Potential Health and Climate Co-Benefits of Biomass Pellets in Ghana

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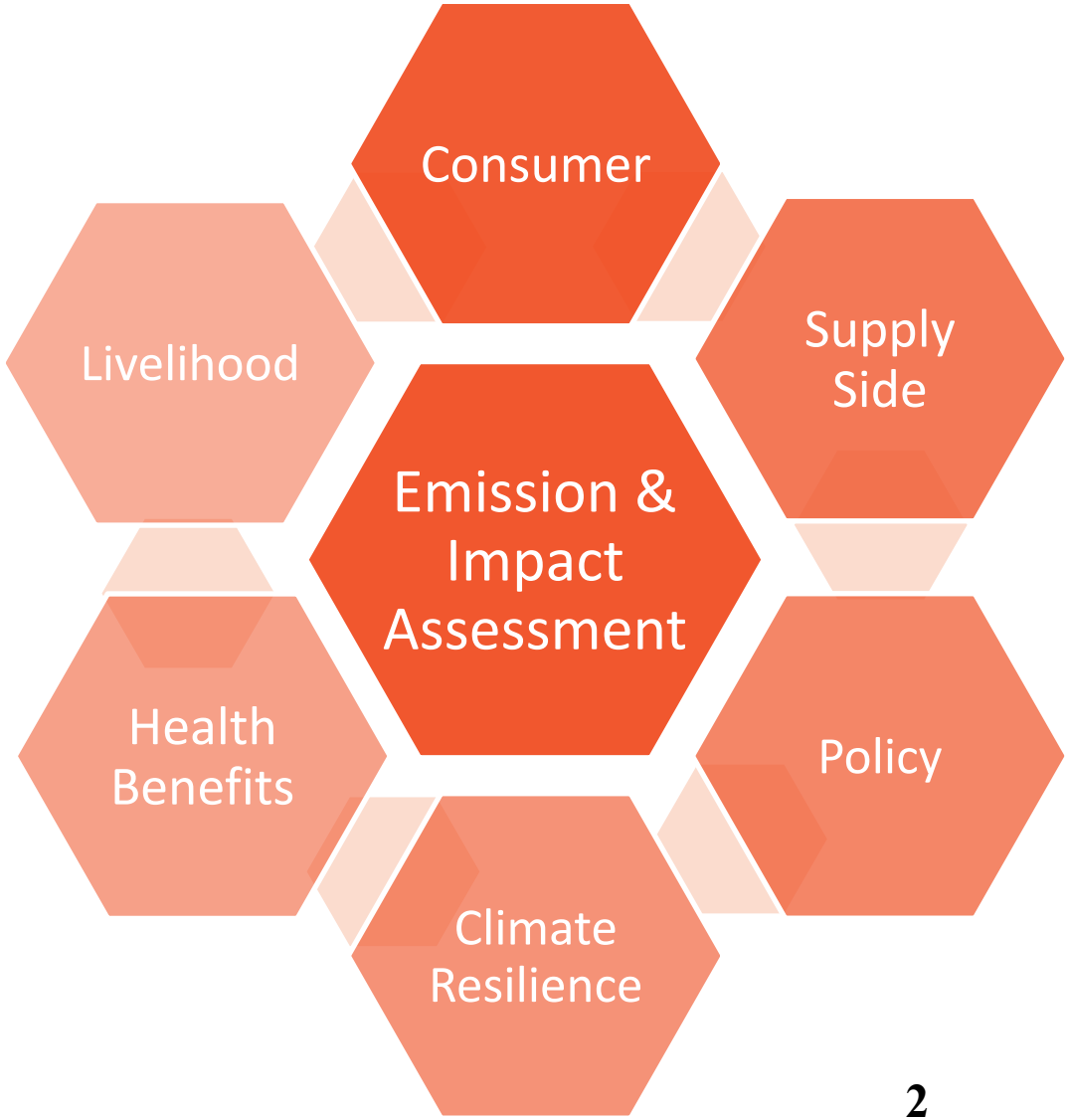
Pellets for Ghana – Why?

