Appendix D

This is an appendix of the report

'Fuelling the Transition'

from Prayas (Energy Group) and

Prayas (Health Group) available at

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आरोग्य, ऊर्जा, शिक्षण आणि पालकत्व
या विषयांतील विशेष प्रयत्न

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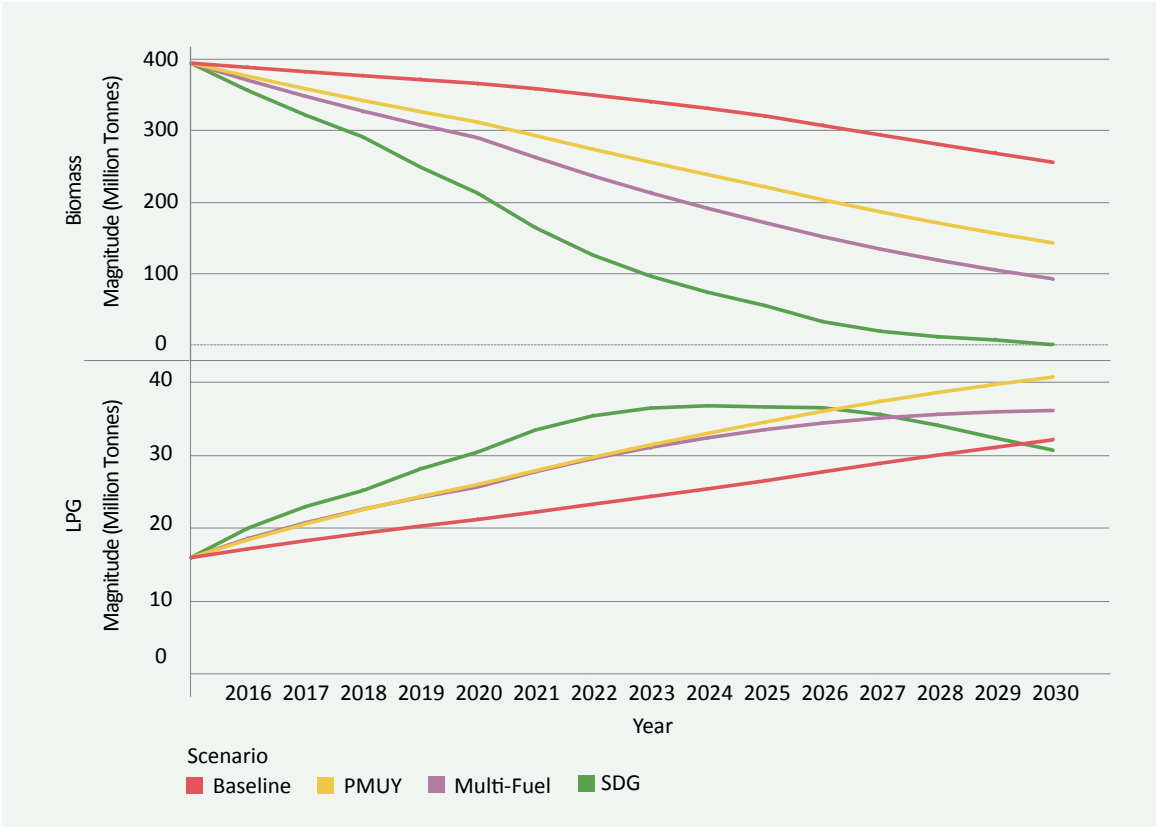
Appendix D: Additional Analysis Findings

D.1 Fuel Demand

Focusing initially on the two most important fuels in the country, biomass and LPG, the quantity of biomass required reduces drastically across all scenarios and reaches zero in the SDG scenario, while the quantity of LPG increases significantly across scenarios. As we can see from Figure 1, biomass usage reduces by 35% between 2015 and 2030 even in the Baseline scenario while it reduces by 64% and 77% respectively in the PMUY and Multi-fuel scenarios respectively. It is primarily this reduction that yields the health (and gender) benefits from the fuel transition. Interestingly, the amount of biomass that is purchased increases in the Baseline scenario from 2015 to 2030 because of increasingly scarce availability of biomass. In the PMUY and Multi-fuel scenarios, since overall usage of biomass itself reduces much more drastically, the amount purchased also reduces.

