TFE Energy

Digital Planning

Part of the report: **Energy Access, Data and Digital Solutions**

DISCLAIMER

This report is supported by the German Federal Ministry of Economic Affairs and Energy on the basis of a decision of the German Bundestag.

February 2020, Munich, Germany.

Authors from TFE Energy

Tobias Engelmeier
William Duren (lead researcher)
André Troost
Sam Duby
Philippe Raisin

Supported by:

Federal Ministry for Economic Affairs and Energy

On the basis of a decision of the German Bundestag

CONTENTS

THIS DOCUMENT IS PART OF THE REPORT "ENERGY ACCESS, DATA AND DIGITAL SOLUTIONS".

The report shows that the large-scale and often realtime collection, analysis and use of all kinds of datasets, enabled by the rapid, global technology shift called "digitalization," is in the process of transforming the energy access industry. Companies across the energy access spectrum use digital solutions to enable their businesses and as the industry matures, there is a growing number of specialized digital solution providers.

The full report can be downloaded here (link).

DIGITAL PLANNING

KEY POINTS

- Digital planning tools significantly de-risk and accelerate electrification efforts.
- More established tools, such as those for technical system design and least-cost electrification planning, are now complemented by decision-making tools for site selection. The tools have the – as yet untapped – potential to work in an integrated manner, where they build on each other to span from the regional or country perspective to specific village level risks and costs.
- The development of underlying technologies (like satellites), increasingly large and qualitatively good available datasets and machine-learning algorithms push planning tools towards ever more precision and predictive power.

Image provided by Sam Duby, TFE Energy

Digital planning tools can support electrification strategies and operations accelerating them, improve their accuracy and reducing uncertainties and, ultimately, risks. Governments and development finance organizations in the energy access sector already start using digital planning to identify least-cost electrification strategies and develop attractive tenders. Mini-grid developers can find suitable sites more quickly and reliably, and they can create initial system layouts and cost estimates. OGS product companies can identify attractive sales regions, cross-check customer information and better plan distribution channels. Planning tools are rapidly gaining in relevance as the market seeks to scale and many stakeholders are shifting from anecdotal or opportunistic approaches to data-driven and strategic decision-making.

Planning tools are rapidly gaining in relevance as the market seeks to scale.

1 THE DEVELOPMENT OF DIGITAL PLANNING TOOLS

The digital planning tool chain, shown in Figure 14 below, emerged from the mini-grid (and grid-extension) sector, where the significant investments made into stationary infrastructure demand a certain amount of planning. Finding the least cost electrification option, the right site for a mini-grid or designing the most cost-effective system configuration crucially impacts the financial viability of the investment.

Currently, the tool chain is applied intermittently and by different stakeholders. Governments and development finance institutions (DFIs) use more and more least-cost maps for planning electrification, but they are not yet available for every country with low energy access rates at sufficient quality. Site identification tools for tendering support are only beginning to be applied. Similarly, mini-grid developers and OGS companies are not yet making full use of the toolchain. Most established is the use of technical design software for mini-grids. These are either in-house or third-party solutions, such as HOMER. For site identification, most still work manually with Google Earth. Some use more sophisticated geographic information system (GIS) tools (e.g. QGIS[73]) and freely available information layers. The work is almost always done by electrification companies in-house. Advanced site assessment tools, such as Village Data Analytics, are only now available in the market. However, as the OGS and mini-grid markets grow and actors are looking to accelerate project development or sales, or venture into new areas, site assessment tools that offer an analysis of target areas become increasingly important. They help mini-grid companies better locate suitable sites and OGS companies identify prospective customers and formulate optimized sales and supply strategies. One advantage of the OGS market, as compared to the mini-grid market, is that companies often have a large amount of existing customer data (e.g. point-of-sale information) that can be used to validate and strengthen GIS-based analyses.

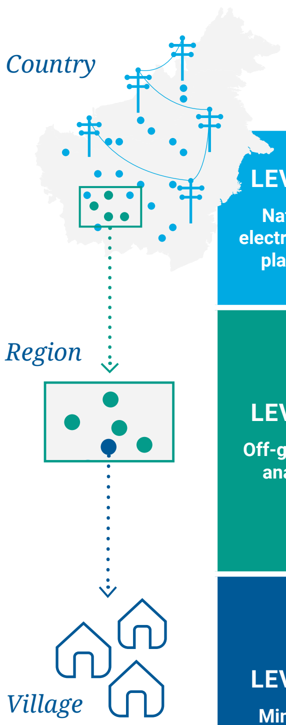
—

Photo by Văn Ngọc Tăng on Unsplash

73 – QGIS is an open-source GIS software (link)

Figure 14 – The digital planning tool chain[74]

The digital planning toolchain helps electrification planners identify the most cost-effective approach, locate suitable areas and settlements for business and estimate system cost.



