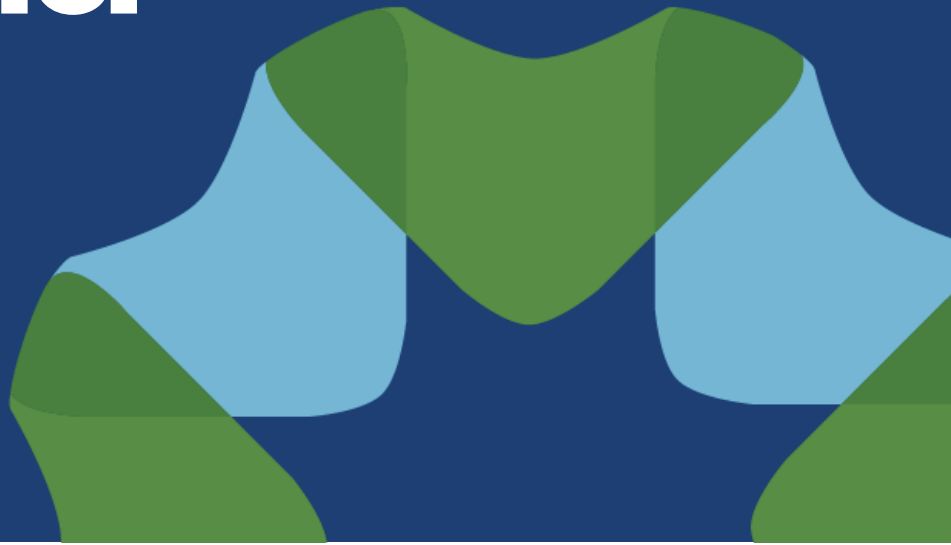
CLEAN COOKING ALLIANCE

fraym

Ghana Consumer Segmentation

Prepared by Fraym

July 2021



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Scope of Work

Scope of Work

The Clean Cooking Alliance commissioned Fraym to produce consumer segmentations for Kenya, Nigeria, Ghana, Ethiopia, Rwanda, and Uganda.

Assessments include an overview of demographic and socioeconomic characteristics and use of energy at the national and urban/rural level, national maps of four consumer segments, and market sizing and hyperlocal mapping at the subnational level for each consumer profile.

Fraym worked with the Clean Cooking Alliance to identify four target consumer groups: urban early-adopters, peri-urban and rural early-adopters, fast-followers, and secondary-followers.

Fraym then identified where there are pockets of high demand within the country by generating hyperlocal maps of the four target consumer segments. Initially, these maps can provide a snapshot understanding of where different customers and overall demand are concentrated.

How it works

Fraym uses advanced machine learning models to produce unprecedented, local information on human and population characteristics in critical geographies around the world – down to 1 km^2 even in remote areas.

ACQUIRE DATA

Geo-tagged household surveys

Satellite imagery

Partner datasets

HARMONIZE DATA

Validate

Clean

Geospatially enable

MACHINE LEARNING

Proprietary algorithms

Human-centric QA/QC

Automation

GEOSPATIAL INSIGHT

Predictive modeling

API enabled

Analytic services

Front-end tools

02

National Context

Household Characteristics

There are roughly 9 million households in Ghana, with nearly 44 percent living in cities and the remaining 56 percent in peri-urban and rural areas.[1]

There are education completion disparities between urban and rural households. About three quarters of urban household heads have completed primary school, compared to roughly half of rural household heads.

Financial inclusion is relatively low nationwide, especially in rural areas where only 39 percent of households have a bank account and 18 percent have a mobile money account.

Note 1: Urban areas were defined using the EU Global Human Settlement Layer (GHSL). Urban centers, dense urban clusters, and semi-dense urban clusters are classified as urban. Suburban or peri-urban and all rural areas are classified as peri-urban and rural.
Note 2: The source of all population data in this report is WorldPop.
Note 3: High quality housing materials are defined as durable materials like concrete, metal, brick, or finished wood. All housing refers to the roof, wall, and floor.
Source: Fraym, Ghana 2019 MIS, Ghana 2014 DHS, Ghana 2014 FII

Ghana Snapshot

Demographics

	National	Urban	Rural
Population[2]	33M	11M	22M
Number of households	9M	4M	5M
Female headed household	35%	38%	30%
Household head completed at least primary education	67%	77%	53%
Household head completed at least secondary education	21%	29%	11%
Household head completed higher education	7%	9%	3%
All high-quality housing material[3]	81%	91%	63%
Bank account	55%	64%	39%
Mobile money account	20%	23%	18%

Cooking Fuels

Around 22 percent of households nationwide use clean cooking fuel.

Clean cooking fuel use is especially limited in rural areas, where only 5 percent of households use LPG.

Wood is the most common cooking fuel in rural areas, whereas charcoal is most common in urban areas.

Households that use charcoal spend a similar amount on the fuel as households that use wood. On average, households using wood spend 40 Cedi per month purchasing wood for all energy purposes and households using charcoal spend 50 Cedi per month.[3]

Note 1: Clean cooking fuel is defined as LPG, natural gas, electricity, and biogas.
Note 2: Other solid cooking fuels include straw, agricultural crops, and dung.
Note 3: Spending data is in 2017 Cedi and includes spending on the fuel for cooking, heating, and lighting.
Source: Fraym, Ghana 2019 MIS, GLSS 2017

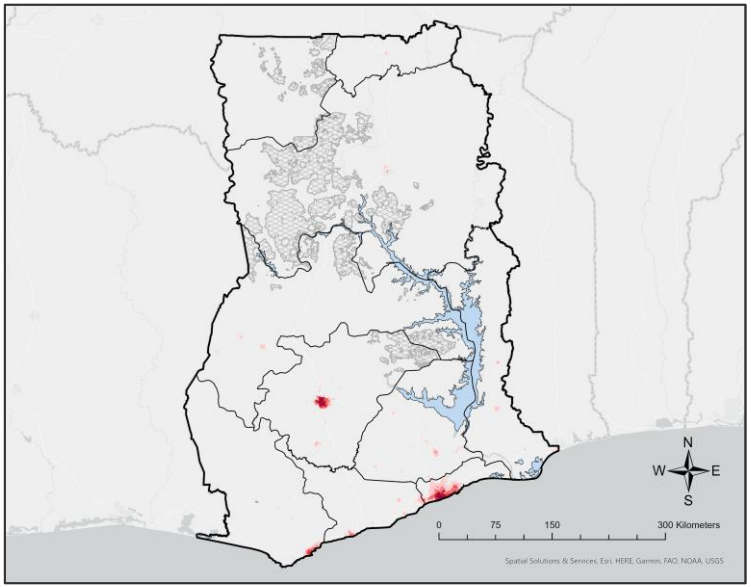
Ghana Snapshot

Household energy use

	National	Urban	Rural
Primarily use clean cooking fuel[1]	22%	32%	5%
Primarily use LPG to cook	22%	31%	5%
Primarily use natural gas or biogas to cook	0%	0%	0%
Primarily use electricity to cook	<1%	<1%	<1%
Primarily use wood to cook	35%	14%	73%
Primarily use charcoal to cook	41%	53%	20%
Primarily use kerosene to cook	0%	0%	0%
Primarily use other solid fuels to cook[2]	1%	<1%	1%
Average monthly spending on charcoal (Cedi)[3]	50	50	50
Average monthly spending on kerosene (Cedi)[3]	10	10	10
Average monthly spending on wood (Cedi)[3]	40	40	40
Average total monthly spending (Cedi)[3]	1,000	1,200	700
Access to electricity	87%	94%	76%

Clean Cooking Fuel

The roughly 2 million households that use clean cooking fuels are concentrated in urban areas and almost all use LPG as their primary cooking fuel.



