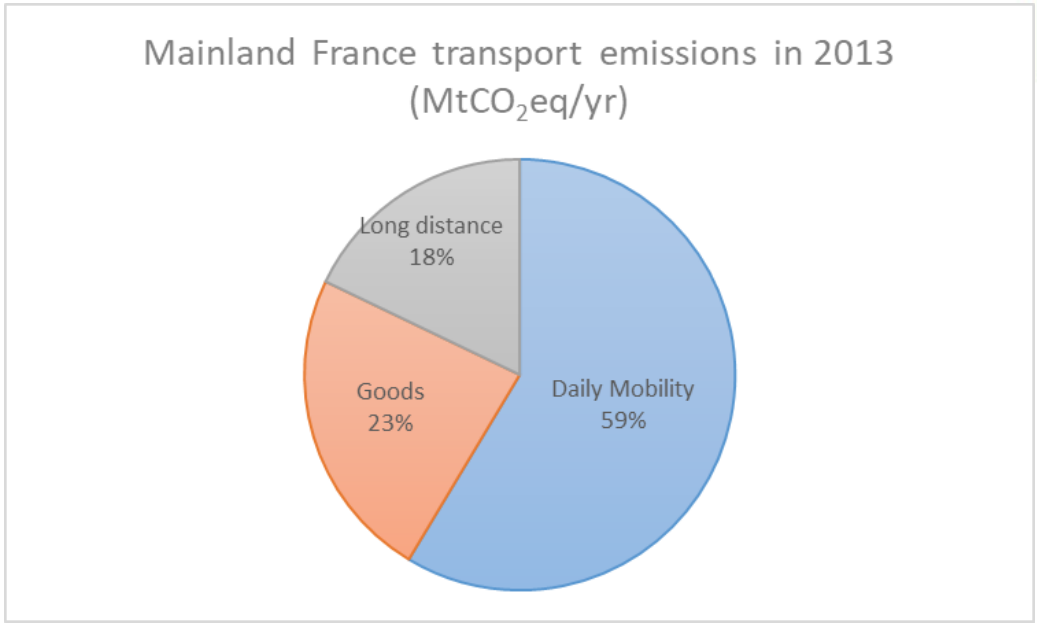
126 $MtCO_2$/year in mainland France = 39% of total emissions

Low-carbon national strategy (SNBC)

Objective : a 29 % reduction of transport-related CO_2 emissions by 2028

(base: 2013)

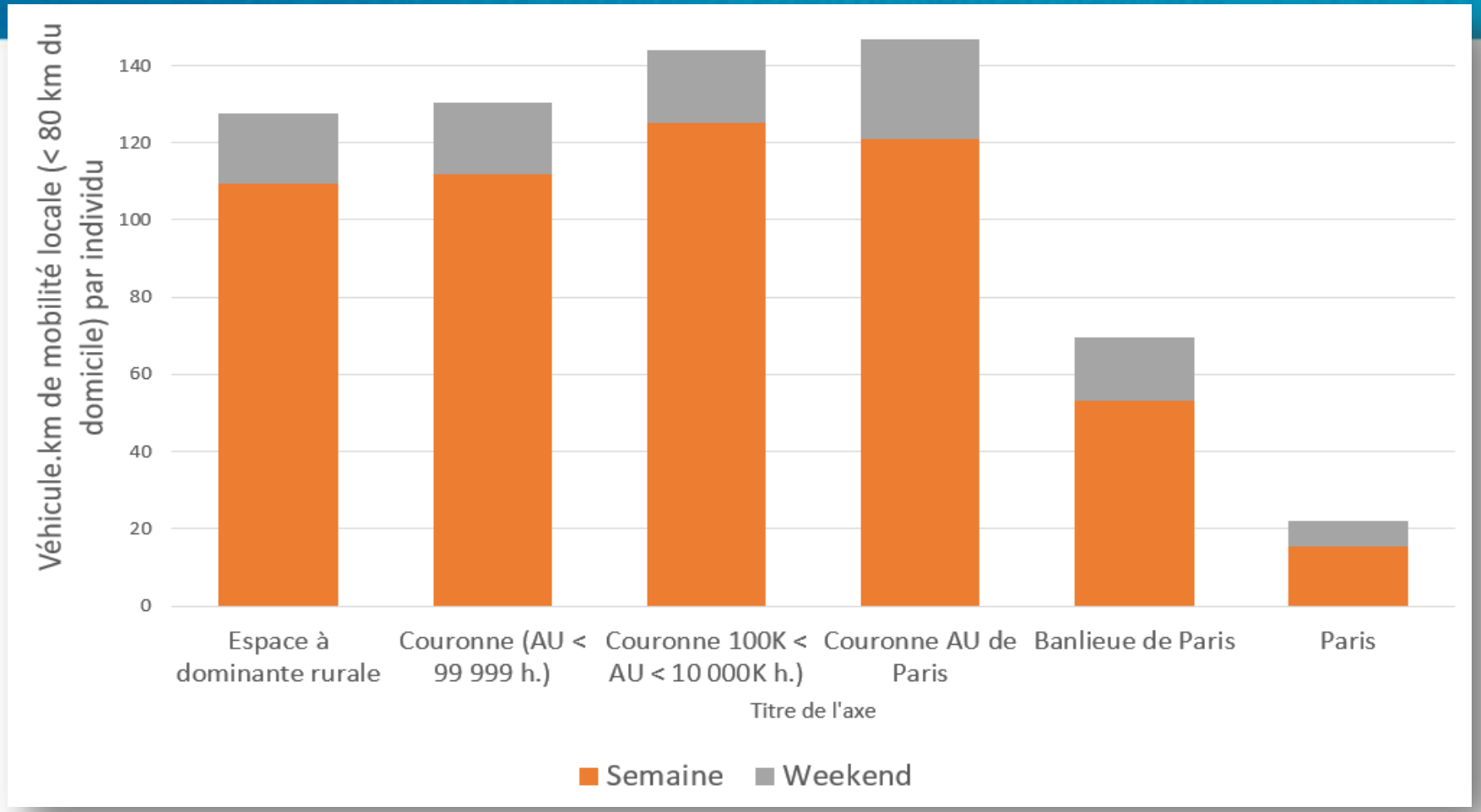




Introduction

Travelled distances (as a driver)

daily mobility



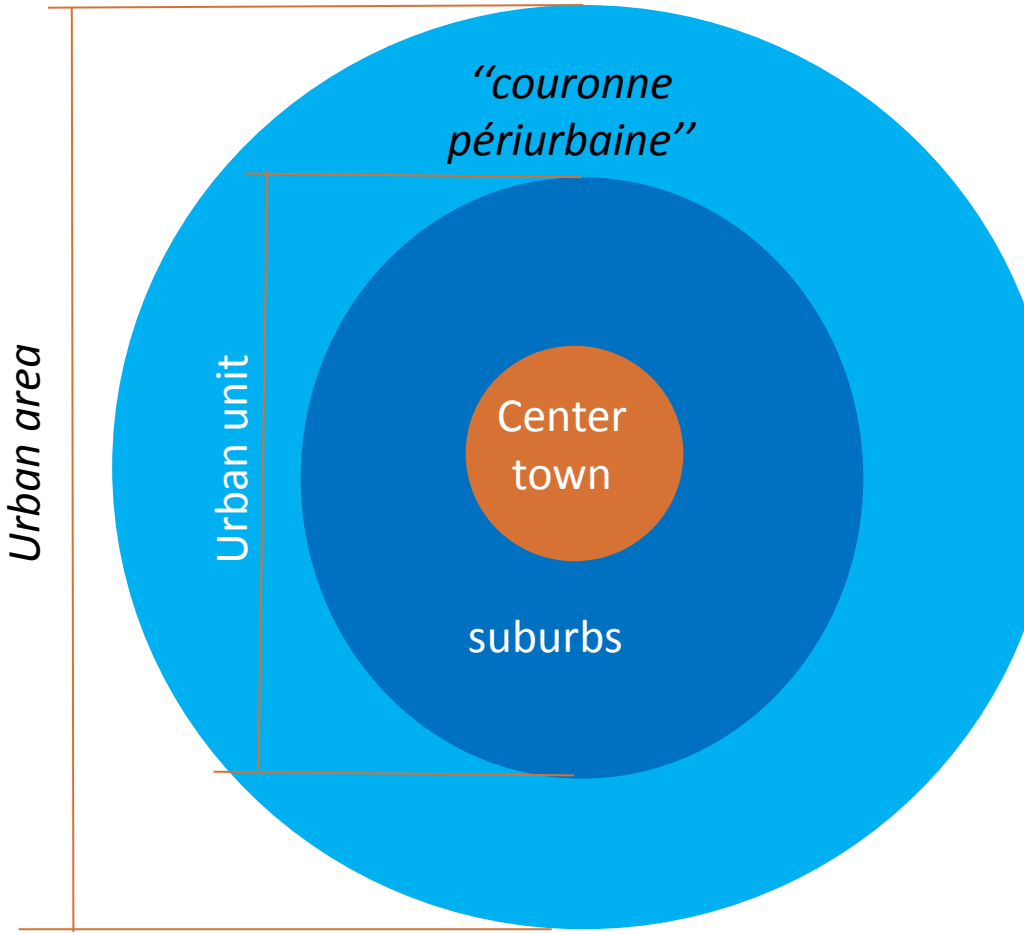
Source: Centre d'analyse stratégique, 2012, sur base traitement CERTU & ENTD 2008

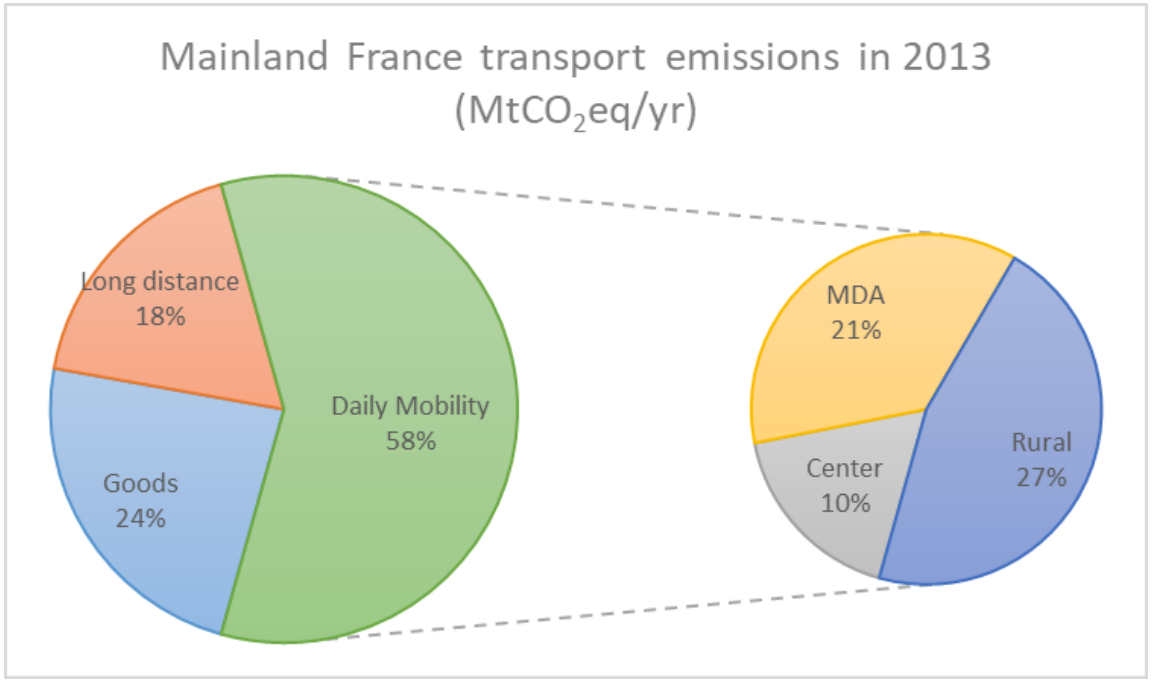
Objectives of the working group

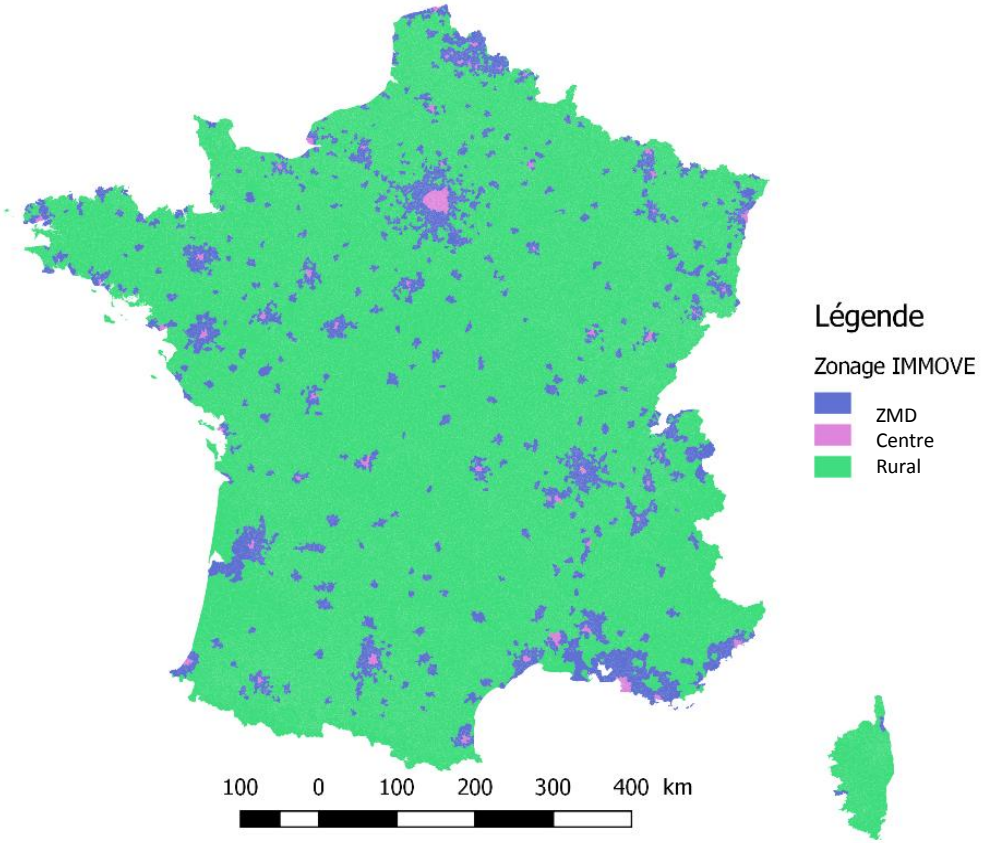
Propose short- and medium-term actions to reduce carbon emissions generated by daily mobility in medium density areas.

Medium density areas ?

.... density is not the only criterion







Introduction

medium density areas =

27 M hab	450 hab. /km²	186 Gpkm/an	21,3 MtCO₂/an
43%		37 %	39 %

Study Perimeter

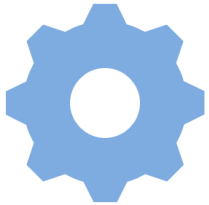
people	goods
daily mobility (<80km)	long distance
medium density areas	urban and rural
medium term	long term (> 10 yrs)
CO_2	NOx , VOC , O_3 , PM , SO_2
mainland France	rest of the world
most promising mesures	other possibilities…

Out of scope

domains of action

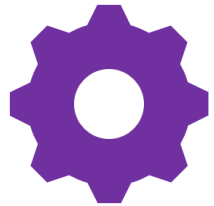
teleworking

grocery delivery



$$\frac{\text{person km}}{\text{vehicle km}\sout{\text{ traveled (VKT)}}} \times \frac{CO_2}{VKT} = CO_2$$

