REGIONAL INFRASTRUCTURE FINANCE FACILITY (RIFF) PROJECT

Needs and Market Assessment of Off-Grid Renewable Energy in the COMESA and TDB Region

July 2022
Disclaimer

This Report has been prepared by Deloitte Touche Tohmatsu India LLP ("DTTILLP") in accordance with the Contract executed on 29th November 2021 between DTTILLP and COMESA SECRETARIAT ("Client") and is subject to the scope of work, approach, assumptions, and other conditions mentioned in the Contract.

This Report and the information contained herein has been prepared by DTTILLP solely for the benefit of the Client and is intended for use by the Client solely for the purpose defined in the Contract. The Client shall not use this Report for any other purpose and shall not use this Report in connection with the business decisions of any third party and for advisement purposes.

This Report contains analyses that are intended to provide high-level information on the subject and are not an exhaustive treatment of the subject. The analyses in the Report are limited by the scope of work, the time allocated, information made available to DTTILLP or collected by DTTILLP and are heavily dependent upon the assumptions specified in the Contract and this Report. It should be noted that a different set of assumptions will lead to a different analysis. This Report is not intended to be relied upon as a sole basis for any decision and the Client should take decisions only after seeking professional advice and after carrying out their own due diligence procedures, detailed analysis to ensure that they are making an informed decision. This Report is not and should not be construed in any way as giving any investment advice or any recommendations by DTTILLP to the Client or any other party. The Client shall be solely responsible for all decisions (including the implications thereof) made by the Client based on this Report. The Client shall hold us harmless from any claims for damages arising from the use of our deliverables.

This Report has been prepared on the basis of information made available, obtained and collected by DTTILLP from Client and various secondary sources. The sources of any material information used in the Report has been mentioned or cited herein. The information obtained and collected from the Client and various secondary sources has been used on an “as-is” basis without any independent verification by DTTILLP. DTTILLP shall not be responsible for any error or omissions, or for the results obtained from the use of this information and provides no assurance regarding the accuracy, timeliness, adequacy, comprehensiveness and/or completeness of such information and provides no warranty of any kind, express or implied, including, but not limited to warranties of performance and fitness for a particular purpose. DTTILLP shall not be liable for any losses and damages arising as a result of any inaccuracy or inadequacy or incomprehensiveness or incompleteness of such information.

This Report is solely for the use of the Client, as per the terms of the Contract. The Report is issued on the basis that this Report or any information derived therefrom, shall not be shared with or provided to any third party without the prior written consent of DTTILLP.
# Table of Contents

Executive Summary .................................................................................................................. 12

A. Engagement Context ........................................................................................................ 14
   1. About COMESA ................................................................................................................ 14
   2. About TDB ......................................................................................................................... 15
   3. RIFF Project ...................................................................................................................... 16
   4. Engagement Objective ..................................................................................................... 16

B. Economic Overview & Electrification Trends in COMESA and TDB Region ...................... 18
   1. Global RE Trends .............................................................................................................. 18
   2. Macroeconomic View of COMESA Region ...................................................................... 22
   3. Electrification Scenario in COMESA and TDB region ..................................................... 30
   4. Key Options to Expand Electricity Access in COMESA and TDB regions ......................... 37

C. Off-grid Solar Market Assessment .................................................................................... 40
   1. Key Product Segments in Off-grid Market ....................................................................... 40
   2. Demand Potential for Off-grid Solar Solutions ................................................................ 44
   3. Supply Landscape of Off-grid Solar Solutions .................................................................. 49
   4. Key Players in Off-grid Solar Sector ................................................................................ 52
   5. Key Associations to support Off-grid sector .................................................................... 53
   6. Market Development Programs active in COMESA & TDB regions ................................. 54
   7. Gender Mainstreaming .................................................................................................... 56

D. Study of Regulatory & Institutional Landscape for Off-grid ............................................. 58
   1. Policy, Legal and Regulatory Frameworks ....................................................................... 58
   2. Institutional Structure ..................................................................................................... 67
   3. Mini-grid Development Framework ................................................................................. 82

E. Financing in Off-grid Solar Sector .................................................................................... 88
   1. Commercial Funding Instruments ................................................................................... 93
   2. Consumer Financing Models .......................................................................................... 124

F. Gap Assessment in Off-grid Solar Sector .......................................................................... 132
   1. Key Challenges faced by the Off-grid Solar sector ......................................................... 132
   2. Categorization of Countries ............................................................................................ 134

G. Recommendations to scale Off-grid Solar Sector ............................................................ 136
   1. Off-grid Solutions ............................................................................................................ 136
   2. Business and Distribution Models .................................................................................. 138
   3. Proposed Policy Framework and Institutional Structure .................................................. 152
   4. Financing Recommendations ......................................................................................... 160
   5. Quality Assurance Framework ....................................................................................... 169
   6. Technical Assistance and Capacity Building ................................................................. 172
   7. Roadmap ......................................................................................................................... 178
List of Figures

Figure 1: Benefits offered by COMESA to its Member Nations ................................................................. 14
Figure 2: Key Objectives of the Engagement .............................................................................................. 17
Figure 3: Key Goals of COP26 .................................................................................................................... 18
Figure 4: Annual Renewable Energy Capacity Additions of Major Technologies Globally .................. 19
Figure 5: Countries leading in Installed Renewable Energy Capacity in 2020 ........................................ 20
Figure 6: Annual Solar Capacity Additions Globally .................................................................................. 20
Figure 7: Trends in Global Renewable Energy Investment ........................................................................ 21
Figure 8: RE Investment Trend in Sub-Sahara Africa .................................................................................. 22
Figure 9: GDP growth trend of COMESA vs Africa vs World ............................................................... 23
Figure 10: GDP growth rate in COMESA countries .................................................................................. 23
Figure 11: GDP Growth Rate of COMESA Countries in 2021 ................................................................. 24
Figure 12: Comparative Analysis of GDP Per Capita PPP (USD) of COMESA, Africa and World ... 24
Figure 13: GDP per Capita comparison of COMESA countries ............................................................... 25
Figure 14: COMESA Inflation Trend .......................................................................................................... 25
Figure 15: COMESA Fiscal Balance Trend ................................................................................................ 26
Figure 16: COMESA Objectives for Trade Promotion .............................................................................. 27
Figure 17: COMESA Global Trade ............................................................................................................. 27
Figure 18: COMESA Average Productive Capacities Index ..................................................................... 28
Figure 19: Ease of Doing Business Ranking in COMESA countries ...................................................... 29
Figure 20: COMESA regional strategies ..................................................................................................... 29
Figure 21: Analysis of Electricity access rate (%) of COMESA, Africa and World .............................. 30
Figure 22: Key Challenges in Electricity sector in COMESA and TDB countries .................................... 31
Figure 23: Access to Electricity (%age of Population) in COMESA and TDB countries ....................... 31
Figure 24: Case Study of Green Energy Scheme for Cooperatives in Mauritius ..................................... 32
Figure 25: PV Democratization 2.0 Project in Seychelles ........................................................................ 33
Figure 26: Case Study of UAE Rural Electrification Initiative in Egypt .................................................. 34
Figure 27: Case Study of Renewable Energy Law of Tunisia ............................................................... 34
Figure 28: Case Study of Comoros Energy Integration Platform ............................................................. 35
Figure 29: Partnership for Affordable Renewable Energy in Eswatini .................................................... 36
Figure 30: Comparison of Electricity Affordability in COMESA and TDB region ................................. 36
Figure 31: Key Options to expand Electricity Access .................................................................................. 38
Figure 32: Benefits of Off-grid Solar Systems ............................................................................................ 39
Figure 33: Key Stand-alone Solar Systems Product Segment ................................................................. 40
Figure 34: Standalone Solar Systems Value Chain Analysis ..................................................................... 41
Figure 35: Installed Mini-grids by Region and Technology ................................................................. 43
Figure 36: Mini-grid Value Chain Analysis ................................................................................................ 43
Figure 37: Potential for Off-grid Solar in Sub-Saharan Africa region ..................................................... 45
Figure 38: Market Potential of Off-grid solutions in COMESA and TDB countries ............................. 45
Figure 39: Customer Segmentation for Off-grid Solutions ...................................................................... 46
Figure 40: Key Drivers for C&I consumers to adopt off-grid Solutions .................................................... 48
Figure 41: Case Study of Off-grid Solutions being employed by C&I consumer segment .......... 48
Figure 42: Global Sales Volume of Lighting Global Affiliated Off-grid Solar Lighting Products ....... 49
Figure 43: Sales Distribution of Lighting Global Affiliated Off-grid Lighting Products ..................... 50
Figure 44: Sales of Lighting Global Affiliated Off-grid Lighting Products in COMESA and TDB countries .................................................................................................................................................. 50
Figure 45: Sales of Lighting Global Affiliated Off-grid Solar Appliances in COMESA and TDB countries .............................................................................................................................................. 51
Figure 46: Top 10 World Economies in Mini-grid Development ......................................................... 52
Figure 47: Key Off-grid Solar System Suppliers .................................................................................. 53
Figure 48: Key Notable donors in Off-grid Solar sector in COMESA & TDB region ......................... 54
Figure 49: Interdependence of Institutional and Legal Framework .................................................. 58
Figure 50: Two Major Aspects for Legal and Regulatory Framework for Off-grid sector ............... 59
Figure 51: Important Policies for the development of the Off-grid sector in a country .................. 60
Figure 52: Heatmap of Legal Framework in COMESA and TDB countries ..................................... 61
Figure 53: Need of a robust Institutional Framework for efficient deployment of Off-grid Solutions .............................................................................................................................................. 68
Figure 54: Effective Institutional Structure for the development of energy sector in a country. 69
Figure 55: Heatmap of Institutional Framework in COMESA and TDB countries .......................... 70
Figure 56: Key elements of Mini-grid Development Framework .................................................... 82
Figure 57: Heatmap of Mini-grid Development Framework in COMESA and TDB countries .... 83
Figure 58: Global Climate Financing Trend ....................................................................................... 88
Figure 59: Climate Financing by Sector ............................................................................................. 89
Figure 60: Global Investment in Off-grid Solar Sector ....................................................................... 90
Figure 61: Region Wise Investment in Off-grid Solar Sector (2012-2019) ........................................ 90
Figure 62: Sources of Capital in Global Off-grid Solar Sector .......................................................... 91
Figure 63: Key Components of the Off-grid Financing Section ......................................................... 93
Figure 64: Different Stages of an Off-grid Solar Company ............................................................... 93
Figure 65: Different rounds of Funding for a Startup ......................................................................... 94
Figure 66: Sources of Grant Financing in Global Off-grid Solar Industry ........................................ 95
Figure 67: Types of Grant Instruments ............................................................................................... 95
Figure 68: Case Study of Grant Window ........................................................................................... 96
Figure 69: Case Study of Results Based Financing ............................................................................ 98
Figure 70: Case Study of Reward Based Crowdfunding ................................................................. 99
Figure 71: Grant Financing from Official Donors for Solar Isolated Grids and Standalone Systems in 2019 ................................................................. 99
Figure 72: Grant Financing in COMESA and TDB countries ............................................................ 100
Figure 73: Sources of Debt Financing in Global Off-grid Solar Sector .............................................. 101
Figure 74: Types of Debt Instruments ............................................................................................... 102
Figure 75: Case Study of Term Loan ............................................................................................... 103
Figure 76: Case Study of Line of Credit ........................................................................................... 103
Figure 77: Case Study of Accounts Receivable Financing ............................................................... 105
Figure 78: Case Study of Securitization ........................................................................................... 106
Figure 79: Case Study of Convertible Note ...................................................................................... 106
Figure 80: Case Study of Peer to Peer Business Lending ................................................................. 108
Figure 81: Case Study of Online Debt Based Securities .................................................. 108
Figure 82: Case Study of Government Issued Mobile Bond ........................................... 109
Figure 83: Debt Financing in COMESA and TDB countries ......................................... 110
Figure 84: Sources of Equity Financing in Global Off-grid Solar Sector in 2020 .............. 112
Figure 85: Types of Equity Financing .......................................................................... 113
Figure 86: Case Study of Preferred Stock .................................................................... 114
Figure 87: Equity Financing in Off-grid Solar Companies operating in COMESA and TDB region ............................................................................................................... 115
Figure 88: Financing Blend in Global Off-grid Solar Sector .......................................... 117
Figure 89: Summary of all Financing Instruments proposed for Off-grid Solar Sector .... 117
Figure 90: Lending Interest Rates in COMESA and TDB countries ............................... 119
Figure 91: Key Challenges and Solutions in Access to Finance in Off-grid Solar Sector in COMESA and TDB region .................................................................................. 121
Figure 92: Demand and Supply Side Measures of Public Funding Program .................. 122
Figure 93: Case Study of Demand Side Subsidy Program .............................................. 122
Figure 94: Case Study of Public Procurement in Off-grid Sector .................................. 123
Figure 95: Poverty Assessment in COMESA and TDB countries .................................. 125
Figure 96: Different Consumer Financing Models in Off-grid Solar Sector ................... 126
Figure 97: Working of PAYGO Model ......................................................................... 127
Figure 98: Financial Inclusion Comparison of COMESA and TDB countries ............... 128
Figure 99: Analysis of Domestic Credit to Private Sector in COMESA and TDB countries ... 128
Figure 100: Mobile Cellular Subscriptions in COMESA and TDB countries ............... 129
Figure 101: Information and Communication Technology Assessment in COMESA and TDB countries .......................................................... 130
Figure 102: Key Challenges in Consumer Financing Models ....................................... 131
Figure 103: Key Challenges faced by Off-grid Solar Sector in COMESA and TDB region ............................................................... 132
Figure 104: Country wise comparison on enabling factors for Off-grid Solar Sector development ................................................................................................................ 134
Figure 105: Recommendations for Off-grid Solar Sector .............................................. 136
Figure 106: Different Off-grid Solutions proposed for electrification ......................... 137
Figure 107: Different Off-grid Solutions and their suitability ...................................... 137
Figure 108: Business Models for Off-grid Solar Sector ................................................ 138
Figure 109: Case Study of Hybrid Mini-grid Model ....................................................... 141
Figure 110: Case Study of Community based Mini-grid Model .................................... 142
Figure 111: Distribution Models for Pico/ SHS ............................................................... 143
Figure 112: Case Study of CSO Distribution Model ...................................................... 144
Figure 113: Key Components of Institutional Structure ............................................... 153
Figure 114: Key Bodies responsible for Policy Planning and Development .................. 153
Figure 115: Implementation Wing responsible for Day-to-Day Administration of Off-grid Solar Sector ........................................................................................................... 156
Figure 116: Case Study of IDCOL SHS Program in Bangladesh ................................. 158
Figure 117: Key Components of the Financing Recommendations ............................... 160
Figure 118: Case Study of Aggregation of Mini-grids ..................................................... 161
Figure 119: Reducing Intermediaries in the Financing chain ......................................... 162
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

Figure 120: Operating Company and Asset Company structure for obtaining Financing........... 163
Figure 121: Risk Mitigation Tools in Financing ............................................................................. 164
Figure 122: Case Study of First Loss Guarantee.............................................................................. 165
Figure 123: Case Study of Foreign Exchange Hedge........................................................................ 166
Figure 124: Case Study of Blended Finance in Off-grid Sector ...................................................... 169
Figure 125: Key functions performed by VeraSol.............................................................................. 171
Figure 126: Technical Assistance and Capacity Building for different stakeholder groups....... 173
Figure 127: Training Initiatives for Off-grid Enterprises in COMESA and TDB region .............. 174
Figure 128: Modes of Delivery proposed in Capacity Building activities for Off-grid Companies/Mini-grid Developers.............................................................................................................. 174
Figure 129: Modes of Delivery proposed in Capacity Building activities for Financial Institutions ................................................................................................................................. 176
Figure 130: Modes of Delivery proposed in Capacity Building activities for Customers .......... 177
Figure 131: Roadmap for development of Off-grid Solar Sector ...................................................... 179
List of Tables

