- **Travel Carbon Project: Towards Net Zero Carbon emissions and Tackling Poverty and Health Inequalities**

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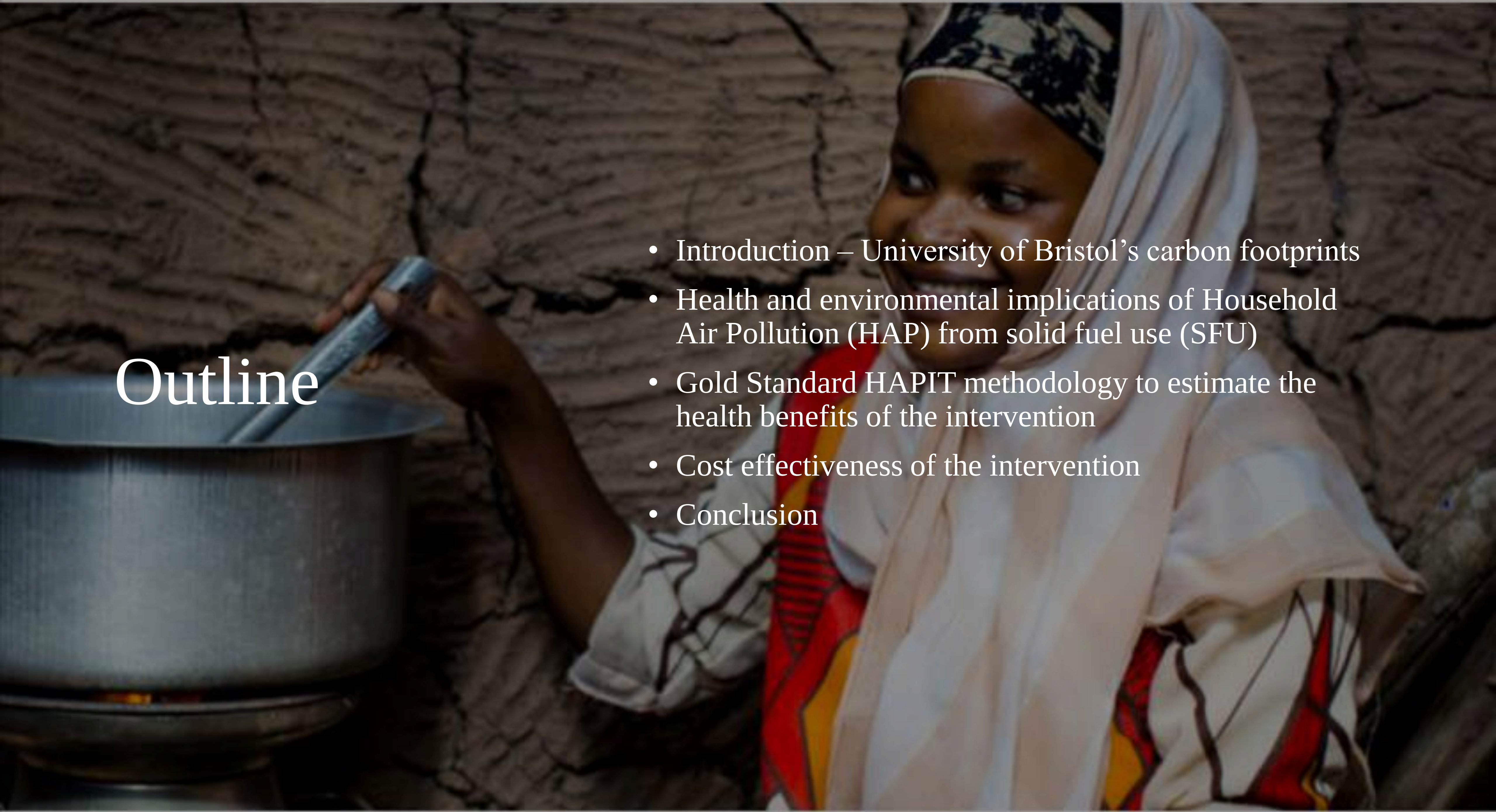


