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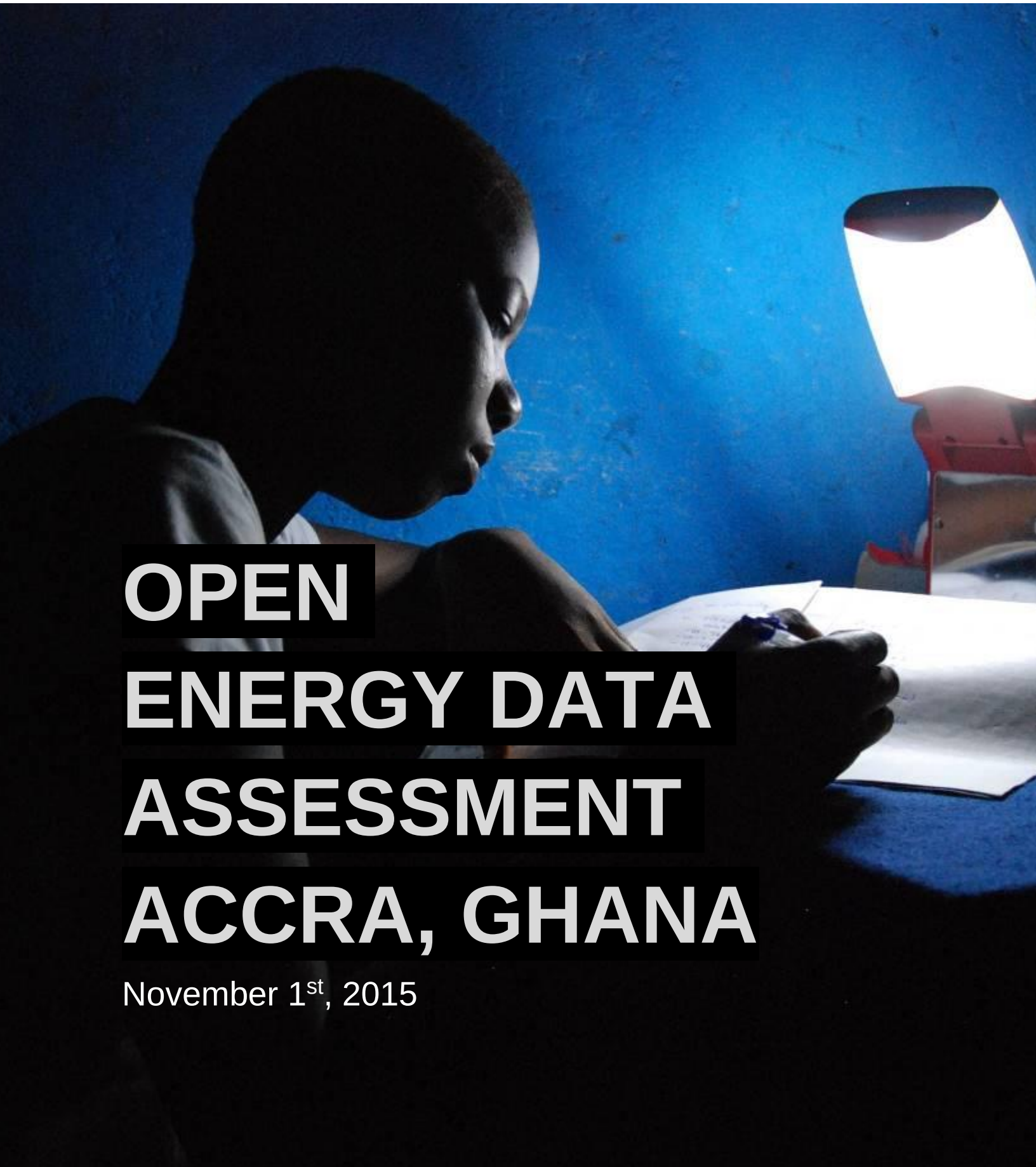

OPEN ENERGY DATA ASSESSMENT ACCRA, GHANA

November 1st, 2015

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Content

Acknowledgement

The Open Energy Data Assessment for Accra has been prepared as part of the World Bank Negawatt Challenge for Energy Efficiency activity.

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Disclaimer

The analysis and recommendations in this Open Energy Data Readiness Assessment are based on the information and opinions collected from the interviews undertaken and materials provided by the government and other stakeholders during this study.

The findings, interpretations, and conclusions expressed in this report are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent

This Open Energy Data Readiness Assessment is not based on detailed, legal due diligence and does not constitute legal advice. It is recommended that prior to undertaking any action to address any policy, legal or regulatory issue raised herein, the responsible stakeholders ensure that a competent, locally qualified, legal counsel undertake the legal due diligence that it deems appropriate.

Glossary[1]

Energy sector this methodology considers the energy sector in a broad sense, including all the stakeholders involved in the production, transmission, distribution, regulation, management and planning of energy on a given territory.

Energy statistics refers to statistics on energy stocks and flows, energy infrastructure, performance of the energy industries and the availability of energy resources within the national territory of a given country during a reference period.[2]

Energy data refers to any data that may be useful for the development of the energy sector. This definition of energy data extends the definition of energy statistics as it includes data which is not usually collected within the National Statistics System.

Open data data is considered to be "open" if anyone can freely use, reuse and redistribute it, for any purpose, without restrictions. To be considered "open," the data must be reusable meaning they can be downloaded in open formats and read by software and users have a legal right to reuse the data.

Open energy data is any energy data considered "open". Open energy data can be data produced by any entity representing public sector, private companies, researchers, NGOs or media.

[1] For a comprehensive glossary of terms used in the energy sector, you may refer to the International Energy Agency Glossary, www.iea.org/aboutus/glossary/

[2] United Nation Statistics Division, International Recommendations for Energy Statistics (IRES), 2011

Acronyms or abbreviations

AMA	Accra Metropolitan Assembly
DLR	Deutsches Zentrum für Luft und Raumfahrt
DVLA	Driver and Vehicles Licensing Authority
EC	Energy Commission
ECG	Electricity Company of Ghana
GEDAP	Ghana Energy Development and Access Project
GLSS	Ghana Living Standards Survey
GODI	Ghana Open Data Initiative
GRIDCo	Ghana Grid Company
GSS	Ghana Statistical Service
KNUST	Kwame Nkrumah University of Science and Technology
LPG	Liquefied Petroleum Gas
MEST	Meltwater Entrepreneurial School for Technology
MDA	Ministry, Department or Agency
MoEP	Ministry of Energy and Petroleum
NEDCo	Northern Electricity Distribution Company
NEDPIC	National Energy Data Processing and Information Center
NITA	National Information Technology Agency
NPA	National Petroleum Authority
NREL	National Renewable Energy Laboratory
ODRA	Open Data Readiness Assessment
OSM	Open Street Map
PURC	Public Utilities Regulatory Commission
REEP	Renewable Energy and Energy Efficiency Partnership

SNEP	Strategic National Energy Plan
VRA	Volta River Authority
ISEES	Institute for Sustainable Energy and Environmental Solutions
GHGBC	Ghana Green Building Council
SNV	Netherlands Development Organization

Executive summary

As one of the fastest growing cities in the world, Accra has had to cope with multiple challenges to respond to increased urbanization, population growth and subsequent upsurge in economic activities. A growing economy and the rapid increase in the number of urban residents has translated into a sharply rising demand for energy, both electricity and fuel. As a result, Accra has since 2007 been confronted with a severe and continued electricity crisis, which results in daily scheduled, and unscheduled, blackouts that plague the local economy and infers on citizens well-being.

Access to reliable energy data is essential for the development of sustainable and efficient energy policy for the city as well as for the design and implementation of innovative solutions. Energy entrepreneurs are requesting more granular and localized data, from disaggregated macro statistics to real-time local energy usage data.

The Accra Metropolitan Assembly (AMA) and other key energy sector stakeholders like utilities or the regulator can improve sector performance and support emerging energy entrepreneurship by opening their energy datasets using open data principles. Open energy data refers to the concept that any data that may be useful for the development of the energy sector should be available online in a structured machine-readable format for anyone to use or redistribute with any purpose, including commercial one.

As a first step towards developing a policy direction on energy data, AMA and the Energy Commission have agreed to participate in the first version of the Open Energy Data Assessment, designed and implemented by the Global ICT Practice of the World Bank Group. The assessment was conducted in March 2015, with some preparatory work undertaken in February 2015. The assessment was carried out under the framework of the Negawatt Challenge for Energy Efficiency, a World Bank activity supporting innovation in the energy sector, with funding from the Trust Fund for Statistical Capacity Building.

The overall objective of the Open Energy Data Assessment was to assess the readiness of Accra energy sector to implement or reinforce open data and to prioritize key actions for open energy data policy making.

The result of the assessment is that the electricity sub-sector is in a favorable position to move forward on open data and achieve tangible results within Accra[3] area if appropriate and targeted actions are taken. In particular, this study recommends AMA, the Ghana Open Data initiative (GODI) and the main energy stakeholders to consider the following measures to introduce and mainstream the principles of open data within the energy sector: 1. Mandate the Energy Access Data Task Force to advance open data within the energy sector; 2. Strengthen NEDPIC with

[3] This report refers to Accra as the city administered by the Accra Metropolitan Assembly (AMA) and capital of Ghana. However, it is worth noted that Accra is also the capital of the Greater Accra Region and the anchor of a larger metropolitan area, the Greater Accra Metropolitan Area (GAMA).

open data capacities; 3. Adopt an Open Energy Data Policy; 4. Release existing key energy datasets as open data; 5. Launch AMA's Open Data Initiative; 6. Engage with the tech community to improve quality and usability of open energy datasets and demonstrate value of open data through pilot applications or services.

Regarding the key dimensions of the assessment, the study found that:

The national Ghana Open Data Initiative (GODI) could leverage the efforts to develop open data in the energy sector. However, the national program has been suffering from a lack of investment and oversight since its launch in 2012. As a result, GODI has not fully met its primary objectives. Nevertheless, the demand for government data is expected to remain strong and growing, particularly in the energy sector.