	Users	Solution	Output	Input	Tools	Providers	Age
LEVEL 1 National electrification planning	DFIs/governments	Policy planning tool	Online map and report of a country or region, outlining areas for grid extension and off-grid electrification, based on cost of power provided	Public information on, e.g. population, power grid, electrification policy and goals, topography, designated infrastructure (e.g. schools)	• GIS software • Least-cost models	• Research institutes (KTH, MIT, Columbia) • Energy/GIS consultants	Ca. 10 years
LEVEL 2 Off-grid area analysis	• OGS companies • Mini-grid developers • DFIs /governments	Decision-making tool	Interactive map and report identifying and ranking suitable mini-grid sites or OGS sales regions, based on estimated demand and ability to pay	• Satellite data on, e.g., settlements, grid/road infrastructure, agriculture • Survey data on, e.g. asset ownership, type of agriculture • Public information (as for national maps)	• Automated image recognition • Advanced data analytics • Energy modelling	Energy access/tech specialists (TFE Energy /Village Data Analytics, Fraym, AtlasAI)	Ca. 2 years
LEVEL 3 Mini-grid design	Mini-grid developers	Technical design tool	Preliminary mini-grid system design and bill of materials (BoM), based on load estimates, grid layout, system costing and (in future) on digital village layout	• Local information on, e.g. number/type of loads, energy resources • User inputs on, e.g. system type/size, component costs • In future: Very high resolution satellite or drone images	• Design software • In future: automated image recognition	• Energy access/tech specialists (Homer, VIA, Taos.ai, MIT) • In-house solutions	Ca. 20 years

74 – TFE Energy analysis

2 NATIONAL ELECTRIFICATION PLANNING

Geospatial, least cost electrification planning was pioneered by a group of universities, including the KTH Institute of Technology in Sweden, the Massachusetts Institute of Technology (MIT) and Columbia University, both in the USA. Today, DFIs and governments routinely tender such studies to provide a planning framework for national electrification efforts.

The analyses typically encompass a high-level comparison of the relative benefits of central grid expansion, construction of mini-grids and the provision of OGS solutions. Many of the methodologies are open source as part of academic publications. The most widely used open source tool is the OnSSET model developed by KTH.[75] Other players, such as the Reiner Lemoine Institute (RLI)[76] or the World Resources Institute (WRI),[77] apply these or similar methodologies. The platform Energydata.info, initiated by the World Bank Group, collects and presents a number of these maps.[78] In September 2019, the Global Electrification Platform was launched by a number of partners, including the World Bank and Google. It hosts different datasets related to electrification for around 40 countries.[79]

Image provided by Sam Duby, TFE Energy

2.1 DATA COLLECTION

Least cost mapping typically takes into account information layers from two domains:

- **Physical factors:** e.g. solar irradiance, topography (elevations, islands), water surfaces
- **Demography and infrastructure:** e.g. population maps, grid extension and reliability, road networks, schools, medical centers

The number and types of information layers depend on the model used and, on the availability and quality of country-specific data. Typically, datasets are collected from local government offices. These are then cleaned and quality-checked before being fed into the model. In addition, datasets and maps from satellite imagery are increasingly available in the public domain. These can be used to complement and cross-check the other datasets. A third dataset is open source information from e.g. the Humanitarian Open Street Map (HOT) or Humanitarian Data Exchange (HDX).[80]

2.2 MODELING

By combining the geospatial layers collected in the first step, a LCOE is calculated for different regions on a map and for different electrification technology choices.[81] These include grid extension and various mini-grid gener-

75 – OnSSET, GIS based electrification platform developed at KTH (link)
76 – Nigeria Rural Electrification Plans platform, created by Integration and Reiner Lemoine Institute (link)
77 – Energy Access Explorer, with data for Uganda, Kenya and Tanzania, created by World Resource Institute (link); The World Resource Institute in turn supports KTH in their ongoing development of the OnSSET tool.
78 – Energydata.info, open access collection of renewable energy related platforms and tools (link)
79 – Global Electrification platform (link)
80 – Humanitarian Open Street Map (link); Humanitarian Data Exchange (link)
81 – The levelized cost of energy refers the average cost per kWh produced over the lifetime of a system, thus making high CAPEX / low OPEX technologies like solar more comparable with low CAPEX / high OPEX technologies like diesel generators.