persons per vehicle

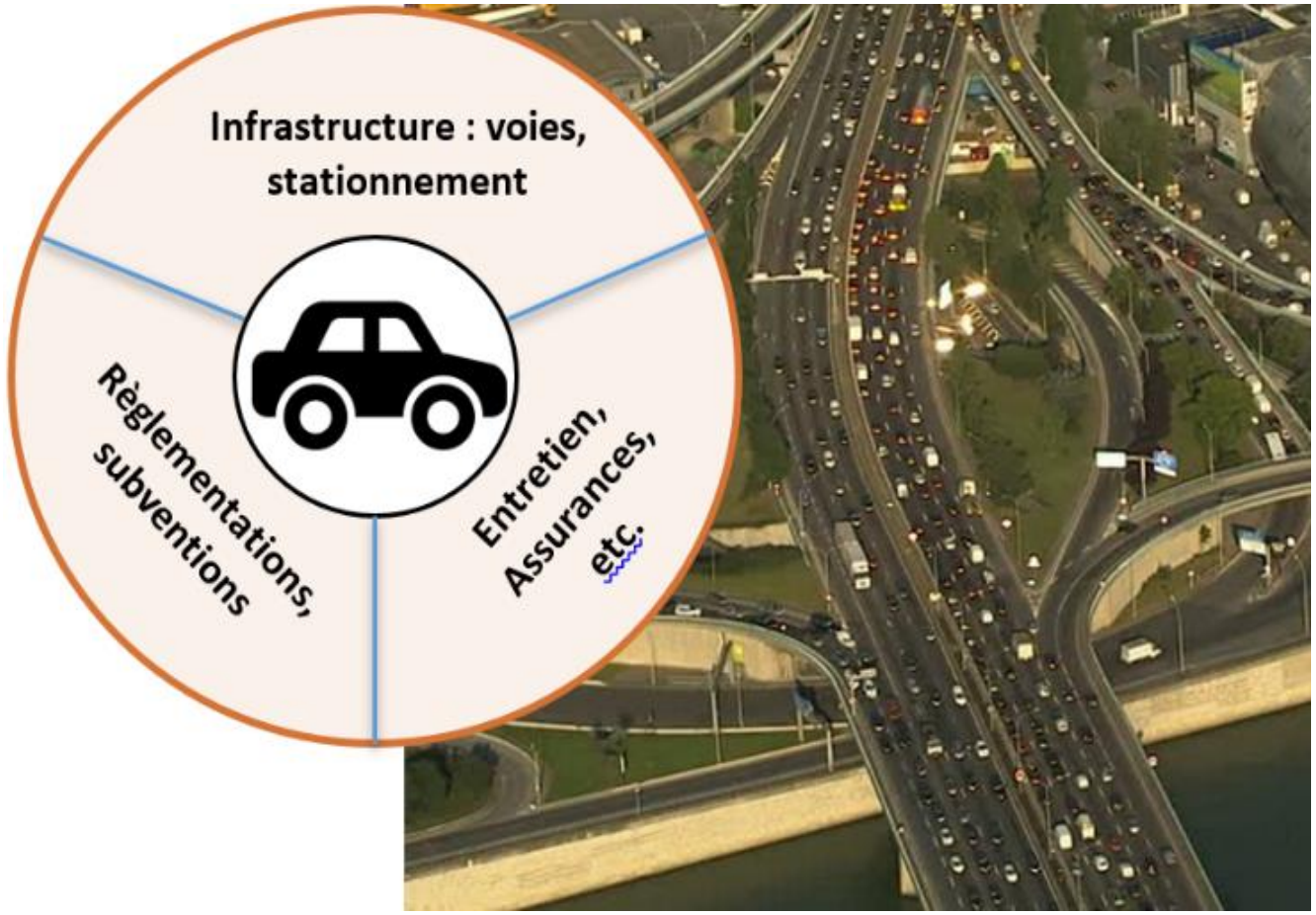


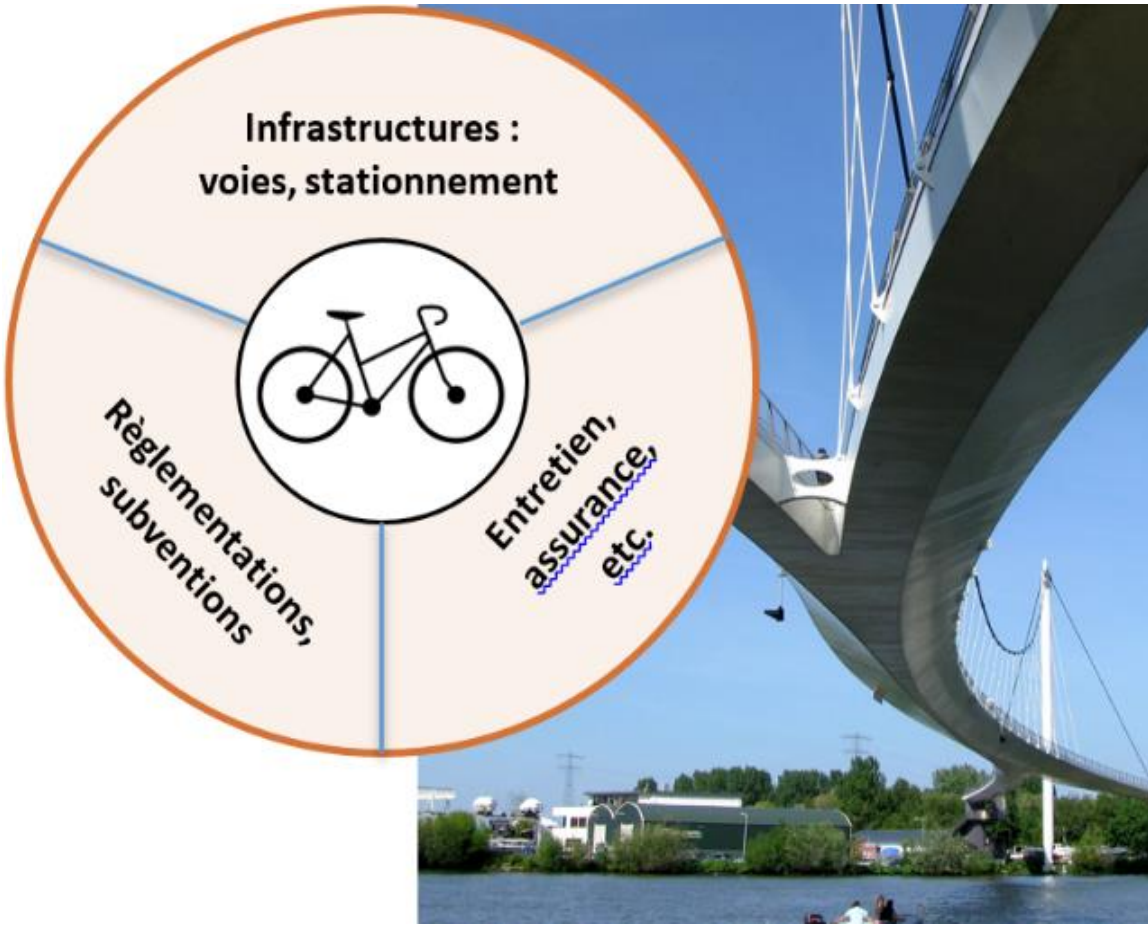
bike system

ridesharing

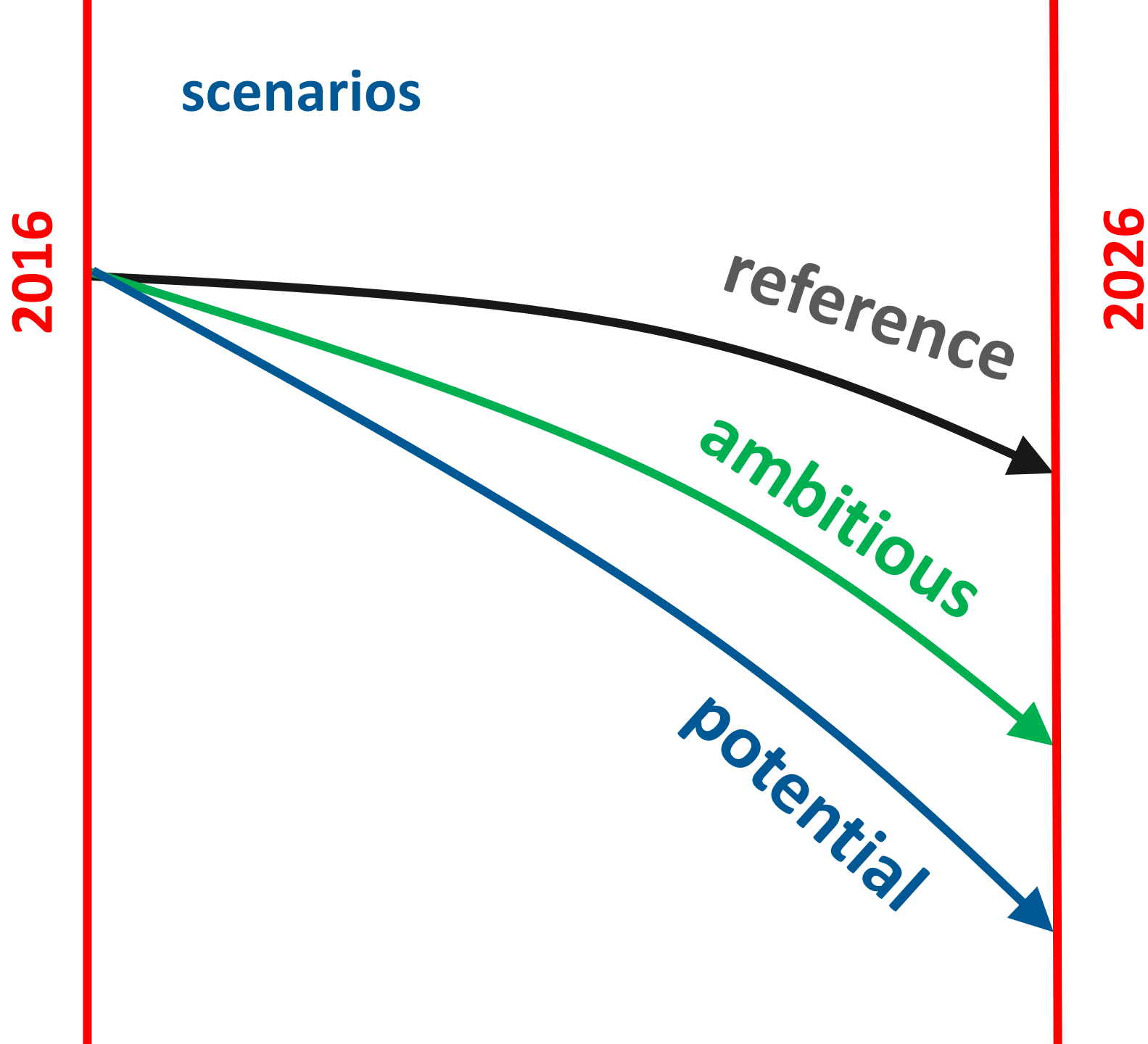
express public transport

Introduction





Introduction



Introduction

First strategy : avoid trips

- **Telework**
- Grocery delivery
- Bike system
- Ridesharing
- Express Public Transportation

Why look into teleworking ?

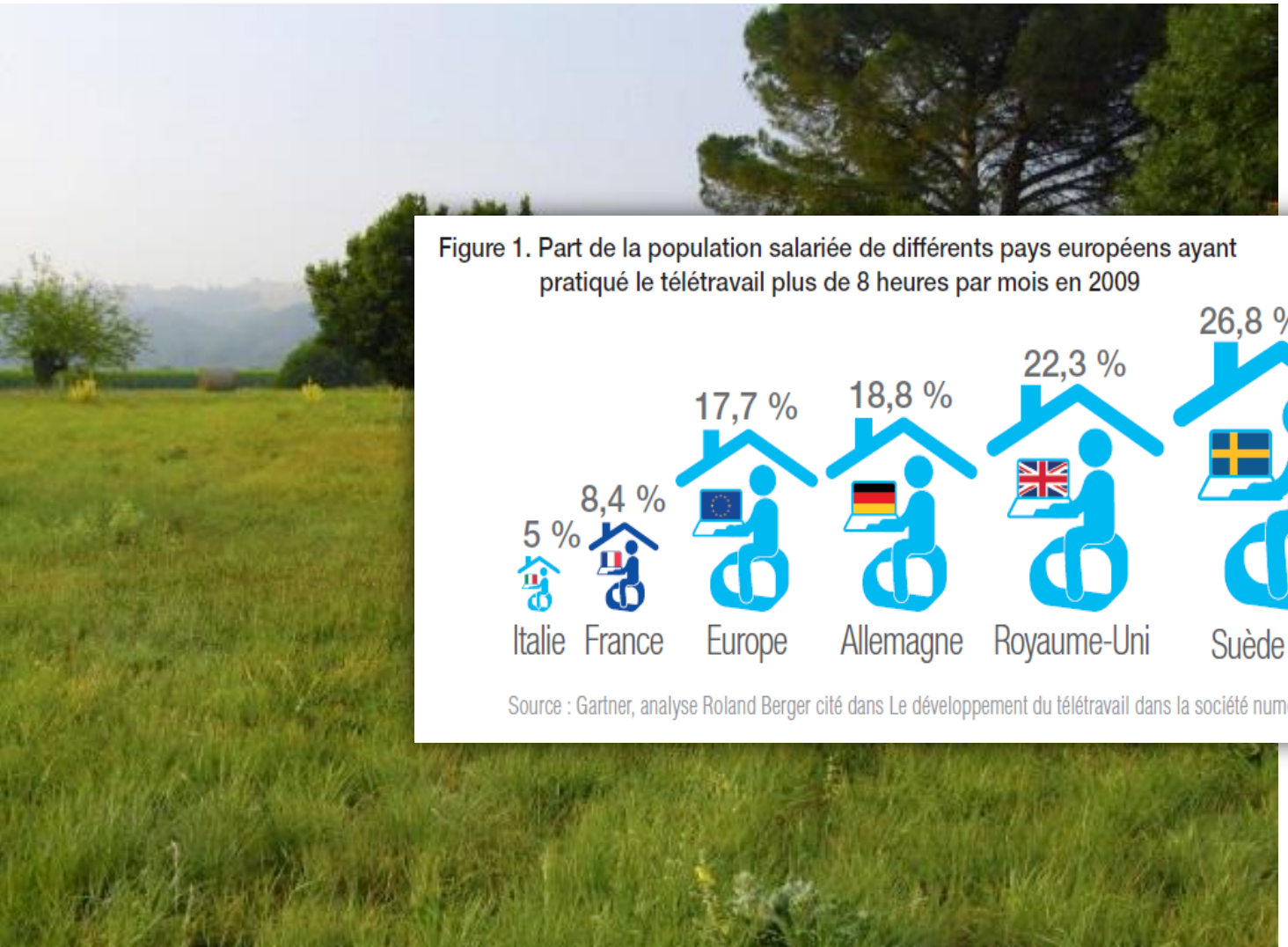


Figure 1. Part de la population salariée de différents pays européens ayant pratiqué le télétravail plus de 8 heures par mois en 2009

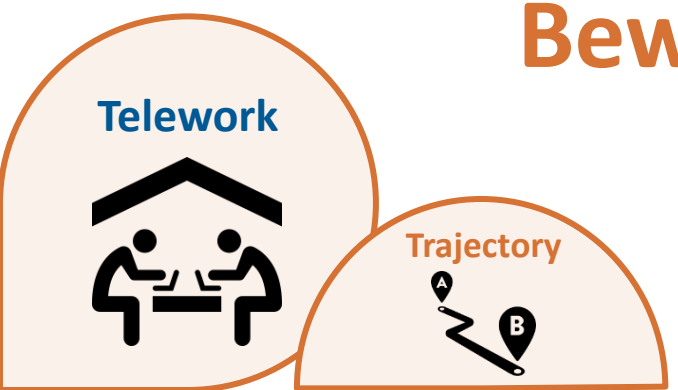
Source : Gartner, analyse Roland Berger cité dans Le développement du télétravail dans la société numérique de demain, Centre d'analyse stratégique, 2009.

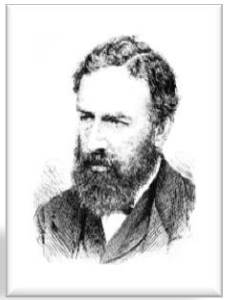
- daily commutes produce CO_2
- long daily commutes
  -work
  d the
  vice
  sibilities

site Dominique Valentin

- Install teleworking facilities in all medium-density areas (altogether 2 km²)
- Foster eco-design and reuse of existing buildings
- Allow employees to telework 2 days a week
- Adapt management practices
- Inform and communicate about advantages of teleworking

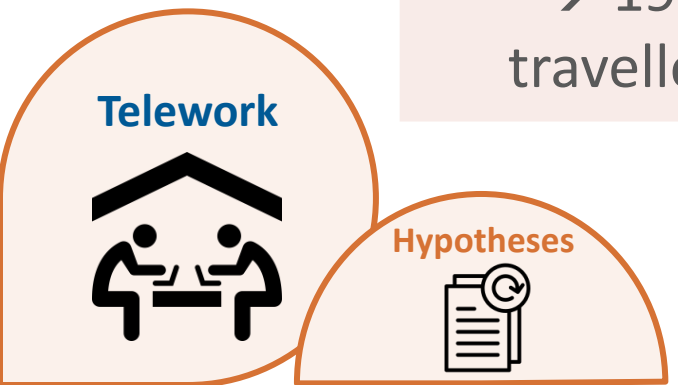
Beware of rebound effects !





hypotheses behind the teleworking scenarios

MAX POTENTIAL	AMBITIOUS
47 % of jobs are teleworked	**30 %** of all jobs in medium and large companies and **10 %** of all jobs in smaller companies are teleworked
2 days a week	1 day per week
→ 19 % decrease of p.km travelled for daily commute	→ 4.8 % decrease of p.km travelled for daily commute



MAX POTENTIAL

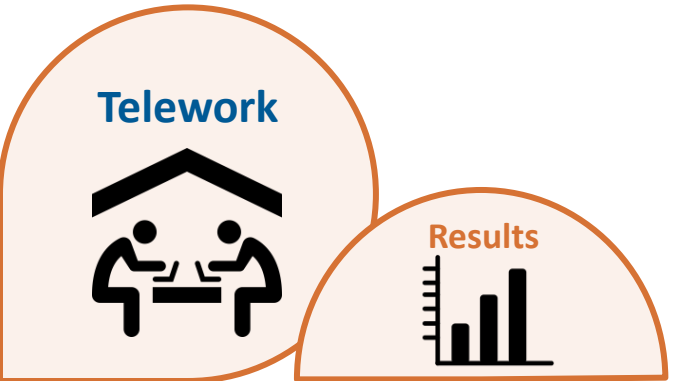
- 4.6 % of p.km

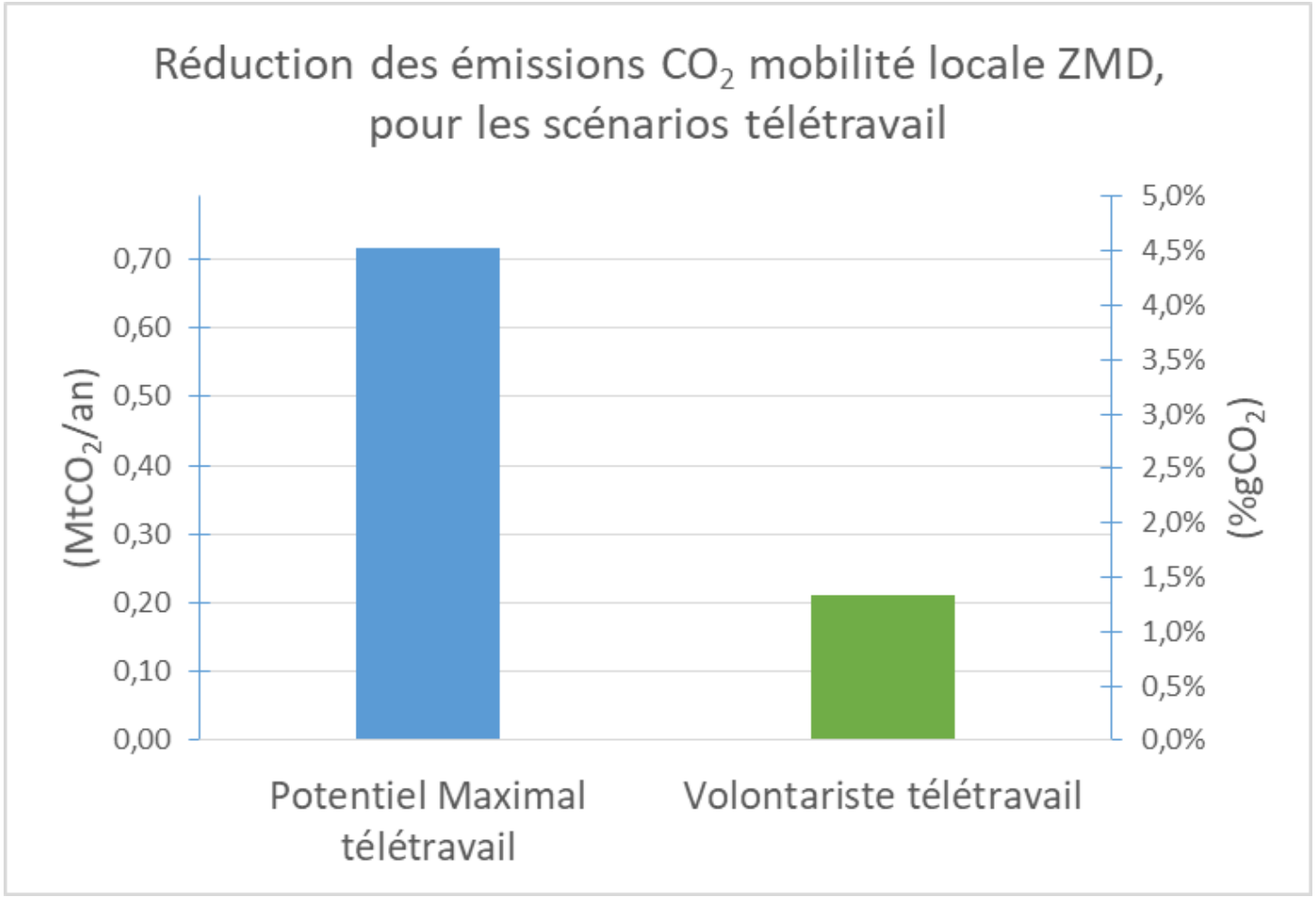
- 4.5 % of CO_2 (around 0.72 Mt/an)