Figure 1: Magnitude of Biomass and LPG



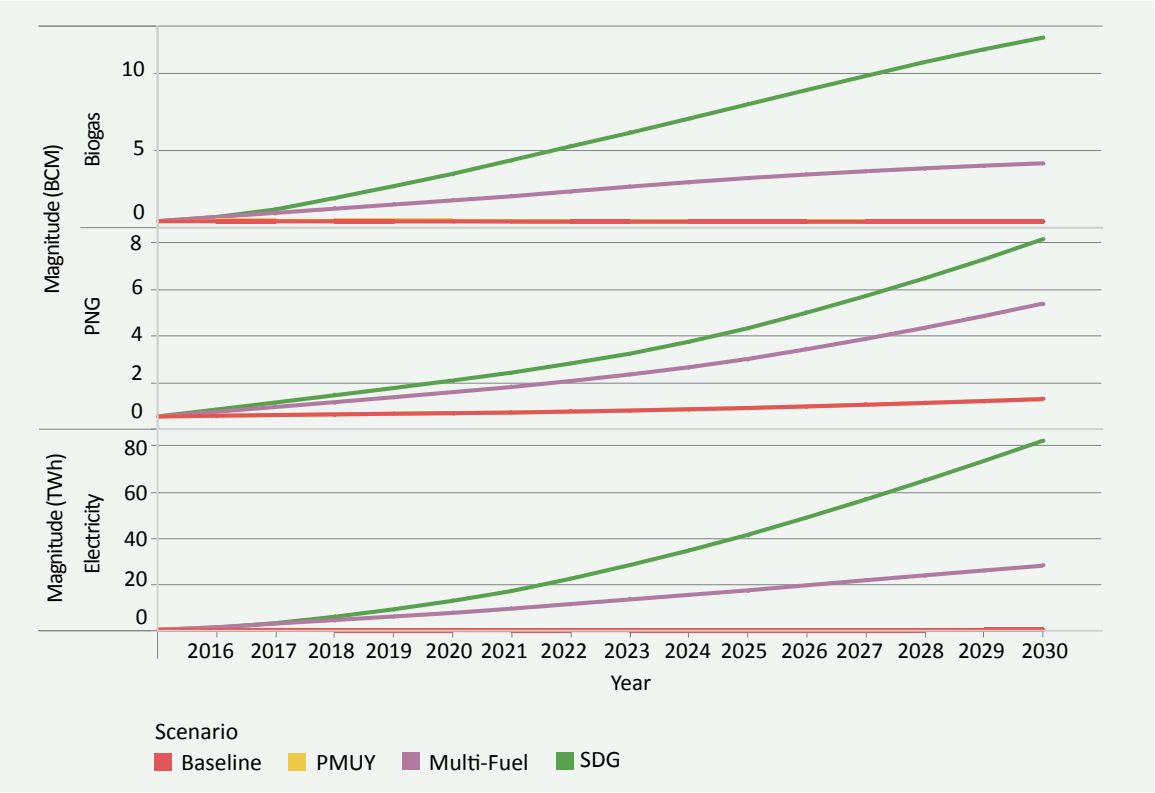
Not surprisingly, it is the PMUY scenario that sees the highest annual use of LPG in 2030. However, as shown in Figure 2, it is interesting to note that aggregated over the 16 years of the analysis period, the most LPG is consumed in the SDG scenario (491 MT as against 477 MT in the PMUY scenario). This is because, in the SDG scenario, there is an aggressive shift to LPG in the initial years followed by a shift away to other modern fuels as they become available and affordable.