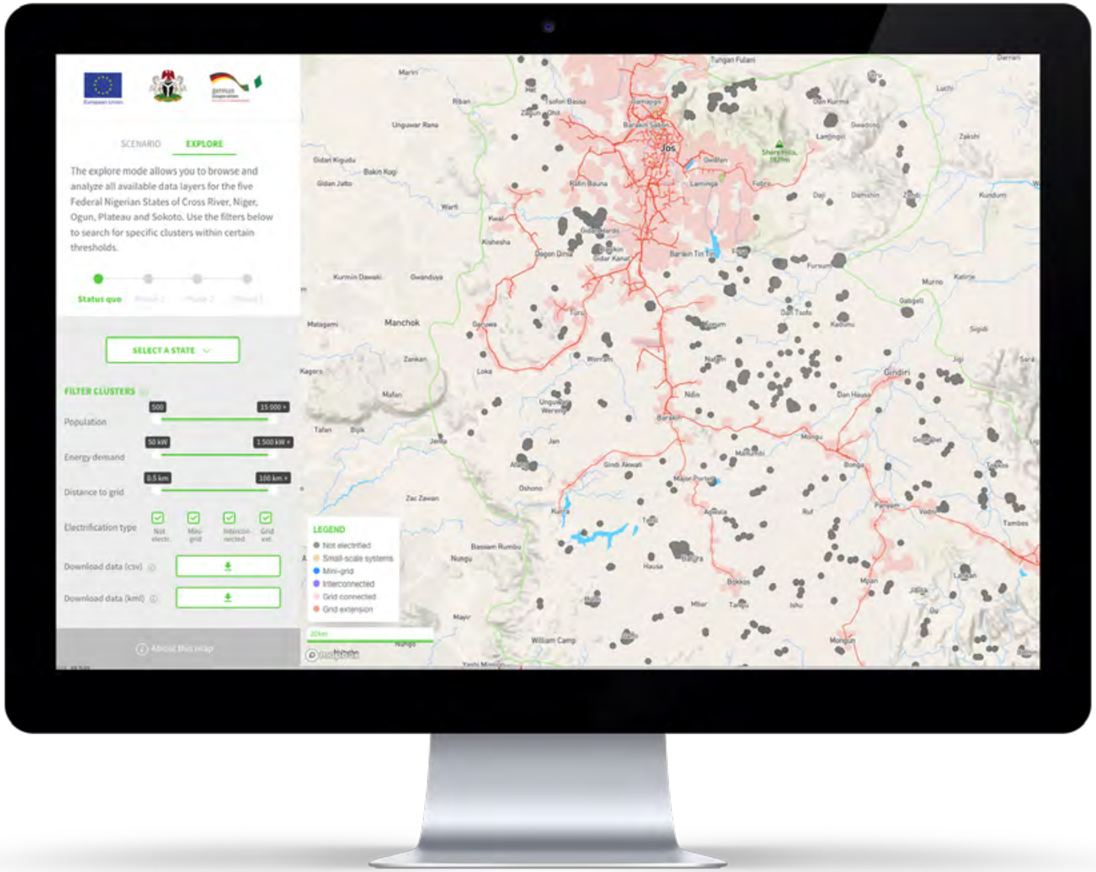
ation technologies, such as small-hydro, solar or biomass, as well as OGS products. Simpler models are based on broad assumptions around population, distance to grid and topography. More advanced models use an algorithm that iterates through scenarios and picks the one with the lowest overall LCOE. Parameters can be set regarding estimated population growth, energy demand (and growth) and political priorities. The costs and benefits of investment options can be calibrated.

2.3 ACTIONABLE INSIGHTS

The output of these least-cost electrification maps is a rough area plan, primarily used by governments to inform their grid extension and rural electrification strategies. The maps indicate which regions should be electrified by extending the grid, which should be served by mini-grids and which are markets for OGS. Mini-grid developers and OGS companies can use these maps to identify regions for potential business activity that merit further investigation. Typically, these maps are not granular enough to provide actionable business intelligence.

—

Figure 15 – Example least-cost electrification map (Nigeria)[82]



Rural electrification scenarios and least-cost maps help estimate potential demand and best supply options for energy access.

