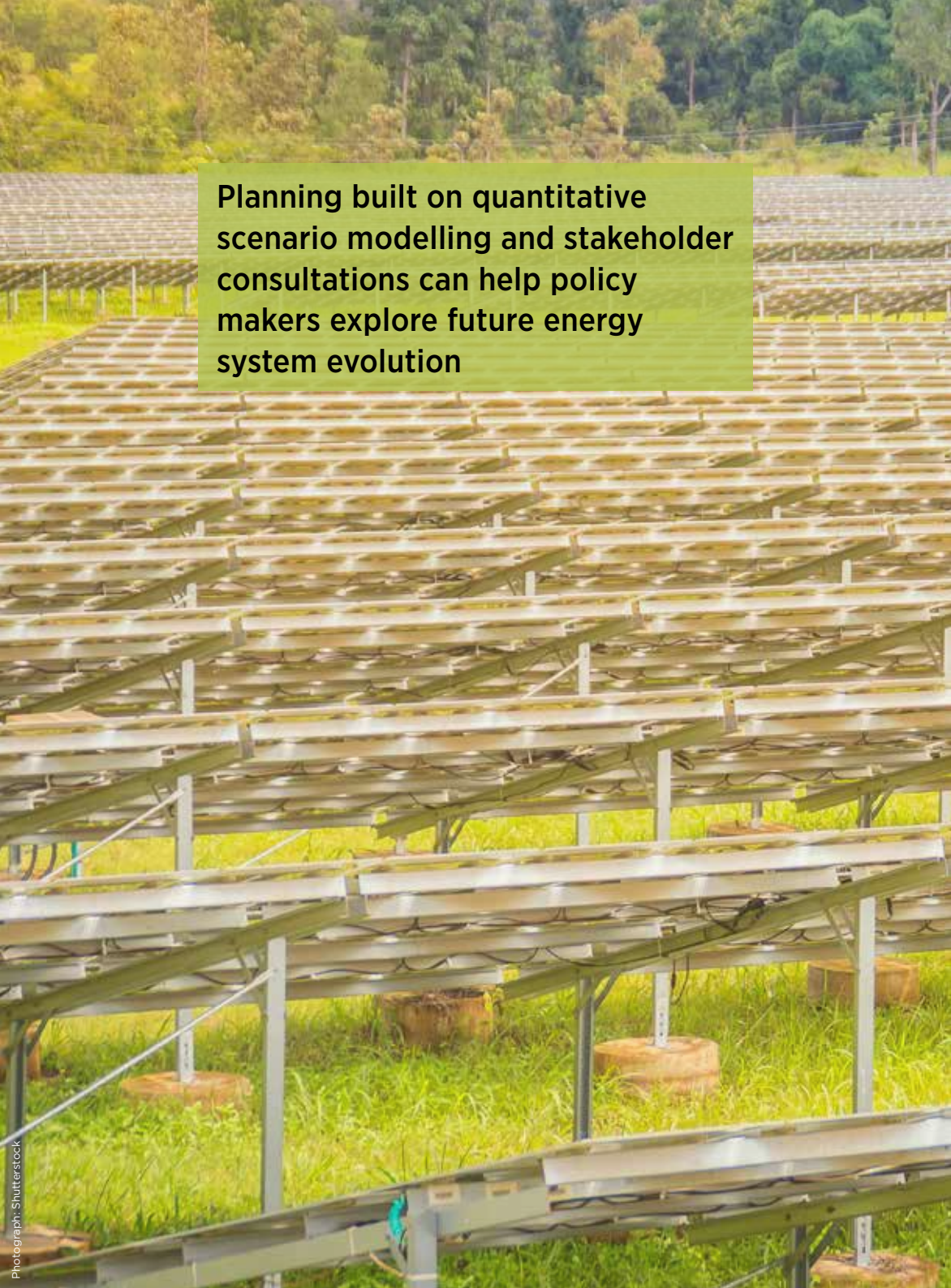




ENERGY PLANNING AND MODELLING SUPPORT IN AFRICA

PROGRAMME HIGHLIGHTS



Planning built on quantitative scenario modelling and stakeholder consultations can help policy makers explore future energy system evolution

1 ENERGY PLANNING SUPPORT AT IRENA

Long-term energy planning lays the foundations for effective policies, investment strategies and targets at the national or regional level. An astute and up-to-date master plan for energy development fosters predictable investment conditions. This makes it an essential prerequisite for scaling up renewable energy technologies.