- **By 2030,** one-third of the energy demand from the residential sector
- **Ambitious targets** in the 2019 Renewable Energy Master Plan (REMP)

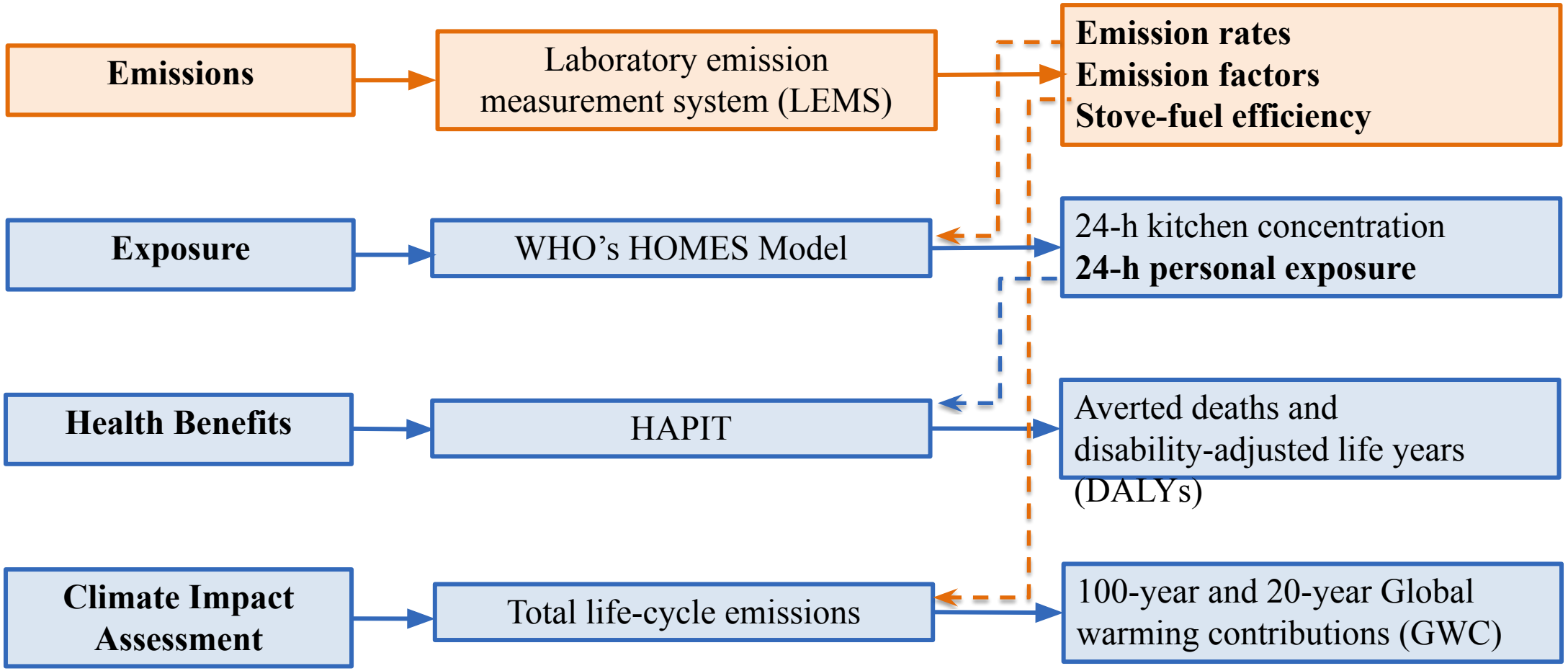
  3 million pellet stoves by 2030

  43000 hectares of woodlots for pellet production
- Potential to fulfill **40%** of the residential sector demand
- **20.8 million** (80% of rural) people use wood and charcoal