82 – Image taken from the Nigeria Rural Electrification Plans platform, created by Integration and Reiner Lemoine Institute (link)

3 OFF-GRID AREA ANALYSIS

A key challenge in the off-grid sector is the lack of timely, available, actionable information about markets. This often means that business decisions are based on reacting to opportunities, on anecdotal insights in a region or on expensive, time-consuming and often inaccurate customer surveys. As a result, business development timelines are long and unreliable, and decisions are inaccurate, driving up costs, uncertainty and, ultimately, the risk associated with working in conditions of uncertainty.

» There seem to be two camps in terms of demand prediction. One camp says that we will collect a lot of detailed data on our customers and apply sophisticated quantitative models. Another camp says that it is hopeless and there is no way you can predict people's demand so let's have modular systems and install minimum capacity when we get there, observe what the demand is, control people's consumption and then we can scale up from there. «

NATHAN WILLIAMS, CMU[87]

New digital planning tools address this market challenge. They usually combine several data layers. In some cases, advanced machine learning tools are applied to give more depth, texture and precision to the information maps. Site identification tools are gaining momentum as the electrification market matures. They empower governments to run much better large-scale mini-grid tender processes, help growing mini-grid developers identify suitable new sites quickly and at scale, and enable OGS companies to scale faster and reduce customer repayment risk.

© Contains modified Copernicus Sentinel data, processed by ESA

3.1 DATA COLLECTION

An important data-stream for initial site identification and analysis is satellite imagery or earth observation (EO) data. Satellite imagery is becoming more widely available through both publicly funded satellites from the European Space Agency (ESA) and the US National Aeronautics and Space Administration (NASA), as well as a growing number of satellite constellations operated by private companies, such as Planet Labs or DigitalGlobe.[83] At the same time, the cloud-based computing and data storage services required for work with large amounts of image data, have become more affordable, accessible and faster. Various teams – both academic and from the private sector – have published freely available datasets derived from satellite imagery. Facebook has recently released a population map of most of Africa as well as an electricity grid network map, based on nightlight imagery.[84] We expect more of these satellite-derived products to be published in the future.

Large-scale household surveys, in many cases publicly available, are another important data source. The two most widely used ones are the Living Standards Measurement Study (LSMS) from the World Bank and the Demographic and Health Surveys (DHS) from USAID.[85] These extensive datasets provide socio-economic information on factors including primary income sources or quantity and type of agricultural produce. However, the datasets are "geo-shaked", i.e. the geolocations of the households have a random offset in order to ensure anonymity. Some companies have a slightly different approach and value proposition. Nithio, for instance, combines socio-economic layers with point-of-sale data to predict the creditworthiness of OGS customers.[86]

83 – ESA, Copernicus fleet providing free imagery of the planet (link); NASA, Landsat mission overview (link); Planet, commercial provider of satellite imagery (link); DigitalGlobe/Maxar, commercial provider of satellite imagery (link)
84 – Facebook, Data for Good program repository on The Humanitarian Data Exchange (link); NASA, VIIRS satellite providing nightlight imagery (link)
85 – USAID, Demographic and health surveys (DHS) (link); World Bank Group, Living standards measurement studies (link)
86 – Nithio, rural customer credit intelligence (link); Fraym, geospatial market intelligence (link)
87 – TFE Energy, market expert interview, Nathan Williams, Carnegie-Mellon University (CMU)

The survey process itself, is becoming digitally enabled, too, which improves the data quality. Site identification tools based on granular village analysis, such as Village Data Analytics, allow a user to create shortlists of relevant survey locations and contextual information about them. For dedicated on-ground household surveys, smartphone based survey tools are replacing the traditional pen-and-paper approach. This has many advantages, including increasing the speed of data entry, making surveys dynamic (e.g. answers can change follow-up questions), automatically linking to GPS coordinates, real-time outlier detection and reduced error rates at the point of data entry.

The most widely used example of smart phone-based surveys is the open-source Open Data Kit (ODK), from which various tools, such as KoBoToolbox have been developed.[88] The tools allow users to generate and run survey campaigns. Once gathered by on-site enumerators, data is automatically sent to a central server. The apps were initially developed for quick disaster response, e.g. in refugee camps. Challenges to using electronic surveys include acceptance by local staff and survey participants, as well as technical challenges, such as the need to recharge devices in the field. One innovative way of addressing these survey challenges is offered by the German startup Groots. It has developed a technology-enabled process, by which village data is collected through local mom-and-pop-shops in an ongoing manner, and where questions can be adjusted over time.[89]

» Village Data Analytics helps donors, governments, companies and investors make data-driven electrification decisions based on their customized set of criteria.«