Clean Cooking Fuel Households[1]

- 0 – 120
- 121 – 540
- 541 – 1300
- 13,01 – 2,300
- 2,301 – 3,500
- 3,501 – 6,000
- Zero population areas

Note 1: This map shows the estimated number of households that use clean cooking fuel per 1km^2. Clean cooking fuel includes electricity, LPG, natural gas, and biogas.
Source: Fraym, Ghana 2019 MIS , Ghana 2014 DHS

2M Households use clean cooking fuel

31% of households are headed by a woman

5.4 Average household size

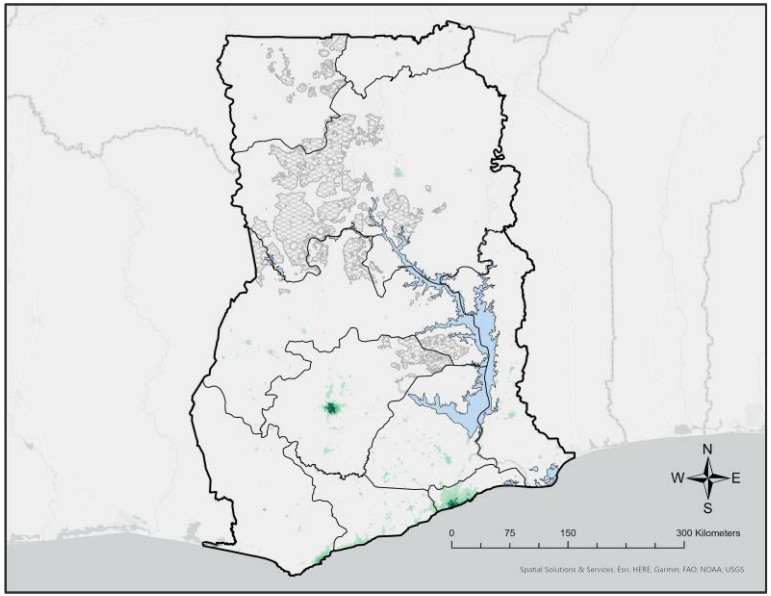
51% of household heads have completed secondary education

99% use LPG as their primary cooking fuel

1% use electricity as their primary cooking fuel

Electricity Access

Around 87 percent of households in Ghana have access to electricity and they are concentrated in cities. Two fifths of these households still use charcoal as their primary cooking fuel.



Households with Access to Electricity[1]

- 0 – 150
- 151 – 760
- 761 – 2,000
- 2,001 – 3,800
- 3,801 – 5,900
- 5,901 – 9,700
- Zero population areas

Note 1: This map shows the estimated number of households that have electricity access per 1km^2. Estimates Northern and Upper West regions failed to pass Fraym standard quality checks and should thus be interpreted with caution.
Source: Fraym, Ghana 2019 MIS, Ghana 2014 DHS

8M Households with access to electricity

35% of households are headed by a woman

6.8 Average household size

26% of household heads have completed secondary education

42% use charcoal as their primary cooking fuel

32% use wood as their primary cooking fuel

25% use LPG as their primary cooking fuel

Identifying key characteristics

Nearly all households that use clean cooking fuel have high-quality housing, own a high-cost asset, and have access to electricity and a bank account.

Households that use clean cooking fuel are concentrated in cities and have more educated household heads.

Close to half of solid cooking fuel households own high-cost assets, live in households constructed with all high-quality materials, and have access to bank accounts and electricity. These indicators are suggestive of relatively high consumption power.

Ghana Snapshot

Characteristics by cooking fuel type

	Clean Cooking Fuel Households[1]	Solid Cooking Fuel Households
Number of households	2M	7M
Urban	91%	56%
Female headed household	31%	38%
Access to electricity	98%	84%
Primary cooking fuel	LPG (99%) Electricity (1%)	Charcoal (52%) Wood (45%) Straw (1%)
Bank account[2]	82%	47%
All high-quality housing material[3]	96%	77%
Own at least 1 high cost asset[4]	95%	66%
Own a radio	82%	60%
Household head completed at least secondary education	51%	10%

Note 1: Clean cooking fuel households are households that use liquified petroleum gas (LPG), electricity, natural gas, or biogas as the primary cook fuel.
Note 2: Bank account ownership is defined as any household member having a formal bank account. Mobile money accounts are not included. Data is from the Ghana 2019 MIS.
Note 3: High quality housing materials are defined as durable materials like concrete, metal, brick, or finished wood. All housing refers to the roof, wall, and floor.
Note 4: A high-cost asset is defined as a television, refrigerator, or car.
Source: Fraym, Ghana 2019 MIS.

Communications

Radio is the most common media outlet in rural areas, while both television and radio are common in urban areas.

Around three quarters of rural households tune into their radios at least once a week and close to half regularly watch television.

Both television and radio are regularly used in urban areas. Almost 80 percent of urban households tune into either of these two media outlets at least once a week.

Mobile phone ownership rates are high across both urban and rural areas, with around 98 percent of all households owning at least one mobile phone.

Ghana Snapshot

Household communications access[1]

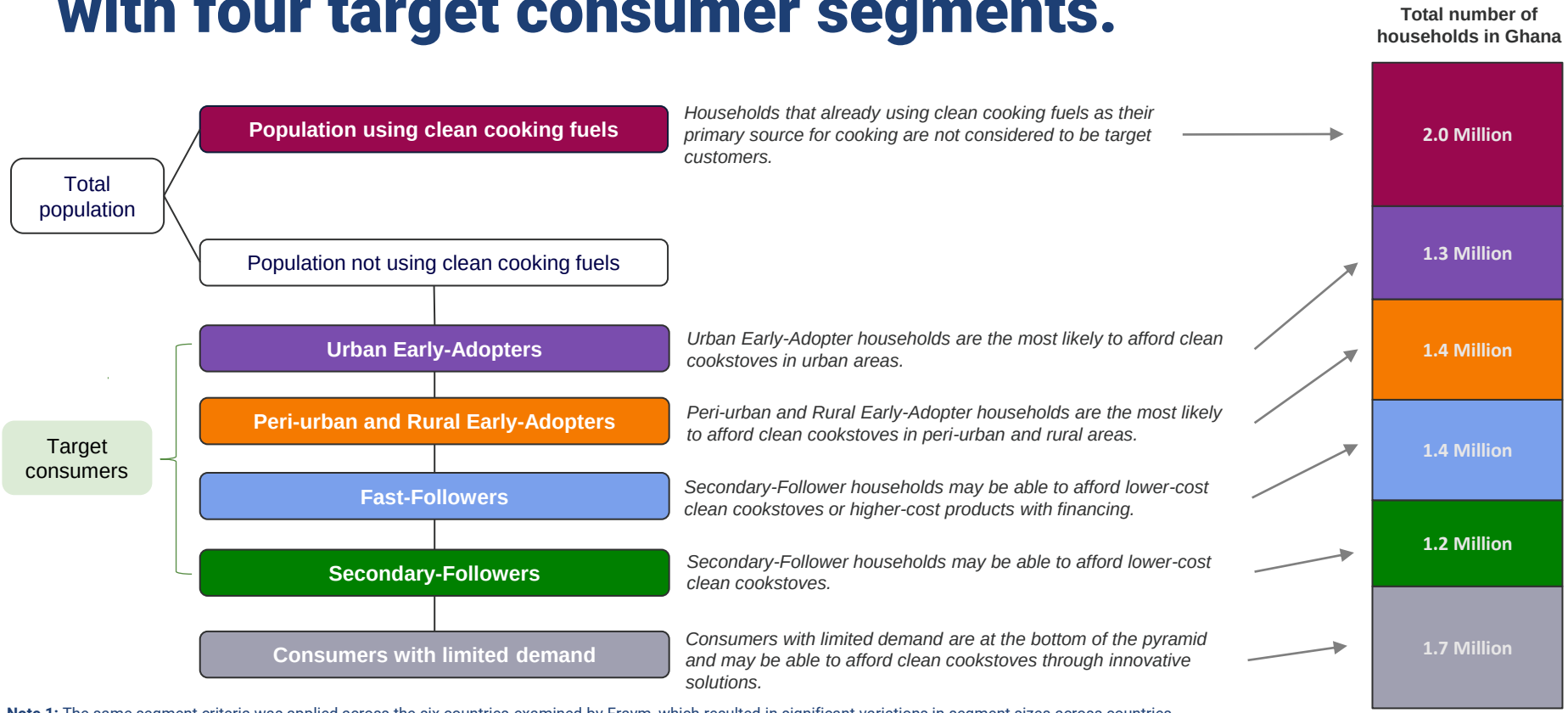
	National	Urban	Rural
Television ownership	70%	81%	50%
Radio ownership	65%	68%	59%
Mobile phone ownership	98%	98%	98%
Regular print media readership	19%	26%	9%
Regular television viewership	68%	79%	52%
Regular radio listenership	77%	78%	75%

Note 1: Regular use of a media form is defined as the adult household head (age 15-49) using the media at least once a week.
Source: Fraym, Ghana 2019 MIS, Ghana 2014 DHS,

03

Mapping Consumer Segments

The total population is segmented into six groups, with four target consumer segments.