Outline

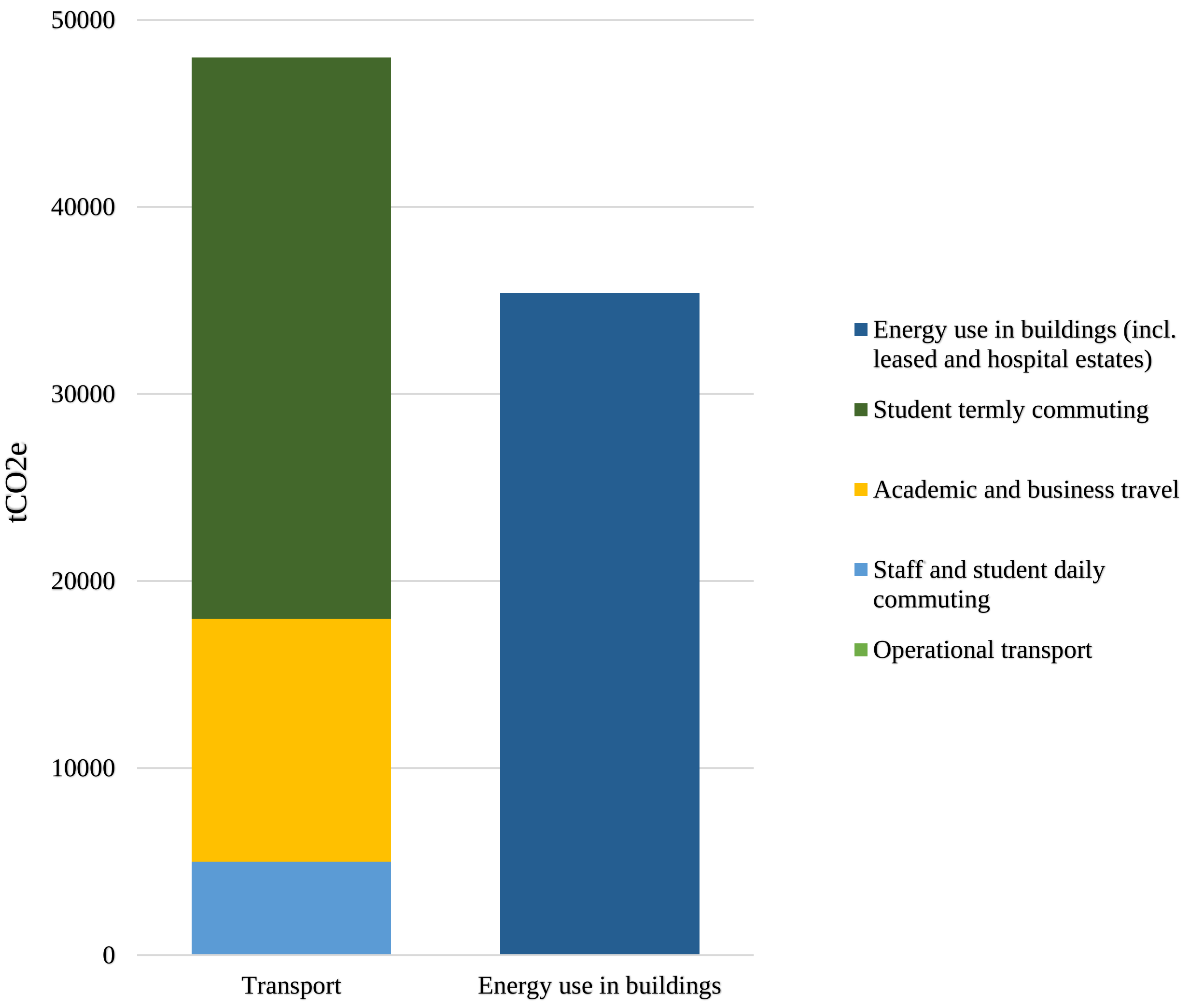
- Introduction – University of Bristol’s carbon footprints
- Health and environmental implications of Household Air Pollution (HAP) from solid fuel use (SFU)
- Gold Standard HAPIT methodology to estimate the health benefits of the intervention
- Cost effectiveness of the intervention
- Conclusion

University of Bristol’s Net-Zero carbon target

- Clean air is vital to population health and the environment.
- The UoB adopted a carbon-neutral position in 2015, which has since then remained a centre of its operation
- Mitigative measures have led to a 38% reduction of tonnes of CO_2 equivalent (tCO_2e) between 2007 and 2018 from University buildings.
- Despite such progress, it would be impossible to attain the Net –Zero targets by 2030 at this rate of reduction, given that a 90% reduction of carbon emissions is required over ten years