The policy, regulation and state of maturity of the energy data ecosystem make it possible to release energy data as open data. The main energy policies such as the Strategic National Energy Plan (SNEP) 2006 - 2020 are promoting an easier access to information given that access to data is recognized within the policy as a success factor for the development of the renewable and energy efficiency sectors. However, there is no specific provision in the policies explicitly calling for the incorporation of open data principles such as releasing data in machine-readable format. Similarly, there is no general right of access to information applying to the sector, which means that the availability of energy data relies exclusively on the consent of data producers. The enactment of the Right to Information Law and the adoption of a proper licensing regime for GODI would be the first important steps from the open data policy making perspective.

Among the main public sector energy stakeholders in Ghana, the Energy Commission has a clear mandate for collecting, analyzing, and disseminating government energy data. Although the level of open data awareness and capacity to work with data in the energy sector as a whole is still limited, the Energy Commission has shown dedication and leadership in driving the release of energy data and engaging multiple stakeholders through its Energy Access Data Task Force. The Energy Comission has been one of the few public sector entities releasing the data in machine-readable formats such as excel or csv.

In order to make the agenda salient in the public discourse, a clear commitment towards open data is required from the Ministry of Energy and Petroleum and the main energy utilities: Volta River Authority (VRA, power generation), Ghana Grid Company (GRIDCo, power transmission), the Electricity Company of Ghana (ECG, power distribution) and the Northern Electricity Distribution Company (NEDCo, power distribution) - that all have been collecting relevant data for many years. It is recommended that the energy sector develop standard practices and management procedures for government data sharing as well as follow a proper resource allocation policy to enable frequent data collection, release and updating. The public sector may also consider establishing a deeper cooperation with academia, for example with The Energy Center at Kwame Nkrumah University of Science and Technology (KNUST) which has the technical capacity to collect and analyze energy data, and is already part of the Energy Access Data Task Force. It will be also important to capture and release information from decentralized

and private energy supply projects, in particular in the area of off-grid solar to ensure the development of the market.

There is a strong demand for energy data from various stakeholders including entrepreneurs working on energy-efficient hardware and software solutions (for example, waste-to-power, wind power, cook stoves, clean fuel) and academics working on energy modeling. Among public sector entities, the Town and Country Planning Department of AMA is one of the primary entities seeking the release of energy data for enhanced operations and evidence-based decision making. The assessment shows that several high-value energy datasets, which are in explicit demand by the private sector, could be released as open data within a short time frame and at very low cost. For instance, this is the case of the GhEA Toolkit of the Energy Commission which contains geolocalized data on communities and facilities associated with energy data, and of city maps that include accurate street names, currently in sole possession of the Accra Metropolitan Assembly (AMA).

Optimizing energy supply and adjusting energy demand is one of the key priorities for the government, however, to date, only a fraction of government financing went to finance the energy data activities or open data. It is evident that energy data ecosystem development requires financing to enable sustainable operations of the main energy data-holding agencies. For example, the Energy Commission is currently seeking funding for the implementation of its National Energy Data Processing and Information Center (NEDPIC) which intends to promote best practices around energy data by training people and offering data analytic capacity. One of the important assessment findings is that the World Bank, through its eTransform ICT Project, has resources to address the energy data capacity and funding issue through the re-launch of the GODI. Further funding opportunities could arise from the energy sector in projects such as electricity expansion and renewable energy development.

Methodology

This report was prepared following the Open Energy Data Assessment methodology, an energy sector-specific version of the Open Data Readiness Assessment (ODRA) which defines key dimensions where actions are needed to be taken in order to develop an open data program.

This methodology relies on an “ecosystem” approach whereby both the “supply” and “demand” sides of open energy data are analyzed going beyond a mere analysis of the data collection and publishing function of government institutions. It analyzes the environment in which supply of data takes place and demand for it emerges to ensure that the government is well informed as to which policies or measures it has to implement to stimulate open energy data and its active reuse by various user communities.

The dimensions of the Open Energy Data Assessment are: Policy, regulation and structure of the energy sector; Legal framework components within the energy sector related to data management; Leadership, responsibilities and capabilities within the energy sector; Data management within the energy sector; Key energy datasets availability; Use and demand for energy data; ICT use and infrastructure in the energy sector; and Funding an open energy data program within the energy sector.

In addition, a specific section covering basic and essential evidence for the background framework of open data in Ghana and Accra has been added to the report. This section uses a lightweight version of the standard Open Data Readiness Assessment.

Evidence

The Assessment framework suggests some hard evidence - existing documents or facts - which are relevant to the dimension, though these are intended to be illustrative only and do not present an exhaustive list.

Individual items of evidence are marked “+” for evidence of a higher level of readiness and “-“ for evidence of a lower level of readiness. The “o” sign indicates that evidence has mixed implications or neither favors nor weighs against readiness.

Assessment

The qualitative assessment of the degree of readiness for each dimension uses the following color scale:

- Green means there is clear evidence of readiness
- Yellow means that evidence of readiness is less clear
- Red means there is an absence of evidence for readiness
- Grey means insufficient information to assess readiness

1. Open Data Readiness Assessment for Ghana and Accra

Importance Very High

The existence of a National or local Open Data Initiative or basic components for the establishment of an open data program at national and city level are essential to the success of open data within the energy sector.

Evidence

1. 1 Leadership on national and city-level open data Yellow

- o At the end of 2011, the President of the Republic of Ghana, His Excellency Prof. J.E. Mills, signed the Open Government Partnership (OGP). The Ghana Open Data Initiative (GODI) was part of the action plan. However, three years later, while GODI has been launched, most of the commitments of the OGP Ghana Action Plan are still to be implemented.[4]

- The 2011 Web Foundation feasibility report[5] indicated that the Government of Ghana had the political will to make information transparently available to its citizens. In January 2012, John Mahama, then Vice President of Ghana, informed a delegation from the Web Foundation that he was committed to championing the GODI at the cabinet level. On 24 July 2012, John Mahama took office as new President. Since then, there has been no sign such as a public declaration that open data was on the new President or Cabinet agenda.

- o An Open Data Steering Committee was appointed to guide GODI in August 2012. It included representatives of Cabinet, NITA Board, Ministry of Communication and CSOs. However, the Committee only met twice, failing in delivering proper guidance and leadership to GODI. As agreed by most of interviewees, the re-composition of the Steering Committee or a more focused Open Data Taskforce is considered to be key to the success of GODI. The activities of such a group should not be conditional on financing.

+ Ghana is home to some Internet and access to information champions. Among them is Nii Narku Quaynor, who is a member of the Internet Hall of Fame and NITA Board. Quaynor was co-chair of the Open Data Steering Committee. It is advisable that the Steering Committee consist of open data as well as access to

[4] See http://www.opengovpartnership.org/country/ghana/action-plan

[5] See http://www.webfoundation.org/2011/05/open-government-data-reports-published/

Internet and information champions in order to raise sufficient awareness on open data at the political level.

+ Even though there is no open data initiative yet at Accra city level, the Director of Budget of AMA expressed commitment to making city-level data open. However, there is no detail yet as to whether this would be an independent initiative or a part of GODI. In other countries, where local and national open data initiatives co-exist, the Government often decides to federate all datasets on a single portal.

1.2 Legal framework Red

o Adoption of the RTI law is one of the government's Open Government Partnership action plan items, and was also a recommendation from the Web Foundation's Open Data report[6] which assessed the feasibility of a national open data initiative for the country. The law has been pending in the parliament since 2010. In February 2015, the Select Committee on Constitutional, Legal and Parliamentary Affairs has advanced the amendment of the Right to Information Bill for consideration by the Parliament, which is a step forward.[7] CSOs are also urging the parliament to pass the bill.[8]

- Contrary to what is specified in the "terms of use" of the GODI website, there is no open data license attached to the government produced datasets, making the whole content of data.gov.gh not legally open with regard to open data international standard.

+ Ghana has adopted a Data Protection Act in 2012[9].The Act established a Data Protection Commission[10] whose mandate is to protect the privacy of the individual and personal data by regulating the processing of personal information.

1.3 Institutional structures on national and city-level open data Yellow

o GODI is run by a team of 5 people at the National Information Technology Agency (NITA). The team comprises a project manager, data officer, open data portal officer, communications officer, and administrative officer. GODI is their primary responsibility, although it is understood that they can be delegated to other NITA's project. The GODI team has demonstrated sufficient capacity in

[6] Web Foundation, Open Government Data Feasibility Study in Ghana, 17 May 2011, https://public.webfoundation.org/2011/05/OGD_Ghana.pdf

[7] See http://www.freedominfo.org/2015/02/ghana-committee-approves-right-information-bill/

[8] See http://www.spyghana.com/be-firm-on-mps-to-facilitate-the-passage-of-the-rti-bill-ghanaians-told/

[9] See http://www.dataprotection.org.gh/sites/default/files/Data%20Protection%20Act%20,%202012%20%28Act%20843%29.pdf

[10] See http://www.dataprotection.org.gh/

implementing and managing the open data portal. As of now, GODI team is in a process of preparation for the upgrade of the open data portal, of formulation of policies and regulations for open data development, and of preparation of content for open data. However, the funding for these activities does not seem to be sufficient and its sustainability is likely compromised, as the team has expressed concerns about the chronic lack of funding. The World Bank Ghana eTransform project is expected to provide support to these actions.[11]

- o The IT-Management Information Systems Unit (IMIS) from AMA is responsible for the data systems management of the City of Accra. Its mandate is to convert data from internal and external sources into information and communicate it in an appropriate form to all user departments of AMA to enable them to make timely and effective decisions. As such, the unit is responsible for hosting and operating all AMA data. However, for now, IMIS only manages a subset of all information collected by AMA. The head of IMIS expressed that they would need more technical and human resources to extend their information system to all AMA's data.

- \+ The Ghana Statistical Service (GSS) is responsible for production, management and dissemination of national statistics in the country. GSS published in 2008 the Ghana Statistics Development Plan 2009 - 2013[12] which aims notably at building the capacity of the statistics units of the sector Ministries; reducing inconsistencies and duplications in official statistics; and improving the dissemination of official statistics and access to users. The plan is currently implemented through a multi-donor funded project managed by the World Bank which ends in 2016.[13]

1.4 Data management and availability Yellow

- \+ There are already 1407 datasets available on the national open data portal administered by GODI, including datasets from the following ministries: Ministry of Food and Agriculture; Ministry of Local Government and Rural Development; Ghana Statistical Service (GSS); Ministry of Health (MoH); Ministry of Finance;[14] Ministry of Communications; Ministry of Transport; Ministry of Energy and Petroleum (MoEP); Ministry of Environment, Science & Technology; Ministry of Interior; Ministry of Education; and Ministry of Tourism.

