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Quantifying the benefits of switching to an e-bike

A multi-criteria calculation tool

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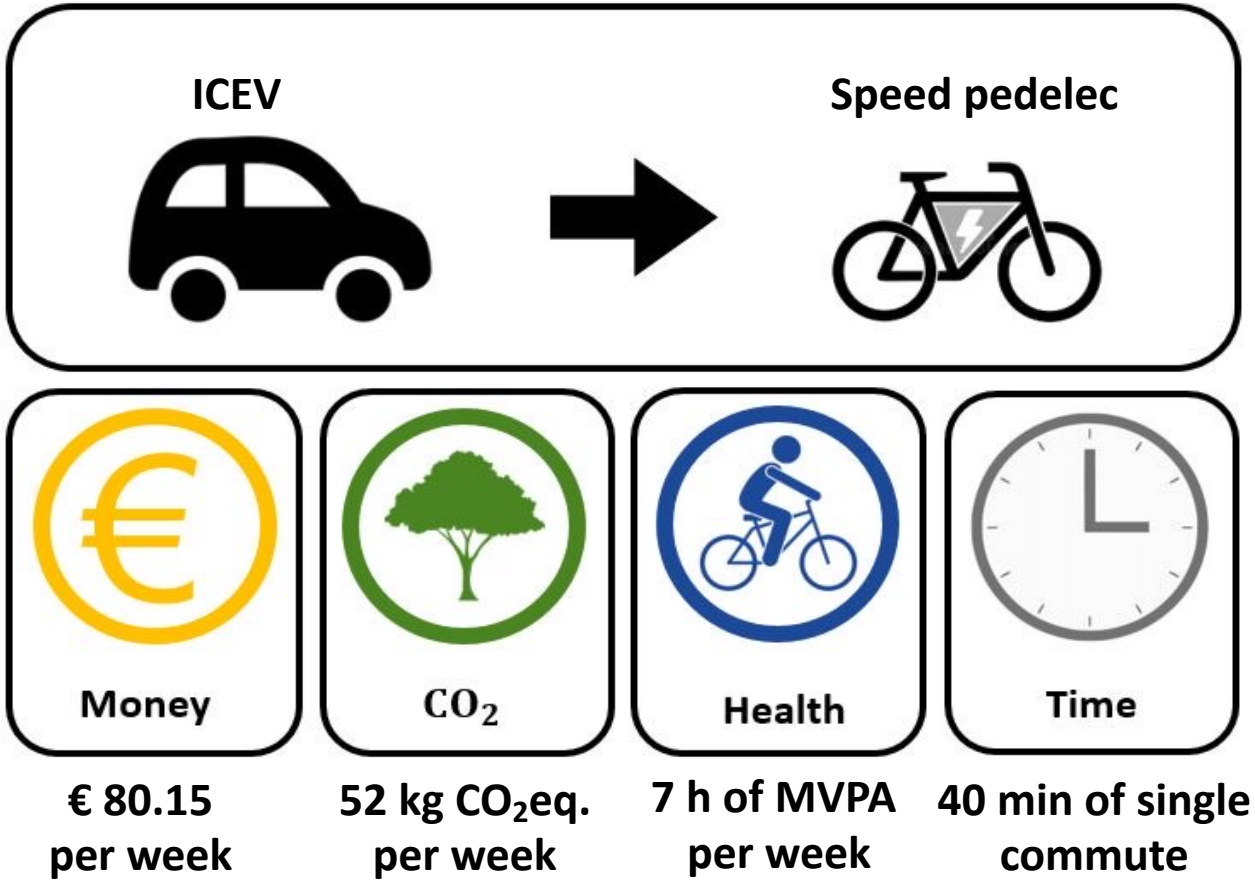
Multi-criteria calculator



