Powering Accra: Additional Findings, Results and Basis for further Policy Recommendations

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Abstract

The primary research objective of this work was to create an agent-based urban simulation based on land use at the plot level for projecting the disaggregated electricity demand of the Greater Accra Metropolitan Area (GAMA). A simulation system comprised of location choice, regression, and simple models were used to project household, employment and land development decisions. Households, persons, and jobs tables were synthetically generated from GLSS5 (Ghana Living Standards Survey 2005) data and incorporated for use in the Open Platform for Urban Simulation (OPUS). Electricity demand was projected for each of the simulation years based on a robust linear regression. Numerous geospatial datasets were projected and edited in ArcGIS which describe the physical composition of Accra in its totality, including buildings, roads and electricity infrastructure. Household mobility was estimated from a modified Cox Regression of residential mobility in Accra (Bertrand et al.) and applied to the GLSS5 for use in the location choice model, while employment coefficients and parameters describing land value were derived from literature (Buckley et al.). This agent-based urban simulation has been successfully applied for projecting the electricity demand of the Korle Bu district for the time period 2006 until 2025, based on monthly electricity consumption per meter.

One of the most important findings of this work is that a higher rate of household mobility is essential to poverty reduction. GAUSS simulation runs demonstrated that household mobility increases as income increases, which was especially true at younger ages, and that one building type, smaller live-work kiosks, may be contributing as stepping stones towards middle income status. The household location choice model also consistently projects Sabon Zongo as an attractive location for new households moving to the district, as well as existing households moving to new locations within the district. Agbogbloshie also consistently projects as an attractive location, particularly for small live-work kiosks which are in close proximity to Kwame Nkrumah Boulevard and the opportunity to transition from informal commercial activities to more formal ones. Furthermore, Korle Gonno projects as a relatively stable neighborhood which exhibits moderate but consistent growth.

With regard to employment location choice, the lions share of new jobs and relocating existing jobs are seeking workplace locations in the South Industrial Park.

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Korle Dudor is a very attractive location for formal commercial activities, while Agbogbloshie is an attractive location for informal commercial activities. The neighborhood marketplace in Korle Gonno has a relatively stable employment profile, while dispersed workplace locations throughout Sabon Zongo are highly attractive locations, as well as the limited number of commercial activities in Abossey Okai facing Obetsey Lamptey Circle. Finally, the Korle Bu Teaching Hospital consistently attracts professional employees and exhibits modest growth even at low growth rates.

Electricity demand projections indicate that at a low growth rate of 2% (economic and demographic) Korle Bu GAUSS exhibits an aggregate increase in electricity demand from less than 42mil kWh to 50mil kWh. A 20% increase would equate to a nearly 8% increase in local domestic product (the population of Korle Bu represents about 1% of the total population of Ghana), which amounts to a significant impact on the national economy by only one of Accras 12 districts (under low economic and demographic growth rates). GAUSS also consistently projects plots with large numbers of kiosks as high consumers of electricity, which equates to small live-work household arrangements which appear to be having some success towards poverty reduction and movement towards middle income. Formal commercial activities also project large demands for electricity, especially when they are in proximity to large groupings of informal activities (Agbogbloshie / Korle Dudor / Kwame Nkrumah Boulevard). GAUSS projects the South Industrial Park as the most significant consumer of power as well as the largest increases in power consumption over the time period 2006 to 2025.