WORKSHOP A: A LOW-CARBON AND CLIMATE RESILIENT HEALTH SYSTEM IN LUXEMBOURG

Climate Change and Health

07.07.2026

Observatoire de la Politique Climatique

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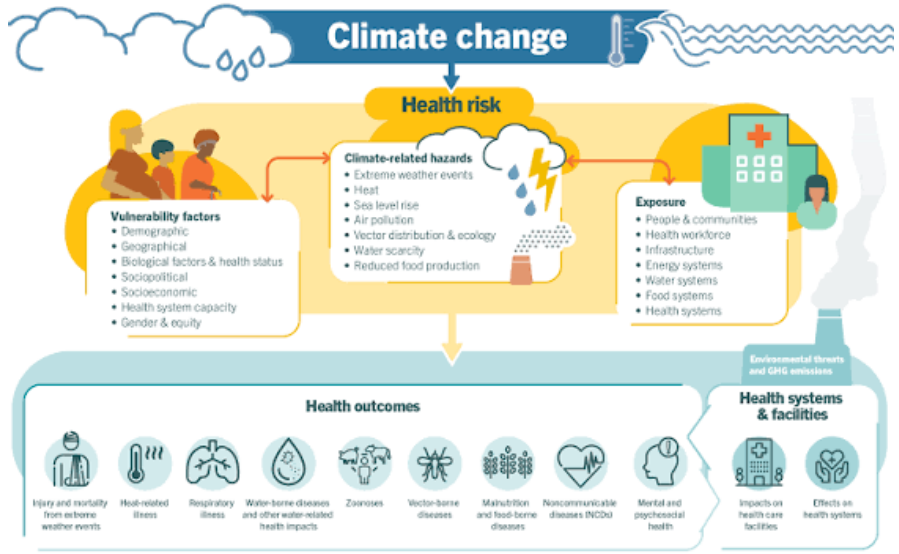
CLIMATE CHANGE AND HEALTH

A strong *double materiality**

Climate change is the main factor of more frequent heat waves and other extreme weather events, stress, anxiety, flood dangers, spreading disease vectors, etc.



Climate change

Health

Healthcare in Luxembourg ~ 12000 employees across 10 hospitals, 3500 practicing doctors, 4700 care workers, 2500 in healthtech…
A sector with substantial impacts (medicine, energy use, single-use products, …)

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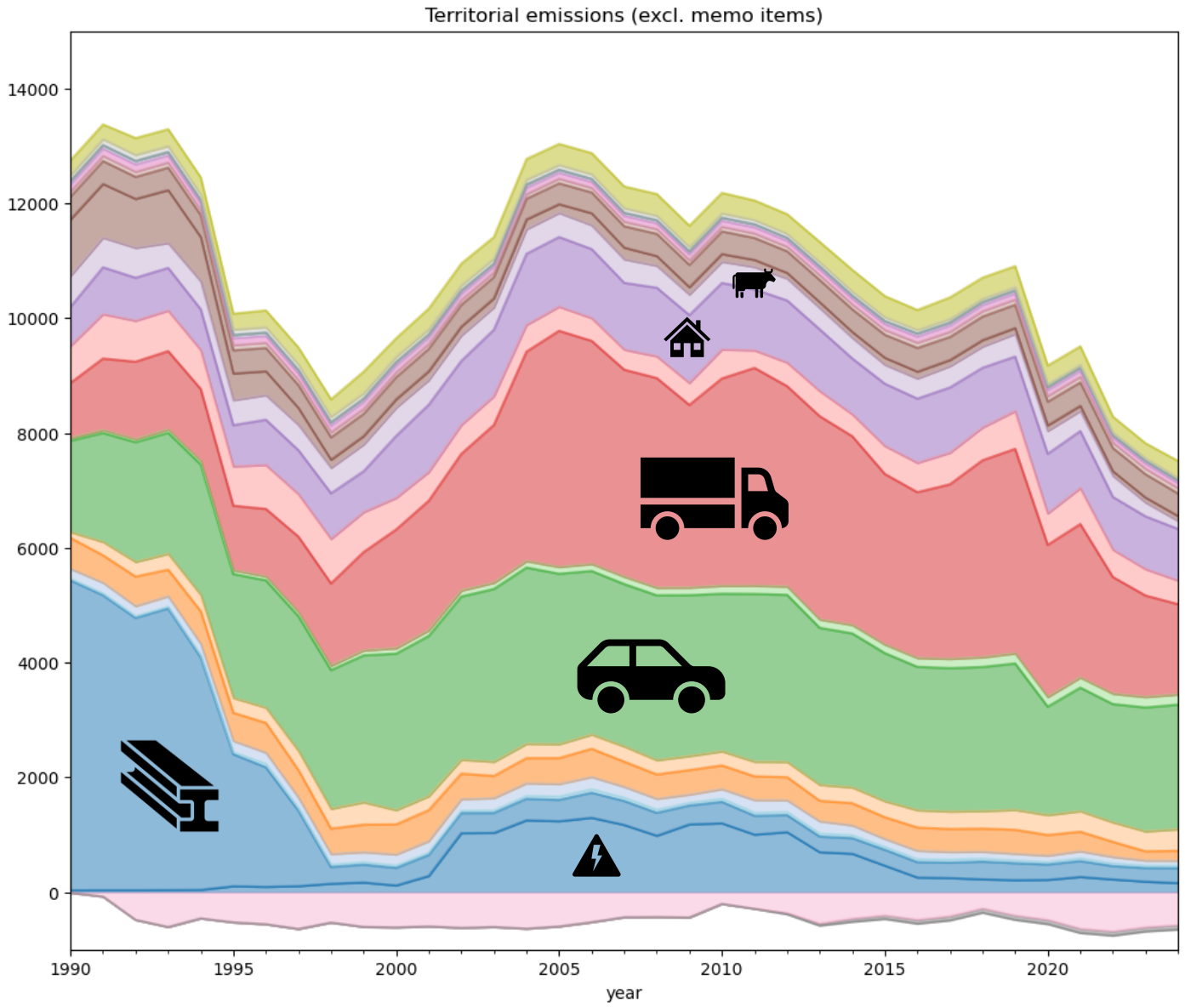
* In climate finance, **double materiality** is an accounting and sustainability reporting principle stating that companies must disclose how **environmental issues affect their business value** (financial materiality) and **how the company's operations impact society and the environment** (impact materiality)