Figure 2: Aggregate LPG demand (2015-30) across scenarios

Among the other modern fuels, the usage of PNG and biogas for cooking increases in the Multi-Fuel and SDG scenarios respectively, both of which prioritise the fuel. In the SDG scenario, backed by strong policy support and investments in technological improvements to reduce costs and increase efficiency, biogas used increases sharply to 12.3 BCM in 2030. According to (Bond and Templeton 2011), producing 12.3 BCM of biogas in the country requires about 110 million to 130 million bovines, which is less than half the number of bovines in rural India as per the 2012 livestock census (DAHD 2014)[1]. Therefore, production of this quantity of biogas seems eminently feasible. The large increase of PNG in the SDG scenario in particular is likely to necessitate import of PNG, either in the form of LNG or through pipelines from neighbouring countries which are likely to have been completed by around the mid-2020s. This is not a major challenge given the overall imports of natural gas, particularly if a sizeable part of this can be sourced from pipelines. Figure 3 shows the magnitude of biogas, PNG and electricity in all the scenarios.

1. There are no projections available for likely bovine population in 2030, hence the comparison with 2012 bovine population.

Figure 3: Magnitude of Biogas, PNG and Electricity in all scenarios

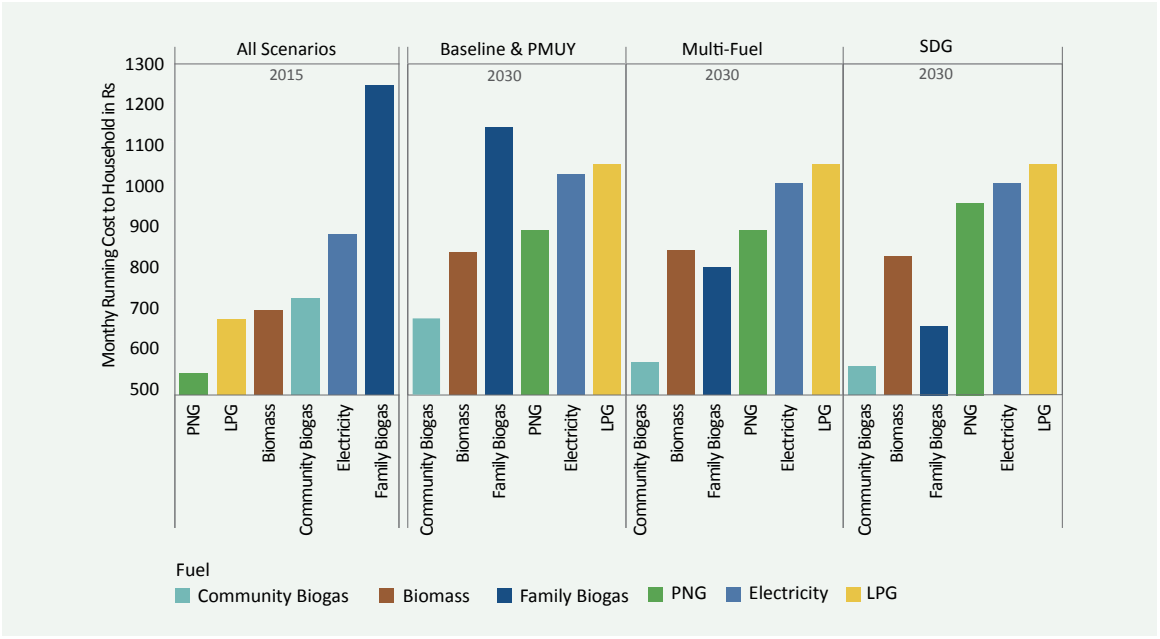


Note: The curves for Baseline and PMUY overlap with each other as the magnitude of electricity, PNG and biogas is almost the same in these scenarios

