

# Multi-criteria evaluation of the environmental impacts of research activities

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Congrès  
Management  
du Cycle de Vie  
2025

[www.labos1point5.org](http://www.labos1point5.org)

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## carbon footprint calculator

		<i>Base empreinte (ADEME)</i>
	Buildings & energy	
	Travels	
	Commutes	✓ Climate change
	Vehicles	✗ Multicriteria
	Computers & IT	✓ Mitigation scenarios

		<i>CEDA/ USEEIO</i>
€	Purchases (scope 3)	✓ Climate change ✗ Multicriteria ✗ Multi-region tech. ✗ Mitigation scenarios

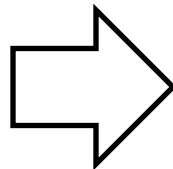
- Unit: French research laboratory
- Activity data for 109 laboratories with 10-500 staff each. 15000 staff in total
- Direct and indirect upstream emissions (no downstream)
- Free and open source calculator:

<https://apps.labos1point5.org/ges-1point5>

## GES 1point5 carbon footprint calculator

	Buildings & energy	<i>Base empreinte (ADEME)</i>
	Travels	
	Commutes	
	Vehicles	
	Computers & IT	
		✓ Climate change ✗ Multicriteria ✓ Mitigation scenarios

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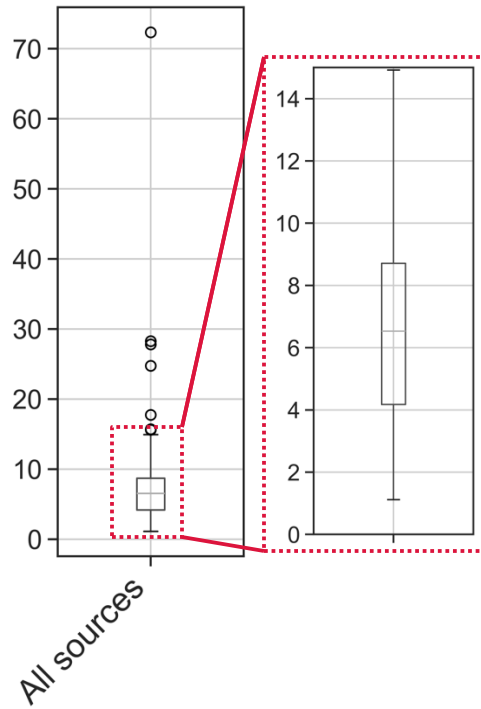
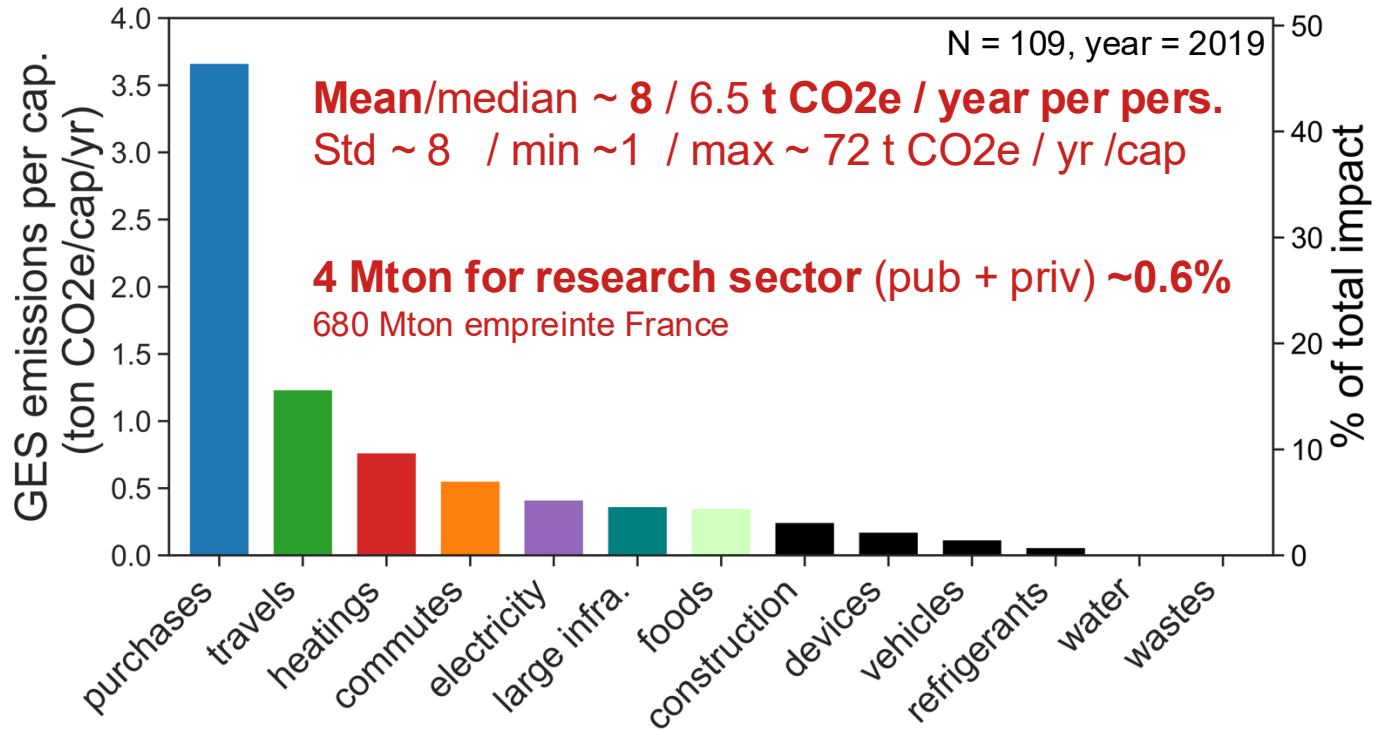
## GES 1point5 O-LCA extension