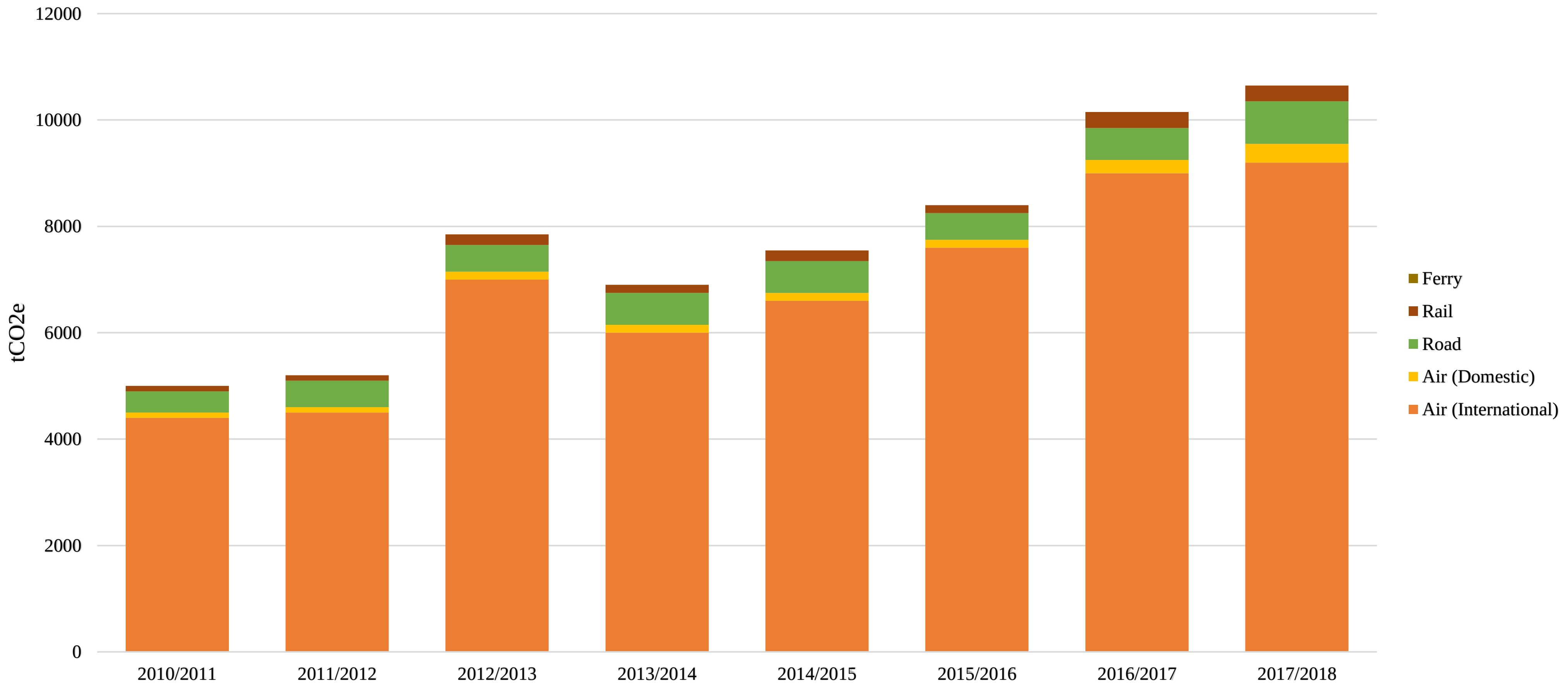
Scope three emission objectives

Reduce carbon emissions from activities associated with the university's supply chain, construction, and business travel.