Note 1: The same segment criteria was applied across the six countries examined by Fraym, which resulted in significant variations in segment sizes across countries.
Source: Fraym

Overview of Target Consumers

Urban Early-Adopter Households are those with the highest ability to afford clean cooking technologies. Only households that live in urban areas were included in this group. They own high-cost assets, live in homes made of high-quality materials, and have access to electricity. These households are expected to be the consumer segment most able to afford clean cooking technologies.[1] There are an estimated 1.3 million urban early-adopter households in Ghana.

Peri-urban and Rural Early-Adopter Households are wealthy households with a high ability to afford clean cooking technologies. These households own high-cost assets, live in households made of high-quality materials, and have access to electricity. Only households that live in peri-urban or rural areas are included in this consumer group.[1] There are roughly 1.4 million peri-urban and rural early-adopter households in Ghana.

Fast-Follower Households are any remaining households that own high-cost assets that did not fit the early-adopters profiles. Also included in this group are households with homes partially constructed from high-quality materials and with formal bank accounts, making these households better positioned to maintain savings and/or take out loans for the purchase of household assets. There about 1.4 million households in Ghana are fast-followers.

Secondary-Follower Households are any remaining households that own high-cost assets that did not fit the early-adopters profiles and fast-followers profile. They have homes partially constructed from high-quality materials and own radios, suggesting modest consumption power and some ability to afford clean cooking technologies. Their lack of access to services, like electricity and bank accounts, suggests a lower-middle class in both urban and rural markets. These households are mostly found in rural areas but have some presence in urban markets as well. There are about 1.2 million secondary-follower households in Ghana.

Note 1: High-cost assets are defined as televisions, refrigerators, and cars. High quality housing materials are defined as durable materials like concrete, metal, brick, or finished wood. All housing refers to the roof, wall, and floor. Urban areas were defined using the EU Global Human Settlement Layer (GHSL). Urban centers, dense urban clusters, and semi-dense urban clusters are classified as urban. Suburban or peri-urban and all rural areas are classified as peri-urban and rural.
Source: Fraym, Ghana 2014 DHS

1.3M Urban Early-Adopter households

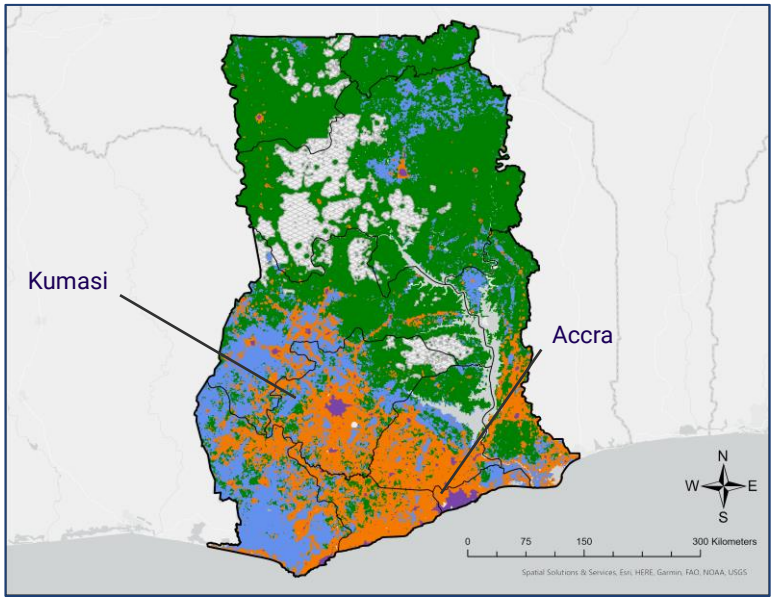
1.4M Peri-urban and Rural Early-Adopter households

1.4M Fast-Follower households

1.2M Secondary-Follower households

Consumer Segment Distribution

Consumer segments are clustered in different areas of Ghana, indicating that strategies for market entry will differ by location.



Most Common Consumer Segment[1]

- Urban Early-Adopters
- Peri-urban and Rural Early-Adopters
- Fast-Followers
- Secondary-Followers
- Zero population areas

Urban early-adopters are most common in the two largest cities, Kumasi and Accra.

Peri-urban and rural early-adopters are most common in the South and in areas surrounding large cities.

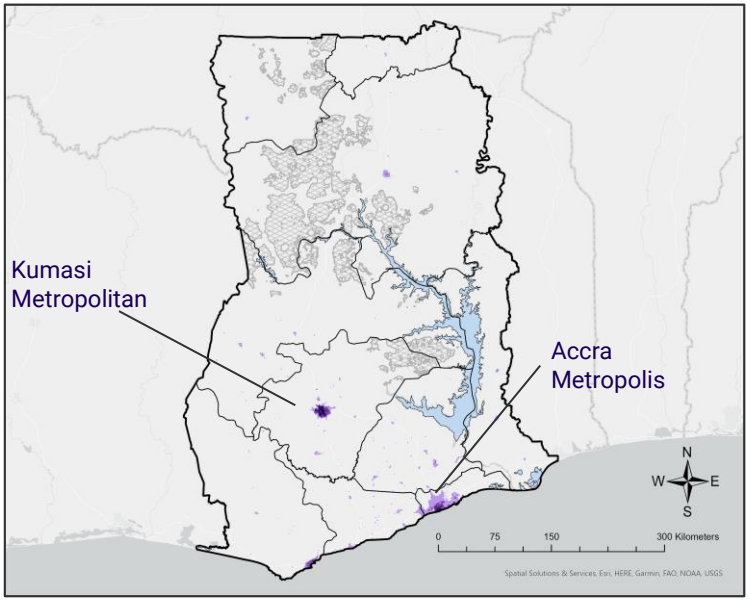
Fast-Followers are most common in the southwestern part of the country.

Secondary-Followers are most common in rural parts of the northern and central areas where population density is low.

Note 1: This map shows the most common consumer segment among all households per 1km^2 area. Each 1km^2 area varies in population density.
Source: Fraym, Ghana 2014 DHS

Urban Early-Adopters

There are about 1.3 million urban early-adopter households, representing around 14 percent of all households. They are heavily concentrated in Kumasi and Accra.