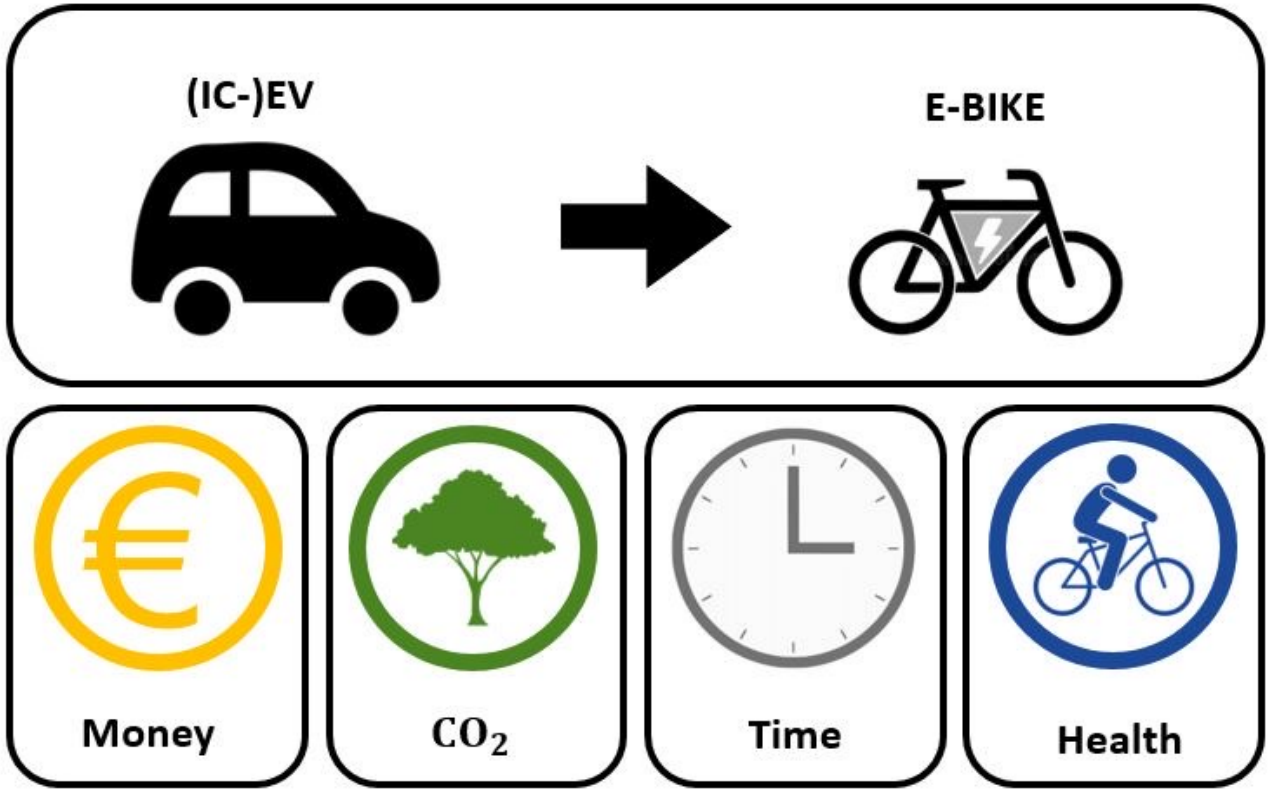
- 22.9 km (average commute)
- Full time job
- ICEV to speed pedelec

So how did we calculate this?

