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Tools for mini-grid practitioners

General tools for rural electrification planning and mapping	
Name	*Description*
Bing Maps	Bing Maps is a web mapping service provided as a part of Microsoft's Bing suite of search engines and powered by the Bing Maps for Enterprise framework. The tool allows overlays of satellite imagery onto maps and highlights roads and major landmarks for easy identification amongst the satellite images. The tool can be used for preliminary network planning for mini-grids.
Google Maps	Google Maps is a desktop web mapping service which offers satellite imagery, street maps, 360° panoramic views of streets and route planning. The tool can be used for preliminary network planning for mini-grids.
GeoSim	GEOSIM is a tool dedicated to decision support for planning rural electrification aimed at decision-makers and planners. It aims at preparing rural electrification scenarios including grid extension projects, decentralized energy projects (hydro, biomass and PV/ Wind hybrid mini grids) and other distributed energy projects.

[Network Planner] 	Network Planner is an online tool for planning grid, mini-grid and off-grid electricity from community to national scale. Network planner is a decision support tool for exploring electrification options in rural communities. It has been used to compare the long-term costs of installing solar, diesel or grid distribution networks and perform sensitivity analyses on variables such as demand growth for electrification plans in Kenya, Senegal and Ghana.
[LAP] 	LAP is a software tool for technical and economical evaluation of Low Voltage electrification projects. After calculating the electrical behavior of the LV network (currents, voltages, losses, etc.), LAP generates the bill of materials of necessary investments. Considering on the one hand the costs of such investments and for network operation, and on the other hand the revenues from the consumers, LAP presents an optimized economic balance sheet of the project. Results obtained for several sites (villages) can be aggregated to obtain an overall balance sheet at regional level.
[developmentmaps.org] 	Development maps provides detailed information on household location and can be used for finalizing and optimizing the site selection, distance measurement, rural electrification planning, mini-grid design and grid extensions.
[SWARM Software] 	The SWARM software analyses satellite data and automatically identifies suitable sites for mini-grids through density of built environment. The SWARM software remotely analyzes sites based on financial, technical, and geospatial data and can provide detailed site analyses that are ranked based on profit potential. The software also helps streamline the process of ground-truthing and customer acquisition.

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Tools for resource assessment	
Name	*Description*
Solar and Wind Resource Maps	The Solar and Wind Energy Resource Assessment (SWERA) initiative brings together solar and wind energy resource data sets and analysis tools from a number of international organizations in a dynamic user-oriented environment. The information and data provided on the site are freely available to the public and intended to support the work of policy makers, project planners, research analysts and investors.
IRENA Global Atlas for Renewable Energy	The Global Atlas for Renewable Energy is an initiative coordinated by IRENA, aimed at closing the gap between nations having access to the necessary datasets, expertise and financial support to evaluate their national renewable energy potential, and those countries lacking such elements. The Global Atlas facilitates a first screening of areas of opportunity where further assessments can be of particular relevance. Currently, the initiative includes maps on solar, wind, geothermal and bioenergy resources along with one marine energy map. The initiative will eventually encompass all renewable energy resources, providing global coverage through the first-ever Global Atlas for Renewable Energy.
PVGIS	PVGIS is a data platform hosted by the EU Joint Research Commission. PVGIS offers data on solar irradiation for Europe, Africa and Asia. Geographic information on monthly or daily global irradiation data can be presented on a google-based map. A quick PV yield estimation can also be calculated, both on- and off-grid.

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Tools for technical system design and analysis

Name	Description
SMA Off-grid Calculator	The SMA Off-Grid Configurator provides a professional and customized solution for the simulation and dimensioning of off-grid systems. Every design aspect is mapped out, from dimensioning the PV plant, the battery and the inverter to calculating profitability and calculating the battery life. -
SMA Sunny Design Off-Grid	SMA Sunny Design Off-grid is an online tool which provides support in the design of off-grid applications. The tool features an off-grid specific workflow which shows compatibility of components as well as the degree of fulfillment of the project developer's requirements. The tool is designed to work well with off-grid Multicluster systems with homogenous battery layout. It enables the visualization of the distribution network as well as the degree of solar autonomy on a monthly basis.
HOMER	HOMER Pro is the global standard for optimizing microgrid design in all sectors, from village power and island utilities to grid-connected campuses and military bases. HOMER (Hybrid Optimization Model for Multiple Energy Resources) nests three powerful tools in one product, so that engineering and economics work side by side: 1) Simulation, 2) Optimization, 3) Sensitivity analysis.