Table 1: Key Statistics of Trade and Development Bank .......................................................... 16
Table 2: Legal Framework in Ethiopia ......................................................................................... 61
Table 3: Legal Framework in Kenya ............................................................................................ 62
Table 4: Legal Framework in Madagascar ................................................................................... 63
Table 5: Legal Framework in Malawi .......................................................................................... 64
Table 6: Legal Framework in Rwanda ......................................................................................... 64
Table 7: Legal Framework in Uganda ......................................................................................... 65
Table 8: Legal Framework in Zambia .......................................................................................... 66
Table 9: Legal Framework in Zimbabwe ...................................................................................... 66
Table 10: Institutional Structure of Burundi .................................................................................. 71
Table 11: Institutional Structure of Djibouti .................................................................................. 71
Table 12: Institutional Structure of DR Congo ............................................................................. 72
Table 13: Institutional Structure of Eritrea .................................................................................... 72
Table 14: Institutional Structure of Ethiopia ............................................................................... 73
Table 15: Institutional Structure of Kenya .................................................................................... 74
Table 16: Institutional Structure of Libya .................................................................................... 74
Table 17: Institutional Structure of Madagascar .......................................................................... 75
Table 18: Institutional Structure of Malawi ................................................................................. 75
Table 19: Institutional Structure of Mozambique ........................................................................ 76
Table 20: Institutional Structure of Rwanda ................................................................................. 77
Table 21: Institutional Structure of Somalia ................................................................................. 77
Table 22: Institutional Structure of South Sudan ......................................................................... 78
Table 23: Institutional Structure of Sudan ................................................................................... 78
Table 24: Institutional Structure of Tanzania ............................................................................. 79
Table 25: Institutional Structure of Uganda .................................................................................. 79
Table 26: Institutional Structure of Zambia .................................................................................. 80
Table 27: Institutional Structure of Zimbabwe ............................................................................. 81
Table 28: Pillars for Mini-grid Development in Ethiopia .............................................................. 83
Table 29: Pillars for Mini-grid Development in Rwanda ............................................................... 84
Table 30: Pillars for Mini-grid Development in Sudan ................................................................. 85
Table 31: Pillars for Mini-grid Development in Tanzania .............................................................. 85
Table 32: Pillars for Mini-grid Development in Zimbabwe ........................................................... 86
Table 33: Benefits and Challenges of Grant Window ................................................................. 96
Table 34: Benefits and Challenges of Results-based Financing .................................................. 97
Table 35: Benefits and Challenges of Reward-based Crowdfunding ......................................... 98
Table 36: Potential Sources of Grant Financing in COMESA and TDB region ........................... 100
Table 37: Benefits and Challenges of Term Loan ....................................................................... 102
Table 38: Benefits and Challenges of Line of Credit ................................................................. 103
Table 39: Benefits and Challenges of Venture Debt ................................................................. 104
Table 40: Benefits and Challenges of Accounts Receivable Financing .................................... 104
Table 41: Benefits and Challenges of Securitization ............................................................... 105
Table 42: Benefits and Challenges of Convertible Note ........................................................ 106
Table 43: Benefits and Challenges of Revenue-based Mezzanine Debt ............................... 107
Table 44: Benefits and Challenges of Peer-to-Peer Business Lending ............................... 107
Table 45: Benefits and Challenges of Online Debt Based Securities ................................ 108
Table 46: Benefits and Challenges of Government Issued Mobile Bond ............................ 109
Table 47: Potential Sources of Debt Financing in COMESA and TDB region ....................... 111
Table 48: Benefits and Challenges of Common Stock ....................................................... 113
Table 49: Benefits and Challenges of Preferred Stock ....................................................... 114
Table 50: Benefits and Challenges of Equity Crowdfunding ............................................ 114
Table 51: Potential Sources of Equity Financing in COMESA and TDB region .................. 116
Table 52: Different Mini-grid Operator Models ............................................................... 139
Table 53: Pros and Cons of Utility Operator Model ......................................................... 139
Table 54: Pros and Cons of Private Operator Model ........................................................ 140
Table 55: Pros and Cons of Hybrid Operator Model ........................................................ 141
Table 56: Pros and Cons of Community Operator Model ............................................... 142
Table 57: Key responsibilities of major actors involved in the Implementation Wing ............ 156
Table 58: Recommendations for Institutional Structure and Policy Framework in COMESA and TDB countries ...................................................................................... 159
Table 59: Key Benefits and Challenges of Risk Mitigation Tools ....................................... 167
Table 60: Blended Finance Instruments for Off-grid Sector .............................................. 168
List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFDB</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
</tr>
<tr>
<td>CAPEX</td>
<td>Capital Expenditure</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for Eastern and Southern Africa</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of the Parties</td>
</tr>
<tr>
<td>CSO</td>
<td>Civil Society Organization</td>
</tr>
<tr>
<td>DFI</td>
<td>Development Finance Institution</td>
</tr>
<tr>
<td>DFID</td>
<td>Department for International Development</td>
</tr>
<tr>
<td>EAPP</td>
<td>East Africa Power Pool</td>
</tr>
<tr>
<td>ESMAP</td>
<td>Energy Sector Management Assistance Program</td>
</tr>
<tr>
<td>ESREM</td>
<td>Enhanced Sustainable Regional Energy Market</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
</tr>
<tr>
<td>FI</td>
<td>Financial Institution</td>
</tr>
<tr>
<td>GBP</td>
<td>Great Britain Pound</td>
</tr>
<tr>
<td>GCF</td>
<td>Green Climate Fund</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GIZ</td>
<td>German Agency for International Cooperation</td>
</tr>
<tr>
<td>GNI</td>
<td>Gross National Income</td>
</tr>
<tr>
<td>GOGLA</td>
<td>Global Off-Grid Lighting Association</td>
</tr>
<tr>
<td>GW</td>
<td>Gigawatt</td>
</tr>
<tr>
<td>IDCOL</td>
<td>Infrastructure Development Company Limited</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>INDC</td>
<td>Intended Nationally Determined Contribution</td>
</tr>
<tr>
<td>IPP</td>
<td>Independent Power Producer</td>
</tr>
<tr>
<td>IRENA</td>
<td>International Renewable Energy Agency</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal Rate of Return</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>KW</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>MFI</td>
<td>Micro-Finance Institution</td>
</tr>
<tr>
<td>MIGA</td>
<td>Multilateral Investment Guarantee Agency</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>OPEC</td>
<td>Organization of the Petroleum Exporting Countries</td>
</tr>
<tr>
<td>OPEX</td>
<td>Operating Expenses</td>
</tr>
<tr>
<td>PAYGO</td>
<td>Pay-As-You-Go</td>
</tr>
<tr>
<td>PE</td>
<td>Private Equity</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>PPA</td>
<td>Power Purchase Agreement</td>
</tr>
<tr>
<td>PPP</td>
<td>Public-Private Partnership</td>
</tr>
<tr>
<td>PTA</td>
<td>Preferential Trade Agreement</td>
</tr>
<tr>
<td>PULSE</td>
<td>Productive Use Leveraging Solar Energy</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>RAERESA</td>
<td>Regional Association of Energy Regulators for Eastern and Southern Africa</td>
</tr>
<tr>
<td>RBF</td>
<td>Results Based Financing</td>
</tr>
<tr>
<td>RE</td>
<td>Renewable Energy</td>
</tr>
<tr>
<td>RIFF</td>
<td>Regional Infrastructure Finance Facility</td>
</tr>
<tr>
<td>RISE</td>
<td>Regulatory Indicators for Sustainable Energy</td>
</tr>
<tr>
<td>SAPP</td>
<td>Southern Africa Power Pool</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goals</td>
</tr>
<tr>
<td>SEFA</td>
<td>Sustainable Energy for All</td>
</tr>
<tr>
<td>SHS</td>
<td>Solar Home Systems</td>
</tr>
<tr>
<td>SIDA</td>
<td>Swedish International Development Agency</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium Enterprises</td>
</tr>
<tr>
<td>SPP</td>
<td>Small Power Producers</td>
</tr>
<tr>
<td>SPV</td>
<td>Special Purpose Vehicle</td>
</tr>
<tr>
<td>TDB</td>
<td>Trade and Development Bank</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>USADF</td>
<td>U.S. African Development Foundation</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
</tr>
<tr>
<td>VAT</td>
<td>Value Added Tax</td>
</tr>
</tbody>
</table>
Executive Summary

Common Market for Eastern & Southern Africa (COMESA) is the largest regional economic organization in Africa, with a population of about 583 million\(^1\). It constitutes 21 Member States with a common aim of promoting regional integration through trade and development of natural and human resources for mutual benefit of all the people in the region. It is one of the eight Regional Economic Communities (RECs) to be recognized by the African Union.

The Eastern and Southern African Trade and Development Bank (TDB) was established in 1985. It is a multilateral, treaty-based Development Finance Institution (DFI). The bank promotes trade, regional economic integration and sustainable development through its various offerings including Trade Finance, Project and Infrastructure Finance, Asset Management and Business Advisory Services.

COMESA and TDB have partnered with World Bank to implement the Regional Infrastructure Finance Facility (RIFF), an Investment Project Financing with the objective of expanding long-term finance to private firms in selected infrastructure sectors in Eastern and Southern Africa. RIFF has a credit line of USD 415 million and a grant of USD 10 million from Investment Development Association, World Bank.

With an intent of empowering energy sector for realizing its regional integration agenda, COMESA RIFF engaged Deloitte Touche Tohmatsu India LLP (DTTILLP) to do a “Need and Market Assessment of the Off-grid Renewable Energy (Solar Energy) Sector in the COMESA and TDB region”. The proposed work included assessment of off-grid renewable energy (RE) market in the region, understanding the role of Financial Institutions (FIs) in commercial/consumer financing to solar sector and proposing business models to incentivize and support adoption of off-grid renewable energy in the region.

Around 40% of the population in the COMESA region has no access to electricity\(^2\). Also, there is significant disparity in electricity access between rural and urban population in COMESA and TDB countries. Except for few countries such as, Mauritius, Seychelles, Egypt, Tunisia, Comoros, Eswatini and Kenya other countries in COMESA and TDB region are struggling with very low level of electrification in rural areas. Rural electricity access in countries such as South Sudan, Mozambique, Malawi, Burundi, DR Congo is less than 10%.

One of the major reasons identified for low electricity access level in the region is the lack of investment especially from the private sector. The off-grid renewable energy solutions can dramatically accelerate the growth trajectory of electricity access in the region.

---

\(^1\)Source: COMESA

\(^2\)Source: COMESA
The countries in the COMESA and TDB regions are at different levels of maturity when it comes to off-grid solar sector. Countries such as Kenya, Ethiopia, Tanzania, Uganda, and Rwanda are quite advanced when it comes to off-grid solar sector; whereas countries such as DRC, Madagascar, Zimbabwe, Malawi, Mozambique, Zambia have a reasonable market for off-grid solar and are gradually evolving but have certain gaps which need to be bridged for scaling the sector. However, countries such as Burundi, Djibouti, Libya, South Sudan, Sudan, and Somalia have underdeveloped market for off-grid solar and require the most policy, institutional, financial, capacity building support for building their off-grid solar market.

Deployment of off-grid technologies on a massive scale requires conducive legal framework and robust institutional setup to ensure effective implementation of national energy access strategies and related policies including policies for off-grid. Presence of key Policies and mini-grid frameworks are necessary for an enabling ecosystem for deployment of off-grid solutions. Similarly, presence of key institutions such as Ministry of Energy, Regulatory Authority, Rural Electrification Agency and Renewable Energy Association and their operational autonomy are important for effective off-grid deployment. Countries such as Djibouti, Eritrea, Libya, Mozambique, Somalia, South Sudan, and Sudan would need to focus on strengthening their legal and institutional framework for greater adoption of off-grid solutions. However, other countries such as Ethiopia, Kenya, Madagascar, Malawi, Rwanda, Uganda, Zambia, and Zimbabwe are getting considerable support to the off-grid sector and they can aggressively pursue their universal access goals.

The off-grid solar sector in COMESA and TDB regions also face various financing challenges such as high cost of capital, lack of collateral, unwillingness of local Financial Institutions to lend, etc. Various measures will have to be undertaken to overcome the financing challenges in the sector and increase investor appetite; including bundling of mini-grid projects (with low-risk correlation) and SHS units to reduce the overall risk, reducing the intermediaries in the financing value chain, introducing risk mitigation tools such as political risk insurance first loss guarantees, collateral buyback, etc.

Robust quality assurance measures are also imperative to establish credibility of off-grid products in the market. Adequate measures are required for adhering to the Quality Standards for off-grid solar products. Quality assurance program, launched by Lighting Global can be adopted by COMESA and TDB countries for selecting suppliers, streamlining import processes, meeting customer expectations and reducing the cost of providing warranty services.

Based on needs assessment and various recommendations, a Roadmap needs to be developed to achieve the objective of off-grid electrification and the milestone of universal access in the region. Various measures are required to promote the consumer awareness and enhance consumer adoption of off-grid solutions. The Roadmap can be tailor made to meet the requirements and address the needs of individual countries to achieve universal access. Periodic monitoring is essential to set accurate objectives and performance targets for each activity, measure gaps between planned and actual achievements and propose corrective measures for continuous improvement to achieve the mission of universal access.
A. Engagement Context

1. About COMESA
The Common Market for Eastern and Southern Africa (COMESA) consists of 21 African Member States with the goal of promoting regional integration through trade and the development of natural and human resources for the mutual benefit of all the people in the region. COMESA's history began in December 1994, when it was established to replace the old Preferential Trade Area (PTA), which had existed since 1981. COMESA (as defined by its Treaty) was founded "as an organisation of free independent sovereign states that have agreed to cooperate in developing their natural and human resources for the benefit of all their people," and therefore it has diverse set of goals which include regional peace and security as top priorities. COMESA's major focus is on the establishment of a huge economic and trading unit capable of overcoming some of the limitations that individual states confront.

Member states of COMESA include Burundi, Comoros, DRC, Djibouti, Egypt, Eritrea, Eswatini, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Somalia, Sudan, Tunisia, Uganda, Zambia & Zimbabwe. The different benefits offered by COMESA to its member countries include:

Figure 1: Benefits offered by COMESA to its Member Nations

Source: COMESA

COMESA has various institutions, each of which is entrusted with a specific responsibility:

---

3 Source: COMESA
• COMESA Court of Justice (CCJ): It upholds the rule of law in the enforcement of COMESA Treaty
• COMESA Business Council (CBC): It promotes business participation in regional integration, investment and global trade
• Regional Investment Agency (RIA): Investment promotion arm of COMESA responsible for attracting regional and international investors
• Africa Leather and Leather Products Institute (ALLPI): It promotes the development of leather industry in COMESA countries
• Africa Trade Insurance Agency (ATIA): It provides political risk insurance to companies, investors and lenders interested in doing business in Africa
• COMESA Competitions Commission (CCC): It promotes competition by preventing restrictive business practices and protecting consumers
• PTA Reinsurance Company (ZEP-RE): Underwrites life and non-life reinsurance risks in member states such as Kenya, Ethiopia, Tanzania, Zimbabwe, Uganda and Sudan
• COMESA Monetary Institute (CMI): It is responsible for implementation of the COMESA Monetary Cooperation Programme
• Federation of National Associations of Women in Business in COMESA (FEMCOM): It promotes programs that integrate women into trade and development activities
• The Regional Association of Energy Regulators for Eastern and Southern Africa (RAERESA): It has objectives of capacity building in energy sector, facilitation of energy supply policy, legislation and regulations
• Trade and Development Bank (TDB): It is a trade and development financial institution in Africa which serves as the financial arm of COMESA

2. About TDB
The Eastern and Southern African Trade and Development Bank (TDB) was established in 1985. It is a multilateral, treaty-based Development Finance Institution. The bank promotes trade, regional economic integration and sustainable development through its various offerings: Trade Finance, Project and Infrastructure Finance, Asset Management and Business Advisory Services.

TDB’s regional members consist of Burundi, Comoros, DRC, Djibouti, Egypt, Eritrea, Eswatini, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe. TDB also consist of non-regional members such as People’s Bank of China and JSC Development Bank of the Republic of Belarus. 15 institutional members such as African Reinsurance Corporation (Africa-Re), African Development Bank (AfDB), African Economic Research Consortium (AERC), Arab Bank for Economic Development in Africa (BADEA), BNI Mozambique, Caisse Nationale de la Securite Sociale of Djibouti, Eagle Insurance (Mauritius), Investment Fund for Developing Countries, National Pensions Fund (Mauritius), NSSF Uganda, OPEC Fund for International Development,
PTA Reinsurance Company, Rwanda Social Security Board, Sacos Insurance Group (Seychelles) and Seychelles Pension Fund also form a part of TDB.