AMBITIOUS

- 1.4 % of p.km

- 1.3 % of CO_2 (around 0.21 Mt/an)





compared to the reference scenario in 2026

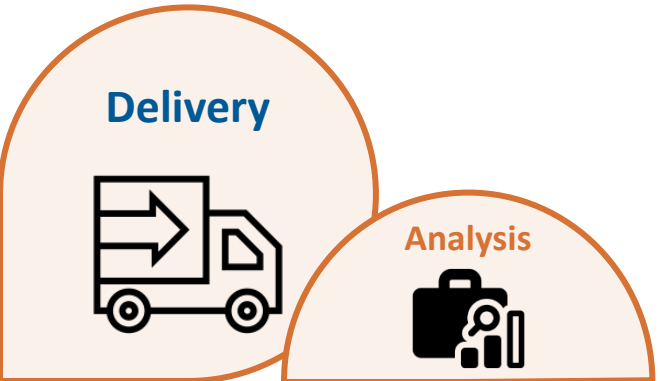
First strategy : avoid trips

- Telework
- **Grocery delivery**
- Bike system
- Ridesharing
- Express Public Transportation

E-commerce expansion goes along with:

- purchase fragmentation
- over-packaging of e-commerce goods;
- delivery failures;
- 20% to 30% return rates;

However some forms of e-commerce could significantly reduce CO_2 emissions



Rounds

- group purchases
- reduce the amount of packaging
- implement more multi-service delivery points

  100,000 automated lockers

  230,000 refrigerated drop-off points
- provide order booking, confirmation and preparation services

  3,500 jobs in call-centers to take orders (an option to e-commerce)
- perform rounds

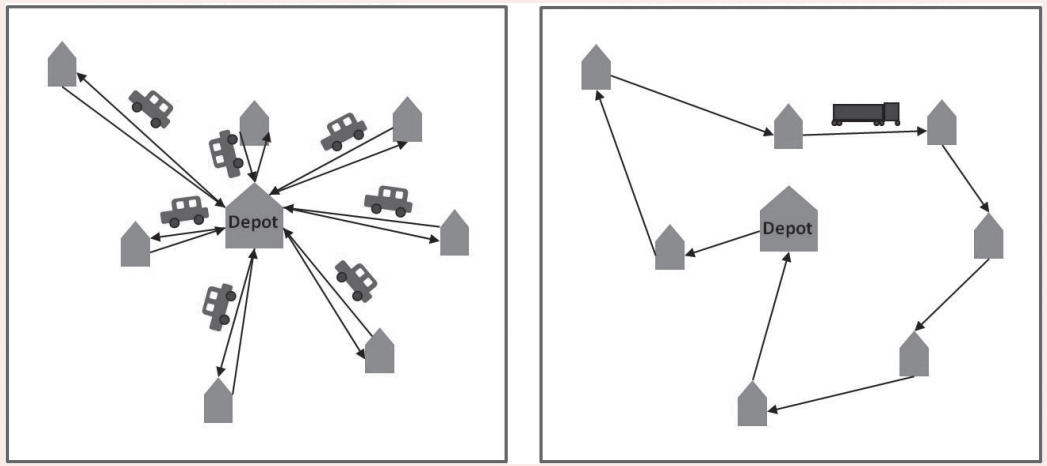
  50,000 jobs for delivery

Collaborative

- order preparation by retailers

  100,000 jobs

hypotheses behind deliveries

MAX POTENTIAL Rounds	MP Collaborative
All trips to and from supermarkets are replaced by delivery rounds 	40 % of trips to and from supermarkets are replaced by deliveries by neighbors
Leisure-shopping trips are not replaced (12 % of pkm)	95 % over 65 have internet access
Rounds cover the same area once every three days, delivering groceries to 15 households	75 % over 65 have internet access
→ 78 % decrease of VKT for supermarket purchases	**→ 36 % decrease of VKT for supermarket purchases**

Delivery

Hypotheses

MAX POTENTIAL rounds

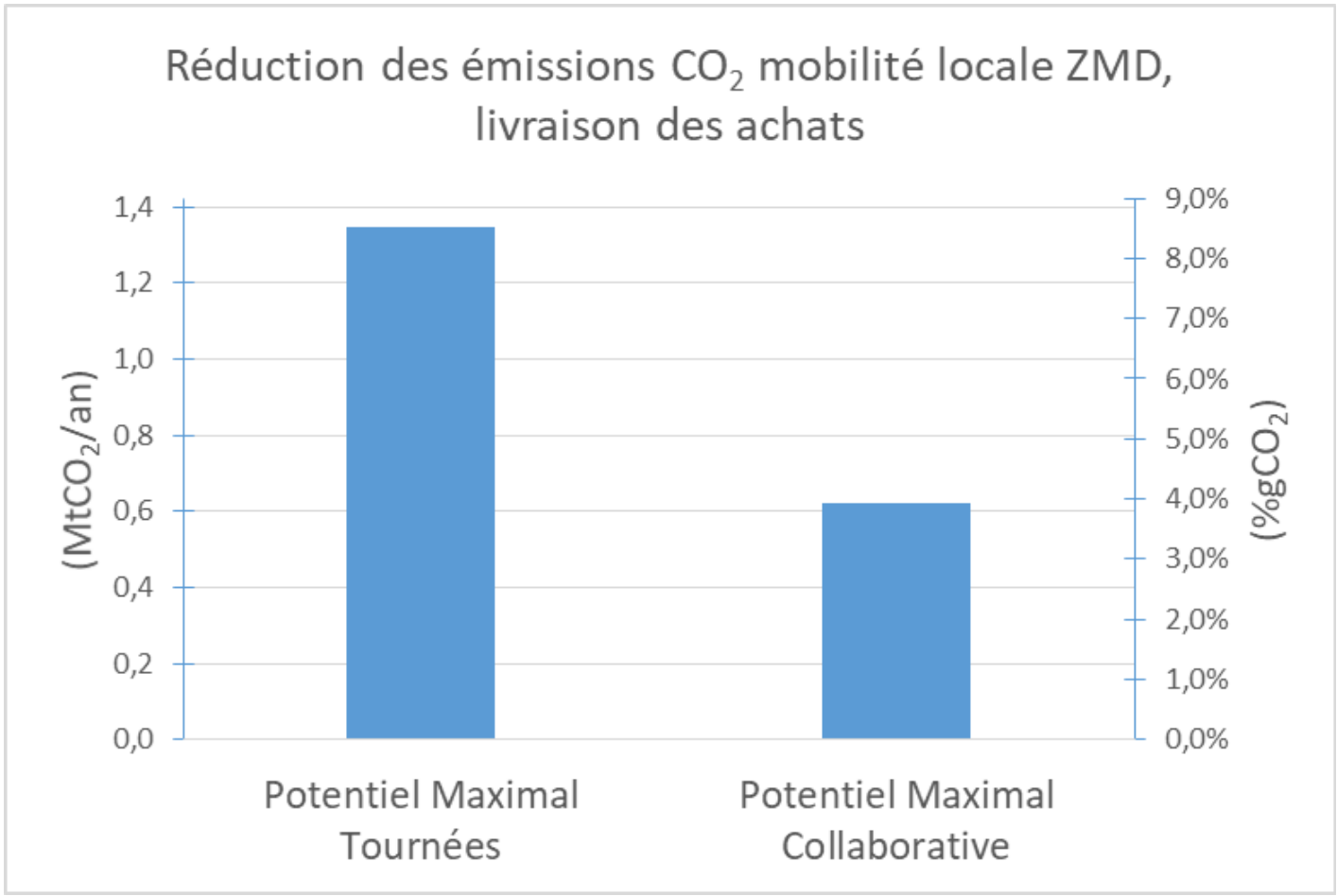
- 8 % of p.km

- 9 % of CO_2

MAX POTENTIAL collaborative

- 4 % of p.km

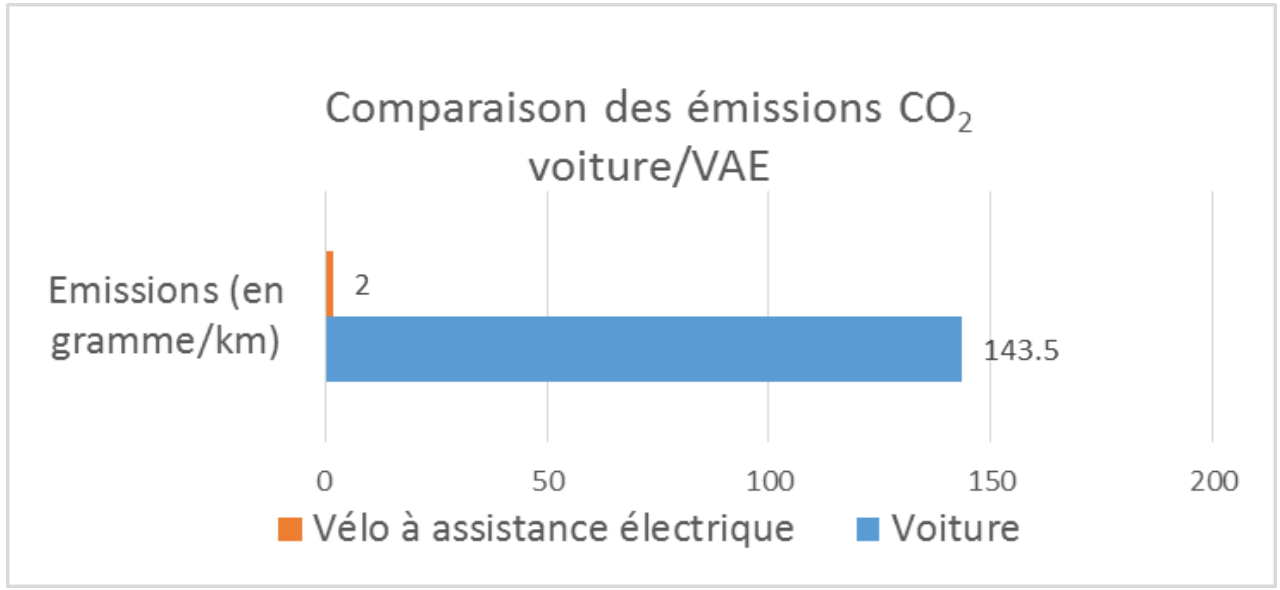
- 4 % of CO_2



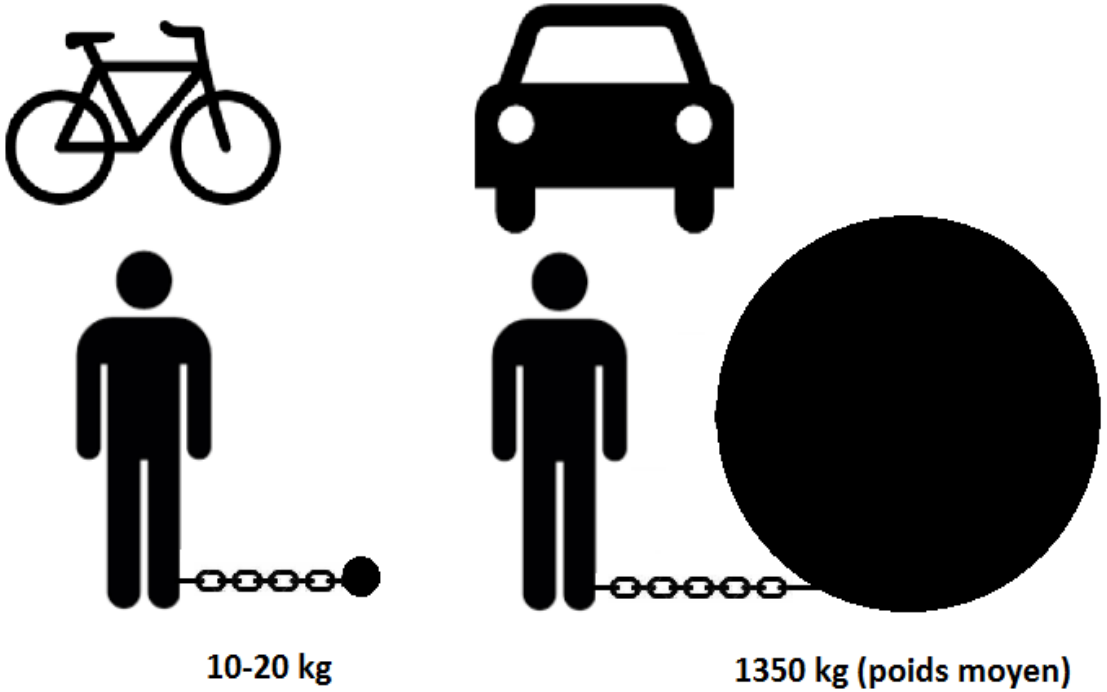
compared to the reference scenario in 2026

Second strategy : shift to more efficient modes

- Telework
- Grocery delivery
- **Bike system**
- Ridesharing
- Express Public Transportation