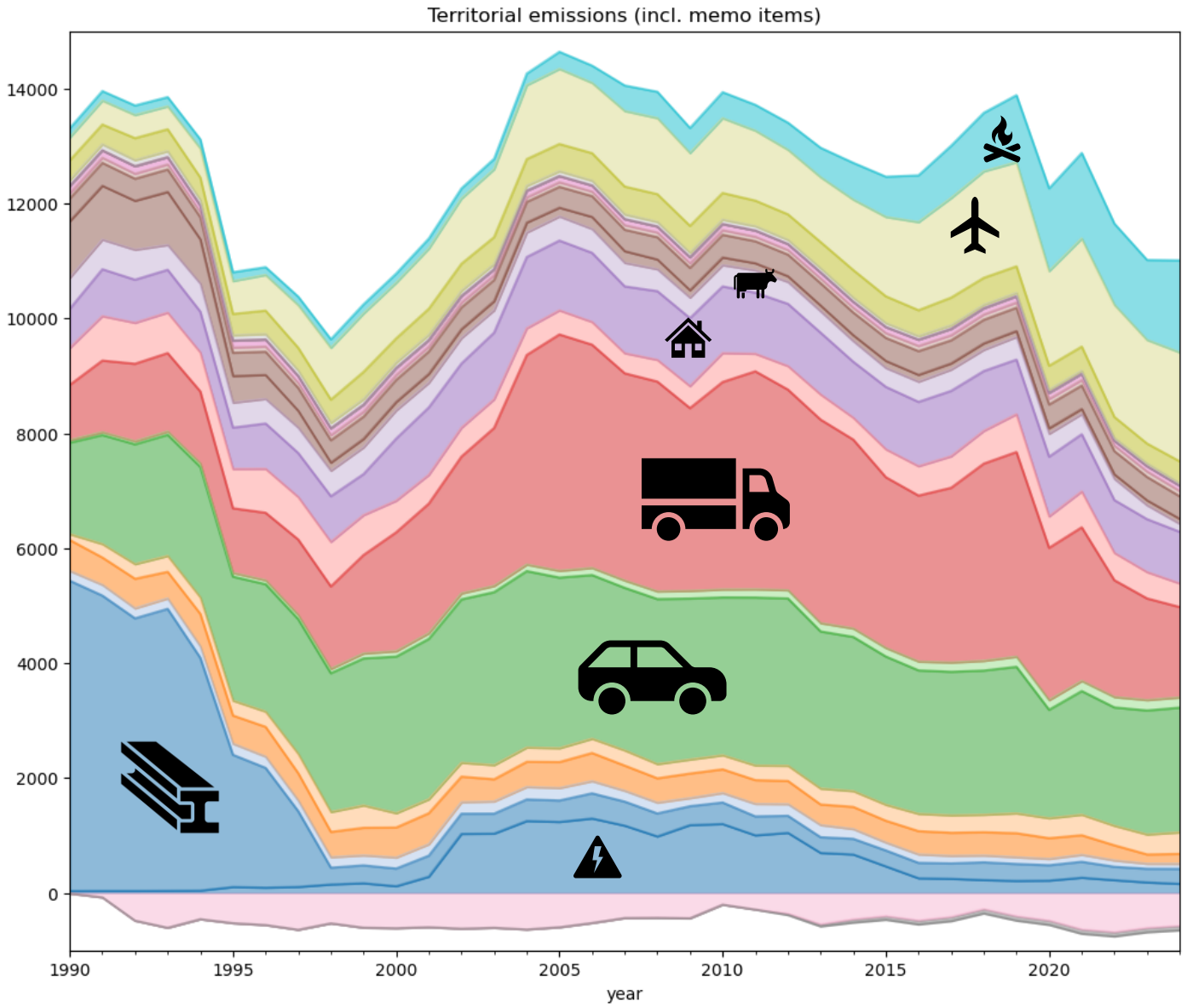
LUXEMBOURG'S GREENHOUSE GAS EMISSIONS



Total 2024 = 6.8 Mt CO_2 eq.

(10.1 t CO_2 eq./capita)

LUXEMBOURG'S GREENHOUSE GAS EMISSIONS



Total 2024 = 10.4 Mt CO_2 eq.

(15.3 t CO_2 eq./capita)

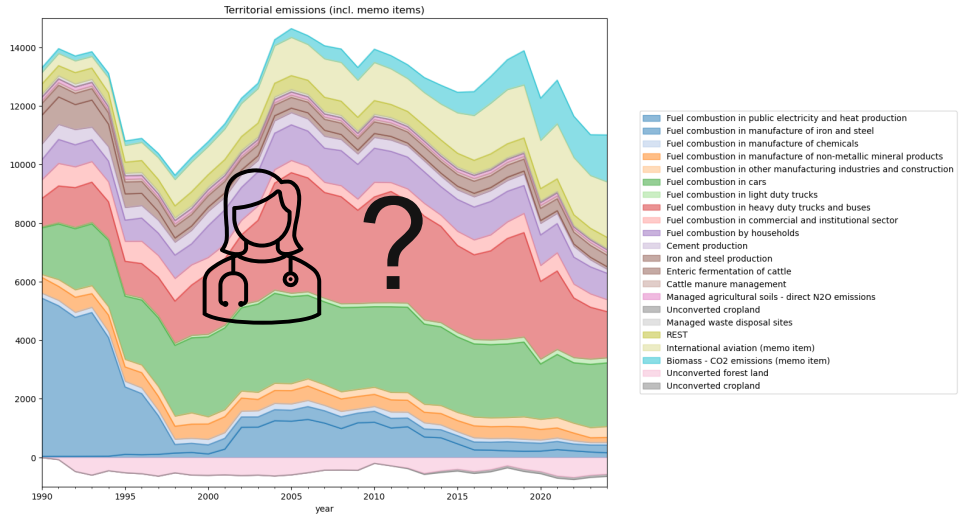
- Fuel combustion in public electricity and heat production
- Fuel combustion in manufacture of iron and steel
- Fuel combustion in manufacture of chemicals
- Fuel combustion in manufacture of non-metallic mineral products
- Fuel combustion in other manufacturing industries and construction
- Fuel combustion in cars
- Fuel combustion in light duty trucks
- Fuel combustion in heavy duty trucks and buses
- Fuel combustion in commercial and institutional sector
- Fuel combustion by households
- Cement production
- Iron and steel production
- Enteric fermentation of cattle
- Cattle manure management
- Managed agricultural soils - direct N2O emissions
- Unconverted cropland
- Managed waste disposal sites
- REST
- International aviation (memo item)
- Biomass - CO2 emissions (memo item)
- Unconverted forest land
- Unconverted cropland

LUXEMBOURG'S GREENHOUSE GAS EMISSIONS

Where is healthcare?

- Healthcare does not appear as a direct emitter of GHG

- Instead, we need to track healthcare's supply chains
  - Pharmaceuticals,
  - Infrastructure (hospitals, clinics, …)
  - Energy usage in transportation and building use
  - Production of high-end and/or single-use equipment



Territorial emissions (almost zero) + **Imports (a lot)** − **Exports** = **Consumption-based emissions (footprint)**