Table 1: Key Statistics of Trade and Development Bank

<table>
<thead>
<tr>
<th>Key Statistics</th>
<th>Year 2021 Value in USD (Approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Income</td>
<td>248 million</td>
</tr>
<tr>
<td>Profit after Tax</td>
<td>174 million</td>
</tr>
<tr>
<td>Total Assets</td>
<td>7, 943 million</td>
</tr>
<tr>
<td>Equity</td>
<td>1, 733 million</td>
</tr>
<tr>
<td>Return on Equity</td>
<td>10%</td>
</tr>
<tr>
<td>Credit Rating</td>
<td>Baa3 (Moody's) and BB+ (Fitch Ratings)</td>
</tr>
</tbody>
</table>

Source: Trade and Development Bank

3. RIFF Project

The Regional Infrastructure Finance Facility (RIFF) is an Investment Project Financing, with a credit line of USD 415 million and a grant of USD 10 million from Investment Development Association, World Bank. The borrowers are the Trade and Development Bank (TDB) and the Common Market for Eastern and Southern Africa (COMESA) Secretariat. The objective of the project is to expand long-term finance to private firms in selected infrastructure sectors in Eastern and Southern Africa. The project is expected to be implemented between the years 2020 to 2025. The project has 3 components:

- **Project and Infrastructure Finance Facility (USD 325 million):** Credit line facility to provide long term project finance to infrastructure projects
- **COVID Infrastructure Sector SME Response (USD 75 million):** Provide debt financing to Solar Home Systems SMEs operating in Southern and Eastern Africa
- **Capacity Building and Technical Assistance (USD 25 million):** USD 15 million component to support TDB’s scale up project and strengthen its capacity on Environmental and Social safeguards. USD 10 million component to support COMESA Secretariat to expand regional infrastructure finance market and build foundation for off-grid energy market.

As part of the RIFF project, TDB has started financing off-grid enterprises in the region. **TDB closed a USD 4.2 million financing deal with Sunspot Energy Kenya Limited to finance Solar Home Systems in Kenya.**

4. Engagement Objective

Most of the Countries in COMESA and TDB regions are lagging in terms of rural electrification levels. The off-grid energy solutions can offer a faster and cheaper alternative to achieve the

---

4 Source: Trade and Development Bank
5 Source: Trade and Development Bank
SDG7 Goal of universal access to affordable, reliable, sustainable, and modern energy services in the African Region.

In sync with the SDG7 goal of energy access for all, COMESA has set for itself the target of building an enabling environment for private sector infrastructure development in the off-grid energy market in the COMESA region. There is a large infrastructure financing gap in the COMESA region which affects the power sector expansion. COMESA aims to promote off-grid renewable energy growth in the region by identifying countries that need support to introduce various market development activities, study and harmonize policies & regulations for trade & investments at regional and national levels, and conduct other regional integration activities on the off-grid energy sector to achieve universal access.

COMESA recognizes the strategic importance of empowering energy sector for realizing its regional integration agenda. With this objective in mind, DTTILLP has been engaged to do the “Needs and Market Assessment of the Off-grid Renewable Energy (Solar Energy) in the COMESA and Trade and Development Bank (TDB) region”.

The main objective of the assignment is to provide support to assess the overall market needs for off-grid renewable energy implementation and expansion in COMESA and TDB regions.

**Figure 2: Key Objectives of the Engagement**

1. Establish the current state of access and Off-grid market environment, including the review of trade conditions for renewable energy equipment at regional and national level

2. Understand the role of financial institutions in the provision of commercial and/or consumer financing to the Off-grid solar sector

3. Propose models to incentivize and support the Private Sector and Financial Institutions to expand Off-grid solar solutions and to harmonize a regional market to achieve universal access

*Source: Deloitte Analysis*

Keeping the overall aim of the project in mind, the overall approach and methodology was focussed on the as-is analysis, studying of various business models, identifying barriers, understanding role of financial institutions, proposing business models to support private sector and knowledge transfer for effective implementation. An implementation roadmap has been prepared to handhold the stakeholders in the overall process of achieving universal access through off-grid electrification.
B. Economic Overview & Electrification Trends in COMESA and TDB Region

1. Global RE Trends
The 26th UN Climate Change Conference of the Parties (COP26) held in Glasgow in 2021 was attended by leaders from 120 countries. They negotiated for about two weeks on action for climate change. The outcome of COP26 was the Glasgow Climate Pact. The four main goals of Cop26 are - “Secure global net-zero by mid-century and keep 1.5 °C within reach; adapt to protect communities and natural habitats; mobilize finance; and work together to deliver”.

Figure 3: Key Goals of COP26

Mitigation: The countries agreed to limiting increase in global average temperature to well below 2°C and pursuing efforts to limit it to 1.5 °C to achieve net zero by 2050. 153 countries put forward new 2030 emission targets (NDCs). About 90% of the world’s GDP is currently covered by Net Zero targets.

Adaptation: The countries agreed to boost efforts to deal with the impact of climate change. The global average temperature is already higher by 1.1 °C due to global warming. 80 countries are now covered by either Adaptation Communications or National Adaptation Plans to increase

---

6 Source: UN
7 Source: UK COP26
preparedness to the impact of climate change. The countries committed to doubling the 2019 adaptation financing by 2025.\textsuperscript{8}

**Finance:** Developed countries have been falling short on their annual USD 100 Billion commitment to developing countries. The Glasgow Pact reaffirmed the pledge and the developed countries expressed confidence to reach the target by 2023. Developed countries committed to stop funding the fossil fuel energy sector and increase the funding to Least Developed Countries Fund to fight Climate Change.\textsuperscript{9}

**Collaboration:** At COP26, countries agreed to finalize the Paris Rulebook for establishing a framework for common reporting of emissions and support, standards for international carbon markets and timeframes for emissions reduction targets.

**World is Increasingly Adopting Green Energy**
The world has shown commitment towards fighting climate change by reducing carbon emissions. The energy sector is a major contributor of carbon emissions leading to catastrophic phenomena such as global warming and greenhouse effect. To mitigate the impact of climate change, the world is increasingly transitioning to green sources of energy. The total RE installed capacity in the world stood at nearly 3055 GW in 2021. The annual capacity additions have been witnessing an increasing trend as depicted in the trend below:

*Figure 4: Annual Renewable Energy Capacity Additions of Major Technologies Globally*

\[\text{Source: IRENA}\]

\[\text{Source: UK COP26}\]

\[\text{Source: UK COP26}\]
In 2020, over 165 countries had targets for Renewable Energy. Many countries such as China, US, UK, Japan and Kenya have submitted stronger Nationally Determined Contributions (NDCs) under the Paris Agreement. The developed countries such as US, Germany and developing countries such as China, Brazil, India are leading in the installation of Renewable Energy.

Figure 5: Countries leading in Installed Renewable Energy Capacity in 2020

Source: REN 21

Overview of Global Solar Energy Sector
Solar Energy is the fastest growing segment in the Renewable Energy industry. The installed capacity of solar energy has increased from 301 GW in 2016 to 717 GW in 2020, growing at a CAGR of 19%.

Figure 6: Annual Solar Capacity Additions Globally

Source: IEA

10 Source: REN 21
Most of the new capacity additions have been in the Utility-scale projects accounting for more than 50% of the annual capacity additions. The solar installation in the off-grid sector has just been 0.5 GW in 2020. The off-grid solar sector is expected to grow due to the impact of increasing investments and favourable regulations in this space.\textsuperscript{11}

**Global Investment Trends in Renewable Energy Sector**

The global investment in renewable energy sector has seen an uptrend over the past decade. The investments have grown from USD 266 Billion in 2011 to USD 303 Billion in 2020. 2020 was the 6\textsuperscript{th} consecutive year when the investments in developing countries exceeded those made in developed countries. Solar power represented nearly half of global renewable energy capacity investment in 2020, at USD 148.6 billion.\textsuperscript{12}

*Figure 7: Trends in Global Renewable Energy Investment*

In 2020, China was the leader in overall renewable energy investment accounting for nearly 28% of the global investment. The highest investment by region in 2020 was observed in Asia and Oceania, followed by Europe, Americas (North America and South America), Middle East & North Africa and finally Sub-Saharan Africa.\textsuperscript{13}

A majority portion of Africa has been left out of energy transition as only 2% of global investments in renewable energy in the last two decades were made in Africa and electrification rate in Sub-Saharan Africa was only 46% in 2019.

\textsuperscript{11} Source: IEA
\textsuperscript{12} Source: REN 21
\textsuperscript{13} Source: REN 21
Despite low investment in the region, the region possesses good resource potential of wind, solar, hydro, and geothermal energy which can be exploited for economic growth of the region.

The decarbonization policies have fuelled the Renewable Energy capacity additions at a faster pace worldwide. The developed countries have committed to support developing countries with USD 100 billion investment in climate finance every year, which they are expected to accomplish by 2023. The developing countries have surpassed developed countries in terms of annual investment in renewable energy. Developing countries such as China and India are leading the revolution in adoption of RE.

2. Macroeconomic View of COMESA Region

The COMESA region with its 21 member states was established to promote economic prosperity by utilizing the region’s natural and human resources. COMESA has been one of the fastest growing regions in the World, consistently growing at a rate higher than both the World and Africa average. The region grew by an impressive 5.2% in 2019 before the COVID pandemic put brakes on its growth journey in 2020. The region still managed to show resilience compared to Africa and the World during the pandemic by registering a growth rate of 0.2%.14

---

14 Source: COMESA
The low GDP growth rate (0.2%) of COMESA in 2020 was due to majority of COMESA countries registering negative growth due to the pandemic induced lockdown disruptions. Some of the countries fared better than the others such as DRC, Malawi, Uganda, Egypt, Comoros and Ethiopia, growing faster than both the region and global average inspite of the impact of pandemic.

In 2021, the economic situation of the COMESA countries improved due to easing of lockdown restrictions and vaccination efforts. All the countries witnessed positive GDP growth rate in 2021 due to the impact of low GDP in the base year (2020). Economies like Libya, Kenya, Rwanda and Eswatini bounced remarkably after the pandemic with higher GDP growth rate than the world average (5.8% in 2021).
Despite having higher GDP growth rate than both the World and Africa, COMESA region has a lower per capita GDP. The low GDP in absolute terms in COMESA is primarily due to low consumption, lack of investment and negative trade balance.

Though COMESA countries such as Seychelles, Libya and Mauritius are prosperous countries with high economic output per person, most of the countries are economically weak. Most of the COMESA countries had a GDP per capita which was lower than world average (USD 18,724 in 2021).\textsuperscript{15}

\textsuperscript{15} Source: World Bank
13 out of total 21 COMESA countries such as Burundi, Comoros, DRC, Djibouti, Eritrea, Ethiopia, Madagascar, Malawi, Rwanda, Somalia, Sudan, Uganda, and Zambia have been categorized by UN as Least Developed Countries (LDCs) on the criteria of per capita income, human assets and economic vulnerability. These LDCs require support from international community in terms of development financing, multilateral trading system and technical assistance for their socio-economic progress.

**Figure 14: COMESA Inflation Trend**

Source: COMESA
The inflation in COMESA region has seen an uptrend over the last few years. The recent inflation spike has been driven by rising food, commodity and fuel prices due to pandemic-related containment measures. The COMESA countries such as Sudan and Zimbabwe witnessed mammoth consumer price inflation of 382.8% and 98.5% respectively in 2021.

*Figure 15: COMESA Fiscal Balance Trend*

COMESA’s overall fiscal deficit has widened over the years. The fiscal deficit as percentage of GDP widened by 0.9% to 5.7% in 2020 from -4.8% in 2019. The recent fiscal deficit has been triggered by increase in borrowing and fall in revenue during the COVID-19 pandemic. Most countries in the region responded to the pandemic with fiscal packages which consisted of massive health spending, tax cut measures to cushion households and SMEs, support to vulnerable households through cash transfers and food rations etc. As a result of these measures, the region’s average government debt as percentage of GDP increased to 59.3% in 2020 from 56.6% in 2019.

**Trade View of COMESA**

Trade development has been a key focus area of COMESA. It was established to promote trade through regional integration and harmonization of policies. Today, COMESA is a major marketplace for both internal and external trade. COMESA has the following objectives for Trade Promotion:
The **global trade of COMESA** was **USD 324 billion in 2019** (imports of nearly USD 212 billion and exports of nearly 112 billion).\(^{16}\)

In 2019, COMESA’s **top export destinations were EU, UAE, South Africa, China, US, Switzerland, Saudi Arabia, Turkey and India**. Highest exports were observed in manufacturing sector followed by fuel, food, ores and metals. In 2019, COMESA’s **top import sources were EU, China, India**, etc.
USA, UAE, Saudi Arabia, South Africa, Turkey and Russia. COMESA’s intra-COMESA trade account for a small percentage (7% in 2019) of its global trade.\(^{17}\)

*Figure 18: COMESA Average Productive Capacities Index*

![COMESA Average Productive Capacities Index 2010-2018](image)

*Source: Intra COMESA Export Trade Potential Report 2021*

As per the UNCTAD’S Productive Capacities Index, COMESA performs well in private sector and natural capital productive capacities; however, it lags in many sectors including energy sector. With a productive capacity index of 20.5, energy infrastructure requires special attention to promote regional integration.

To promote economic growth, the countries would need a favourable business environment where processes such as starting a business, dealing with construction permits, obtaining power, registering property, accessing finance, paying taxes, trading across borders, etc. will have to be streamlined.

Some of the COMESA countries such as Mauritius, Rwanda and Kenya are ranked high in the ease to do business index and are therefore attractive destinations for investors. Mauritius undertook some significant reforms which includes automation of public services, reviewing of licensing procedures, and regulatory amendments through its Business Facilitation Acts. The country has experienced rise in the Ease of Doing Business rankings due to consistent reforms since 2005, the time required to register a property has decreased by more than 12-fold, while the time required to incorporate a business has decreased by nearly 10-fold.\(^{18}\)

\(^{17}\) *Source: COMESA Annual Report 2020*

\(^{18}\) *Source: Sovereign Group*
Majority of the COMESA countries lag in the Ease of Doing Business rankings because of the challenging business environment. Zimbabwe faces business challenges due to hyperinflation, volatile exchange rates, shortage of foreign currency and absence of ports. Countries such as Ethiopia, Comoros and Madagascar lag in the Ease of Doing Business due to challenges in obtaining electricity and finance. Countries such as Burundi, Sudan, DRC, Libya and Somalia face governance, economic and business challenges due to their political instability caused by their history of armed conflicts.

COMESA has been undertaking programs to improve trade, customs, and monetary cooperation for creating integrated and competitive marketplace in which commodities, services, capital, and labour can freely move across national borders. COMESA has implemented regional strategies such as creating Free Trade Area and COMESA Simplified Trade regime to boost cross border trade in the region:

---

**Figure 19: Ease of Doing Business Ranking in COMESA countries**

Source: World Bank

**Figure 20: COMESA regional strategies**

Source: COMESA
The COMESA is one of the fastest growing economic regions in the world. The economic growth and growing population are expected to fuel the electricity demand in the region. The region has some Least Developed Countries (LDCs) in the world which offer huge potential for development. Majority of the COMESA countries have a tough environment for doing business therefore the region needs favourable policies for trade promotion. COMESA has taken some active steps such as establishment of Free Trade Area and Simplified Trade Regime to incentivize trade.

3. Electrification Scenario in COMESA and TDB region

Electricity access is crucial for poverty alleviation, economic growth, and improved lifestyle. The UN recognizes the importance of electricity access and has set a Sustainable Development Goal (SDG7) of Ensuring Access to Affordable, Reliable, Sustainable and Modern Energy for All by 2030. IEA estimated that providing universal energy access globally by 2030 would require an investment of USD 31 billion per year and majority of this investment needs to be routed to Sub-Saharan Africa region.

The electricity access in COMESA region is low which impacts its economic growth. COMESA has a population of about 583 million and only 60% of this population has access to electricity.19 The electrification rate in COMESA is better than Africa but much lower than the world electrification rate.

Figure 21: Analysis of Electricity access rate (%) of COMESA, Africa and World

The COMESA and TDB countries have a huge gap between the demand and supply of energy. The demand for energy is growing on account of increasing population and economic growth. There is deficit in energy supply due to lack of grid expansion, rehabilitation of generation assets and financing of new assets.

19 Source: COMESA

© 2022 Deloitte Touche Tohmatsu India LLP  Page | 30
There is significant disparity in electricity access between rural and urban population in COMESA and TDB countries. The rural electrification rate in COMESA and TDB countries such as South Sudan, Mozambique, Malawi, Burundi, DR Congo is low to the extent that less than 10% of rural population has access to electricity in these countries.  

