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Working paper

Data needs for county energy planning in Kenya

Narrative Report

27/10/2022

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List of Acronyms

ADP	ANNUAL DEVELOPMENT PLAN
ASDSP	AGRICULTURE SECTOR DEVELOPMENT SUPPORT PROGRAMME
CEP	COUNTY ENERGY PLAN
CIDP	COUNTY INTEGRATED DEVELOPMENT PLAN
EDM	ENERGY DELIVERY MODELS
EECM	ENERGY EFFICIENCY AND CONSERVATON MEASURES
EPRA	ENERGY AND PETROLUEM REGULATORY AUTHORITY
FGD	FOCUS GROUP DISCUSSION
GDC	GEOTHERMAL DEVELOPMENT CORPORATION
GDP	GROSS DOMESTIC PRODUCT
GIZ	DEUTSCHE GESELLSHAFT FÜR INTERNATONALE ZUSAMMENARBEIT (GERMAN DEVELOPMENT AGENCY)
GPS	GLOBAL POSITIONING SYSTEM
IED	INNOVATION, ENERGIE, DÉVELOPPEMENT

INEP	INTEGRATED NATIONAL ENERGY PLAN
KENGEN	KENYA ELECTRICITY GENERATING COMPANY
KETRACO	KENYA ELECTRICITY TRANSMISSION COMPANY
KII	KEY INFORMANT INTERVIEW
KNBS	KENYA NATIONAL BUREAU OF STATISTICS
KPLC	KENYA POWER AND LIGHTING COMPANY
MoE	MINISTRY OF ENERGY
MTEF	MEDIUM TERM EXPENDITURE FRAMEWORK
MTP	MEDIUM TERM PLAN
NUPEA	NUCLEAR POWER AND ENERGY AGENCY
REREC	RURAL ELECTRIFICATION AND RENEWABLE ENERGY CORPORATION
SDG	SUSTAINABLE DEVELOPMENT GOAL
SETA	SUSTAINABLE ENERGY TECHNICAL ASSISTANCE PROGRAMME
SHS	SOLAR HOME SYSTEM

SNV	NETHERLANDS DEVELOPMENT AGENCY
WAS	WARD ADMINSTRATOR SURVEY
WRI	WORLD RESOURCES INSTITUTE
WRMA	WATER RESOURCES MANAGEMEN AUTHORITY

1. Executive Summary

This working paper and accompanying data mapping are the first attempt to identify the data required for county energy planning in Kenya. The mapping is based on the requirements for county energy planning under the draft Integrated National Energy Planning Framework (April 2021), and the real-world experience of developing two county energy plans (CEPs) using the inclusive, cross-sectoral Energy Delivery Models (EDM) planning approach.

The new INEP draft Framework has been developed under Kenya's Energy Act (2019) and is a response to changes in the national and global energy sector including adoption of Sustainable Development Goal (SDG)7 on universal energy access. INEP recognises the need for energy services to be planned as enablers of wider development goals, for stakeholder and end-user engagement in planning, and for evidence and data collection and analysis for effective planning. However, while the Framework provides guidance on the process and content of CEPs, and mandates certain data functions between national and county actors, minimal guidance is provided to counties on tools and institutional mechanisms to support data collection and address data gaps. A current programme of capacity building support to national and county governments, the Sustainable Energy Technical Assistance Programme (SETA), has identified significant challenges for counties relating to data collection, management, sharing and analysis.

The data mapping exercise identifies data required for the CEP content under INEP combined with the concrete data sets gathered under the six-step EDM process to develop two CEPs. EDM works with stakeholders and end users to identify their priority development needs, the (energy and non-energy) gaps preventing those needs being met and build sustainable solutions to meet the needs. The EDM CEP processes have involved iterative primary and secondary data collection and analysis along the six steps, from initial baselining (Steps 1-2) through in-depth needs assessment (Step Three) through to design and testing of solutions (Steps Four to Five).

The following INEP-EDM CEP sectors were considered for the data mapping: Baseline data; Energy Resource Assessment; Energy Access; Energy Efficiency and Conservation (EEC), Bioenergy, Electricity (INEP Draft CEP Chapters). In addition, data required for baselining needs assessment and solutions in the following key development sectors was mapped: Agriculture, Livestock Farming, Health, Water, Cooking.

For most sectors analysed, there were significant data gaps:

- For Energy Resource Assessment, current data sets for most resources do not exist and the few that do have very restricted access.
- For EEC data, there are significant gaps with limited national data sets for specific energy end users. Counties hold no or minimal data on EEC.
- For electricity and for energy access, there are considerable data gaps in terms of the data points required for electricity expansion planning and least-cost electrification modelling. Datasets do exist or could be developed but access is highly restricted as they are proprietary to national energy service providers (KPLC, REREC and KETRACO). There is also insufficient disaggregation of electricity data with regards to gender, sector or sub-sector.
- For bioenergy, there is little county-specific data on bioenergy on demand, costs, supply and supply potential, markets for bioenergy, etc

For sectoral data, there are cross-cutting gaps in the data required for planning energy-enabled solutions. One of the most significant is the granularity of the data available. For baselining, needs assessment and to build solutions for specific end-users in all sectors, data is needed to ward level

while for most reliable data sources, namely KNBS, the level of granularity is to county or sub-count level.

Potential ways to address these data gaps include the following:

- For energy sector data to support energy access and LCE planning, a protocol could be developed by the MoE to enable counties to access relevant data sets held by national energy service providers. Further thought could be given to policy harmonisation of the LCE planning tools and data requirements across the counties.
- For a more systemic solution, the MoE could develop a data governance framework and issue directives to the power sector agencies to reconfigure geospatial databases according to a Common Information Model (which would need to be developed). KPLC could be further directed to reconfigure its database to organise data according to county, sub-county and ward levels and sectors. These actions could contribute to development of a National Energy Database to aggregate energy resource data, electricity network data, electricity demand and reliability data.
- The KNBS National Census (2019) and Statistical Updates are a very useful source of information for baseline and sectoral analysis, but as highlighted, the data points published are disaggregated to county, or at best sub-county, level. As KNBS gathers information for the survey and other statistical updates to ward level, dialogue could take place with KNBS to understand what unpublished datasets it holds to ward level, and how these could be made available for county energy and development planning.
- In addition, KNBS could carry out additional collection of data points useful for county energy planning - for example, through the periodic national census or sectoral statistical updates.
- National actors supporting INEP could also support counties to develop standardised data sets to facilitate CEP development, with standardized tools for data collection and management. Counties would need additional resource and capacity building for such activities, including potentially dedicated data manager and analysts. This could be further incentivised by linking data collection to existing county development planning frameworks.

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2. Introduction

This narrative report accompanies the Excel mapping *Data Needs for County Energy Planning*. The Data Mapping and narrative should also be seen as companion pieces to the report on *Vertical Collaboration for Energy Planning between National and County Actors*. The Excel mapping is a first attempt to identify the data sets needed to develop County Energy Plans (CEPs), and the data gaps. Both these papers and subsequent outreach around them with actors involved in energy planning in Kenya will be inputs to the output on *County Energy Guidelines* under 3.1 (Knowledge Products) under the UK PACT CCG Kenya Energy Planning Project.

The Mapping is informed by (a) the requirements for CEPs outlined in the draft (and as yet unpublished) Integrated National Energy Planning Framework (April 2021), referred to henceforth as the INEP Framework; and (b) the real-world experience of the Loughborough and International Institute for Environment and Development (IIED) team and local partners in supporting development of two CEPs, one for Kitui County (published July 2021) and one for Meru County being developed under the Sustainable Energy Technical Assistance (SETA) Programme to the Ministry of Energy funded by the European Union (see below). The tentative date of completion for the Meru CEP is March 2023. The methodology used to develop both these CEPs is the needs-based Energy Delivery Models (EDM) planning approach.

The team involved in developing the Data Mapping includes the international and national leads of the EDM team, who have been working on county energy planning in Kenya since 2018 and one of the National Mentoring Experts (NMEs) supporting counties with energy planning under the SETA Programme who works for the National power company, KPLC, and involved in data management issues related to KPLC's mandate.

3. Context and enabling environment for energy planning in Kenya

Energy planning is a function of both the national and the 47 county governments in Kenya as provided in the Fourth Schedule of the Constitution of Kenya (2010), and the Fifth Schedule of the Energy Act (2019). Under the Energy Act, the national government is required to develop an Integrated National Energy Plan (INEP) and county governments and national service providers (MoE, EPRA, KPLC, KenGen, REREC, KETRACO, GDC and NuPEA) are mandated to develop county energy plans as inputs to the design of the INEP.

However, Kenya's Energy Policy (2018) identified several challenges to integrated planning, most significantly related to issues of coordination between national and county level actors. First, it identified a lack of coordination between the national and county governments. Second, it highlighted uncoordinated approaches in policy formulation and implementation by the relevant ministries and agencies to reduce overreliance on biomass as the primary source of energy and, third, uncoordinated approaches in policy implementation and promotion of solar energy projects.

The Energy Act (2019) makes coordination/collaboration between national and county governments mandatory. Section 5 (4) of the Act requires the Minister to consolidate plans developed by the national energy service providers and the CEPs into one integrated national energy plan. CEPs are to be reviewed every three years.

3.1 INEP Framework for CEP planning

The INEP Framework is currently under development and discussion by the MoE, associated state agencies and other stakeholders, including the Council of Governors as the umbrella body representing Kenya's county governments. The latest version of the Framework reviewed by the LU team dates from April 2021. All references henceforth are to this version.

The INEP Framework recognises the energy planning now takes place in the context of Sustainable Development Goal (SDG)7 on access to affordable, reliable, sustainable and modern energy for all, and that "to provide reliable and affordable energy for all, there has to be a paradigm shift from the traditional energy planning to adequately respond to the evolving global energy market, [and] the changing roles and responsibilities across the energy value chain." (Foreword).

INEP further recognises that "the energy sector is a major enabler of wider economic & social development" (1.8.2). Thus, the INEP appears to acknowledge the increasingly accepted view, that energy planning and service delivery should not be a standalone, siloed process but address "wider societal goals" as expressed in international, national, sub-national (& regional) development goals and plans. At the county level, the INEP Framework specifically references the County Integrated Development Plans (CIDPs) that counties produce every five years as their development programming blueprint, and which inform the production of Annual Development Plans and budgetary allocation (1.8.1).

Furthermore, the Framework recognises that this will "[c]hallenge long-standing assumptions [and] rules-of-thumb in traditional energy planning [….] The traditional energy value chain was linear with energy carriers produced centrally and distributed to a passive end user." (1.2). This assumed passivity of the end user in energy planning is no longer acceptable". The Framework further states that: "Increasingly, environmental regulations, low-cost energy resources, *customer preferences and investments*, and risk management will drive investment decisions" (1.2, emphasis added). Thus, the INEP appears to recognize in principle the need for active participation of customers or end users in the planning of services and that these services should be designed to meet their needs, along with other societal considerations such as environmental sustainability.

The INEP stipulates a process for developing county energy plans (CEPs) and mandates the content of CEPs (this process and the structure and content of CEPs can be found in *Annex One* and is also summarised in the Master Datasheet on the Data Mapping excel). Each county government is mandated to develop an energy plan that is responsive to its development needs and context (Chapter One of the INEP Framework, see Annex One). Such planning requires, according to INEP, a "clearly articulated, transparent, and shared vision of the energy future [that] sets the direction for subsequent decisions about goals, strategies, and actions" (3.3.4). In turn, this requires the engagement from the outset of stakeholders at all levels of planning, for the following reasons:

> Involving a wide range of stakeholders across the government and the entire energy value chain is important because:
>
> i. Broad-based stakeholder engagement helps to lay the foundation for necessary support.
>
> ii. The plan needs the support of departmental heads and officials who are interested in their constituents' and stakeholders' points of view.
>
> iii. Stakeholders have valuable insights to offer and provide real local context for ideas.
>
> iv. *Input from stakeholders helps prioritize recommendations based on their aspirations and priorities.* (3.3.3; emphasis added)

However, while the INEP Framework appear to recognise the value of more participatory approaches to planning, it does not provide guidance on participatory planning methodologies that could be used for planning at national or county level – or on any other tools or methodologies.

Section 1.7 on **Choice of planning tools for INEP r**efers to the importance of scenario planning and use of modelling tools, and the need to maintain databases to support modelling. Reference is also made specifically to counties using the World Bank ESMAP Multi-Tier Framework (MTF) to identify difference scenarios or levels of energy access for CEP Chapter Three on Energy Access (6.1.9; see also *Annex 4*). However, there is no guidance on *how* counties should use the MTF in planning energy access interventions. In conclusion, there is a critical gap in the Framework in terms of the minimal guidance on specific methodologies and tools that could be used for CEP development, and it is not clear how counties will be supported to build their capacity to operationalise the Framework.

Based on the understanding that previous energy planning prior to INEP has been top-down and the sole purview of the Ministry of Energy (MoE) and its associated agencies at the national level, there is a need to ensure effective collaboration and coordination between the county governments and national government, including on data collection, sharing and analysis, if truly integrated planning is to be achieved.

3.2 INEP Framework requirements for data collection for county energy planning

The INEP Framework recognizes the need for collaboration between and among the national, county governments, and other stakeholders, such as the national service providers, to ensure the county's energy objectives are realized, and for the delivery of energy access for all Kenyans. This includes collaboration on data collection, sharing and analysis, for effective county energy planning.