[Demand Analyst](#) 	Demand Analyst® is a tool for planning rural electrification. It allows to estimate the evolution of the electricity demand in each locality of the study throughout the planning period to optimize the equipment necessary for the electrification of a village or group of villages area. Unlike traditional approaches "top-down" of the demand forecasting, Demand Analyst® is based on a detailed analysis of the demand for each end user (different classes of households, public services, shops etc.), established from socio-economic surveys.
[ASIM](#) 	Power and Water has developed a comprehensive model about Solar/Diesel power generation in remote communities. ASIM is a flexible open-source modelling tool that has been developed to simulate solar/diesel power system operation and conduct analysis of its technical and financial performance. The Handbook for the tool has been developed to provide information about key technical, design, implementation and operational considerations for solar/diesel hybrid mini-grid systems in remote Australia, with a particular focus on the NT context.
[Mini-grid Builder](#) 	Mini-grid Builder is a publicly available tool, that allows interested parties to enter data from site surveys into a database and perform calculations on the energy demand, and thus the required generation capacity. Further the tool includes financial aspects that allow to come up with an initial project budget, that allows decisions towards the next steps. All data on each project is stored in a secure database, that allows future review and changes to any project entered.
[Paladin DesignBase](#) 	Paladin® DesignBase™ is a comprehensive power systems simulation platform for modelling, analysing and optimizing power system performance. The solution can be re-deployed for model-validated analysis in live environments using Paladin® Live™. The model includes a 800-component library with more than 100,000 device-specific manufacturers' specifications, a comprehensive range of integrated analysis modules, easy-to-navigate CAD-like user interface, allowing unprecedented ease of use, as well as personal and team-based productivity features and data management tools.

DAPPER SKM Power*Tools ELECTRICAL ENGINEERING SOFTWARE	DAPPER (Distribution Analysis for Power Planning Evaluation and Reporting) is an integrated set of modules for Three-Phase Power System Design and Analysis including rigorous load flow and voltage drop calculations, impact motor starting, traditional fault analysis, demand and design load analysis, feeder, raceway and transformer sizing, and panel, MCC, and switchboard schedule specification.
DC System Analysis Module SKM Power*Tools ELECTRICAL ENGINEERING SOFTWARE	The DC System Analysis includes Battery Sizing, DC Load Flow, DC Short Circuit (ANSI), and DC Short Circuit (IEC). The module complies with various industry standards and includes both a DC equipment library as well as DC component types.
ETAP etap Powering Success	ETAP is a fully integrated AC and DC electrical power system analysis tool. Engineers use ETAP in thousands of companies and electric utilities worldwide in the design, analysis, maintenance, and operation of electrical power systems. The AC network includes the ETAP modules on arc flash analysis, load flow analysis, motor start analysis, cable analysis, etc. The DC network utilizes the same database as AC modules. DC Load Flow and DC Short Circuit provide analysis capabilities for engineers to design and maintain DC power systems. Battery Discharge and Sizing Analysis is used to select the most appropriate battery banks, verify the maximum capability of existing batteries, and easily simulate a wide range of backup, control, and other DC scenarios.
RLI Energy System Model RLI REINER LEMOINE INSTITUT	Based on the GIS analyses RLI's Energy System Modelling allows the detailed simulation of energy systems. The in-house-developed simulation tools in Matlab and Python model power flows and optimise system configurations including system operation strategies. The individual set up of components and loads allows in depths technology comparisons. Energy systems can be optimised according to the desired outputs such as lowest generation costs, highest renewable energy share or lowest carbon dioxide emissions.

PV Syst	PVSyst is a software that calculates energy yields for a given site taking into account solar irradiation and temperature through its meteo database. The effect of shading can be included. Engineering factors such as determining the number of modules per string, identifying the appropriate inverter etc. can be derived. Output is presented in graphs and tables, data can be exported.

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Tools for financial planning / business model development

Name	Description
SME Toolkit	The SME Toolkit was developed to lead small and medium businesses worldwide towards more sustainable practices and enable them to access finance and new markets by providing comprehensive business management solutions. The Toolkit currently provides over 5,000 free business forms, tools, and how-to-articles, as well as a global business directory, multilingual community forums, and a host of other interactive features.
Business model canvas	The business model generator tool allows to captures an entire business model in one place. It helps invent new models and improve old ones. The tool allows entrepreneurs to sketch out, and test the viability of their business model quickly.
RETScreen	RETScreen is a Clean Energy Management Software system for energy efficiency, renewable energy and cogeneration project feasibility analysis as well as ongoing energy performance analysis.
NREL Crest	The Cost of Renewable Energy Spreadsheet Tool (CREST) is an economic cash flow model designed to allow policymakers, regulators, and the renewable energy community to assess project economics, design cost-based incentives (e.g., feed-in tariffs), and evaluate the impact of various state and federal support structures. CREST is a suite of four analytic tools, for solar (photovoltaic and solar thermal), wind, geothermal, and anaerobic digestion technologies.