- *Multiregional input-output databases* are used to calculate exactly that

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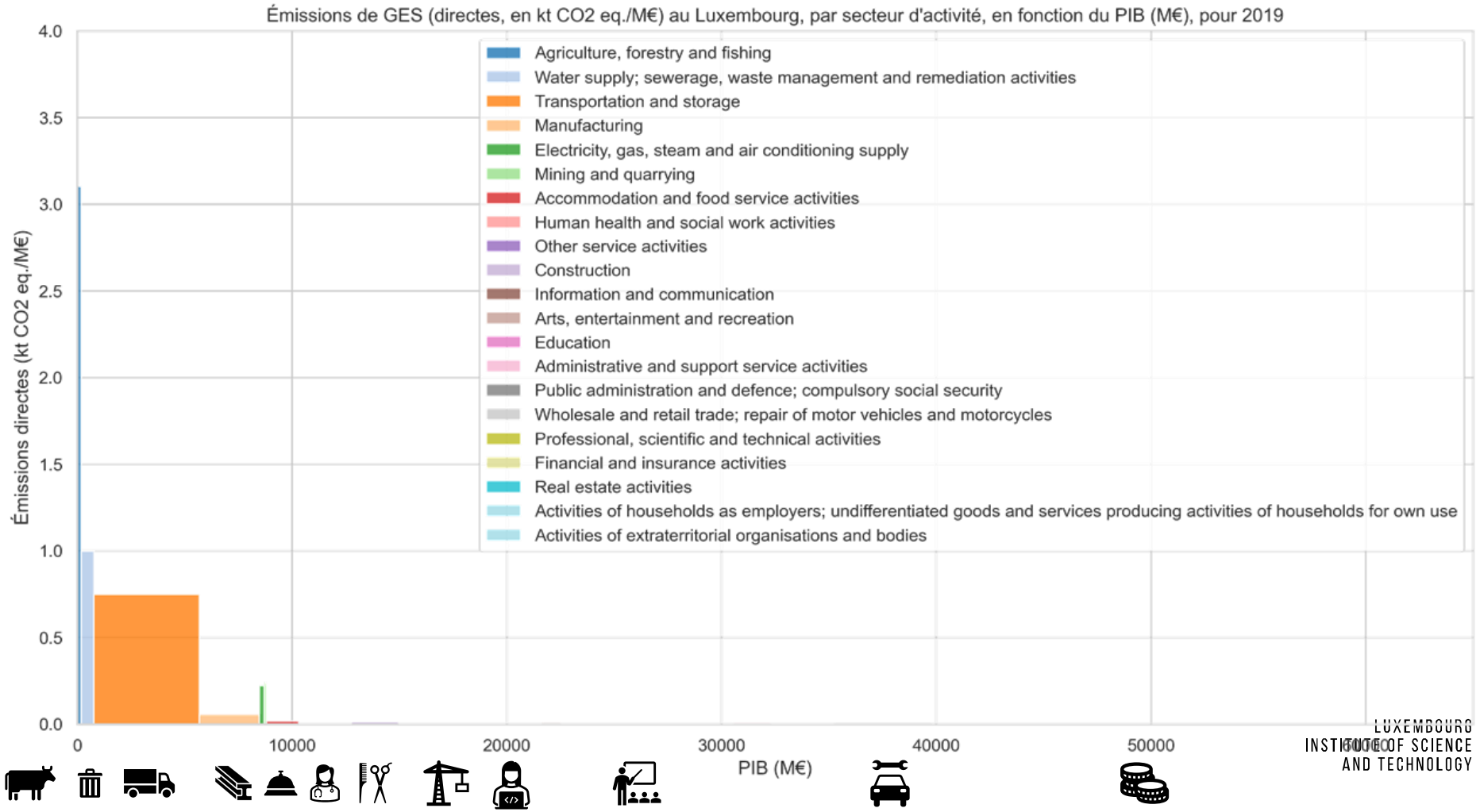
LUXEMBOURG'S GREENHOUSE GAS EMISSIONS

"Invisible" emissions



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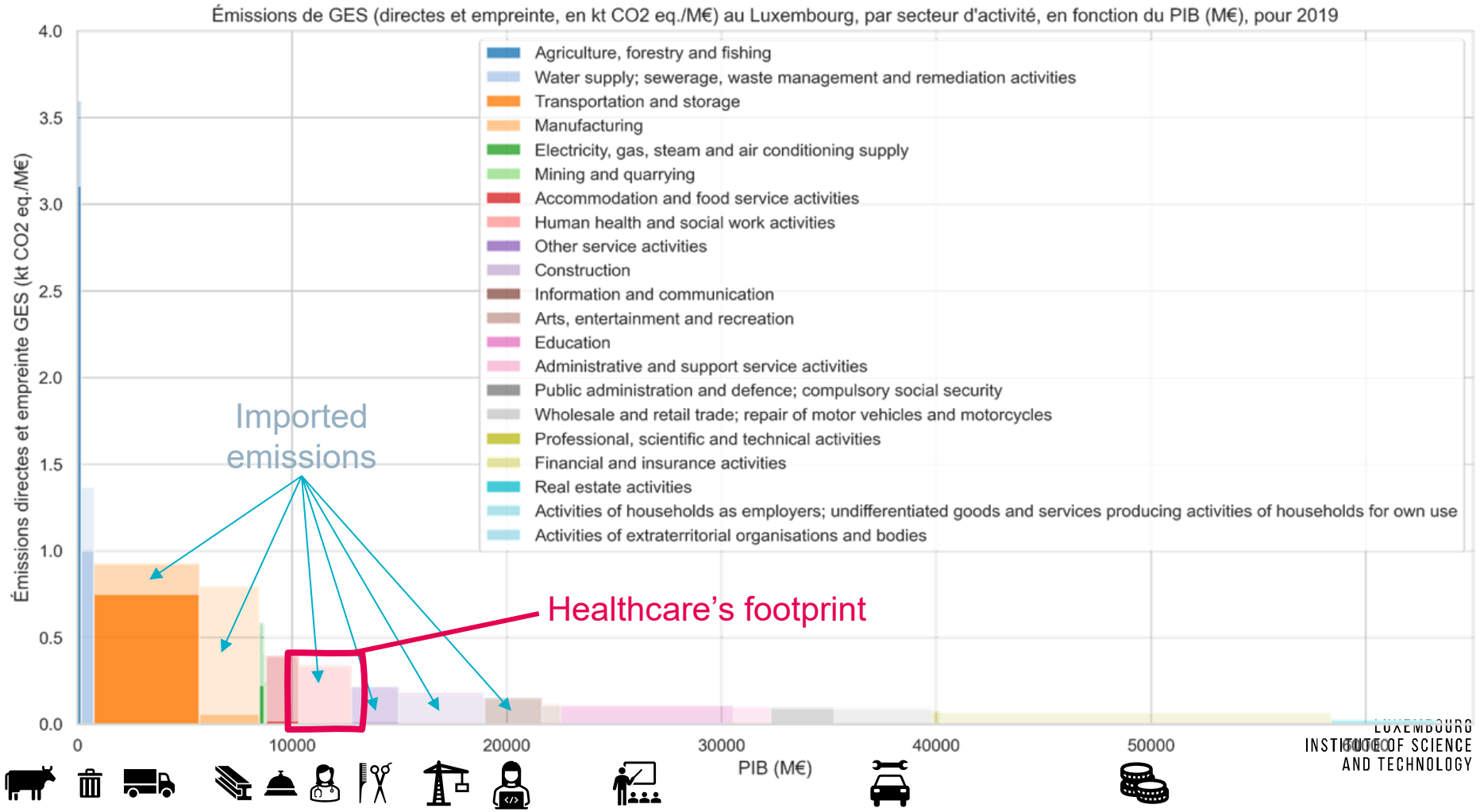
LUXEMBOURG'S GREENHOUSE GAS EMISSIONS