D.2 Costs

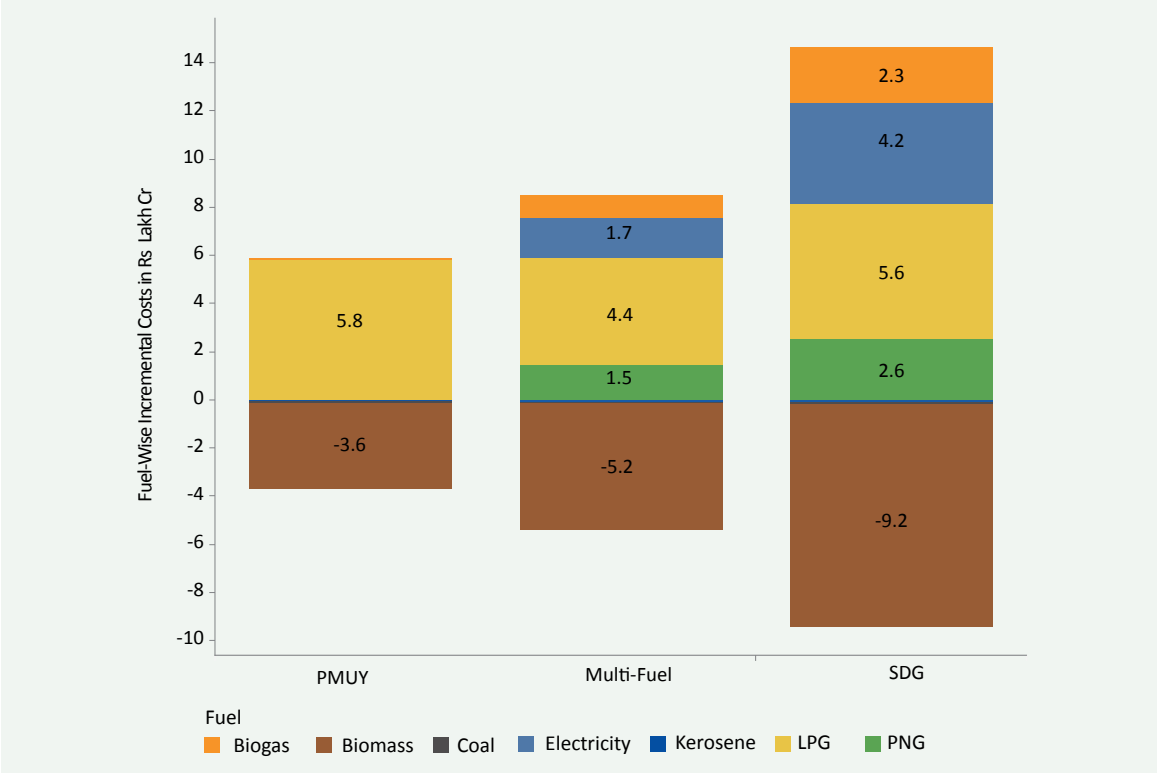
Figure 4 shows the monthly running costs to an average household for different fuels based on the prices of these fuels in 2015 and 2030. Biomass here stands for purchased biomass. These costs are one of the drivers for switching to different modern fuels, as it is the running costs that constitute the majority of the total cooking related costs to the household. The price of non-LPG modern fuels changes relative to LPG across time and scenarios. Since additional demand for LPG is likely to be imported and given likely trends of oil prices as compared to gas and electricity prices, LPG becomes costlier compared to other fuels such as PNG, electricity and biogas. While PNG is cheaper than LPG in all years, biogas and electricity become cheaper in later years. Fuelled by economies of scale, bulk procurement of dung by families and communities using biogas, and technological improvements, biogas becomes especially affordable in the Multi-fuel and SDG scenarios, and community sized plants become cheaper than even purchased biomass.