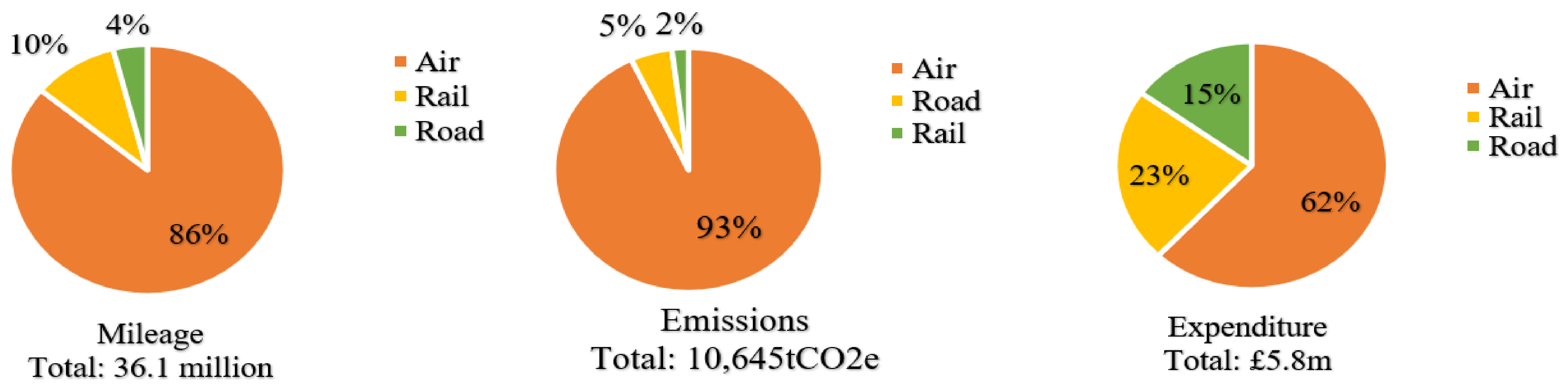


UoB sources of CO_2 emissions

International air travel made up the bulk of the university's carbon travel emissions compared with emissions from road and rail travel and have been rising since 2010



Trends in travel-related carbon emissions (Source: UoB 2018)



Business travel, mileage and expenses incurred in 2017/2018 (UoB 2019)

Estimates further show that air travel constitutes the bulk of the total mileage (86%), accounting for approximately 93% of tCO_2e released into the environment, which costs the University 62% of the total travel expenses (£5.8 million).

Offsetting carbon emissions

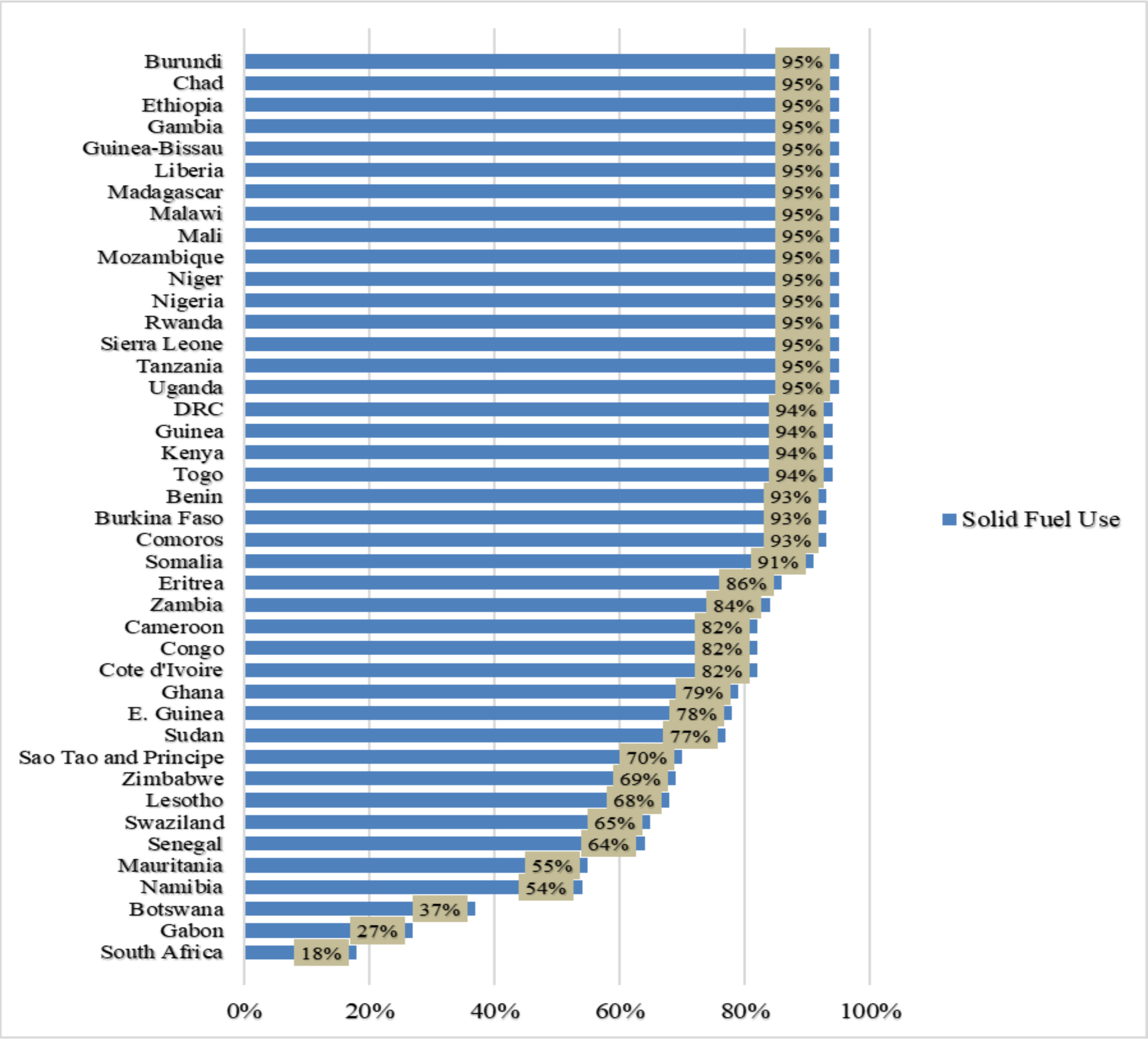
- Part of the UoB’s sustainability plan aims to reduce all forms of transport-related carbon emissions to Net Zero emissions by 2030.
- One pathway is through a Gold Standard project in a low- and middle-income country.
- We propose using improved cooking stoves (ICS) to offset the UoB’s carbon footprints