In terms of the draft content of CEPs, there are numerous references to the need for counties to collect both secondary and primary data to support the different chapters of the CEPs (e.g., 6.1.10 for Chapter Four on Energy Efficiency) including the requirement for stakeholder engagement on data collection and analysis in Chapter Nine of the CEP, during the monitoring and evaluation of the CEP (7.1.14)

Certain data provision functions are designated under the INEP Framework. This includes the requirement on the Ministry of Energy (MoE) in Section 2.2.2. for general "[c]ollection and maintenance fo energy data" and specifically for the CEPs to provide standardized briefs on the status and ongoing resources assessments (Section 2.3 to 2.9 of the CEP), namely:

- Geothermal resource potential
- Hydropower potential
- Solar potential
- Wind resource potential
- Fossil fuel potential
- Nuclear programs
- Any other energy resources to be adopted by counties.

The INEP also established a Committee (INEPC) whose terms of reference include the following data management functions (*Annex 3: Terms of Reference and Membership of the Integrated Energy Planning Committee*):

- Collect, collate and analyze data and information relevant for energy planning.

- Provide technical data, statistics, and information to policy makers in the energy sector as may be appropriate from time to time.

INEPC is also mandated to "[f]ollow-up on data gaps and ensuring adequacy of information and data." (3.2.2).

Counties are similarly mandated to carry out a general function of "collection and maintenance of energy data" and, as part of the preparation of their plans to:

- Follow-up on data gaps and ensuring adequacy of information and data in their energy plans.
- Consult with other relevant national energy service providers to get data (1.5.3)

In Section 1.6 of the INEP Framework, counties are advised to seek national reticulation plans and geospatial maps from MoE and statistics from the Kenya National Bureau of Statistics (KNBS). They are also mandated along with the other agencies involved in planning to consider cross-cutting issues, including gender in planning. This includes consideration of the data needs to identify and integrate gender issues in their plans including the "types and courses of data needed" and whether "women involved in the collection and interpretation of this data" (4.2).

However, INEP provides minimal guidance on the tools that counties could use to carry out this data gathering and analysis or specific institutional mechanisms that can support counties to fill the data gaps they are mandated to address. Again, Section 1.7 on **Choice of planning tools for INEP r**efers to the importance of scenario planning and use of modelling tools, and the need to maintain databases to support modelling but with minimal detail. There is similar reference to "several gender analytical tools that are available to energy planners" but these are not specified. The one data gathering tool that is included is the *Data Collection Tool For County Energy Profile* in Annex 3 of the Framework. Overall, it is not clear what capacity building would be required to support counties in data gathering and analysis for planning and how this support would be accessed.

As will be discussed in the next section, county energy planning experience to date in Kenya shows there are significant challenges in relation to data availability, accessibility, and quality as well as the capacity of county governments to collect and analyse data for county energy planning in Kenya.

A further, critical question that arises is that, while the content of the various Chapters of the CEP framework outlined under INEP stipulate the type of data that should be collected, much of this data appears to meet the requirement of an "County Energy Outlook". It is unclear from the perspective of undertaking real-world energy planning at county level whether all this data would be pertinent to the goal of identifying the energy needs of county citizens (current and projected county energy demand) and developing programmes and priority investments based on this analysis for integration into county development planning and to inform the INEP.

4. Current support for county energy planning

Different stakeholders are currently supporting county governments to develop their county energy plans using different planning approaches/methods and tools. These stakeholders include the MoE through the Sustainable Energy Technical Assistance (SETA) project, the World Resources Institute (WRI), and Strathmore University. Development organizations such as GIZ, WWF, and SNV are also funding county energy planning processes. One of the most recent programmes targeting a large number of actors involved in energy planning is the SETA Project.

4.1. SETA Project

The SETA project (2020-23) aims to assist the national energy institutions and the county governments through a comprehensive capacity development program in developing resilient and implementable sustainable energy plans under the INEP Framework.[1] SETA is a partnership with the MoE and is funded by the European Union. SETA is led by Innovation, Energie, Développement (IED) and Practical Action. The Centre for Sustainable Transitions (STEER) at Loughborough University and the International Institute for Environment and Development are project partners. The intended impacts of the SETA project are the following:

- Improved capacity of the energy sector actors and other stakeholders at the national and county level for integrated planning, developing and implementing RE, EA, and EE projects.
- More effective engagement in energy planning of the private sector and CSOs, and vulnerable and poor groups, mainstreaming of gender, climate change, environment, and other critical issues.

SETA has adopted the Energy Delivery Model (EDM) methodology (see Section 3.3.) as a means of both designing the first generation of CEPs in 12 counties (under what is termed the Advanced Training Programme or ATP) and more widely strengthening the understanding of inclusive and cross-sectoral planning approaches among other counties (46 counties participated in a Basic Training Project) and national actors (including MoE and other national service providers, the Council of Governors, private sector and civil society organisations). This includes ongoing discussion with officials in the MoE and other agencies involved in developing the INEP Framework.

4.1.1 Data challenges for county energy planners identified by SETA

As part of its inception, the SETA project carried out baseline studies in early 2021, including a capacity assessment with county energy departments which identified several challenges relating to data collection, sharing and analysis to support county and national integrated energy planning. These are summarised as follows:

- Lack of access to current and reliable data relating to both energy and other development sectors to inform evidence-based planning, especially at the county and sub-county levels.
- Lack of institutional mechanisms and culture of sharing of data vertically (national to county) and horizontally (county to county or national to national agency).
- Lack of awareness of which channels to use to access/request data from national service providers such as KPLC.
- Lack of technical capacity to collect, store and analyse data to inform planning at the county level.

[1] See https://www.seta-kenya.org/.

4.2. The Energy Delivery Models (EDM) planning approach

The EDM approaches energy as an enabler of wider development needs and through a six-step process (see Figure 1), systematically identifies the varied needs and contexts of end users (in this case, county citizens) and the gaps or barriers preventing these priority needs being met. These gaps can involve energy or other, non-energy factors (e.g., cost of inputs or access to markets for farmers). EDM then works with end users and other stakeholders to develop context-appropriate and costed solutions for inclusion in the CEP, and to inform Least Cost Electrification (LCE) and energy efficiency (EE) investments. Through its inclusive methodology, EDM also engages local stakeholders along the planning cycle to build understanding and buy-in of both the priority needs and the solutions developed to address them. This increases the likelihood that CEPs will be taken forward to implementation through the next generation County Integrated Development Plan (CIDP) and Annual Development Plans (ADPs).

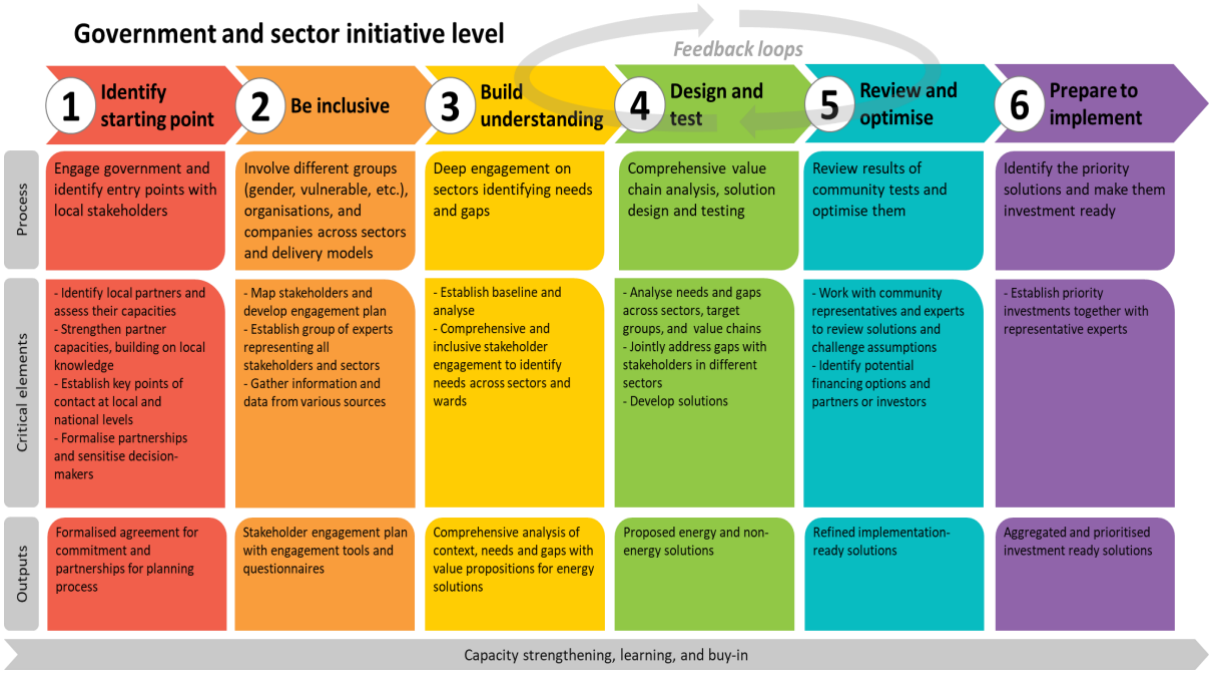

Figure 1: Energy Delivery Model (EDM) 6-step government and sector-level process for county energy planning (source: Garside & Perera 2021)

To plan and deliver successful energy services, we need to start with needs-based planning approaches, where energy services are *enablers* for clearly identified priority development needs of our target end users (in this case, county citizens). These can be at the level of individual households, community service such as health and education, and livelihood needs.

Needs-based planning approaches can help us to identify the development needs of the target end users and the energy and non-energy gaps or barriers preventing these needs being met. This includes the "softer" socio-cultural factors often ignored in top-down and technology-focussed energy planning. By this, we mean the practices, preferences and power relationships which are

often not considered when planning energy services, but which can "make or break" an energy service. Understanding and managing these socio-cultural enablers or barriers, as well as the formal aspects of the enabling environment, is crucial to building financially, socially, and environmentally sustainable solutions.

As an example, a smallholder poultry farmer in Meru County might want access to reliable and affordable electricity for incubation to increase the productivity of his or her flock and thus hincome. When discussing end users' needs, it is crucial to focus not only on the immediate product or activity but the end benefits or impacts. So, in the case of a farmer, the desired impact is not the electricity access or incubation equipment or but *generating additional income for the farmer.*

All the gaps or problems preventing the farmer generating additional income must be understood - not only the energy gaps (e.g., lack of reliable and/or affordable power and incubation appliances and equipment) but also the *non-energy* gaps (e.g., does the farmer have sufficient knowledge of flock management to increase productivity; can she afford the cost of inputs; does she know how to market her products and access new markets etc.) – before we can identify the various interventions and supporting services the farmer will need to achieve the desired impact.

If such approaches are inclusive, i.e., end users identify and prioritise their own needs and desired impacts, and identify the gaps preventing them achieving these impacts, their understanding of the solutions is built along with the critical social buy-in needed to ensure successful solutions implementation and service delivery. The approach also works across different county ministries and sectors, breaking down planning siloes and building county government understanding of energy as an enabler.

The EDM approach was developed and tested for use at the community level in Indonesia and used subsequently to design new services and review existing projects in different countries in developing Asia and sub-Saharan by NGOs, businesses, and social enterprises. More recently, it has been adapted for use at the macro-level of county energy planning in Kenya, notably to develop the Kitui County Energy Plan (CEP), which was validated in November 2021 and now a CEP for Meru County as a demonstration plan for eleven other counties under the SETA Project.

4.3. The EDM and the INEP Framework

It must be noted that the EDM is a needs-based planning methodology whereas INEP is a Framework for national and county energy planning.

However, EDM six-step process can help to operationalise INEP by supporting counties to develop needs-based, fully costed, and sustainable solutions, involving both energy and non-energy services and supporting interventions, as part of CEP development. As a live document, the CEP can build a more accurate "energy demand forecast" at the County level that will help both county and national planners, and other actors (such as private sector developers, NGOs, and donors) implementing energy and other sectoral projects at county level.

The CEP can help map the energy services and infrastructure needed in specific locations in the County to meet the needs of county citizens and provide a roadmap for priority interventions and investments to move from planning to implementation more rapidly. Using the EDM inclusive,

approach for CEP development will help socialise and build buy-in from county citizens, the ultimate end users, from the outset for the final investments and interventions developed and help to ensure integration of the CEP with other development sectors, linking to, and helping shape, the goals and programmes in CIDPs and Annual Development Plans (ADPs).

In terms of how the EDM process specifically aligns with the INEP Framework CEP process, and how EDM can operationalise planning to meet the requirements of the structure and content of the CEP as mandated under the Framework, it should be noted again that the two have different aims and INEP Framework is not a planning methodology.

However, the potential alignment of both processes, and the value added of the EDM approach are illustrated in Annex 2. It should be noted that the EDM process does not product a plan that follows religiously the structure of the INEP Framework CEP. Whereas the INEP CEP structure has standalone Chapters on Energy Resource Assessment, Energy Access, Energy Efficiency, Bioenergy and Electricity, the EDM CEP planning process approaches these thematic areas as cross-cutting data sets and inputs that can are needed to understand priority development needs, gaps and both inform and form components of solutions design.

So, for instance, while there is Least Cost Electrification (LCE) using the ONSSET modelling tool carried out for both Kitui and Meru CEPs, this is linked to building the solution to meet the need identified in both counties for better quality and more affordable household lighting, and different scenarios are developed and costed aligned to different tiers of access under the MTF approach. Energy access levels across the county are assessed as part of baselining but equally all the solutions involve components of energy access, and in the case of energy efficiency (EE), there is promotion of EE appliances and equipment through solution design. In addition to this, the EDM process at county level also carries out energy resource assessment, assesses the enabling environment and key initiatives on energy access, energy efficiency, bioenergy etc. as part of understanding the development context of the county (corresponding to Chapter One of the INEP CEP structure).