NABIN RAJ GAIHRE,

Village Data Analytics

Further interesting datasets are mobile coverage information, GPS data from mobile subscribers, data from machines located in villages, such as water pumps, food processing machines or diesel generator sets.[91]

3.2 MODELLING

Site identification planning tools ingest satellite imagery, freely available geospatial layers as well as socio-economic data streams to estimate the most promising sites for mini-grids or areas for OGS sales. Physical factors (populations, distances, terrain) are combined with socio-economic factors (economic activity, willingness and ability to pay for electricity, potential energy demand). Algorithms can help overcome data gaps and automate analyses. The parameters are then fed into specific energy access models to compare and rank regions or sites and provide decision-making guidance. The more data is available, the more accurate statistical forecasts can be, and the less on-ground surveys are needed.

After acquiring household survey data on shortlisted villages, a village energy demand profile is calculated. Here, the survey data and predictive data from the site selection tool are cross-checking each other. Often, the distinction between residential and productive use of power is useful. Different customer groups are defined, and their demands are specified.

3.3 ACTIONABLE INSIGHTS

Site identification based on remote analysis (i.e. via socio-economic survey data and satellite imagery) provides mini-grid developers with a shortlist of ranked settlements and OGS companies with interesting sales

» Detailed energy consumption and socioeconomic data are often scarce in remote or low-income areas. Today, the expansion of information and communication technologies (like satellite imagery, mobile phones, and mobile payment systems), has made available an increasing amount of interrelated data that can be integrated in energy planning models «

ESMAP
ENERGY ANALYTICS FOR DEVELOPMENT:
Big Data for Energy Access, Energy Efficiency, and Renewable Energy[90]

88 – Open Data Kit, toolkit for digital field surveys (link); KoboToolbox, an ODK-based digital field survey software suite (link)
89 – Groots (link)
90 – ESMAP, Energy Analytics for Development: Big data for Energy Access, Energy Efficiency, and Renewable Energy, 2017 (link)
91 – The Access 2 Energy Institute has started integrating smart meters in diesel pumps in Nigeria to measure current electricity demand and understand the market potential for alternative solar plus storage options (link).

regions. Additional data layers can include statistics about, for example, the total area, number of villages, road network and accessibility. Governments and DFIs can have a shortlist of sites to plan grid extension or to feed into tender process for large-scale mini-grid development. Investors can use the analysis to support due-diligence processes and to measure impact.

—

4 MINI-GRID DESIGN SOFTWARE

For mini-grids, a design software can create initial technical layouts once a suitable village has been identified. Design software has been among the first digital tools to emerge in the energy access market and is widely used today. The best-known one is from HOMER Energy.[93] It was initially developed by the US National Renewable Energy Laboratory (NREL) under the Village Power program in the 1990s. There are now more than 2,000 active users and a total of 2.7 million HOMER files have been created over the last 5 years.[94] These files offer initial cost and generation estimates. Later in the mini-grid planning process and with more on-ground data, a final layout is created manually and optimized.

Advances in processing power and architectures, such as parallel computing, have made design software ever more sophisticated and faster.

4.1 DATA COLLECTION

Energy system design software requires data about sites and consumers, i.e. potential consumption, customer groups, productive loads, number and location of households. This information might have already been gathered during the site selection process (site identification tools, socio-economic modelling, identification of productive loads) and can be reinforced by additional, specific on-site surveys. These can also reveal constraints on the location of the generation asset as well as the distribution grid. Building footprints can be extracted from satellite or drone imagery, either manually or aided by machine learning algorithms.

Another source of information for building footprints and type is the Humanitarian OpenStreetMap project, which has digitally mapped large areas in East Africa and beyond.[95] In addition, companies such as Development Maps offer a digitalization service of households based

Figure 16 – Site selection using Village Data Analytics for a mini-grid developer in Nigeria[92]

Site selection based on data analytics and satellite imagery can create a ranked shortlist of promising villages within an area of interest and reduce the number of on-ground surveys needed.

92 – Image provided by TFE Energy / Village Data Analytics
93 – HOMER Energy Platform (link)
94 – TFE Energy, case study interviews, HOMER Energy
95 – Humanitarian OpenStreetMap, crowdsourced mapping for development (link)

on Google Earth imagery.[96] Taos.ai, an Engie spin-off, used drone imagery of rural villages to generate mini-grid distribution layouts.[97]

Cost relevant information, such as equipment choices and datasheets, as well as prices have to be gathered from vendors.