Gold Standard project

- Three billion people rely on solid fuel use (wood, charcoal, crop residues and dung) for cooking.

- Africa and Southeast Asia constitute the overall burden of SFU.

- Their usage is exacerbated by increasing population growth, poverty and the rising inequalities in the continent.



Proportion of Solid Fuel Use by African states in 2013 (Source: HAPIT model)

Health and environmental impacts of SFU

- The most common pollutant from SFU is $PM_{2.5}$, detrimental to children and adult health.

- The 2010 Global Burden of Disease study revealed SFU was a significant risk factor associated with acute child respiratory infections and chronic adult diseases including ischaemic heart disease, stroke, and lung etc.

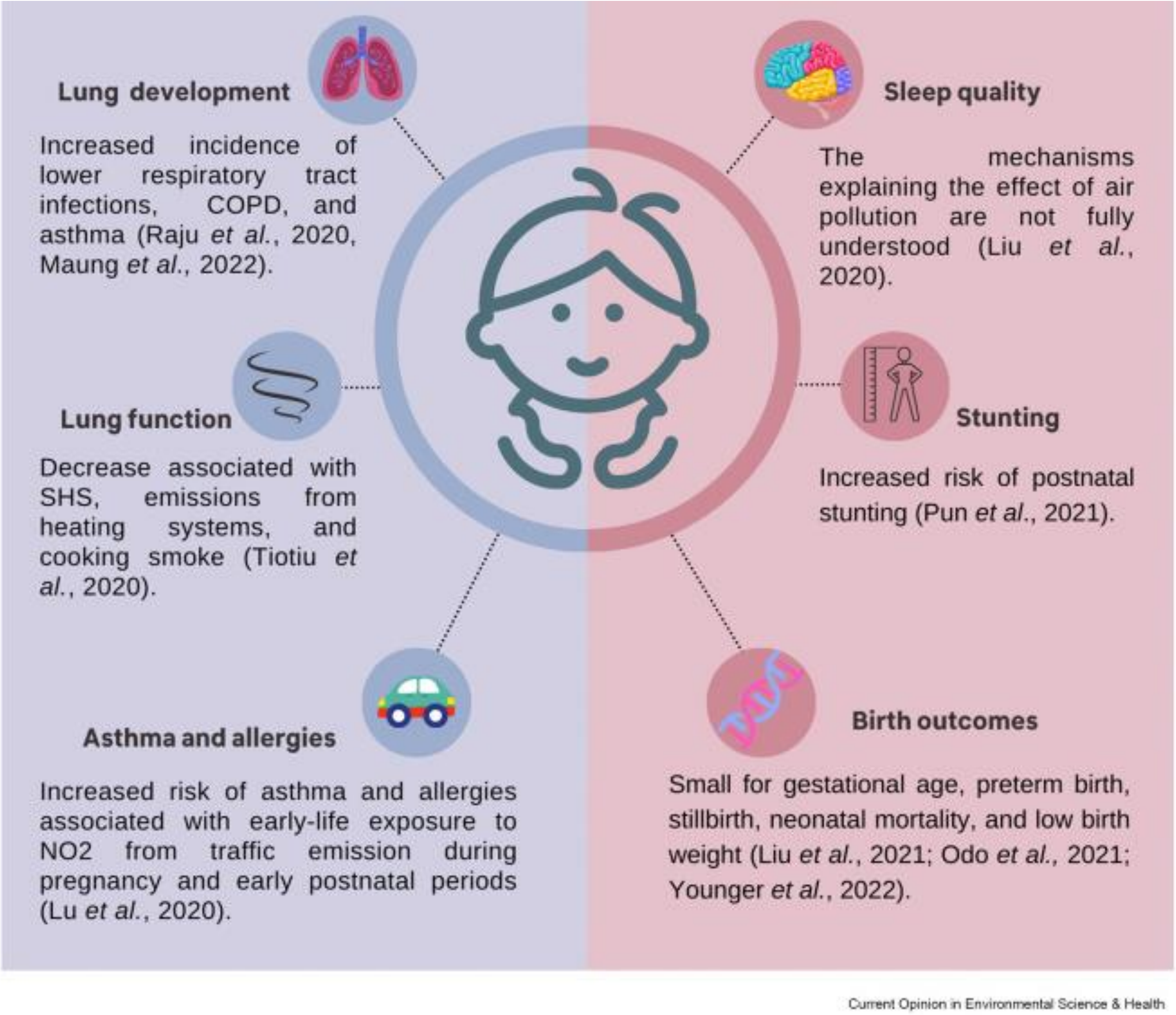


Figure 4. Health impacts of $PM_{2.5}$ exposure (Nardocci et al. 2023)

Objectives

- To estimate how much it will cost to offset carbon emissions from work-related air travel, which could be written into a grant application.

- Estimate the health benefits of the intervention by estimating the years of life saved from ill health or death

- Calculate the cost-effectiveness of the intervention.

Traditional three-stone fireplace

Improved cooking stoves

Success stories from Gold standard projects

32,625 ICS were distributed in Zambia and about 60000 in Rwanda

Project beneficiaries reported a reduction in smoke production.

Reduced cooking time and more time dedicated to other productive activities, such as schooling or economic activities

Less wood consumption and tonnes of carbon saved

Improved cook stove (ICS) for Zambia

Canarumwe ICS for Rwanda

Gold standard methodology

The Gold standard methodology calculates the health benefits (averted Disability-adjusted life years and averted death) associated with minimal exposure to $PM_{2.5.}$

We use an internet-based household air pollution intervention toolkit (HAPIT model) to input background data in a related country so as to estimate lives saved with such minimal exposure to air pollutants.

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HAPIT model assumptions

25000 HH sampled; at least 50% of HH use the intervention within a one-year period.

At least five adults and a child in a household.

Pre-exposure $PM_{2.5}$ was set at 285ug/m^3 and post-exposure $PM_{2.5}$ was set at 140ug/m^3.