- Knowledge gap of health and climate impacts of pellets



Research Approach



Stove-Fuel Tested

Wood Rocket 1

S32-13
natural draft
wood stove

Wood Rocket 2

Kuniokoa classic
natural-draft
wood stove

Pellets

F-18 semi-gasifier
forced-draft
wood pellet stove

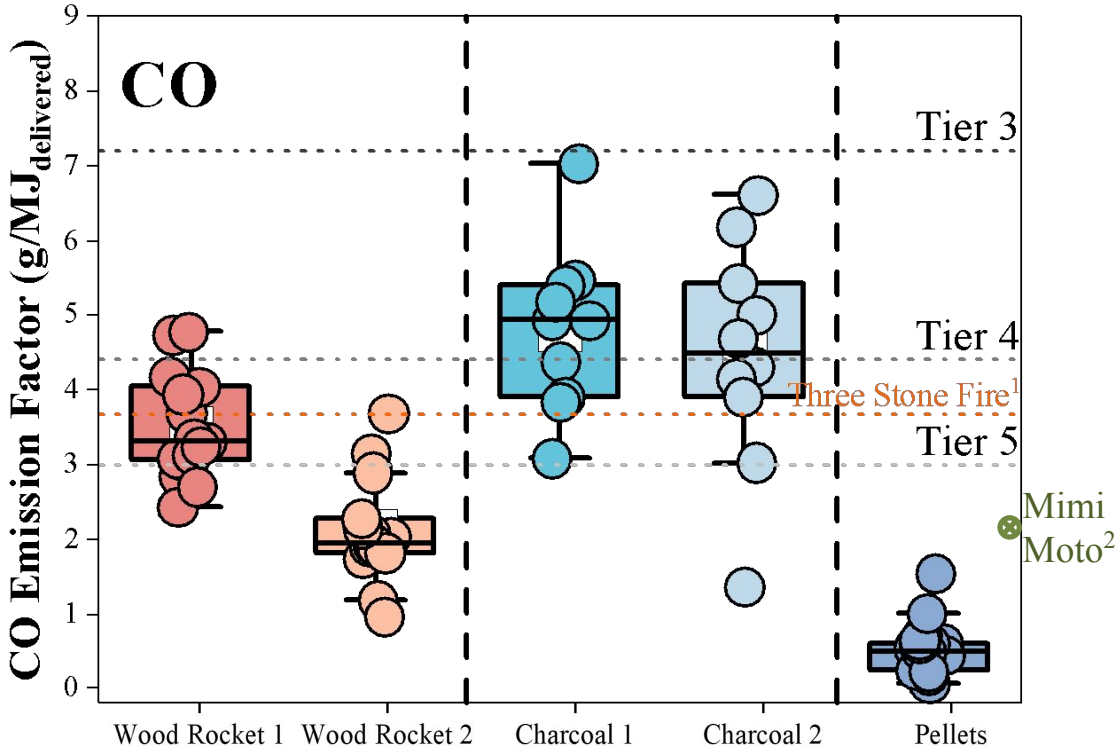
Charcoal 1

C26-12
wood/
charcoal stove

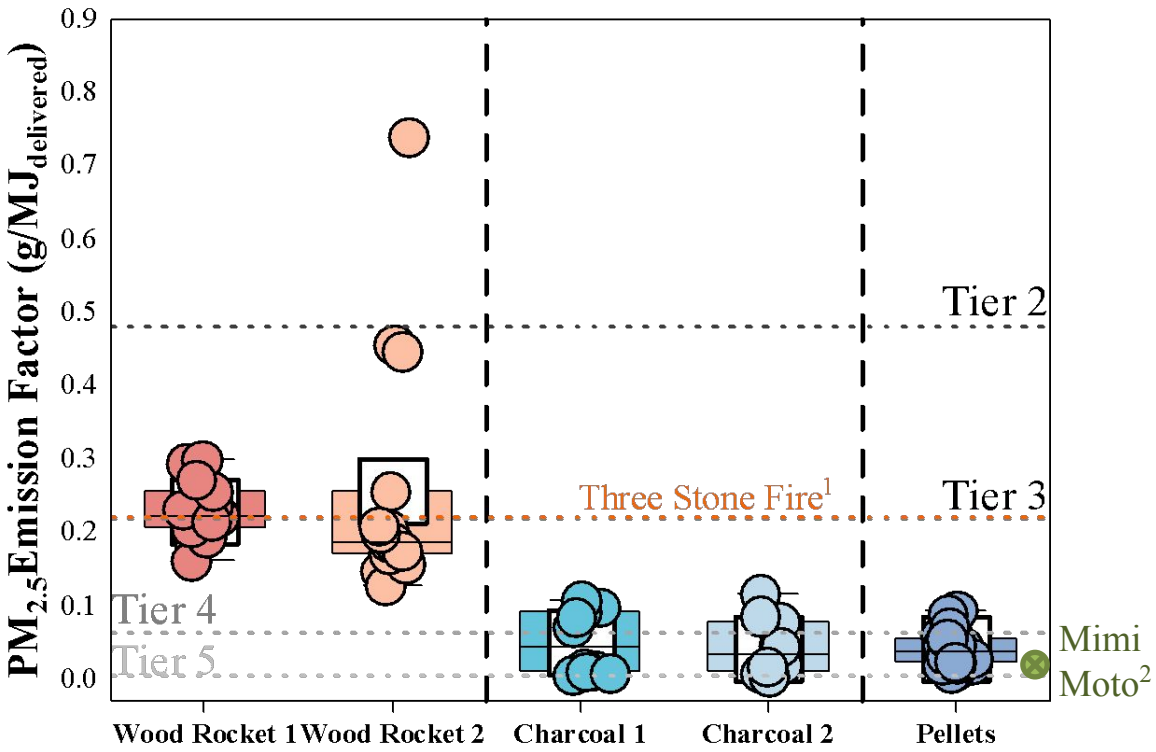
Charcoal 2

C28-12
wood/
charcoal stove

Lower emissions and higher efficiency with Pellets stove



CO	3.506	2.115	4.820	4.474	0.511



$PM_{2.5}$	0.229	0.256	0.051	0.043	0.041
Efficiency	33.7 ± 4.3	37.6 ± 2.2	41.4 ± 2.0	39.9 ± 2.2	43.0 ± 1.6
MCE	98.2 ± 0.3	98.8 ± 0.4	96.2 ± 1.4	96.7 ± 1.5	99.8 ± 0.2