[11] See http://www.worldbank.org/projects/P144140/gh-etransform-ghana?lang=en

[12] Ghana Statistical Service, Statistics Development Plan, November 2008, rhttp://www.paris21.org/sites/default/files/GHANA-NSDS-2009-13.pdf

[13] World Bank, Ghana Statistics Development Program, http://www.worldbank.org/projects/P118858/ghana-statistics-development-program?lang=en&tab=overview

[14] Also in charge of and Economic Planning

- The number of datasets featured on the portal is inflated because many datasets are actually subsets of distinct national datasets, provided at district or regional coverage. For example, the national education dataset, providing statistics on schools, is split into datasets by districts.

- There is no data collection procedure in place between MDAs focal points and GODI. As a result, GODI data officer needs to collect by himself all of the datasets from each MDA separately and then ensure that the datasets are updated on a regular basis. This process, which is not sustainable, has resulted in very few available datasets updated in 2014.

+ Some important energy sector relevant datasets are already available, including geo-localized water points. Other ministries' data could be added to GODI portal through the release of non-personal data, such as the data from the DHIS 2 database managed by the Ministry of Health or data collected at the level of schools by the Ministry of Education and including information on facilities, location, equipment, school performance, absenteeism rate, etc.

+ AMA does not provide data on the national open data portal. However they are in the process of digitizing geo-localized information such as street names, maps and properties information and may soon release it online, subject to approval from the AMA committee.

1.5 Demand for open data Yellow

- Demand side of open data seems to have been neglected by GODI resulting in very few exchanges between its team and external stakeholders over the past two years (as reported by external stakeholders).

- On a technical perspective, there is no mechanism for external stakeholders to request specific datasets from the portal and for the GODI team to handle such requests in due manner.

+ However, there is an active and vibrant ecosystem represented by multiple CSOs, IT companies, media and MDAs who would greatly benefit from the more proactive demand side activities initiated by GODI.

+ Ghana is also home to successful mobile applications such as Farmerline, a service for improving information access and communication channels for smallholder farmers and agricultural workers.[15]

1.6 Civic engagement Yellow

+ Open Data events have been organized by and for CSOs, including Data Literacy

[15] See http://farmerline.org/

Bootcamp on Extractive Industries in May 2013;[16] Open Data Clinic organized in December 2014 on Transparency and Accountability issues[17] with local CSOs as participants and the Open Data Accra in February 2015, co-organized by Mobile Web Ghana and Code for Ghana.[18] Together with the recent appointment of a Ghanaian Data Fellow a part of the School of Data initiative,[19] these evidences show that there is an emerging open data community which has among its priorities to develop data literacy among the civil society.

- Eric Akumiah, Director of Operations, National Information and Technology Agency (NITA) reported in an interview for the Open Data Barometer survey 2015 that GODI and the CSOs held a meeting on Ghana Open Data Portal in April 2014. There have been some interactions with CSOs and professionals on open data but this has not been widespread and yet to yield satisfactory results as there has not been any coordinated campaign for open data usage.[20]

+ There are various ICT techology spaces (Hub Accra, iSpace Foundation, Mobile Web Ghana), incubators (Meltwater Entrepreneurial School for Technology (MEST), Ghana Multimedia Incubator Center, Stanford SEED) and technology institute (The Ghana-India Kofi Annan Centre of Excellence in ICT) in Accra. There is evidence to suggest that all of these stakeholders would benefit from a more developed open data ecosystem.

1.7 Funding Yellow

- Since its launch GODI has suffered from the lack of funding which impeded capacity of its team to upgrade the available IT infrastructure, receive capacity building training, engage with the ecosystem and receive policy guidance and support from open data experts.

+ World Bank's eTransform Project is an opportunity to inject new funding into the GODI to support the re-launch of its portal, upgrade its technical capacity, drive demand side activities and pave the way for a successful open data initiative for the country.

- Whereas the eTransform project will enable the much needed reboot for GODI, there is still uncertainty as to whether the initiative is economically sustainable. There is no specific line in the Government annual budget on financing of GODI

[16] See http://goxi.org/profiles/blogs/ghana-extractive-industries-data-literacy-bootcamp-27th-to-19th

[17] See http://schoolofdata.org/2014/12/31/breaking-borders-the-opendata-party-in-accra-ghana/

[18] See http://fiifibaidoo.com/2015/02/open-data-day-at-mobile-web-ghana/

[19] Seehttp://blog.okfn.org/2015/04/22/meet-the-2015-school-of-data-fellows/

[20] Primary data context impact, Open Data Barometer 2015

and the contract of the current project manager has ended. It is expected that the new Steering Committee or Open Data Taskforce raise the issue at the highest level.

1.8 ICT infrastructure Red

- The open data portal is currently based on the Open Government Platform (OGPL) version 1, an open source data-management platform, developed by India's Open Data team in collaboration with US data.gov team. The OGPL version that GODI is using is quite outdated and contains bugs, security and other issues. There is a much newer version of the OGPL software available, and other software platforms are available, too. For the next version of the open data portal GODI team has taken a decision to migrate to a CKAN-based solution, an open source portal developed by Open Knowledge (UK).

- Although it was not possible to assess the server architecture during the field mission, it was noted that the access to the portal was sometimes constrained. GODI team asked that a part of funding via eTransform to be dedicated to upgrading hosting servers and work on mirror / virtual server solution to ensure availability to the portal from both whole Ghana and outside the country.

- There is no centralized information system to store all the data that the city of Accra manages. AMA received some support in the past from NITA to set up the network but there is still the lack of technical capacity. For instance, several AMA departments cannot connect to the network because of an insufficient number of ports. More ICT skills are also needed to manage the infrastructure.

+ NITA is in the process of acquiring GIS infrastructure so that all government agencies could use GIS services for their own purposes (land administration, urban planning, service delivery monitoring, electrification project management, etc.).

o Only 12% of the population of Ghana uses broadband Internet. However, mobile subscription penetration (120%) is one of the highest of Africa.[21] The reason is a competitive market which led to cheap mobile subscription packages.

Assessment

The global Ghana Open Data Initiative (GODI) has been suffering from a lack of investment and oversight since its launch in 2012. As a result, the program has not met its objectives as set out at the launch such as enhancing participation between the Government, academia, media and the industry; and enabling citizen feedbacks for greater accountability. However, the demand for government data remains to be strong and growing, particularly in the energy sector.

[21] ITU Statistics, 2013

Sub dimensions	Assessment
Leadership	Yellow
Legal framework	Red
Institutional structures	Yellow
Data management	Yellow
Demand for open data	Yellow
Civic engagement	Yellow
Funding	Yellow
ICT Infrastructure	Red
Overall	Yellow

2. Policy, regulation and structure of the energy sector

Importance Very-High

The way the energy sector is structured and regulated has an impact on how easily open data principles can be integrated into it and how the sector can benefit from open data. For instance, the incentives for a public monopoly to release its energy data as open data would not be the same as for a private utility operating in a free market. Understanding how the energy industry is organized and regulated is therefore key to identifying the structural barriers as well as surfacing opportunities for open data.

Evidence

2.1 What is the current structure of the energy sector (its main policies, regulations, actors) and how could it benefit from open data? Yellow

- o The Energy Commission and the Public Utilities Regulatory Commission (PURC) are the current regulatory bodies within the energy sector. Both were set up in 1997 through specific legislative acts. The Energy Commission is a technical regulator of the industry and is a body responsible for assessing applications for licensing, whereas PURC sets tariffs and monitors performance of the different energy stakeholders. Prior to 2008, generation and transmission of electricity was mainly controlled by the Volta River Authority (VRA). The sector changed with the amendment of the Volta River Development Act in 2005, which resulted in the effective separation of electricity generation and transmission three years later. VRA remains a public company operating power generation only, now in a free market environment together with new Independent Power Producers (IPPs). Regarding electricity transmission, a new entity was formed, Ghana Grid Company (GRIDCo), which is the only body allowed to operate in the transmission area. On the distribution side, the main companies are the Electricity Company of Ghana (ECG) which is covering Accra and Southern Ghana and the Northern Electricity Distribution Company (NEDCo), a wholly owned subsidiary of VRA covering Northern Regions.

- o The other texts regulating the electricity sector are the National Electricity Grid Code, 2009; the Environmental Protection Agency Act, 1994 (Act 490) and the Renewable Energy Act, 2011 (Act 832), which is the most recent energy related legislation.

+ The main policy document for the energy sector is the Strategic National Energy Plan elaborated by the Energy Commission for the period of 2006 - 2020 (SNEP

2016 - 2020).[22] The report contains a number of provisions regarding access to information which are described in the following sections.

+ Under the framework of the UN Sustainable Energy for All Initiative, Ghana developed in 2012 a Sustainable Energy For All (SE4ALL) Action Plan[23] which focuses on two high-impact, high-priority areas: i) access to energy for productive uses (use of electricity to generate revenues); ii) access to modern energy for cooking (use of improved energy-efficient and smoke-free cook stoves and liquefied petroleum gas (LPG)). The report identified data access as key to improving the energy efficiency. In particular, it noted the challenge of *"weak collection and management of data on appliances with energy-saving potential"*. The report therefore recommends the inclusion of energy access and utilization data requirements in the Ghana Living Standards Survey (GLSS), a statistical survey framework focusing on households which has been conducted six times by the GSS since 1987.[24]

- According to the Ghana Green Building Council (GHGBC), the regulation for energy audits is weak and fragmented. Some inputs or provisions can be found in the National Housing Policy,[25] in the Procurement Act, regarding sustainability and in the construction industry standards. The Energy Commission, although being one of the stakeholders, is not currently involved in the process of regulating the energy audits. GHGBC is currently devising a framework on energy audits implementation which will be first piloted in Accra and then the rest of the country. Other entities interested in the agenda include the Energy Foundation and Ghana Institution of Engineers. GHGBC believes that access to primary data on energy supply and consumption in buildings is the main weakness impeding energy audits implementation and calls for a proper regulation enforcing data collection and open release.