Figure 4: Running cost to the average household of different fuels



Although the household expenditure on modern fuels for cooking in 2030 seems substantial and more than traditional fuels, it is important to note that expenditure on purchased biomass is also significant. In urban areas particularly, traditional fuels are almost as expensive as modern fuels throughout the 2019–30 period since many households purchase biomass which is not easily available and costs are more than rural areas. Thus affordability is not a major hurdle for these households, and the remaining urban households can transition to modern fuels if they are made easily accessible. But for the others, appropriate subsidies on modern fuels will be necessary to make them affordable. The cooking fuel expenditure of an average modern fuel using household formed 4% of the per capita GDP in 2030 in the Multi-Fuel scenario. As a comparison, it was 8% in 2015.

Figure 5: Aggregate (2019–30) fuel-wise incremental costs across scenarios

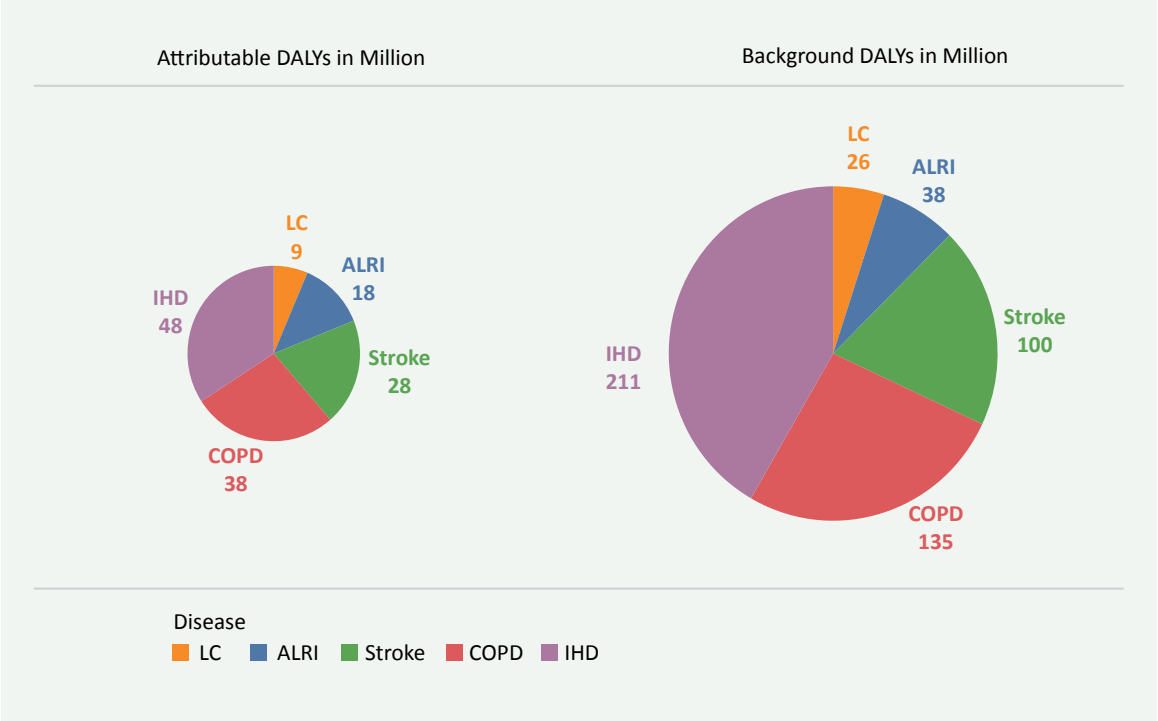


The bulk of the incremental cost of all intervention scenarios is due to LPG as it continues to be the most used modern fuel even in the SDG scenario (see Figure 5). Close behind is electricity in the SDG scenario, as it emerges as a cooking fuel for both rural and urban areas. Since the use of traditional fuels reduces from the Baseline to SDG scenario, this results in cost savings to the tune of Rs. 9.2 lakh crore over 12 years (2019–30) —offsetting more than the increased cost due to LPG and PNG. In the PMUY and Multi-fuel scenarios, reduced use of biomass offsets about 62% and 88% of increased LPG and PNG costs respectively.