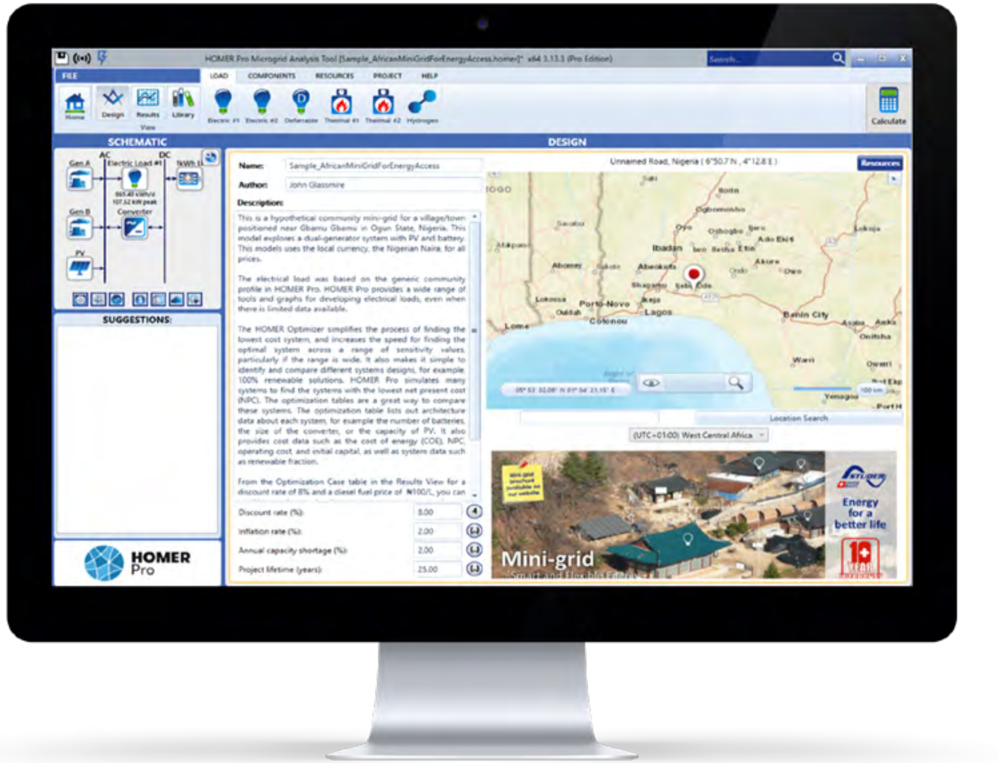
4.2 MODELLING

The design of a mini-grid power system is very sensitive not just to the total consumption and peak load, but also to the daily and seasonal load profile. For this reason, software packages like HOMER PRO use a yearly load profile. In case the data is not available, assumptions based on prior customer profiles and existing databases are used to create the load profile.

The user then selects a set of generation and storage assets (diesel gensets, PV, wind, batteries, converters, loads) for the software to consider. For PV and wind, irradiance and wind speed information can be added from public repositories. It is important for the user to stipulate the variability of parameters, such as wind speeds over the year, fuel prices, customer demand or maintenance down-time. The software then goes on to simulate all possible system layouts for these scenarios and calculates financial indicators (e.g. upfront CAPEX, revenue, LCOE, excess energy generated, payback times, performance when compared to a pure diesel mini-grid). A set of filters and additional, user-defined constraints helps to identify the optimal mini-grid layout.[98]

Figure 17 – Example mini-grid design software user interface[99]

Mini-grid design software, such as Homer Pro generates optimized layouts for a given demand profile. The process is typically automated and compares many different designs.



Homer is the most mature design software. It allows for simulations and optimization of mini-grid layouts, as well as sensitivity analyses for the user to learn how external factors (e.g. fuel cost) impact the financial performance of the mini-grid. Homer has an API to integrate with other software (e.g. Odyssey Energy Solutions), as well as add-on modules for different generation technologies.

96 – Development Maps, on-demand mapping of settlements for development (link)
97 – Taos.ai, self-learning tool for optimal mini-grid design (link); the company may no longer be operational
98 – TFE Energy, case study interviews, HOMER Energy
99 – Image provided by HOMER Energy

Another key cost driver of the mini-grid is the length of low-voltage distribution lines required to connect the households. Given the digitized locations of the buildings, there are algorithms, such as the minimum spanning tree, to draw the shortest grid network which connects the targeted number of households. While on-ground constraints might significantly change the final design, automatically generated grid layouts provide valuable cost estimates during a feasibility study.[100]

4.3 ACTIONABLE INSIGHTS

The design software described in this section structures a feasibility study of a mini-grid. It includes optimal layout of generation and distribution assets for a specific site given a user-defined list of parameters, hardware specifications and demand estimates collected during surveys. The output includes yearly system performance estimates, key financial indicators (e.g. CAPEX, LCOE) as well as the overall financial viability of a mini-grid. The optimized design as well as distribution layout are key elements of the business plan and investor discussions. In addition, the refined design can be handed over to an engineering, procurement and construction (EPC) company to create engineering drawings and plan the logistics for the construction.