	<i>ecoinvent &amp; Impact World+</i>
	✓ Climate change ✓ <b>Multicriteria</b> ✓ Mitigation scenarios

<i>EXIOBASE &amp; Impact World+</i>		
€		✓ Climate change ✓ <b>Multicriteria</b> ✓ <b>Multi-region tech.</b> ? <b>Mitigation scenarios</b>



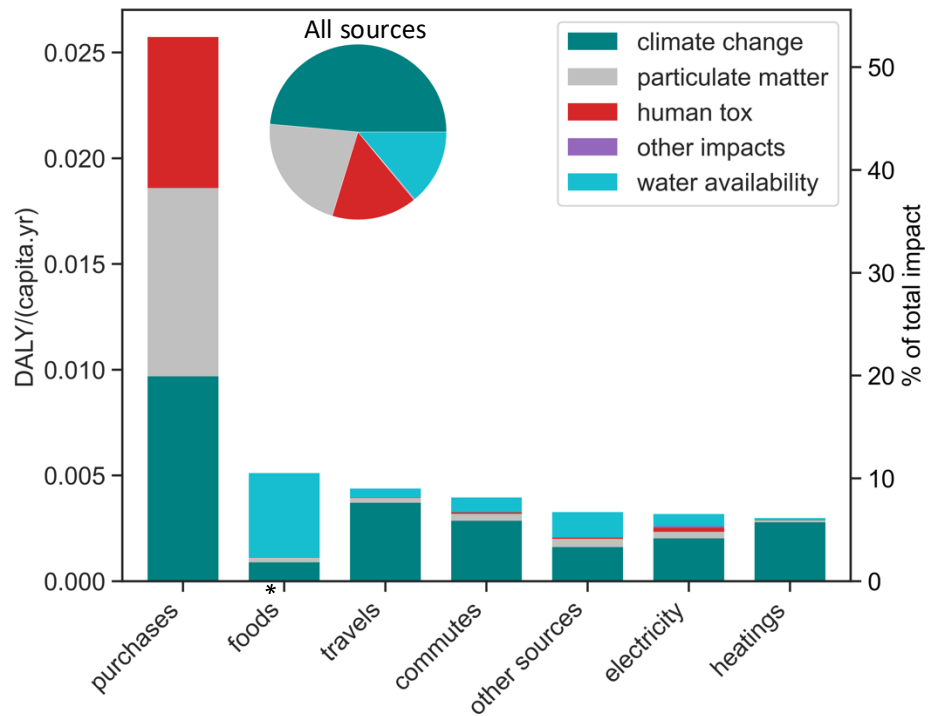
# Previous work: The carbon footprint of research laboratories in France is dominated by purchases with large differences between laboratories