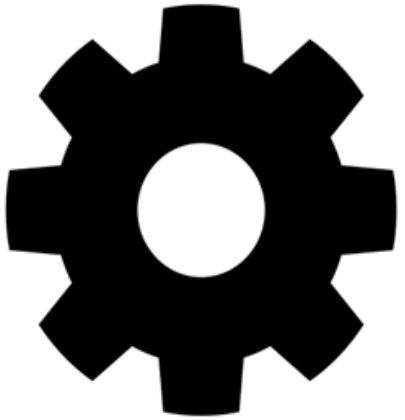


Source : TNO 2008, ADEME 2014



Puissance

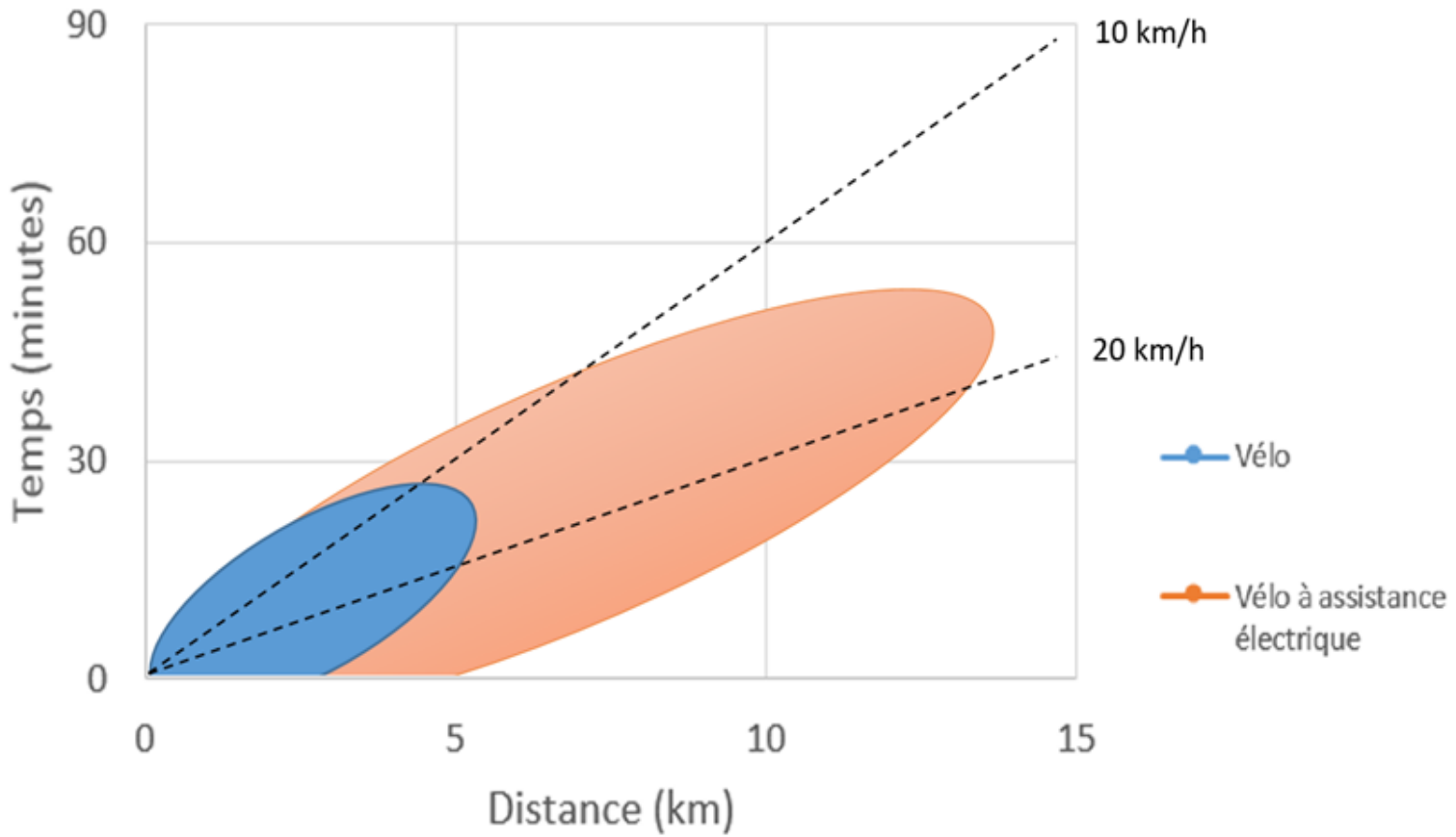
252 W

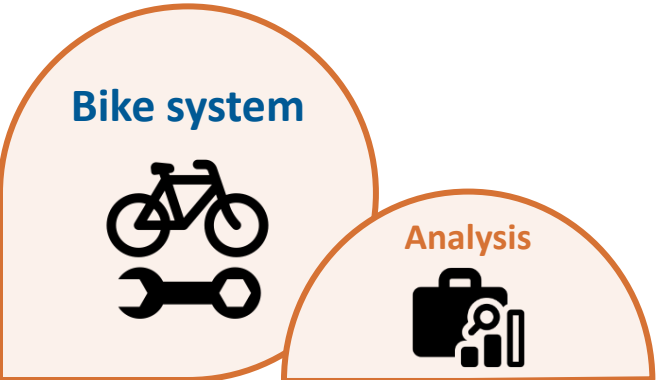


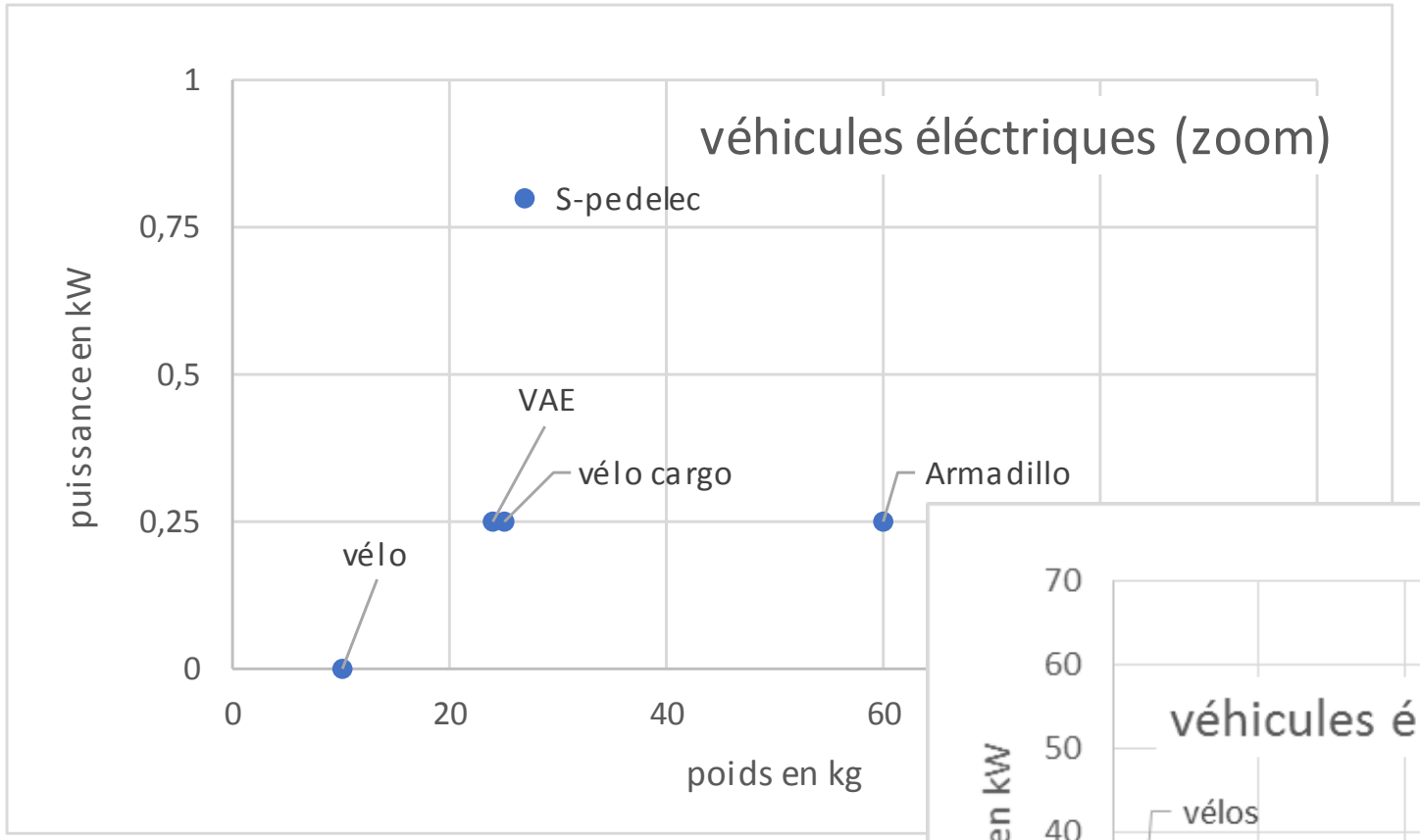
Bike system

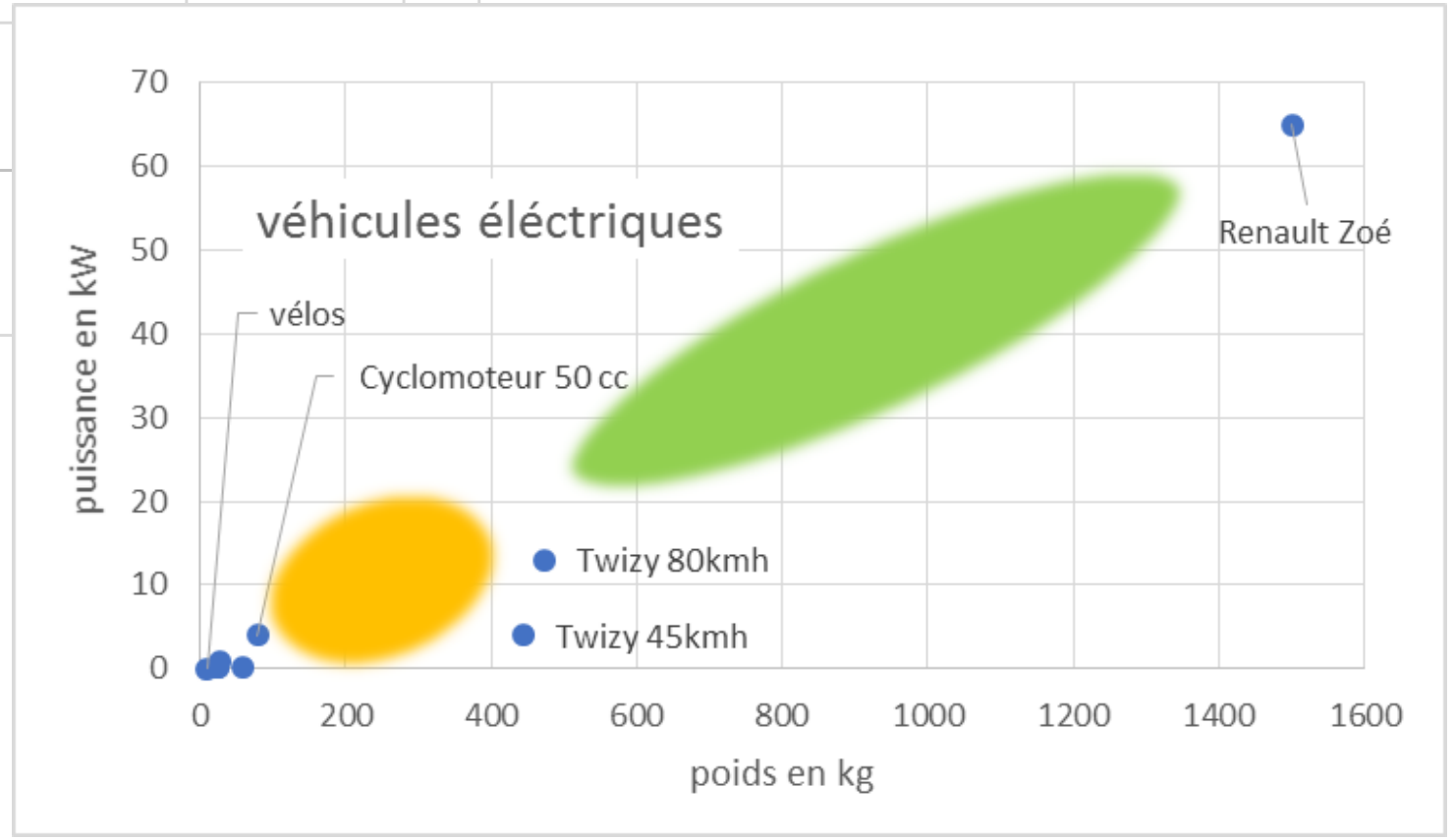
Analysis

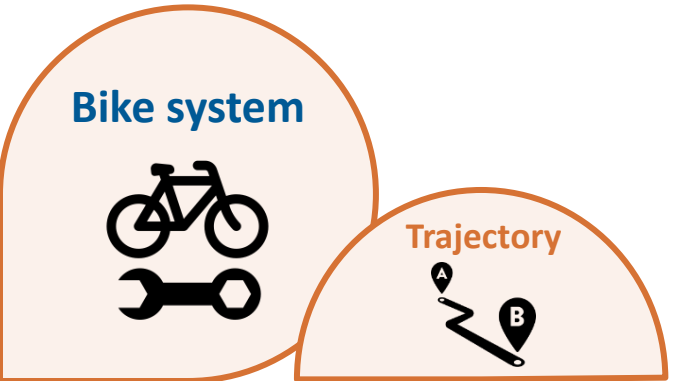
bikes are evolving





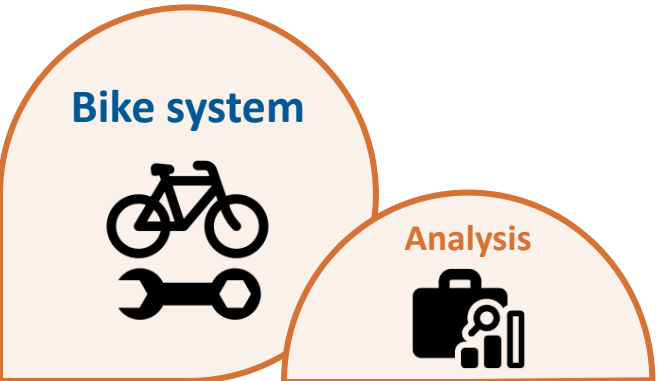

véhicules éléctriques (zoom)
puissance en kW
poids en kg
1
0,75
0,5
0,25
0
0
20
40
60
S-pedelec
VAE
vélo cargo
Armadillo
vélo


véhicules éléctriques
puissance en kW
poids en kg
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
1400
1600
vélos
Cyclomoteur 50 cc
Twizy 80kmh
Twizy 45kmh
Renault Zoé


Bike system
Trajectory
A
B

bike = mobility + health

… or why there are exercise bikes but no exercise cars



Infrastructure enabling cycling over the whole territory

- Fast cycle lanes (45,000 km of cycle highways and cycle paths)
- Bike lanes (75,000 km)

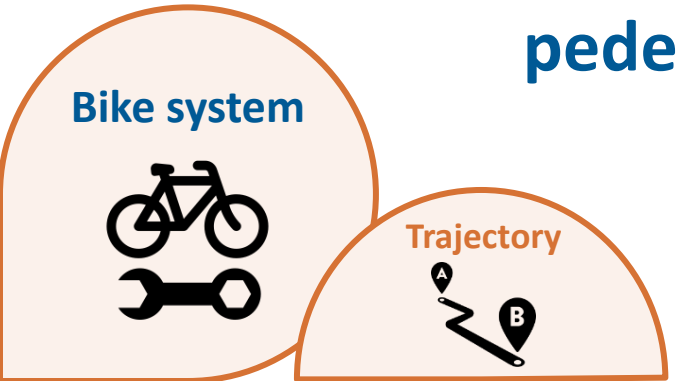
Bike services and equipment

- a pedelec for each adult (19 million adults in medium density areas)
- a cargo-bike or trailer in each household (12 million households in MDAs)

Bike training

- 3,000 new jobs in bike-schools and information points

Development of human-powered vehicles filling the gap between pedelecs and e-cars

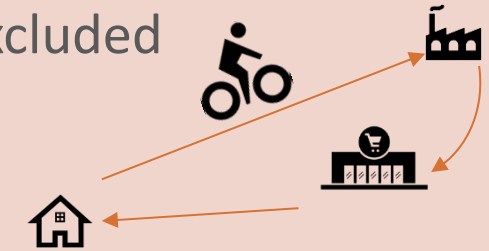


Fietsstraat

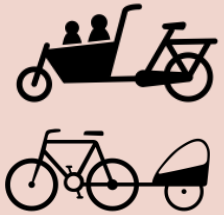
hypotheses behind the bike system scenarios

MAX POTENTIAL

15 % of p.km are part of trip chains and are excluded



< 20 km



< 7 km

AMBITIOUS

Modal shift estimated by experts, taking into account social category, trip motive and length of trips.
E.g. : bike share for students is greater than for the elderly (for the same distance and same trip purpose)

< 15 km

Bike system

Hypotheses

MAX POTENTIAL

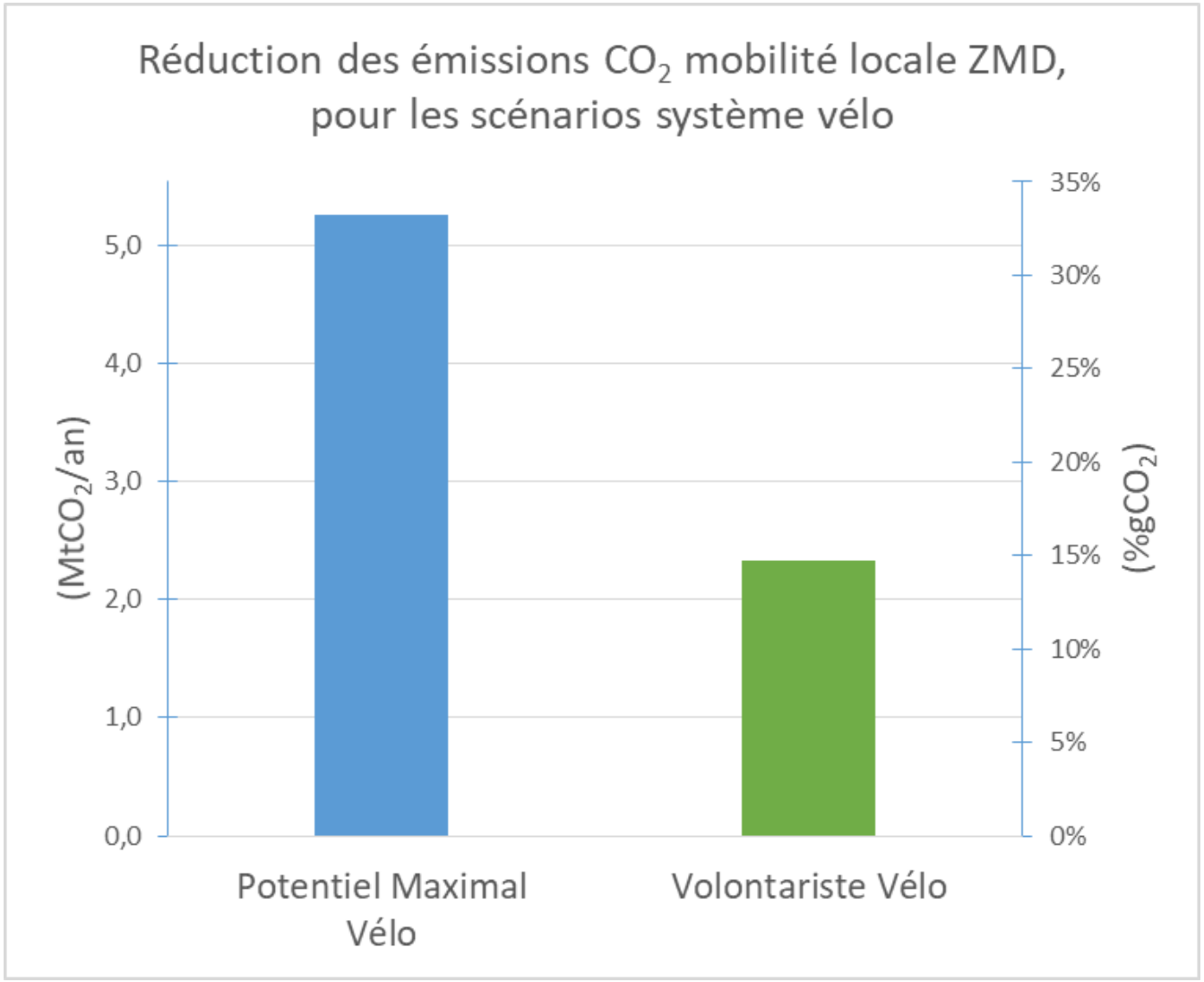
35 % of p.km by bike

- 33 % of CO_2 (around 5.3 Mt/yr)