—

Image provided by Nabin Raj Gahire, Village Data Analytics

100 – See, for example, Village Infrastructure Angels (link)

5 HOW DIGITAL PLANNING ADDRESSES THE MAIN CHALLENGES OF ENERGY ACCESS

As a whole, digital planning accelerates the growth trajectory of the electrification industry. It is a key driver helping the industry reach global targets (SDG7) and become profitable through scale. Digital planning solutions also reduce the error margin in planning and business development for mini-grid developers and OGS companies.

5.1 IMPACT ON SCALE

The data void in off-grid communities and the difficulty of estimating energy demand and customers' ability to pay have led to an anecdotal and slow approach to selecting sites and sales regions, making the scaling of energy access solutions challenging. The emerging digital planning toolchain addresses this challenge.

Least cost electrification planning provides a crucial framework to help utilities, mini-grid and OGS companies identify focus regions. Site assessment tools allow both governments and companies to move quickly from a region to a shortlist of viable villages, and technical design software enables fast cost estimates.

5.2 IMPACT ON COST

According to a recent World Bank report, least cost electrification maps and site identification tools have decreased the cost of pre-selecting a mini-grid site, ready for detailed on-ground assessment and community engagement, from $30,000 to about $2,300.[101] Cost reductions will be most visible for companies who work on large numbers of sites or sales regions and take a strategic approach. Digitized building footprints and connection cost estimates reduce the amount of in-house engineering man-hours. It is currently difficult to quantify the reduction in financing costs derived from data-based investment decisions and operational risk reductions.

5.3 IMPACT ON RISK

Digital planning tools significantly reduce uncertainty for electrification policymakers and businesses by introducing new and independent information layers to the analysis that allow them to quantify risks and make data-based decisions. The analyses can be continually improved upon as they are deployed, and they can be cross-referenced with existing site identification approaches to improve the accuracy of both. The tools can also help monitor impact and support due diligences in an emerging secondary market. Finally, the toolchain offers the opportunity to establish best practices and more transparency in the sector, which decreases the overall, actual and perceived industry risk.

—

» To reduce mini-grid cost, don't look to panels and batteries, that's going to be cheap. Look to distribution, maintenance and payment collection.«

AFNAN HANNAN,
Okra Solar[102]

Image provided by Sam Duby, TFE Energy

101 – ESMAP, Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers, 2019 (link)
102 – TFE Energy, Market expert interview, Afnan Hannan, Okra Solar

6 CHALLENGES TO DEPLOYMENT

Least-cost electrification tools are typically financed by DFIs such as the World Bank and deployed by governments and state-owned utilities. The quality of their results is strongly linked to the availability and quality of information. One particular challenge is to detect the electricity grid. Part of the solution can be ground-truthing the analysis. An example of this is the work of the GIZ team in Nigeria to map the grid infrastructure through photography and geotagging from cars.

Technical design software, on the other end of the spectrum, is bought by mini-grid companies. The challenge there is mainly the cost. The off-grid energy access market is still maturing and has slim margins and thus reduced acceptance of external, commercial software tools that do not reduce current investment or operational costs.[103] Sometimes technical assistance grants step in. In other cases, the technical design is still regarded as a core-competency of developers and therefore developed in-house.

Off-grid area analytical tools can be used by the public sector (DFIs and governments) and by companies (mini-grid and OGS companies, investors and banks). The challenge with the former group is that it takes time to implement innovation into established procurement processes and program designs.

Overall, companies who develop digital planning tools, often struggle to find a pricing model that can cater to the market but still provide reasonable returns. They are fundamentally built for a scale that the market is only beginning to grow towards. The most important push for their more widespread use could come from investors and banks, looking for ways to reduce risks and transaction costs through improved due diligences and more standardized processes.