Source: World Bank Database
Countries such as Mauritius, Seychelles, Egypt, Tunisia, Comoros and Eswatini have high rural electrification rate as these countries have well established institutions for electricity development. Most of these countries depend on fossil fuels to a large extent for their electricity generation. Due to the recent impetus on climate change, these countries have started to frame policies, programs and projects to diversify their energy sources and include renewable energy in their generation portfolio. A brief overview of the Power Sector of these countries is discussed below:

**Mauritius**

The country is one of the most developed countries in the COMESA and TDB regions. The country has 100% rural access to electricity with a total installed capacity of 877 MW in 2020. The energy mix consisted of 71% non-renewable and 29% renewable sources (11% Bioenergy, 10% Solar energy, 7% Hydro energy and 1% Wind energy).\(^{21}\)

The country has a vision of increasing share of renewable energy to 35% of the energy mix by 2025 and maintain it at this target by 2030. To fulfil this vision of the government, Mauritius Renewable Energy Agency (MARENA) was setup in 2016 for promotion of renewable energy. The institution has objectives of creating an enabling environment for the development of renewable energy, sharing information and experience on renewable energy research and technology, and fostering collaboration with institutions at regional and international levels for promoting renewable energy. The country is implementing a Green Energy Scheme for Cooperatives in line with Government’s vision of increasing RE in overall energy mix.\(^{22}\)

**Seychelles**

Seychelles is an archipelago of 115 islands off East Africa in Indian Ocean. It has 100% rural electrification rate but most of the energy generation (97% in 2019) occurs through non-renewable sources. The country had a total installed capacity of 126 MW in 2020. The installed capacity consisted of 92% non-renewable and 8% renewable sources (5% Wind energy and 3% Solar energy).\(^{23}\)

---

\(^{21}\) Source: World Bank, IRENA  
\(^{22}\) Source: IEA  
\(^{23}\) Source: World Bank, IRENA
The Republic of Seychelles is working actively to increase renewable energy in the overall energy mix. Ministry of Environment, Energy and Climate Change (MEECC) is working on Seychelles 100% Renewable Energy Strategy (SeyRES 100). Sustainable Power Solutions (SPS), a South African-based company, built the first off-grid solar power plant on Alphonse Island in the Seychelles in 2018. The government is also focusing on the training of technicians and financial officials in off-grid sector by collaborating with Gridworks and Sustainable Power Solutions. UNDP has been the country’s partner for its transition to renewable energy.

Figure 25: PV Democratization 2.0 Project in Seychelles

---

**Case Study: PV Democratization 2.0 Project**

The PV Democratization 2.0 Project is a project led by Seychelles Energy Commission which is a recipient of Climate Investment Platform’s Thomas Jensen Energy Transition Award. Through the Climate Investment Platform, UNDP is supporting Seychelles in adoption of renewable energy. The PV democratisation 2.0 project aims to increase access to solar PV to households who cannot afford a rooftop PV system by providing them with a low-cost loan. Through this project, the Government of Seychelles will identify large rooftops suitable for PV installation. Consumers can buy a share of the system and pay it back by monthly installments through electricity bills or other mechanisms.

Source: UNDP

**Egypt**

The country is a net exporter of energy with 100% rural electricity access rate. However, the country’s energy sources are not diversified. The total installed capacity in 2020 was 59,420 MW, out of which 90% was from non-renewable sources and 10% (5% hydro, 3% solar and 2% wind) from renewable energy sources.

The country has implemented policies for RE development in the last two decades. Egypt’s Supreme Council of Energy announced New National Renewable Strategy in 2008 to generate 20% of the country’s electricity from renewable sources by 2020, target which couldn’t be met in 2020. Nevertheless, the generation from RE sources such as solar and wind has seen an uptrend over the years. Egypt adopted the Renewable Energy Law in 2014 to encourage the private sector participation in production of renewable energy. The Law introduced competitive bids, feed-in tariff, and independent power production through third party access. The country has also employed off-grid projects for rural electrification in the past decade.

---

24 Source: World Bank, IRENA

25 Source: IEA
Tunisia
The North African country has 100% rural electrification rate. The country had a total installed capacity of 6673 MW in 2020, out of which 94% was from non-renewable and 6% was from renewable sources (4% Wind energy, 1% Solar energy and 1% Hydro energy).26

The country established Energy Efficiency Fund (FNME) in 2006 to guarantee public support to energy efficiency and renewable energy activities through the allocation of subsidies. The country implemented tax exemptions on renewable energy equipment way back in 1995 which were again revised in 2010.27 The country has presence of enabling policies for development of renewable energy.

Comoros
The archipelago had a rural electricity access rate of 81% in 2020.28 There is significant electricity access disparity among the three islands. The country has an installed capacity of 23 MW in 2020, out of which 94% is from non-renewable sources and 6% from renewable sources (Hydro energy).29

The country has a high electrification rate, but the electricity service is poor in the country. Due to lack of rehabilitation and maintenance, the generation is often below the installed capacity. The electricity tariffs are high and the national utility, SONELEC is in a state of financial distress.

26 Source: World Bank, IRENA
27 Source: IEA
28 Source: World Bank
29 Source: IRENA
The country is reliant on imported fossil fuels for its energy generation. The country needs to diversify its energy sources for reliable and cheap supply of electricity. Development Partners such as World Bank are helping the country diversify its energy mix to solve existing problems in the electricity sector.

**Figure 28: Case Study of Comoros Energy Integration Platform**

*Case Study: Comoros Solar Energy Integration Platform*

The project is financed by IDA World Bank and is being implemented by Ministry of Production, Environment, Energy, Industry and Handicrafts. The objective of the project is to improve commercial performance of electricity utility and its capacity to dispatch renewable energy. The key focus areas of the project are:

- **Financing of 9 MWp (Megawatt Peak) of PV** on a pilot basis on Grande Comore
- **Strengthening SONELEC’s financial performance** by improving billing and metering infrastructure, as well as targeted consumer awareness campaigns

The project is expected to create a demonstration effect for participation by development partners and private financiers in renewable energy projects in future.

*Source: World Bank*

**Eswatini**

The Southern African country had a rural electrification access rate of 76% in 2020. The country has a target to increase total electrification access rate to 85% in 2022. The country had an installed capacity of 179 MW in 2020 out of which 6% was from non-renewable sources and 94% from renewable sources (59% Bioenergy, 35% Hydro energy and 1% Solar energy).

The country’s generation supply is less than its demand and it has to import electricity from Eskom in South Africa to make for its shortfall. The country is implementing policies for renewable energy deployment to address this gap. The country promulgated a National Energy Policy in 2018 to support development of renewable energy sources to provide households with access to modern, efficient and affordable energy. The Ministry of Natural Resources and Energy released an Energy Masterplan in 2018 which stated the importance of off-grid solutions (mini-grids and SHS) for electrification in areas where grid extension is not viable due to high capital costs. In 2018, MNRE in conjunction with UNDP created a framework to achieve affordable clean energy for all, known as the Partnership for Affordable Renewable Energy (PAREE). UNDP is assisting Eswatini to access funding for off-grid solutions from a Global Environment Facility (GEF).

---

*Source: World Bank*

*Source: World Bank, IRENA*
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

Figure 29: Partnership for Affordable Renewable Energy in Eswatini

**Case Study: Partnership for Affordable Renewable Energy (PAREE)**

UNDP has a aim to promote investment in renewable energy and build generation capacity through public private partnerships in Eswatini. The PAREE framework aims to assist Eswatini in attracting investment into both On-grid and Off-grid renewable development projects. The PAREE framework identified the need to:

- Conduct feasibility studies to identify appropriate Mini-grid pilot sites
- Establish at least 4 Mini-grids
- Roll out 200 solar home systems

Source: UNDP

**Countries Studied in Detail as part of Engagement**

The 18 COMESA and TDB countries that have less than 70% rural electrification rate in 2020 have been analysed in detail on aspects such as present off-grid market, Institutional and Legal framework, Financing, etc. as part of this engagement to provide recommendations for scaling up off-grid solar energy in these 18 countries.

Most of the COMESA and TDB countries such as Ethiopia, Uganda, Rwanda, Malawi, DR Congo, Sudan, Madagascar, South Sudan, Mozambique, Somalia, Burundi are Low Income nations. The consumer affordability of electricity is a big constraint restricting electricity access in COMESA and TDB region. Somalia, South Sudan, Madagascar, Malawi & Eritrea have low affordability of electricity, the effect of which is reflected in the low rural electricity access rate in these countries.

Figure 30: Comparison of Electricity Affordability in COMESA and TDB region

Affordability of Electricity Score (2019)

<table>
<thead>
<tr>
<th>Country</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zambia</td>
<td>100</td>
</tr>
<tr>
<td>Tanzania</td>
<td>100</td>
</tr>
<tr>
<td>Sudan</td>
<td>100</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>100</td>
</tr>
<tr>
<td>Mozambique</td>
<td>93</td>
</tr>
<tr>
<td>Kenya</td>
<td>87</td>
</tr>
<tr>
<td>DR Congo</td>
<td>82</td>
</tr>
<tr>
<td>Uganda</td>
<td>80</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>67</td>
</tr>
<tr>
<td>Rwanda</td>
<td>67</td>
</tr>
<tr>
<td>Burundi</td>
<td>67</td>
</tr>
<tr>
<td>Madagascar</td>
<td>60</td>
</tr>
<tr>
<td>South Sudan</td>
<td>56</td>
</tr>
<tr>
<td>Somalia</td>
<td>53</td>
</tr>
<tr>
<td>Malawi</td>
<td>52</td>
</tr>
<tr>
<td>Eritrea</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: RISE ESMAP
COMESA realizes the importance of strengthening the energy sector to promote regional integration. Chapter 13 of the COMESA Treaty has listed various provisions for co-operation in the development of energy in the region. COMESA has taken various measures for the development of energy infrastructure in the COMESA region:

- **COMESA, TDB, and the World Bank have signed the RIFF Project:** It’s an Investment Financing Facility Project that is scheduled to run from July 2020 to September 2025 with the goal to expand long-term lending to private enterprises in chosen infrastructure in the electricity industry, as well as in the transportation, logistics, and social sectors.

- **RAERESA is implementing the Program on Enhancement of a Sustainable Regional Energy Market in Eastern Africa, Southern Africa, and Indian Ocean Region (ESREM)** funded by the European Union. As part of the program Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP -EA-SA-IO) was developed to create an enabling environment to promote investment in renewable energy. RAERESA also received a grant of USD 1.5 Mn from AfDB to drive cross-border power trading in the COMESA region.

- **COMESA is implementing the Zambia-Tanzania-Kenya (ZTK) electricity interconnector** which links the East African Power Pool (EAPP) and the South African Power Pool (SAPP) with the goals of promotion of electricity trade, enhancement of security of power supply and faster regional integration.

4. **Key Options to Expand Electricity Access in COMESA and TDB regions**

The huge electricity gap in the COMESA and TDB region needs to be addressed for enabling economic growth in the region. The type of electrification solution to be adopted depends upon different factors such as population distribution, investment levels, affordability, etc. The different kinds of electrification solutions that can be explored by COMESA and TDB region to expand access in the region are:
### Figure 31: Key Options to expand Electricity Access

<table>
<thead>
<tr>
<th>Options</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Extending the Main Grid | • Lowest cost of power generation  
• Good for high quantum of power demand | • High initial cost  
• Lengthy process to build  
• Cost rises with remoteness |
| Mini-grids/Micro-grid | • Local aggregation of demand  
• Powers AC or DC appliances | • Risk of stranded assets if the grid is extended  
• Low power demand makes it difficult to cover costs |
| Solar Home Systems  | • Deployed through retail channels  
• Targeting based on individual credit risk  
• Optimal for segregated population | • Costly per unit of energy  
• Limited range of appliances that can be powered |
| Solar Lanterns      | • Very little cost                                                           | • Provides only lighting and possibly phone charging  
• Generally considered insufficient for even basic electricity access |

*Source: Deloitte Analysis*

### Why Grid Expansion is not a Viable Option

Population density in countries such as Madagascar, Djibouti, Mozambique, DR Congo, Zimbabwe, Eritrea, Zambia, Somalia, Sudan, South Sudan and Libya is low than the world average (60 people/ sq. km)\(^{32}\); hence electrifying these countries with grid extension is cost inefficient.

There is also lack of resources for generating of power in the region. The region faces coal shortage for its thermal power plants and the frequent droughts lead to capacity underutilization in hydro plants. The coal production dropped by 4.1% in 2020 in South Africa\(^{33}\) (major supplier in Africa), and the world has set a target to phase out coal from power generation by 2040\(^ {34}\). All these factors are likely to impact the generation of grid electricity.

The grid extension is also difficult in tough terrain. The tough terrains such as those of Tibesti Mountains in Southern Libya and Ethiopian Highlands in Ethiopia pose challenges in transmission and distribution of electricity.

The existing grid electricity in COMESA and TDB region has been unreliable and marred by frequent outages. The infrastructure is old and in need of rehabilitation for which there has been lack of funds. Poor grid Infrastructure in countries such as DR Congo, Tanzania, Ethiopia, Kenya, and Zimbabwe cause frequent power outages (more than 200 hours in 2018)\(^ {35}\).

\(^{32}\) Source: World Bank  
\(^{33}\) Source: BP Statistical Review of World Energy 2021  
\(^{34}\) Source: UK COP 26  
\(^{35}\) Source: Statista
Why Off-grid RE solutions is a Viable Option

The off-grid solar systems are a viable option for providing electricity access in COMESA and TDB regions. These solutions are modular and cost effective, therefore these are particularly suited for COMESA and TDB countries where there is low population density and affordability. These solutions are easy to scale in a short period and can fulfil electricity needs of the large unserved population. The high solar irradiance and payment flexibility (consumer financing models such as Pay-As-You-Go) make them apt for adoption by consumers in COMESA and TDB regions for fulfilling electrification goals.

Figure 32: Benefits of Off-grid Solar Systems

<table>
<thead>
<tr>
<th>Technology</th>
<th>Economic</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proven technology solutions</td>
<td>Cost-competitive</td>
<td>Environmentally sustainable</td>
</tr>
<tr>
<td>Adaptable</td>
<td>Local job creation</td>
<td>Reduced Pollution</td>
</tr>
<tr>
<td>Scalable</td>
<td>Skill Development</td>
<td>Low carbon</td>
</tr>
<tr>
<td>Innovation in financing models</td>
<td>Benefits of modern energy access</td>
<td>Climate resilience</td>
</tr>
</tbody>
</table>

The COMESA and TDB regions have low electricity access rates because of lack of investment in generation and grid expansion. The region has some of the most electricity deficit countries of the world such as DRC, Burundi, Malawi, South Sudan, and Madagascar. The electricity infrastructure in the region is fragile and plagued with challenges such as lack of fuel, lack of infrastructure maintenance, lack of efficient policy support and lack of bankability of most of the utilities. Low population density, ageing grid infrastructure, lack of financial strength of utilities, lack of fossil fuel supply and tough terrain act as a barrier for grid extension in the region. The off-grid solutions are suited for providing electricity access to the poor and dispersed population in COMESA and TDB regions because they are cost-effective and easily scalable.
C. Off-grid Solar Market Assessment

1. Key Product Segments in Off-grid Market

The mini-grids and stand-alone systems are two basic approaches towards ‘off-grid systems’ and both types of systems operate independently of the national electricity grid:

- The stand-alone systems are small electricity systems, which are not connected to a central electricity distribution system and provide electricity to individual appliances, homes, or small businesses. They thus serve the needs of individual customers, while utilising locally available renewable resources.

- A mini-grid, also known as a micro or isolated grid, is an off-grid system that uses small-scale power generation (10 kW to 10 MW) and serves a small number of customers through a distribution grid that may function independently of national electricity transmission networks.

Stand-alone Solar Systems

The stand-alone solar household products can be segmented into three types based on price and function: Pico, Solar Home Systems (SHS), and Appliances.

Figure 33: Key Stand-alone Solar Systems Product Segment

Source: Deloitte Analysis

- **Pico Products**: Pico products consist of small, portable solar lanterns, flashlights, or lanterns designed to satisfy basic lighting needs as a direct substitute for kerosene lamps in a small household. These products are typically packaged either as a simple, one-light system with one LED light, an embedded 0.5–3.0 Watt-peak (Wp) solar panel, and an
internal rechargeable lithium-ion (Li-ion) battery or as multi-light systems of up to three or four LED lights with a standalone solar panel rated up to 10 Wp and a rechargeable Li-ion battery. Some models even contain USB charging for mobile phones. Pico-scale solar devices have the lowest entry cost for most rural, low-income families.