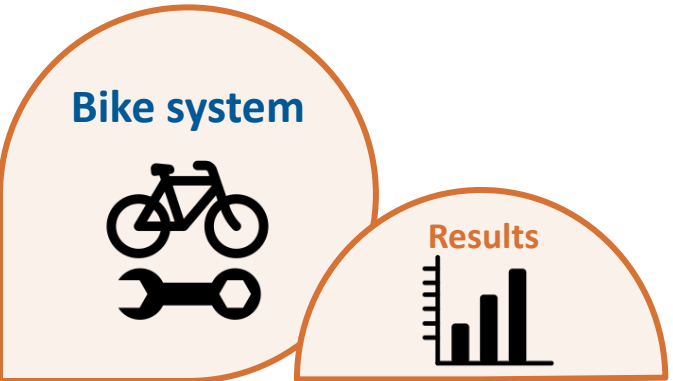
AMBITIOUS

17 % of p.km by bike

- 15 % of CO_2 (around 2.3 Mt/yr)



compared to the reference scenario in 2026



MAX POTENTIAL Moped

35 % of p.km by moped

- 16 % of CO_2

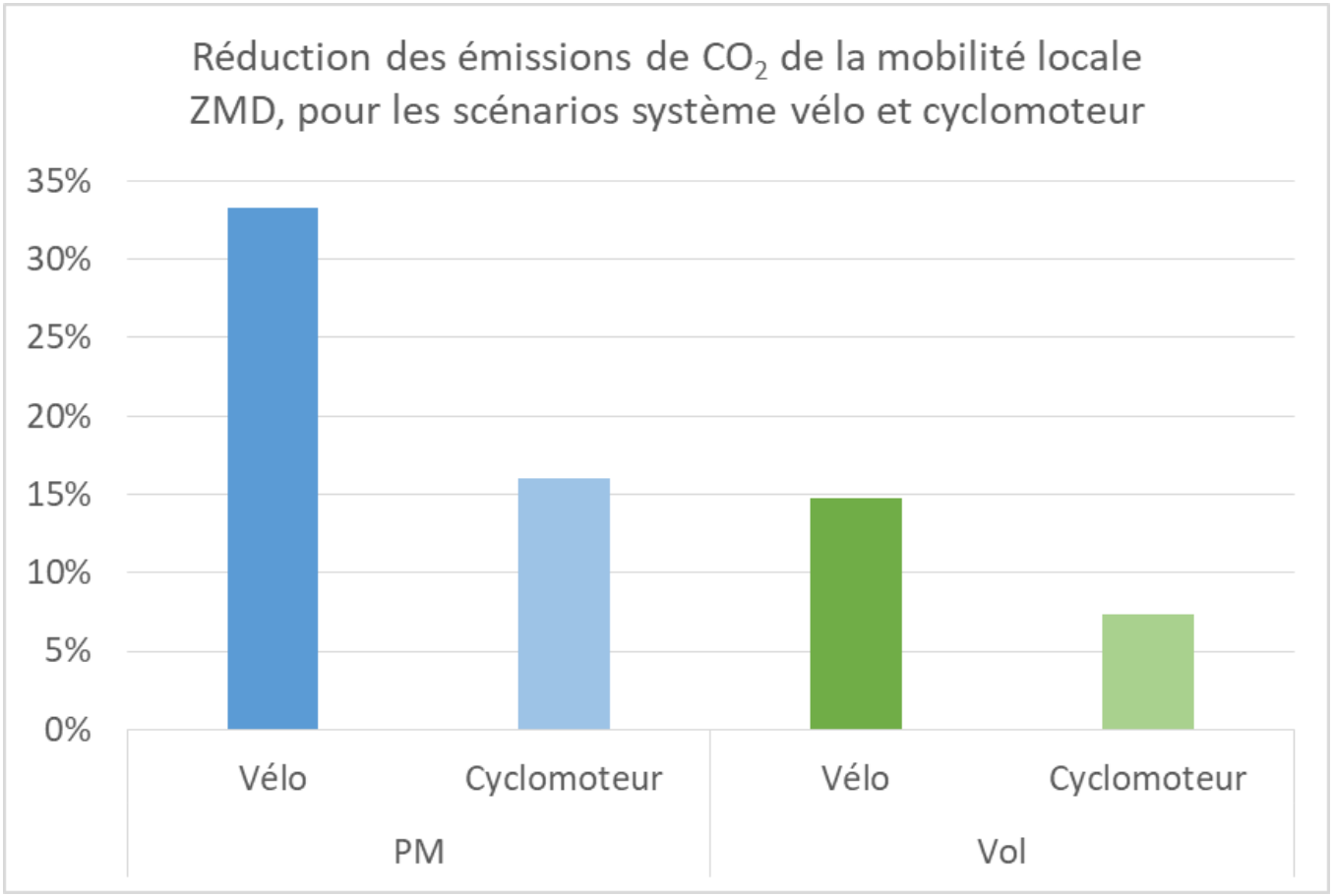
(around 2.5 Mt/an)

AMBITIOUS Moped

17 % of p.km by moped

- 7 % of CO_2

(around 1.2 Mt/yr)



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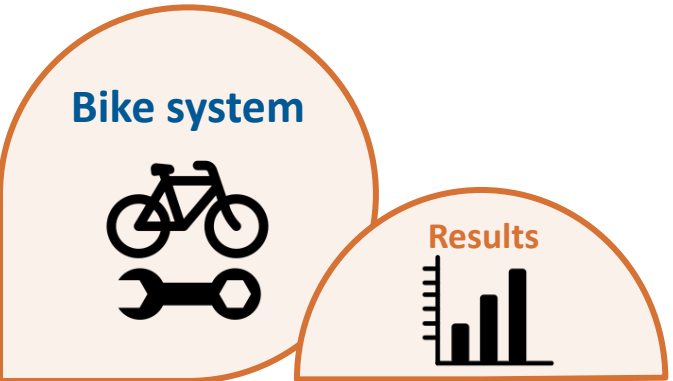
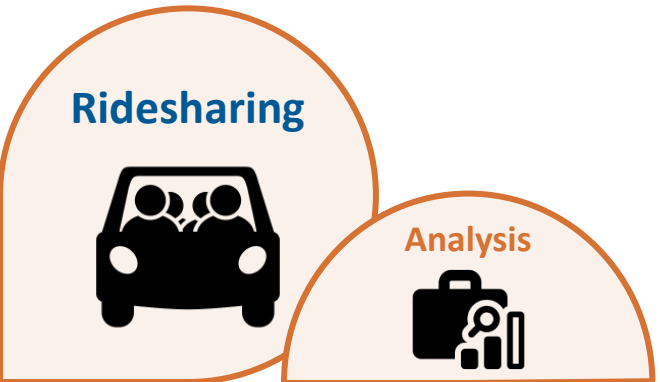


Third strategy : increase occupancy rate

- Telework
- Grocery delivery
- Bike system
- **Ridesharing**
- Express Public Transportation

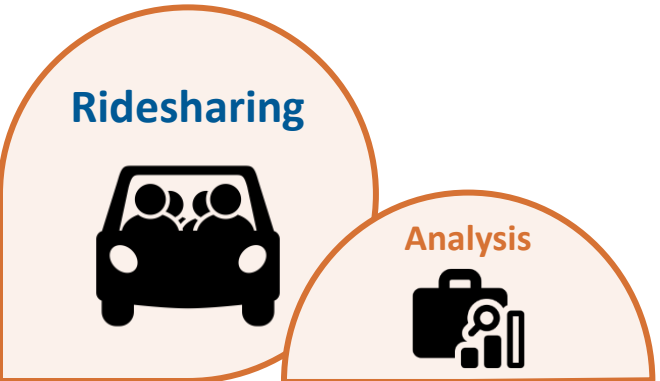
- **10 % of the workers carpool everyday at least for a part of their trip; around half of the carpoolers share their trips with family members**
- New ridesharing systems using new technologies are designed. They are more flexible and hence more adapted to daily trips
- More than 200 ridesharing platforms exist in France. Some of them do not fully develop.
- Why non-carpoolers do not carpool:
  - **Monetary gains are too low compared to organizational constraints**
  - **Ridesharing stakeholders fail to cooperate**
  - **Legal framework is not adapted; laws are too restrictive for ridesharing to be beneficial for drivers**
  - **Public financing is limited (but the idea of considering ridesharing as a form of public transport is becoming increasingly popular…)**



Why study ridesharing?

Because

- **it increases occupancy rates**
- **it is easy to implement because it does not question the "car system"**
- **it can increase mobility for those with limited or no access to cars**



Adapt infrastructures to promote ridesharing

- HOV lanes (High Occupancy Vehicles) and HOT lanes (High Occupancy Tolls), ridesharing areas (9,000 pick-up points in the Ambitious Scenario)

Implement economic incentives

- fuel tax
- monetary advantages for carpoolers, such as tax reductions
- create a special status for frequent carpoolers

Involve all economic stakeholders

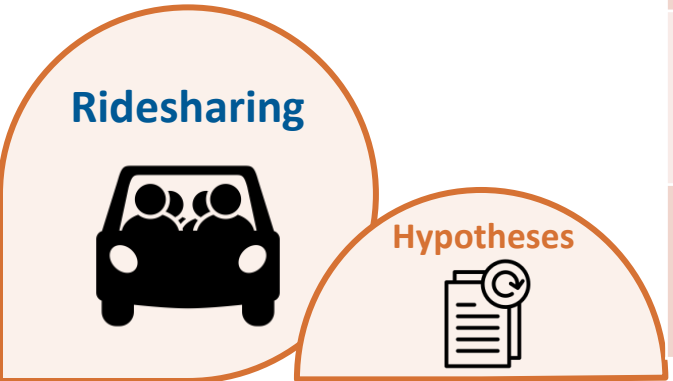
- mobility organization authorities (AOM)
- mobility plans

Implement an information and a matching strategy

- for potential carpoolers
- involve digital actors as partners

hypotheses behind the ridesharing scenarios

MAX POTENTIAL	AMBITIOUS
Communities :  Commute	 Other motives
Chained trips (48%) are not carpooled	
Everybody who cans, rideshares	Motivation to rideshare is a function of trip length, motive, household type and access to car
 30 min time flexibility for both driver and passenger	
MonteCarlo : carpoolers are on the same path (maximum detour = 10% of total trip) 	
41 % increase of average occupancy rate	7 % increase of average occupancy rate

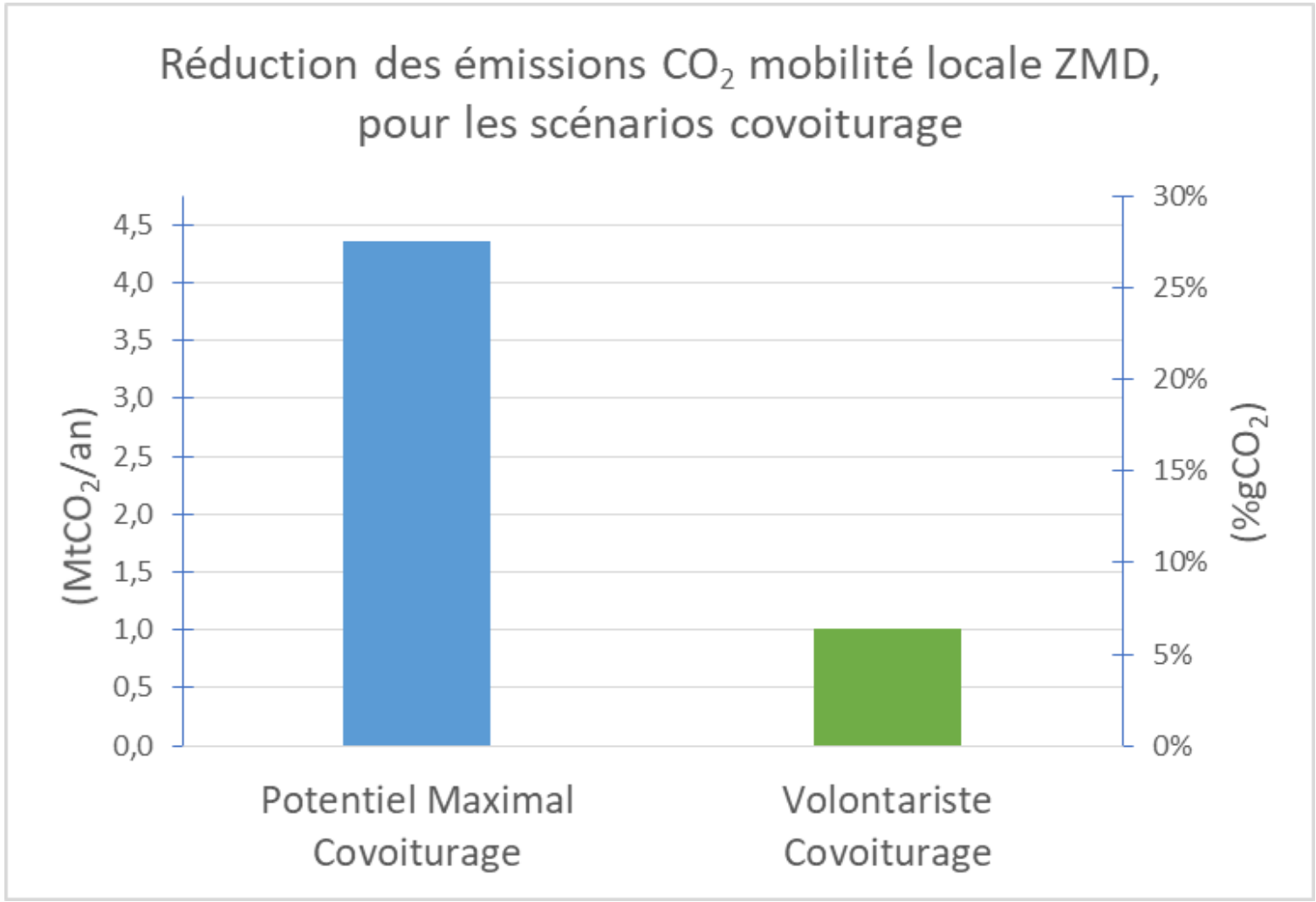


MAX POTENTIAL

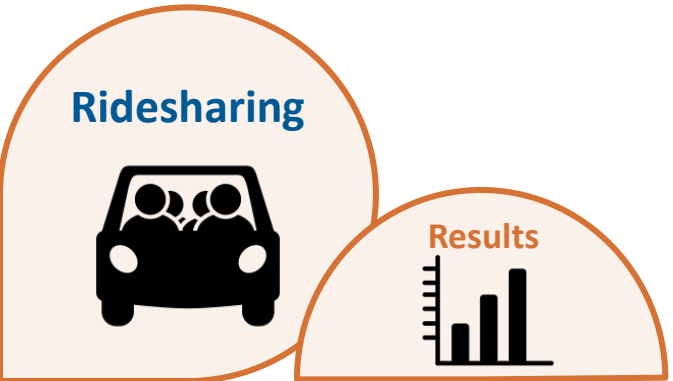
- 27 % of CO_2 (around 4.3 Mt/yr)

AMBITIOUS

- 6.4 % of CO_2 (around 1.0 Mt/ayr)



compared to the reference scenario in 2026

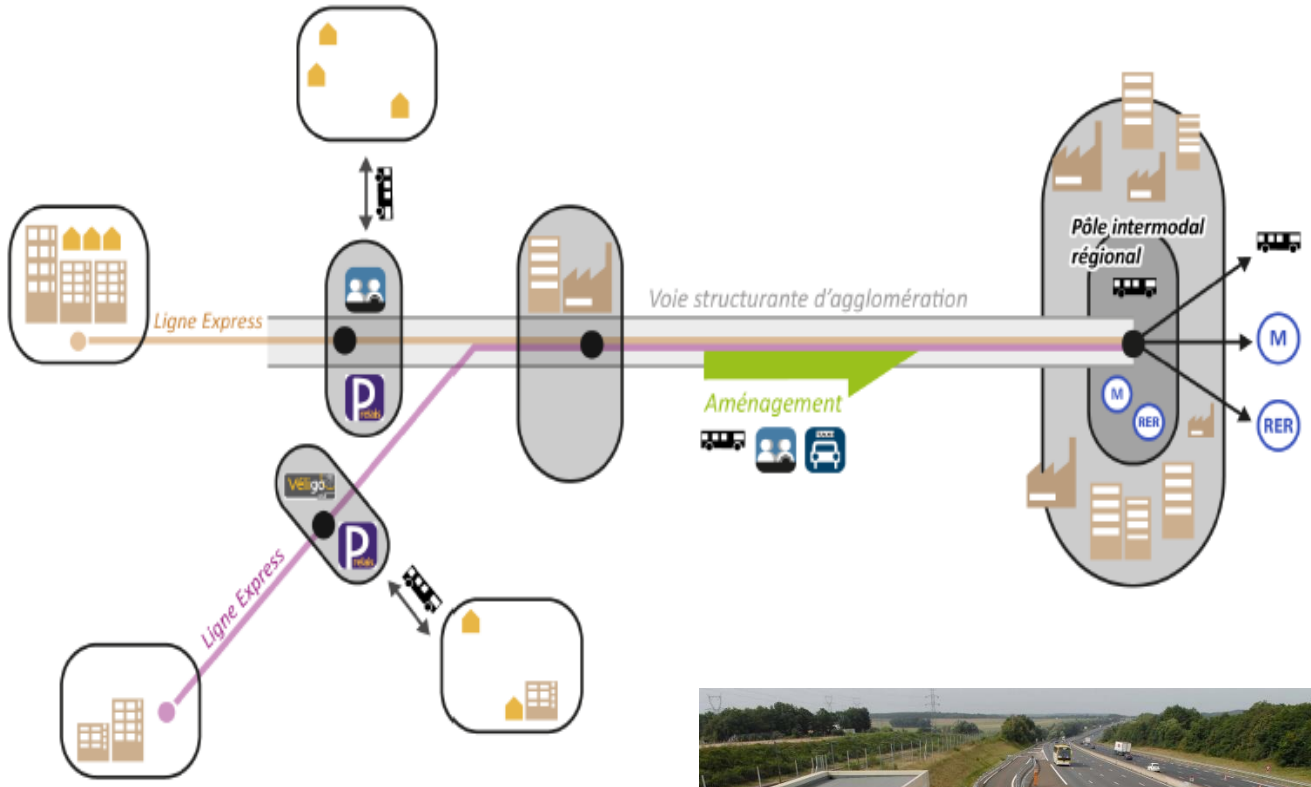


Increase occupancy rate & reduce emissions per km

- Telework
- Grocery delivery
- Bike system
- Ridesharing
- **Express Public Transportation**

E.P.T.