Urban Early-Adopter Households[1]

- 0 – 100
- 101 – 500
- 501 – 1,100
- 1,101 – 1,800
- 1,801 – 2,700
- 2,701 – 5,300
- Zero population areas

Note 1: This map shows the estimated number of urban early-adopter households per 1km^2. Urban early-adopter households own at least one high-cost asset, have housing made of all high-quality material, have access to electricity, and live in urban centers, dense urban clusters, and semi-dense urban clusters according to the EU Global Human Settlement Layer.
Source: Fraym, Ghana 2014 DHS, Ghana 2019 MIS

1.3M Urban Early-Adopter households

42% of households are headed by a woman

6.8 Average household size

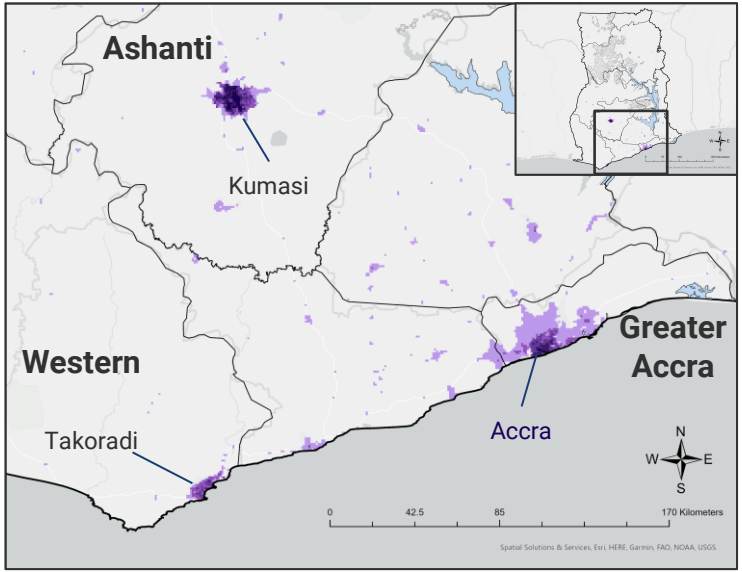
17% of household heads have completed secondary education

82% use charcoal as their primary cooking fuel

17% use wood as their primary cooking fuel

Urban Early-Adopter

More than half of all urban early-adopter households live in Kumasi, Accra, and Takoradi. Roughly 43 percent of households in Kumasi are urban early-adopters.



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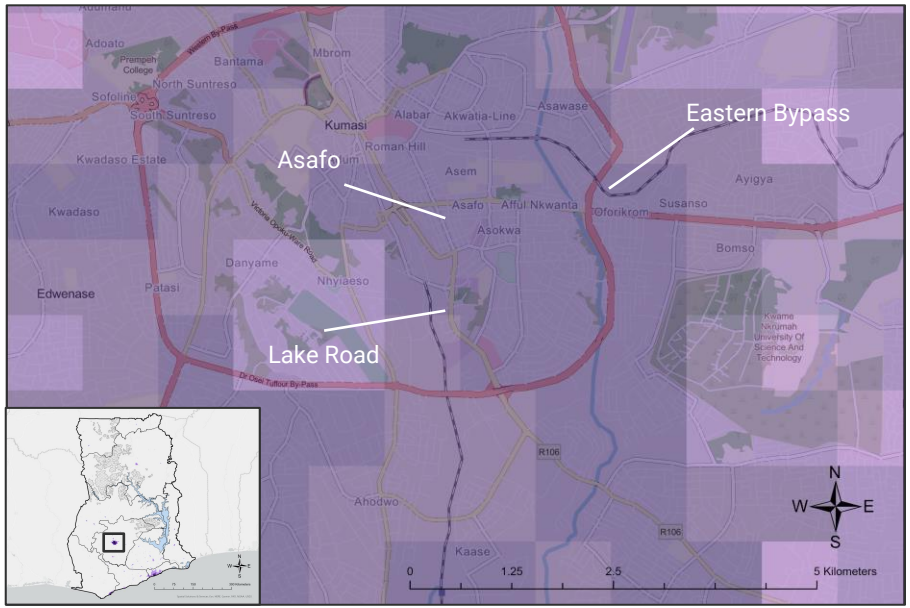
Source: Fraym, Ghana 2014 DHS

Top Local Government Areas with Urban Early-Adopters

State	Districts	Number of Urban Early-Adopter Households
Ashanti	Kumasi Metropolitan	435,000
Greater Accra	Accra Metropolis	214,000
Western	Sekondi Takoradi Metropolitan	88,000
Ashanti	Asokore Mampong Municipal	42,000
Greater Accra	Ga South	42,000
Greater Accra	La Dade-Kotopon Municipal	32,000
Greater Accra	Tema Metropolitan	23,000
Greater Accra	Ledzokuku-Krowor Municipal	22,000
Greater Accra	Ga West	22,000
Eastern	New Juaben Municipal	19,000

Urban Early-Adopter Households

Neighborhoods at the center of Kumasi Metropolitan have the highest number of urban early-adopters.



Urban Early-Adopter Households[1]

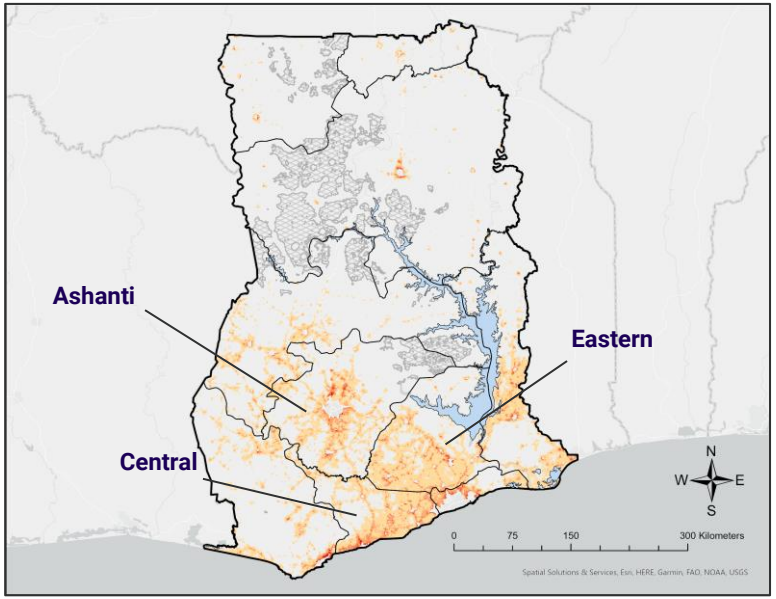
- 0 – 100
- 101 – 500
- 501 – 1,100
- 1,101 – 1,800
- 1,801 – 2,700
- 2,701 – 5,300
- Zero population areas

Neighborhoods between the Eastern Bypass and Lake Road such as Asafo have a high density of urban early-adopters.

Note 1: This map shows the estimated number of urban early-adopter households per 1km^2. Urban early-adopter households own at least one high-cost asset, have housing made of all high-quality material, have access to electricity, and live urban centers, dense urban clusters, and semi-dense urban clusters according to the EU Global Human Settlement Layer.
Source: Fraym, Ghana 2014 DHS

Peri-urban and Rural Early-Adopters

There are about 1.4 million peri-urban and rural early-adopter households, representing almost 16 percent of all households in Ghana. Many of these households are concentrated in the South.



Peri-urban and Rural Early-Adopter Households[1]

- 0 – 7
- 7 – 30
- 31 – 70
- 71 – 140
- 141 – 280
- 281 – 860
- Zero population areas

Note 1: This map shows the estimated number of peri-urban and rural early-adopter households per 1km^2. Peri-urban and rural early-adopter households own at least one high-cost asset, have housing made of all high-quality material, have access to electricity, and live in suburban or peri-urban rural areas according to the EU Global Human Settlement Layer.
Source: Fraym, Ghana 2014 DHS, Ghana 2019 MIS

1.4M Per-urban and Rural Early-Adopter households

31% of households are headed by a woman

8.0 Average household size

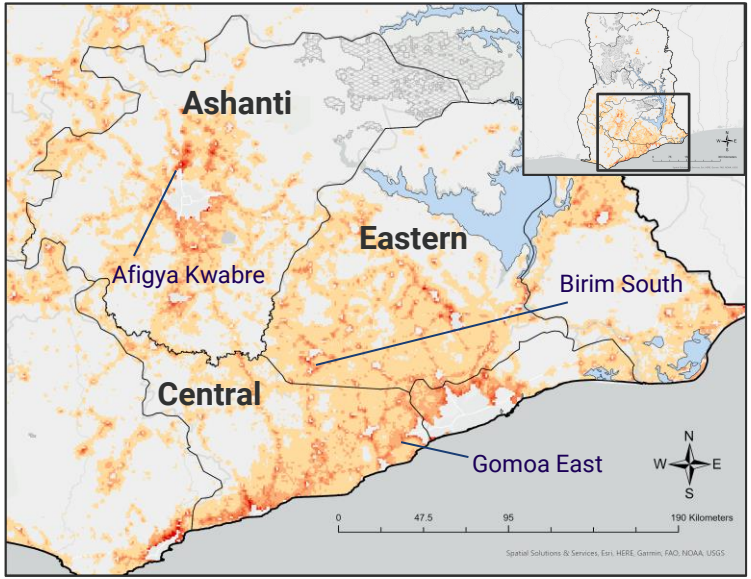
13% of household heads have completed secondary education

67% use wood as their primary cooking fuel

33% use charcoal as their primary cooking fuel

Peri-urban and Rural Early-Adopters

Around half of peri-urban and rural early-adopter households are in Ashanti, Eastern, and Central regions. About a quarter of households in the Central and Eastern regions are peri-urban and rural early-adopters.