D.3 Disease specific analysis

Aggregated over 2019–30, IHD, stroke, COPD, LC and ALRI contributed to 510 million background DALYs with the distribution of the diseases as shown in Figure 6 (WHO 2008). Of the 140 million DALYs attributable to HAP in the Baseline scenario, the disease-wise attribution was as shown in Figure 6. Thus, cardiovascular diseases (IHD and stroke) contributed to more than half of the HAP related disease burden, while COPD contributed 27% and ALRI contributed 12% of the total HAP related disease burden attributable to these five diseases.

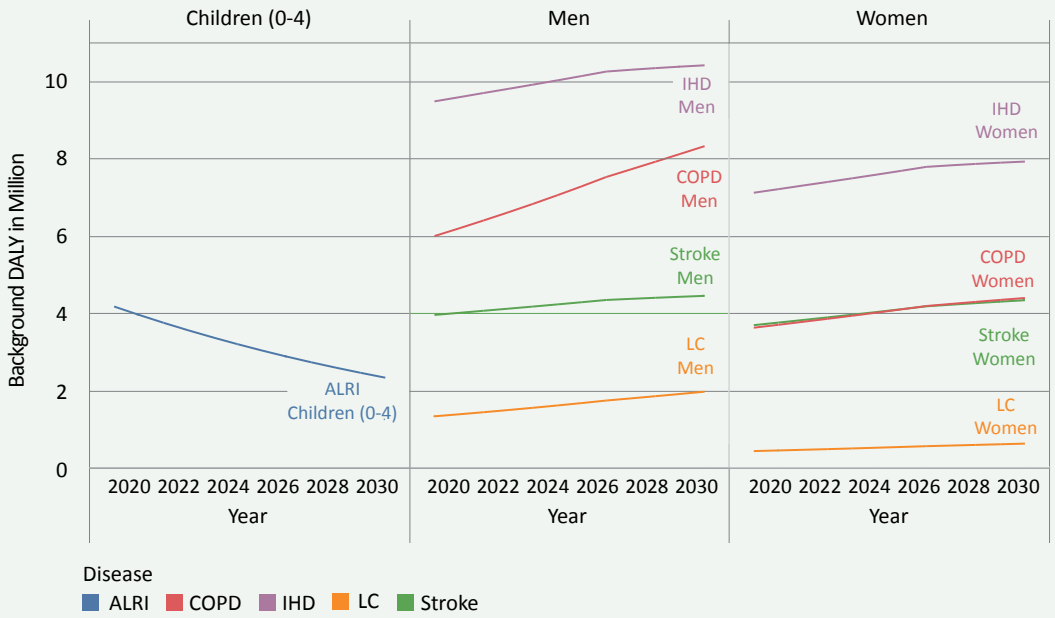
Figure 6: DALYs from 2019–30 due to various diseases considered



Examining the role of HAP in various diseases aggregated over the 2019–30 period, out of the total burden of ALRI, 47% was attributable to HAP. This proportion was 35%, 28%, 28% and 23% for LC, stroke, COPD and IHD respectively.[2] The reduction in DALYs for different diseases across scenarios is related to the pattern of change in the background disease burden. Except for ALRI, the background disease burden is estimated to increase from 2015 to 2030 for all diseases among both men and women as shown in Figure 7.