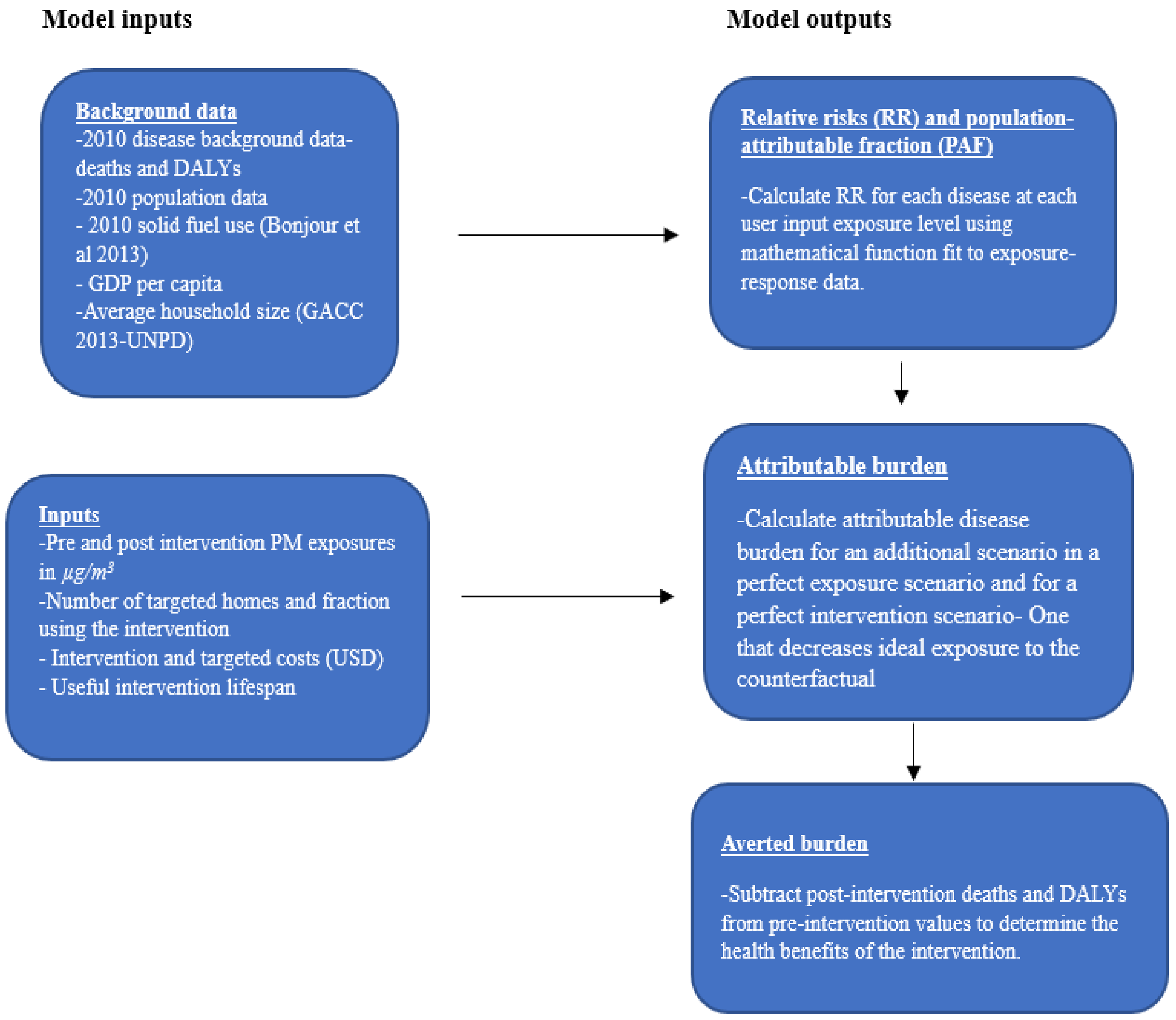


Figure 6. Averted ill health using the HAPIT model (Sourced from Pillarisetti et

Estimates

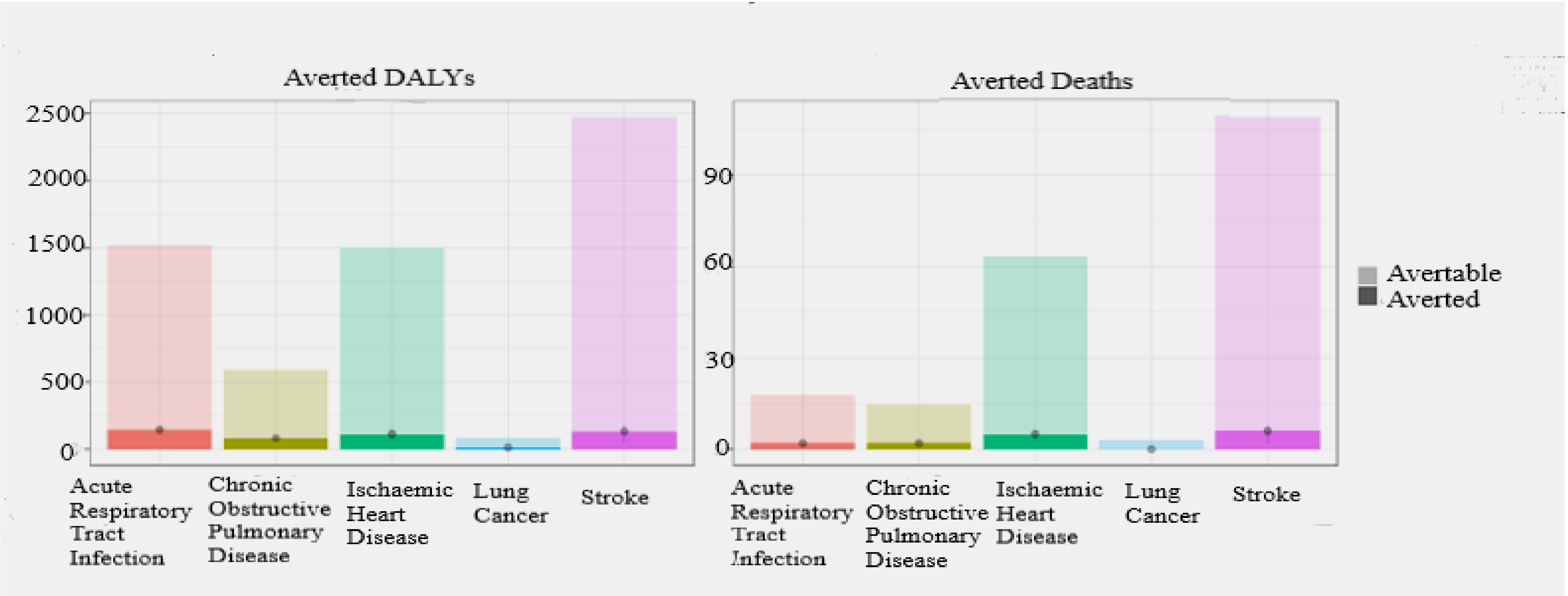
- The Gold Standard project assumes a baseline cost for offsetting carbon using a clean cooking stove of $14/tonne. So, each improved cooking stove saves 1tCO2e.