2.2 To what extent are key indicators of the energy sector conducive to an energy sector specific open data program? Red

o Since 2007, Ghana has been facing a severe in scope and continued energy crisis which is causing daily blackouts that exert a negative impact on the country's economy. The start of the crisis has been attributed mainly to the low water reservoir levels in the Volta Lake serving the Akosombo Hydroelectric Plant. The other contributing factors are the poor maintenance of the transmission

[22] See http://www.energycom.gov.gh/Strategic-National-Energy-Plan/strategic-national-energy-plan.html

[23] Energy Commission, Sustainable Energy For All Action Plan, June 2012, http://energycom.gov.gh/files/SE4ALL-GHANA%20ACTION%20PLAN.pdf

[24] See http://www.statsghana.gov.gh/nada/index.php/catalog/72

[25] Ministry of Water Resources, Works and Housing of Ghana, National Housing Policy, 2015

and distribution systems, inadequate fuel and gas stocks in power thermal plants, and the overall dependence on hydroelectricity.[26]

- o Regarding electricity generation, the two principal sources are hydroelectricity (54% of installed capacity as of 2013) and thermal (46 %).[27]
- o In terms of electricity consumption, residents and commercials buildings account for 70% of energy use while the mining industry uses 14% and the aluminum, through the Volta Aluminum company (Valco), consumes 6%. The remaining 10% goes mainly to export to Nigeria.[28]
- o Almost 30% of the country's population still does not have access to electricity. Many Ghanaians, particularly in rural areas, rely on traditional biomass and waste, particularly firewood for household cooking and heating. Firewood accounts for about 40% of Ghana's total primary energy consumption.
- o The total electricity consumption in Accra is estimated at 2080 GWh per year. This translates into a consumption of 1212 KWh per inhabitant per year, well above Nairobi (120 KWh).[29]

2.3 What is the dynamic of the energy market, in particular regarding development of IPPs and SMEs; and to what extent does it rely on the energy broker system and broker companies?

Yellow

- \- There are four IPPs currently in operation in Ghana: Takoradi International Company (TICo), Sunon Asogli Power Plant (SAPP), CENIT, and Cenpower. The attraction of new IPPs is hindered by the liquidity constraints in the power sector. This is affecting ECG, the principal buyer (off-taker) of power purchase agreements (PPAs), in meeting payment obligations.
- \+ A growing number of foreign IPPs are seeking to enter the Ghanaian market. Since 2009, the Energy Commission has issued 46 licenses for energy supply facilities but most of them are still to be constructed.[30]

[26] World Bank, Energizing Economic Growth in Ghana, June 2013, http://documents.worldbank.org/curated/en/2013/06/18027411/energizing-economic-growth-ghana-making-power-petroleum-sectors-rise-challenge

[27] The Energy Commission, 2014 Energy Outlook For Ghana, p 1, http://www.energycom.gov.gh/files/Energy%20Commission%20-%202014Energy%20Outlook%20for%20Ghana_final_2014.pdf

[28] Ibid. 26

[29] World Bank, Development of Energy Efficiency in Three Pilot Cities in Sub-Saharan Africa – Accra, 2015

[30] Energy Commission, Energy Wholesale Supply License Register, http://www.energycom.gov.gh/files/WHOLESALE%20SUPPLY%20LICENCE%20REGISTER.pdf

- o According to an energy sector private player, the local startup scene is developing in the energy sector but there is less capital available compare to East Africa. Furthermore, most of startups in the renewable energy sector are driven by foreigners. Lastly, prevalence of mobile money is becoming an important decision factor for foreign investment into digital startup, and East Africa is also better here.

- o Waste Enterprisers,[31] which turns human waste into fueling, is an originally Ghanaian startup founded in 2012 but relocated to Rwanda in 2015. It is now called PivotWorks.[32]

2.4 How are the national Government and AMA supportive of renewable energy solutions and what are the current or foreseen reforms in this area? Yellow

- \- Through the SNEP 2006 – 2020 the Energy Commission pursues an objective to increase the use of renewable energy sources to 10% of the national energy mix by 2020. It provided the implementation of a regulatory framework for grid-connected renewable energy power generation, which led to the adoption of the Renewable Energy Act in 2011. However, in 2013, halfway through the implementation of the strategy, the share of renewable in electricity generation accounted for only 0.1% (hydro excluded), thanks primarily to the VRA solar installation.

- \+ The SNEP 2006 - 2020 recognizes that energy information is essential for planning and policy formulation, in particular for the development of a viable market for renewable energy technologies. It therefore recommends to strengthen information capacity by establishing an efficient energy information system.

- \+ Ghana has adopted energy efficiency standards for appliances and related labeling regime since 2015. Standards have been developed for lighting, air conditioning and refrigerating appliances, backed by the following laws: the Energy Efficiency Standards and Labeling Regulation (Non-Ducted Air Conditioners and Self Ballasted Fluorescent Lamps), 2015; and the Energy Efficiency Standards Regulation (Household Refrigerating Appliances), 2009.[33] Data of lamps available on the Ghanaian market and complying with the regulation can be found on the Energy Commission's website.[34] Data on energy efficient refrigerators are available on the Energy Commission website, however not data on Air Conditioners could be found.

[31] See https://www.seed.uno/support/about/capacity-building/701-ghana-2011-seed-winner-waste-enterprises.html

[32] See http://www.pivotworks.co/

[33] Regulations can be found here: http://www.energycom.gov.gh/Regulation-Lisencing/legislative-instrument.html

[34] See http://www.energycom.gov.gh/files/Compliant%20CFLs.pdf

+ In 2014, the World Bank conducted a study to assist AMA in the formulation of a long-term sustainable urban energy efficiency strategy.[35] The study, based on the World Bank's TRACE methodology (Tool for Rapid Assessment of City Energy), identified energy audits and solid waste utilization as the main priorities for the city of Accra. It recommends to introduce energy audit standards for residential and commercial buildings as well as to implement pilot energy-efficient projects in municipal buildings. As for the waste sector, the principal recommendations are to adopt a more efficient waste collection and transportation system and reduce the amount of waste produced through targeted awareness raising among general public. The study provides a number of sub-recommendations which relate to open data or could benefit from incorporation of open data such as "collate, benchmark and track data on energy consumption in new and existing buildings". Industrial and captive generation sectors are excluded from the study because of the lack of available datasets which shows that data availability is an issue when evidence-based energy planning is designed.

o AMA did several studies to develop a waste-to-power generation facility but nothing has been implemented as of yet. The data on waste is not available to third parties who could be potentially interested in designing projects on waste-based electricity generation.

Assessment

The policy, regulation and state of maturity of the energy data ecosystem make it possible to release energy data as open data. The main energy policies such as the SNEP 2006 - 2020 are promoting an easier access to information because it is recognized as a success factor for the development of the renewable and efficient energy sectors. However, there is no specific provision in the policies explicitly calling for the incorporation of open data principles.

Sub dimensions	**Assessment**
Structure of the energy sector	Yellow
Key indicators	Red
Dynamic of the energy market	Yellow
Government is supportive of renewable energy	Yellow

[35] World, Development of Energy Efficiency in Three Pilot Cities in Sub-Saharan Africa – Accra, 2014

Overall	Yellow

3. Energy sector legal framework provisions relevant to open data

Importance High

The long-term success and sustainability of an open data program is greatly impacted by the policy and legal framework. When addressing open data for the energy sector, the legal framework regulating the energy sector is of equal importance as the more general legal framework.

At an early stage of an open data initiative it is important to identify existing policies, laws and regulations with respect to a core set of issues and to identify actual or perceived obstacles to the release of data in order to have the necessary policy or legal change initiated early enough.

Evidence

3.1 Does the legal and policy framework of the energy sector contain specific components related to the protection of personal data? Yellow

- o No evidence of provision related to the protection of personal data could be found in the different acts or code regulating the electricity sub-sector. However the country does have a general data protection framework (see 1.2 Legal framework)

3.2 Is there any exception applied to the energy sector within the right of access to information (if it exists)? Red

- \- There is still no Access to Information legal framework in Ghana. This is the main stumbling block to energy data access for the public and media, in particular in the context of the ongoing energy crisis.

3.3 What are the components related to data management, archiving and data security within the legal and policy framework of the energy sector? Green

- \+ The Energy Commission, under the Energy Commission Act, 1997(Act 541) has the mandate to “secure a comprehensive database for national decision making on the extent of development and utilization of energy resources available to the nation”.

- \+ The SNEP 2006 - 2020 reiterated the need for an efficient energy information system and mandated the Energy Commission to put in place a National Energy information Centre to disseminate available information on Energy matters to the public, researchers and other stakeholders. According to the Energy Commission, the data component of the Center is now in place (see section 5), but the data

analytic component is still to be funded.

- Publicly owned energy utilities VRA, ECG and GRIDCo have their own ICT or Information Management Department, from where they set their own internal data management strategy and standards. There is no evidence that MoEP, which is supervising the energy utilities, is providing guidance for data management framework.

Assessment

The Energy Commission has a clear mandate for collecting, analyzing and disseminating energy data. In contrast, there is no general right of access to information applying to the sector, which means that the availability of energy data relies exclusively on the consent of data producers. The enactment of the Right to Information Law and the adoption of a proper licensing regime for GODI would be the first important steps from the open data policy making perspective.

Sub dimensions	**Assessment**
Data protection within the energy sector	Yellow
Right of access to information within the energy sector	Red
Framework for data management, archiving and data security	Green
Overall	Yellow

4. Leadership, responsibilities and capabilities within the energy sector

Importance High

Open data often requires the implementation of changes - including legal, institutional, technological and cultural changes - affecting stakeholders both inside and outside the energy sector. Leadership is therefore critical to lead the changes and ensure appropriate coordination between main stakeholders.

At the same time, open data requires strong commitment and capacity from stakeholders in the energy sector to ensure management of processes for data gathering, security, quality control and publishing.

Evidence

4.1 To what extent is the energy sector aware of open data and its potential benefits? Yellow

+ The Energy Commission is aware of the importance of data sharing within the energy sector as evidenced by the rationale behind the Ghana Energy Access Database (GhEA database) which states that the availability of a comprehensive and reliable data is a key requirement for effective energy planning and policy analysis and recognizes in the same time that the required data for energy planning and policy analysis is located at different organizations and there exists the challenge of collecting them for planning for sustainable energy access expansions.[36] Moreover, the term open data seems to be well understood among the representatives of the Energy Commission, even though it is not yet widely used.