First some background

Multi-criteria calculator

as a decision-making tool



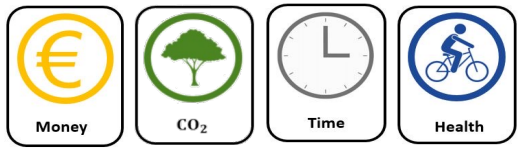
Methodology

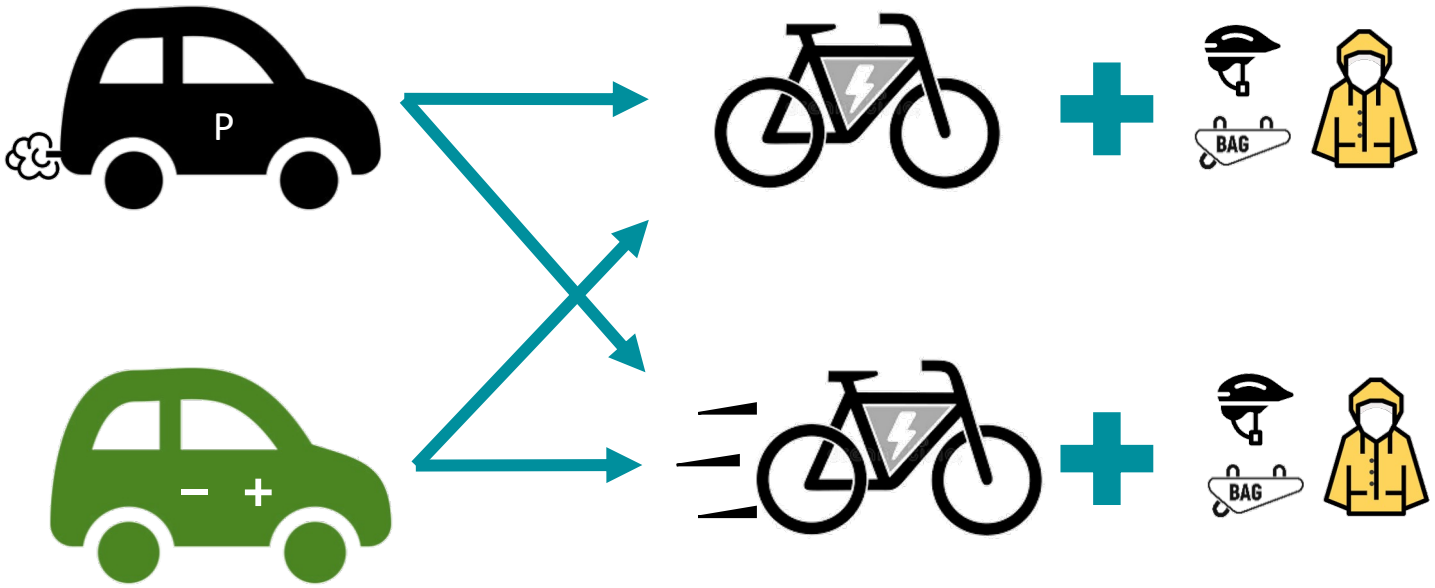
- Literature study on **TCO** & **LCA** for ICEV, BEV, speed pedelec & pedelec
- Market study with over 131 models for speed pedelecs **prices**
- Desktop study of **insurances, leasing prices, e-bike components**, …
- Questionnaire to e-bike repair shops on **maintenance**
- **Personae** based on average Belgian

System boundaries

4 personae based on average Belgian:

22.9 km & full time





System boundaries

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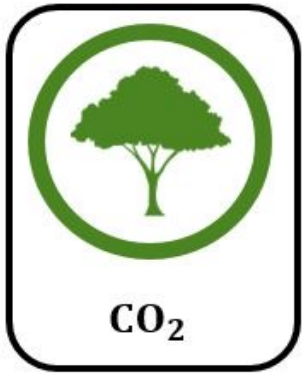
LCA

Manufacturing:
- Bike components
- E-drive components
- Battery

Transport & Packaging

Usage:
- Charging
- Replacement battery
- Maintenance

End-of-life:
- Recycling
- Disposal



TCO

Purchase costs:
- Buy/lease
- Accesories
- Licence plate

Operational costs:
- Electricity cost

Non-operational costs
- Bicycle allowance
- Insurance costs
- Maintenance costs
- Leasing costs
- Premiums