- **Plug-and-Play (PnP) Solar Home Systems**: PnP Solar Home Systems consist of an all-in-one packaged kit. The kit contains LED lights for multiple rooms (as many as 10, depending on size), a solar panel with power rating up to 100 Wp for small SHS and higher for large SHS, and a rechargeable battery. SHS products, can be pre-assembled for plug-and-play or based on open-market components, and offer functions such as powering appliances at higher price points. These systems may also comprise of assorted energy-efficient appliances, including mobile charging stations, radios, fans, televisions, and, in some higher-end systems, refrigerators.

- **Component-based Solar Home Systems**: In component-based systems, individual components, such as the solar photovoltaic (PV) module, battery, lights, inverter, wiring, and appliances, are sourced and assembled independently by either a product aggregator or an individual for their own household. Component-based SHS typically have power ratings above 11 Wp, which classifies them as SHS products, although some are smaller.36

- **Solar Powered Appliances**: The off-grid solar appliances are categorized by their intended use-case: household (fans, refrigerators, televisions etc.) or PULSE. Productive Use Leveraging Solar Energy (PULSE) is any agricultural, commercial, or industrial activity that uses solar energy as a direct input to the production of goods or provision of services. The popular PULSE products used in the market consist of solar water pumps, cold storage solutions, solar milling etc.

**Value Chain**

Broadly the stand-alone solar systems value chain can be divided into the following key segments:

*Figure 34: Standalone Solar Systems Value Chain Analysis*

![Value Chain Diagram](image)


Hardware Design and Manufacturing: Many manufacturers constitute this segment of the value chain, hence creating healthy competition. Commoditization of Pico goods, and to a lesser extent, SHS, has put downward pressure on prices as more participants have entered the market. Notable players in this segment are Sinoware, Renewit, Boxin Solar, BioLite, Amped Innovation, SolaRun Energy, Fosera, Lemi etc. which are carving a niche for themselves in this field.

Software Development: Software solutions are used in the market to process PAYGO payments, remotely regulate and lock usage of solar devices based on prepaid credit balances, offer call centre support to registered customers and monitor customer payment performance, sales agent performance, and inventory levels. The off-grid solar companies can either develop their own software or purchase software from a third-party provider. The off-grid solar companies such as Zola Electric and M-KOPA develop their own software. There is presence of several third-party suppliers, such as Angaza, Solaris, and Paygee, who offer PAYGO software to different off-grid solar clients in different parts of the value chain.

Marketing and Distribution: Marketing and distribution companies concentrate on retail and last-mile distribution to sell to businesses (B2B) or directly to consumers (B2C). Companies such as M-KOPA, BBOXX, d.light, and Greenlight Planet have established B2C distribution networks and use a mix of field-based staff, and customer care centres to deliver products and after-sale services to last-mile consumers. Certain OEMs, hardware, and software specialists have adopted B2B distribution models which enable them to sell their products and services directly to B2C companies; for instance, d.light also sells to PAYGO companies such as PEG Africa and Pawame, which then distribute products to their customers.

Consumer Financing: PAYGO model is the leading consumer finance model. The PAYGO business model permits the consumers to pay for off-grid products over time, increasing affordability for larger products. The users make an initial down payment and then regularly pay the off-grid company, gaining access to energy services for a specified period. The product is used as collateral, and systems can be de-activated and repossessed in the event of non-payment. To avoid sales to uncreditworthy consumers who are more likely to default, PAYGO companies must have strong in-house tools to assess consumer creditworthiness and default risk.

PAYGO implementation necessitates the usage of digital payment infrastructure. PAYGO has had a lot of success in East Africa, where mobile penetration and mobile money adoption rates are high, due to favourable regulation and government assistance. Low mobile-money penetration in other geographical areas, particularly in West and Central Africa, is a big barrier to PAYGO expansion. Several off-grid companies have outsourced finance to both Microfinance Institution (MFI) and larger financial institutions. Some MFIs are forming subsidiaries dedicated solely to the distribution and financing of solar products. MFIs such as FINCA Uganda and Baobab in Senegal have established subsidiary firms called BrightLife and Baobab+ to distribute and finance solar systems.

After Sales and End-of-Life Support: Most after-sales support services are integrated into the operations of companies that also provide distribution and consumer financing. Technical
services such as product operation, repair and maintenance are examples of after-sales assistance. Some newer companies, such as Village Energy in Uganda, offer customised after-market services such as solar system maintenance and repair.

**Mini-grids**
The State of the Global Mini-grids Market Report, 2020 commissioned by SEforALL defined mini-grid as a group of interconnected distributed energy resources (DERs) plus load(s) or a single DER plus load(s) within clearly defined boundaries. The main feature of mini-grids is their ability to operate independently, either in remote locations not reached by the Maingrid (isolated mini-grids) or in grid-connected areas where the electricity supply from the Maingrid may be interrupted (grid-connected mini-grids). The report classified micro-grid and mini-grid as having capacity between 1-10 KW and 10 KW-10 MW respectively. The mini-grids offer various advantages such as local aggregation of demand and higher reliability of electricity (Tier 3) than off-grid solar kits but suffer from risks of main grid arrival and low power demand which causes difficulty to recover cost.  

*Figure 35: Installed Mini-grids by Region and Technology*


**Value Chain**
The mini-grid value chain consists of the following broad elements of services:

*Figure 36: Mini-grid Value Chain Analysis*

Site Identification: The site identification involves activities such as analysing GIS data of settlements that lack electricity, talking to local communities, and conducting detailed studies on power demand and sources of renewables. Developers make site selection judgments based on factors such as distance from the Main grid, population density, average income, and economic activity level. In Sub-Saharan Africa, developers tend to focus on communities with existing commercial and industrial (C&I) facilities to ensure predictable level of demand.

Project Planning and Development: This phase involves the technical design of mini-grid systems, negotiating with relevant stakeholders including authorities and local communities for approvals, financing, administration works such as obtaining required licences, and capacity development.

Construction and Installation: The developers and local installers commit to civil and electrical works to build and commission a mini-grid system in this phase. Procurement and Logistics constitute integral activities of this phase.

Operation & Maintenance: Emergency response, fuel management and distribution, revenue collection, equipment replacement, and quality control are all part of this stage. Remote systems and control systems are typically installed in remote areas difficult to access by maintenance staff.

The standalone solar systems (Pico/SHS) and mini-grids are two types of off-grid solutions suitable for electrification of COMESA and TDB region. Pico/SHS solutions provide lower service level of electricity access (Tier 1-3) compared to mini-grids (Tier 2-5). Value chain of standalone solar systems is product-based whereas value chain of mini-grids is service-based.

2. Demand Potential for Off-grid Solar Solutions

Demand for off-grid solar products broadly comes from 2 key market segments:

- **People without electricity access**: These comprise of people remote from the grid and people under-the-grid (those who are near to but not connected to grids/mini-grids due to technical or financial constraints).
- **People with an unreliable grid**: These people face frequent or lengthy outages of grid electricity or experience voltage fluctuations that can damage electrical appliances.

The global potential of off-grid market remains substantial, with 840 million people without electricity access and over 1 billion connected to an unreliable grid. The highest potential occurs in the Sub-Saharan Africa region which contains large electricity deficit countries.

---

Figure 37: Potential for Off-grid Solar in Sub-Saharan Africa region

Potential Off-grid Solar Market (Millions of People)

<table>
<thead>
<tr>
<th>Region</th>
<th>Potential off-grid Solar Market (Millions of People)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>588 - 153</td>
</tr>
<tr>
<td>Eastern Africa</td>
<td>273 - 30</td>
</tr>
<tr>
<td>Western Africa</td>
<td>187 - 77</td>
</tr>
<tr>
<td>Central Africa</td>
<td>115 - 29</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>13 - 17</td>
</tr>
</tbody>
</table>


Within Sub-Saharan Africa region, the largest market for off-grid exists in Eastern Africa followed by Western Africa, Central Africa and Southern Africa. The market opportunity for off-grid solutions in COMESA region is huge with nearly 230 million people without electricity access. The existing grid infrastructure in the COMESA and TDB regions is weak and causes frequent power outages therefore off-grid solutions can also be used as a back-up for uninterrupted supply of electricity. The market potential for off-grid solutions in COMESA and TDB regions is:

Figure 38: Market Potential of Off-grid solutions in COMESA and TDB countries
The demand for off-grid solutions comes from population without electricity access and those with unreliable grid connections. Countries such as Madagascar, South Sudan, Mozambique, Malawi, Burundi, and DRC have less than 10% rural electrification access as per 2019 estimates (World Bank). The potential market for off-grid solutions is more than 5 million households in countries such as DRC, Ethiopia, Tanzania and Kenya.

Customer Segmentation
The off-grid solar solutions can serve different consumer types such as agriculture, public establishments, commercial & industrial and households.

Figure 39: Customer Segmentation for Off-grid Solutions

Households
According to our estimate, nearly 40 million households (assuming 6 people per household) in COMESA region lack access to electricity. These households depend on polluting sources such as kerosene to meet their energy needs which poses environment and health hazards. The off-grid solar solutions can provide electricity access to such households which that are remote and unconnected with the grid.

Complex geographies such as island nations and mountainous countries pose challenges for grid electrification. Laying cable is often not economically viable, even if it is technically possible. Undersea cables to islands are viable only if they are close to a Main-grid and there is enough power demand to justify the cost.
The off-grid solutions such as mini-grids have been a viable source of providing electricity to island communities across Philippines, Indonesia, Bangladesh etc. In Bangladesh, IDCOL’s solar mini-grids have ensured productive access to electricity and facilitated local industries.

**Agriculture**

One of the target market for off-grid solar solutions is agriculture sector. The off-grid solar solutions have the potential to increase the productivity and yield of farmers by finding practical use in agricultural activities such as irrigation, threshing, milling, drying, chilling, cold storage, food processing, etc. Farmers can use solar water pumps for irrigation, solar milling for agro-processing and solar refrigeration for food storage. In countries such as Kenya, about 40-50% of food is wasted along the value chain due to cold storage. Solar-powered cold storage systems can mitigate this waste and ensure food security and healthy income for farmers.

The estimated potential market for off-grid solar solutions in agriculture is 5.4 million farmers for solar water pumps and 6.5 million farmers for solar cold storage in Sub-Saharan Africa region. PULSE technologies start-ups such as Bright Solar, FuturePump, Inspira Farms, and SunCulture are making their presence felt in the Sub-Saharan Africa region by piloting their technologies.

**Public Establishments**

The off-grid solar solutions can serve the electricity needs of various public establishments such as schools, hospitals, offices etc. Electricity in schools is a basic infrastructure requirement for imparting quality education. Electricity enables access to ICT (Information and Communication Technologies) methods of teaching for holistic development of students. The electricity access in schools can be increased by use of off-grid solar solutions which can promote extended study hours and enhanced staff training. Uganda implemented a project, Energy for Rural Transformation (ERT) to provide electricity access to schools through off-grid technologies.

The off-grid solar solutions also offer scalable, reliable and cost-effective solutions for healthcare facilities. They can enable electricity access to power neonatal intensive care, medical devices and laboratory diagnostics. PULSE products such as solar power refrigerators can be used to store vaccines. UNDP implemented a Solar for Health initiative in Zimbabwe to support government to install off-grid solar systems in health centres in rural areas to reach underserved communities.

**Commercial and Industrial**

Close to 70% of Africa’s power demand is generated by C&I sector. According to IRENA, the sector’s electricity demand is expected to grow by more than 270% from 247 TWh/year in 2013 to 920 TWh/year in 2030. The C&I demand for electricity is huge in African countries such as Kenya, Nigeria and Ghana. In COMESA and TDB countries such as DRC, Zimbabwe, Tanzania, Mozambique, mining is a major industry which accounts for large consumption of electricity.
The C&I sector currently suffers challenges due to high grid tariffs, grid outages, diesel price fluctuations, etc. This sector offers an attractive market for off-grid solar solutions. The key drivers for the C&I sector to use these solutions for electricity consumption are:

- **Low Cost**: Solar PV combined with battery storage is a cheaper option for electricity access than grid tariffs for most of the C&I consumers.
- **Reliable Supply**: Solar PV combined with battery storage offers continuous supply of electricity against load shedding and grid outages/failure.
- **Environment Impact**: Off-grid solar solutions help corporates to reduce their Scope 2 emissions to reduce the impact of climate change.

Sources: Deloitte Analysis

Renewable energy Micro-grids have been a preferred source of energy generation for C&I consumers in West African countries such as Burkina Faso:

**Case Study: Renewable Energy Micro-grid for Essakane Mine in Burkina Faso**

The gold mine consumed power from a 55 MW oil power plant. It upgraded its energy portfolio to include a 15 MW solar PV micro-grid. This transition had several benefits for the extractive mine:

- **Energy Security**: Allowed the mine to become fully autonomous, despite long distance from the nearest grid.
- **Cost Savings**: The solar PV installation decreased fuel consumption by around six million liters.
- **Sustainability**: The transition helped the mine to reduce CO2 emissions by 18,500 tons per year.
- **Social Benefits**: Creation of large number of local jobs during both the construction phase and its ongoing operation.

Sources: Deloitte Analysis

The use of off-grid solutions for C&I market faces commercial, regulatory and financing barriers in COMESA and TDB region. Nevertheless, countries such as Tanzania have developed use of mini-grids for serving electricity needs of the C&I sector. The country has implemented Small Power Producers framework to encourage private sector participation in off-grid projects through
standardised PPA. The Rural Energy Agency has established a number of results-based financing (RBF) programmes for development of mini-grids. All these initiatives have developed enabling environment for development of mini-grids and greatly benefitted the C&I sector by serving their electricity needs. For instance, mini-grids installed on Lake Victoria in Tanzania serve C&I users such as mills, workshops and telecom towers.

3. Supply Landscape of Off-grid Solar Solutions

The Pico and SHS solutions have played an increasing role in providing electricity access to unserved population. More than 180 million units of standalone solar systems have been sold in the past decade. These solutions have served more than 100 million people in their homes and provided electricity access to 2.6 million people to run their business.  

![Figure 42: Global Sales Volume of Lighting Global Affiliated Off-grid Solar Lighting Products](image)

Source: GOGLA

Around 6.63 million Lighting Global affiliated off-grid lighting products were sold globally in 2020 with nearly 1/3rd of products sold under PAYGO model. During this period 4.27 million affiliated portable lanterns, 1.17 million affiliated multi-light systems and 1.18 million affiliated solar home systems were sold globally resulting in newly installed capacity of about 70 MW. Kenya, India, Ethiopia, Uganda and Nigeria were the top five off-grid solar markets globally by sales volumes.

39 Source: REN 21

40 Source: GOGLA
Figure 43: Sales Distribution of Lighting Global Affiliated Off-grid Lighting Products

Highest sale of off-grid solar lighting products in 2020 was recorded in East Africa region followed by South Asia and West Africa. Kenya, India and Nigeria recorded highest sales in East Africa, South Asia and West Africa regions respectively in 2020.

Figure 44: Sales of Lighting Global Affiliated Off-grid Lighting Products in COMESA and TDB countries

Countries such as **Kenya, Ethiopia, Tanzania, Uganda and Rwanda** from the **COMESA and TDB region** are **leading the way in adoption of off-grid lighting products**. Countries such as Malawi, DR Congo and Zambia from the region also reported decent sales of off-grid lighting products in 2020. For countries such as Madagascar and Mozambique, there is room for improvement and need for measures to push the sales of off-grid lighting products further.
In addition to off-grid lighting products, **1.38 million affiliated off-grid solar appliances were also sold globally in 2020.** Highest sales were recorded for TVs and Fans (33% each) followed by Radios (31%).  

*Figure 45: Sales of Lighting Global Affiliated Off-grid Solar Appliances in COMESA and TDB countries*

<table>
<thead>
<tr>
<th>Sales of Solar Off-grid Appliances in 2020</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>269,894</td>
</tr>
<tr>
<td>DR Congo</td>
<td>38,485</td>
</tr>
<tr>
<td>Tanzania</td>
<td>31,191</td>
</tr>
<tr>
<td>Uganda</td>
<td>17,401</td>
</tr>
<tr>
<td>Rwanda</td>
<td>11,458</td>
</tr>
<tr>
<td>Zambia</td>
<td>9,115</td>
</tr>
<tr>
<td>Mozambique</td>
<td>2,444</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>1,313</td>
</tr>
</tbody>
</table>

*Source: GOGLA*

During the same period, **Kenya recorded highest sales** of off-grid appliances in the COMESA and TDB regions. Countries such as **DR Congo, Tanzania and Uganda** reported **decent volumes of sales of off-grid appliances**. For countries such as Rwanda, Zambia, Mozambique and Ethiopia, there is room for improvement and need for measures to push the sales of off-grid appliances such as solar fans, refrigerators, pumps etc. further.