"Invisible" emissions



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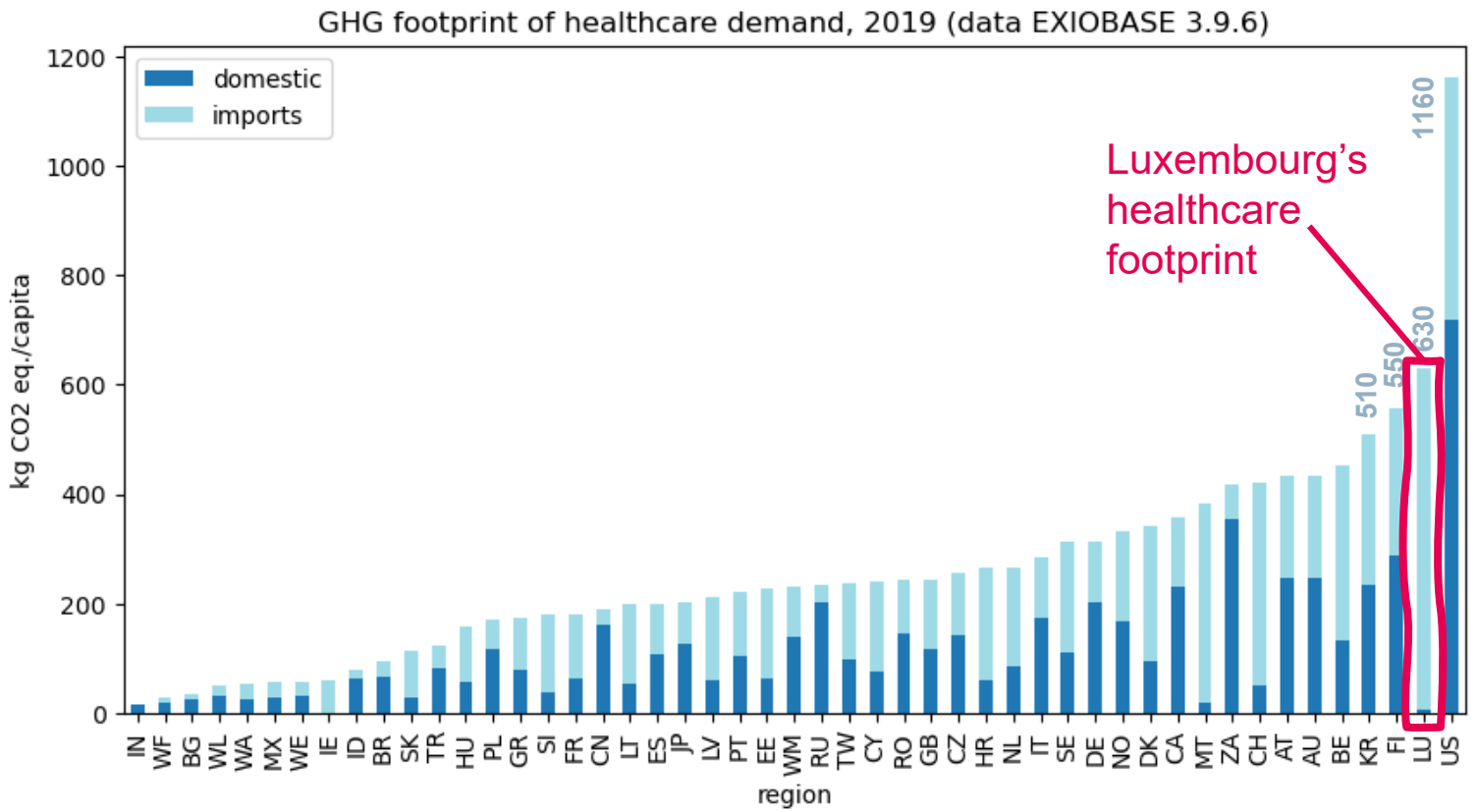
HEALTHCARE'S ENVIRONMENTAL IMPACTS GLOBALLY

Climate impacts, per capita

According to the EXIOBASE database, Luxembourg has the second-highest healthcare sector footprint in the world, with **630 kg CO_2 eq./capita**

Virtually all of this footprint is from imported products

Methodology: consumption-based environmental accounts of each country's final demand for sector "Health and social work (85)" divided by resident population



exiobase Author's calculation with EXIOBASE 3.9.6 data

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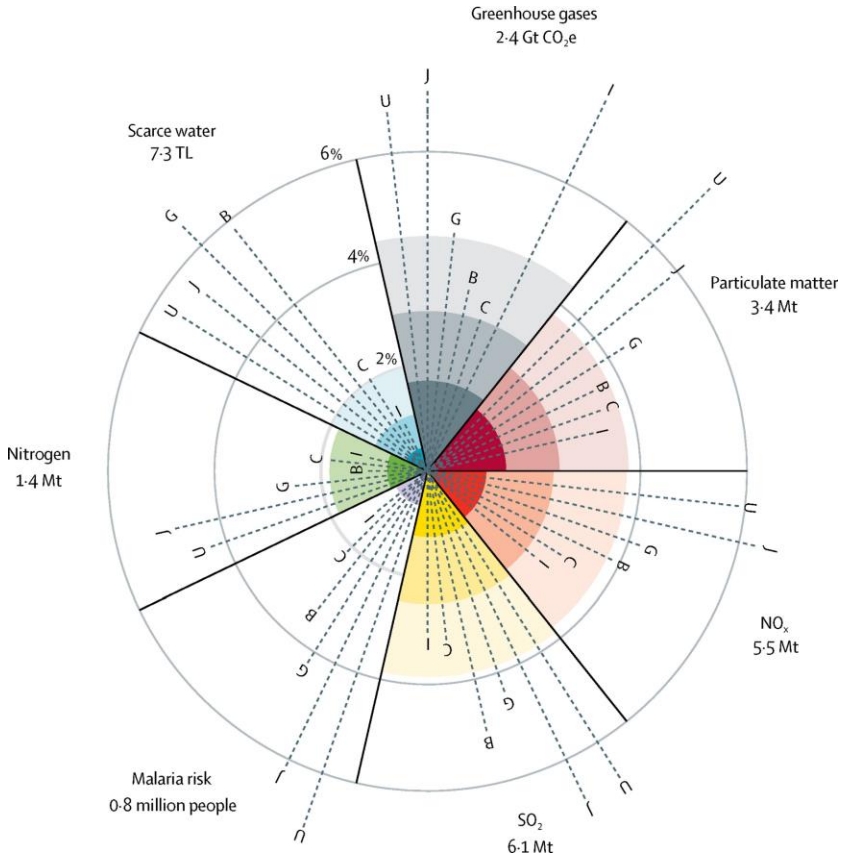
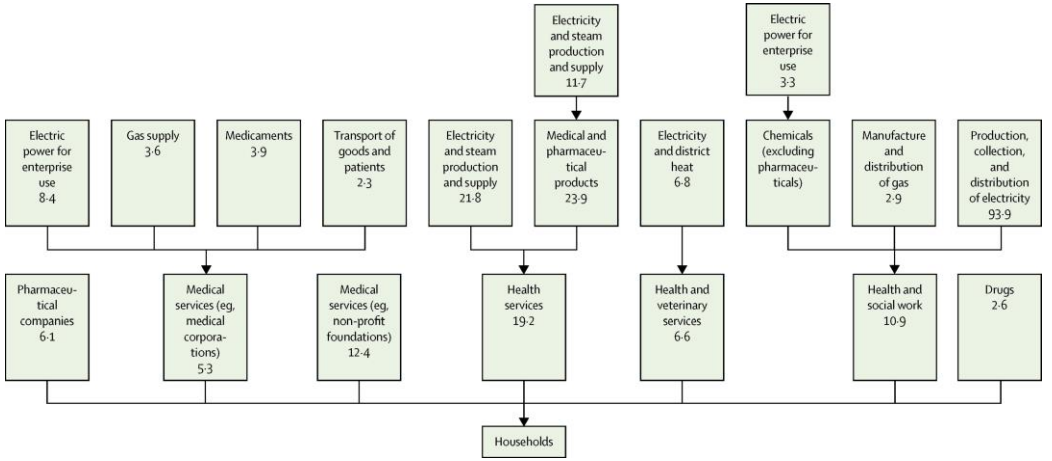
HEALTHCARE'S ENVIRONMENTAL IMPACTS GLOBALLY

Climate change

- Healthcare contributed to **2.4 Gt CO2 eq.** in 2015, about **4.5% of global emissions**



- Ultimately, energy usage contribute the most via:
  - Production of pharmaceutical products
  - Provision of health services
  - Transportation