4.4. Data collection along the EDM Planning Process

The EDM planning process involves iterative primary and secondary data collection and analysis along the six steps, from initial baselining (Steps 1-2) through in-depth needs assessment in Step Three through to design and testing of solutions (Steps Four to Five). Further data gathering and analysis will be needed for Step Six, when demonstration solutions are optimised implementation with specific target end user groups and scale up. The types of data gathering tools and data sets needed along the six steps are summarised below (*Figure 2: Data gathering along the EDM process*).

EDM Steps (INEP)	Data (Kitui CEP)
Steps 1-3: ○ **Identify the Starting Point** ○ **Be Inclusive** ○ **Build Understanding** Step 1 & 2: Preliminaries & Establish a County Energy Planning Committee (CEPC) Step 3: Identify & engage stakeholders (maximize value) Step 4: Formulate a Vision & reassess objectives Step 7: Identify & Prioritise Actions	○ Stakeholder and power mapping ○ Literature Review (enabling policies at national & county level, key development programmes & targets including CIDP, other secondary data such as climate information etc.) ○ Baselining: Household Survey, Key Informant Interviews (different sectors), Ward Administrator Surveys, Focus Group Discussions ○ Selection of sample wards across the eight sub-counties for more in-depth needs assessment (workshops at community level + priority development sectors) ○ Identification of priority needs for disaggregated end users & sectors; energy & non-energy gaps; gathering stakeholder data ○ Mapping of energy resource potential ○ GSI mapping of grid electrification, transport infrastructure, socio-economic & demographic data plus other relevant sectoral data (e.g., location of health facilities) to assist with solution development

Figure 3: Data gathering and analysis along the EDM planning process (continued on next page)

EDM STEPS 4 (INEP)	DATA – KITUI CEP
EDM Step 4: Design and test Step 6: Develop Energy Goals & Strategies Step 8: Funding and Financing Strategy Step 5: Conduct situational analysis of the county energy profile (current & future use & supply; current projects, plans, policies – national & county)	• Archival research on socio-economic data • Enabling policies & linkages to national plans/programmes (energy & other sectors, climate change). • (Sub) sectoral data collection, creation & analysis • Intensive systems & business modelling • Intensive engagement with line ministries & TC • Stakeholder engagement (eg energy businesses, service providers, finance organisations etc). ○ RE resource mapping ○ EE assessment ○ LCE scenario planning with support from WRI (GSI mapping, socio-economic & demographic data, tiers of access, T1-3 rural, T4 urban)
EDM STEP 4 **Design & Test** Solutions development including supporting services to ensure financial, environmental & social sustainability.	• Archival research on socio-economic data • Enabling policies & linkages to national plans/programmes (energy & other sectors, climate change). • (Sub) sectoral data collection, creation & analysis • Intensive systems & business modelling • Intensive engagement with line ministries & TC • Stakeholder engagement (eg energy businesses, service providers, finance organisations etc). ○ RE resource mapping ○ EE assessment ○ LCE scenario planning with support from WRI (GSI mapping, socio-economic & demographic data, tiers of access, T1-3 rural, T4 urban)

Step 5: Optimise and Review Step 6: Develop Energy Goals and Strategies Step 7: Identify & Prioritise Actions Step 8: Funding and Financing Strategy	○ **Additional research (eg locations mapping for ag solution; business modelling)** ○ **Risks & mitigation** ○ **Identify synergies & aggregate solution (components) into investments that can attract and pool/blend public and private finance** ○ **Mapping of potential delivery partners/initiatives by sectors** ○ **Mapping energy equipment suppliers** ○ **Mapping potential co-financiers**

5. Methodology for mapping data needs for county energy planning

The methodology used for mapping the Data Needs (henceforth referred to as the Mapping) was to map the data required both for the EDM planning process to identify the county's priority development needs with the additional content required under the INEP Framework CEP. The data needs mapped correspond to the following sectors:

- Baseline data
- Energy Resource Assessment
- Energy Access (ONSSET modelling; linked to household lighting solution)
- Energy Efficiency and Conservation
- Bioenergy
- Electricity

In addition, data required to assess priority needs, gaps and develop solutions was mapped for the following representative key development sectors where energy can be an enabler were also mapped. The sectors chosen were some of those where priority needs were identified and solutions developed under the Kitui CEP and the current Meru CEP processes, namely:

- Agriculture
- Livestock
- Health
- Water
- Cooking

For each of these sectors, the data points mapped correspond to, first, the baseline stage of needs identification (EDM Step One to Three) and, second, to the stage of solution development (EDM Steps Four to Five).

The data points identified were collated under each sector and a scoring matrix was developed for the Mapping (see Legend). The first scoring category was availability of the data set. The data was categorised as either available (available with a confirmed source), partially available (partially available but with missing attributes or gaps in geographical or spatial aspects) or unavailable (data set does not exist). The next category was accessibility of the data set. Again, three categories were used: public access (open source or publicly accessible), restricted access (available subject authorization of requests) or classified (can only be accessed with the necessary clearance).

Finally, a scoring matrix was developed to try to capture data quality characteristics and issues. Four categories were used for this: accuracy, completeness, consistency and timeliness. Within each of these four categories, each data point was scored between 0-4 (unavailable through to excellent). Detailed information the scoring matrix including how each point for each category was defined can be found in the Mapping (Legend). The scoring for 0-4 under each of the data quality categories was also expressed in percentage terms.

Both the Mapping and the data scoring matrix are a work in progress, and it is not suggested either that the Mapping captures the totality of data needs for county planning nor that this is a completely scientific or definitive method for assessing the availability, accessibility and quality of the data mapped. However, the Mapping represents the team's best efforts to map and evaluate the availability, accessibility and quality of the data points needed for each stage of CEP development.

The Dashboard of the Mapping collates the scores under each of the top line categories (availability, accessibility and quality) for each of the sectors and allows a snapshot view of the data trends for each sector. This is not intended to be a conclusive picture but a starting point for discussion.

The Mapping then goes on to identify the specific gaps in the data needed for each sector and stage of planning, and finally suggests ways that these data gaps could be addressed. Again, these ideas are work in progress that will be used as a springboard for discussion with actors in Kenya involved in implementing or supporting county energy planning, including a future outreach event under the UK PACT CCG Project. The next section offers a short narrative summary and explanation for each sector of the data needs, the key data gaps and finally ideas for addressing these.

6. Overview of data needs and gaps for each sector and stage of energy planning

6.1. Baseline data

The baseline is an important foundation for developing the CEP, linked to INEP Framework CEP process steps 4 and 5 (formulating a vision and re-assess objectives; conduct situation analysis of the county energy profile) and subsequent steps 6 and 7 (developing energy goals and strategies; identify & prioritise actions). In content terms, it would inform Chapter One (Introduction) on the development context, economy and demographics, enabling environment etc. Also Chapters Three on Energy Access, Five on Bioenergy and Six on Electricity.

Within the EDM process the baseline is carried out in EDM Steps 1-2 to build initial understanding of energy infrastructure, grid versus off-grid electricity, its reliability, and household access. As well as other socio-economic and demographic information. In addition, sector specific baseline data is gathered across a range of sectors where energy acts as an enabler. Together this data is used to:

- Select representative wards across the county where community needs assessment will be carried out (EDM Step Three).
- Shortlist wards/locations with relevant sectoral project/initiative examples. These are used to convene sector specific workshops to deepen understanding on energy-enabled needs for the sector and the local contextual issues relevant to developing solutions.
- Identify initial list of needs and sector solution ideas - Combined with the community needs assessment (EDM Step Three), this is key to feed in to identifying the top-priority focus areas for each sector which are worked up in more detail in EDM steps 4&5 and delivery of INEP stages 6 onwards.

The data needed can be divided into four categories:

1. Socio-economic demographics
2. Infrastructure access
3. Household energy use/experience examples
4. Sector specific data

6.1.1. Socio-economic data

The following data points are needed to the level of granularity of the sub-counties and wards in each county: number of households, villages and urban centres; population type (by gender, age, ethnicity, marginalised groups, and income per capita). Population density across the county is also needed. This data is all quantitative and the granularity is important for identifying ward-specific characteristics to help with selection of wards for needs assessment that are both representative of the range of socio-economic characteristics and the diversity of needs.

Some of this data is available from the Kenya National Bureau of Statistics (Census 2019), which is considered reliable data and represents a large data set but for many data points, the level of granularity to ward level is not available. For instance, the primary source of income is available but per capita income by ward (or sub-county) is not. Significant data gaps include: a breakdown of villages and urban centres (names and numbers) by location, age ranges (identifying numbers of youth and elderly), percentage of female-headed households, and marginalised groups (noting that some data is available on people living with disabilities (PWLD).

6.1.2. Infrastructure

Infrastructure data needed includes the following: main sources of domestic lighting (grid, solar, kerosene etc), main sources of cooking, mini-grid infrastructure locations and capacity, communication access, road access, and main mode of transport to urban centres. In addition: geospatial locations and area of mini grids (including their power capacity), urban centres, and road infrastructure. Again, granularity of data to ward level data is a challenge for all these data points. Sources of lighting, cooking and mobile phone usage are available from KNBS (2019) to sub-county level. Information on grid reliability and mini-grid locations are likely held by KPLC and REREC but were not accessible for CEP development in Meru or Kitui.

Data on road networks is available from a SEDAC (NASA sourced) data set of Africa but this is not timely (dating from 2010). Data on urban centres is available from by proxy from an international dataset (CIESIN) mapping of population density, but this is likely not to match government definitions of urban centre borders and again is not timely. The County Department of Lands should hold urban zoning information which may or may not include geo-spatial references.

6.1.3. Household energy use

Household energy use data needs include qualitative information on recent locations where grid reliability has improved, significant new customer connections and significant new uptake of modern cooking solutions and the percentage of households relying on free firewood. None of this data is readily available, though there may be some data points (usually poor quality) in project documentation.

6.1.4. Sector-specific data

This consists of energy and non-energy data points required to build understanding for specific sectors, including health, water, and a range of livelihood needs. Such data points are also discussed under the specific development sectors discussed.

6.1.5. Baseline data gaps and ways to address them

One critical, cross-cutting gap is around the granularity of the data to ward level. KNBS 2019 is a very useful source of information, but data points published are for county or at best sub-county level.

However, KNBS gathers information for the periodic national survey and other statistical updates to ward level. It would be useful to understand from KNBS what datasets it holds at ward level and how these could be made publicly available – including the current constraints on doing so. Second, it would be useful to engage with KNBS on whether they could carry out additional data gathering that could be used for county energy planning - for example deepening the data gathered on elderly and other marginalised groups or adding more energy specific questions to future data collection activities – for example, whether households pay or use free firewood for cooking. Counties are advised under the INEP draft Framework to seek statistical data from KNBS.

KPLC and REREC also hold baseline data on electricity access that could be useful if made more readily available to county planners – for example data on power outages by zone (if not to ward level). Again, it would be good to understand what the current constraints to releasing this data are and how these could be addressed. Other more qualitative data such as locations where new customers have connected to the grid could perhaps be quantified through coding and analysing existing data sets (for example on new customers). These data accessibility issues are also discussed in the sections on energy access and electricity below.

Finally, county governments could also play more of a role in collating data into standard formats., for example on cooking access. This could involve an effort supported by the Council of Governors and national agencies – both energy-sector and other sectoral ministries – to identify what data points it would be useful to collect, over what period (e.g., to complement the five-yearly CIDP process) and how it should be standardised. Support would also be needed for both the data collection and its management.

6.2. Energy resource assessment data

This dataset details all energy resources within a county that could be exploited to supply final demand: data points needed include energy resources and potential, technical viability, and level of current exploitation. This data is required under the INEP Framework for Chapter Two (County Energy Resource Assessment) and can also inform Chapter One (Introduction) of the CEP. There is also a dedicated Chapter on Bioenergy (Chapter Five), whose data requirements overlap with Chapter Two.

In the EDM process, the energy resource assessment could be a useful input to Step Four, as an input to designing the energy component of solutions (for instance, if the load envisaged was sufficient t to merit exploration of a mini grid). Give the potentially contentious nature of energy infrastructure investments, in terms of issues such as land tenure, way rights and social and environmental impacts, understanding any potential impacts would be a critical aspect of solution risk identification and mitigation.

Most of the quantitative spatial data needed for the Assessment should be provided by the Ministry of Energy, according to the INEP Framework. However, currently this information has not been communicated to county planners. Currently, solar, wind and hydro resources datasets are available from global open-access spatial datasets, such as Energydata.info. or the Global Wind Atlas. Such datasets score highly on availability and accessibility, but quite poorly on the quality measures of accuracy, completeness and timeliness. Most wind and solar radiation datasets, for instance, have a resolution that does not give accurate ward-level data.

National level data can also be accessed from government research such as the Solar and Wind Energy Resource (SWERA) Report for Kenya, the National Wind Atlas, and the Small Hydro Atlas. Some data is also available from policy documents such as the National Geothermal Strategy, the Coal Master Plan, the Nuclear Master Plan and Energy Policy and the National Oil and Gas Masterplan.

In terms of the granularity of data needed, most energy resources have little variability within the smaller counties, but there is significant variability in counties with larger geographical areas. An example is the variability of solar global horizontal irradiance or wind speed. For these counties, granularity of data to the sub-county level would be sufficient.

More qualitative data sets that are required would include wood availability, agricultural residues and assessment of biogas potential from livestock. For these data sets, ward level data would be required. However, as discussed below, there are significant gaps in existing data sets and almost a complete lack of data sets at the county level.