The COMESA and TDB countries such as **Kenya, Tanzania, Madagascar, DR Congo, Uganda** have a healthy presence of mini-grids. **TANESCO in Tanzania, JIRAMA in Madagascar, and KPLC in Kenya** are utility companies that **operate dozens of mini-grids** nationwide. These Mini-grids are **typically diesel-powered** (or, in the case of JIRAMA, hydro powered). Tanzania and Kenya are making significant progress in installation of **Solar PV mini-grids** or **hybridization of existing diesel mini-grids** with Solar PV.

---

41 *Source: GOGLA*
The total installed capacity of solar PV and wind power in Africa consequently increased from 108 MW to 6,100 MW and from 739 MW to 5,500 MW respectively between 2009 and 2018. The local solar assembly plants have been established in countries such as Algeria, Kenya, Nigeria, South Africa, Tunisia, Egypt and Ethiopia. Similarly, local wind-turbine component production units have been set up in a number of African countries, such as Kenya, South Africa, Morocco and Egypt.

Kenya is a role model country in the off-grid solar industry. The country has ambitions to become an industrialized middle-income country by 2030. The government has established robust institutions and policies to increase off-grid penetration in the country. The country has established ease of doing business which has attracted corporate investments in the off-grid sector. The quality standards and fiscal incentives provide impetus to the off-grid industry. The country has pioneered consumer financing models such as PAYGO (Pay-As-You-Go) by leveraging the mobile money landscape in the country. The government has also taken special steps to increase consumer awareness of off-grid technologies.

4. Key Players in Off-grid Solar Sector

Many local and international off-grid solar players have entered the COMESA and TDB regions to leverage the huge market potential that this region offers. The suppliers play a key role in
providing electricity access by manufacturing innovative products, employing distribution networks for last mile distribution and providing consumer financing.

There is presence of players such as Paygee (engaged in Software Development) and Orb Energy (engaged in Marketing and Distribution) who focus only on one segment of the standalone solar systems value chain. There are players such as Zonful Energy, and Bright Life who focus on multiple segments of the standalone solar systems value chain such as Marketing & Distribution, Consumer Financing and After Sales support. The market is also dominated by vertically integrated companies such as Azuri, Zola Electric, BBOXX, Fenix International, Solar Now, Greenlight Planet and M-KOPA Solar. Similarly, the mini-grid segment consists of players such as Powerhive which focus on one segment of the value chain and players such as Engie Power Corner with presence across entire value chain of mini-grids. The Prominent off-grid suppliers with operations in COMESA and TDB region are:

Figure 47: Key Off-grid Solar System Suppliers

Source: Deloitte Analysis

5. Key Associations to support Off-grid sector

Different market associations work for the promotion of the off-grid sector. These associations provide market intelligence and guidance to the market players for the development of the off-grid sector. They also represent their members’ interest in various forums by advocating for conducive policies. Some of these associations are:

**GOGLA**

Global Off-grid Lighting Association (GOGLA) is the voice of the off-grid solar energy industry. The association has a target to improve the lives of 1 billion people by 2030 by promoting off-grid solar industry. The association has more than 150 off-grid enterprises as its members and has IFC, UK AID, CDC, Shell Foundation, Swedfund, etc. as its financing partners. The association offers various services such as:
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

- Knowledge sharing and networking through events and communications
- Market Intelligence by providing insights on market trends and investment opportunities
- Advocacy for building enabling policy, regulations and investment by meeting with several government representatives and development partners
- Develops industry standards and guidelines by publishing GOGLA Consumer Protection Code

AMDA

Africa Mini-grid Developers Association is the voice of the decentralized utility companies and mini-grid developers across Africa. The association was created by developers and is supported by donors, governments and financiers to achieve the goal of universal access by 2030. The association currently represents 41 members across 17 African countries. The association performs the following services:

- Policy and Regulation Advisory: The association collaborates with industry, policy-makers, government authorities and donors to advocate for favourable policies to benefit the mini-grid sector
- Finance Advisory: AMDA collaborates with financiers to build debt facilities and provide guidance for funding programs for achieving SDG7 goal
- Evidence and Research: The association promotes transparency of industry performance through market data and analytics which helps businesses to overcome market barriers

6. Market Development Programs active in COMESA & TDB regions

The participation of international donors has played a major role in expanding the off-grid solar sector in COMESA and TDB regions. The prominent market development programs such as Lighting Africa, Power Africa and Green Mini-Grid Development Program by development partners such as World Bank, USAID and AfDB have been working tirelessly for the development of the off-grid solar sector by optimizing business models, providing regulatory support, lending financial support and developing market intelligence.

Figure 48: Key Notable donors in Off-grid Solar sector in COMESA & TDB region

Source: Deloitte Analysis
Lighting Africa
Lighting Africa is a joint International Finance Corporation and World Bank program that supports the global lighting industry in developing affordable, clean, and efficient modern lighting and energy solutions. The program is intended for millions of Sub-Saharan Africans who currently live without access to the electricity grid. The program has enabled 32.2 million people across Africa to meet their basic electricity needs. After running its first pilot projects in Kenya in 2009, it is now focused on contributing towards Sustainable Development Goal of achieving universal energy access by 2030. The program conducts market research and publishes reports identifying opportunities for the off-grid sector in Sub-Saharan Africa region. It also provides consultancy services and critical data to help manufacturers, distributors and retailers to make informed business decisions. Lighting Africa has been working towards ensuring quality of off-grid solar products through its quality assurance program which has been adopted by IEC. Lighting Africa works with governments to help them remove regulatory barriers and facilitate development of off-grid market. It collaborates with governments to introduce off-grid technologies in their rural electrification programs. The program operates in COMESA and TDB countries such as Burundi, DR Congo, Ethiopia, Kenya, Madagascar, Rwanda, Tanzania and Uganda.43

Power Africa
Power Africa is a U.S. government led initiative that addresses the challenges in access to electricity in Sub-Saharan Africa. The program is designed as a multi-stakeholder partnership among the governments of the United States of America, Tanzania, Kenya, Ethiopia, Ghana, Nigeria, Liberia and the African private sector. US has committed more than USD 7 billion in financial support over the duration of 5 years from agencies such as U.S. Agency for International Development (USAID), Overseas Private Investment Corporation (OPIC), U.S. Export-Import Bank (Ex-Im), Millennium Challenge Corporation (MCC) and U.S. African Development Foundation (USADF) for the program. The goal of the program is to add at least 30,000 megawatts (MW) of clean and reliable electricity generation capacity and 60 million new connections by 2030. Power Africa supports the off-grid sector by providing pre-feasibility support, long-term financing, insurance, guarantees, credit enhancements and capacity building.44

Green Mini-Grid Market Development Program (GMG MDP)
The program is supported by AFDB as part of the Sustainable Energy for All Africa Hub. The program aims to help investors scale up their investments in commercially viable GMG projects. The Sustainable Energy Fund for Africa (SEFA) approved a USD 1 million grant in June 2015 to commence Phase 1 of the program, and a USD 3 million grant in June 2017 to support Phase 2. The program is implemented through 5 business lines:

- **Market Intelligence**: A pan-African mini-grid database with market information (CAPEX, OPEX, connections, etc.) for each green mini-grid that is being built

---

43 Source: Lighting Africa
44 Source: Power Africa
- **Business Development Support**: A green mini-grid toolkit with a complete range of knowledge products and tutorials for green mini-grid developers is available through GMG MDP Help Desk
- **Policy and Regulatory Support**: SEFA and the SE4ALL Africa Hub work with individual ministries of energy to develop policies, strategies and plans for green mini-grids development in African countries
- **Quality Assurance**: A Quality Assurance Framework (QAF) for mini-grids has been developed by Global LEAP (Lighting and Energy Access Partnership), the U.S. Department of Energy and the USG National Renewable Energy Laboratory
- **Access to Finance**: AfDB created the Facility for Energy Inclusion (FEI) in 2017 which is a $500 million fund that provides debt to small renewable IPPs, green mini-grids and off-grid solar companies. The GMG MDP is also developing a results-based financing fund that will provide grant bonuses to green mini-grids based upon new power connections

**AECF REACT SSA**

REACT Sub-Saharan Africa (REACT SSA) is a program to support the development of renewable energy in Sub-Saharan Africa in COMESA and TDB countries such as Ethiopia, Kenya, Mozambique and Zimbabwe. The program is funded by SIDA (Swedish International Development Agency) and implemented by AECF (Africa Enterprise Challenge Fund). Its overarching aim is to reduce poverty through an increase in the use of renewable energy technologies. The activities included in the program consist of:

- **Financing**: Financing of renewable energy companies happens through provision of matching grants after following of competitive process. Grant funds are used according to the business plans submitted by the recipient business.
- **Technical Support**: The program provides technical assistance to support the management capacity of businesses. AECF has launched AECF Advisory Studio and AECF Academy to help SMEs improve their business models.

**7. Gender Mainstreaming**

It is important to consider interests of all genders in all activities central to off-grid solar sector such as policy making, investing, marketing etc. for gender equity. The off-grid solar sector shall promote holistic development of all the genders for equality and empowerment. Some of the countries in COMESA and TDB region such as Kenya are really taking initiatives for gender mainstreaming.

A Gender Policy was formulated for Ministry of Energy in Kenya to achieve gender equity and equality within the energy sector in Kenya. The objectives of the policy were:

- Strengthen institutional frameworks for gender equality in energy at both national and county levels
- Ensure compliance with the constitution on gender
- Promote awareness on gender in the energy sector

---

45 Source: SE4All Africa
• Integrate gender in the market development programs

It is also important to advance gender equality in off-grid companies. Lessons can be learnt from companies such as PEG Africa operating in West African countries such as Ghana, Senegal and Mali. PEG collaborated with Power Africa to develop a Gender Action Plan to become gender responsive. The objectives of Gender Action Plan were:
• Increase the number of women in the company’s decision-making positions by 15%
• Increase women’s employment in the field positions by 13%
• Strengthen the company’s internal policy documents by adding gender considerations
• Acquire more female customers

Most of the investments in the off-grid solar sector occur in gender-neutral way that reinforces gender disparities and exclusion of vulnerable groups. It is necessary to adopt gender lens investing to increase number of women employed in off-grid sector. In 2018, Africa Enterprise Challenge Fund (AECF) launched its Gender Lens Investing (GLS). The GLS targets four areas, agriculture, sustainable energy, private sector and women. It has objectives to:
• Ensure at least 50% of development impact accrues to women
• Ensure at least 35% companies are women-led
• Ensure at least 40% of created jobs are held by women

Countries such as Kenya, Tanzania, Uganda and Rwanda are leading in adoption of Pico/SHS solutions. Countries such as Kenya, Tanzania and Madagascar have experience in mini-grid installations for providing electricity access. The international players such as BBOXX, Greenlight Planet, d.light, Powerhive, Engie Powercorner have made their presence felt in the COMESA and TDB regions. The market development initiatives such as Lighting Africa, Power Africa, Green Mini-Grid Market Development Program, AECF React SSA by development partners such as World Bank, USAID, AfDB and SIDA respectively have helped to expand the off-grid solar sector in COMESA and TDB regions.
D. Study of Regulatory & Institutional Landscape for Off-grid

Two of the most important factors contributing to the expansion of off-grid solar sector in any country are the policy, legal and regulatory frameworks and supporting institutions of the country. Legal Framework constitutes the laws and regulations created by the government of the country to support policy implementation. Institutional Structure constitutes the ministries, agencies and associations, which are responsible to develop policies, vision, and holistic strategies and then ensure proper implementation of those policies and strategies to achieve the vision of universal access. Institutions are mandated to implement policies and enforce regulations.

![Figure 49: Interdependence of Institutional and Legal Framework](image)

**Source: Deloitte Analysis**

1. Policy, Legal and Regulatory Frameworks

A robust policy, legal and regulatory framework is key to effective off-grid planning and implementation in a country. Electrification plans and strategies of a country should clearly identify areas that will be reached by grid extension in a reasonable amount of time, as well as those that will benefit from off-grid solutions. Dedicated policies and regulations for distinct off-grid alternatives, such as mini-grids and stand-alone systems, must be backed up by holistic and integrated energy access initiatives.

- In the specific case of **stand-alone systems**, policies can strongly influence the accessibility and sustainability of such solutions for rural communities. Import duty and value-added-tax exemptions are common fiscal incentives used to encourage market development; as these directly impact the pricing and affordability of stand-alone systems. However, the fiscal incentives should be stable to encourage private sector participation. Other supportive
measures for promoting standalone systems include having a level playing field, creating quality standards, and developing dedicated consumer/business finance channels, etc.

- Scaling up renewable energy mini-grids requires dedicated policies and regulations to address key areas such as licensing and permitting requirements, tariff setting frameworks, the implications of arrival of the Main-grid and the distinctive aspects of mini-grid financing. Countries are taking initiatives to establish a favorable climate for attracting private sector engagement and scaling up deployment in response to the increased competitiveness of renewable energy mini-grid solutions.

**Figure 50: Two Major Aspects for Legal and Regulatory Framework for Off-grid sector**

### Stand alone Systems
- Policies can strongly influence the accessibility and sustainability of SAS for rural communities
- Import duty and VAT exemptions can encourage market development
- Quality standards & dedicated consumer finance channels will bring in confidence in the sector

### Mini-Grid
- Mini-grids requires dedicated policies and regulations
- Licensing and permitting requirements, tariff setting frameworks, the implications of arrival of the main grid are some of the supportive measures for mini-grids

**Policies & Regulations**
Dedicated policies and regulations for distinct off-grid alternatives, such as mini-grids and standalone systems, backed up by holistic and integrated energy access initiatives are key to efficiency in the sector.

*Source: Deloitte Analysis*

Some of the important Policies which can act as a pre-requisite for comprehensive and fast development of the off-grid sector are Electricity Laws, PPP Laws, Renewable Energy Policy, Rural Electrification Master Plan, Tax & import duty exemptions for solar off-grid products and IEC or Solar PV standards.

- Electricity Laws generally lays out the laws relating to generation, transmission, distribution, trading and use of electricity to build a conducive environment for the electrification situation of the country.
- Renewable Energy Policy is required to lay out targets to gradually increase the renewable energy share of the country.
- Rural electrification Master plan lays out a well-structured plan with defined targets to achieve rural electrification in the country.
- Strong PPP laws are required to encourage private sector participation to supplement public sector capabilities in the expansion of the off-grid solar sector.
- Tax Incentives and Import duties exemptions are important to encourage private sector participation as these fiscal incentives result in low price of off-grid products hence increasing consumer affordability and market size for off-grid products. The tax incentives and import duty exemption require strong political will to make an impact
• A country also needs to put in place various technical standards that off-grid solar products must adhere to maintain and regulate the quality of the solar products available for the consumers. A country can adopt IEC standards or form their own Solar PV standards. Lighting Global has launched a comprehensive quality assurance program, Verasol for off-grid products and appliances which can be adopted by the COMESA and TDB countries for market development.

• Enabling policies and regulations for mobile money adoption for implementation of consumer financing mechanisms such as PAYGO (Pay-As-You-Go). Key provisions for Mobile Money usage include Authorization, Consumer protection, Transaction Limits, Know Your Customer (KYC), Agent Networks etc. Mobile Money Regulatory Index score issued by GSMA measures attractiveness of mobile money regulations in a given country.

• E-waste management policy or strategy for responsible management and disposal of electronic waste to save the environment from negative impact of release of toxins.

Figure 51: Important Policies for the development of the Off-grid sector in a country

Source: Deloitte Analysis

To analyze the policy, legal and regulatory frameworks of each of the COMESA and TDB countries, four key parameters were utilized namely the presence of: (i) Electricity Law, (ii) Renewable Energy Policy, (iii) Rural Electrification Master Plan and (iv) the presence of PPP Laws.
Figure 52: Heatmap of Legal Framework in COMESA and TDB countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Electricity Law</th>
<th>Renewable Energy Policy</th>
<th>Rural Electrification Master Plan (REMP)</th>
<th>PPP Laws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burundi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Djibouti</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DR Congo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eritrea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Libya</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madagascar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malawi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rwanda</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somalia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Sudan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

The analysis reveals that countries such as Djibouti, DR Congo, Somalia, South Sudan and Tanzania lack a national Renewable Energy Policy. Countries such as Djibouti, DR Congo, Eritrea, Libya, Mozambique, Somalia, South Sudan, and Sudan do not have a Rural Electrification Master Plan. There is absence of PPP laws in countries such as Eritrea and South Sudan.