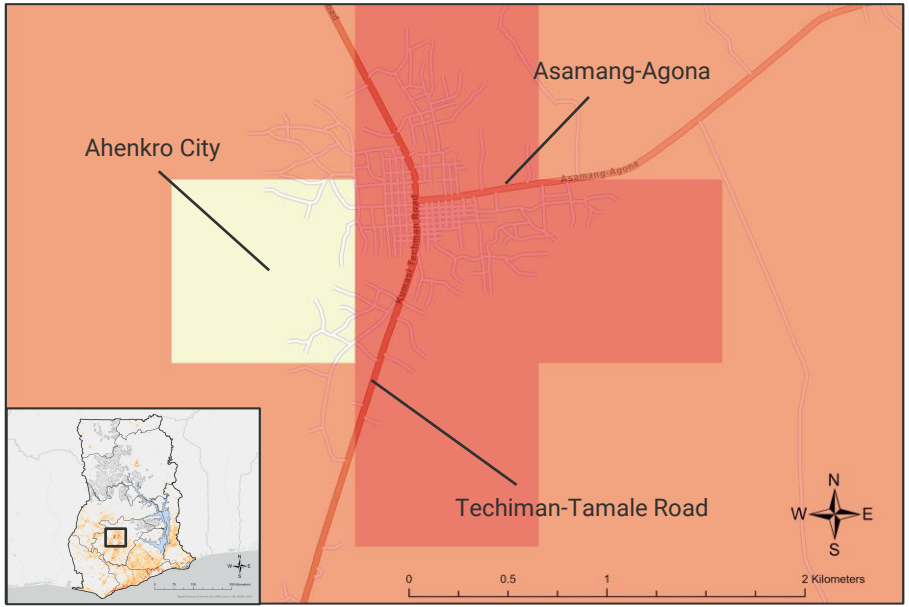
Note 1: This map shows the estimated number of peri-urban and rural early-adopter households per 1km^2. Peri-urban and rural early-adopter households own at least one high-cost asset, have housing made of all high-quality material, have access to electricity, and live in suburban or peri-urban rural areas according to the EU Global Human Settlement Layer.
Source: Fraym, Ghana 2014 DHS

Top Local Government Areas with Peri-urban and Rural Early-Adopters

State	Districts	Number of Peri-urban and Rural Early-Adopter Households
Ashanti	Afigya Kwabre	21,000
Central	Gomoa East	21,000
Central	Komenda Edna Eguafo / Abirem	20,000
Western	Shama	20,000
Eastern	Birim South	19,000
Eastern	East Akim	19,000
Ashanti	Sekyere South	19,000
Ashanti	Bekwai Municipal	18,000
Central	Ajumako-Enyan-Esiam	18,000
Volta	Hohoe Municipal	18,000

Peri-urban and Rural Early-Adopters

Peri-urban and rural early-adopters are heavily concentrated in Afigya Kwabre, a small town to the north of Kumasi.



Peri-urban and Rural Early-Adopter Households[1]

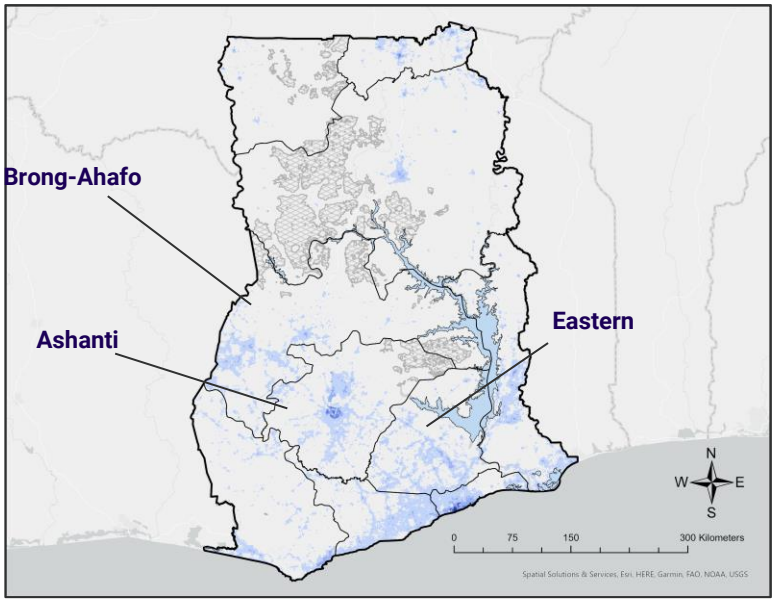
- 0 – 7
- 7 – 30
- 31 – 70
- 71 – 140
- 141 – 280
- 281 – 860
- Zero population areas

In Afigya Kwabre, there is a high concentration of peri-urban and rural early-adopters east of Techiman-Tamale Rd.

Note 1: This map shows the estimated number of peri-urban and rural early-adopter households per 1km^2. Peri-urban and rural early-adopter households own at least one high-cost asset, have housing made of all high-quality material, have access to electricity, and live in suburban or peri-urban rural areas according to the EU Global Human Settlement Layer.
Source: Fraym, Ghana 2014 DHS

Fast-Followers

There are roughly 1.4 million fast-follower households, representing around 16 percent of all households in Ghana. Ashanti, Brong-Ahafo, and Eastern regions have the largest concentrations of fast-followers.



Fast-Follower Households[1]

- 0 – 10
- 11 – 50
- 51 – 160
- 161 – 420
- 421 – 770
- 771 – 1,250
- Zero population areas

Note 1: This map shows the estimated number of fast-follower households per 1km^2. Fast-Follower households own at least one high-cost asset or have access to a bank account and have housing made of at least one high-quality material.
Source: Fraym, Ghana 2014 DHS, Ghana 2019 MIS

1.4M Fast-Follower households

26% of households are headed by a woman

7.4 Average household size

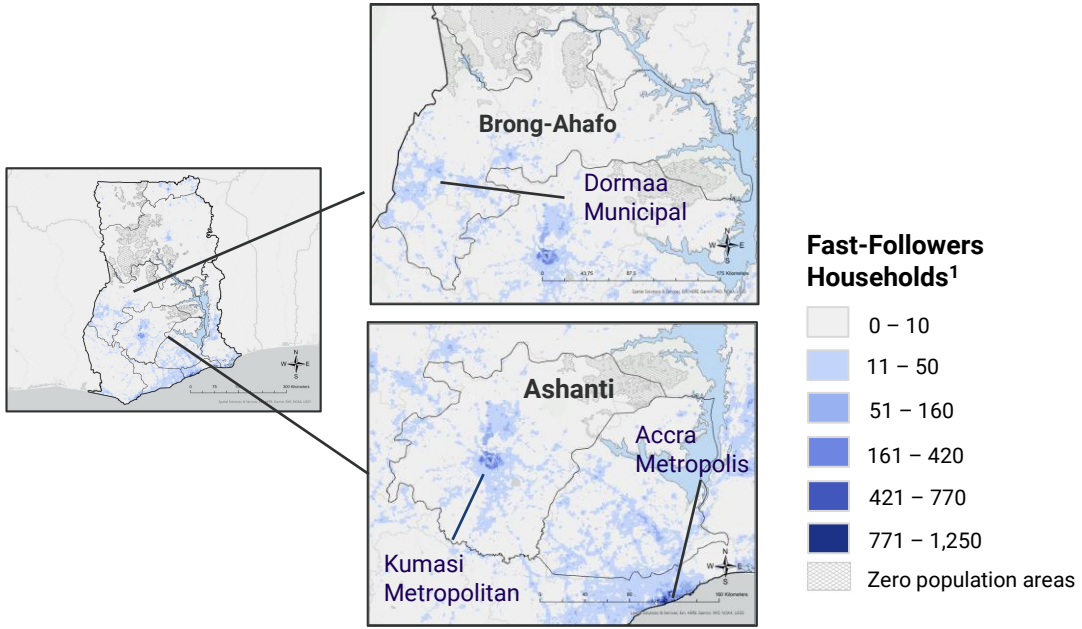
12% of household heads have completed secondary education

63% use wood as their primary cooking fuel

29% use charcoal as their primary cooking fuel

Fast-Followers

About 30 percent of all fast-follower households live in the Ashanti and Brong-Ahafo regions. In Brong-Ahafo, nearly a quarter of households are fast-followers.