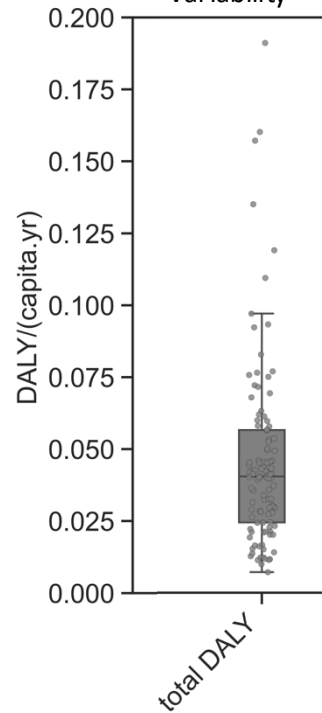
# Results: human health damage is dominated by climate change, particulates, toxicity



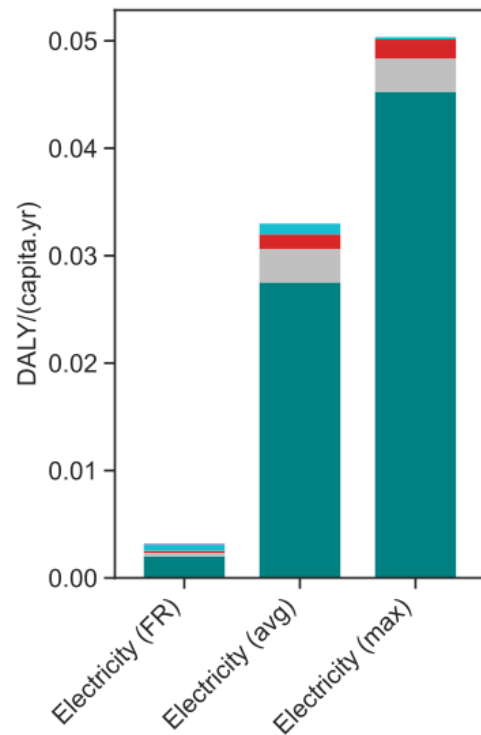
Average contribution of each impact by activity