Contribution by healthcare service supplier, globally, in %

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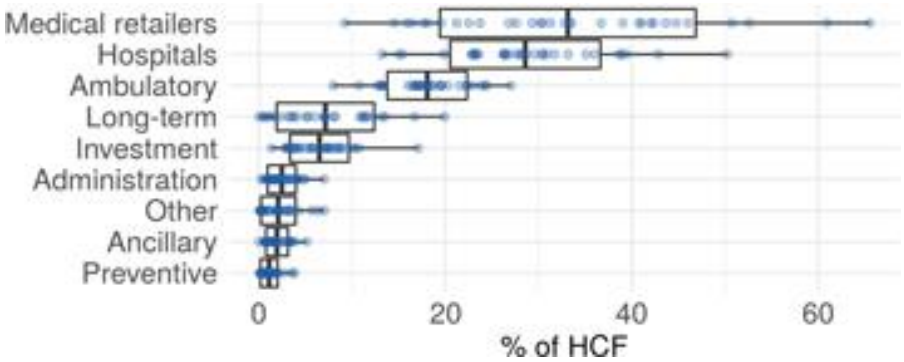
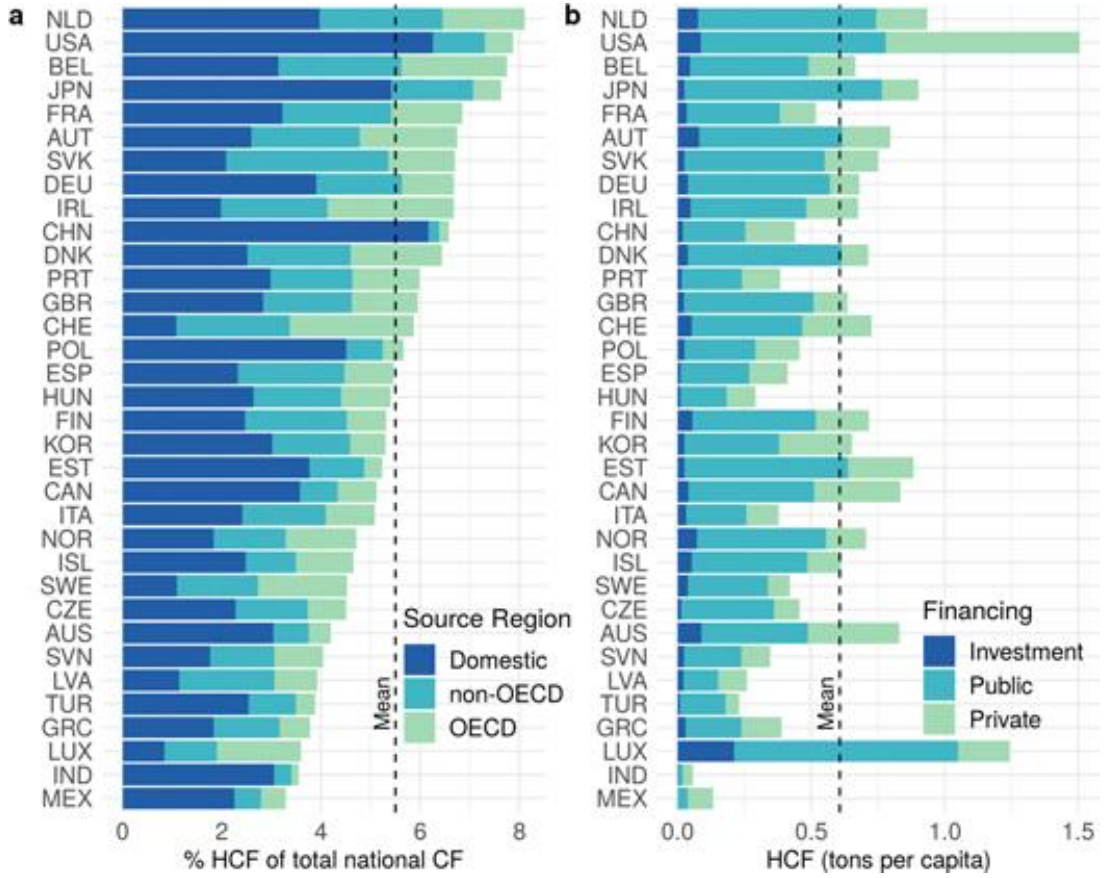
Lenzen, M., Malik, A., Li, M., Fry, J., Weisz, H., Pichler, P. P., ... & Pencheon, D. (2020). The environmental footprint of health care: a global assessment. *The Lancet Planetary Health*, *4*(7), e271-e279.

HEALTHCARE'S ENVIRONMENTAL IMPACTS GLOBALLY

Climate change

- A better mapping of healthcare sectors' expenses reveals slightly different results
- Medical retailers contribute the most, followed by hospitals, and ambulatory care (globally)





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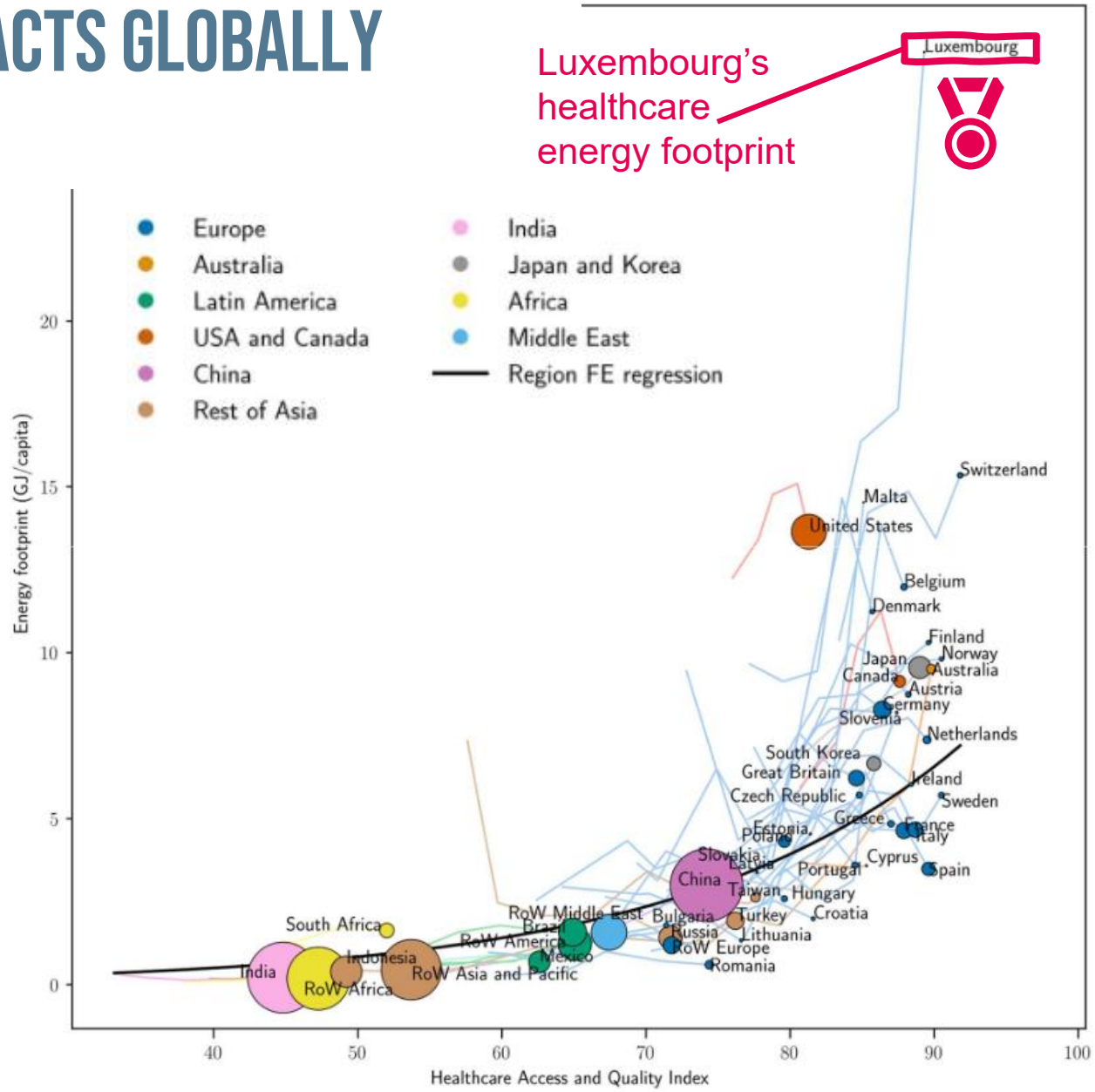
Pichler, P. P., Jaccard, I. S., Weisz, U., & Weisz, H. (2019). International comparison of health care carbon footprints. *Environmental research letters*, *14*(6), 064004.