EPT = Periurban Train and Express Coaches

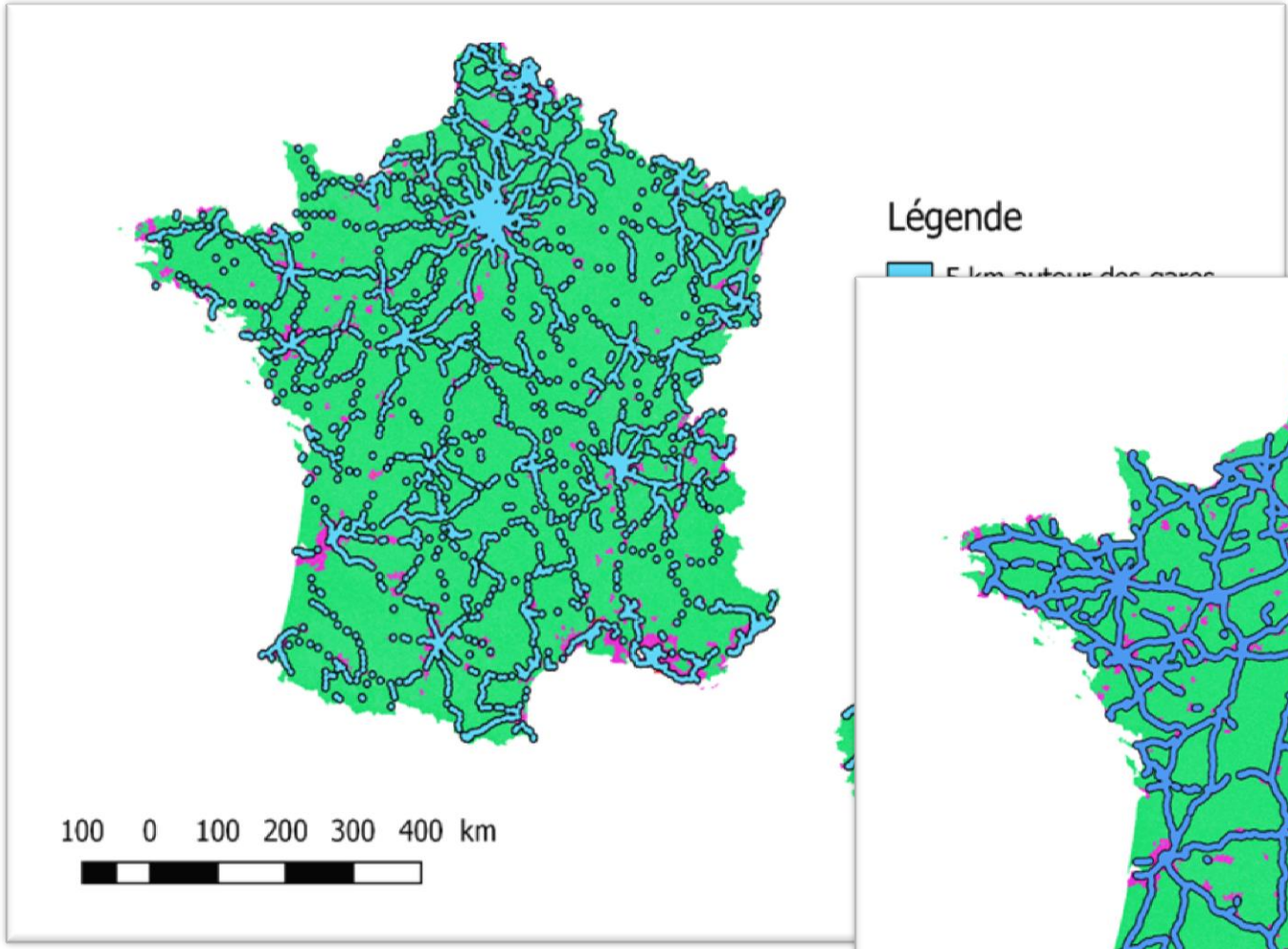


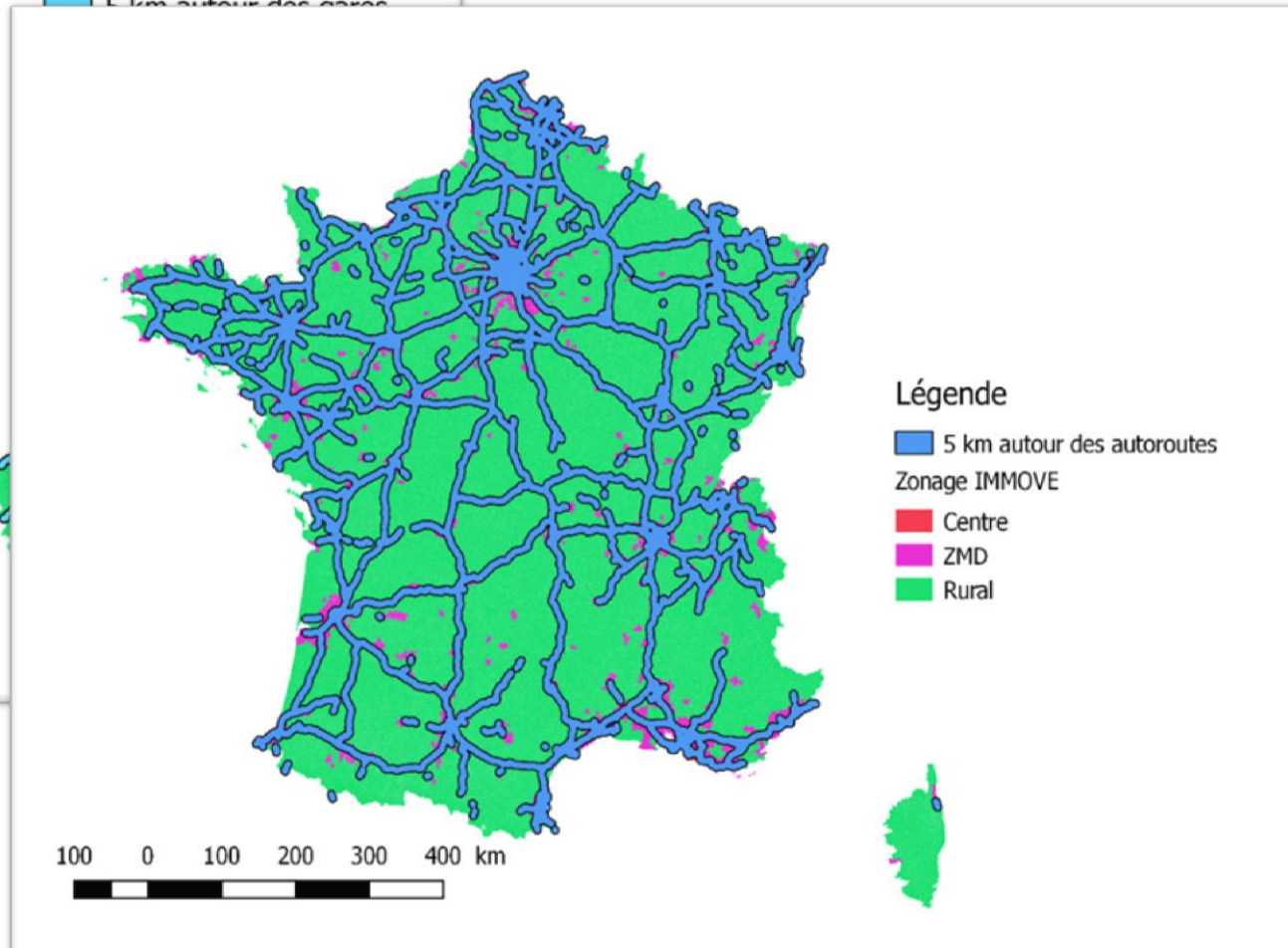
E.P.T.

Analysis

Sources : Bus express et partage multimodal des voies structurantes d'agglomération en Ile-de-France, Région Ile-de-France
Wikipédia, Vinci Autoroutes

Current situation

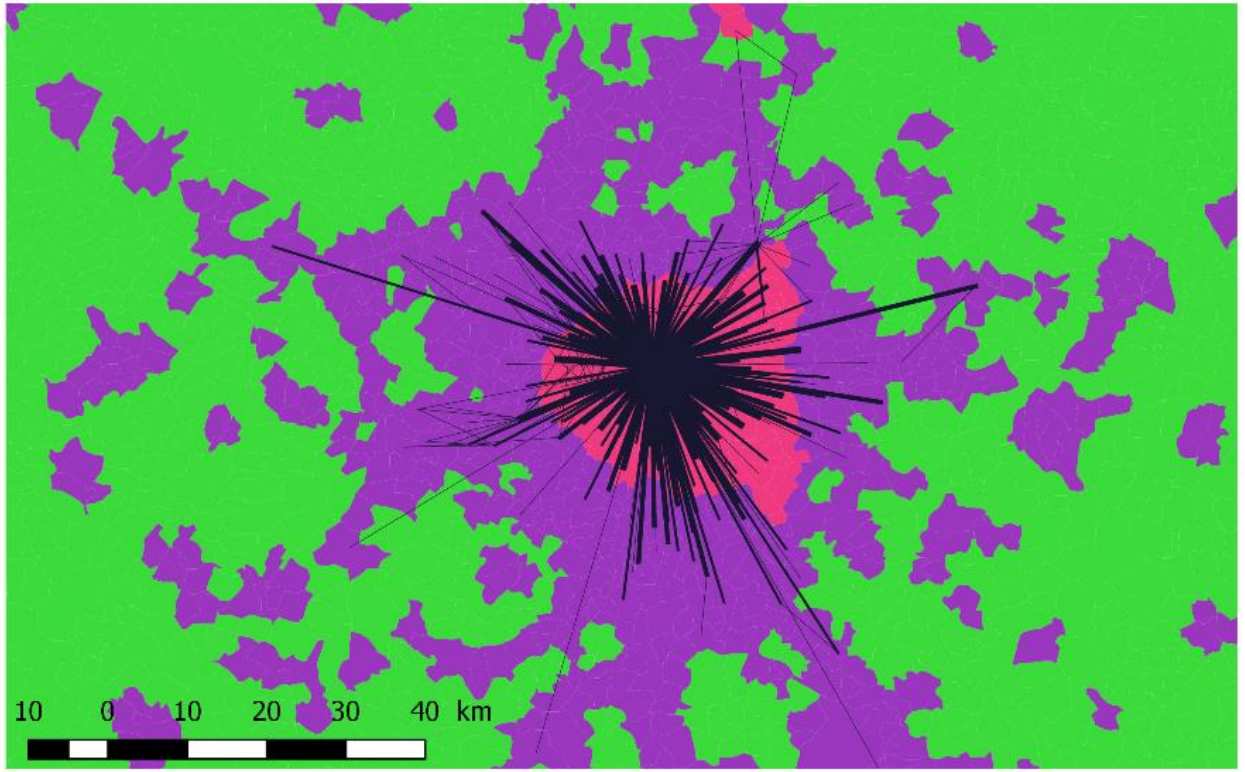




E.P.T.

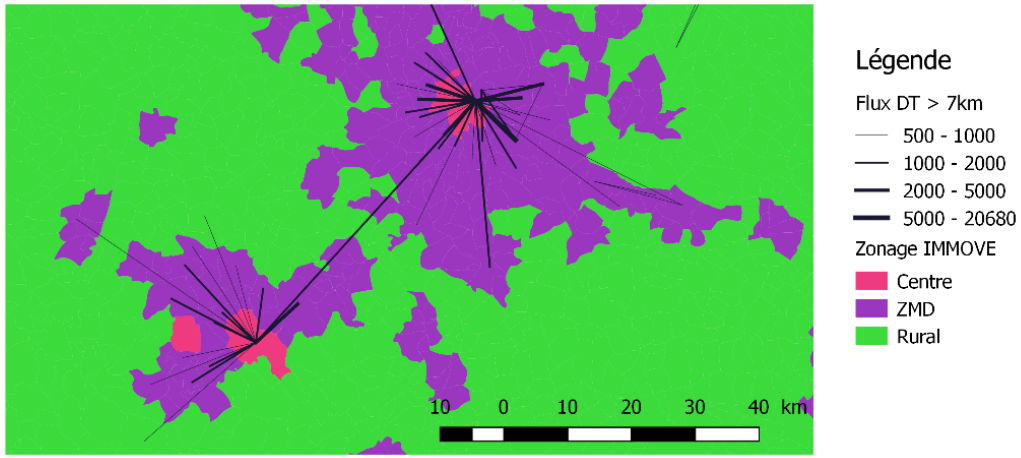
Analysis

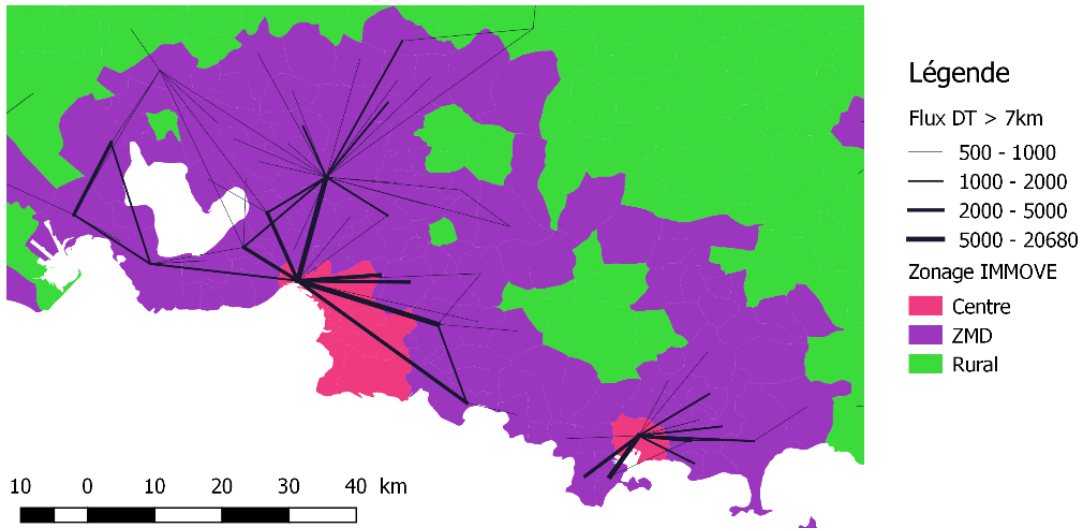
Why study Express Transit ?



Paris area

Lyon Saint-Etienne





Aix-Marseille

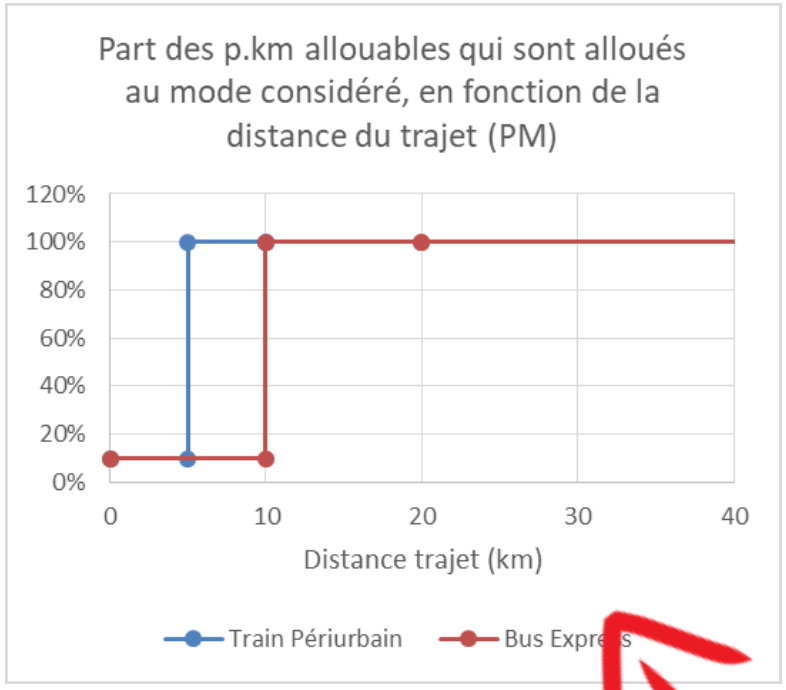
E.P.T.

Analysis

Sources : Wikipédia

- Intermodal transfer points around city centers (34 units)
- Coach-only lanes (136 km)
- Transfer points along highways (136 units)
- New suburban trains with higher capacity (1,300 units)

Sources : mobilicites.com
Vinci Autoroutes



hypotheses behind the transit scenarios

Traffic induction effect and mode report from modes other than car *not* taken into account

All « concentrated » flows included:

Trips affected to transit if origin <5km to highway or station

47 %

> xx km

17 pax

67 gCO_2/p.km

7 %

46 %

> yy km

80 pax

9 gCO_2/p.km

Unlimited capacity increase

Maximum capacity increase compared to 2008 = + 30 %

E.P.T.

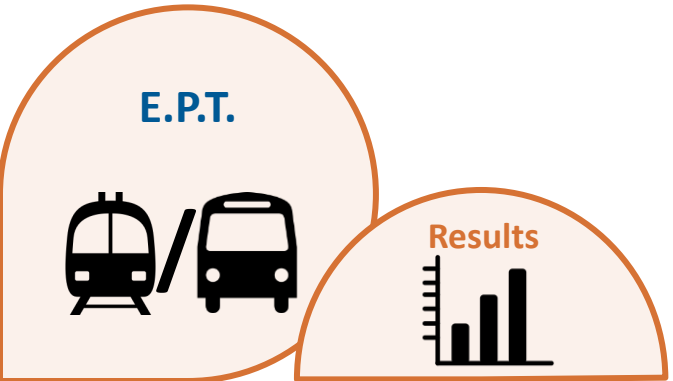
Hypotheses

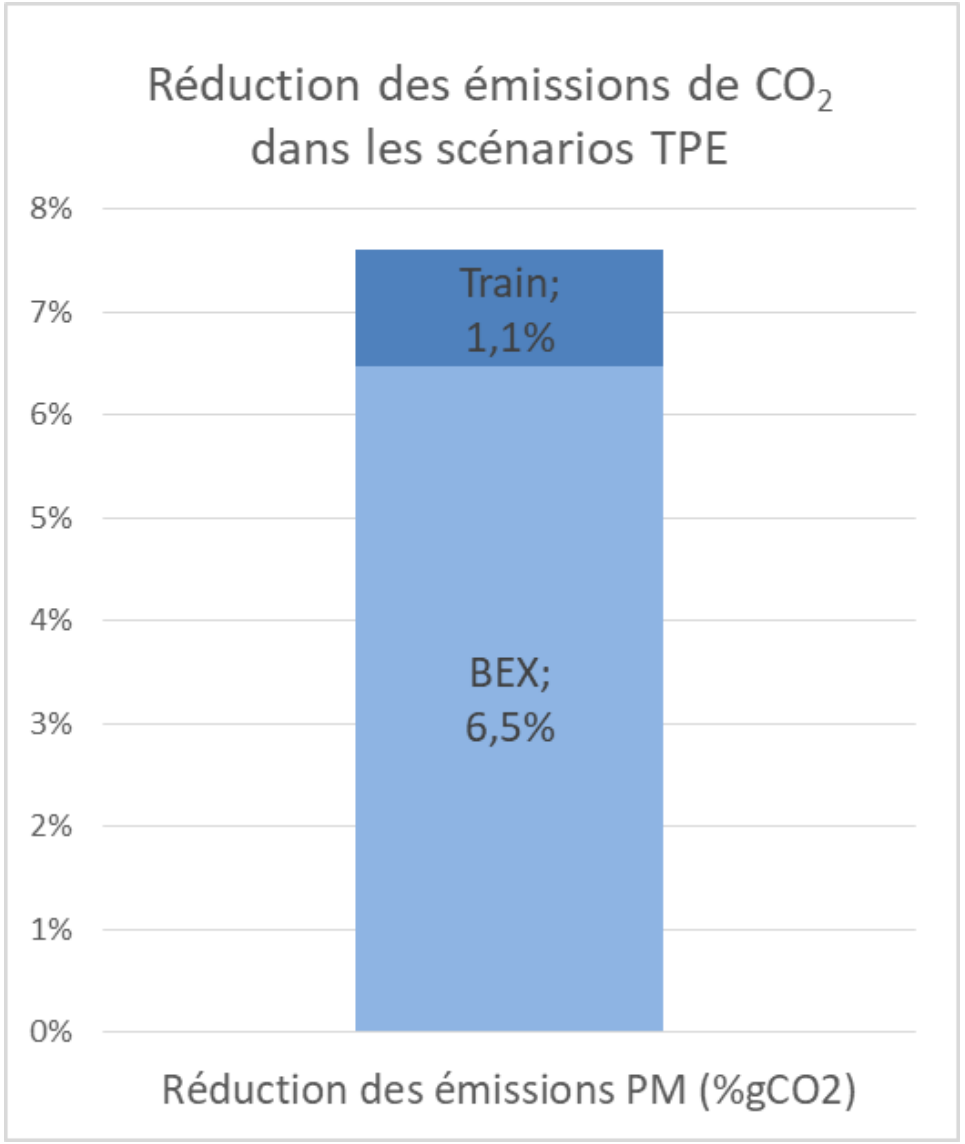
MAX POTENTIAL

10 % of daily p.km in MDA and

14 % of daily v.km in MDA shift from car to transit

7,6 % of MDA daily mobility emissions avoided





A combination of all measures

Telework

Grocery delivery

Bike system

Ridesharing

Express Public Transportation

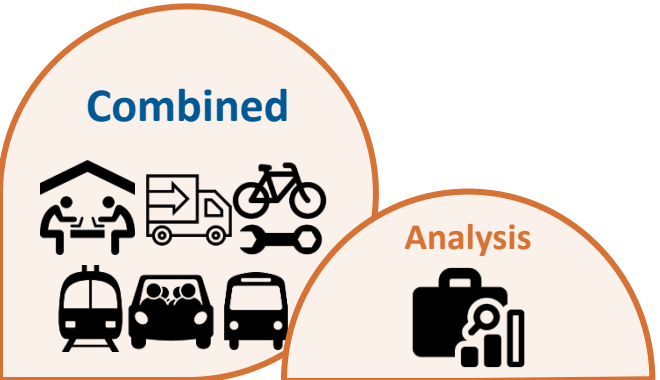
Combined

Priorities : Avoid Shift Improve

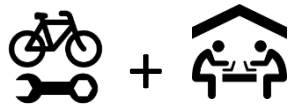
deduct trips that are avoidable

shift trips from car to low-carbon modes

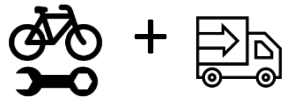
optimize occupancy rate for remaining high-carbon vehicles