Variability



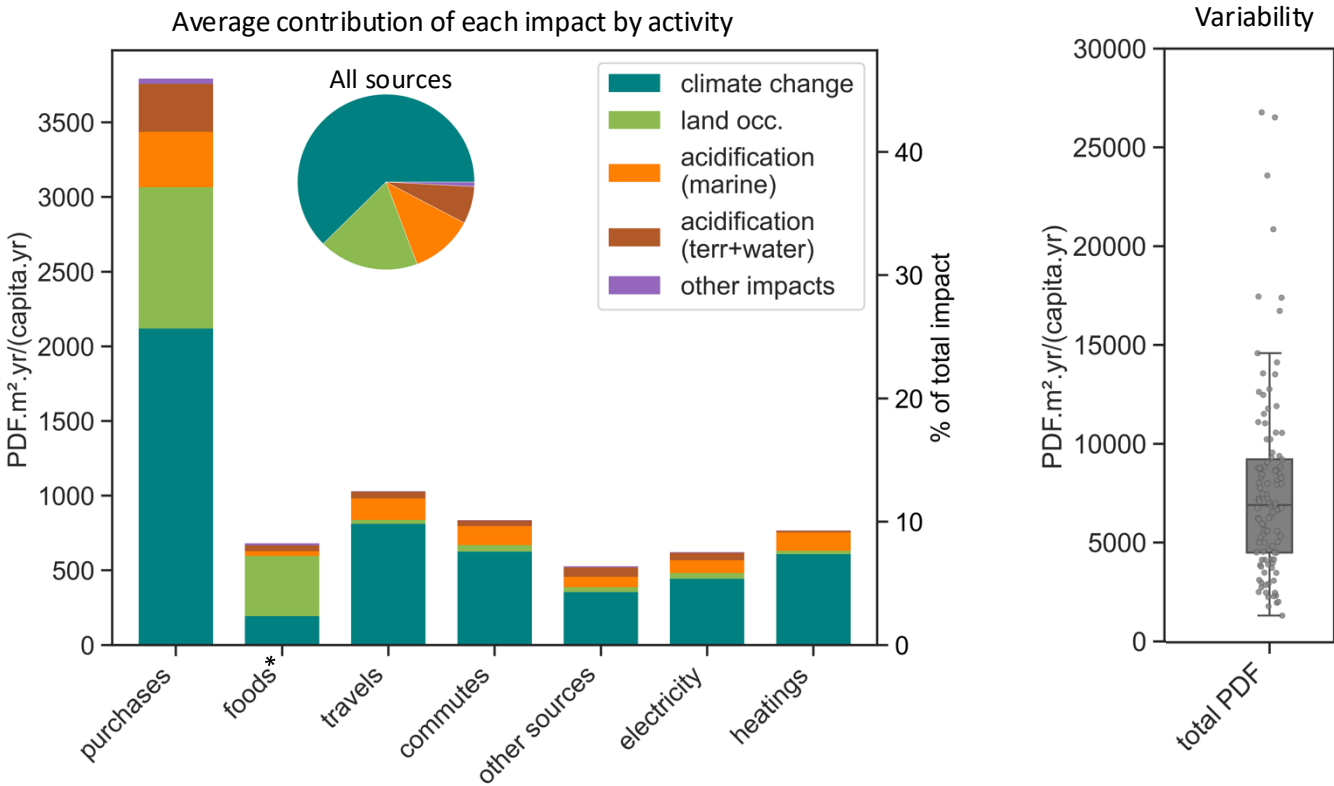
Strong effect of electricity



**On average: 0.05 DALY/(capita.year) > means a loss of 17 days of life globally / research staff**

In IW+, world capita = 0.035 DALY/(capita.yr)

# Results: ecosystem damage is dominated by climate change, land use and acidification

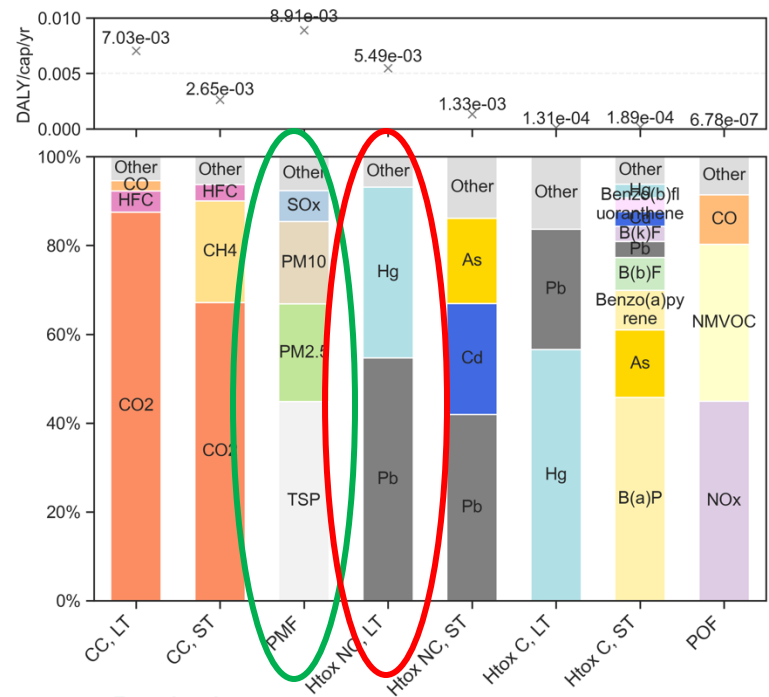


**On average: 8000 PDF.m<sup>2</sup>.yr/(capita.yr)** > means all species on 8000m<sup>2</sup> disappear (during 1 year)  
 > in IW+, world-capita = 8500 PDF.m<sup>2</sup>.yr/(capita.yr)