6.2.1. Energy resource data gaps and how to address them

Current data for county energy resources such as biomass, geothermal, coal, oil and gas for the most part does not exist. The few data sets that do exist are usually in reports prepared by various government agencies, with very restricted access. This constraint also applies to data sets generated by large global corporations, for instance data on Kenyan oil and gas blocks. Timeliness is also an issue: data sets on geothermal and coal resource potential are held by state agencies but are not timely due to long periods between updates.

The is a need to make the current national wind, solar, geothermal, and hydroelectric atlases fit for purpose for use in county energy planning processes. These atlases could be aggregated to form a new National Energy Database. The database should adopt world-class data governance and data engineering practices, to provide a system for aggregation and updating of energy planning-related planning datasets. The database should ideally either be open access or if with restricted access, the approval process should be straightforward and timely. Second, resource allocation is required for primary data gathering on county energy resources, particularly for biomass, geothermal, coal, oil and gas related datasets.

6.3. Energy access data

In the context of the INEP framework, there is a standalone Chapter (Three) on energy access. Access covers electricity, cooking and heating; all forms of delivery infrastructure (e.g., grid, mini grids and standalone systems), and all types of access (energy for households, community facilities and productive activities); policy and regulatory frameworks and is intended to inform the vision and priority setting for the CEP. Data on energy access also informs other Chapters of the Framework, including the introductory context chapter (Chapter One), Chapter five on Bioenergy and is also linked closely to Chapter Six on Electricity.

Within the context of EDM, data on energy access is critical and cross-cutting through all the steps of the EDM process, from baseline understanding of electricity and cooking access and mapping the key stakeholders in the sector (Step One to Three); through needs assessment and identification of specific energy gaps (Step Three) and finally the development of energy components of solutions in Steps 4 to 6. It also informs LCE, linked to solution development.

Most of the data required in quantitative, with granularity up to ward level for the purpose of the CEP. In baselining, there is need for data such as current electrification levels, energy demand, cooking fuels progression and identification of energy access gaps. However, as mentioned in 5.1.3 above, qualitative data on household energy use is needed to build understanding and identify needs, including recent locations where grid reliability has improved, significant new customer connections and significant new uptake of modern cooking solutions and the percentage of households relying on free firewood. Data on energy affordability, reliability and quality, is also needed during solutions design to understand any specific energy gaps that are preventing priority needs being met and to design costed solutions. Currently this requires primary data collection for specific target groups.

Under both the EDM process and the INEP Framework, counties are required to carry out Least Cost Electrification (LCE) analysis. For high-level LCE analysis, there are various modelling tools to identify least-cost electrification options for population clusters. The choices are typically grid extension, standalone solar systems or mini grids. The geospatial tool used for LCE in both the Kitui and Meru CEPs is ONSSET. This tool requires several spatial datasets such as existing and planned electricity distribution networks, energy resources, current electricity access levels, and resources, demographic data and various cost data as inputs. Geospatial clean cooking modelling tools are still under development.

Most of the spatial datasets required for ONSSET modelling are available and open access. However, data points such as the distribution network data, grid cost data and specific demand profiles for sectors and administrative zones are largely in the possession of national service providers such as KPLC, REREC and KETRACO (see below).

6.3.1. Energy access data gaps and ways to address them

There are considerable data gaps in terms of the cost data required for electricity expansion planning and least-cost electrification modelling. These include the existing and planned distribution network, service transformers, energy technology CAPEX, OPEX, unit cost of expansion, fuel costs etc., and accurate data on electricity demand and consumption per sector. These datasets do exist or could be developed but, as above, are the property of KPLC, REREC and KETRACO, and currently access is highly restricted, owing to strict internal data policies. Counties undertaking energy planning are, however, requesting access to these data sets for use in LCE.

Additional technical challenges apply to certain data sets. For instance, KPLC databases are designed to optimize business operations. For distribution network management, the granularity of data below the level of counties is organised in “distribution areas”, whose expanse is determined by distribution feeders, and so would not map onto the demarcations of sub-counties and wards as the distribution areas sometimes traverse wards and sub counties. REREC network data could potentially be organized differently.

For electricity sales data, the KPLC database is organised into regions, counties, sectors and zones, which do not absolutely correlate to counties, sub-counties or wards. Further, the data does not drill down to sectoral demand and consumption as well as specific energy uses such as cooking.

The same gaps apply to electricity reliability data. KPLC electricity reliability data makes use of indices such as Customer Average Interruption Duration Index (CAIDI) and System Average Interruption Frequency Index (SAIFI),which drill down to county level and are not disaggregated further. In addition, no datasets exist on annual reliability indices disaggregated by sector (health, education etc.).

Another challenge are the corporate silos within the power sector agencies. For instance, KPLC databases may not necessarily include the entire KETRACO and REREC transmission and distribution network data and vice versa.

Finally, in relation to the choice and use of modelling tools for least cost electrification planning, such planning tools have specific input data requirements and there is no consensus or guidance to counties on which tool(s) to use, hence data needs are not standardised.

In terms of solutions, currently primary data gathering is needed to fill the energy access data gaps and resource allocation could made for primary data gathering activities and capacity building on data collection and analysis. There is also a need to for policy harmonisation of the LCE planning tools and data requirements across the counties, and between CEPs and national level INEP planning.

A further action to address this situation would be for the MoE to develop a data governance framework and then issue directives to the power sector agencies to reconfigure geospatial databases according to a Common Information Model (which would need to be developed). KPLC could be further directed to reconfigure its database to organise data according to county, sub-county and ward levels. Finally, these actions could contribute to development of a National Energy Database, potentially housed within the Kenya Power Institute of Energy Studies and Research. The Database would aggregate energy resource data, electricity network data, electricity demand and reliability data.

6.4. Energy efficiency and conservation data

Energy efficiency and conservation measures (EEC) are needed in all the sectors that are enabled by energy. Therefore, EEC data is needed for all steps of the EDM process except for Step One. Steps Two and Three

Under the INEP Framework, EEC has a standalone Chapter (Chapter Four). EEC data also informs Chapters Three and Four on energy access and electricity respectively. Such data includes the efficiency of different appliances used at household level (e.g., in terms of cooking devices and light bulbs) or for community services (e.g., in educational or health facilities) and for productive uses, ranging from light bulbs, cookstoves, refrigerators/freezers to water pumps, etc.

Both quantitative and qualitative data are needed to have a clear understanding of EEC within the county. The types of quantitative baseline data that are needed include: per capita energy consumption across different categories of end-users including households, institutions, businesses; numbers of households, institutions etc. that have adopted EEC measures (e.g., use of LED lightbulbs); data on incentives and barriers numbers of buildings that are compliant with EEC building codes etc., and for the transport sector, data is needed on vehicles passing through the county, vehicles owned and operated within the county, number using non-motorized transport, vehicles inspected annually, motorbikes registered and operating in the county.

In Step Four, designing and testing solutions, EE data is required on EE the energy efficiency potential of energy components (power systems, equipment), appliances and also the potential for energy conservation measures to be included in the solutions

Qualitative data includes EEC actors/stakeholders, national and county enabling environment (e.g., building and heating codes for county government buildings; policies and standards for technology and user specific regulations), and the status of EEC initiatives within the different sectors across the county (any government or external actor initiatives).

Data on EEC needs to be collected and analysed at a county level and also to the level of specific energy end-users (e.g., public buildings, industries & commercial outlets, households, businesses, farms etc., and transport.

6.4.1. Energy efficiency and conservation data gaps and ways to address them

There are significant gaps on EEC data, at both national and county level. National data is available on policies and regulation relating to EEC, namely the Energy Efficiency and Conservation Strategy but there are limited national data sets on EEC as it relates to specific energy end users. Counties hold no or minimal data on EEC, including qualitative data, and data sets are not consolidated but dispersed across different sectors. Primary data collection is necessary through surveys, KIIs, and FGDs.

One way to address this lack of data would be for INEP actors to identify standardised EEC data sets that counties could collect as part of CEP development, with standardized tools for data collection and management. Counties would need additional resource and capacity building for such activities, including dedicated staff. This could be further incentivised by requiring existing county development planning frameworks (such as the ADPs) to include matrices for EEC in each sector and for specific programmes and investments.

Another option could be for the MoE or a national-level body such as the Council of Governors to host an EEC depository for which counties could collect data. This could be linked to development of a National Energy Database suggested in the energy access section above.

6.5. Bioenergy data

Bioenergy data is critical to building an understanding of cooking sector needs, as part of understanding potential energy sources to increase energy access, and also issues such as environmental sustainability through forest conservation.

In terms of the INEP Framework, Chapter Five of the CEP is a standalone Chapter on bioenergy within the county, but mapping of biomass data also contributes to introductory chapter on the county development context (Chapter One), the county energy resource assessment (Chapter Two) and Chapter Three on energy access, particularly as regards cooking sector data as the cooking sector in Kenya relies heavily on biomass fuels. Finally, bioenergy data informs Chapter Six (Electricity) where bioenergy is used for co/generation of electricity.

Bioenergy data is required in the EDM CEP process for baselining important to understand the status and development context of bioenergy in a county including the demand and supply potential of different bioenergy (solid, liquid, and gaseous). In Step Four, designing and testing solutions, bioenergy data could be required to develop specific solutions including in the cooking and productive sectors (e.g., use of bioenergy to power solutions in the agricultural sector), including considerations of environmental and social as well as financial sustainability.

The specific data required includes quantitative data such as:

- The (potential) demand for different biofuels (solid, liquid, and gaseous) (types of consumers, numbers of households, farms and consumption data etc.)

- Supply and supply potential of different bioenergy including energy crops (for bioethanol and biodiesel), crop residues, forest products, and feedstocks for gaseous fuels (animal dung, etc).
- Current and projected costs for different bioenergy resources

Qualitative data is also required including:

- Markets for different bio-energy products (domestic, commercial, institutional markets, etc.)
- Driver and barriers influencing the bio-energy markets including relevant environmental policies related to bioenergy sector
- Stakeholders active along the bioenergy supply chain
- Past and current projects in the bioenergy (successes and failures)

County and sub-county level data is required given that bioenergy resources such as forests, crop residues, and biofuel feedstocks like cow dung cut across sub-counties and county boundaries.

6.5.1. Bioenergy data gaps and ways to address them

There are significant data gaps. Most of the published literature on bioenergy is at the national level (e.g., the national Bioenergy strategy 2020-2027). There is little county-specific data on bioenergy on demand, costs, supply and supply potential, markets for bioenergy, etc. Primary data collection is required to determine bioenergy demand, costs, supply, and map the different stakeholders. GIS mapping is required for the estimation of woodlots.

As with EEC, there is a need to build the capacity for counties to collect and manage bioenergy data as part of CEP development, with standardized tools for data collection and management, and by integrating data collection into existing development planning cycles. Enhanced cross-sectoral collaboration could also support data collection, for instance between the Department of Energy and the Directorate of Livestock to improve data on feedstock from livestock or with the Department of Environment to collect data on woodlots. Additionally, the County Energy Centre under EPRA could play a role in collecting and managing energy data relevant for planning in their areas of operation. However, currently there are only 17 centres for the 47 counties and additional resource allocation and capacity building would be required.

6.6. Electricity data

The datasets required for this sector are intended to inform CEP planning in relation to current and future demand, current and future infrastructure, associated costs and timelines, and cross-cutting socio-economic issues.

The datasets are meant to inform the mapping of electricity sector stakeholders, establishment of baseline supply and demand and providing an overview of existing infrastructure. They are also required to aid in the identification of cross-cutting issues in the electricity sector, development of electricity sector goals and strategies and informing inputs to energy modelling software.

Demand forecasting is the starting point for electricity planning. Under the EDM process, estimating electricity demand is cross-cutting and is a critical input to, and output from, designing the various solutions. This means that county energy demand could be estimated by aggregating the power required to deliver each sectoral solution to its target end users – and from any scale up to further end user groups – with various scenarios depending on the rate of implementation and scale-up.

Along with the aggregate load, the locations in the county where power would need to be delivered could also be estimated. This would ideally feed into LCE modelling which extends beyond access to different tiers of household lighting to estimate the LCE options for delivering electricity to meet all the priority needs for all sectors identified in the CEP, accross households, community services and productive uses, including options for e-cooking in the cooking sector. This demand forecast would inform generation expansion and transmission expansion plans respectively, and the distribution masterplan.

Under the INEP Framework CEP, there is a standalone Chapter (Six) dedicated to electrification planning and a standalone Chapter on energy access (Chapter 3). In addition, the bulk of electricity planning work is the purview of the national energy service providers. In the CEP, only summary information on the outputs from the sectoral plans is required.

However, it is still worth considering the associated data needs. For electricity planning, the data demands are decidedly quantitative given that electricity planning relies heavily on software systems for demand modelling and forecasting, power systems expansion scenarios and investment analysis.

The more granular the demand data, for instance if, as above, it was possible to determine demand across sectors in different locations of the county down to the ward level, the more refined the electricity demand forecasting would be.

On the other hand, spatial granularity of the data is less important for generation expansion planning modelling and transmission and distribution expansion planning. For these models, precision and completeness of equipment data and other socio-economic data is important to build assumptions. The demand data required would be data relating to peak, average and minimum demands for various sectors/consumer classes and regions. In the Kenyan context, three demand scenarios are considered: reference, vision and low.

Generation expansion planning requires both macroeconomic and macroeconomic data such as GDP, correlation of GDP and energy demand, energy consumption per sector, among others. In addition, data is required on the reserves/capacity of primary energy resources, as well as lifecycle costs. These econometric datasets are largely in the possession of the Kenya National Bureau of Statistics, the Ministry of Energy and KENGEN/Independent power producers respectively.