HEALTHCARE'S ENVIRONMENTAL IMPACTS GLOBALLY

Energy footprint

The energy footprint of healthcare roughly correlates with the Healthcare and Quality index, except for a few outliers

- **USA**: low quality index for the level of energy footprint
- **Luxembourg**: can be explained by a combination of accounting approximations (small country effect, like **Malta**), use of healthcare systems by crossborder workers (possibly like **Switzerland**), and simply very high standards of living and healthcare



Andrieu, B., Marrauld, L., Vidal, O., Egnell, M., Boyer, L., & Fond, G. (2023). Health-care systems' resource footprints and their access and quality in 49 regions between 1995 and 2015: an input–output analysis. *The Lancet Planetary Health*, *7*(9), e747-e758.

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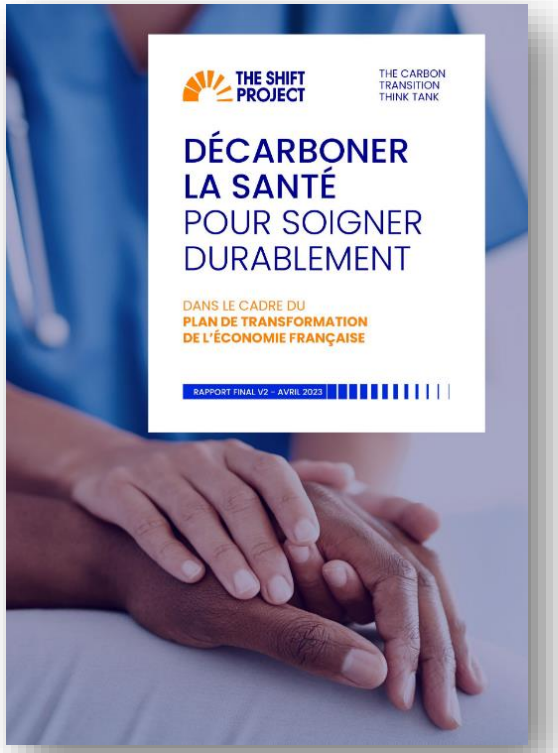
HEALTHCARE'S ENVIRONMENTAL IMPACTS GLOBALLY

A quick comparison with France

- The climate footprint of healthcare is a rather difficult value to quantify, it can vary widely by source, year, scope, accounting method…

Source	France	Luxembourg	Method
EXIOBASE 3.9.6, year 2022	**11** Mt CO_2 eq.	**0.40** Mt CO_2 eq.	Consumption-based footprint of the "Healthcare and social care" economic sector, author's calculations
	~1.9% of footprint	*~2.3%*	
FIGARO v25, year 2022	**21** Mt CO_2 eq.	**0.33** Mt CO_2 eq.	
	~3.7%	*~3.9%*	
Pichler et al. (2019), year 2014	**34** Mt CO2 eq.	**0.7** Mt CO2 eq.	OECD expenses of healthcare applied to EORA database
	~6.9%	*~3.6%*	
The Shift Project (2023), year 2021 (?)	**49** Mt CO_2 eq.	-	Fine modelling of expense categories, and of individual medicine categories + administrative expenses (social security and mutuelles)
	~8%	*8%?*	
Andrieu et al. (2025), year 2015	**24** Mt CO_2 eq.	**1.4** Mt CO_2 eq.	OECD expenses of healthcare applied to EXIOBASE database

the sector is probably **between 6.6% and 10%** of France's footprint



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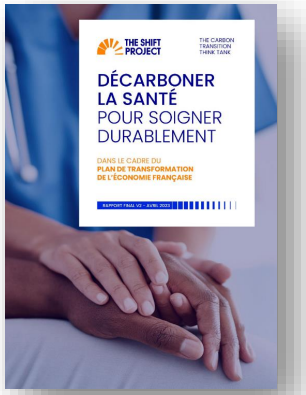
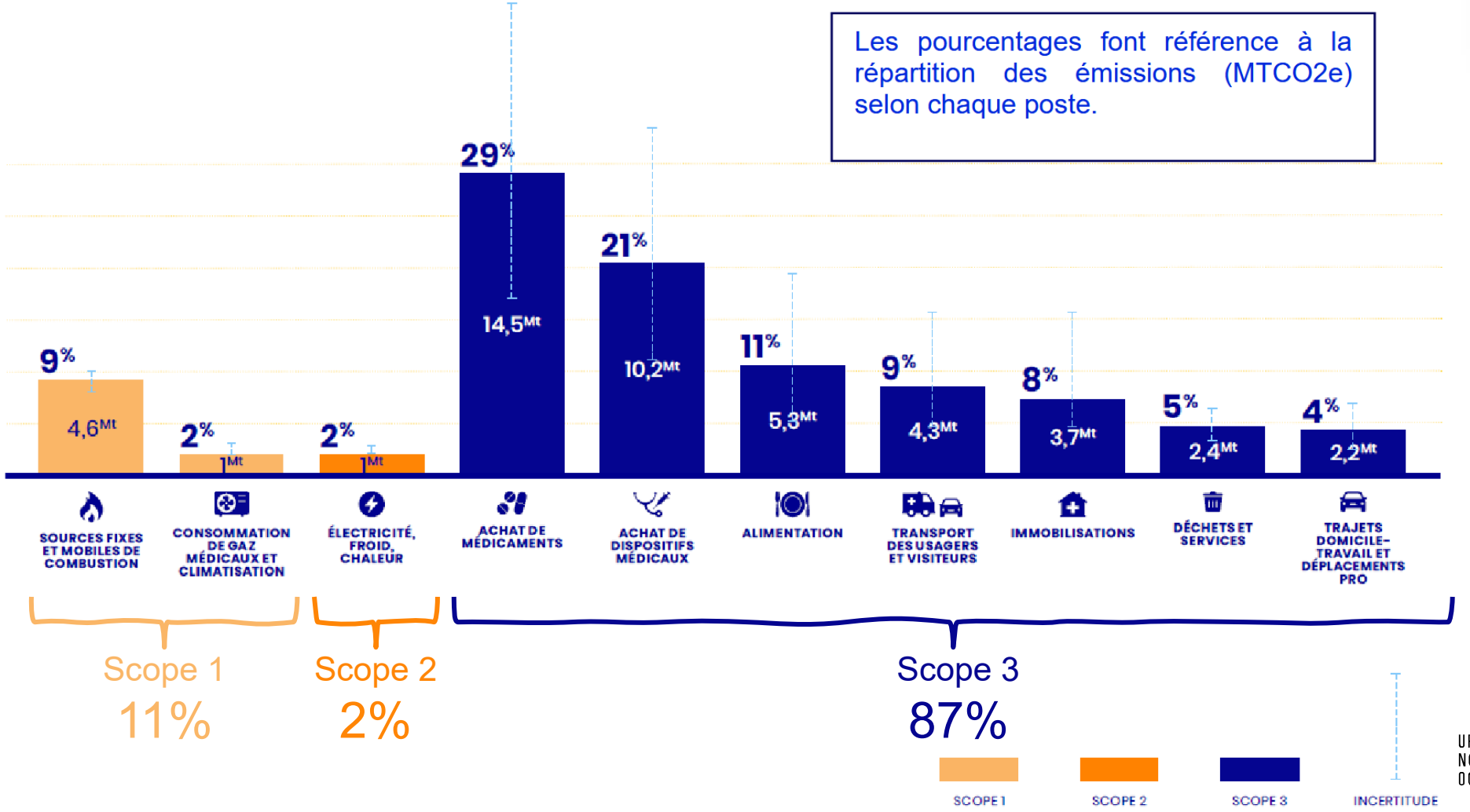
HOW DO WE DECARBONISE HEALTHCARE?