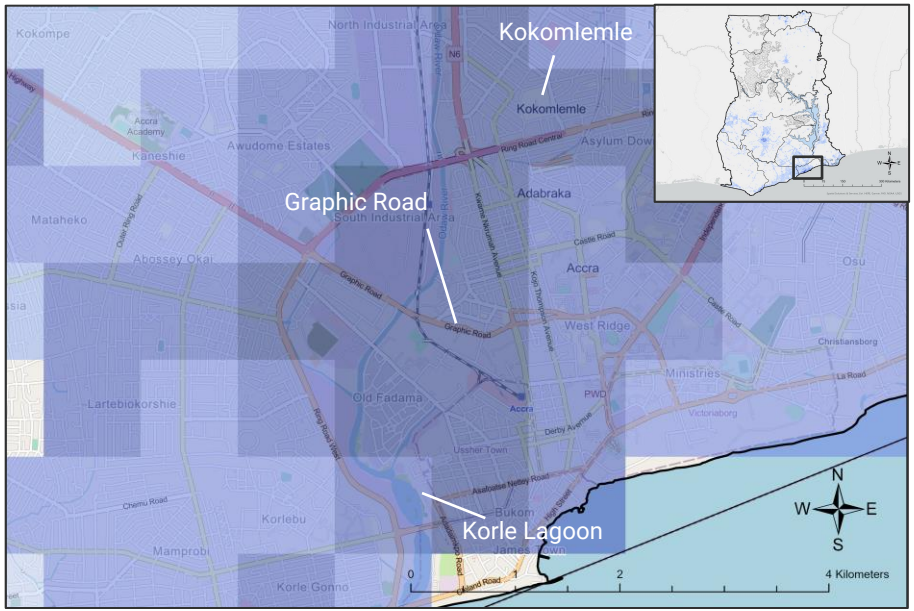
Note 1: This map shows the estimated number of fast-follower households per 1km^2. Fast-Follower households own at least one high-cost asset or have access to a bank account and have housing made of at least one high-quality material.
Source: Fraym, Ghana 2014 DHS

Top Local Government Areas with Fast-Followers

State	Districts	Number of Fast-Follower Households
Greater Accra	Accra Metropolis	49,000
Ashanti	Kumasi Metropolitan	40,000
Western	Jomoro	19,000
Central	Gomoa East	17,000
Ashanti	Afigya Kwabre	16,000
Brong-Ahafo	Dormaa Municipal	16,000
Brong-Ahafo	Berekum Municipal	15,000
Volta	Hohoe Municipal	14,000
Ashanti	Sekyere South	14,000
Greater Accra	Ga South	14,000

Fast-Followers

There is a large concentration of fast-followers in the center of Accra.



Fast-Followers Households²

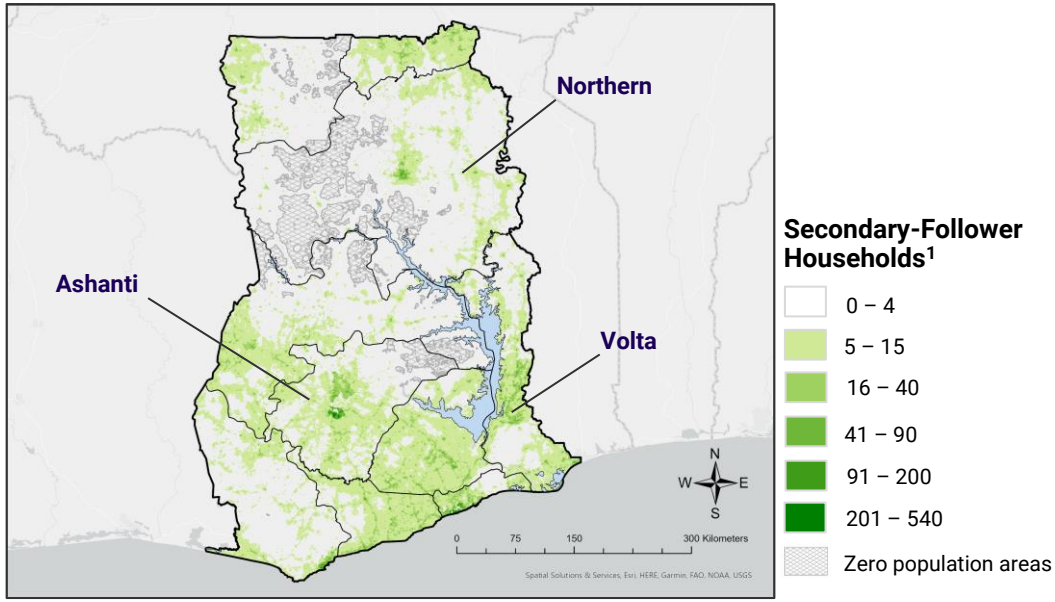
- 0 – 10
- 11 – 50
- 51 – 160
- 161 – 420
- 421 – 770
- 771 – 1,250
- Zero population areas

Concentration of fast-followers stretch out along the east of the Korle lagoon, with a high density of consumers in the neighborhood of Kokomlemle and the areas around Graphic Road.

Note 1: This map shows the estimated number of fast-follower households per 1km^2. Fast-Follower households own at least one high-cost asset or have access to a bank account and have housing made of at least one high-quality material.
Source: Fraym, Ghana 2014 DHS

Secondary-Followers

There are about 1.2 million secondary-follower households, representing 13 percent of all households in Ghana. Secondary-Follower households are more dispersed compared to other segments.



Note 1: This map shows the estimated number of secondary-follower households per 1km^2. Secondary-Follower households own at least one high-cost asset or own a radio and have housing made of at least one high-quality material.
Source: Fraym, Ghana 2014 DHS, Ghana 2019 MIS

1.2M Secondary-Follower households

33% of households are headed by a woman

8.6 Average household size

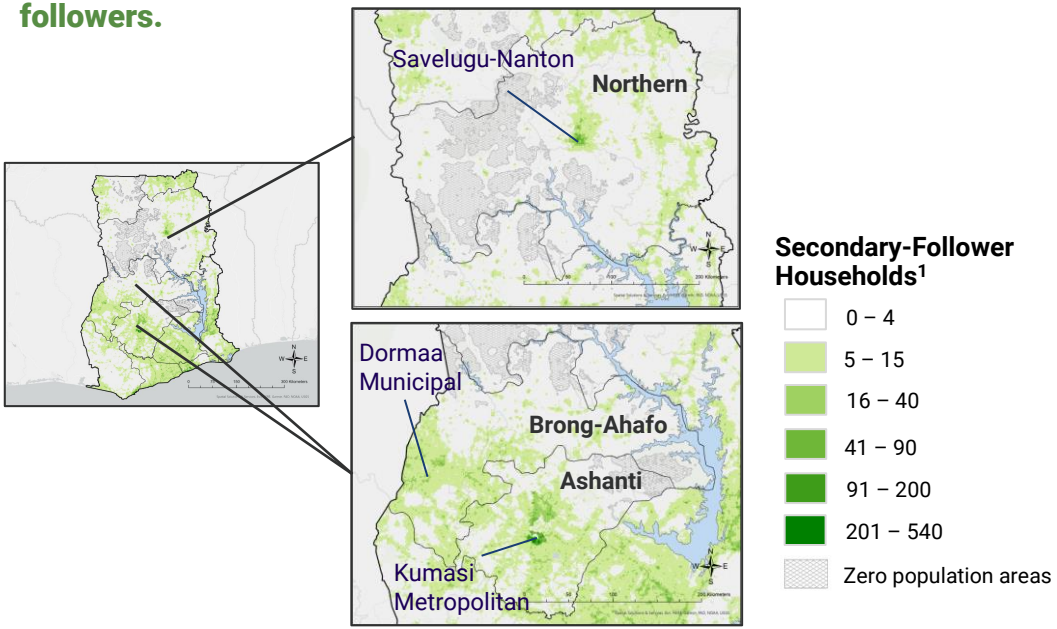
3% of household heads have completed secondary education

59% use wood as their primary cooking fuel

35% use charcoal as their primary cooking fuel

Secondary-Followers

Over 40 percent of secondary-follower households live in the Ashanti, Northern, and Brong-Ahafo regions. Around 20 to 25 percent of all households in Northern and Brong-Ahafo regions are secondary-followers.



