**Problem statement**

In South Africa, households burn unclean fuels to meet their cooking, heating, and lighting needs. Emissions from those fuels contribute to ambient PM2.5 and impact human health. Improved cookstoves might be deployed in South Africa to help reduce household PM2.5 exposure. In this problem, we want to estimate the health benefits of implementing cleaner coal cookstoves in the country. The intervention is to deploy cleaner cookstoves (90.7 % reduction in coal PM2.5 emission factor) in all households.

To do that, we employ preliminary results from the Rapid Estimation of Air Concentrations for Health (REACH) RCM\*\*. You are given the following information, all data is at the local municipality level:

| File name | Description | Units |
| --- | --- | --- |
| *PM25-PRI\_ground\_damages.csv* | PM2.5 damages caused by each local municipality | mortalites/tonne |
| *SR\_PM25-PRI\_ground.csv* | Source-receptor matrix for ground-level primary PM2.5 | µg/m3/tonne |
| *emis\_diff.csv* | Emissions reductions in each municipality | tonne |
| *southern\_africa.shp* | Geometry attributes for the Southern Africa region | N/A |
| *base\_concentration.csv* | PM2.5 concentrations from emissions of PM2.5, NOx, SO2, NH3 and VOCs | µg/m3 |
| *plot\_concentrations.R* | Plot script to map PM2.5 concentrations to municipalities | N/A |

Additional details about each file are available in the README document. The solutions describe in more detail how the emissions were estimated, and will be provided after the workshop.

1. How many lives are saved from deploying improved coal cookstoves?
2. Assuming a VSL for the nation of South Africa of $1.9M1, what are the monetized benefits?
3. Given the estimated implementation costs of this intervention to be $2M, does this policy intervention pass a cost-benefit test? What is the benefit:cost ratio?
4. Make a map of the estimated ambient PM2.5 concentration reductions due to this intervention.
5. Plot an updated map of the PM2.5 concentrations (baseline PM2.5 – intervention PM2.5) in South Africa.

Note

\*\* We are estimating ambient PM2.5 concentrations for the cooking scenario. The cooking emissions are transported outdoors and impact regional PM2.5. This is related to household PM2.5, but does not reflect high concentrations from proximity to stoves in enclosed environments.

Source

1. Roy, R. (2016), "The cost of air pollution in Africa", *OECD Development Centre Working Papers*, No. 333, OECD Publishing, Paris,<https://doi.org/10.1787/5jlqzq77x6f8-en>.