Other costs:
- Societal cost
- Resale cost
- Accident cost
- Fees & fines

Assumptions

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Ownership

8 years

Work year

220 days in
52 weeks

Real discount rate

- 0.5 %

Electricity price

0.35 €/kWh

Maintenance

Every 3000 km

Extra kilometres

15 km/week for pedelec
20 km/week for speed pedelec

Battery

500 Wh
500 cycles

Purchase price

Pedelec: € 2,050
SP: € 5,700

Metabolic Equivalent Task

E-cycling:
> 3

Speed

City: 20.6 km/h; 28.2 km/h
Cruising: 22.2 km/h; 34.2 km/h

Personae

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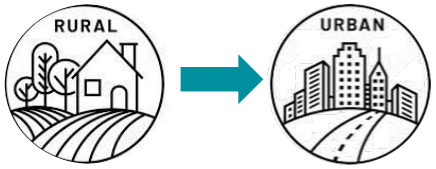
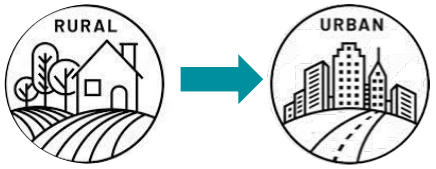
1

- 22.9 km
- Full time job
- 0.24 €/km



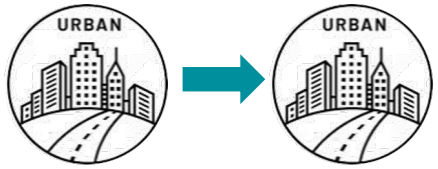
2

- 22.9 km
- 4/5 time job
- 0.15 €/km



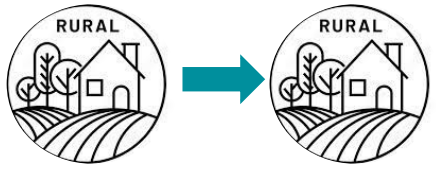
3

- 30 km
- 2/5 time job
- 0.24 €/km



4

- 10 km
- Full time job
- 0.24 €/km



General results

Minimum ≈ 85 $kgCO_2eq.$ MVPA[2]

Better > 300 MVPA[2]

≈ 10 $kgCO_2eq.$[1]