Along with the master plan itself, the process behind it is at least as important. Effective energy planning, built on quantitative scenario modelling and stakeholder consultations, allows policy makers to understand and explore the complexities and uncertainties of future energy system evolution. Around the world, governments rely on such model-based analysis to guide their key decisions on when, where and how to invest.

For many African countries, however, the lack of robust long-term planning often results in costly, ultimately short-term solutions. Astute, well informed planning and modelling will help to create the energy system for a prosperous future.

The International Renewable Energy Agency (IRENA) provides energy planning support with a view to enhancing institutional capacity at country level and strengthening each country's ownership of the planning process. The ability to translate key energy data into robust energy planning enables countries to develop comprehensive national energy master plans and to continually update these as the basis for sound policies and investments.

IRENA's energy planning support comes through a mix of online software training and hands-on working sessions guided by IRENA experts and partners. The primary focus is on long-term power system investment planning, but this can be extended, upon official request, to cover the entire energy system.

Throughout the training activities and the parallel process of developing master plans, IRENA experts guide each country team through customised technical support, on-demand advisory services and reviews of draft plans.

Energy planning, scenario analysis and models

Scenario analysis is a subset of long-term planning and is often, though not always, aided by the use of modelling tools. To develop national and regional capacity, and ultimately achieve long-term goals, a thorough systematic planning process can achieve even more than the energy master plan itself.

Energy planning expertise

IRENA's planning support programme draws on a deep repository of best practices for renewable energy planning. Drawing on the insights of member countries from around the world, expert staff can identify and illustrate practical solutions to meet country and regional planning needs and facilitate the continual exchange of stakeholder experiences and insights.

Dedicated expertise and software tools support the development of effective long-term planning frameworks, including the integration of rising shares of variable renewable energy (VRE). With specialised customisable System Planning Test (SPLAT) models for 47 African countries, built using IRENA's latest renewable energy data, IRENA can provide a robust starting point for countries to further develop their own scenarios independently.

A wide network of partners at the global, regional and national levels ensures the best-suited advice and training to meet each country's needs.

IRENA energy planning partnerships

Given the wide range of actors involved in supporting energy planning in Africa, co operation with other organisations is an important feature of IRENA's activities. Through various memoranda of understanding and participation in the *Roundtable Initiative on Strategic Energy Planning*, IRENA co-ordinates with both international and regional partners to avoid needless duplication, and leverages complementary resources whenever possible. IRENA's energy planning support activities in Africa benefit from strong partnerships with the International Atomic Energy Agency (IAEA), UN Department of Economic and Social Affairs (UN DESA), UN Development Programme (UNDP), UN Economic Commission for Africa (UNECA), the World Bank, ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), Regional Center for Renewable Energy and Energy Efficiency (RCREEE) and others.



2 REGIONAL MODEL ANALYSIS AND PLANNING PROGRAMME

IRENA's regional Model Analysis and Planning Programme provides training on the development and application of calibrated SPLAT models.

The training programme enhances user knowledge and ownership of energy planning tools, which can provide an entry point for countries to independently maintain and expand their national models for long-term planning. Using IRENA's SPLAT models, it focuses on capacity expansion planning for the power sector for the next 20 years. The tailor-made training programme for Africa includes at least four weeks of hands-on training on the SPLAT models to develop specific national scenarios.

Regional analyses of **renewable energy prospects** for all five African power pool regions (West, Southern, Eastern, Central and North) serve as valuable benchmarks. Studies linked to IRENA's Africa Clean Energy Corridor (ACEC) initiative, spanning countries of the Eastern Africa and Southern African power pools, combine SPLAT models with analysis of high-potential zones for economical solar photovoltaic (PV) and wind power development.