For transmission and distribution expansion planning, the data required is majorly power system equipment data, whose format and dimensioning are dependent on the power system modelling software used.

The output from the electricity expansion planning initiatives relevant for the CEP are the demand forecasts, summaries of baseline supply and demand – with an element of gender disaggregation, listing of priority generation, transmission and distribution projects and the accompanying investment prospectus. Again, if demand was estimated in function of the energy needs of county citizens identified through the needs assessment and subsequent solutions development process under EDM, it might be possible to build a more real-world demand forecast and more efficient investments in electricity generation, transmission and distribution expansion.

6.6.1. Electricity data gaps and ways to address them

The main data gaps for county energy planning are due to restricted access to data held by the national energy service providers. There is currently no common protocol for sharing this data in a way that would permit replication of models. Further, there is insufficient disaggregation of electricity data with regards to gender, sector or sub-sector.

To address these gaps, the MoE could develop a common information model. Furthermore, regulations could be developed under the INEP Framework to ensure electricity data held by the national energy service providers was made available to county energy planners. Again, as recommended in the section on energy access, this data could be held under a new National Energy Database.

6.7. Agricultural sector data

Data is required for the baselining, needs assessment and solutions development stages of the EDM process. Under the INEP CEP Framework, data on the agricultural sector feeds into Chapters One on the county development context, into Chapter Three on Energy Access and potentially Chapter Five on Bioenergy.

By way of example, in the CEP development for both Kitui and Meru, priority needs were identified around the opportunities for increasing farmer income through powered irrigation and a focus on higher-value horticultural crops. In Meru, where significant irrigation is already happening, the priority focus for powered irrigation was in areas beginning to experience water scarcity and rationing – where technologies like drip irrigation using solar water pumping could offer benefits. There was also interest in the potential for agricultural processing for certain crops (potatoes and bananas) clustered around crop aggregation centres. However, this was of secondary interest, given the nascent state of these aggregation centres.

Baseline data needs include quantitative data such as:

- Percentage of households with agriculture as a main source of income (to the ward level)
- Percentage using irrigation pumps and the associated energy source (to the ward level)
- Average farm size (both rainfed and irrigated)
- Crop types grown
- Number and type of agricultural processing and associated source of energy.

In addition, qualitative data is needed on current and past agriculture projects (successes and failures) and associated energy usage.

The data required to develop costed solutions for specific target groups of farmers can be categorised as follows:

- **Farm areas, climate, and water availability:** This is needed to quantify overall target areas where energy-enabled agricultural solutions will be delivered, for crop-cycle analysis and water pumping solutions development. This includes:
    - Total farmland area including geospatial information
    - Permanent river geospatial information
    - Monthly precipitation (for relevant locations)
    - Temperature data (for relevant locations).
- **Non-energy agriculture inputs and market pricing.** This helps model optimal crop cycles for farmers in specific locations to maximise farmer income. This includes:
    - Agricultural input costs for specific crops
    - Monthly local market prices for specific crops

- Market demand and prices for processed goods

- **Energy related equipment:**
  - Irrigation system costs for specified crop cycles (according to water requirements)
  - Processing facility component costs

KNBS (2019) contains some of this information, specifically on households with agriculture as main income and crop types grown. It can also provide some information on where agricultural farming is the main source of income, and some indication of irrigation taking place through calculating the value on household irrigation as a percentage of total crop production. However, these datasets are limited to sub-county level.

6.7.1. Agricultural data gaps and ways to address them

One critical cross-cutting gap is the level of granularity of data for baselining, i.e., lack of ward level data. As discussed above, it would be useful to engage with KNBS on whether they could release ward level data points collected by them or carry out additional data gathering that could be used for planning agriculture secto solutions (e.g., on farmer equipment currently in use).

Farmland area is difficult to quantify accurately as there is no data available at the county level and no zoning records kept outside of urban areas. There are some international data sets available, but their granularity and accuracy are questionable (this includes a 2017 dataset on crop production statistics in Africa and a 2010 NASA data set on cropland by water source). These data sets do not enable a (reasonably) accurate prediction of seasonal versus permanent rivers, which is critical for deploying irrigation seasons.

These data points will likely continue to prove challenging. The satellite mapping data is useful and could be improved with better granularity and more current data. At the county level, better record keeping within each sub-county and ward on farmland would enhance data availability. Counties could also undertake periodic research, for instance on different agro-ecological zones. Again, INEP actors (and the Ministry of Agriculture) could support a standardised approach to what data should be collected and how.

Historical climate data (precipitation and temperature) Is available from the Kenya Meteorological Department (KMD) but are only accessible by payment (per data point). The number of weather stations is also limited in some locations, which is an important data gap if there are significant climatic variations across the county. There are other sources, but the data is not timely or complete. World Weather Online has climate datasets for download, which permit more timely and granular analysis – for example, over the last five years and several Kenyan counties are covered.[2]

County governments should be able to access data from KMD without payment and the request processes should be simplified. Where there are significant climatic and weather differences across a county, the number of weather stations could be reviewed to see if there are any gaps.

Data points on farm size, agricultural processing, and information on projects and initiatives is only available through literature review and information provided by the County Government, which is

[2] See https://www.worldweatheronline.com/.

often incomplete. The County Agriculture Ministries held some information on crop varieties and associated input requirements. These were not current, and incomplete in terms of covering newer hybrid varieties or the range of crops farmers are growing, and water requirements.

For agriculture input costs and expected yields, given this will vary by context and location, customised data needs to be collected. However, for the purposes of developing the agronomy component and costing inputs it would be useful to the national Ministry of Agriculture to develop a database of crop varieties (with associated yields and water requirements), input prices, and potentially a list of agro-dealers with distribution locations (such as the list of certified solar PV contractors and technicians held by EPRA, where the technician list is by county; see section 5.8). This would require resource for development and updating of the database for it to be useful in planning.

For market pricing of crops, the national Ministry of Agriculture makes this information available in a monthly spreadsheet sent by email to County Governments. If this is made available, the monthly spreadsheets can be aggregated to show changes prices across a one-year period, but challenges remain over incomplete data sets for crops of interest. To assist with planning solutions for crop farming with a high value-add from irrigation (for example horticulture), a central, easily accessible dataset on crop prices would be useful, rather than the Ministry of Agriculture sending spreadsheets being emailed to individuals and being hard to access.

Demand for processed goods is not available and requires primary data gathering (e.g., a market survey). Similarly, irrigation system and processing facility costs require primary data gathering, although some data is available on supplier websites.

These gaps on irrigation and other equipment using energy (such as solar water pumps) could be addressed if there were a regularly updated database on off-the-shelf equipment specifications, pricing, and retail locations by county (again, similar to the EPRA list of solar contractors and technicians).

6.8. Livestock farming sector data

Livestock farming sectoral data mapping is needed in the EDM CEP process for baselining (Steps Two to Three) to solutions development (Steps Four and Five). Under the draft INEP CEP framework, an overview of the Livestock farming sector and explanation of its importance to the county economy could inform Chapter One (*Introduction*) and Chapter Two *Energy Access*, which includes access to energy for productive activities. Understanding Livestock farming production chains may also be an important input to the assessment of bioenergy in Chapter Five.

In the EDM process, mapping of Livestock farming value chain actors first takes place under Step Two (Be Inclusive), and Step 3 (Build Understanding), as part of baseline analysis carried out to understand the key socio-economic and cultural features of the County and its development priorities. This happens through literature review and primary data gathering (e.g., household surveys, Ward Administrator surveys, FGDs and KIIs with the County Government Ministries and other stakeholders).

If needs related to livestock farming emerge as a priority for county development (e.g., improved farmer income from dairy/cattle/pig/poultry etc. farming), then data needs to be gathered on these Livestock farming value chains. This includes through the in-depth specific livestock sectoral workshops held as part of the community needs assessment.

Both quantitative and qualitative data is needed during baselining to build a clear picture of the economic and socio-cultural importance of livestock farming in the County; the distribution of

livestock farming activities; who benefits from them and how (e.g., who is involved in livestock farming; is it subsistence or income-generating or both; its importance to household income etc.).

Both quantitative and qualitative data is need. Quantitative data includes average herd/flock size, mortality rates, income, costs of inputs etc., while qualitative data includes farmer perceptions of gaps and of the impacts. Information on current and past projects carried out by the County Government and other actors to improve livestock farmers' livelihoods, their aims, target groups and impacts, is also needed to identify any lessons learned in terms of success or failure. This includes quantitative and qualitative information on good practice involving energy access interventions (e.g., improved dairy herd productivity through mechanical milking or improved income from poultry farming through incubation) and mapping locations/target groups where livestock farmers have no or limited access to electricity.

Ideally, the baseline data will provide an overview of the key components, actors and characteristics of the critical Livestock farming value chains from farm to fork (production support, production and markets). It should help to identify the gaps in current value chains (both energy and non-energy) from the end-user (farmer) perspective, as well as potential opportunities for adding value through our solutions, through enhancing existing interventions, plugging identified gaps in value chains, or building new solutions.

Further data is needed to develop solutions for the Livestock farming priority development need identified, including to understand the (energy and non-energy) gaps, identify key value chain actors whose support is needed and identify potential target groups that this solution will benefit. This includes quantitative and qualitative data.

1. **Production support data** – farmer training, group organisation, access to finance, inputs, technology and equipment. This includes information data on:
    - Types of training current and future (methodology, providers, costs, [impacts]
    - Farmer group structure (benefits & costs)
    - Examples of successful farmer groups
    - Access to finance: savings circles, current and potential financial service providers (products, terms of payment etc)
    - Flock management
    - Medicines & vaccinations (types and costs, projections for annual or cycle costs, providers)
    - Extension services
    - Feedstock (lifecycle volumes & needs (types, quality, costs, and challenges and opportunities for enhancement of feed formulation)
    - Technology & appliances e.g., feed mixers, incubators, hatcheries, lighting and heating appliances (management, suppliers, pricing, capex & opex including maintenance costs, suppliers etc)
    - Energy systems (management, suppliers, pricing, capex & opex including maintenance costs, suppliers etc)
    - Breed stock (suppliers & costs of procuring quality breed stock; infrastructure and management, productivity and mortality rates, productivity)

2. **Production data** including data on:
    - Production rates (eggs, chicks of various ages, mature birds, cockerels)
    - Production practices
    - Cost benefit and business productivity
    - Challenges, / barriers for different types of production
    - Examples of success or failures
3. **Market access and sales date** including:
    - Demand for current products & market channels/actors (individual farm gate, middlemen, retailers plus any aggregation for selling, volumes & market prices etc.)
    - Potential for value addition
    - Potential aggregation for sales and market access models (partnership requirements etc.)

Data may be needed for GIS mapping to understand where potential target groups are in relation to grid and other infrastructure (e.g., roads, market centres). Subsequently, once the draft solution has been tested, further data collection/analysis may be needed to refine the solution for implementation under Step Five (*Review and Implement*) – for instance, on identified target groups and to develop fully-costed solutions in particular locations - and to reach the stage of investment-ready solutions.

6.8.1. Livestock farming data gaps and how to address them

Most data for baselining is needed to the ward level, to build an accurate picture of the distribution of livestock farming, end users and Livestock farming value chains throughout the County. This level of data is not currently available in most counties. Most quantitative data is available at national level or county level (for instance through the national Ministry or programmes such as the Agriculture Sector Development Support or ASDSP programme) or through available international data sets. At best, data is available to sub-county level (e.g., KNBS socio-economic data).

In addition, there is no standard data gathering approach to livestock sector data and no standard data sets at county level. What data is available from the County Government is usually restricted access, i.e., can only be accessed with the permission of the relevant Directorate of Livestock.

As discussed above, associated energy data (e.g., levels of electrification in particular locations; grid expansion and transmission and distribution planning) can only be accessed by the County Government on request from KPLC or REREC. Other actors (including academic authors) may publish data from relevant Livestock farming projects and programmes but usually KIIs and specific requests to the project organisers are required to access background project data and detailed impact studies (if the latter exist).

This means in practice that primary data gathering is required to access most of the data required baselining and also for solutions development, including to obtain the data needed at the appropriate level of granularity. Secondary data, for instance, on prices and suppliers of various inputs and infrastructure/equipment can be accessed online (for instance EPRA maintains an

database of solar PV contractors and technicians, the latter disggregated by county)[3] but this data may not be timely or updated regularly (the EPRA databases were last update in July 2021). Primary data gathering (e.g., market surveys) are usually needed to identify the full costings and the suppliers operating in specific locations. KIIs are also usually required to access information from different value chain actors, including farmers.

Potential ways to address these gaps apart from primary data gathering could be, first, through exploring whether current data repositories could be made more "open source". Again, KPLC could provide County Governments with standardised and easier access to various data sets pertaining to grid electrification and KNBS access to data collected at ward level for the periodic national census and statistical updates or additional data points added to those data collection activities. This could include data on the distribution of livestock farming activities by sub-sector across the county; what percentage of household income it represents; types of appliances and equipment used by livestock farmers etc.

Another option would be for either the county government or national ministry to develop databases to collect and harmonise relevant data across the counties (as discussed in section 5.7). Again,this could include maintaining up-to-date information on energy equipment suppliers and pricing; input prices & suppliers; local and seasonal market prices for different livestock products etc. If this additional data collection was to be done at the county level, capacity building would be required including on standardised data collection methods and tools.

6.9. Health sector data

An overview of any health-related development priorities in the County could be included in Chapter One (*Introduction*) of the CEP under the draft INEP framework, and health sector data is required for Chapter Two *Energy Access*, which includes access to energy for community services, including health facilities. Use of biomasss for cooking in health facilities would also inform Chapter Five on Bioenergy.