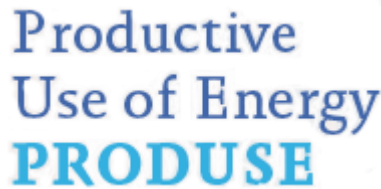|	
IRENA Project Navigator 	The IRENA Project Navigator enables project developers to create their own workspace where they can start their own renewable energy project and navigate through each of the development phases of their project. It allows the use of various tools, at no cost, to complete the process. Since the tools work on the basis of filled out templates, users are made aware of what information the template should include and what the different questions mean, through the use of pop-up windows. The implication of the use of each tool is also well explained. The resulting data can then be stored in any Microsoft Office application format and/or downloaded for any further processing to turn the gathered information into a high-quality project proposal.
Power and Tariff Calculation Tool for Solar Mini-grids in Indonesia 	The tool allows to estimate solar mini-grid capacity and investment as well as electricity fee. The electricity tariff is calculated based on common practices in rural electrification where the mini-grid is managed by the community. The tool allows to integrate various types of loads including households, social institutions and productive customers.
Financial Modelling tool 	The tool supports the calculation of cash-flows; including key financial figures as well as the split of fixed and variable costs. It was designed for project developers and policy makers to understand the economics behind mini-grids and to calculate their profitability. The model can consider cash-flows from different sites and consolidate the cash-flows of each site. The tool can also illustrate a mini-grid company's income statement and balance sheet. Financial indicators like the project IRR, the equity IRR, the Net Present Value (NPV) and the Debt Service Coverage Ratio (DSCR) are calculated automatically.

Feed-in-tariff tool	This tool is designed for the calculation of technology-specific Feed-in Tariffs (FiTs) for mini-grids selling power into the main grid. The main output of this tool is the calculation of appropriate level of FiT, being received for the period of 20 years. Based on the initial investment costs and ongoing operational costs, inflation rate and the yearly revenue from FiT, the tool also calculates the project cash flows (operating, investing, financing and net cash flows) for the period of 20 years.
Retail tariff calculation tool	This tool helps to determine average tariff levels for covering the costs - creating confidence among operators and lenders. The tool allows accommodating various inputs in order to calculate appropriate retail tariffs.
SPP Evaluator	The SPP evaluator was developed as part of a World Bank advisory support to the regulator in Tanzania (EWURA) on small power producers. The tool provides the possibility to project cash flows, estimate revenues and project returns for small power projects.
Solar PV–diesel hybrid business planning checklist	The document contains a checklist for the major parameters related to the development of technically feasible and economically viable SPV-hybrid business cases for power generation in off-grid areas. For each of these parameters, this checklist presents general specifications and critical issues/recommendations, which should be taken into consideration.

| [Excel Tool for Financial Analysis of micro-hydro power projects](#) giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH | This tool allows a financial analysis of a project by calculating in an automated process the necessary indicators of financial feasibility. The analysis is based on project data that has to be introduced manually into the first spreadsheet in approximately 70 cells. The following automatic process allows analyzing the project in a minimum of time and thereby enables the user to consider different project scenarios. |

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Tools for operations and management

Name	Description
Productive use promotion tool and impact evaluation guide Productive Use of Energy PRODUSE	The PRODUSE manual includes a step by step guide on integrating elements for promoting productive uses of energy in electrification projects. The PRODUSE Impact Monitoring and Evaluation Guide gives guidance for the design and implementation of different types of evaluations of the impact of productive use of electricity, ranging from qualitative to rigorous quantitative methodologies. The guide includes three modules: one simpler module based on a short SME survey, one module based on an extended and profound SME survey and one module based on anecdotal case studies.
Supplier Capability Assessment Tool The Practitioner Hub FOR INCLUSIVE BUSINESS	This tool has been created to help companies assess the strengths and weaknesses of their suppliers in order to address the weaknesses and build capability within the supply chain – to the benefit of the company, the supplier and the wider community. This excel tool takes the user, step by step, through the assessment of suppliers and can be tailored to meet a company's specific environment/requirements