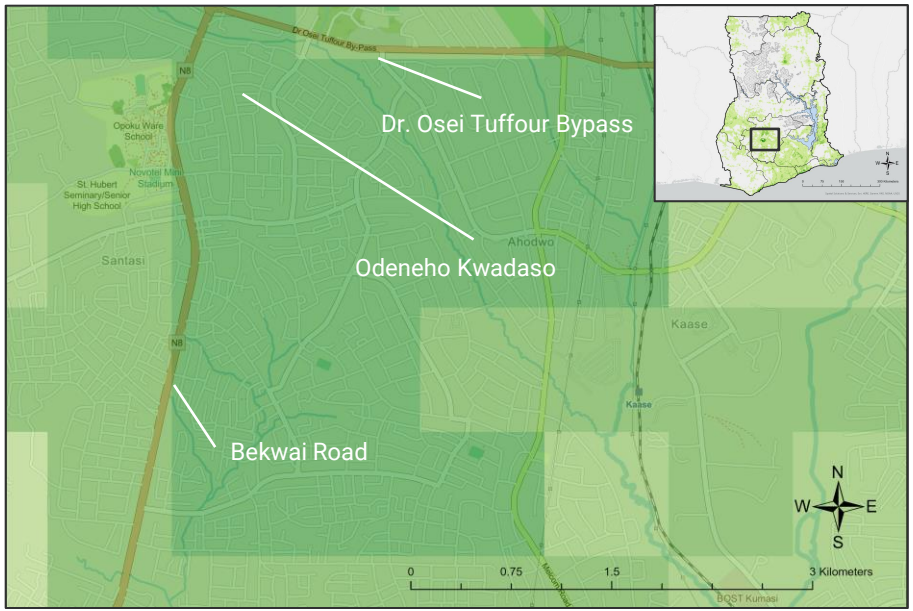
Note 1: This map shows the estimated number of secondary-follower households per 1km^2. Secondary-Follower households own at least one high-cost asset or own a radio and have housing made of at least one high-quality material.
Source: Fraym, Ghana 2014 DHS

Top LGAs with Secondary-Followers

State	Districts	Number of Secondary-Follower Households
Ashanti	Kumasi Metropolitan	23,000
Volta	Hohoe Municipal	14,000
Greater Accra	Accra Metropolis	14,000
Eastern	Kwahu Afram Plains South	13,000
Brong-Ahafo	Dormaa Municipal	12,000
Northern	Savelugu-Nanton	12,000
Upper East	Garu-Tempane	12,000
Northern	East Gonja	12,000
Volta	Afadjato South	12,000
Central	Assin North	11,000

Secondary-Followers

Secondary-Follower households are more dispersed, particularly in the North. However, the highest concentration of these consumers can be found in southern Kumasi.



Secondary-Follower Households[1]

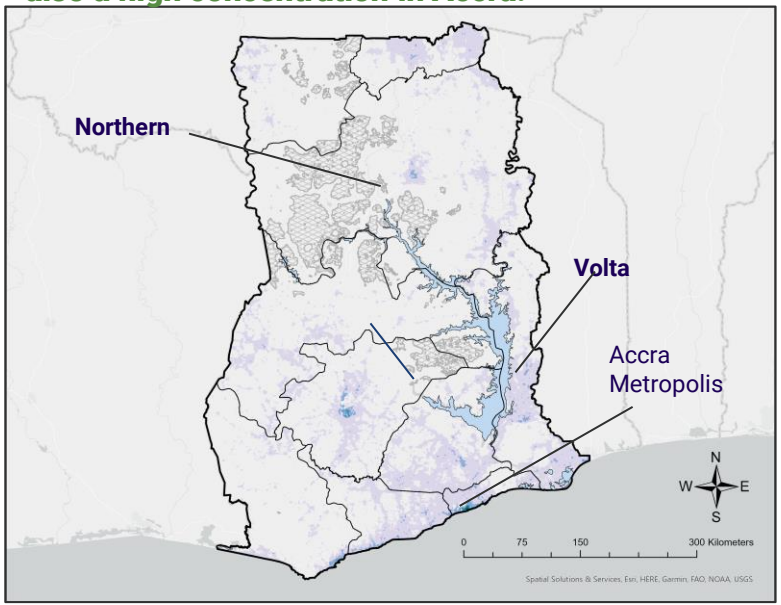
- 0 – 4
- 5 – 15
- 16 – 40
- 41 – 90
- 91 – 200
- 201 – 540
- Zero population areas

Neighborhoods near the intersection of Bekwai Road and Dr. Osei Tuffour Bypass such as Odeneho Kwadaso have a high concentration of secondary-followers.

Note 1: This map shows the estimated number of secondary-follower households per 1km^2. Secondary-Follower households own at least one high-cost asset or own a radio and have housing made of at least one high-quality material.
Source: Fraym, Ghana 2014 DHS

Limited Demand

There are around 1.7 million limited demand households, accounting for about 19 percent of all households in Ghana. Limited demand consumers are common in the Northern region and in Volta. There is also a high concentration in Accra.



Note 1: This map shows the estimated number of limited demand households per 1km^2. Limited demand households do not fit any of the four core consumer profiles due to their limited consumption ability.
Source: Fraym, Ghana 2019 MIS, Ghana 2014 DHS

1.7M Limited Demand households

52% of households are headed by a woman

6.0 Average household size

1% of household heads have completed secondary education

61% use wood as their primary cooking fuel

37% use charcoal as their primary cooking fuel

04

Data Sources and Methodology

Asset-Based Consumer Segmentation

Improving upon previous studies of African consumers, Fraym fills two critical gaps by offering reliable market estimates and sub-national specificity. Consumer segments provide a useful framework for thinking about different markets for clean cooking technologies. The goal of this effort is to understand different levels of consumption power within each group of potential clean cooking fuel consumers.

To understand the potential market for different types of clean cooking technologies, Fraym segmented households that primarily use solid cooking fuels into four groups. Instead of basing the profiles on consumers' income and spending, which can be susceptible to seasonal fluctuations, Fraym used a composite measure that classifies households based upon key characteristics such as asset ownership, household building material, and access to services. Each consumer segment only includes households not currently using clean cooking fuel, and each of these groups are mutually exclusive, with each household being classified into the highest tier for which it is eligible.

Early-Adopter households are those with high consumption power, as evidenced by their ownership of high-cost assets, access to electricity, and homes made from high-quality materials.[1] Early-Adopter households were segmented into two groups: *Urban Early-Adopters* and *Peri-urban and Rural Early-Adopter households*.

Follower households have moderate consumption power as evidenced by asset ownership, home construction material, and financial inclusion. Follower consumer households were segmented into two groups: *Fast-Followers* are households with bank accounts suggesting some access to financial tools to facilitate larger purchases, and *Secondary-Followers* are households that own a radio, suggesting some discretionary spending power. Both groups can be found in both urban, peri-urban, and rural areas.

The remaining solid fuel cooking households were categorized into a limited demand profile, with very low consumption ability.