Health sector data is needed for baselining under Steps Two and Three, through literature review and primary data gathering (e.g., household surveys, Ward Administrator surveys, FGDs and KIIs with the County Health Ministries and other stakeholders, including other health sector workers and private sector or civil society actors delivering health services).

If needs related to health emerge as a priority for county development (e.g., improved access to basic health services in remote areas) then data needs to be gathered as part of the community needs assessment.

Quantitative and qualitative data is needed to build a clear picture of the health sector in the County. This includes standardised data on the service delivery, staffing levels, medicines, associated equipment and infrastructure (water and energy) that are mandated for each level of health facility in Kenya (levels one to five). Data on the number of different levels of facilities and their distribution across the county is needed, particularly the distribution of level two and three facilities (dispensaries and clinics) dispensing basic health care services is required. GPS locations for all the

[3] See https://www.epra.go.ke/download/solar-photovoltaic-contractor-register-11_06_2018/; and https://www.epra.go.ke/download/solar-photovoltaic-technicians-register-13_june_2018

facilities is an important adjunct for GIS mapping of facility distribution as well as distance from population centres, transport, energy and water infrastructure.

Once the "baseline" of what services, staffing levels, infrastructure, medicines and equipment/appliances are mandated for each level of facility is in place, more granular data is needed for each facility to understand the *actual* level of service delivery, staffing, energy and water infrastructure, appliances and equipment and medicines, with respect to delivering the mandated services, in order to identify which facilities have gaps in which areas, and to begin identifying which facilities should priorities for solutions development. For instance, under the CEP it may be pertinent to target those facilities which are currently not electrified, e.g., are not grid connected and do not have a functioning alternative power source, as well as experiencing other gaps in staffing, equipment etc. Any solution components developed to address non-energy gaps for these target groups will have future application to other non-target group and in the case of any off-grid energy solutions developed, these may also have application to non-target group facilities, for instance, that are seeking more affordable forms of power supply over their existing grid plus back-up diesel-powered gensets.

Quantitative data is needed on the following:

- Numbers and level of staff per facility
- Types and costs of equipment, appliances and medicines
- Electricity supply (including source of main power supply and back up; reliability/hours and frequency of outages; monthly consumption/expenditure; opex including maintenance);
- Water supply (including reliability; source of electricity for electrified water points; monthly consumption/expenditure; opex including maintenance).

Qualitative information includes information on issues relating to staff retention and recruitment; management of water points and current and past health projects carried out by the County Government and other actors to improve access to health services or community health (depending on the need identified), their aims, target groups and impacts, is also needed to identify any lessons learned in terms of success or failure. This project information should include quantitative and qualitative information on good practice involving energy access interventions (e.g., improved service delivery through reliable electricity for mandated services such as maternity, refrigeration for vaccines etc.) and mapping locations/target groups where facilities have limited or no access to electricity.

Further data collection will be needed in EDM Step Four to develop concrete solutions for the health priority development need identified, including to understand the (energy and non-energy) gaps, identify key actors and stakeholders whose support is needed and identify potential target groups that this solution will benefit (or not). This includes further data collection on potential model or best practice solution components to address both energy and non-energy gaps. The latter could include identification of good or best practice for recruitment or retention of staff for remote facilities and on procurement of medicines.

For developing the energy components of solutions, accurate data is required on the following:

- Spects/power requirements per level of facility (depending on loads for equipment and appliances)
- Energy system/equipment suppliers, costs including for energy efficient equipment/appliances

- After sales and maintenance services including data on qualified local technicians are there locally to provide repair and maintenance functions.
- Financing options and payment mechanisms.

6.9.1. Health sector data gaps and how to address them

Data on sector standards in terms of mandated services, staffing levels and appliances is accessible open access on the national Ministry of Health website. Data on the number, level and distribution of facilities is available on Kenya Health Information Sytem (KHIS) database and can be accessed by the County Health Directorate.[4] It is also possible to access the GPS coordinates of individual facilities through this central database. Having this data is an important input to carrying out, for instance, GIS mapping to visualise the distribution of health facilities and their distance from population centres, transport, grid and water infrastructure, to support identification of priority target facilities and solutions development.

There is no standard data gathering approach and no standard data sets related to actual levels of service provision, staffing, infrastructure, appliances etc. at the county level. This requires primary data gathering activities with the County Government (surveys and KIIs with the Sub-County Health Officers).

Associated energy data (e.g., levels of electrification in particular locations; facility consumption data) can only be accessed by the County Government on request from KPLC or REREC and will not currently include data on consumption and outages per facility given the constraints of current data collection and management by these national service providers (see section 5.6 on electricity sector data above). Currently this data will have to be obtained by primary data collection. In the case of water access, data on location of water points, including GPS coordinates and source of electrification of water points is available from the County Government or WRMA on request. Data on consumption, expenditure and opex is not available except through primary data gathering.

The availability and quality of information on health sector initiatives and examples of success and failure appears to vary from county to county. Other actors (including academic authors) may publish data from relevant health projects and programmes but usually KIIs and specific requests are required to access background project data and detailed impact studies (if the latter exist).

Some data, for instance, on prices and suppliers of various medicines, appliances/equipment and off-grid energy solutions can be accessed online but primary data collection (market surveys) are usually needed to identify the full costings and the specific suppliers. KIIs are also usually required to access information from different value chain actors, including health service users.

Potential ways to address these gaps apart from primary data gathering could be through exploring whether current health sector data repositories such as KHIS could be made more “open source” for county planning. KNBS may have additional data on health facilities that is not public or could include statistical updates on health facility access to water and electricity and on equipment and appliances and other critical data points.

[4] See https://hiskenya.org/dhis-web-commons/security/login.action

For electricity access data gaps, as discussed above in section 5.6, whether KPLC could provide County Governments with standardised access to existing data sets pertaining to grid electrification and connectivity of health facilities, through development of a common information model and regulations under the INEP Framework. Again, as recommended in the sections on energy access and electricity, this data could be held under a new National Energy Database.

Finally, the county Health Directorates could collect standardised data sets periodically on the actual level of services, staffing, infrastructure etc. at county facilities, linked to the county integrated development planning and CEP processes. Capacities may again require capacity building on standardised data collection methods and tools.

6.10. Water sector data

As one of the key development sectors in all counties, an overview of water supply sources and demand would be useful for the introductory chapter of the INEP Framework CEP under background in relation to demographic features. This data is also a critical input to Chapter Three of the INEP Framework, Energy Access.

Water data is required for baselining and for the solutions development of the EDM process. Under Steps Two and Three, data collection includes mapping water sector actors from county government to community level water management committees. Other quantitative and qualitative data required includes the following:

- Ward level data on water supply sources (boreholes or dams)
- Population density vs water supply sources
- GPS coordinates for boreholes
- Electrified and non-electrified boreholes, power sources and functionality
- Ward level data on household and institutional water demand and use
- Ground water geomap for the County at different depths (80ft, 100ft, 300ft)
- Data on water yield and use intensities
- Data on water quality to sub-county and ideally ward level
- Qualitative data on end user resource management behaviour; past and current county government on external actor water projects or programmes

The above data points are also needed for Step Four (solutions design), to identify target end user groups (e.g., populations living in areas of water scarcity) and build solutions, including for GIS mapping of water points in relation to population centres and grid infrastructure. Additional quantitative data in terms of number of target populations to be served, daily water demand for computation of supply requirements.

For developing the energy components of solutions, accurate data is required on the following:

- Specs for water pumping systems and appliances
- Energy system/pumping equipment suppliers, costs including identifying of energy efficient equipment/appliances
- After sales and maintenance services including data on qualified local technicians are there locally to provide repair and maintenance functions

- Financing options and payment mechanisms.

Qualitative data on use points and user behaviour in resource conservation is important to build environmentally and socially sustainable solutions, including data on effective community water point management and best practices in community water governance.

6.10.1. Water sector data gaps and ways to address them

Secondary data from KNBS 2019 on county water supply and demand is useful but this is only available to the sub-county level and is not disaggregated to the ward level. County governments and WRMA hold data on distribution of public water points, including GPS locations. whether they are electrified or not, source of electrification and functionality. WRMA also holds some information on electrification status of private boreholes data, but the functionality of these boreholes is not available.

Other key data gaps in the water sector at the ward level include datasets on residential and institutional water supply sources and water demand. Moreover, water quality information is not readily available although it is a statutory requirement for all boreholes to test water quality. There is usually no groundwater geomapping at county level.

There is little qualitative data on actual community water management practices and limited data on good practice.

Primary data gathering is required to fill in the data gaps, including technical research and surveying e.g., on water quality and surveys/KIIS to assess water demand in institutional such as hospitals and schools, and understand water management and conservation practices. In the availability of resources these interviews would be done in representative samples, and for energy system and and equipment supplier mapping.

Water demand and use data will be collected through simple online survey albeit clouded with numerous accuracy challenge including the degree of honesty, accuracy of answering the survey by the community members and distribution of survey forms because of number of rural community members with smart phones and are able to access internet. As such whereas this approach has been used, it will be combined by triangulation of information from other interviews.

As discussed in other sections, one of the key potential ways to address these gaps would be for the County Water Department or Statistics Office to collect standardised data sets periodically to address the missing data points, including on residential and institutional water supply sources and water demand to ward level, water quality etc. Another option is to explore whether KNBS holds any of this ward level data currently or could add questions to future iterations of the national census or carry out statistical updates on the water sector. The County Government could also undertake geomapping of ground water resources and research on depletion rates, but this would potentially require additional resourcing and technical assistance.

6.11. Cooking Sector Data

The cooking sector in Kenya is heavily reliant on biomass fuels, thus data mapping for the sector contributes to Chapter Two of the INEP Framework County Energy Plan (CEP), County Resource Assessment as well as to Chapter Three of the CEP (Energy Access). Data on efficient cooking devices and thus contribute to Chapter 4 of the CEP (Energy Efficiency and Conservation). Analysis of supply and demand for different biomass fuels i.e., solid, liquid, and gaseous fuels forms part of the data requirements for Chapter Five of the CEP (Bioenergy). An overview of cooking needs and trends

could also contribute to the county development outlook in Chapter One. It is worth noting that the cooking sector may not be considered a development priority by the county governments. This could be attributed to a limited understanding of the cooking sector linkages with other sectors such as household health, environment (especially deforestation issues), agriculture (use of waste feedstocks and competition between food crops competing against energy crops), and so on.

Under the EDM process, cooking data is needed for baselining and for sectoral solutions development if needs relating to cooking access are prioritised. For the baseline, it is important to understand household cooking trends and patterns, sociocultural and economic drivers of cooking practices and preferences and trends within the county. The data at the baseline could be obtained through a review of literature, household surveys, KII, and FGDs among others. Specific quantitative data required for baselining includes but is not limited to:

- Percentage distribution of households by cooking fuels
- Percentage distribution of cooking technologies (households)
- Per capita consumption of cooking fuels and technologies (disaggregated by gender)
- Sources of cooking fuels
- Types of cooking technologies in use

Qualitative data includes:

- Data on cooking practices and preferences for types of fuels and cooking technologies, including economic (e.g., affordability) and socio-cultural (e.g, gender) factors.
- Past and current initiatives promoting cooking solutions (successes and failures; drivers and barriers for the success or failures of these initiatives; good practices).

To develop specific solutions and identify target groups, additional data will be required on:

- Costs of the cooking fuels and appliances
- Suppliers of fuels and appliances (disaggregated by gender)
- Financing arrangements available to the cooking solution suppliers and the end-users, including:
    - Which type of households are targeted by these programmes
    - Which type of households have mainly applied for this funding
    - The barriers/challenges to implementing the programme in certain areas (e.g., remote areas; uptake among lower-income households, etc).

6.11.1. Cooking sector data gaps and ways to address them

There are very significant data gaps for the cooking sector and a lack of the level of granularity needed (to ward level). There is a huge gap around accurate end-user data for the datasets that form the cornerstone for the development of the cooking solution, namely, types of fuels and cooking technologies used by end-users, sources of these fuels, cooking technologies, costs of these fuels and cooking technologies, economic and socio-cultural drivers of cooking practices and preferences and practices, and financing models for the solutions.

Data in most of the published literature on cooking technologies and fuels are mainly at the national level (for instance, MoE & CCAk, MECs 2021), while KNBS data on cooking only reaches the county and sub-county levels (KNBS, 2019). National-level data can also be useful when considering business models and financing approaches that can be adapted to the specific county context.). In summary, all the available literature on the cooking sector at county level lacks ward-specific data on cooking fuels, technologies, the cost of these solutions, affordability and socio-cultural drivers of practices and preferences etc.

Access to different fuels and cooking technologies in an urban ward differs from that of a rural ward in arable land, and to a rural arid ward and a rural forested ward and so on. Therefore, the unit of analysis needs to be at the ward level. However, other data sets will be considered at the sub-county or county level, for example, suppliers of cooking fuels and appliances, financing arrangements, past, current, and future projects, etc. In addition, given the highly gendered nature of cooking poverty and cooking practices, data disaggregated by gender is critical for understanding the drivers of cooking fuel and technology use and developing viable solutions.

Primary data gathering is required for almost all the data points required to develop solutions.

As discussed in other sections, one of the key potential ways to address these gaps would be for the County Energy Departments or Energy Centres to collect standardised data sets periodically to address the missing data points, potentially linked to county integrated development planning. Another option is to explore whether KNBS holds any relevant ward level cooking data currently or could add questions to future iterations of the national census or carry out statistical updates on the cooking sector related on per capita consumption of cooking fuels and technologies sources of cooking fuels and types of cooking technologies in use. It would be important for data collection to be disaggregated by gender.