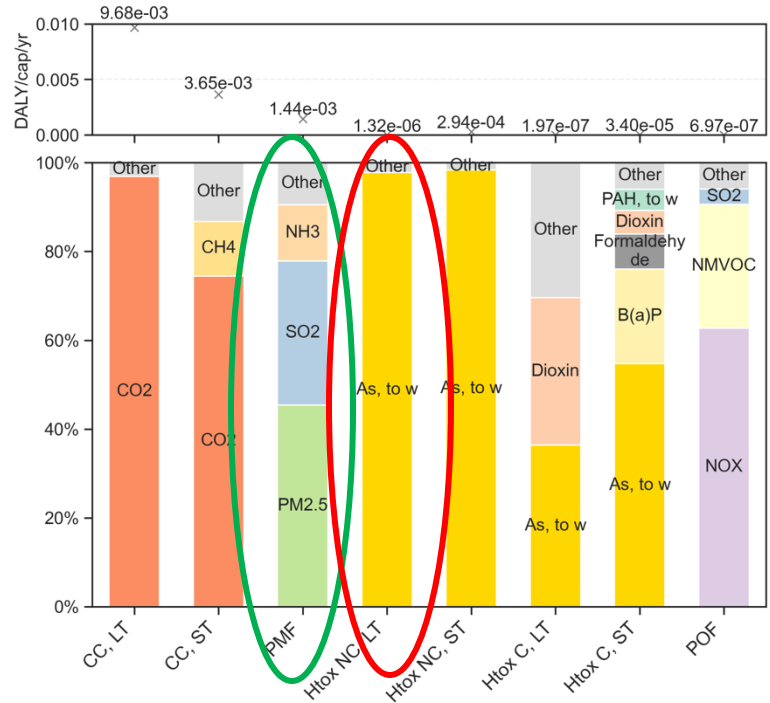
# Substance emission and hybridization quality

## Purchases (IO-LCA, exiobase)



Particulates Human tox non-cancer long-term

## Other modules (process-LCA, ecoinvent)



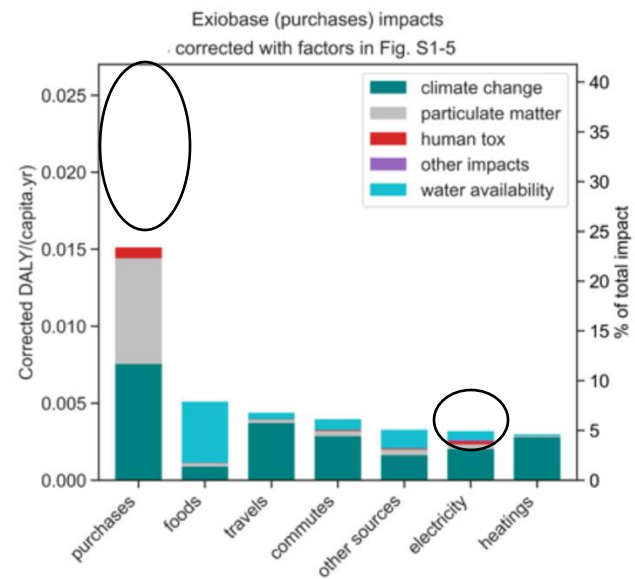
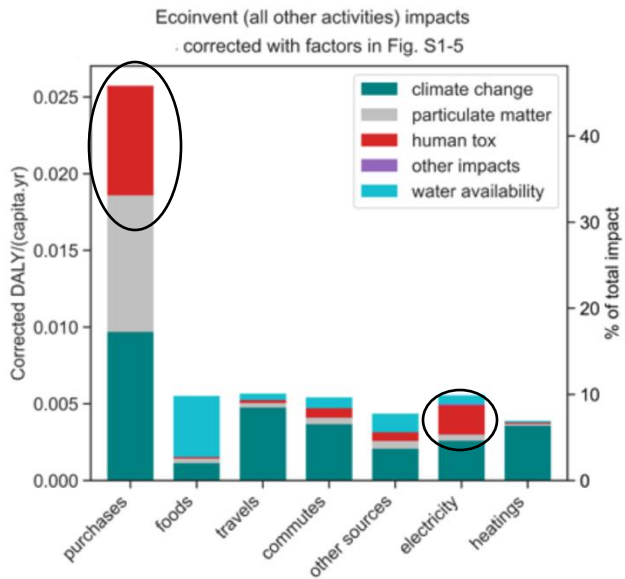


# Quality of hybridization is satisfactory except for human toxicity

Input-output vs. Process LCA  
for airplane travel

Impact	Ecoinvent/exio base ratio
Climate change	0.8
Human tox	0.1
Land use	0.6
Particulate matter	0.8
Acidification	1.5