IRENA's suite of planning tools

IRENA's training programme typically uses SPLAT models, built using the IAEA's MESSAGE software. MESSAGE is widely used by government planners around the world and identifies the cost-optimal supply mix and associated investment needs through a bottom-up approach. The training programme can be expanded to include other tools and methodologies, such as accounting models for developing energy demand scenarios, IRENA's FlexTool for dedicated flexibility analysis, and rural electrification planning elements, depending on the country's priorities and existing planning capacity.

Regional model analysis and planning: West Africa example

Long-term planning and modelling support has helped to boost capacity in ten of the member countries of the Economic Community of West African States (ECOWAS)*. The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and the IRENA team conducted a six-month capacity development programme in 2016 in collaboration with the IAEA and the United Nations Framework Convention on Climate Change (UNFCCC). The programme brought together experts from energy planning offices at national ministries, specialised agencies and electric utilities.

Through training courses (one online and two face-to-face) and various assignments, country teams developed scenarios for cost-optimised integration of renewable energy in the power sector. These scenarios were aimed at guiding national renewable energy policies in line with the ECOWAS Regional Renewable Energy Policy adopted in 2013.

The SPLAT-W model for West Africa enables energy planners to assess the future electricity mix from economic, technical and environmental perspectives. In the final session, participants submitted draft reports on electricity prospects for their respective countries based on quantitative scenario analyses. The IAEA provided technical expertise in the use of the MESSAGE software, while the UNFCCC provided complementary training sessions on carbon finance via the Clean Development Mechanism and grid emission-factor calculation methodology.

Following training, country models were combined into a single model for West Africa to provide perspectives on a co-ordinated approach for the region. Results were published in an IRENA report, *Planning and prospects for renewable power: West Africa* (2018).

* The ten participating countries are: Benin, Burkina Faso, Cabo Verde, the Gambia, Guinea, Liberia, Niger, Senegal, Sierra Leone and Togo.



3 NATIONAL MASTERPLAN DEVELOPMENT SUPPORT PROGRAMME

At the national level, Masterplan Development Support helps countries to build and enhance their governmental and institutional energy planning capacity through a series of structured in-depth training sessions for national energy planning practitioners.

IRENA offers capacity-building support to countries wishing to develop or update their national energy master plans. Support is tailored to meet each country's specific requirements, with a government support request initiating the process to co-develop a programme.

The aim is to enhance country capacity to analyse energy data and develop scenarios using modelling tools for long-term energy planning. The additional tools to support energy planning may be selected according to each country's needs and existing modelling expertise.

The programme includes several weeks of in-country training sessions to calibrate a SPLAT or equivalent model, explore energy planning scenarios and develop a national energy master plan document. In-country sessions are complemented with online training and other meetings.

Through this programme IRENA supported the Eswatini team in developing the [Eswatini National Energy Masterplan 2034](#), published in 2018 (see example on following pages). [Sierra Leone](#) and [Cameroon](#) are also currently working with IRENA to enhance their national energy planning capacity and master plan development. Countries wishing to participate in the National Masterplan Development Support Programme should send a formal country request to IRENA.

Masterplan development support: Eswatini example

IRENA worked with the Eswatini government on capacity building during a 30-month programme to support expansion of their national energy planning capacity, which includes developing and regularly updating their national energy master plan.

Prior engagement

IRENA facilitated a Renewables Readiness Assessment (RRA) conducted by Eswatini (then known as Swaziland) in 2014. The RRA identifies long-term energy planning and energy statistics as important areas for action. As a result, in 2015 a programme to enhance its national long-term capacity for energy planning was designed.