- Although other main stakeholders within the energy sector recognized the importance of accessing and sharing reliable data, they showed less, if any, awareness of open data and its potential benefits for the sector.

4.2 To what extent are the lead stakeholders within the energy sector (Government, Energy Regulatory Authority, energy utilities) supportive of open data/open government/access to information? Yellow

+ The Energy Commission is already publishing energy data and has expressed interest in making its data more open by integrating open data principles.

[36] See http://energycom.gov.gh/GhEAdatabase/

o The MoEP has not explicitly expressed commitment towards open data. However, it is represented and has been active in the Energy Access Task Force coordinated by the Energy Commission.

- Even though the electricity utilities such as VRA, GRIDCo, ECG contribute to the GhEA database driven by the Energy Commission. None of these actors has been, on its own, proactively engaged in open data, nor demonstrated a strong commitment towards more transparency in the energy sector.

4.3 Which stakeholders within the energy sector are primarily responsible for data or statistics production, collection and management? Green

+ By its mandate, the Energy Commission is primarily and solely responsible for the collection, analysis and dissemination of energy statistics in the country[37]. GSS does not publish reports on the energy sector but provides data to the Energy Commission.

4.4 How strong are ICT and data management skills within the energy sector? Yellow

+ Since 2013, GRIDCo has been managing the centralized Systems Control Center for electricity. This positions the entity at the forefront in terms of ICT capacity within the energy sector.

- The Energy Commission is also well equipped, with its teams managing the GhEA database and setting up the NEDPIC (See section 5.1). However the entity identified data analysis and data management as one of its weaknesses.

+ The Energy Center from the Kwame Nkrumah University of Science and Technology (KNUST) has been an important implementing partner of the Energy Commission on ICT projects. The Energy Center, in conjunction with the Energy Commission and the Energy Access Data Task Force, developed the GhEA database. The Energy Center has also worked with the Energy Commission on the GhEA Toolkit for modeling energy access expansion. The Energy Center in a previous project which ended in 2011 developed the GIS-based Energy Access Review (GEAR). With funding from the UNDP, the GEAR was enhanced, updated and renamed the GhEA toolkit. The toolkit provides many datasets to perform energy analysis and planning[38]. However, the data from the GhEA toolkit has not yet been made available online and its application has not been mainstreamed – it is one of the objectives of the Energy Commission for the future.

[37] See http://oslogroup.org/documents/meetings/ninth/presentations/4th_day/Session_9/Ghana_Data_Dissemination.pdf

[38] See http://www.ecreee.org/sites/default/files/event-att/gis-based_energy_access_project.pdf

Assessment

Among the main public sector energy stakeholders the Energy Commission is the only entity with a clear mandate for collecting, analyzing, and disseminating government energy data. Although the level of open data awareness and capacity to work with data in the energy sector, as a whole, is quite low, the Energy Commission has shown dedication and leadership in driving the release of energy data and engaging multiple stakeholders through its Energy Access Data Task Force. It has been one of the few public sector entities releasing the data in machine-readable formats in excel and csv.

Yet in order to make the agenda salient in the public discourse, a clear commitment towards open data is required from the Ministry of Energy and Petroleum and the main energy utilities: Ghana Grid Company (GRIDCo), Volta River Authority (VRA), the Electricity Company of Ghana (ECG) and the Northern Electricity Distribution Company (NEDCo) - that have been collecting relevant data for many years. It is recommended that the energy sector develop standard practices and management procedures for government data sharing as well as follow a proper resource allocation policy to enable frequent data collection, release and updating. The public sector may also want establish a deeper cooperation with academia, namely the Energy Center at KNUST, which has the technical capacity to collect and analyze energy data, and is already part of the Energy Access Data Task Force.

Sub dimensions	**Assessment**
Energy sector aware of open data	Yellow
Stakeholders within the energy sector supportive of open data	Yellow
Responsibility for data or statistics production, collection and management	Green
ICT and data management skills	Yellow
Overall	Yellow

5. Data management and availability within the energy sector

Importance High

Open energy data can build on established digital data sources and information management procedures within government where they already exist.

For a comprehensive examination of key datasets availability, please refer to the Annex: Key energy-related datasets assessment.

Evidence

5.1 What are the current practices and procedures for data sharing among the main energy stakeholders and between the energy sector and others? Yellow

- o Under its mandate to provide a comprehensive national database and expand access to clean energy, the Energy Commission established and led the Energy Access Data Task Force whose objectives have been since its inception "to facilitate the collation of all forms of data required to monitor progress in the implementation of energy access programs in Ghana; and perform analysis of energy access data to provide timely information to Government and other stakeholders on prospects for achieving Ghana's energy access targets"[39]. The Task Force comprised representatives from the Energy Commission; the MoEP; the National Petroleum Authority; NEDCo; ECG; GSS; The Energy Center at KNUST; CERSGIS, University of Ghana, Legon; and the Ministry of Local Government and Rural Development. The Task Force decided on the development of the Ghana Energy Access Database (GhEA database) and delegated to the Energy Center at KNUST a right to implement it. A worrying sign though is that the Task Force has not convened for several months.
- \+ In response to the SNEP 2006 -2020, The Energy Commission has started to working on NEDPIC which represents a new step towards the implementation of a comprehensive national energy database. The portal is soon to be released.
- \- GRIDCo, an entity in charge of electricity transmission, set up in 2013 the centralized Systems Control Center with funding from the World Bank. The system aims to facilitate real-time control of the electricity network from power generators (such as VRA) to distributors (ECG). It also enables GRIDCo to manage connections with country neighbors for imports and exports of electricity.

[39] http://energycom.gov.gh/GhEAdatabase/

Yet, because of security concerns, there is no mechanism or interface for third parties to access the data they need directly. For this they have to submit a formal request to GRIDCo. As a result, GRIDCo is the only entity to have a global and detailed overview on the operating electricity system in the country, such as, for example, real-time status of power plants, however it is not sharing any of this information proactively to third parties, nor to the public.

- The Information System Department of VRA is managing corporate information through an Enterprise Resource Planning system (ERP) which has been recently rolled out. However, the ERP does not integrate data systems from power facilities. In practice, this means that an entity at the headquarters of VRA such as the Planning and Business or the Engineering Service Department would have to request and collect the data directly from the power facilities, or from GRIDCo which has direct access to some of the power facilities data.

- The MoEP mainly manages data on energy projects, through a data warehouse. MoEP uses the data mainly to perform impact assessments which it then shares in an Excel format with the Energy Commission, but not general public. The MoEP shares data about the projects with the concerned stakeholders. However, the data can be accessed upon request and MoEP receives regular requests from other MDAs and from the private sector. MoEP recognizes that it does not have an overview and all layers of information from the different energy stakeholders. In the context of the energy crisis, this impacts the Ministry's capacity to communicate effectively with the public and media. Lastly, MoEP also needs data from other sectors, such as hydrological maps from the Ministry of Water Resources Works and Housing (MoWRWH).

5.2 Which data management policies and standards have been implemented to improve quality and diffusion of data within the energy sector?

- One of the roles of the Energy Access Data Task Force is to improve data management within the energy sector, however there is no evidence of actions taken towards the adoption of particular standards or formats for improving data management in the area.

  - In order to feed its GhEA database, the Energy Commission requests the data on a regular basis: monthly to yearly, depending on the data. The process is the following: the Energy Commission sends the format structure required to the energy data producers who submit the data in a spreadsheet format mainly via email. This process could be largely improved if proper standards and interfaces were in place between the IT systems for data producers to feed the GhEA database.

5.3 Which energy data is made available outside the energy sector - either free or for a fee - and on what conditions? Yellow

+ The Energy Commission is releasing most of its documents, publications and data online for free. This includes the regulations, policies, statistics reports, and data from the GhEA database.[40] The data from GhEA database are released in an Excel format. Yet, there is no clear terms of use or license attached to the data released. For instance, it is unclear whether one can reuse the data for commercial purpose.

- Other energy stakeholders within the Government are mostly releasing data at an aggregated level and encapsulated in reports, but not in spreadsheets or other machine-readable formats.

- The Energy Commission under the Ghana Energy Development and Access Project (GEDAP), a World Bank supported-project, conducted a wind energy resource assessment at eight locations along the coast of Ghana to measure wind capacity. A summary of the assessment was released in 2014. The raw data garnered during the assessment is being sold at GHC 2700 per site.[41]

- An energy expert has observed competition between energy data producers and those who want to reuse energy data, because of the value attached to it, implying some energy data are sell.

o SNV Netherlands Development Organization is operating in Ghana with a particular focus on renewable and energy efficiency issues. Through its studies and surveys, SNV has collected a sizeable amount of primary data in the areas of energy use and home appliance ownership by various user groups, biogas production, and data on energy efficiency indicators. Furthermore, SNV has produced studies on the analyzing the switch of energy inefficient appliances to solar technology and assessed efficiency of various types of cooking stoves owned by Ghanaian households. SNV has committed to releasing its energy data as open data in response to the World Bank's request. It is expected that a wide range of energy sector stakeholders would benefit from SNV data once it is published online.

5.4 To what extent and how does the energy sector communicate to the population about the status of the energy system (capacity level, power outages, construction plan, etc.)? Red

- In the context of the energy crisis and electricity power outages, ECG publishes on its website a load shedding plan per main districts and facilities in a pdf format. However, only load shedding plan for February 2015 was available on the portal

[40] See http://energycom.gov.gh/

[41] See http://energycom.gov.gh/files/Graph-Average%20Monthly%20Wind%20Speed%20at%2060m%20at%208%20Sites%20along%20the%20Coast%20of%20Ghana%20-%20April%202014.pdf

at the time of the assessment.[42]

- o GRIDCo publishes on its website the data on daily peak demand, together with forecast for the following day, thus allowing consumers to determine which power facility is expected to provide which share of the energy demand as well as determine demand overload and potential blackouts. Yet, this information is published only on the website at a highly aggregated level and not released as open data, precluding any use of the data from third parties which could communicate the information in a more informative and practical way for consumers.

- Overall, the communication around the energy crisis has been considered weak by the non-governmental energy stakeholders, notably due to the fact that information provided or lacking accuracy and relevant level of detail.

