

Renewable Energy Integration in Cities of Developing Countries: The Case Study of Tema City, Ghana

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Abstract : Global electricity demand of households in 2005 is estimated to double by 2025 and nearly double again in 2030. The residential sector promises considerable demand growth through infrastructural and equipment investments, the majority of which is projected to occur in developing countries. This lays bare the urgency for enhanced efficiency in all energy systems combined with exploitation of local potential for renewable energy systems. This study explores options for reducing energy consumption, particularly in residential buildings and providing robust, decentralized and renewable energy supply for African cities. The potential of energy efficiency measures and the potential of harnessing local resources for renewable energy supply are quantitatively assessed. The scale of research specifically addresses the city level, which is regulated by local authorities. Local authorities can actively promote the transition to a renewable-based energy supply system by promoting energy efficiency and the use of alternative renewable fuels in existing buildings, and particularly in planning and development of new settlement areas through the use of incentives, regulations, and demonstration projects. They can also support a more sustainable development by shaping local land use and development patterns in such ways that reduce per capita energy consumption and are benign to the environment. The subject of the current case study, Tema, is Ghana's main industrial hub, a port city and home to 77,000 families. Residential buildings in Tema consumed 112 GWh of electricity in 2013 or 1.45 MWh per household. If average household electricity demand were to decline at an annual rate of just 2 %, by 2035 Tema would consume only 134 GWh of electricity despite an expected increase in the number of households by 84 %. The work is based on a ground survey of the city's residential sector. The results show that efficient technologies and decentralized renewable energy systems have great potential for meeting the rapidly growing energy demand of cities in developing countries.

Keywords : energy efficiency, energy saving potential, renewable energy integration, residential buildings, urban Africa

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