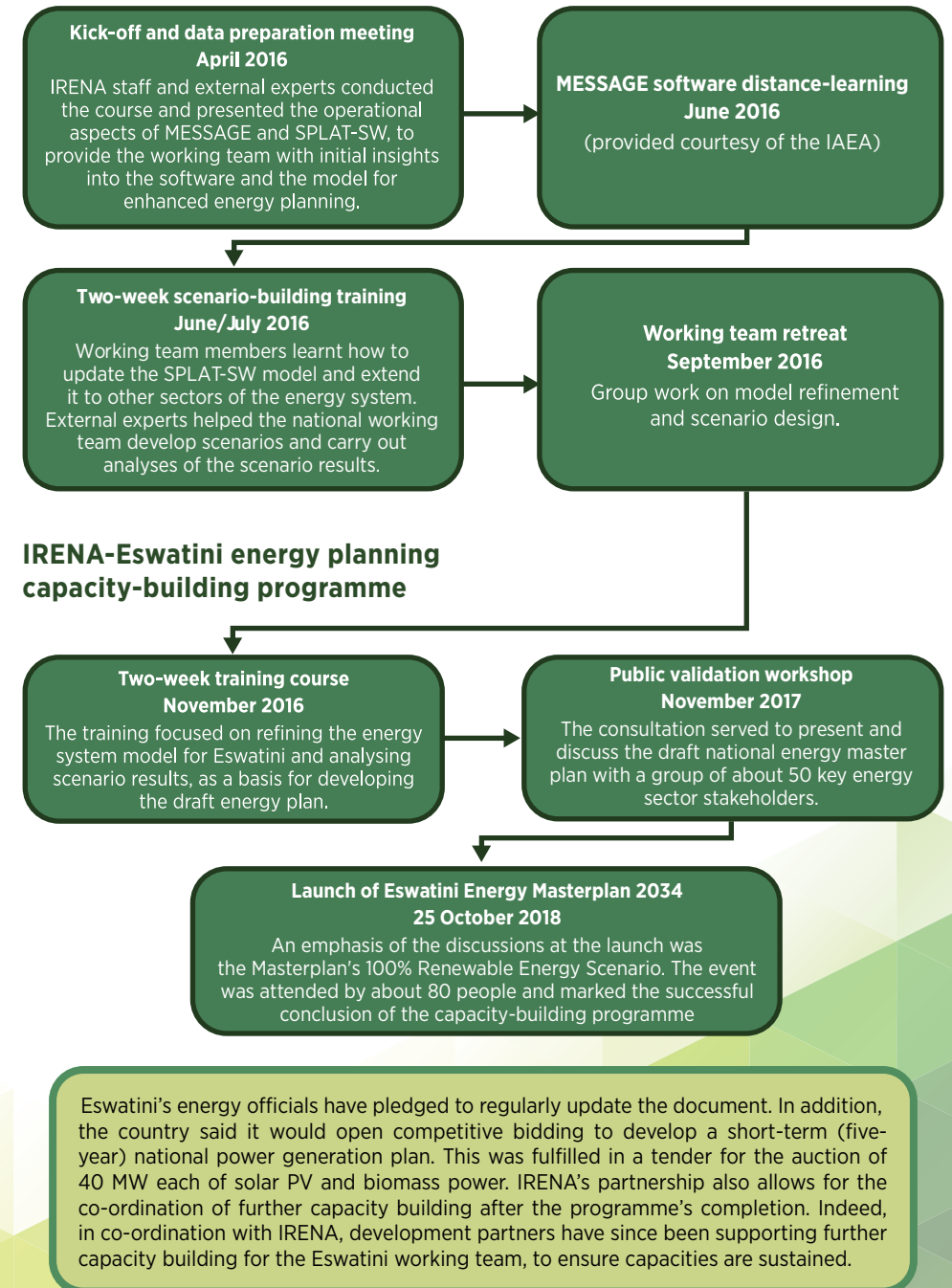
The IRENA-Eswatini capacity-building programme aimed to provide a team of national practitioners with the means to design a comprehensive energy master plan. The programme was based on developing and applying the System Planning Test model for Eswatini (SPLAT-SW), using energy demand analysis from the LEAP (Long-range Energy Alternatives Planning System) model that the country had developed prior to the programme.

Scope of the plan

Eswatini's master plan:

- Reviews the current national energy policy landscape and national energy balance.
- Projects national energy demand up to 2034.
- Identifies untapped potential for domestic energy supply from renewable sources.
- Provides a firm quantitative basis for future energy sector development to 2034.
- Analyses energy supply options by their financial requirements and their implications for energy security, energy access, carbon emissions and other related policy objectives.

Based on quantitative analysis and scenario development, the National Energy Masterplan 2034 can guide the development of tailored policy instruments for sustainable energy development in Eswatini in the years ahead.