Some observations from The Shift Project



Les pourcentages font référence à la répartition des émissions (MTCO2e) selon chaque poste.



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HOW DO WE DECARBONISE HEALTHCARE?

Some observations from The Shift Project

Limited data to work with

- **Very few life cycle assessment studies of pharmaceuticals exist** – while being (most probably) the highest contribution to the sector's footprint

- **Public institutes have no obligation to include Scope 3 emissions** in their carbon footprint: no pressure on suppliers to provide such data

- Current and future healthcare professionals **have no training on climate-energy** topics despite their growing importance

500 kg CO_{2e} par k-euro en moyenne
Source : Base Carbone®
Incertitude : 50 %

TABLEAU 10.a : DÉPENSES, ÉMISSIONS ET EFFICACITÉ DE LA PRO-DUCTION DE PRODUITS PHARMACEUTIQUES PAR ORIGINE (2004)

Origine des médi-caments (2004)	Dépense (£M)	Émissions CO_2 (Mt CO_2)	Intensité Carbone (kgCO_2/£ dépensé)	Intensité Carbone (kg CO_2/k€ dépensé)[34]
UK	1,81	0,69	0,38	258
OECD Europe	3,83	1,09	0,28	190
Non-Eu-rope OECD	0,36	0,24	0,67	455
Non OECD	1,23	2,03	1,65	1 120
Total	7,23	4,05	0,56	380

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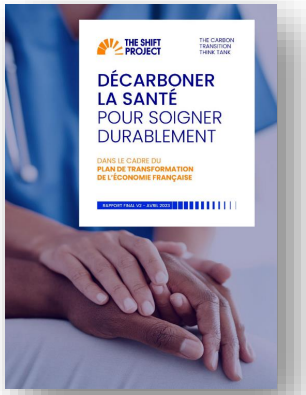
HOW DO WE DECARBONISE HEALTHCARE?



Recommendations

Measure physical flows	Make full Scope 3 reporting mandatory
Evidence-based action	Fund decarbonisation research
Train health professionals	On climate urgency and eco-design of care
Long-term thinking	Plan, anticipate, embed carbon constraints in all planning tools
Communicate progress	Valorise efforts, build momentum
Highlight cobenefits	Health, climate, and inequality reduction go together
Engage patients and the public	Health professionals as climate ambassadors

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HOW DO WE DECARBONISE HEALTHCARE?

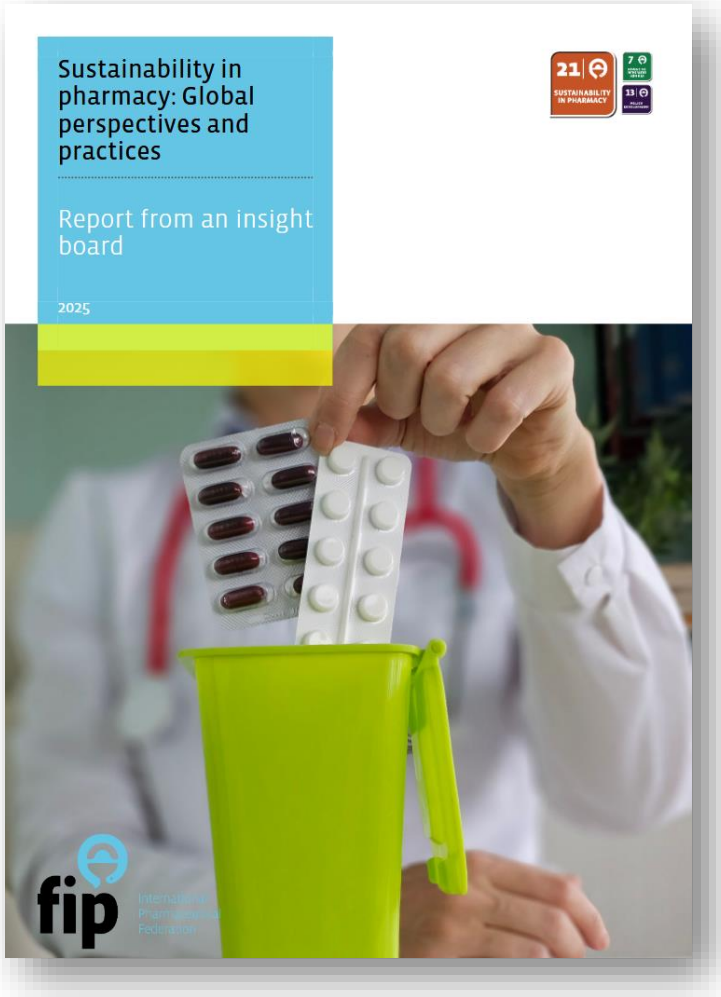
Sustainable pharmacy

Main contributions to environmental impacts in pharmacy

- Pharmaceuticals' supply chains contribute the most
- Overprescribing and inappropriate medicine use
- Disposal of unused medicines
- Packaging waste
- High-global-warming-potential inhalers and anaesthetic gases

Recommendations

1. Avoid unnecessary medicine
2. Optimise use
3. Reduce waste
4. Improve supply chains and procurement
5. Decarbonise pharmacy operations



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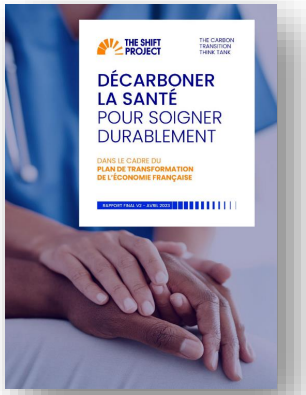
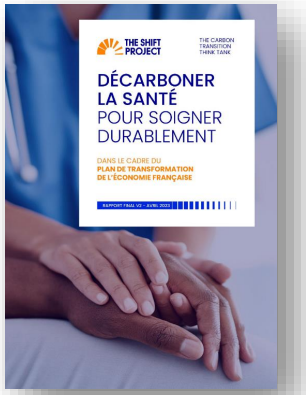
HOW DO WE DECARBONISE HEALTHCARE?