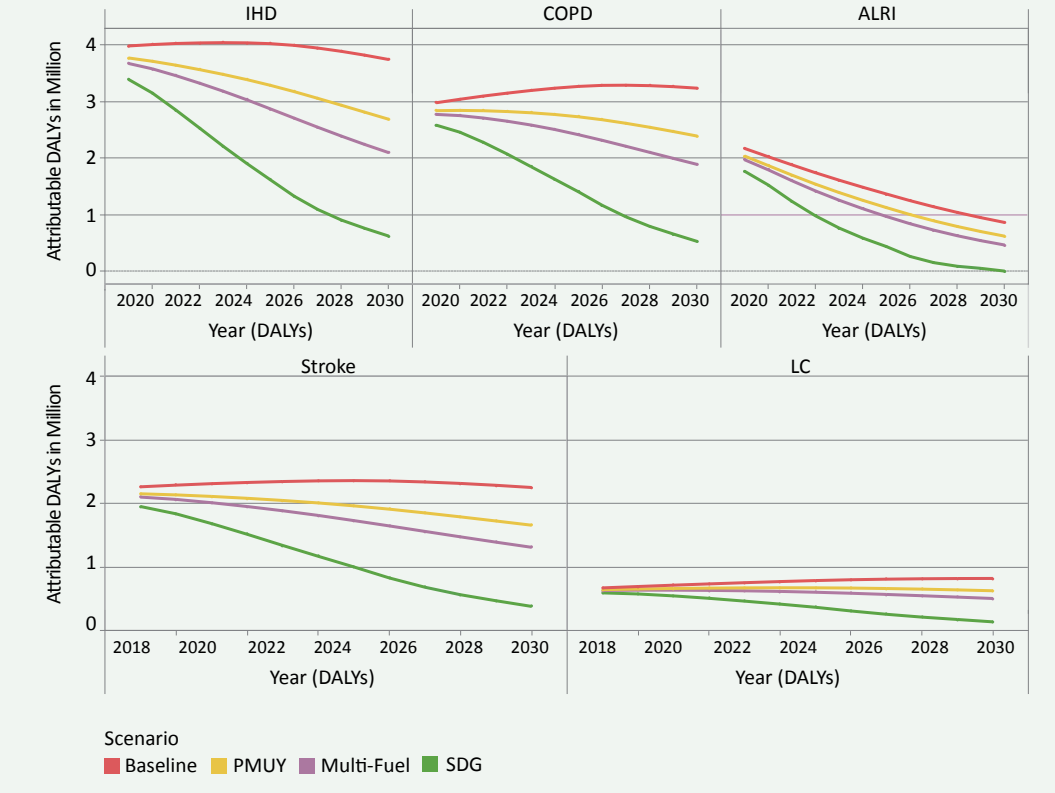
2. These numbers may not match those reported by (IHME 2017) since the numbers used in the analysis are based on the global burden of disease projections by the World Health Organisation (WHO).

Figure 7: Background DALYs of various diseases



The attributable DALYs for ALRI significantly reduce even in the Baseline scenario because of the rapid reduction in the background DALYs itself. However, there is no significant change in the attributable DALYs of the other diseases in the Baseline scenario as their background DALYs are estimated to increase while their HAP attributable fraction decreases over time. For all other scenarios, there is a reduction in DALYs over time as shown in Figure 8.

Figure 8: Attributable DALYs for the diseases across scenarios



References

Bond, Tom, and Michael R. Templeton. “History and future of domestic biogas plants in the developing world.” Energy for Sustainable Development, 2011: 347-354.

DAHD. “19th Livestock Census-2012 All India Report.” Department Of Animal Husbandry,Dairying AND Fisheries, Ministry of Agriculture. June 17, 2014. http://dahd.nic.in/sites/default/files/Livestock 5.pdf (accessed August 20, 2017).

IHME. “Global Burden of Disease Results Tool.” 2017. http://ghdx.healthdata.org/gbd-results-tool (accessed January 23, 2018).

WHO. “Global Disease Burden : Projections 2015 to 2030.” World Health Organisation. 2008. http://www.who.int/entity/healthinfo/global_burden_disease/projections2015_2030/en/index.html (accessed May 3, 2017).