Modelling framework

The SPLAT-SW model provides a customised energy supply optimisation framework for a reference energy system, including the power sector. The analysis systematically identified and evaluated potential sites for solar and wind power development in Eswatini, based on the Multi-criteria Analysis for Planning Renewable Energy (MapRE) conducted by the Lawrence Berkeley National Laboratory and IRENA in 2015.

Training courses and activities

The programme comprised a series of training courses for the national “working team” of around 20 energy experts from the Ministry of Natural Resources and Energy, the national utility and academia, among others. The courses covered the means and tools for configuring the national energy planning model (SPLAT-SW), designing energy planning scenarios and developing a national energy master plan.

The national working team held regular meetings between courses to review and discuss progress on the energy master plan report, and frequently conferred with IRENA staff on aspects of model development and scenario design. The cabinet-approved **Eswatini Energy Masterplan 2034** was the result of this process.

The collection and adequate management of renewable energy data is key – and often a main shortcoming – for the development of proper energy scenarios and a robust energy planning framework. Thus, at the outset of the energy planning support activities, a regional energy statistics workshop held in Eswatini in December 2015 gave energy decision makers training and support in gathering key renewable energy statistics and updating the national energy sector database.

“Proper energy planning facilitates and enables well-informed policy making and, importantly, the achievement of key energy policy objectives. Besides a robust national energy planning process, there is a need to align national and regional-level planning to enhance trade, efficiency and security of energy supply and reap the benefits of economy-of-scale production. To achieve this, Eswatini was supported by IRENA to build institutional capacity in long-term strategic energy planning through training courses and technical support. The resulting Eswatini Energy Masterplan 2034 provides national decision makers with a robust basis for planning future energy sector developments through identifying and addressing the country’s distinct barriers in the supply of energy. Furthermore, the Masterplan presents a pathway for achieving a balance between affordability and sustainability of energy supply, through harnessing domestic resources while also maintaining electricity trade with neighbouring countries.”

Ms Lindiwe C. Dlamini – Chief Energy Officer
Eswatini Ministry of Natural Resources and Energy



MORE INFORMATION

Roundtable Principles for Supporting Strategic Energy Planning:

energyeconomicgrowth.org/content/roundtable-principles-supporting-strategic-energy-planning

Regional Model Analysis and Planning Programme:

irena.org/energytransition/Energy-Planning-Support/Regional-training-workshops

National Masterplan Development Programme:

irena.org/energytransition/Energy-Planning-Support/National-Energy-Master-Plan-Development

IRENA's support to Eswatini:

irena.org/events/2018/Oct/IRENA-Eswatini-Energy-Planning-Capacity-Building-Programme-Masterplan-2034-Launch

Eswatini Energy Masterplan 2034:

www.gov.sz/index.php/center/129-natural-resources-a-energy/2084-eswatini-energy-masterplan-to-bring-impressive-development-in-the-energy-sector-2

IRENA's support to Sierra Leone:

www.energy.gov.sl/international-renewable-energy-agency-conducts-in-country-energy-planning-capacity-building-for-energy-sector/

IRENA's work on the five Africa Power Pools:

irena.org/publications/2015/Mar/Africa-Power-Sector-Planning-and-Prospects-for-Renewable-Energy-synthesis-report

Planning and prospects for renewable power – West Africa:

irena.org/publications/2018/Nov/Planning-and-prospects-for-renewable-power

To learn more...

Partners and countries interested in working with IRENA or learning more about IRENA's support for long-term energy planning are encouraged to contact the IRENA Innovation and Technology Centre at iitc@irena.org for further information and an exploratory discussion.

IRENA connects with countries through dedicated regional officers in its Country Engagement and Partnerships (CEP) division. IRENA can respond to requests for energy planning support on receipt of a formal country letter.

In addition to supporting member countries in long-term energy planning, IRENA engages in a wide range of activities to facilitate renewable energy deployment worldwide.

About IRENA

The International Renewable Energy Agency (IRENA) serves as the principal platform for international co-operation, a centre of excellence, a repository of policy, technology, resource and financial knowledge, and a driver of action on the ground to advance the transformation of the global energy system. An intergovernmental organisation established in 2011, IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity. www.irena.org

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