RES4Africa Foundation
Knowledge Platform

Cornerstones to develop a national Energy Masterplan

Enel Green Power
A roadmap to guide the national energy sector towards sustainability

The Platform covers the following thematic areas:

- Technologies
- Policies and regulations
- Access to market
- Permitting
- Financing
- Operation
- Sustainability

Cornerstones to develop a national Energy Masterplan

What is the context: Energy Masterplans are usually drafted by Ministries in charge of energy and outline the way forward for the development of the energy sector by defining goals and drivers, critical infrastructure needs and an actionable strategy, including the investments needed to allow the country to meet the energy demand with the least cost.

Why is this relevant: Energy Masterplans provide a roadmap to guide the national energy sector towards a future with adequate, sustainable, efficient and reliable supply that is environmentally friendly, competitively priced, and which puts the country on the path to achieving its development objectives in order to attract private capital.

What are the key questions:
- Which are the main topics covered by a national Energy Masterplan? How do they work?
- Which are its key elements?
- How can a national Energy Masterplan be drafted?
Enel Green Power: the world leader in Renewables
A global presence and a different portfolio

2021 Installed RES Capacity\(^1\) (GW)
of which 220MW BESS

1. Including managed capacity by 3.3 GW
2. Countries with assets in operation or under construction
The importance of national Energy Masterplans

What is an Energy Masterplan?

▪ A Masterplan outlines the way forward for the development of the energy sector by defining goals and drivers, critical infrastructure needs and an actionable strategy, including the investments needed to allow the country to meet the energy demand with the least cost.

▪ Energy Masterplans are usually drafted by Ministries in charge of energy, as this institution has usually a 360° view of the whole sector.

Why is an Energy Master Plan so important?

▪ Energy Masterplans provide a roadmap to guide the national energy sector towards a future with adequate, sustainable, efficient and reliable supply that is environmentally friendly, competitively priced, and which puts the country on the path to achieving its development objectives.

▪ It shows the willingness of a country to engage in a sustainable development path, through the technologies, the capacities and the market models selected for the evolution of generation and of the infrastructures. This is key to lower the risk perception of investors and to attract private capital.
What are the key elements of a Masterplan?

**Measurement & Verification**
- Define monitoring actions & KPIs
- Evaluate and measure costs, benefits, environmental and social impacts
- Seek improvements actions
- Keep Masterplan updated

**Assessment**
- Understand and evaluate energy demand and supply
- Macroeconomic, demography and fuel price data
- In-depth analysis of energy demand and resource potential
- State of the infrastructure

**Consultation**
- Integration of key stakeholders’ views; Ministry of Energy, Environment, Finance, Energy Regulator, Planning and Development authorities, energy efficiency Agencies, TSO…
- Align local visions with national plan (need for energy access, socio-economic development of specific areas…)

**Scenarios**
- Establish scenarios based on demand, macroeconomics and other relevant variables
- Mapping resource potential & zoning Analysis for the identification of high potential locations per technologies to serve as a basis to set new targets

**Implementation**
- Define institutional roles and responsibilities for the implementation of the masterplan
- Define actions and strategies to achieve the targets
- Set an enabling Regulatory Framework to reach those targets (RES priority, incentive & support system)
- Define rules for procurement, local content and ownership

**Comprehensive Plan** *(short-, mid- and long-term)*
- Define rules for procurement of new generation capacity & local content
- Define support measures for key technologies (eg RES, BESS…)
- Coordination of Generation & Transmission to avoid Grid connection issues
- Define measures and tools for flexibility and resiliency of the power system
- Define cross-border cooperation areas (eg cross border trading, import / export)
- Action plan can include also energy access and job creation strategies

**Target**
- Set feasible & realistic targets for energy access and capacity increase
- Short-, mid- and long-term targets differentiated by technologies (eg solar PV, onshore wind, BESS…)
- Clear, Updated and Realistic targets provide evidence of a government’s long-term commitment to clean energy transitions and serve as critical signals to attract investment
Key steps to draft a Masterplan

1. Have a responsible organizational structure, but with the involvement of all relevant stakeholders (Ministry of Energy / Environment / Finance, the Energy Regulator, Energy Planning and development authorities, state / regional / provincial institutions, specialized funds and Agencies) and providing a consultation period.

2. Measuring and evaluating fundamentals (resources, macroeconomics...)

3. Conduct an analysis of past and ongoing renewable energy initiatives to identify success factors and implementation gaps, as well as consider lessons learnt from international experience. → what policies are missing? What went wrong in past initiatives? How implementation can be ensured?

4. Enabling framework: objectives, support schemes, enhance local benefits.

5. Develop a roadmap that includes all relevant technologies (and sectors)

6. Evaluate and measure costs, benefits, environmental and social impacts

7. Implementation plan

8. Assessing the situation, reviewing variables and updating
Focus on targets
Clear, updated and realistic targets provide evidence of Government commitment to sustainable development, and attract investments.