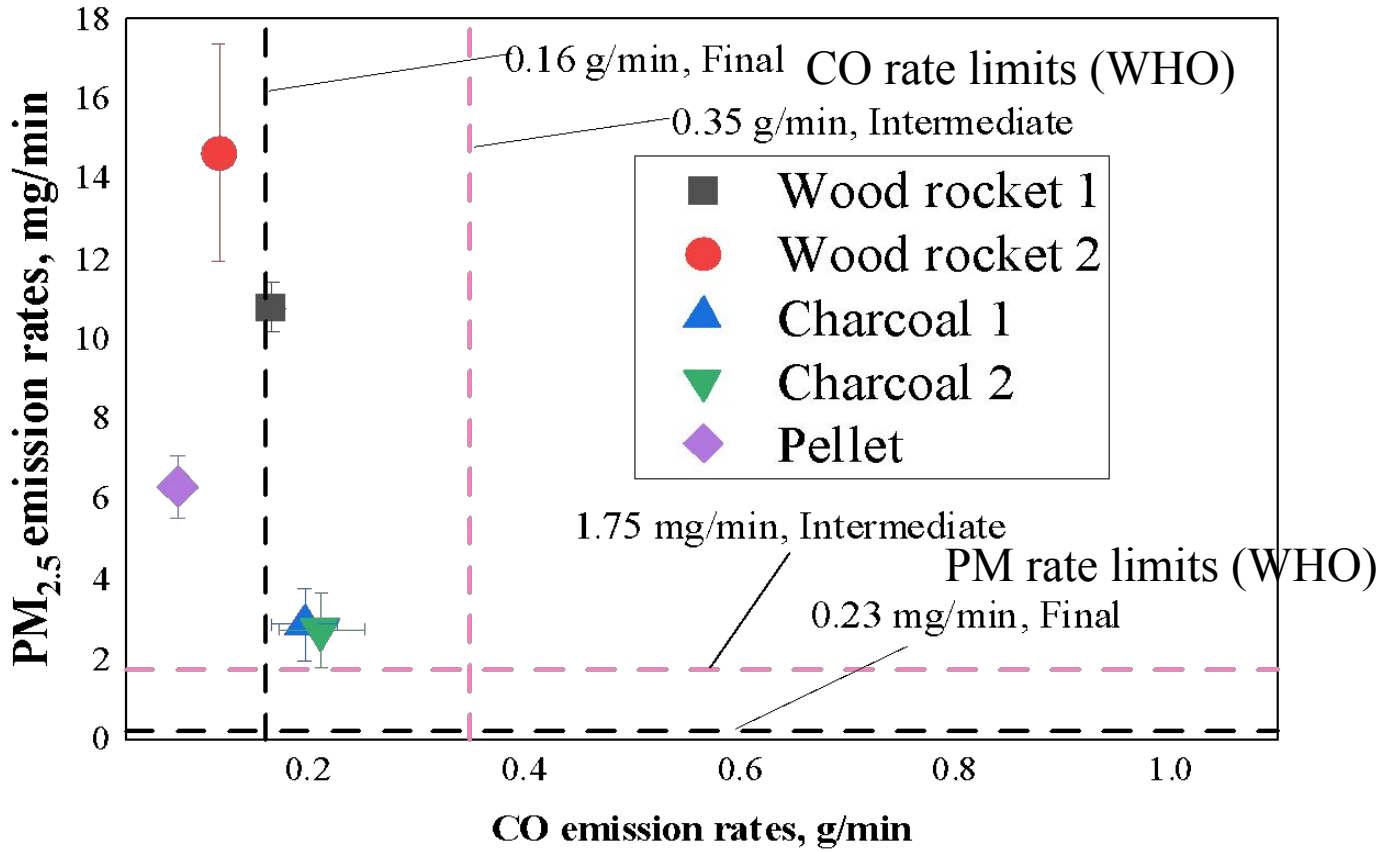
1 Coffey, E. R., et al. (2017). New Emission Factors and Efficiencies from in-Field Measurements of Traditional and Improved Cookstoves and Their Potential Implications. Environmental Science & Technology, 51(21), 12508-12517. https://doi.org/10.1021/acs.est.7b02436