A country wise analysis of countries who have strong regulatory policies for the development of the electricity sector have been done below:

**Ethiopia**

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

**Table 2: Legal Framework in Ethiopia**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Law</td>
<td>Energy Proclamation No. 810/2013 regulates the energy generation and distribution in the country. It is supplemented by EEA Establishment Regulation No. 308/2014 and Energy Regulation No. 447/2019 which oversees licensing and tariff setting</td>
</tr>
</tbody>
</table>
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

<table>
<thead>
<tr>
<th>National Energy Policy</th>
<th>The policy focuses on developing renewable sources of energy, diversifying energy generation mix, promoting decentralized energy supply for the rural areas and encouraging the private sector participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth and Transformation Plan II</td>
<td>Comprehensive strategy which includes renewable energy generation targets to guide country’s development</td>
</tr>
<tr>
<td>Electrical and Electronic Waste Management and Disposal Council of Ministers Regulations No. 425/2018</td>
<td>The regulations implemented in Ethiopia to minimize the environmental impacts of electrical and electronic waste by reduction, refurbishing, recycling and disposal of waste</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

The country has favourable policies for the development of off-grid sector. The country adopted Ethiopian Standard ES IEC TS 62257- 9-8 in 2016 for standalone solar systems. Lighting Africa certified products are eligible to be imported duty-free in the country although new products such as Solar TVs are sometimes incorrectly classified and made liable for tax payment.

The country had a Mobile Money Regulatory Index score of 89.7 in 2021. Licensing and Authorization of Payment Instrument Issuers Directive No. ONPS/01/2020 has permitted non-financial institutions to make mobile money transfers which is expected to positively impact the off-grid sector.

**Kenya**

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

Table 3: Legal Framework in Kenya

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Act 2019</td>
<td>The Act created the Renewable Energy Resources Advisory Committee (RERAC) for management, licensing and development of renewable energy sources.</td>
</tr>
<tr>
<td>REREC Strategic Plan (2017-2021)</td>
<td>The Plan calls for construction of 450 mini-grids and the interconnection of existing diesel mini-grids</td>
</tr>
<tr>
<td>The Energy (Solar PV Systems) Regulations, 2019</td>
<td>The regulations provide a framework for enforcing standards in the importation, design and installation of solar PV systems. The regulations also oversee the certification and licensing fees for solar PV contractors</td>
</tr>
<tr>
<td>Kenya National Electrification Strategy</td>
<td>The strategy lays out a plan for achieving universal access by 2022 by increasing 2 million connections with a large off-grid component (SHS and mini-grid)</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis
The off-grid market in Kenya has been a success story and a role model for other COMESA and TDB nations. The country is among the top 5 off-grid markets in the world due to favourable government policies and private sector participation. The country has adopted KS IEC 62257 quality standards for solar home systems and solar appliances. Kenya had provided tax exemptions initially for off-grid products to kickstart off-grid sector but removed them in 2020 as the sector is gradually maturing.

National Payment System Regulations (2014) issued under the National Payment Systems Act (2011) by the Central Bank of Kenya regulates mobile money sector in Kenya. The country had Mobile Money Regulatory Index score of 85.5 in 2021. The country has high transaction limits for mobile money and customer funds are safeguarded in the country through establishment of trust accounts.

**Madagascar**

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Energy Policy, 2015</td>
<td>The policy laid out an objective of expanding energy availability to 70% by 2030 with renewable energy accounting for 85% of the energy mix. To achieve these targets the policy proposed an energy mix consisting of 70% grid extension, 20% via mini-grids and 10% from standalone solar systems</td>
</tr>
<tr>
<td>Electricity Code of Madagascar (Law 17-20)</td>
<td>The law provided for Separate authorizations or concessions for each of the generation, transmission, and distribution activities</td>
</tr>
<tr>
<td>General Tax Code and Customs Code</td>
<td>The government defines the tax and customs benefits linked to goods and services meant for the Production and Exploitation of renewable energy</td>
</tr>
<tr>
<td>Decree Nr. 2015-930 on Classification and Management of Electronic and Electric Waste</td>
<td>The decree stipulates general guidelines for disposal of electric and electronic waste</td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*

The country recognizes the importance of off-grid technologies in electrification of the country. The Tax Code of 2015 exempts solar PV panels from VAT. The country’s institutions such as ADER provide subsidies for rural electrification projects.

Law No. 2016-056 of 2 February 2017 on electronic money and electronic money institutions regulates the mobile money in the country. The law allows Mobile Network Operators to provide mobile money services under a license issued by the Central Bank of Madagascar. The country had a Mobile Money Regulatory Index score of 78.3 in 2021.
Malawi

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

Table 5: Legal Framework in Malawi

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi Electricity Act, 2004</td>
<td>The Act unbundled Electricity Supply Corporation of Malawi (ESCOM) into two state-owned power utilities, EGENCO and ESCOM.</td>
</tr>
<tr>
<td>Malawi Renewable Energy Strategy, 2017</td>
<td>It has set a target of electrification access through grid connections (45%), mini-grids (10%) and standalone systems (45%)</td>
</tr>
<tr>
<td>SE4All Action Agenda, 2017</td>
<td>The action plan has set target of 1.51 million (25%) grid connections, 13,500 (0.2%) mini-grid connections, 75,000 (1%) SHS and 4.5 million (74%) Pico-Solar by 2030</td>
</tr>
<tr>
<td>National Energy Policy, 2018</td>
<td>The policy has set target of 80% electricity access by 2035: 35% Tier 4-5 access (from the grid), 45% with Tier 1-2-3 access (from mini-grids and Pico-Solar)</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

The Government of Malawi has established clear targets that different off-grid technologies will play in providing electrification access to its population although the targets have been revised from time to time. In line with its commitment to promote off-grid, the government removed VAT and import duty from all standalone solar systems in 2019.

The Payment Systems (E-Money) regulations (2019) is the framework through which mobile money providers are licenced in the country. The country’s mobile money operators are granted approval to perform outward and inward remittances. The country had a Mobile Money Regulatory Index score of 94.7 in 2021.

Rwanda

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

Table 6: Legal Framework in Rwanda

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Law No. 21/2011</td>
<td>The law governs electricity production, transmission, distribution and trading within or outside the national territory</td>
</tr>
<tr>
<td>Renewable Energy Policy, 2015</td>
<td>The policy was aimed at building decentralized energy and private sector participation</td>
</tr>
<tr>
<td>Rural Electrification Strategy, 2016</td>
<td>Strategy was aimed to achieve 70% of access to electricity by 2018 and 100% by 2020 through a combination of On-grid and off-grid systems</td>
</tr>
<tr>
<td>National Electrification Plan, 2019</td>
<td>The plan divided the country into on-grid and off-grid areas using ground data and assumptions. The plan also demarcated zones where mini-grids and standalone solar systems will be eligible for subsidies</td>
</tr>
</tbody>
</table>
Rwanda supports off-grid sector through a variety of policies and initiatives. The National Strategy for Transformation targets to achieve universal electrification by 2024 by utilizing off-grid solutions (48%) and grid connections (52%). The Ministry of Infrastructure (MININFRA) along with Rwanda Standards Bureau (RSB) developed Ministerial Guidelines on Minimum Standards Requirements for SHS to enforce quality standards and service levels of off-grid products. The government has also established an E-waste dismantling facility under PPP model to dispose SHS waste.

Mobile money was introduced in the country in 2020 is regulated by the National Bank of Rwanda. Regulation N° 05/2018 Of 27/03/2018 governs licensing requirements for mobile money providers. The country recorded the highest Mobile Money Regulatory Index score of 97.5 in 2021. The country has established excellent provisions for mobile money usage such as high transaction limits, consumer protection rules and online verification services for mobile money providers.

**Uganda**

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

**Table 7: Legal Framework in Uganda**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Act, 1999</td>
<td>The Act regulates the generation, transmission, distribution, sale, export, import and distribution of electrical energy in Uganda</td>
</tr>
<tr>
<td>Renewable Energy Policy, (2007-2017)</td>
<td>The Policy stated to increase the share of RE from 4% to 61% of national energy consumption by 2017</td>
</tr>
<tr>
<td>Rural Electrification Plan, 2013-2022</td>
<td>The plan aims to achieve a rural electrification access of 26% by 2022, 51% by 2030 and 100% by 2040</td>
</tr>
<tr>
<td>Electronic Waste Management Policy, 2012</td>
<td>The policy provided for establishment of e-waste facilities, standards and guidelines.</td>
</tr>
</tbody>
</table>

Uganda has been one of the top performers in electricity regulation in the COMESA and TDB regions. The country promotes off-grid sector through its various interventions. The country has adopted quality standards for solar PV kits which are based on IEC standards. The test procedures for the quality of lighting products accompanying the kits are being developed by Uganda National Bureau of Standards (UNBS) and Rural Electrification Agency (REA).
The country implemented Mobile Money Guidelines in 2013. The country had a Mobile Money Regulatory Index score of 77.4 in 2021. The country can improve on its dentification requirements for mobile money accounts and taxation on mobile money transactions to strengthen mobile money landscape in the country.

**Zambia**

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

**Table 8: Legal Framework in Zambia**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Energy Policy, 2019</td>
<td>The policy aims to promote use of solar energy by introducing renewable energy feed-in tariff strategy. A National Renewable Energy Strategy is under development and includes targets to generate 100MW from solar by 2030. It is further envisaged that 500,000 SHS will be distributed, and 350,000 solar water heaters will be installed in the country.</td>
</tr>
<tr>
<td>Rural Electrification Master Plan 2008-2030</td>
<td>The plan is a blueprint for rural electrification which is aimed to increase rural energy access to 51% by adopting solutions such as SHS</td>
</tr>
<tr>
<td>Extended Producer Responsibility (EPR) Statutory Instrument No. 65 of 2018</td>
<td>The regulations require entities whose activities generate e-waste to employ measures to minimize waste through treatment, reclamation, re-use, recovery or recycling</td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*

The Government of Zambia is taking active steps towards promotion of rural access through off-grid solutions. To lower the cost of importing off-grid equipment in the country, the government exempted solar panels, batteries, solar geysers from VAT. The Zambian Bureau of Standards (ZABS) and Zambia Information and Communications Technology Authority (ZICTA) are leading the way in the adoption of e-waste standards for disposal of e-waste.

The National Payment Systems Directives on Electronic Money Issuance 2018 governs the usage of mobile money in Zambia. The country had a Mobile Money Regulatory Index score of 78.5 in 2021. The country can strengthen its mobile money landscape by establishing capital requirements for mobile money providers and introducing electronic KYC mechanism.

**Zimbabwe**

The country is one of the nations in the COMESA and TDB regions with strong policy, legal and regulatory frameworks for the electricity sector. Some of the important policies for energy access are as follows:

**Table 9: Legal Framework in Zimbabwe**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
</table>
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

<table>
<thead>
<tr>
<th>Energy Regulatory Act, 2011</th>
<th>The Act created ZERA with the responsibility of issuing and withdrawing licences from players in the energy sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Energy Policy, 2012</td>
<td>The Policy stated establishment of a fund to promote use of solar energy to address the electricity crisis</td>
</tr>
<tr>
<td>Draft Rural Energy Master Plan, 2016</td>
<td>Policy outlined the plan for rural energy access by combination of off-grid and on-grid components</td>
</tr>
<tr>
<td>National Renewable Energy Policy, 2019</td>
<td>Policy set up a target of 1,100 MW from RE, or 16% of total generation by 2025, and 2,100 MW from RE, or 27% of total generation by 2030</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

The Government of Zimbabwe realizes the importance of off-grid technologies for energy access. The National Renewable Energy Policy, 2019 contains provisions such as standards, procurement, financing, tax exemption, awareness etc. for development of off-grid systems. There are import duty exemptions available for integrated solar lanterns, integrated SHS kits, solar panels, lithium-ion-batteries, mini-grid component parts, solar streetlights, and solar geysers. The country has also adopted International Electrotechnical Commission (IEC) standards for Pico and SHS and established a laboratory to test off-grid products for quality.

The Guidelines for Retail Payment Systems and Instruments, 2017 govern the mobile money operations in the country. The country has one of the highest mobile money penetration among COMESA and TDB countries, but scores low on Mobile Money Regulatory Index (60.93 in 2021). This is due to suspension of agent activities and reduction of transaction limits. The country needs to strengthen its mobile money landscape for PAYGO adoption in the country.

Well established policies, legal and regulatory frameworks direct stakeholders to promote efficiency in the electricity sector. Clear and coherent regulations such as Electricity Law, Renewable Energy Policy, Rural Electrification Master Plan and PPP Laws are required for holistic development of off-grid solutions. Countries such as Ethiopia, Kenya, Madagascar, Malawi, Rwanda, Uganda, Zambia and Zimbabwe have strong legislations to promote Renewable Energy. Countries such as DRC, Eritrea, Somalia and South Sudan have weak regulatory landscape and would need to strengthen their policy, legal and regulatory frameworks by learning lessons from their peers in the COMESA and TDB regions.

2. Institutional Structure

An appropriate institutional structure is crucial to ensure the effective implementation of national energy access strategies and related policies including policies for off-grid. Earlier, roles and responsibilities of the various agencies involved in centralized energy planning were straightforward. However, the growth of liberalized markets in recent years, has made the institutional framework more complicated. Different countries in COMESA and TDB regions have different institutional framework for effective functioning of Energy sector. Governments of few of the COMESA and TDB countries such as Tanzania, Zimbabwe have established new institutions to help rural electrification efforts, while others such as Sudan and South Sudan have entrusted the task to existing ministries or agencies.
Figure 53: Need of a robust Institutional Framework for efficient deployment of Off-grid Solutions

Institutional structure approach differs across countries but successful governance shares some common characteristics, such as clearly defined roles and responsibilities of all stakeholders, streamlined administrative procedures and processes, and enhanced cooperation among diverse national and international institutions and agencies.

Robust institutional set up in a country for effective implementation of off-grid requires presence of key Institutions namely, Ministry responsible for Energy, Regulator, Rural Electrification Agency and Rural Electrification Association.
• **Ministry** - National governments oversee electrification, which includes energy availability. The government creates a Ministry dedicated to overseeing the whole electrification situation of the country. The Ministry responsible for Energy formulates & implements policies for energy development, monitors and evaluates implementation of policies and initiates suitable reforms in those policies. The Ministry responsible for Energy usually begin with a vision, which is then turned into a National Electrification Plan, a form of "master plan" that is supplemented by a Rural Electrification Plan focused on "energy access" in rural areas. Following adoption, the master plan is frequently divided down into shorter-term goals and objectives (3-5 years) for implementation.

• **Regulator** - The Energy Regulator is mandated to regulate the entire energy sector in a fair, transparent, efficient, and cost-effective manner for the benefit of the consumers and energy suppliers. The Energy Regulator normally derives its mandate from the Energy Regulatory Authority Act of the concerned country. Regulators are frequently part of the executive department of government, but they should be free to function independently to ensure the stability and continuity required to maintain a stable regulatory framework that safeguards the interest of all the stakeholders involved in the sector.

• **Rural Electrification Agency** - In most developing countries, the concept of a Rural Electrification Agency (REA) is relatively new. The major responsibility of these agencies is to plan, organize, and finance rural electrification efforts on behalf of the government and potentially the regulator. The national rural electrification plans, and strategies are normally prepared by REAs in close collaboration with rural communities and rural development agents, using a bottom-up approach.
• **Renewable Energy Associations** - Renewable Energy Associations are generally not for profit organizations who are dedicated to promoting and enabling the establishment of renewable energy businesses in the country. Their major roles are to promote the interests of the members associated with them, which include the government, donor organizations, non-governmental organizations, the public and any other groups that have an impact on the sector’s development.

Analysis has been done of the broad level institutional structures of the selected 18 COMESA & TDB countries. An assessment has been made of the presence of key institutions in these selected countries and the broad efficiency level at which these institutions are operating in these selected countries. Below Heatmap indicates the presence of key institutions in each of these countries essential to promote electrification. The Heatmap also identifies Institutions which are present; However, are not operating independently or in their full capacity and hence need attention.

![Figure 55: Heatmap of Institutional Framework in COMESA and TDB countries](source: Deloitte Analysis)

A country wise analysis of the institutional framework of each of these countries has been done below:

**Burundi**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following: 

- **Ministry of Electricity**
- **Regulator**
- **Rural Electrification Agency**
- **Renewable Energy (RE) Association**
Table 10: Institutional Structure of Burundi

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Hydraulics, Energy &amp; Mines designs and implements national policies on energy, geology and mines</td>
</tr>
<tr>
<td>Regulator</td>
<td>Energy &amp; Water Regulatory Authority, established in 2018, is responsible for concession and tariff approval</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Burundi Agency for Rural Electrification (ABER) is responsible for management of rural electrification infrastructure, mainly isolated mini grids</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Burundi Renewable Energy Association, founded in November 2012, promotes renewable energy and quality standards</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: Burundi has shown its commitment towards off-grid energy in its long-term vision. ABER currently owns and manages 5 mini-grids (solar, hydro and wind) serving over 600 households.