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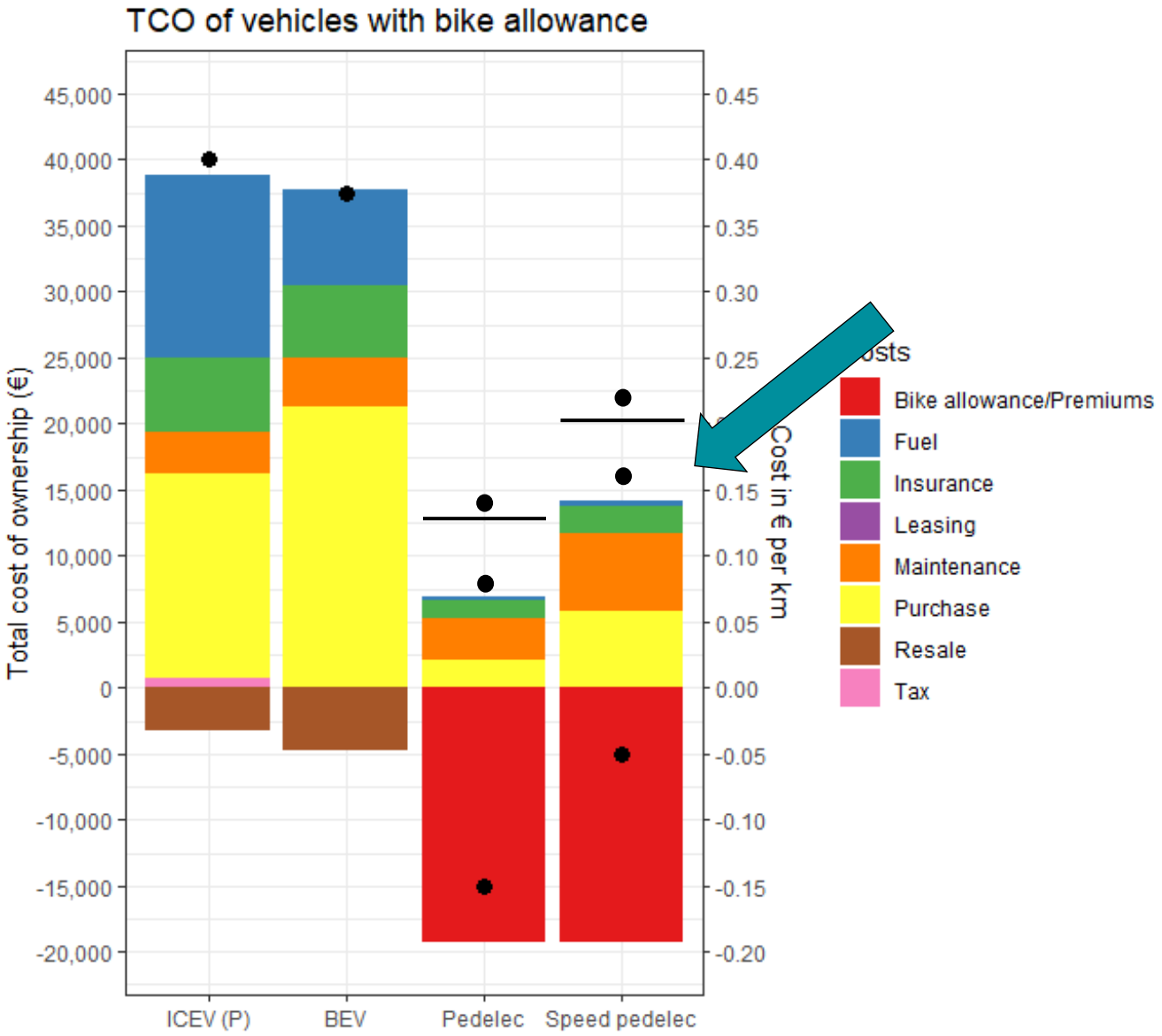
	Pedelec 22.9 km	SP	Pedelec 22.9 km	SP	Pedelec 30 km	SP	Pedelec 10 km	SP
Cost [€/km]	Full time job -0.08 0.24 €/km	0.01	4/5 time job 0.03 0.15 €/km	0.12	2/5 time job -0.04 0.24 €/km	0.09	Full time job -0.01 0.24 €/km	0.12
CO_2 [gCO_2/km]	7.4	11.4	7.6	12.1	8.7	12.9	9.9	13.8
Time [min]	63	42	63	42	83	56	27	18
Fitness [min/week]	628	416	502	333	331	224	272	179

1. Poore, J. & Nemecek, T., (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. https://doi.org/10.1126/science.aaq0216
2. Nagata, J. M., Vittinghoff, E., Gabriel, K. P., Garber, A. K., Moran, A. E., Sidney, S., … Bibbins-domingo, K. (2021). Physical Activity and Hypertension From Young Adulthood to Middle Age. *American Journal of Preventive Medicine*, *60*(6), 757–765. https://doi.org/10.1016/j.amepre.2020.12.018

TCO



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Purchase vs. Leasing ➔ Leasing is better

