Transitioning rural households into clean cooking fuels using biogas

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South Africa has one of the highest electrification rates (87 %) in Africa, surpassed only by countries such as Cape Verde (96%), Seychelles (98%), and Mauritius (100%). In 2014, South Africa had an electricity access rate of 86%, far above the 35 % average of other countries in Sub-Saharan Africa. On average, the access rate is 85 % for rural areas in the country, meaning that the majority of resource-poor rural households are electrified. With such a high electrification rate, it is expected that rural households, like their urban counterparts, can rely on electricity to supply all their domestic energy needs, particularly cooking, which is the priority energy use. However, experience has shown that in some cases, electrification does not always translate to households transitioning from traditional fuel sources to electricity for cooking. For example, a 2006 study carried out by Madubansi and Shackleton, in the Bushbuckridge area of South Africa, revealed that 10 years after electrification, with a free basic electricity policy of 6 kWh per month, over 90% of households still used firewood for cooking and heating. The above highlights that electrification alone might not be an effective enough solution to reduce the use of traditional solid fuels and minimize the impacts associated with the continued use of firewood.

The apathy towards electricity use for cooking is perhaps due to issues of affordability, reliability of electricity supply, and preference for traditional cooking methods. SA's acute energy crisis, displayed by recurrent load shedding and escalating electrifying tariffs, is most likely going to cause more rural households to revert to firewood or other dangerous fuels such as coal and paraffin. This will subsequently lead to accelerated deforestation. Furthermore, the use of fuelwood and paraffin poses health and safety challenges as it can result in indoor air pollution, poisonings, burns and fires, and respiratory diseases amongst women and children, as was the case prior to electrification. Additionally, the carrier technologies that make use of paraffin and fuelwood for cooking and lighting are often energy inefficient. There is therefore a need to introduce alternative cooking fuels that are clean, affordable, and readily accessible for rural households. Furthermore, the high electrification rates witnessed thus far were made possible by coal-fired power stations, a major contributor to GHG emissions. As SA, like the rest of the world, battles to meet its rapidly increasing energy demand, and is moving towards decarbonizing its energy sector and meeting net zero emission targets, unlocking additional low carbon energy sources is vital.

Biogas technology, that converts organic waste (e.g., manure, food waste, crop residues, grasses) into biogas energy and organic fertilizer, is a promising pathway to supplying cooking energy in rural setups, including rural households, schools, and hospitals. Biogas consists of up to 70 % methane, a flammable gas that can be used for heating and cooking like LPG gas. Rural households that own livestock, particularly

cattle, can benefit immensely from biogas digesters as they can generate their own energy using their animal manure. Biogas digesters are an attractive option because they are robust, highly scalable, environmentally friendly, and can counter the health and safety issues associated with using fuelwood and paraffin as energy sources. Combined with other renewables such as solar PV, rural households have the potential to go off-grid and help reduce electricity demand on the national grid.

The Natural Resources and Engineering (ARC-NRE) and Vegetable and Industrial Medicinal Plants (ARC-VIMP) campuses of the Agricultural Research Council are currently implementing a biogas digester project, funded by the Department of Agriculture, Land Reform and Rural Development (DALRRD), which is installing small–scale, demonstration, and research biogas digesters in rural households across the country. The project aims to promote and demonstrate biogas technology, and youth capacity building and investigate the viability of the technology for rural areas. Furthermore, to address food insecurity risks faced by rural households, the project is combining the installation of biogas digesters with rainwater harvesting and the setting up of backyard vegetable gardens that use the organic digestate from the biogas digester as a fertilizer. This integrated energy, vegetable production, and rainwater harvesting system, is a good demonstration of the water-energy-food nexus.

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