5.5 Which agencies with established capabilities could give leadership to drive open data in the energy sector? Green

+ The Energy Commission already has the mandate and demonstrated a high sufficient degree of leadership in the area of access to information in the energy sector. It could benefit from the guidance of GODI to ensure that its efforts are in line with open data best practices and to raise awareness of the importance of energy data for the sector development.

[42] At the date of April 22, 2015. See http://www.ecgonline.info/index.php/news/latest-news/238-current-load-shedding-guide

Assessment

The energy sector lacks standard practices and management procedures for data sharing. Overall, the energy stakeholders are spending too much resource for requesting and accessing data and not enough to analyze them. The Energy Access Data Task Force may have a role to play here but has been dormant for several months. In terms of access to data outside the energy sector, for the general public, the main stakeholders are essentially releasing data as part of PDF reports. One of the only entities releasing data in a more useful format, such as excel or csv, is the Energy Commission. Lastly, the key datasets assessment shows that several high-value datasets for energy in Accra could be released as open data rapidly and without additional resources. This is the case for the GhEA Toolkit of the Energy Commission and maps and street names from AMA.

Sub sections	**Assessment**
Practices and procedures for data sharing among the main energy stakeholders	Yellow
Management policies and standards	Yellow
Energy data available outside the energy sector	Yellow
Agencies with established capabilities for leadership in open data	Green
Overall	Yellow

6. Use and demand for energy data

Importance Very High

The value of energy data is in its use. A strong demand-side "pull" of data is important not only in creating and maintaining pressure on the government to release data but also in ensuring that the wider open energy data ecosystem matures, and that open data turns into economically or socially valuable services for citizens. The "pull" can come from civil society, private sector, international organizations, donors, and individual citizens. The capacity of data users to perform effective data analysis is also essential to ensuring that a greater availability of data will lead to greater data usability and data-informed actions.

Evidence

6.1 What is the level and nature of actual demand and latent demand for energy data from MDAs and local government outside the energy sector? Yellow

- o AMA recognizes data shortage in the energy and other sectors as an impediment to the realization of its institutional mission and seeks solutions to get more accurate data. AMA is also in a need to strengthen its capacity to perform data analysis.

- \+ The Ministry of Local Government and Rural Development collects primarily fiscal data from local communities. According to the Ministry, there is no particular issue in collecting the data from the communities: the Ministry provides the format for data collection and receives the data as specified from the Metropolitan, Municipal and District Assemblies who have paramount jurisdiction over the communities.[43] The Ministry of Local Government and Rural Development needs and uses information from the energy sector such as percentage of households with access to energy network in order to provide support in the development and formulation of sector policies, programs and projects. The information that the ministry possesses is only available through reports and specific projects.

6.2 What is the level and nature of actual demand and latent demand for energy data outside the government from business/the private sector, development partners, academics, civic tech organizations, and media? Green

- \+ As part of the World Bank Negawatt Challenge Accra, whose aim is to support innovative urban energy efficiency solutions, a number of energy stakeholders representing private sector, academia, tech organizations, media, and others

[43] For a better understanding of local administrative competencies in Ghana, see Local Government Act, 1993 (Act 462) and National Development Planning Act, 1994 (Act 480).

were convened during a one-day workshop to identify which specific datasets would be needed for tackling the challenges from the following sub-themes such as energy audits, energy data ecosystem, demand side management, financing energy projects, building insulation, and efficiency of appliances. As a result, a list of required - and not easily accessible - datasets was compiled (see Annex 3) showing the importance of access to reliable data when creating energy efficiency solutions.

+ There is an emerging Open Street Map (OSM) community in Accra which is working towards the release of maps by AMA, in particular street names and household numbering, in order to improve the coverage of OSM for the city. OSM is a crowd sourced map of the world used in various web-based and mobile applications. The work of the OSM community has proven to be particularly important in areas of the world where there is no reliable online map.

o According to the Energy Commission, the current energy crisis raised demand for transparency and accountability in the energy sector, and release of energy data thus should be perceived as a step in the right direction.

- The private sector is regularly requesting for detailed consumption data to the relevant energy utilities, but, according to a sector energy private player, some key information seem to be not tracked (effective coverage of power cuts), or not easily accessible (electrification plans). This hampers the development of economic activities in the sector.

- Renewable energy entrepreneurs are seeking detailed data on energy resource assessment (wind, solar, waste) but it has been reported that these data were often difficult to access, or did not exist at all.

6.3 How do the energy sector data holders react to these requests and engage with energy data users? Yellow

- Requests for energy data and its release are mainly handled on a one-on-one basis between third parties and energy data producers. The same applies if public sector entities within the energy sector request access to this data. There is no proactive mechanism in place to release data online when one or more entities can request it. In practice, this is a “lose-lose” situation for both entities: data producers are losing time for handling these requests whereas data users are losing time for requesting the data.

+ The Energy Commission organized media training on the understanding and use of energy data (e.g. data journalism). The training lasted one week and convened 20 journalists. The Energy Commission sees a need for more training in the field of energy data literacy for media representatives.

+ Through the establishment of the NEDPIC, the Energy Commission is seeking to

build a dedicated facility with a specialized library for those interested in energy data and access to computers. However, funding for the project still has to be secured.

6.4 To what extent can energy consumers access their own consumption data through their contracted utility company, or through third-party services, thanks to specific agreements or mechanisms such as the Green Button? Yellow

- In December 2014, ECG started the installation of prepaid smart meters, enabling consumers to access their average daily consumption data directly through the device, and in the same time providing ECG with the same data on real time. There is, however, no evidence of mechanism in place to share the data with third parties or back to the users via online service.[44]

6.5 To what extent - if it exists - has the Open Data Initiative engaged with the energy sector and facilitated the interaction between data producers and users in this area? Red

- The GODI team engages with the energy sector on limited occasions only (e.g. during workshops). It has also participated and resourced some of the Energy Access Data Task force's meetings. But overall, there is low awareness in the energy sector about open data and about GODI, as evidenced by several interviews.

Assessment

There is a strong demand for energy data from various stakeholders including entrepreneurs working on energy-efficient hardware and software solutions (for example, waste-to-power, wind power, cook stoves, clean fuel) and academics working on energy modeling. The Town and Country Planning Department of AMA is also one of the primary entities seeking release of energy data for enhanced operations and evidence-based decision making. The assessment shows that several of high-value energy datasets, which are in demand by the private sector, could be released as open data quite time- and cost effectively. This is for instance the case of the GhEA database of the Energy Commission which contains geolocalized data on communities and facilities associated with energy data, and of AMA that possess maps and street names.

Sub sections	Assessment
Demand for energy data from MDAs and local government outside the energy sector	Yellow

[44] See https://stateofgreen.com/en/profiles/kamstrup/news/partnering-with-nuri-telecom-kamstrup-delivers-30-000-prepaid-smart-meters-to-the-electricity-company-of-ghana

Demand for energy data from business/the private sector, development partners, academics, civic tech organizations and the media	Green
Energy sector data holders reactions to the demand	Yellow
Access to consumer's consumption data	Yellow
Does the Open Data Initiative engage with the energy sector	Red
Overall	Yellow

7. ICT use and infrastructure in the energy sector

Importance High

In very practical ways, open data programs normally rely for their success, at least partly, on the state of the national technology infrastructure, which is understood as availability of technology and information and communications services as well as the quality of existing ICT skills among officials, infomediaries and the general public. The same applies to open data within the energy sector. The level of ICT and infrastructure and related skills for people in the energy sector is an indicator of the possibility to see energy data effectively collected, used and shared.

Evidence

7.1 What is the level of ICT infrastructure within the energy sector? Yellow

- o Most of the main energy stakeholders still rely on dispatched information systems within their own entity, but project upgrades are underway. ECG is planning a project to set a global Management System Information within the company. At VRA, the Information System Department just rolled out an ERP for corporate entities with an aim to integrate power stations data into one system. MoEP is equipped with a data warehouse for energy projects management.

7.2 What is the level of web and mobile applications used within the traditional energy sector (website, social network, SMS)? Yellow

- \+ All the main energy stakeholders have their institutional websites where they share reports and provide basic information on their activities (a mission statement, organizational chart, basic contact information, etc.).
- \- Only the Ministry of Petroleum is active on the social network Facebook. The Energy Commission also has an account, but it is not regularly updated.
- \+ In 2013, the Energy Commission launched a pilot service which allowed the general public to report on the outages and poor voltage levels by sending SMS messages.[45] Currently the pilot service only covers the Greater Accra East region. There is however question on how such system would benefit the consumer if the data are not transferred and processed by ECG, which is managing the electricity distribution. Under additional financing for the GEDAP

[45] See http://www.ghananewsagency.org/social/energy-commission-launches-code-for-monitoring-power-outages--68691

project [46], the World Bank is supporting ECG to implement an outage management which would allow them to quickly respond to outages due to the network. Such a system could be used to inform the consumers in real time.

7.3 What is the extent of ICT-based innovations within the energy sector? Yellow

+ There is a growing number of companies offering pay-as-you go solar systems for off-grid households in the country. Pay-as-you go solar systems work with homes wired to a common bank of solar-powered batteries and equipped with a smart-meter, which shuts off when running out of credit. Customers are able to top up credit with their mobile phone or via a local agent. Azuri Technologies and Oasis African Resources, in partnership with the Ministry of Power, recently announced that they would install 100,000 homes with such a system.[47] Others companies offering such a service are Persistent Energy, Barefoot Power, Wilkins Engineering, Deng, and Greenlight Planet. Neither local solar companies, nor the Energy Commission provides comprehensive data on off-grid installations.

- There is no evidence of Cleanweb companies operating in Ghana. Cleanweb is described as business solutions in the form of web and mobile applications that use network-based to help consumers make better use of resources understand and reduce their environmental footprint and disrupt traditional cleantech financing models.[48]

Assessment

The energy sector is investing in the upgrade of existing IT infrastructure in use, but to a lesser extent into strengthening of the ICT capacity or piloting of innovative web- and mobile applications. Nevertheless, ICT-based energy solutions are developing in the country, in particular in the off-grid solar area.