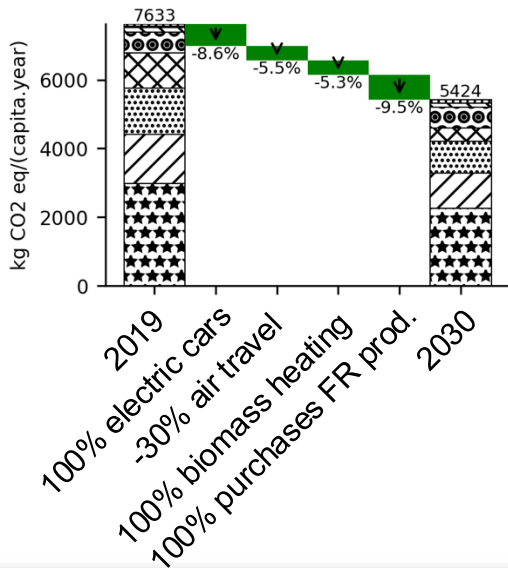
## Corrected human impacts for the average laboratory



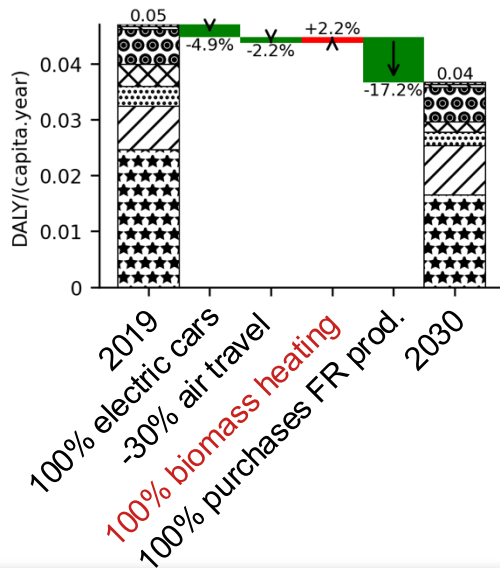


# A -30% decarbonization scenario may have limited trade-offs on other environmental indicators

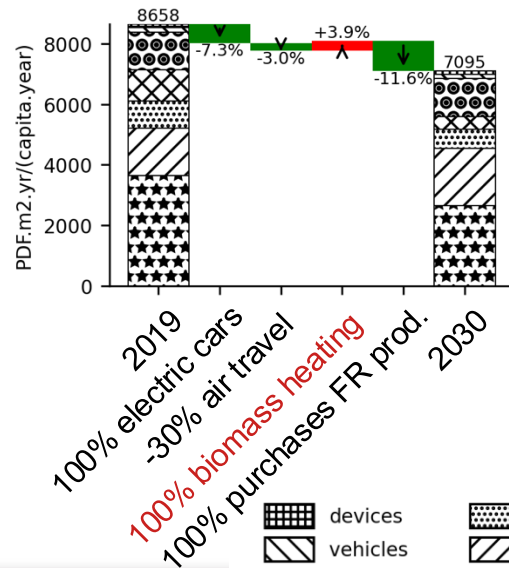
### Climate change (short-term)