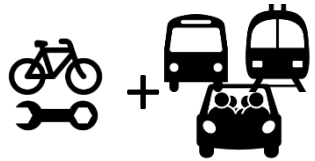
Interactions :



Access to telecenters on foot or by bike

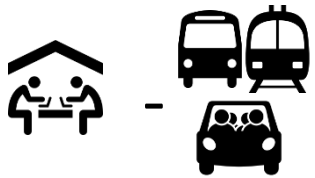


Grocery pick up in pick-up points using (cargo-) bikes

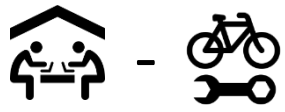


Access to transit stations on foot or by bike

Access to ridesharing stations on foot or by bike



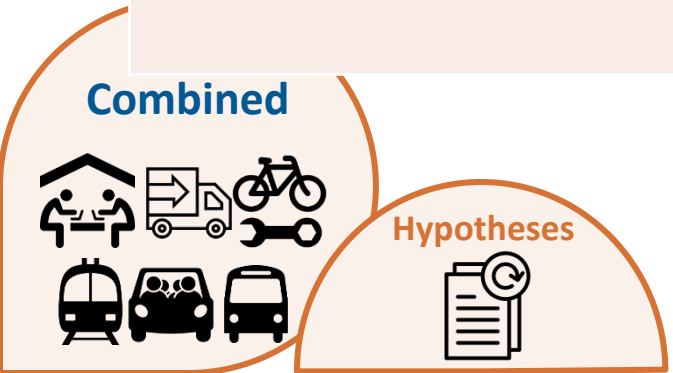
Teleworking reduces trips that could be done using transit, ridesharing or bikes

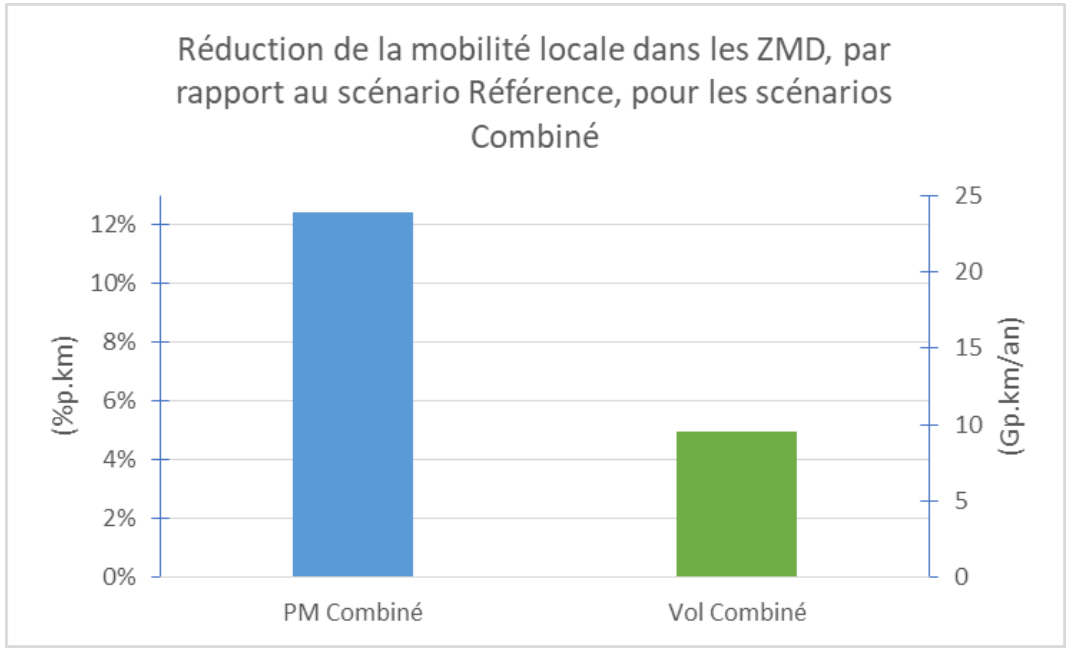


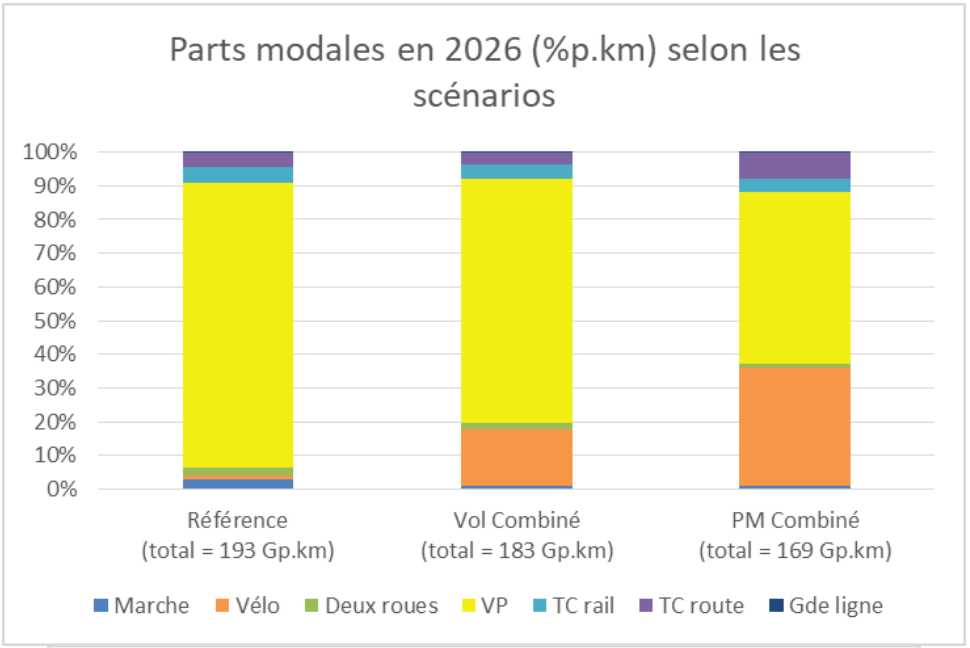
Transit reduces ridesharing potential

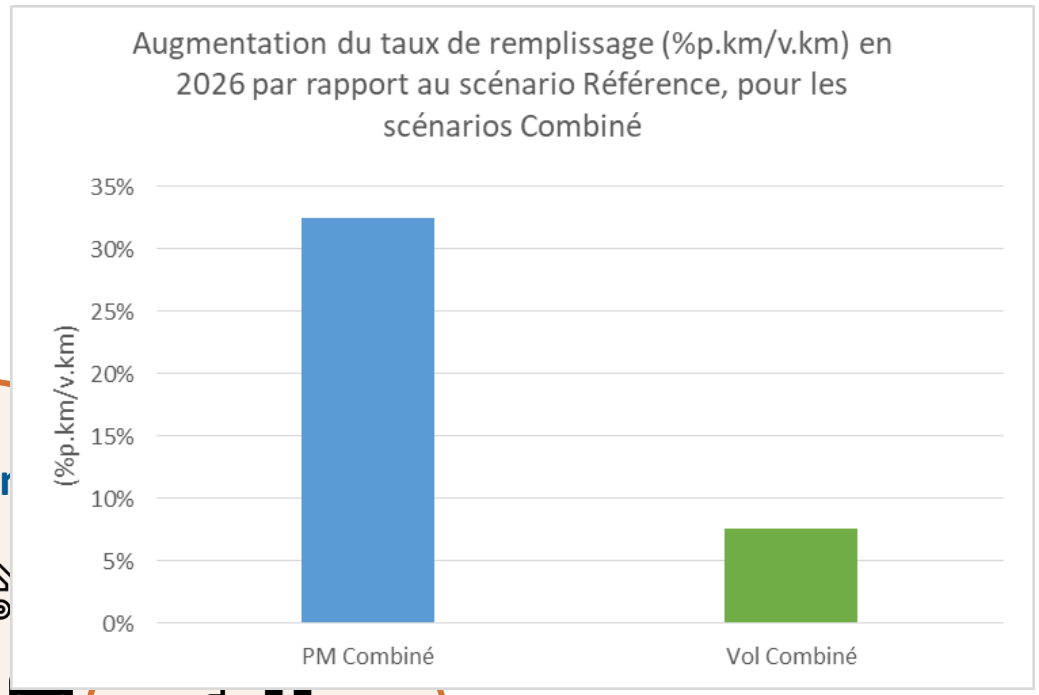
hypotheses behind the combined scenario

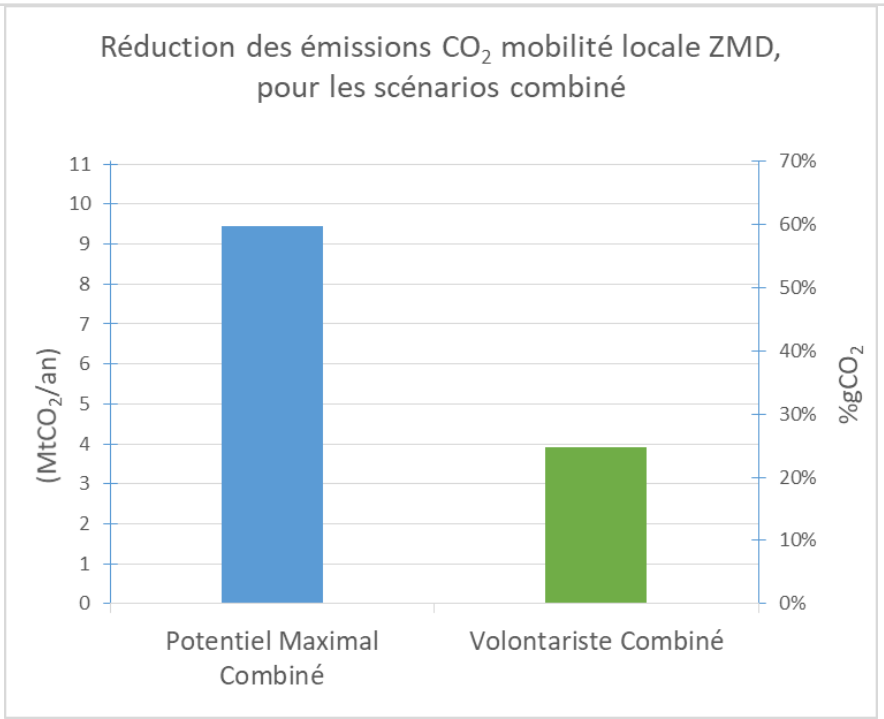
MAX POTENTIAL	AMBITIOUS
Hypotheses from each domain of action are added, prioritized according to ASI:	
Hypotheses from Teleworking and Grocery delivery by rounds MP scenarios	Hypotheses from Telework Ambitious and Collaborative delivery PM scenarios
Hypotheses from bike MP scenario	Hypotheses from bike Ambitious scenario
Hypotheses from EPT MP scenario	
Hypotheses from ridesharing MP scenario	Hypotheses from ridesharing Ambitious scenario




Réduction de la mobilité locale dans les ZMD, par rapport au scénario Référence, pour les scénarios Combiné
12%
10%
8%
6%
4%
2%
0%
(%p.km)
25
20
15
10
5
0
(Gp.km/an)
PM Combiné
Vol Combiné


Parts modales en 2026 (%p.km) selon les scénarios
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Référence (total = 193 Gp.km)
Vol Combiné (total = 183 Gp.km)
PM Combiné (total = 169 Gp.km)
Marche
Vélo
Deux roues
VP
TC rail
TC route
Gde ligne


Augmentation du taux de remplissage (%p.km/v.km) en 2026 par rapport au scénario Référence, pour les scénarios Combiné
35%
30%
25%
20%
15%
10%
5%
0%
(%p.km/v.km)
PM Combiné
Vol Combiné

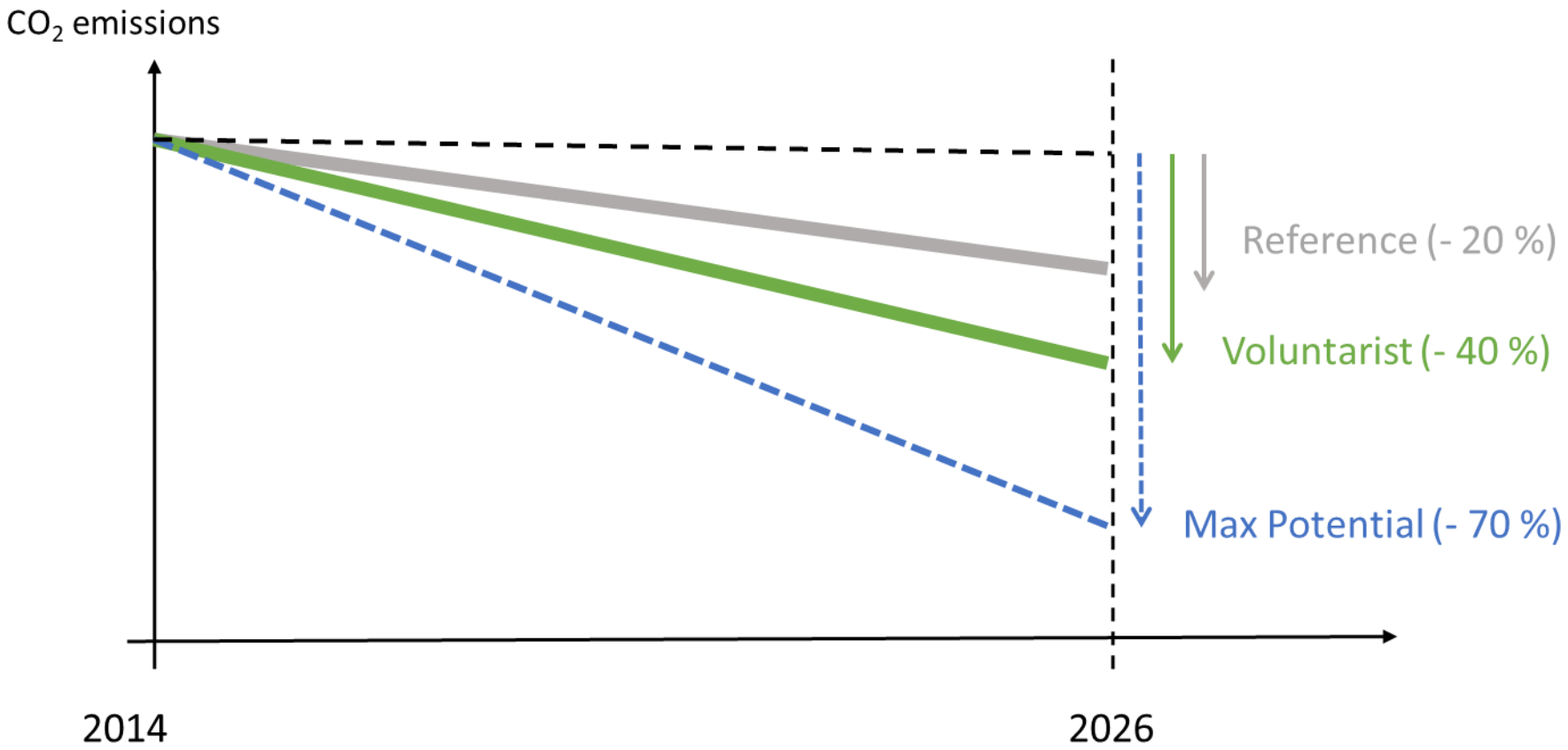

Réduction des émissions CO_2 mobilité locale ZMD, pour les scénarios combiné
11
10
9
8
7
6
5
4
3
2
1
0
($MtCO_2$/an)
70%
60%
50%
40%
30%
20%
10%
0%
%gCO_2
Potentiel Maximal Combiné
Volontariste Combiné