—

7 LOOKING AHEAD

Least-cost electrification plans at the country level are applied to more and more countries. In the process, they will improve in granularity and precision. This can partially be achieved by integrating them with site identification tools. As distributed energy solutions, especially mini-grids, become more prevalent, the models might need to be readjusted to reflect their growing commercial attractiveness. Technical design software is quite established. In the future, it can also integrate more fully with other digital planning solutions. The most dynamic developments can be seen in site identification, where actual decision-making tools, such as Village Data Analytics, have emerged. By adding new data layers and more sophisticated data analytics, they have the potential to become central platforms for planning, customer acquisition and impact measurement. Site identification tools can, in the future, also be integrated with the digital operations tools discussed in the next chapter.

Actual decision-making tools for site identification have emerged.

103 – TFE Energy, Market expert interview, Nikhil Jaisinghani, formerly Mera Gao Power

In addition, digital planning tools can expand their analytical breadth to increasingly take into consideration agricultural value chains and opportunities for productive use of energy[104] that can shift value chains towards village economies. This would be closely linked to questions of water resource availability and the effects of agriculture and climate change on them. In addition, digital planning for electrification could be more systematically integrated with mobile network and internet connectivity planning.

The underlying technologies and datasets that empower decision-making tools are developing rapidly (see Appendix for details). For example, satellites are capturing ever more images and the images capture a wider information spectrum. There is a growing number of satellite operators, both public and private. An increasing number of companies provide platforms for easier access and processing of satellite imagery, such as IBM, Google, Planet, Descartes Labs, Astraea.EarthAI or Up42.[105] In addition, processing power is no longer a major limiting factor and there is continued growth in the number of potent algorithms. Growing datasets mean that machine learning algorithms can be better trained and tested, leading to better predictions. Publicly available datasets on population and grid extension published by Facebook have set an example for how institutions can provide stakeholders with high-quality data.[106]

—

FURTHER READING

CGAP's report, ***Using satellite data in financial inclusion: How financial services providers can use satellite data and advanced analytics techniques to reach remote customers***, 2019, (link), provides an overview of currently available satellite imagery and key characteristics, such as temporal and spatial resolution. It also offers an introduction to machine-learning-based analysis and suggestions on how insights on remote customers can be generated.

A USAID-NREL Partnership report, by Nathan Williams et al., ***Survey use in micro-grid load prediction, project development, and operations: Review and Best Practices***, 2019, (link), describes the current site selection and survey practices of some well-known mini-grid developers in Africa. It shows how mini-grid developers approach the difficult task of collecting quality data in rural villages, survey strategies, types of questions asked and their stance on digital survey tools.

Image provided by Sam Duby, TFE Energy

104 – An interesting recent case study on productive uses of energy was published by CrossBoundary (link)
105 – IBM, Pairs platform for geospatial analysis (link); Google, Google Earth Engine for earth science data and analysis (link); Planet, Platform for automated & scalable access to Planet imagery (link); Descartes Labs, Cleaned and analysis ready catalog of earth observation data (link); Astraea.EarthAI, AI platform for big geospatial data (link); Up42 (Airbus), open platform and marketplace for Earth data and analytics (link)
106 – Facebook, Data for Good program repository on The Humanitarian Data Exchange (link)

The chapter “Creating the environment for take-off of mini-grid portfolios” in the World Bank Energy Sector Management Assistance Program’s (ESMAP) report, ***Mini-grids for half a billion people: Market outlook and handbook for decision makers***, 2019, (link), provides an overview of current geospatial tools for site identification.

The Joint Research Center of the European Commission has, in 2018, published an analysis of then available least-cost electrification tools, called ***Next generation interactive tools as a backbone for universal access to energy*** (link). Slightly older, from 2017, is a comparison of these tools from Oxfam called ***Achieving Universal Energy Access at the Lowest Cost*** (link).

—

Image provided by PowerGen Renewable Energy

ABOUT TFE ENERGY

TFE is dedicated to achieving universal energy access and to improving investments into remote infrastructure. Our team consists of data technology experts on the one side and village electrification experts on the other. This breadth allows us to continuously test and validate new data technologies in the field and work towards specific solutions – such as Village Data Analytics – that create tangible value to the electrification ecosystem. We are always looking for passionate, talented people to join our teams in Munich/Germany and Cape Town/South Africa (for open positions see here).

CONTACT US

10 Franz-Joseph Str.
Munich 80801
Germany

contact@tfe.energy
www.tfe.energy

PUBLISHER

TFE Energy GmbH
10 Franz-Joseph Str.
Munich 80801
Germany

DESIGN

Concept & layout:
www.simpelplus.de

Cover design
Alessandro Burato