### Human health



### Ecosystem quality

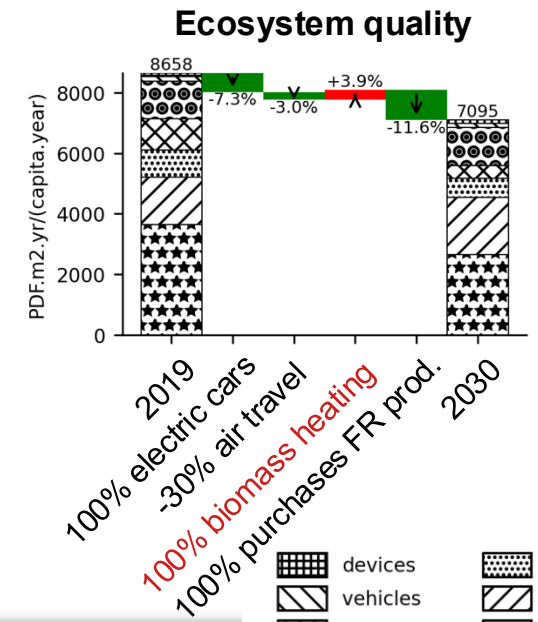
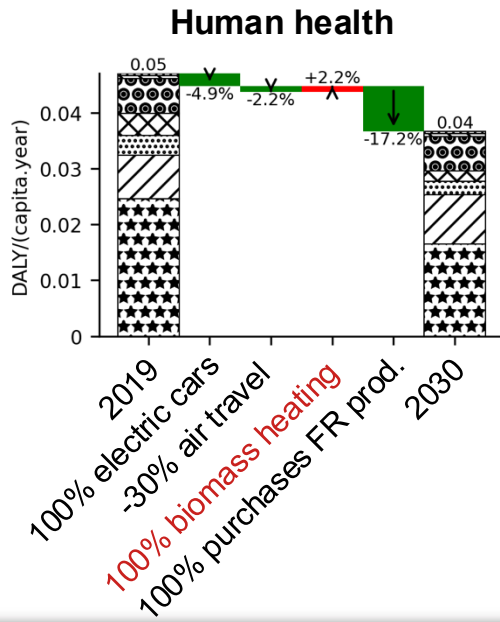
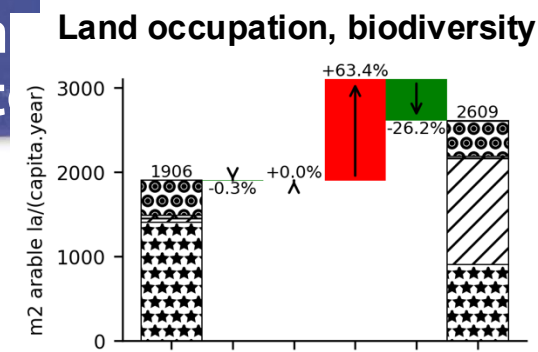
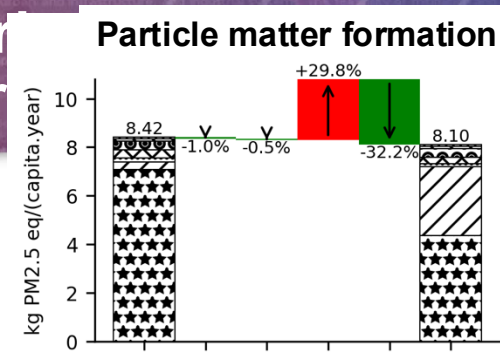
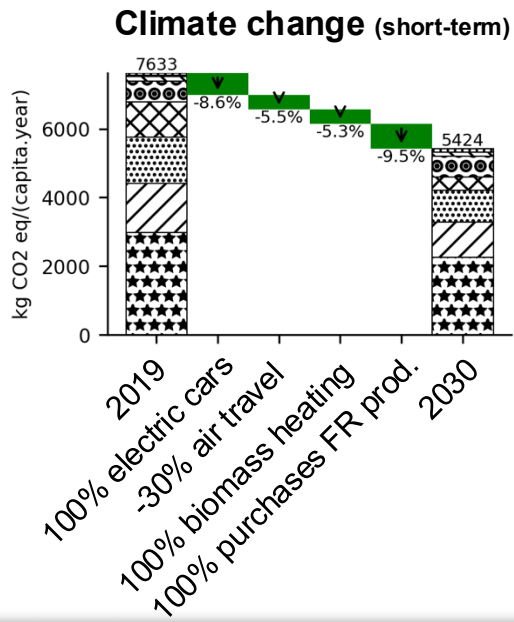


- devices
- travels
- vehicles
- buildings
- foods
- purchases
- commutes



A -30% decarbonisation  
offsets on other

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icac



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## Methodology

- Purchases/**monetary factors** > hybridize EEIO (EXIOBASE) db with process based db (ecoinvent)
- Other modules/**physical factors** > extend/refine LCAs to all modules
- **Regionalization** > purchases at the **country** level (EXIOBASE) + **regionalized impacts** (with Impact World+)
- **Uncertainties** > add at least qualitative uncertainty

## Operationalization in



- Multicriteria currently available for purchases (**Bottleneck: use of ecoinvent data in open tool cost a lot (sub-licencing)**)
- Add multicriteria into « **Scenario 1point5** » to identify potential burden shifting

# Thank you for your attention



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