Combi

Conclusions

… and some food for thought

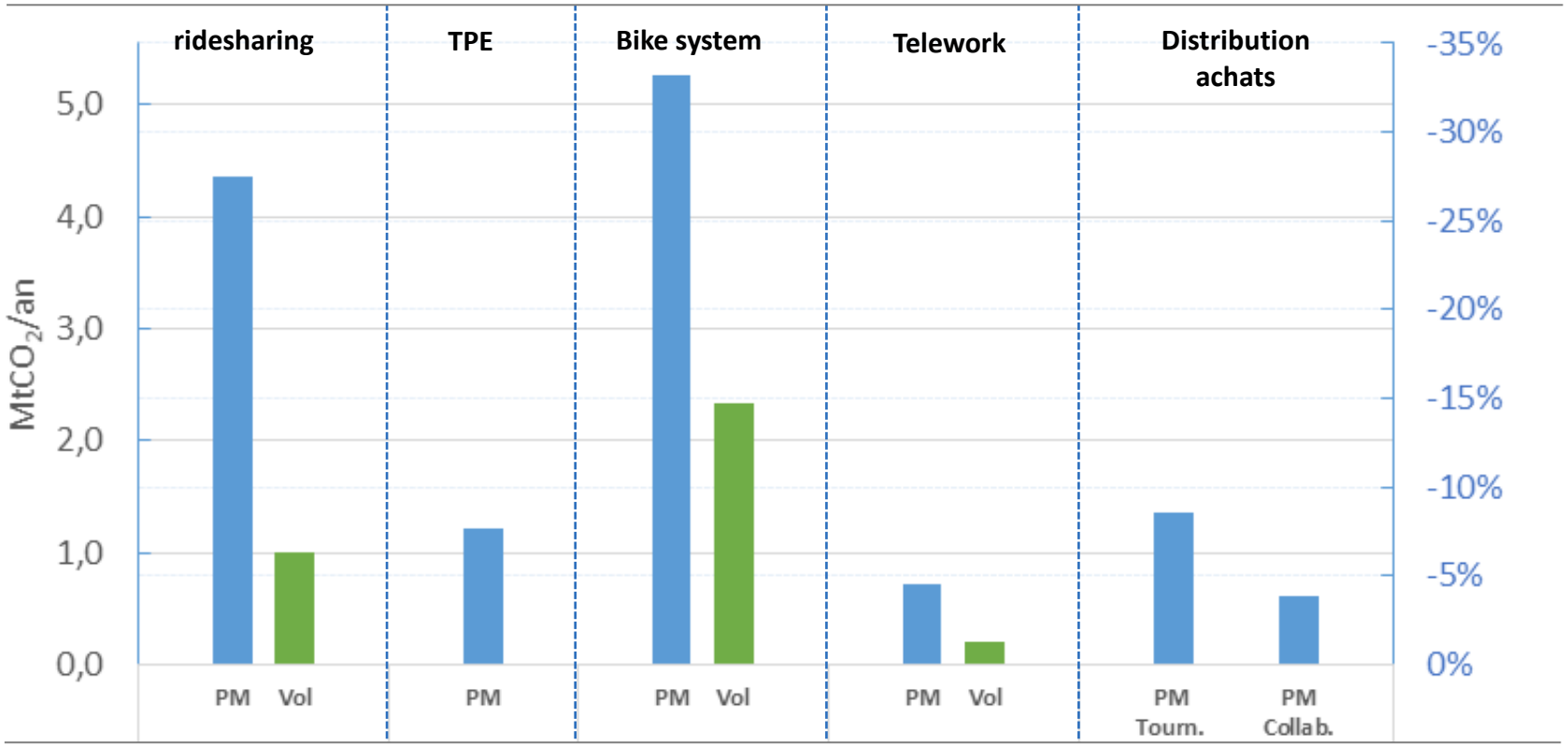
Daily mobility CO_2 emissions in Medium Density Areas for Combined scenarios and Reference scenario



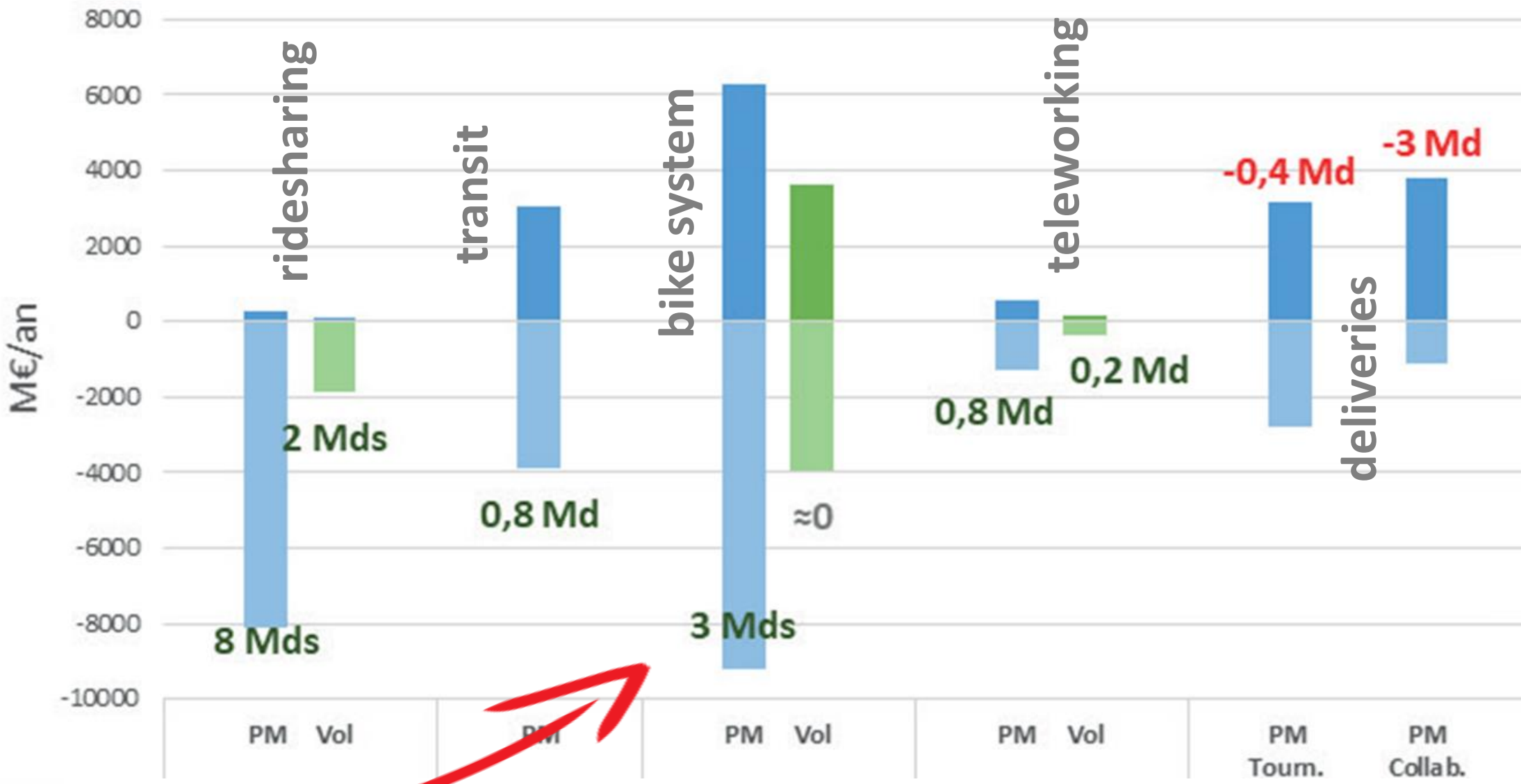
Conclusions

tomorrow: cycles and ridesharing

today: cycles, ridesharing and in some regions, transit



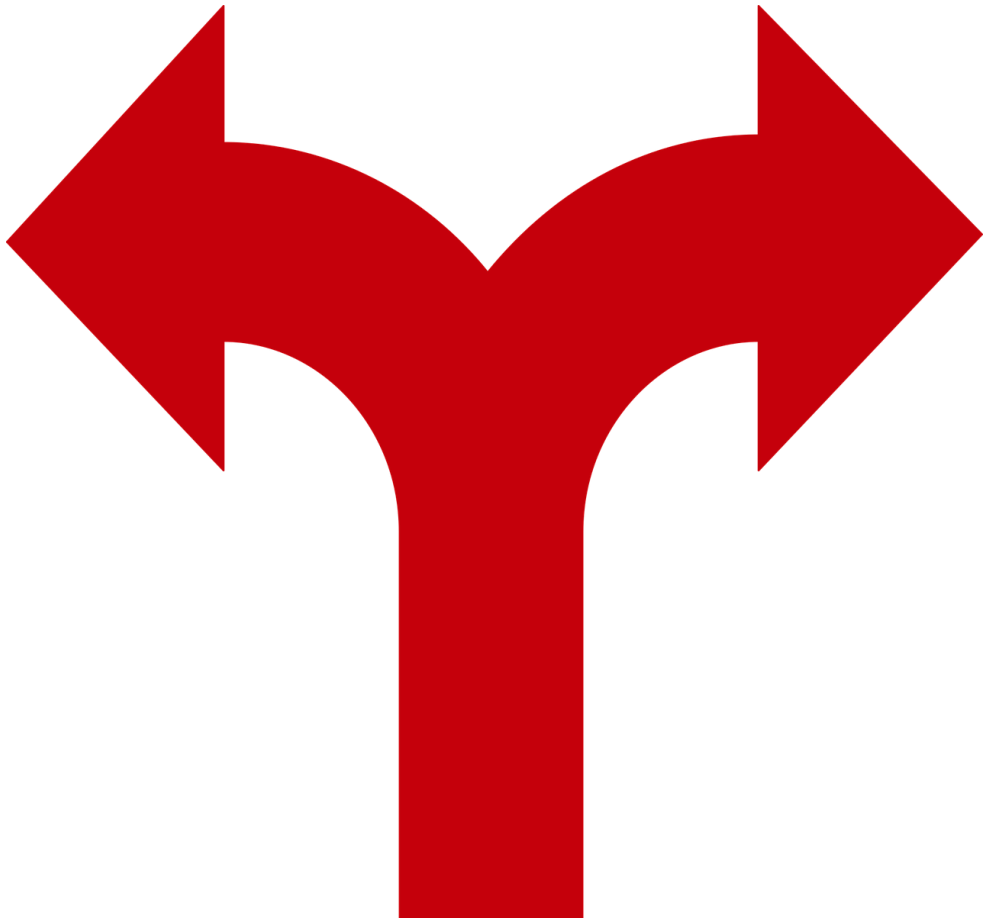
Conclusions



costs & benefits

must we choose between reducing carbon and more immediate goals ?

CO_2



energy consumption

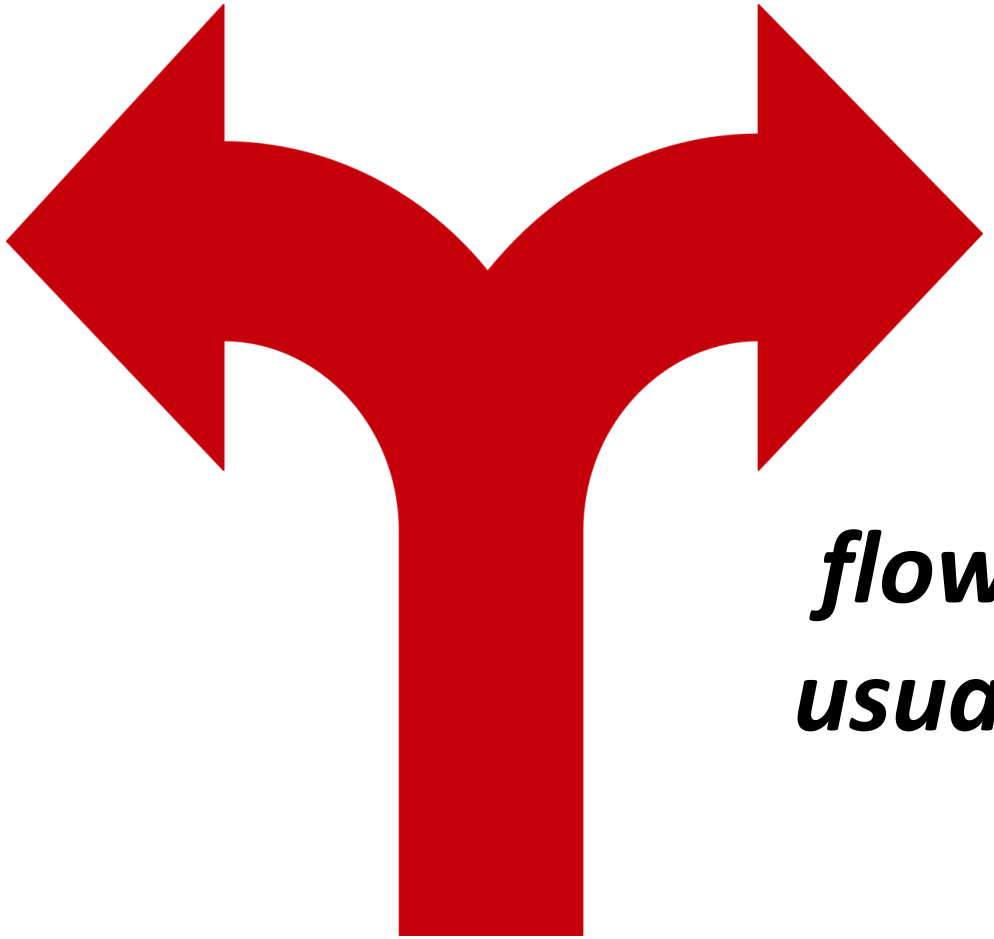
air pollution

exclusion

Conclusions

is congestion an environmental problem ?

CO_2



congestion

flow improvements usually increases car traffic

Conclusions

different *means* or different *objectives* ?

are Time and Speed still our gods ?

or has something changed ?

lock in

Conclusions

only one possible future?

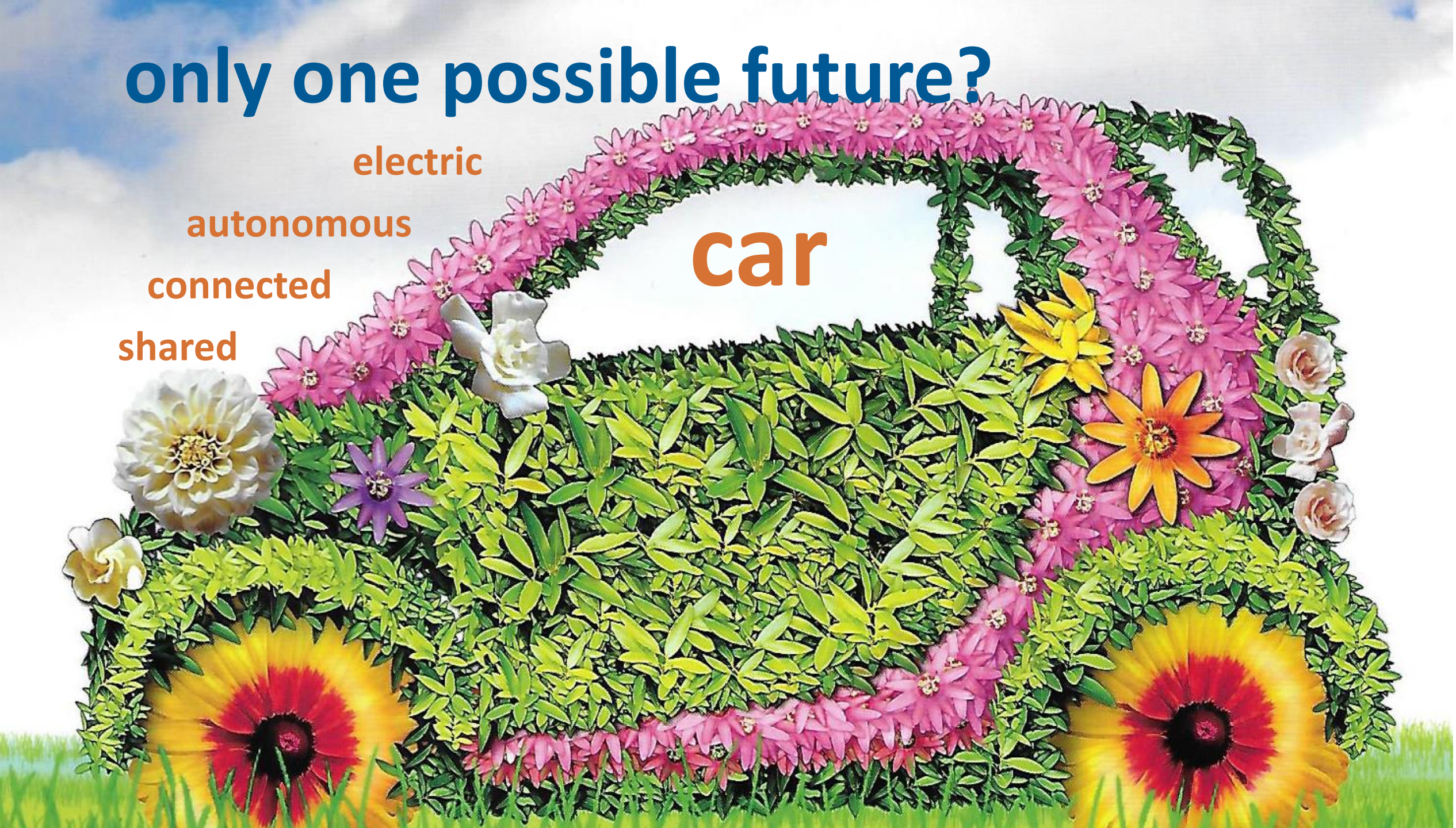
electric

autonomous

connected

shared

car



Change what? what for?

Change our lifestyle

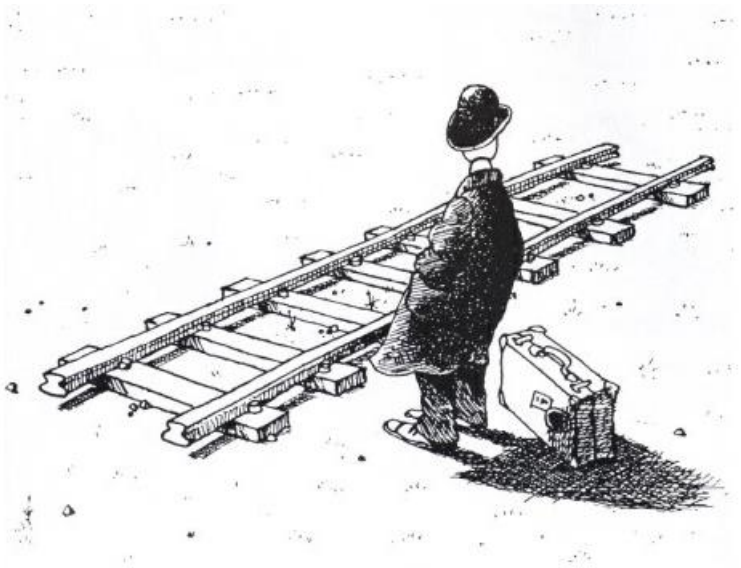
A question of money, representations, values…

Change our behavior

How to share the effort?

change how ?

systemic approach



ambitious scale

Conclusions

contact us

mobilite@theshiftproject.org