2 Champion, W. M., et al. (2021). Cookstove Emissions and Performance Evaluation Using a New ISO Protocol and Comparison of Results with Previous Test Protocols. *Environmental Science & Technology*. https://doi.org/10.1021/acs.est.1c03390

Emission Rates and Exposure

- Solid fuel combustion – a potential heath risk
- Higher exposure amongst women and children
- None of the stoves comply with the emission rate limits of WHO

- Lowest mean CO and $PM_{2.5}$ 24-h kitchen concentrations and exposure for pellets

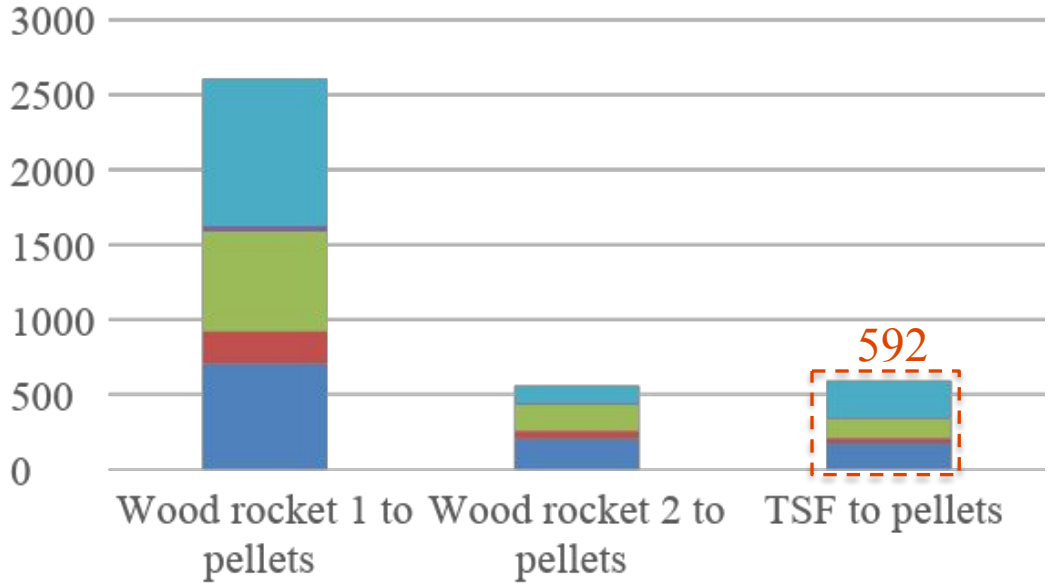


Health Impacts

- **Transition to pellet stoves from wood, coal, and TSF (baseline)**
- Using TSF ~ 4% disease burden

- Among 1 million households using TSF - Averts 24,994 DALYs and 592 deaths annually

- Majority of the health benefits are due to reductions in ALRI (acute lower respiratory infections) in children between 1 and 4 years and strokes



ALRI %	27	36.4	29.6
COPD %	8.3	10	5.6
IHD %	25.5	30.6	21.8
Lung Cancer %	1.4	1.8	1
Stroke %	37.7	21.1	42.1

Climate Impacts

- **Maximum GWC reductions with pellet stoves**
- Long-term climate impact < short-term impact
- Main contributor - CO_2 emissions from non renewable source (Up to 94%)

- Sensitivity Analysis

Having fNRB from 0.9 to 0 lowered GWCs by up to 94%

Conclusion and Recommendations

- Pellets stove a cleaner alternative

  reduces daily kitchen concentrations (55% lower CO and 44% lower PM compared to TSF) and exposures

  averts 24,994 DALYs and 592 deaths per year (TSF to pellets intervention among one million HHs)

- Serve as objective evaluations of the relative benefits but do not replace the required thorough investigations.

- Integrate interventions, policies and research to ‘make the available clean’ and ‘make the clean available’
- Enabling environment to accelerate adoption (capacity building, infrastructure development policy appraisals, public sensitization, and mass demonstrations campaigns)

Thank you

Any questions?

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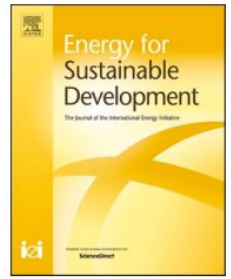

Check for updates

A laboratory assessment of how biomass pellets could reduce indoor air pollution, mitigate climate change and benefit health compared to other solid fuels used in Ghana

Sylvester Mawusi [a], Prabin Shrestha [a], Tong Gao [a], Min Liu [a], Zhimin Li [a], Mingze Jiao [a], Youjie Li [a], Ming Yan [a], Chuang Li [b], Chunyu Xue [a,*], Guangqing Liu [a,*]