Sub dimensions	**Assessment**
ICT infrastructure within the energy sector	Yellow
Web- and mobile applications used within the energy sector	Red

[46] See http://www.worldbank.org/projects/P120016/addtional-financing-ghana-energy-development-access-project-gedap?lang=en

[47] See http://www.azuri-technologies.com/news/azuri-oasis-africa-resources-and-ministry-of-power-lead-the-charge-to-provide-off-grid-home-solar-in-ghana

[48] See World Bank, Cleanweb for development and introduction, 2015

ICT sector contribution to the energy sector	Yellow
Overall	Yellow

8. Funding an open data initiative within the energy sector

Importance Medium High

Funding with respect to both the "supply side" and "demand side" of open data is important to ensure that the objectives of the open data initiative are met within the energy sector.

Evidence

8.1 What funding is available to support open data in the energy sector from the government (from the energy sector itself or from funding for eGovernment, Open Data Initiative, statistical capacity or ICT in Government)? Yellow

- o The implementation of the GhEA database benefited from a grant funded by the Government of Norway which was managed by the Renewable Energy and Energy Efficiency Partnership (REEEP). The grant was awarded for the 2013-2014 period and only funding to maintain the renewable section has been secured. REEEP is an international organization whose main mission is to fund clean energy projects. REEEP usually suggests open data as part of its portfolio to country donors but until now the GhEA database has been one of the only projects to have benefited from a grant under the theme Energy data and communication.[49]

- + The World Bank funded the Ghana - Energy Development and Access Project[50] (GEDAP) whose objective was to improve the operational efficiency of the electricity distribution system and increase the access of population to electricity. The project resulted in the development of a GIS system within the MoEP with the geo-localization of all communities. This system presents an important tool for analyzing areas that are prime targets for grid extension and off-grid electrification. What is also notable is that these datasets are published on the GhEA database. The project is closing in June 2015.

- + World Bank's Ghana eTranform Project (US$97 million) was approved in October 2013. Although the project does not focus on the energy sector itself, it contains an open data component.

- + The multi-donor project Ghana Statistic Development Program managed by the

[49] See http://www.reeep.org/projects/building-reliable-energy-access-database-sustainable-energy-expansion-ghana

[50] See http://documents.worldbank.org/curated/en/2014/04/19617439/ghana-ghana-energy-development-access-project-implementation-support-mission-april-1-11-2014

World Bank, ending in 2016 and amounting to US$74.5 million, has one of its priorities the enhancement of statistical capacities within sectors ministries and dissemination of data.[51]

o In May 2011, the Ghana Statistical Service (GSS) and the Korea International Cooperation Agency signed a US$1 million record of discussion on the project for Capacity Enhancement of the Service. The project led to the establishment of the Ghana Statistical Training Centre, to enhance production, analysis and dissemination of quality statistical data, and build the statistical capacity of the human resource of Ghanaians among others.

- There is no evidence that the Government or AMA has planned to allocate specific budget fund for the development of open data. This is a key issue to address as the long term success of an open data program in the energy sector will not only depend on the initial investment in ICT but also on the capacity to maintain a dedicated team for running the program.

8.2 To what extent are energy industries investing in information management capacity and infrastructure? Green

+ The recent investment from GRIDCo, VRA and the Energy Commission into data systems shows that the funding can be made available for the improvement of information management infrastructures within the energy sector.

8.3 To what extent are there funding mechanisms for innovation in the energy and ICT sector? Yellow

- There is little if any evidence of funding opportunities for innovation in the energy and ICT sector from the Government and local investors. Innovative companies are seeking foreign investment in priority.

+ The European Horizon2020 program financing research and innovation programs through grants is open to private companies, research institutes, universities, NGOs and MDAs from Ghana. The University of Ghana, Kumasi and KNUST already participated in European research consortium in the past. The Horizon 2020 offers grants in various innovation fields related to open data and energy efficiency.

Assessment

Optimizing energy supply and adjusting energy demand is one of the key priorities for the government, however, to date, only a fraction of government financing went to finance the energy data activities or open data. It is evident that energy data ecosystem development

[51] World Bank, Ghana Statistics Development Program, http://www.worldbank.org/projects/P118858/ghana-statistics-development-program?lang=en&tab=overview

requires financing to enable sustainable operations of the main energy data-holding agencies. For example, the Energy Commission is currently seeking funding for the implementation of the NEDPIC which intends to promote best practices around energy data by training people and offering data analytic capacity. One of the important assessment findings is that the World Bank, through its eTransform ICT Project, has resources to address the energy data capacity and funding issue through the re-launch of the GODI. Further funding opportunities could arise from electricity expansion and renewable energy projects.

Sub dimensions	**Assessment**
Funding available to support open data in the energy sector	Yellow
Investment in information management capacity and infrastructure	Green
Funding mechanisms for innovation in the energy and ICT sector	Yellow
Overall	Yellow

Summary of the Open Energy Data Assessment for Accra

Overall	Importance	Assessment
1.Open Data Readiness Assessment for Ghana and Accra	Very-high	Yellow
2. Policy, regulation and structure of the energy sector	Very-high	Yellow
3. Legal framework components within the energy sector related to data	High	Yellow
4. Leadership, responsibilities and capabilities within the energy sector	High	Yellow
5. Data management and availability within the energy sector	High	Yellow
6. Use and demand of energy data	Very-high	Yellow
7. ICT use and infrastructure in the energy sector	High	Yellow

8. Funding open data within the energy sector	Medium-high	Yellow

Recommendations for an action plan

The proposed action plan is based on the findings of the Open Energy Data Assessment for Accra and aligned with a one-year timescale.

Action	Description	Responsible	Sub-Action	Timescale
1. Mandate the Energy Access Data Task Force to advance open data within the energy sector	It is recommended that the Energy Commission convene the Energy Access Data Task Force and invite GODI and AMA to be part of the revamped working group to adopt adequate coordination between the actors for the development and promotion of open data into the energy sector at city and national level. It is also recommended to include external energy data producers and users into the Task Force such as IPPs, SMEs, ICT companies, NGOs, to ensure that the group is representative of the energy sector and in capacity to respond effectively to the demand of energy data.	Energy Commission, GODI, MoEP	1.1 Convene the Energy Access Data Task Force for a presentation of the Open Energy Data Assessment and the recommended action plan.	Q1
			1.2 Set up a clear open data publication procedure between energy data producers, the Energy Commission and GODI to ensure data are published on a regular and timely basis on GhEA, NEDPIC and GODI portals.	Q1
			1.3. Adopt open data standards for energy data available online. Whenever possible, it is recommend that data be published in a machine-readable format under an open license granting everyone the right to use and share the data for any purpose.	Q1

			1.4 Define and adopt data management and dissemination procedures for new energy stakeholders such as off-grid, solar, wind and waste-to-power companies in order to develop open energy data within emerging energy markets, technologies and trends. In particular, it is recommended that authorities mandate off-grid projects to provide key information such as capacity and localization of their installations.[52]	Q2
2. Strengthen NEDPIC with open data capacities	Establish NEDPIC as a leader for open data in the energy sector with data analytics and training capacities. It is worth noted here that the open data component of the World Bank eTransform project which seek to support open data analytics capacity has established the sector of energy as one of the priorities.	Energy Commission, GODI	2.1 Develop open data training activities for energy data producers.	Q2
			2.2 Establish partnerships with local and international data stakeholders to develop a training program for external energy data users.	Q2

[52] The Azuri, Oasis Africa Resources and Ministry of Power off-grid solar project for 100000 homes, if releasing its facilities data as open data, could serve as a leading example http://www.azuri-technologies.com/news/azuri-oasis-africa-resources-and-ministry-of-power-lead-the-charge-to-provide-off-grid-home-solar-in-ghana

3. Adopt an Open Energy Data Policy	It is recommended that the Energy Commission adopt an Open Data "per default" Policy for all the energy data it collects, manages, and disseminates (personal data excluded) including provision on open data format standards, and open license, as defined with the Energy Data Task Force. The aim of the policy is to adopt a proactive approach in the release of energy data and to prevent any data retention clause between the Energy Commission and its counterparts, except when there is a legitimate reason.	Energy Commission, GODI	No sub action	Q2
4. Release existing key energy datasets as open data	This study has identified a number of existing high-value energy datasets which, if released as open data, could led to important benefit for the sector	Energy Commission, GODI, and data	4.1 Ensure datasets from the Energy Commission (GhEA database, and NEDPIC) are released as open data.	Q1

	and leverage current energy policies. Energy Commission and GODI, through the Energy Data Task Force should request and ensure these datasets are released as open data rapidly.	owners	4.2 Release key existing government energy datasets (see Annex 1 for details): Detailed Electricity Consumption Data for Accra (ECG); Electricity Network Transmission and Distribution (ECG and GRIDCo); Detailed Power Plants status (GRIDCo); Facilities connected to off-grid installations (MoEP, Renewable Energy Directorate); Cook stoves market data (MoEP, Renewable Energy Directorate); Geolocalized list of gas stations (NPA); Vehicle registration statistics (DVLA); Hydrological map (MoWRWH).	Q1
			4.3 Release key energy datasets owned by SNV (see Annex 1 for details): Cook stove ownership map; Food vendor electricity use by type; Charcoal stove usage; Charcoal stove electricity consumption; Urban household ownership of LGP; Energy use by agro processing groups.	Q1
			4.4 Improve the availability of social and demographic statistics by releasing census and surveys from GSS as open data at a high level of disaggregation.	Q2

5. Launch AMA Open Data Initiative	AMA's data possess a great value for the energy and other sectors. It is recommended that AMA and GODI partners to ensure the release of key datasets from the city on the national open data portal.	AMA, GODI	5.1 Release AMA's datasets (see Annex 1 for details): Address Register; Base Map; Cadastral Map (Real estate); Cadastral register (Properties); Public Estate Register; Public Transport Statistics; Street Names Register; Business register; Waste statistics.	Q1
			5.2 Integrate open data principles into AMA's energy efficiency strategy. The urban energy efficiency strategy study recommends that AMA take actions on energy audits and waste sectors and collect data in these sectors. This assessment recommends that authorities release those datasets as open data that were created as part of the design and implementation of the strategy.	Q2
6. Engage with the tech community to improve quality and usability of open energy datasets and demonstrate value through pilot applications or services	This report has identified a number of companies, NGOs and persons who have the dedicated skills and desire to work with energy data. As seen in other countries, cooperation through events or more formal partnerships between data producers, publishers and external contributors who have the right data skills can greatly benefit to the value of open datasets and led to potential benefits in terms of services or applications.	Energy Commission, GODI, AMA	6.1 Organize a series of events such as data boot camps or hackathons where energy data producers, developers, data scientists and energy experts gather to work on key energy issues for Accra such as energy audits, demand side management, financing energy projects, building insulation, waste management, and efficiency of appliances.	Q2 – Q4

Annex 1: Assessment of key energy-related datasets

Below is a list of key energy datasets covering the City of Accra or spanning beyond it; the largest number of the datasets pertain to the electricity sub-sector. This list was established based on the identified demand for energy data from local and international actors such as the World Bank's Negawatt Challenge participants, UNDP, etc. The datasets were assessed along two dimensions: their technical and legal openness.[53]

Energy is closely linked to other sectors such as mining and extractive industries, water, transport, environmental protection. The list also includes key datasets in some of these sectors, which, as international experience has shown, are relevant to energy data innovators.