Note 1: High quality housing materials are defined as durable materials like concrete, metal, brick, or finished wood. All housing refers to the roof, wall, and floor.
Source: Fraym

Identifying Early-Adopters

Fraym segmented solid cooking fuel households into early-adopter groups based on high-cost asset ownership, housing quality, and electricity access, which are all indicative of wealth. These households were then further segmented based on urbanicity into Urban and Peri-urban and Rural Early-Adopter households.[1]

Urban Early-Adopters
High consumption ability

Urban households that:

Owns at least one high-cost cost

AND

All high-quality housing material[2]

AND

Access to electricity

Peri-urban and Rural Early-Adopters
High consumption ability

Peri-urban and rural households that:

Owns at least one high-cost asset

AND

All high-quality housing material[2]

AND

Access to electricity

Note 1: Urban areas were defined using the EU Global Human Settlement Layer (GHSL). Urban centers, dense urban clusters, and semi-dense urban clusters are classified as urban. Suburban or peri-urban and all rural areas are classified as peri-urban and rural.
Note 2: High quality housing materials are defined as durable materials like concrete, metal, brick, or finished wood. All housing refers to the roof, wall, and floor.
Source: Fraym

Identifying Followers

Fraym identified follower consumers from the remaining solid cooking fuel households as households with medium to moderate consumption ability, as suggested by some high-cost asset ownership and some high-quality housing materials. While predominantly rural, there are significant numbers of follow consumers in urban areas, especially among fast-follower households.

Fast-Followers Medium-high consumption ability	Owns at least one high-cost asset	**OR**	Bank Account **AND** Housing made of at least one high quality material[1]
Secondary-Followers Medium-low consumption ability	Owns at least one high-cost asset	**OR**	Owns a radio **AND** Housing made of at least one high quality material[1]

Note 1: Urban areas were defined using the EU Global Human Settlement Layer (GHSL). Urban centers, dense urban clusters, and semi-dense urban clusters are classified as urban. Suburban or peri-urban and all rural areas are classified as peri-urban and rural.
Note 2: High quality housing materials are defined as durable materials like concrete, metal, brick, or finished wood. All housing refers to the roof, wall, and floor.
Source: Fraym

Fraym Data

The Fraym database combines satellite imagery and existing household surveys that are harmonized and re-weighted based on population data from third-party sources like multilateral and bilateral development actors, ensuring that indicators are comparable across countries and over time.

For this study, indicators at the individual and household levels were sourced from the 2014 Ghana Demographic and Health Survey (DHS), the 2014 Financial Inclusion Insights survey (FII), the 2019 Malaria Indicators Survey (MIS), and the 2017 Ghana Living Standards Survey (GLSS). These surveys are designed to be nationally representative and use a stratified two-stage sample design. The 2014 DHS data were enumerated between September and December 2014, with a total sample size of 11,835 households. The FII data were enumerated between December 2014 to January 2015, with a total sample size of 3,002 Individuals. The MIS data were enumerated between September 2019 and November 2020, with a total sample size of 1,214 Individuals. GLSS data were enumerated between October 2016 to October 2017, with a total sample size of 14,009.

Fraym data scientists closely examine representativeness, sampling frames, questionnaire coverage, periodicity, and a range of other factors. Fraym obtains microdata, e.g. individual rows of responses of survey data, in order to avoid any manipulation that could potentially occur during the analysis phase. After data collection, Fraym creates post-hoc sampling weights to account for any oversampling and ensure survey representativeness. The weights and resulting population proportions were triangulated with independent, third-party sources, such as the UN Population Division and the World Bank's World Development Indicators.

Additionally, granular population distribution data comes from WorldPop, a publicly available and detailed population distribution and composition data source that leverages existing census data to produce 100m x 100m resolution estimates of population density. In order to build its datasets, WorldPop relies on census data as the main primary data input, and large geotagged household surveys when they are not available. In order to project into the future from the latest census of a given country, WorldPop uses subnational and urban rural growth rates that are reconciled with UN estimates. For this report, population estimates from 2020 were used.

Fraym's Interpolation Process

Fraym has built an artificial intelligence / machine learning (AI/ML) software that weaves together high-quality household survey data with satellite imagery to create localized population information (1 km^2).

The primary data input is data from existing high-quality, geo-tagged household surveys. Key indications of a high-quality household survey include implementing organization(s), sample design, sample size, and response rates. Fraym has collected, cleansed, and harmonized more than 1,000 of these surveys from around the world. Sample sizes are normally 10,000+ households with information for 50,000+ respondents. Response rates are very high, normally higher than 95 percent.

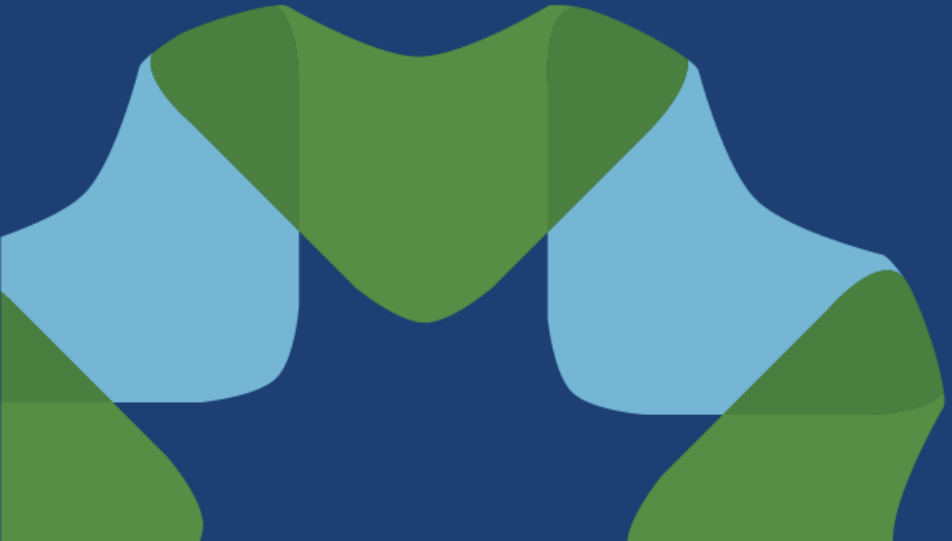
The second major data input is satellite imagery and related derived data products, including earth observation (EO) data, gridded population information i.e. human settlement mapping, and biophysical surfaces like soil characteristics. As with the survey data, Fraym data scientists ensure that the software only uses high-quality imagery inputs. Derived products are carefully assessed for model metrics, contextual checking, and pedigree within the geospatial data science community.

To create spatial layers from household survey data, Fraym leverages machine learning to predict an indicator of interest at a 1 square kilometer resolution. This methodology builds upon existing, tested methodologies for interpolation of spatial data. The resulting model is used to predict the survey data for all non-enumerated areas. A similar approach was pioneered by USAID's Demographic and Health Surveys program in 2015 and since improved upon by Fraym and others.[1]

Once the spatial layer is produced, Fraym performs a series of quality checks including the comparison of the spatial layer's output to the survey at its level of representativeness (national and/or first level administrative division). This survey mean is compared against the implied mean of the surface when all grids are appropriately aggregated through population weighted zonal statistics.

Note 1: Gething, Peter, Andy Tatem, Tom Bird, and Clara R. Burgert-Brucker. 2015. Creating Spatial Interpolation Surfaces with DHS Data DHS Spatial Analysis Reports No. 11. Rockville, Maryland, USA: ICF International. Other notable, relevant work includes: Weiss DJ, Lucas TCD, Nguyen M, et al. Mapping the global prevalence, incidence, and mortality of Plasmodium falciparum, 2000–17: a spatial and temporal modelling study. Lancet 2019; published online June 19. DOI: 10.1016/S0140-6736(19)31097-9 and Tatem A, Gething P, Pezzulo C, Weiss D, and Bhatt S. 2014. Final Report: Development of High-Resolution Gridded Poverty Surfaces. University of Southampton. https://www.worldpop.org/resources/docs/pdf/Poverty-mapping-report.pdf

Source: Fraym



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