Actors involved in county energy planning could also borrow from the Ministry of Health where they have a central depository for key data sets in the sector and has given counties restricted access to establish a similar data collection and data-sharing mechanism.

7 Annexes

7.1 Annex One INEP CEP Process and content

7.1.1 INEP CEP Process

3.2. Development of County Energy Plans

This section provides an eleven (11) step-by-step process for developing and/or review of the CEP as listed herein below;

a. Stage 1: Preliminaries
b. Stage 2: Establish a County Energy Planning Committee (CEPC)
c. Stage 3: Identify and engage stakeholders;
d. Stage 4: Formulate a vision and re-assess objectives;
e. Stage 5: Conduct situational analysis of the County energy profile;
f. Stage 6: Develop energy goals and strategies;
g. Stage 7: Identify and prioritize actions;
h. Stage 8: Develop funding and financing strategy;
i. Stage 9: Develop a blueprint for implementation of CEP;
j. Stage 10: Plan to monitor and evaluate; and
k. Stage 11: Refine, adopt and publicize the CEP and INEP.

3.2.1. Stage 1: Preliminaries

3.2.2. Stage 2: Establish a County Energy Planning Committee (CEPC)

a. Appoint a CEPC.
b. Identify CEPC Programme Coordinator.

3.2.3. Stage 3: Identify and engage stakeholders

a. Identify Stakeholders
b. Engage stakeholders.
c. Plan to maximise stakeholder value throughout the planning process.

3.2.4. Stage 4: Formulate a vision and re-assess objectives

a. Identify guiding principles and priorities to use as a basis for the vision.
b. Create a focused vision statement.

3.2.5. Stage 5: Conduct situational analysis of County Energy Profile

a. Develop the scope and constitute a team of experts to undertake the energy profile work. This may be outsourced where necessary.
b. Assess current energy use and supply.

c. *Identify potential future energy supply.*
d. *Analyze the existing energy activities, projects, plans, programmes and policies of the national government, county government, development partners, private sector stakeholders and non-governmental organizations.*
e. *Identify available human and organizational resources to help implement CEP.*

3.2.6. Stage 6: Develop Energy Goals and Strategies

a. *Choose effective language to communicate the goals.*
b. *Develop clear and measurable goals.*
c. *Identify strategies for achieving goals.*
d. *Integrate input from stakeholders.*
e. *Publicize goals and strategies.*

3.2.7. Stage 7: Identify and Prioritize Actions

a. *Establish a system to rank ideas.*
b. *Identify policies, programmes, and projects to consider.*
c. *Rank and evaluate options against goals and strategies.*

3.2.8. Stage 8: Develop Funding and Financing Strategy

a. *Understand financial requirements for different types of energy actions.*
b. *Identify potential financing and funding sources.*
c. *Design a suite of financial mechanisms for proposed CEP activities.*

3.2.9. Stage 9: Develop a Blueprint for Implementation of the CEP

a. *Develop a blueprint.*

a. *Develop a blueprint.*
b. *Establish operational responsibilities.*
c. *Incorporate the CEP into other planning and budgeting activities.*

3.2.10. Stage 10: Plan to Monitor and Evaluate

a. *Establish a plan for performance measurement and reporting.*

3.2.11. Stage 11: Develop, Adopt, and Publicize the CEP and INEP

a. *Prepare a final CEP.*
b. *Have the CEP officially adopted.*
c. *Publicize and commence implementation of the CEP.*
d. *Develop communication and public relations strategies for the CEP.*
e. *Evaluate and report on the effectiveness of the full CEP and its components on a regular basis.*
Update the CEP when necessary to ensure the best results.

7.1.2 INEP CEP Content

6.1.3. Foreword

The Foreword should contain the rationale for preparing the CEP and the highlights of the development priorities of the county during the plan period. The statement will outline the linkages to the energy sector policy, legal and regulatory frameworks. It will also state how stakeholders have been consulted and engaged, and the process used in identifying the needs and prioritising actions. The Foreword will further stress the county's commitment to the implementation of the plan, together with the key steps to be taken to ensure successful implementation. The foreword shall be signed by the Governor.

6.1.4. Preface

The preface shall highlight the purpose for preparing the CEP and the linkage to CIDP and the requirement for the development of INEP by the Energy Act, 2019. State how the process of CEP development involved consultation, participation and inclusivity of all the stakeholders.

Discuss briefly the objectives and how they will be achieved in terms of strategies. Also highlight the main focus of CEP in terms of key areas (energy sources, energy access, bio-energy, electricity and energy efficiency and conservation), programmes, projects, implementation matrix and its contents, financing, M&E framework and its use in tracking and reporting on its implementation.

Highlight how CEP will be implemented and the key stakeholders and what is expected from them. Highlight the establishment of CEP Committee and its role in development of the plan. State need for support from stakeholders and assure the commitment of the County towards the

implementation of CEP. The preface shall be signed by County Executive Committee Member (CEC) in charge of energy.

6.1.5. Acknowledgement

This section will acknowledge any financial or technical support the county may have received in preparation of the CEP. It will also express appreciation of people who helped in development of the plan.

6.1.6. Executive summary

This section will present a summary of the major qualitative and quantitative features of the plan, recommended projects, priority projects and other actions. It will also briefly explain the main financing plans for the execution of the CEP. The linkage between the actions and expected results will be highlighted, with specific targets, outputs and outcomes mentioned.

6.1.7. Chapter One: Introduction

- ***1.1. Background:***
- ***1.2. This section should provide background of the energy planning, which may include the rationale for the CEP, history of energy planning, plus challenges and opportunities.***
- ***1.3. Process of development of County Energy Plan.***
- ***1.4. Integration of county energy planning into the CIDP process.***
- ***1.5. County Overview:***
  - 1.5.1. Location and size
  - 1.5.2. Demographic features
  - 1.5.3. County economy.
- ***1.6. Development partners, Private actors and non-governmental organizations in the county's energy sector.***
- ***1.7. Policy and regulatory framework for the energy sector:***
  The INEPC will provide a standardised brief on policies and strategies, to be adopted by counties for purposes of this section.
- ***1.8. Applicable legislations on energy in the County***
  Counties should strive to align their county specific legislations on energy to the national legal and regulatory framework.

6.1.8. Chapter Two: County Energy Resources Assessment

This section details all resources and provides statistical data in terms of technical viability and level of current exploitation. Moreover, it specifies functions of the county government in relation to the exploitation of the resource. It also relates the county energy resources to national statistics. Further, it describes energy resources and potential in the county, including projections based on the available data. The required data for the county energy resources assessment include:

a. Availability of fuel wood in the area.
b. Source of fuel wood supply.
c. Amount of agricultural residues (paddy straw, rice husk, maize, millet, sorghum, legumes) produced by a household.
d. Number of cattle owned and their potential for the provision of feedstock for biogas.
e. Location and capacity of potential hydropower generation.
f. Potential of solar power.
g. Location and capacity of potential geothermal power generation.

h. Wind power generation potential and location.
i. Inter-county energy resources potential.
j. Other energy resources potential.

The resource assessment activity framework focuses on five key dimensions: availability and economic potential, adequacy, sustainability, ease of access and cost of use.

2.1. Assessment of biomass energy resources

The biomass resource assessment should inform on local availability, proximity of biomass resource sites and accessibility to local users. It is essential to highlight specific concerns about biomass in the planning framework due to its local availability from forested areas:

a. Differentiate forest areas under the National Government and county government.
b. Establish the supply and demand of forest cover in the county.
c. Identify biomass deficit in the county.
d. Indicate county biomass imports and exports.

The above information could be obtained through the county statistics office, users' survey or stakeholders in the area. The section below discusses the information required to estimate production and potential of fuel wood, agricultural residues, and animal waste, using a general approach.

a. Fuel wood: A map outlining the spatial extent of the various types of ground cover and biomass is required to estimate the production potential of fuel wood.
b. Agriculture residues: The resource assessment requires information on monthly or annual production of agricultural residues locally. The necessary information includes grain production and residue-to-product ratio. The residue-to-product ratio can be estimated through direct measurement in the field during harvesting.
c. Animal waste: Estimates of production potential of animal waste can be based on the population of a particular type of animal and the corresponding animal waste productivity factor per head.

2.2. Assessment of waste resources

The county government to carry out feasibility studies on waste-to-energy potential in the county. This service can be outsourced.

2.3. Assessment of geothermal resources

The MoE will provide a standardized brief on the status of geothermal resource potential and ongoing resource assessments to be adopted by counties. The county government may propose plans and actions to complement and enhance national plans and actions for this assessment.

2.4. Assessment of hydropower resources.

The MoE will provide a standardized brief on the status of hydropower potential and ongoing assessments to be adopted by counties. The county government may propose plans and actions to complement and enhance the national plans and actions for this assessment.

2.5. Assessment of solar resources

The MoE will provide a standardized brief on the status of solar potential and on-going assessments to be adopted by counties. The county government may propose plans and actions to complement and enhance the national plans and actions for this assessment.

2.6. Assessment of wind resources

The MoE will provide a standardized brief on the status of wind resource potential and ongoing resource assessments to be adopted by counties. The county government may propose plans and actions to complement and enhance national plans and actions for this assessment.

2.7. Assessment of fossil fuels

The MoE will provide a standardized brief on the status of fossil fuel potential and ongoing resource assessments to be adopted by counties. The county government may propose plans and actions to complement and enhance national plans and actions for this assessment.

2.8. Assessment of Nuclear programmes.

The MoE will provide a standardized brief on the status of Nuclear programmes. The county government may propose plans and actions to complement and enhance national plans and actions for this assessment.

2.9. Assessment of other energy resources

The MoE will provide a standardized brief on the status of any other energy resources not listed above. The county government may propose plans and actions to complement and enhance national plans and actions for this assessment. The update on the county's energy resource potential and current level of exploitation will be documented as per the table below:

PROSPECTIVE SOURCES				
Sector	**General description**	**Volume/ area**	**Potential energy capacity**	**Location**
Waste				
Cattle manure				
Corn residues				
Rice husks				
Bagasse				
Agricultural waste				
Municipal waste				
Solar				
Solar radiation by area				
Wind				
Wind potential by area				
Hydro power				
Potential for different sites, A, B, C etc.				
Geothermal				
Potential for different sites, A, B, C etc.				
Other Biomass sources				
Nuclear				
Other energy sources				

6.1.9. Chapter Three: Energy Access

Energy access encompasses;

a. All spheres of energy access: households, productive uses, and community facilities, noting the different needs of men and women.
b. All forms of energy access: electricity, cooking, heating and mechanical power.
c. All feasible and appropriate means of energy provision: grid connected, mini-grid and stand-alone systems.

This chapter provides an overview of energy access in the County, this will cover the energy access trends over time, key stakeholders, strategies, goals and barriers to energy access. The chapter shall cover the following:

a. Policies and regulations that relate to energy access.
b. Key stakeholders involved in energy access. This shall include their roles and capacities.
c. Past and current initiatives on energy access.
d. Trends on energy access (electricity, cooking, heating and mechanical).
    i. Energy Access for Households.
        - Lighting
        - Cooking and water heating
        - Space heating
        - Cooling
        - Information and communications
    ii. Energy Access for community services
        - Health care: hospitals, clinics, mortuaries, and health posts;
        - Education: schools, universities, and training centres;
        - Institutions that offer services to the public: government offices, police stations, prisons, community centers, public libraries, orphanages, sports facilities, religious buildings, etc.;
        - Infrastructure services: water and street lighting.
    iii. Productive use of energy
        - Energy and micro and small-scale enterprises (MSEs)
        - Industrial
        - Transport
        - Geothermal direct use

Table 3.1 will provide a summary of the trend of levels and electricity sold commercially, on-grid, off-grid and stand alone.

Table 3.1: Summary of electricity sales

Year	**2008**	**2010**	**2013**	**2015**	**2019**	**2020**
Households (kWh)						
Public Institutions/Facilities (kWh)						
Industrial Customers (kWh)						
Water and street lighting (kWh)						
Total units sold (kWh)						

Household fuels serve the essential energy needs for people's life, particularly cooking and water heating. The quality of supply of household fuels is characterized by different factors, including the type of fuel (firewood, charcoal, LPG, kerosene, biogas, briquettes,

etc.), the appliance used (traditional stove, improved stove, gas stove, ethanol stove, etc.), and delivery system (gathering, purchasing, self-production, etc).

Table 3.2 shows clean cooking fuels progression up-to 2028.

Table 3.2: Energy fuel consumption

Year	2008	2013	2018	2023	2025	2028
LPG (%)						
Biogas (%)						
Bio-ethanol (%)						
Electricity (%)						
Briquettes (%)						
HHs access to clean fuels: non-solids (%)						
Institutions access to clean fuels: non-solids (%)						
SMEs access to clean fuels: non-solids (%)						
Improved cook stoves: Solid fuels (%)						
Total access to modern cooking services (%)						
Access to unclean cooking services (%)						
Geothermal Direct Use (%)						

e. Past and current initiatives on clean cooking solutions.
f. Barriers to increasing access to clean cooking solutions in rural and urban settings.
g. Cross-cutting issues in energy access:
    - Gender issues in energy access,
    - Environment and climate change,
    - Risk and disaster management,
    - Communication,
    - Research and development.
h. Progression to universal access to energy

The planned on-grid connectivity rate together with the off-grid alternatives will enable achievement of 100% access to electricity by the year 2022.