[Lumeter Payment platform](#)	Lumeter's Accounting Platform complements the Customer Meter, AC Meter and OEM Meter provided by Lumeter and is accessible through SMS or Web. The accounting platform enhances the meter's functionality by including payment management features like generation of encrypted tokens for the meters, recording transactions across various meters, managing customers and agents, providing meter top-up data and analysis over a period of time.
[SteamaCo](#)	SteamaCo offers an innovative cloud-based remote metering and payments system that monitors energy use, lets people pay for power using their mobile phones, and quickly troubleshoots any problems. The smart meter acts as a powerful remote switch and remote data logger, keeping assets in constant contact with the cloud. Users can manage any number of connected assets in real time through a unified online interface. SteamaCo's mobile-enabled smart meter, bitHarvester, collects data and controls a wide array of off-grid energy and water assets remotely.
[SparkMeter](#)	The SparkMeter microgrid metering system enables utilities to implement pre-payment as well as real time monitoring and control on microgrids and central grids alike. The system consists of four hardware components, a cloud-based operator interface, and a mobile money or cash-based pre-payment system.
[MG Manager](#)	MG Manager is a tool used by small private power producers (IPP, ESCO, REE) which aims to simplify the management of key tasks. MG Manager helps users to master operational costs and income flows, record purchases and justify expenses for operation and maintenance, identify specific network voltage drops, improve service quality, identify default payments and debts, increase company profitability using an efficient management system

Other tools	
Name	*Description*
[WBG Environmental, Health, and Safety Guidelines](#)	The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors.
[Key Performance Indicators and Sustainability Survey for PV mini-grids](#)	The spreadsheet allows to assess and document key parameters of a solar PV mini-grid system and obtain an facilitate the analysis of quality of energy supply, administration and management as well as operations.
[Cooperative Assessment Tools](#)	This set of tools are aimed at helping cooperative movements better understand, assess and analyze the legal environment in their countries and the existing laws that govern cooperatives. The tools can be used to gauge the current level of cooperative activity in the country. The initial assessment provides a general background for programme developers and managers who are designing or beginning to implement a cooperative development program.

Legal templates for generation/distribution licences and PPAs 	These templates includes exemplary procedures and contents for mini-grid generation/distribution licenses and Power Purchase Agreements. The templates were developed with the aim to help establish a framework for attracting increased investment in mini-grids employing renewable and hybrid generation. Application of the templates requires adaptation to country-specific requirements.
UNFCCC tool to calculate CO_2 emissions from fossil fuel combustion 	The tool provides procedures to calculate project and/or leakage CO_2 emissions from the combustion of fossil fuels. It can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.
UNFCCC tool to calculate CO_2 emissions from electricity consumption 	The tool provides procedures to estimate the baseline, project and/or leakage emissions associated with the consumption of electricity. The tool may, for example, be used in methodologies where auxiliary electricity is consumed in the project and/or the baseline scenario. The tool can also be applied in situations where electricity is only consumed in the baseline or in the project or as leakage source.

[Organizational Capacity Assessment Tool](#) **McKinsey&Company**	The Organizational Capacity Assessment Tool (OCAT) is a free online tool that helps non profits assess their operational capacity and identify strengths and areas for improvement. It is an in-depth, online survey that allows the Board, leadership and staff of a non-profit to measure how well their organization performs against best practices.
[Worldbank collection of Terms of Reference](#) THE WORLD BANK IBRD · IDA	Contains samples of Terms of Reference (TORs) related to various assignments (consultancy and employment) at the World Bank.
[Community Toolbox](#)	The Community Tool Box is a free, online resource for those working to build healthier communities and bring about social change. The toolbox consists of multiple individual tools that help to get a quick start on key activities in community work. The toolkit includes modules on creating and maintaining partnerships, assessing community resources and needs, analysing problems and goals, developing a framework or model of change, developing strategic and action plans, building leadership, developing an intervention, increasing participation and membership, enhancing cultural competence, advocating for change, influencing policy development, evaluating the initiative, implementing social marketing effort, writing a grant application for funding, improving organisational management and development, sustaining the work or initiative.

[Community Sustainability Assessment tool](#)	The tool consists of a questionnaire to help the project or individual assess the current situation and possible areas of growth and improvement in a community. The aim being to provide measuring rods for individuals and for existing villages and communities to compare their current status with ideal goals for ecological, social, cultural and economic sustainability. In addition, the tool can act as a learning instrument by pointing out actions aspiring individuals and communities can take to become more sustainable.