- The cost of an improved cooking stove ranged between $4-11 (based on literature. We rounded this figure to $14 to give any extra cost in case of inflation.

- Considering the university’s travel carbon emissions in 2018/2019 were estimated as 13000 tCO2e, offsetting carbon through a Gold standard project would require =14x13000= $182,000.

- The University of Bristol would need to spend $182000 to purchase 13000 improved cooking stoves in a developing country.

Averted DALYS and Deaths to disease



Averted ill health due to improved cooking stove use in Benin.

Averted disease burden

Countries	Averted child DALYs	Averted adult DALYs	Total averted DALYs
Gabon	328	1325	1653
South Africa	183	1073	1256
Lesotho	262	816	1078
Eswatini	283	741	1024
Sudan	133	817	950
Chad	726	206	932
DRC	488	406	894
G. Bissau	371	511	882
Cote d'Ivoire	406	453	859
Mali	520	316	836
Sierra Leone	461	369	830
Somalia	540	286	826
Congo	193	597	790
Mauritania	299	466	765
Madagascar	173	584	757
Guinea	373	379	752
Cameroon	380	364	744
E. Guinea	307	435	742
Namibia	78	652	730
Niger	482	232	714
ST and Principe	112	529	641
Burkina Faso	413	194	607
Average	341	534	876

Countries	Averted child deaths	Averted adult deaths	Total averted deaths
Gabon	4	65	69
South Africa	2	54	56
Lesotho	3	34	37
Sudan	1	33	34
Eswatini	3	30	33
Namibia	1	27	28
Congo	2	24	26
Madagascar	2	23	25
S T and Principe	1	22	23
G. Bissau	4	19	23
Cote d'Ivoire	5	17	22
DRC	6	15	21
E. Guinea	4	16	20
Cameroon	5	15	20
Ghana	2	17	19
Guinea	4	15	19
Mali	6	12	18
Senegal	2	15	17
Sierra Leone	5	12	17
Somalia	6	11	17
Chad	9	8	17
Zimbabwe	2	14	16
Average	4	23	26

Spending $182000 could save on average, 876 years of life lost to disease and 26 deaths in SSA over a period of one year.

Intervention cost

$$Cost\ per\ DALY = \frac{Total\ intervention\ cost}{Total\ averted\ DALYs}$$

Average cost per year of life saved across SSA= $218

Table 1. Lives saved by using an improved basic clean cooking stove

COUNTRIES	AVERTED DISEASE BURDEN	INTERVENTION COST EFFECTIVENESS
Gabon	1653	$110
South Africa	1256	$145
Lesotho	1078	$169
Swaziland	1024	$178
Sudan	950	$192
Chad	932	$195
DRC	894	$204
Guinea-Bissau	882	$206
Cote d'Ivoire	859	$212
Mali	836	$218
Sierra Leone	830	$219
Somalia	826	$220
Congo	790	$230
Mauritania	765	$238
Madagascar	757	$240
Guinea	752	$242
Cameroon	744	$245
E. Guinea	742	$245
Namibia	730	$249
Niger	714	$255
Sao Tao and Principe	641	$284
Burkina Faso	607	$300
Average	876	$218

Conclusion

- Supplying ICS to a LIC/LMIC can save on average 856 years of life and 26 deaths lost to disease over a one-year period
- Save 13000 tonnes of CO_2 equivalent
- Save 17000 tons of fuel wood consumption and thus reduce deforestation

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