The on-grid and off-grid connectivity progression are shown in Table 3.3:

Table 3.3: Electricity connectivity progression

Year	2020	2021	2022	2023
Total connectivity of the HHs in %				
Total connectivity of the SMEs in %				
Total connectivity of the industries in %				
Total connectivity of the institutions in %				

In regard to electricity access levels, the country will target to have minimum levels of access – a platform to promote affordable, reliable, and sustainable off-grid renewable energy systems in rural areas – to allow for "empowerment" for people in underserved communities with minimum energy targets necessary to improve education, accelerate the transfer of knowledge, facilitate communication, and promote entrepreneurship. The multi-tier framework (MTF) for energy access is as indicated in Annex 4.

a. **Access to modern cooking solutions**

The efforts to provide universal access to modern cooking solutions will include improved cook stoves (ICS) and clean fuels, which refer to the use of non-solid fuels for cooking (electricity, liquid and gaseous fuels). Modern energy inputs for thermal applications include electricity, LPG, biogas, and solar thermal.

Table 3.4. shows clean cooking fuels progression for households up-to 2028.

Table 3.4: Clean cooking fuels sources progression

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028
LPG (%)									
Biogas (%)									
Bio-ethanol (%)									
Electricity (%)									
Briquettes (%)									
HHs access to clean fuels: non-solids (%)									
Institutions access to clean fuels: non-solids (%)									
SMEs access to clean fuels: non-solids (%)									
Improved cook stoves: solid fuels (%)									
Total access to modern cooking services (%)									
Access to unclean cooking services (%)									

b. Development of goals and strategies to promote energy access:
   i. Future energy access outlook
   ii. Alternative scenarios
   iii. Specific objectives of access to energy
   iv. Stakeholder capacity and mandate.
c. Selection of interventions:
   i. List and prioritize potential intervention options
   ii. Specify the selected interventions
   iii. Develop a governance structure for implementation.

6.1.10. Chapter Four: County Energy Efficiency and Conservation Measures Assessment

This section should focus on energy efficiency and conservation measures in the county.

a. Elements of energy efficiency assessment
   i. Development of benchmarking standards for government buildings and transport.
   ii. Identification of energy efficiency gaps and potential solutions.
   iii. Evaluation of costs and benefits of potential solutions.
   iv. Analysis of implementation barriers and constraints.
   v. Recommendations on priority sectors or areas of interventions, investment needs and sequence of actions.

b. Additional important information
    i. Improved cook stoves adoption across the county/sub-county/ ward level.
    ii. Review of awareness levels on energy efficiency at different categories within the county/ sub-county/ward level.
    iii. Energy consumption at household, public and private sectors in the county.
    iv. List of companies compliant with the solar water heating regulations, 2012.
    v. Energy efficient modes of transport.

c. Energy efficiency in households

Counties should look at the following in terms of usability and efficiency:

    i. Improved cook stoves,
    ii. LPG,
    iii. Biogas,
    iv. Lighting bulbs, and
    v. Energy accounting in terms of sales and non-revenue meters by KPLC.

d. Energy efficiency in commercial and institutional buildings

The following statistical data should be provided:

    i. Electricity consumption,
    ii. Appliances and equipment used, and
    iii. Building designs.

e. Energy efficiency in industries

The following statistical data should be provided:

    i. Energy use by type of industry, and
    ii. Number of audited industries.

f. Energy efficiency in transport sector

The following data should be indicated:

    i. Estimated number of vehicles transiting the county,
    ii. Estimated number of vehicles owned by residents and used within the county,
    iii. Proportion of the people using non-motorised transport (NMT),
    iv. Proportion of vehicles inspected per annum (obtained from the motor vehicle inspection agencies).
    v. Number of motorbikes registered in the county (obtained from the licensing office).

Note: Secondary data may be obtained from official statistical publications, including Statistical Abstracts and Economic Surveys, while primary data shall be obtained through surveys, research, focus group discussions etc.

6.1.11. Chapter Five: Bio-Energy

The chapter provides an overview of bio-energy initiatives, the challenges, key stakeholders, future bio-energy outlook, and proposed interventions. The following shall be put into consideration:

a. The ministries or agencies responsible for specific aspects of biomass energy, their mandates, resources, and capacities.
b. Laws and regulations that relate to the production and use of biomass and land tenure. Issues to consider would include: What licenses are required to produce, trade or transport biomass? How effective is their enforcement? Are there provisions to monitor if wood fuel is harvested sustainably and legally?
c. Baseline supply of bio-energy:

i. Bio-energy crops,
ii. Agricultural residues,
iii. Waste,
iv. Forest products.

d. Bio-energy supply costs.
e. Bio-energy trade.
f. Current bio-energy market and demand situation:
    i. Power generation,
    ii. Building sector,
    iii. Manufacturing sector,
    iv. Transport sector.
    v. Households and institutions
g. Analysis of the baseline data.
h. Challenges affecting the bio-energy sector.
i. Cross-cutting issues in bio-energy:
    i. Gender issues
    ii. Environment and climate change,
    iii. Risk and disaster management,
    iv. Communication,
    v. Innovation, Research and development.
j. Development of bio-energy goals and strategies:
    i. Future bio-energy supply and demand situation by sector and counties,
    ii. Challenges in realising the estimated growth in bio-energy demand,
    iii. Challenges in realising the estimated growth in bio-energy supply,
    iv. Alternative scenarios,
    v. Specific objectives of the bio-energy sub-sector,
    vi. Stakeholder capacity and mandate.
k. Future bio-energy costs.
l. Selection of interventions:
    i. List and prioritize potential intervention options,
    ii. Specify the selected interventions,
    iii. Develop a governance structure for implementation.

6.1.12. Chapter Six: Electricity

This chapter includes all the issues in the electricity sub-sector, including current and future demand and supply, key stakeholders, key challenges, and proposed interventions.

a. Key stakeholders involved in electricity. The details shall include their mandates and capacities.
b. Baseline supply and demand situation, preferably by sectors of the economy and trend analysis for the past 10 years.
c. Analysis of the baseline data:
    i. Existing systems/infrastructure,
    ii. Committed expansion programmes/projects.
d. Cross-cutting issues in the electricity sub-sector.
    i. Gender issues,
    ii. Environment and climate change,
    iii. Risk and disaster management,
    iv. Communication,
    v. Innovation, Research and development.
e. Development of electricity goals and strategies:
    i. Electricity

ii. Future supply and demand situation
iii. Alternative scenarios
iv. Specific objectives of the electricity sub-sector
v. Stakeholder capacity and mandate
vi. Stakeholder feedback analysis
vii. Governance structure for implementation.

f. Selection of interventions.
   i. List and prioritize potential intervention options,
   ii. Specify the selected interventions (integrated electricity plan comprising generation expansion plan, transmission expansion plan, distribution plan and retail plan).

6.1.13. Chapter Seven: Programmes and Projects

This chapter will include all the agreed interventions selected to achieve the agreed objectives. Intervention shall be presented in the format attached.

7.1. National Government Projects.
This will include; Power generation; national and regional transmission lines; distribution lines and associated infrastructure; electrification of public institutions and installation of transformers in all constituencies; off-grid electrification of underserved counties; national public street lighting project; alternative energy technologies; and coal, geothermal and nuclear exploration and development.

7.2. County Government Projects.
The county government will identify their projects and programmes

7.3. Non-governmental and Private Sector projects.
The non-governmental organizations and private sector stakeholders will provide information about their projects, to be included in the CEP.

7.4. Development partners.
Development partners will provide information about their projects, to be included in CEP.

7.5. Any other organisations/person(s).

Table 7.1: Summary of Programme/Project Interventions

S/No.	Objective	Project/Programme	Timelines	Specific Activities	Implementing Agency	Project Cost	(Ne
a)	**National Government Projects/Programmes**						
1.							
2.							
b)	**County Government Projects/Programmes**						
3.							
4.							
c)	**Non-governmental and Private Sector Projects/Programmes, etc**						
5.							

6.							

6.1.14. Chapter Eight: Implementation, Coordination, Monitoring and Evaluation

The County Energy Plan should mirror the INEP. Additionally, reference to the Distribution Master Plan is vital. Further, a provision for private sector engagement in energy development should be considered, as well as the roles of project implementers. In documenting selected projects and requirements, training is essential for any new technologies to reduce the risk of ending up with non-viable projects.

8.1. Implementation

Implementation of the energy plan will require legal and institutional frameworks. The county government shall establish a legislative and regulatory framework for the energy sector. Implementation of the plan necessitates a centralised department with an overarching supervisory role to ensure coordination and enactment. The county department responsible for energy shall have the overall supervisory and coordinating role. This section should also define and describe a monitoring mechanism, identified deviations from the plan and achievable systematic deliverables according to the financial budget, quality and time schedule.

8.2. Coordination

Include two levels of coordination: Vertical coordination with the MoE and the national energy service providers; and horizontal coordination at the county level with county departments.

8.3. Monitoring and evaluation

A time schedule showing major activities and those responsible for delivery of the recommended energy projects should be included:

S/n	Programme	Outcome indicators	Baseline		Mid-term Target	End-term Target	Source of Data	Frequency	Responsibility
			Value	Year					

The detailed M&E framework is as indicated in Annex 6 (a) and (b).

6.1.15. Chapter Nine: Conclusions

This section will provide a summary of key issues and recommendations in the CEP

7.2 Annex 2 INEP and EDM CEP Steps

INEP STEP	KITUI CEP PROCESS	EDM STEP	VALUE ADDED
Step 1 & 2: Preliminaries & Establish a County Energy Planning Committee (CEPC)	• MoU among partners • Inter-ministerial Technical Committee • Awareness raising on EDM methodology	**Step 1: Identify Starting Point** **[Step 2: Be inclusive]**	• Establish cross-sectoral focus on energy as enabler from outset • Build stakeholder ownership • Promote ongoing collaboration incl. data provision/creation • Gender mainstreaming
Step 3: Identify & engage stakeholders (maximize value) **Step 4: Formulate a Vision & reassess objectives** **Step 7: Identify & Prioritise Actions**	• Capacity building with officials & wider stakeholders • Data collection at ward level to select for baseline survey, including KIIs (incl. ward administrators) • Baseline survey (socio-econ, energy usage & access levels, infrastructure) • FGDs with youth, women, ethnic groups. • In-depth need assessment: 8 sub-counties (HH & sectors) to identify & prioritize development needs	**Steps 2; Be inclusive** **Step 3: Build understanding**	• Impact focused- starts from perspective of end users on the ground/their wider development needs. • Identifies *specific* development needs of end users. End users & sectors disaggregated (gender mainstreaming) • Starts to identify gaps/barriers, energy & non-energy, to build holistic solution (gender & CC/env mainstreaming) • Inclusive prioritisation process (gender mainstreaming): builds end user/cross sectoral stakeholder buy-in.

INEP	KITUI CEP PROCESS	EDM STEP	VALUE ADDED
Step 6: Develop Energy Goals & Strategies **Step 8: Funding and Financing Strategy** **Step 5: Conduct situational analysis of the county energy profile (current & future use & supply; current projects, plans, policies – national & county)**	• Solutions development including supporting services to ensure financial, environmental & social sustainability: • Archival research (e.g. CIDP & ADPs, KNBS etc), enabling policies & linkages to national plans/programmes. • (Sub) sectoral data collection, creation & analysis • Intensive systems & business modelling • Intensive engagement with line ministries & TC • Stakeholder engagement (eg energy businesses, service providers, finance organisations etc). • RE resource mapping • EE assessment • LCE scenario planning with support from WRI (GSI mapping, socio-economic & demographic data, tiers of access, T1-3 rural, T4 urban)	**Step 4:** **Design & Test**	• Energy & non-energy gaps identified. • Understanding of socio-cultural issues that can be 'make or break' factors (gender mainstreaming). • Disaggregation of end user needs > targeted solutions & quantification of number of end users each solution (component) will benefit (in turn supports aggregation) (gender mainstreaming) • Social, environmental as well as financial costs/benefits & risks & sustainability targeted (gender, CC & env mainstreaming) • Iterative & intensive process (questions end user & stakeholder assumptions), building their buy-in/understanding & helping manage expectations around solutions (gender mainstreaming). • Access to (sub)sectoral knowledge & data/identification of data gaps. • Collaborative design process builds wider problem-solving capacity among officials, including across sectors/agencies,

			& local development partners. • LCE planning for different tiers of electricity access, on & off-grid solutions costed. Promotes informed decision making & vertical collaboration (e.g., KPLC)

INEP STEP	KITUI CEP PROCESS	EDM Step	VALUE ADDED
Step 6: Develop Energy Goals and Strategies **Step 7: Identify & Prioritise Actions** **Step 8: Funding and Financing Strategy** **Step 11: Develop, Adopt, and Publicize the CEP**	• Review & optimise solutions (incl. further gaps & additional supporting services) • Mapping of potential delivery partners/initiatives by sectors • Mapping energy equipment suppliers • Mapping potential co-financiers • Draft CEP & solutions to County Govt for discussion	**Step 5: Optimize & review**	• Designs & tests delivery models, including supporting services, to develop optimal solutions (CC & env mainstreaming) • Verification/optimization of costs. • Quantifies which solution (component)s for which end user groups (gender mainstreaming) • Identify synergies & aggregate solution (components) into investments to attract & pool/blend public and private finance. • Cross-sectoral resource allocation • Soc, env as well as financial risks identified & mitigated (gender, CC & env mainstreaming)

Step 9: Blueprint for Implementation **Step 10: Plan to Evaluate**	• Agreed solutions with list of priority investments by sector & budget allocation/financing • Implementation plan with timelines, delivery unit • Stakeholder outreach plan • M & E plan	**Step 6: Prepare to implement**	• Clear roles & responsibilities for implementation • Solutions costed/funding (gaps) & delivery partners identified • Builds stakeholder/end user buy-in to solution implementation & allows rapid feedback mechanism (gender mainstreaming)