Targets can be expressed in:
- MW
- % of the energy mix in generation, consumption or installed capacity
- GWh (less frequently)

In the table below, targets from Ghana Renewable Energy Master Plan-2019:

<table>
<thead>
<tr>
<th>INTERVENTION</th>
<th>UNITS BASELINE</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Utility scale Solar</td>
<td>MW</td>
<td>23</td>
<td>150</td>
<td>225</td>
</tr>
<tr>
<td>2. Rooftop/net metering Solar PV</td>
<td>MW</td>
<td>1.7</td>
<td>40</td>
<td>120</td>
</tr>
<tr>
<td>3. Standalone Solar PV Systems</td>
<td>MW</td>
<td>2.5</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>4. Street/Community lighting</td>
<td>MW</td>
<td>1.5</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5. Lanterns</td>
<td>Units</td>
<td>70,000</td>
<td>500,000</td>
<td>1,300,000</td>
</tr>
<tr>
<td>6. Solar Irrigation/water supply</td>
<td>Units</td>
<td>&lt;30</td>
<td>200</td>
<td>350</td>
</tr>
</tbody>
</table>

Targets must be:
- Challenging
- Achievable
- Long-term with intermediate milestones
- Declined per technology

In Ghana there are long-term targets with intermediate milestones (5-years blocks) in line with other plans such as the Strategic National Energy Plan (SNEP) and SE4ALL action agenda to 2030.

Source: Renewable Energy Masterplan for Ghana - 2019
Examples of energy Masterplanning in Africa

<table>
<thead>
<tr>
<th>Ghana</th>
<th>Senegal</th>
<th>Cameroun</th>
<th>Ethiopia</th>
<th>Angola</th>
<th>South Africa</th>
<th>Zambia</th>
<th>Uganda</th>
<th>Kenya</th>
<th>Mozambique</th>
<th>DRC</th>
<th>Rwanda</th>
<th>Seychelles</th>
<th>Morocco</th>
<th>Tunisia</th>
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**Generation Masterplan**
- Existence of a Masterplan
- Updated (after 2015)
- RES Target
- Intermediate milestones
- Targets per Technology
- Mapping Resource & Potential

**Generation Investment Plan**
- Investment Plan
- Publicly available

**Transmission Investment Plan**
- Integrated with Transmission
- Publicly available

**Energy Access**
- Energy access target

Current Masterplans can give us a clear picture of what are the energy priorities in most of African countries:
- RES Power generation
- Energy access, as a key issue for Sub-Saharan Africa. Maghreb countries have already reached their electrification target
- Long-term planning for Grid investments is done by National DSOs and usually not disclosed to the public
- In some cases, Masterplans were developed with the support of international organizations (eg United Nations Development Programme (UNDP) in Nigeria and Ghana; IRENA in Eswatini).
The Middle East and North Africa experience

18 over 19 countries have adopted national renewable energy targets

But only

- 10 countries have updated targets (revision or set after 2015)
- 10 countries have targets differentiated per technology
- 8 countries have mid-term milestones
- 2 countries (Morocco and Egypt) are on track to meet their respective targets.
- 1 country (Jordan) has already met its official target of 20% of RES production by 2025

PROGRESS TOWARD RE TARGETS AS OF 2019

Source: RES4Africa Connecting the Dots Study MENA Edition (2021)

Masterplans are frequently adopted in MENA, but targets are often eye-catching, as Countries are keen to show their green commitment
Case study: South African Integrated Resource Plan (IRP)

- Targets in MW
- Targets in % of installed capacity
- Targets per technology
- Targets per year

In 2019 and after several years of extensive public consultations, South Africa published its updated Integrated Resource Plan (IRP), that identifies the preferred energy generation mix required to meet the expected demand growth up to 2030.

- PV and Wind are identified as key technologies to replace coal (11+GW of coal to be decommissioned by 2030)
  - 1600 MW per year for wind for 2022-2030
  - 1000 MW per year of solar PV for 2022-2030
- For the first time, a target on Storage is included, to ensure flexible generation from renewables
Best practices overseas

- The Australian Integrated System (ISP) is released every 2 years by the Australian Energy Market Operator. It defines an optimized long-term outlook (20+ years) in terms of generation, storage and network need.

- By 2050, ISP 2022 identifies:
  - 10,000 km of new network investments (USD 9 bn)
  - 9 X increase in grid-scale wind & solar capacity to 141 GW
  - 3X solar capacity to 71 GW
  - 5X increase in distributed solar to 69 GW

- In 2021, the Ministry of Trade and Industry issued a draft for the period 2021-2030, with a vision to 2045, currently awaiting approval from the Prime Minister (“Revised Draft Master Plan VIII”).

- The “Revised Draft Master Plan VIII” identifies:
  - No new coal-fired power plants pre-2030 & Priority for RES
  - Preparation of a mechanism to encourage the development of flexible power sources including storage technologies
  - Grid connectivity issues are mitigated by a long-term planning of grid improvements

Source: Australian Energy Market Operator (AEMO), Bnef 2021
# Key recommendations for an effective Energy Masterplan

## 1. Include & collaborate
- Involve all relevant stakeholders: public entities, but also Utilities, which have extensive experience in planning networks and in cost definition; complement with academic and industrial partners
- Avail of international cooperation for technical assistance and capacity building on demand forecasting, generation and transmission planning and financial modeling

## 2. Ensure consistency and coordination
- Ensure consistency with other Plans / strategies / regulations of the country (e.g., RE development plan must be consistent with any National Energy Strategy)
- Ensure coordination between generation and transmission development

## 3. Data driven approach
- Positioning of policy on this basis can be done transparently

## 4. Targets are a key driver
- Targets must be long-term with shorter-term milestones. They must be challenging but achievable. Where possible, they should be legislated to make them more enforceable

## 5. Implementation!
- Make sure that regulations for effective implementation follow soon the Masterplan

## 6. Periodic, consistent updating with transparent governance