[53] The technical openness assessment is a slightly modified version of the Tim Berners-Lee five star open data view. In this case, the first star refers to having data available online but does not require an open license (Tim Berners-Lee, *Linked Data*, http://www.w3.org/DesignIssues/LinkedData.html, July 27, 2006).

N/E No evidence that data exists

N/A Dataset not available online

★ Data available online in any form

★★ Data available online as machine-readable data (such as Excel)

★★★ Data available online, in machine readable form, non-proprietary formats (such as CSV)

★★★★ Data available as above and using open standards (such as RDF or SPARQL)

★★★★★ Data available as above and linked to other data to provide context

Data	Data primary producer/ owner	Technically open[54]	Legally open	Description	Source
Solar: monthly and annual average direct normal (DNI) GIS data at 10km resolution for Ghana from DLR	DLR	★★★	YES (ODC-BY)	Data of high resolution (10kmx10km) Direct Normal Irradiance (DNI) for Ghana for the years 2000, 2001 and 2002. The data are available for monthly and annual sums stored in an ESRI-Shapefile. Please read the country report for additional background information. The data are helpful for the assessment of the solar potential of the country and can give project developer a first impression of the solar resource of the country.	Link
Solar: monthly and annual average global horizontal (GHI) GIS data at 10km resolution for Ghana from DLR	DLR	★★★	YES (ODC-BY)	Data of high resolution (10kmx10km) Global Horizontal Irradiance (GHI) for Ghana for the years 2000, 2001 and 2002. The data are available for monthly and annual sums stored in an ESRI-Shapefile. Please read the documentation file for additional information. The data are helpful for the assessment of the solar potential of the country and can give project developer a first impression of the solar resource of the country.	Link
Ghana High Resolution Wind Resource	NREL	★★★	YES (ODC-BY)	This shapefile containing 50 meters height data has been validated by NREL and wind energy meteorological consultants. However, the data	Link

				are not suitable for micro-siting potential development projects. The shapefile was generated from a raster dataset with a 200 m resolution,0 in a UTM zone 12, datum WGS 84 projection system.	
Solar Stations (connected to the grid)	Energy Commission	★★	NO	This dataset consists of grid connected solar installations. Their installed capacities in kilowatts (kW) are also provided. This dataset was last updated in June 2014.	Link
Solar Installations (off-grid)	Energy Commission	★★	NO	This dataset also consists of data on other non-grid connected solar installations/applications such as standalone solar solutions, lanterns, solar pumps and solar water heaters. The capacities of the solar pumps and the water heaters in terms of their flow rates and volumes respectively are reported. This dataset was last updated in June 2014. NB: The number of solar lanterns distributed by the Ministry of Energy And Petroleum (MOEP) is not given, but a total capacity of those lanterns distributed was 42kW.	Link
Community coordinates	MoEP	★★	NO	This dataset consists of the GPS coordinates of communities in Ghana. Not all the communities in the country are captured but this will be rectified as data are made available. The Center for Remote Sensing and Geographic Information Systems (CERGIS) of the University of Ghana started as a Remote Sensing Laboratory. The center now has a GIS unit that stores data on the geographic location and descriptive attributes (size, species, composition, vertical structure, volume, site index, etc) of the forests being managed. This dataset was last updated in June 2014.	Link

Southern Sector Customers	ECG	★★	NO	This dataset consists of customers that are connected to the grid in the southern sector of Ghana. This dataset was last updated in June 2014.	Link
Electricity Network Substations (geo-localized)	NEDCo	★★	NO	Communities that are connected to the grid in the northern sector of Ghana. This dataset was last updated in June 2014.	Link
Lighting Fuels	Energy Commission	★★	NO	The different sources of fuels used for lighting in Ghana are reported. These range from kerosene to torchlights, candles, diesel generators and grid electricity among others. The number of households as well as the population using the particular lighting source is also provided. This dataset was last updated in June 2011.	Link
Cooking Fuels	Energy Commission	★★	NO	The different sources of fuels used for cooking in Ghana are reported. These range from crop residue to firewood and LPG as well as electricity. The number of households as well as the population using the particular fuel, is also provided. This dataset was last updated in June 2014.	Link
Power Plants	Energy Commission	★★	NO	This dataset consists of the different sources of Ghana's power generation and the installed capacities of these sources. Data on the actual available capacities will be provided by EC in the near future. The data were last updated in June 2014.	Link
Electricity Network Substations (geo-localized)	ECG	★★	NO	This dataset consists of communities that are connected to the grid in southern sector of Ghana. Electricity Company of Ghana (ECG), the agency which oversees the southern sector	Link

				power distribution provided this dataset. The data was last updated in June 2014.	
Approved Electricity and Water tariffs	PURC	★	NO	Approved Electricity and Water tariffs for the year 2014	Link
Feed-in tariff	PURC	★	NO	Publication of feed-in tariff and capacity cap for electricity generated from renewable energy sources.	Link
Power outages (Load-Shedding Guide)	ECG	★	NO	Power outages plan for themain buildings and facilities.	Link
Daily Peak Demand (national level)	GRIDCo	★	NO	Daily peak demand available online for years 2009 and 2010 in PDF format. Peak demand of the previous days is also available on the web page.	Link
Address Register	AMA	N/A	NO	AMA completed 80% of building numbers for the city in paper-based version.	
Base Map	AMA	N/A	NO	Includes streets, communities, and parcels. In April, the Planning Committee presided by the Mayor of Accra will make a final decision whether the maps are approved for public release.	
Cadastral Map (Real estate)	AMA	N/A	NO	Parcel boundaries for each real estate.	
Cadastral register (Properties)	AMA	N/A	NO	Value of the property and tax rate.	
Public Estate Register	AMA	N/A	NO	Location of public estate registers including cost of construction and maintenance.	

Public Transport Statistics	AMA	N/A	NO	Database on transport providers (taxis) including vehicle type; vehicle capacity expected number of vehicles	
Street Names Register	AMA	N/A	NO	Paper-based version of the street names register for the city.	
Business register	AMA	N/A	NO	The majority of the data are in a paper format. The registry contains breakdown of businesses by occupation, licenses, renewed permits	
Waste statistics	AMA	N/A	NO	Amount of waste generated and collected per day / not collected per day; Distribution of bins; Waste Disposal location Composition of waste; Number of contractors (companies) licensed to operate waste	
Vehicle registration statistics	DVLA	N/A	NO	AMA is looking for the data.	
Electricity Network Distribution	ECG and GRIDCo	N/A	NO	Geospatial data of lines and stations of electricity transmission and distribution network including length capacity, and expansion project.	
Detailed Electricity Consumption Data for Accra	ECG	N/A	NO	Average electricity consumption at the most detailed level (building, block, district)	
Power Plants status	GRIDCo	N/A	NO	Status of the power facilities in real-time, or at least provided on a daily basis.	
Facilities connected to off-	MoEP, Renewable	N/A	NO	Schools, health facilities, communities, security	

grid installations	Energy Directorate			posts	
Cook stoves market data	MoEP, Renewable Energy Directorate	N/A	NO		
List of gas stations	NPA	N/A	NO		
Cook stove ownership map	SNV	N/A	NOT YET, In process	It is part of a national mapping study on cook stoves which is received from cook stove producers. This study is yet to be studied by mid-June (EC). The study is a collaborative effort of UN, EC, UNDP	
Food vendor electricity use by type	SNV	N/A	NOT YET, In process		
Charcoal stove usage	SNV	N/A	NOT YET, In process		
Charcoal stove electricity consumption	SNV	N/A	NOT YET, In process		
Urban household ownership of LGP	SNV	N/A	NOT YET, In process		
Energy use by agro processing groups	SNV	N/A	NOT YET, In process		
Hydrological map	MoWRWH	N/A	NO		
Building Energy Audit		N/A	NO	There is no policy providing for the creation of an energy audit register.	

Annex 2: List of stakeholders

Below is the list of stakeholders interviewed during this assessment:

- Accra Metropolitan Assembly (AMA)
- Electricity Company of Ghana (ECG)
- Energy Commission (EC)
- Ghana Green Building Council (GHGBC)
- Ghana Open Data Initiative (GODI)
- Ghana-India Kofi Annan Centre of Excellence in ICT
- GIZ
- Institute for Sustainable Energy and Environmental Solutions (ISEES)
- ISpace Foundation
- Kwame Nkrumah University of Science and Technology (KNUST)
- Ministry of Energy and Petroleum (MoEP)
- Ministry of Local Government and Rural Development
- Mobile Web Ghana
- National Information Technology Agency (NITA)
- Netherlands Development Organization (SNV)
- United Nations Development Programme (UNDP)
- Renewable Energy and Energy Efficiency Partnership (REEEP)
- Volta River Authority (VRA)

Annex 3: Data requirements from the participants of the Negawatt Challenge Accra

These datasets were identified as high value in relation to the energy efficiency themes such as: Energy audits, Building an energy data ecosystem, Efficiency of appliances, Demand side management, Building insulation, and Financing energy efficiency projects.

List of principal datasets required

- Building code, rating tools, certified estates
- Energy compliant household
- Consumption data
- Penetration of efficient appliances in households
- Consumption level per appliance
- Customer satisfaction
- Industry specification information
- Appliances use trends
- Energy regulation adoption rate
- Zoning regulation
- Real-time outages statistics
- Metering data.