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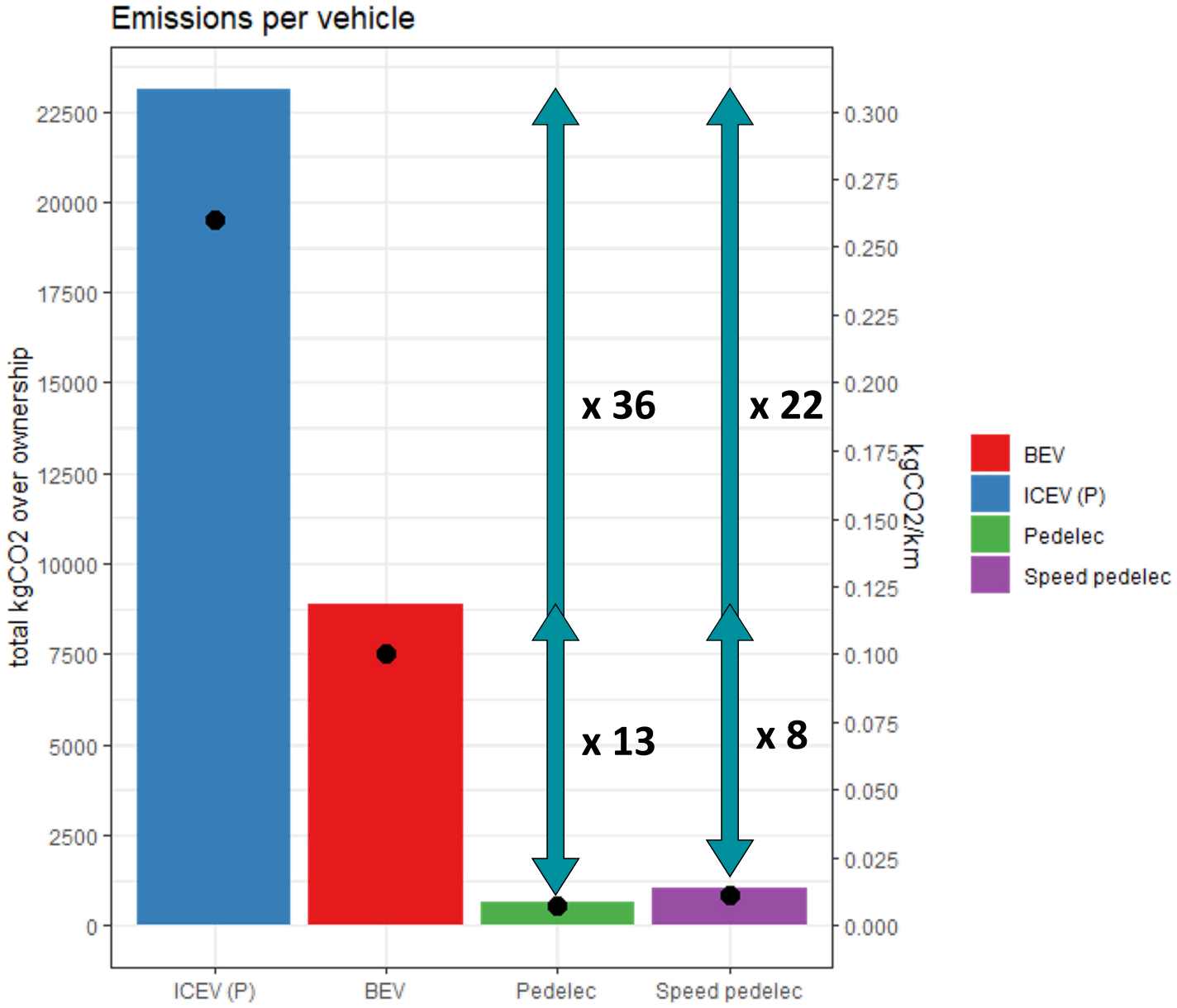
Cost [€/km]	Persona 1		Persona 2		Persona 3		Persona 4	
	Ped.	SP	Ped.	SP	Ped.	SP	Ped.	SP
Leasing	-0.10	-0.02	0.00	0.07	-0.06	0.03	-0.06	0.05
Purchase	- 0.08	0.01	0.02	0.12	- 0.04	0.09	- 0.03	0.12

CO_2



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CO_2

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Conclusion

- First calculator in this form.
- Clarity on specific numbers.
- More analysis needed on sensitivity.
- A switch to an e-bike has significant positive impact on the money, CO_2 and fitness.
- More research is needed.

Questions?

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