The levers, concretely

Area	Potential (France)	Examples
Buildings	-85%	Thermal renovation of hospitals; replace gas/oil heating with low-carbon sources; energy sobriety programmes
Mobility	-94%	Staff mobility plans; active travel; telemedicine; electric ambulances; limit conference travel
Food	-48%	Systematic vegetarian options; local and seasonal sourcing; reduce food waste and packaging
Pharmaceuticals	-63%	Carbon labelling tied to market authorisation; reduce unused medicines; eco-responsible procurement
Medical devices	-67%	Challenge single-use culture; promote reuse and recycling; carbon content tied to CE marking
Medical gases	-75%	Ban high-GWP anaesthetic gases; switch to dry-powder inhalers

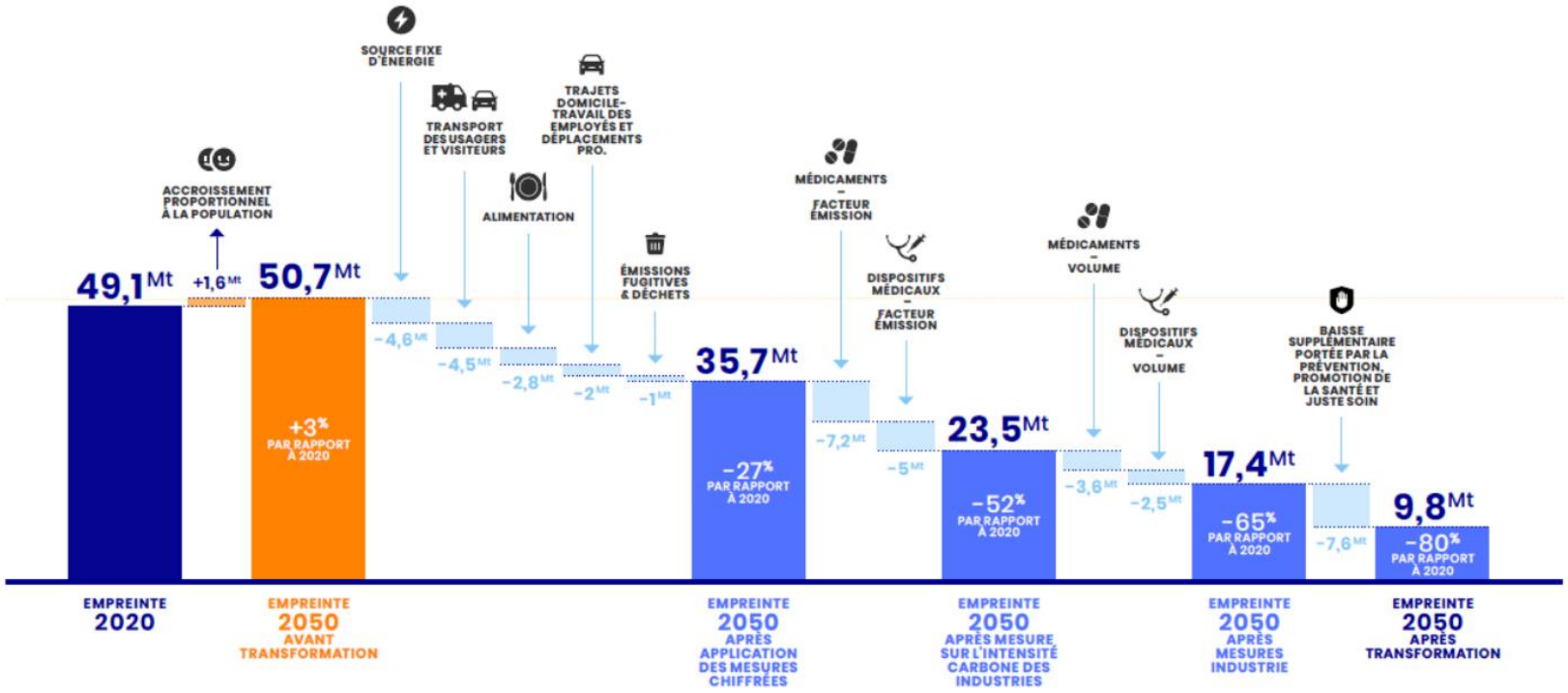
HOW DO WE DECARBONISE HEALTHCARE?



Émissions de GES du secteur de la santé en 2050 après transformation

incluant la prévention, la promotion de la santé et le juste soin

THE SHIFT PROJECT



Source : calculs The Shift Project 2023

Scénario avec réduction du facteur d'émissions des médicaments et des dispositifs médicaux (DM) de 60%. Cela signifie que pour produire une unité de médicaments ou de DM, l'industrie émet 60% de GES en moins.

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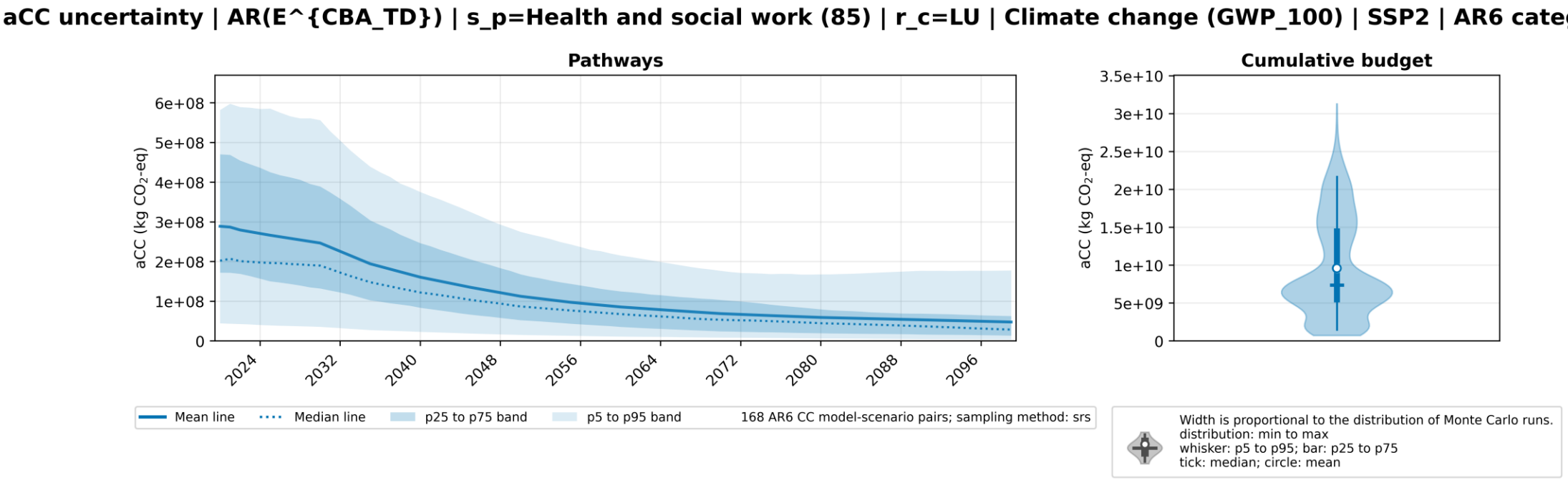
HOW DO WE DECARBONISE HEALTHCARE?

…and how fast?

Applying absolute environmental sustainability assessment (AESA), following 2°C decarbonization pathway, for Luxembourg



Calculations Gonzalo Puig-Samper Naranjo, LIST

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DISCUSSION

Towards a low-carbon and climate resilient health system in Luxembourg

Procurement contributing the most to climate impacts

- Pharmaceutical companies need more environmental scrutiny,
- Mandate carbon labelling of medicine?
- Is a green procurement policy possible today?
- Is there a potential in unused medicine?
- More efficient medicine: prescribe appropriately and avoid unused medication (parallel with food waste?)
- How do we systematically include sustainability in the training of healthcare professionals?

Beyond climate and healthcare only

- The “climate tunnel” effect: all planetary boundaries should be assessed instead of just GHGs,, e.g. biodiversity, water footprint, novel entities (microplastic and PFA pollution)
- Expand to preventive medicine, promote healthy diets (high-meat diet are detrimental both for health and climate), exercise, etc.