Weakness: The institutional bodies in Burundi are young and relatively inexperienced with regards to nascent technologies such as off-grid.

Primary Focus Area: The existing institutions should focus on programs for promoting the standalone solar systems market.

Djibouti
The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 11: Institutional Structure of Djibouti

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Energy &amp; Natural Resources (MERN) is responsible for developing government policy on energy and natural resources</td>
</tr>
<tr>
<td>Regulator</td>
<td>l’Autorité de régulation multisectorielle de Djibouti (ARMD), established by Law No 074/AN/20 of 13 February 2020, is responsible for regulation of the electricity sub-sector. There also is a presence of regulatory department which acts under the Ministry</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Directorate for Rural Electrification in the Agence Djiboutienne de Developpement Sociale (ADDS) is responsible for the rural electrification in areas not covered by the utility grid</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Absent</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: A public institution, Djiboutian Agency for Energy Management (ADME), promotes energy efficiency and renewable energy in all economic sectors.

Weakness: The country lacks a Renewable Energy Association to promote market intelligence and advocate policy making in the renewable energy sector.
Primary Focus Area: The country’s institutions should work towards increasing uptake of off-grid technologies for fulfilling government’s vision of 100% RE by 2035

**DR Congo**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

*Table 12: Institutional Structure of DR Congo*

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Energy &amp; Water Resources (MERH) is responsible for policy planning, program development and oversight</td>
</tr>
<tr>
<td>Regulator</td>
<td>Authority for Electricity Regulation (ARE), promulgated on June 17, 2014, ensures control and monitoring of electricity sector, rules of transparency and free competition</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Agency (ANSER) was established by decree n°16/014 on April 21, 2016 to oversee rural electrification and provides technical support to MERH on matters related to the planning, promotion, and financing</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Congolese Association for Renewable and Decentralized Energy (ACERD), established in July 2018, represents interest of energy sector in national and international forums</td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*

*Positive:* National Agency of Investment Promotion (ANAPI) supports off-grid sector by providing customs and tax-exemption mechanisms.

*Weakness:* SNEL, the national utility, is caught in a vicious cycle of mounting commercial losses.

*Primary Focus Area:* Recently established Rural Electrification Agency (ANSER) should work towards financing for off-grid projects.

**Eritrea**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

*Table 13: Institutional Structure of Eritrea*

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Energy &amp; Mines is responsible for policy planning, program development and oversight</td>
</tr>
<tr>
<td>Regulator</td>
<td>An Electricity Regulatory Committee exists which is not independent and works under Department of Energy of Ministry of Energy and Mines</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Unit under the Department of Energy of the Ministry of Energy and Mines</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Renewable Energy Centre under the Department of Energy of the Ministry of Energy and Mines</td>
</tr>
</tbody>
</table>
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

Source: Deloitte Analysis

Positive: The Ministry of Energy and Mines is playing an active part in rural electrification of the country through financing of solar powered mini-grids in collaboration with UNDP and European Union

Weakness: There is a lack of an Independent Regulator, a dedicated Rural Electrification Agency and an independent Renewable Energy Association

Primary Focus Area: The country’s institutions should work towards increasing private sector participation and deployment of off-grid solutions to accomplish country’s target of 50% RE in electricity mix by 2030

Ethiopia
The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 14: Institutional Structure of Ethiopia

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Water, Irrigation &amp; Energy oversees development of water &amp; energy resources, develops plans, policies &amp; laws and supervises other entities</td>
</tr>
<tr>
<td>Regulator</td>
<td>Ethiopian Energy Authority regulates the electricity sector, issues technical standards, and commissions projects on energy efficiency</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Ethiopian Rural Energy Development &amp; Promotion Centre oversees the Rural Electrification Fund (REF) and the Rural Electrification Executive Secretariat (REES)</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>The Solar Energy Development Association (SEDA-E), established in September 2010, promotes the interests of members of the solar energy industry among government and the public</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: The vertically integrated Ethiopian Electric Power Corporation (EEPCO) was unbundled into Ethiopian Electric Power (EEP) and Ethiopian Electric Utility (EEU).

Weakness: The institutional capacity is complicated due to frequent changes in the names, structures, and mandates of different ministries and agencies pertaining to the energy sector.

Primary Focus Area: The institutions should work towards achieving the country’s target of 35% of universal electrification access by 2025

Kenya
The Kenyan electricity sector is a true success story in Sub-Saharan Africa, with strong leadership at the highest levels of Government, long-standing participation of the private sector in generation, impressive growth in access, and a strong enabling environment for innovation in
off-grid solutions. The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 15: Institutional Structure of Kenya

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Energy is in charge of developing policies, establishing sector rules, and guiding rural electrification</td>
</tr>
<tr>
<td>Regulator</td>
<td>The Energy Act of 2019 established Energy and Petroleum Regulatory Authority (EPRA) to fulfil responsibilities of licencing, technical and economic regulations, enforcement and compliance, and dispute resolution</td>
</tr>
<tr>
<td>Rural Electrification</td>
<td>The Energy Act of 2019 established Rural Electrification &amp; Renewable Energy Corporation to direct Kenya’s renewable energy initiative as well as implement rural electrification programs</td>
</tr>
<tr>
<td>Renewable Association</td>
<td>The Kenya Renewable Energy Association (KERA) is an independent non-profit association formed in 2002 to facilitate the growth and development of renewable energy business in Kenya.</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: The country has recently created a Renewable Energy Resources Advisory Committee (RERAC) to oversees management, licensing and development of renewable energy sources.

Primary Focus Area: The institutions should work towards accomplishing universal access target by 2022 through government led initiatives such as KOSAP (Kenya Off-grid Solar Access Project).

Libya

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 16: Institutional Structure of Libya

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Electricity &amp; Renewable Energy, established in 2011, aims to improve energy efficiency and maintain a clean environment</td>
</tr>
<tr>
<td>Regulator</td>
<td>Absent</td>
</tr>
<tr>
<td>Rural Electrification</td>
<td>Absent</td>
</tr>
<tr>
<td>Renewable Association</td>
<td>Renewable Energy Authority of Libya (REAoL), established in 2007, to meet the governmental target of 10% share of the total energy mix coming from renewable energy sources by 2020</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: REAoL is in charge of program being implemented by GIZ to install 1000 PV rooftop systems (both on-grid and off-grid)
**Weakness:** The country does not have an electricity regulator and rural electrification agency

**Primary Focus Area:** The country needs to establish institutions such as electricity regulator and rural electrification authority to fulfil REAoL’s target of 10% renewables by 2025

**Madagascar**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

**Table 17: Institutional Structure of Madagascar**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Water, Energy &amp; Hydrocarbons, created in July 2008, formulates and implements policies to improve private sector participation in energy sector</td>
</tr>
<tr>
<td>Regulator</td>
<td>Electrification Regulatory Authority (ORE), established in 1999, regulates the energy sector</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Authority (ADER), created in 2002, has an ambition of quadrupling the country's rural electrification rate to 30% by 2030</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Association for the Development of Renewable Energy (ADRE) was established in February 2018 for development of Renewable Energy</td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*

**Positive:** Programs such as Energy Sector Reform Support Program (PARSE) have been implemented to improve Jiro sy Rano Malagasy (JIRAMA’s), the state-owned electric utility governance framework and financial management.

**Weakness:** The inability of country’s utility, JIRAMA to recover operating and debt-service costs.

**Primary Focus Area:** The Economic Development Board of Madagascar (EDBM) should work towards collaborating with ADER to attract investors in off-grid sector in the country.

**Malawi**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

**Table 18: Institutional Structure of Malawi**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Natural Resources and Environmental Affairs ensure sustainable development and management of natural resources and energy</td>
</tr>
<tr>
<td>Regulator</td>
<td>Malawi Energy Regulatory Authority established under the Energy Regulatory Act No. of 20 of 2004 regulates the energy sector in Malawi in a fair, transparent, efficient and cost-effective manner</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Management Committee works under the Ministry</td>
</tr>
</tbody>
</table>
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

| Renewable Energy Association | Renewable Energy Industries Association of Malawi, established in 1999, aims to promote renewable energy technologies |

Source: Deloitte Analysis

Positive: Renewable Energy Industries Association of Malawi has an aim of promoting renewable energy technologies in a sustainable manner for the satisfaction of consumers in Malawi and is a member of GOGLA

Weakness: The institutional framework lacks a dedicated Rural electrification Agency. Currently, the rural electrification is overseen by the Rural Electrification Management Committee under the ministry

Primary Focus Area: The country should focus on promotion of off-grid technologies. The first step in this direction could be establishment of a dedicated rural electrification agency

Mozambique

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 19: Institutional Structure of Mozambique

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Mineral Resources &amp; Energy (MIREME), formed in June 26, 2019, oversees the energy and extractive industries</td>
</tr>
<tr>
<td>Regulator</td>
<td>Energy Regulation Authority (ARENE), established in 2017, is responsible for regulation of the energy sector and tariff setting</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Fundo Nacional de Energia (FUNAE), established in April 2004, operates as the de facto rural electrification agency</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Associação Moçambicana de Energias Renováveis (AMER) has been established to promote private-sector relevant policies in the renewable energy sector</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: New regulations for the off-grid energy sector are currently being drafted with the support of the BRILHO program, in coordination with MIREME, ARENE and FUNAE

Weakness: EDM, state owned utility of Mozambique, sustains technical and administrative losses which results in financial problems

Primary Focus Area: FUNAE should work towards mobilization of funds for the off-grid sector to achieve universal access by 2030

Rwanda

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:
Table 20: Institutional Structure of Rwanda

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Infrastructure (MININFRA) was founded in 1962 and develops minimum standards requirements for SHS</td>
</tr>
<tr>
<td>Regulator</td>
<td>Rwanda Utilities Regulatory Authority (RURA), created by the Law n° 39/2001 of 13 September 2001, has a mission to regulate certain public utilities</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Strategy under RURA established in June 2016, aims to achieve an accelerated pace of electricity access and service penetration in rural areas</td>
</tr>
<tr>
<td>Renewable Association Energy</td>
<td>Rwanda Energy Private Developers focuses on the advocacy of its members to encourage collaborations and partnerships for the development of energy sector</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: The Ministry of Infrastructure has launched a subsidy window as part of Renewable Energy Fund (REF) Project to connect households with solar energy.

Primary Focus Area: The institutions should work towards achieving government’s target of universal access by 2024 through 52% on-grid and 48% off-grid as specified in National Strategy for Transformation.

Somalia

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 21: Institutional Structure of Somalia

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Energy and Water Resources, established in 2014, to fulfil responsibilities of Water Resources and Energy Exploration</td>
</tr>
<tr>
<td>Regulator</td>
<td>Somalia Energy Regulatory Authority has been established in April 2021 for regulation of electricity sector</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Department works under the Ministry of Energy and Water Resources for rural electrification efforts</td>
</tr>
<tr>
<td>Renewable Association Energy</td>
<td>Somali Green Energy Association (SOGEA) is a not for-profit trade association that was established in 2021 to facilitate the growth and development of renewable energy business in Somalia</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: The recent establishment of SOGEA is expected to increase awareness, capacity building and networking activities in the renewable energy sector.
Weakness: The long period of civil strife threatens the working of institutions for development of the energy infrastructure.

Primary Focus Area: Somalia should work towards establishment of a dedicated Rural Electrification Agency to boost rural electrification

South Sudan
The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 22: Institutional Structure of South Sudan

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Electricity &amp; Dams was established in 2011 to fulfill the responsibilities of electricity generation, transmission, distribution, and oversight</td>
</tr>
<tr>
<td>Regulator</td>
<td>South Sudan Electricity Regulator Authority functions under the Ministry of Electricity and Dams</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Department currently operates under the Ministry of Electricity &amp; Dams for undertaking rural electrification efforts</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Renewable Energy Council of South Sudan (RECOSS) was established in 2017 for development of Renewable Energy</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Weakness: South Sudan’s electricity-related institutions are still in their infancy when it comes to institutional governance. The country lacks an independent electricity regulator and a dedicated rural electrification agency.

Primary Focus Area: South Sudan should work towards removing inefficiencies and weaknesses in the institutional structure to expand opportunities for private investment in the sector

Sudan
The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 23: Institutional Structure of Sudan

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td>Ministry of Water Resources, Irrigation and Electricity (MoWRIE) aims at connecting Sudan by stable and developed electric network</td>
</tr>
<tr>
<td>Regulator</td>
<td>Electricity Regulator Authority (ERA) serves as the regulator</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Absent</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis
Positive: Government of Sudan has a plan to provide 2.5 million SHS by 2023 in areas where grid connections are absent

Weakness: The government institutions have been unable to attract private participation in the energy sector

Primary Focus Area: There country should work towards establishment of a dedicated Rural Electrification Agency for promoting development of off-grid technologies

**Tanzania**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 24: Institutional Structure of Tanzania

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td><strong>Ministry of Energy &amp; Minerals</strong> formed in 2017 is responsible for policy-making and overall coordination of the energy sector</td>
</tr>
<tr>
<td>Regulator</td>
<td><strong>Energy &amp; Water Utilities Regulatory Authority</strong> established by Energy and Water Utilities Regulatory Authority Act, 2001 (Act No. 11 of 2001) is responsible for technical and economic regulation of the electricity, petroleum, natural gas and water sectors.</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td><strong>Rural Energy Agency</strong> is an autonomous body under the Ministry of Energy and Minerals of the United Republic of Tanzania to promote access to modern energy services in rural areas of mainland Tanzania.</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td><strong>Tanzania Renewable Energy Association (TAREA)</strong>, established in 2000, focuses on promoting the use of renewable energy in the country</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Positive: TAREA has been working towards development of off-grid sector by certifying solar energy installers and training of Micro-Finance Institutions

Weakness: The government has a bias towards supporting large scale grid connected projects as reflected in Power System Master Plan, 2020

Primary Focus Area: Rural Energy Agency should work towards capitalizing of the newly established Rural Energy Investment Facility to fulfil its plans of electrification of 85% villages by 2025 and achieving universal access by 2030

**Uganda**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

Table 25: Institutional Structure of Uganda

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
</table>
Ministry | **Ministry of Energy & Mineral Development** is promoter of energy related laws, policies and regulations.
---|---
Regulator | **Electricity Regulatory Authority** is a statutory body established in the year 2000 to regulate the generation, transmission, distribution, sale, export and import of electrical energy in Uganda.
Rural Electrification Agency | **Rural Electrification Agency (REA)** was established as a statutory instrument in 2001 (no. 75) to implement the government’s rural electrification program in line with the rural electrification strategy.

*Source: Deloitte Analysis*

**Positive:** Uganda Solar Energy Association (USEA) formed in 2016 by private sector companies in the solar energy business has been active in promoting the solar energy sector through marketing and awareness activities, and keeping members informed about financing opportunities.

**Weakness:** There are efforts to integrate REA as a department under the Ministry of Energy and Mineral Development (MEMD) to cut down on costs and resources. As a result of merger, REA will cease to exist independently and won’t have a dedicated budget as before. This would result in regulatory and investment risks.

**Primary Focus Area:** Uganda has a robust institutional framework for its electricity sector. It should focus on keeping the Rural Electrification Agency autonomous with its own budget for competitive and fast electrification in rural areas.

**Zambia**

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

*Table 26: Institutional Structure of Zambia*

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry</td>
<td><strong>Ministry of Energy</strong>, established in 2016, is responsible for the formulation and implementation of energy policy, and pricing of energy</td>
</tr>
<tr>
<td>Regulator</td>
<td><strong>Electricity Regulatory Board</strong> was established in 1997 to regulate utilities in the energy sector through specialized licenses it issues</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td><strong>Rural Electrification Agency</strong> was established by the Government of Zambia through the enactment of Rural Electrification Act in November 2003 to increase availability and access to electricity in rural areas from 3% to 51% by the year 2030</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td><strong>Zambia Renewable Energy Association (ZARENA)</strong> is an interest group for renewable energy stakeholders in Zambia with the objective to foster and promote the large-scale adoption of renewable energy in Zambia</td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*
**Positive:** In February 2018, the Ministry of Energy established Zambia Off-grid Energy Task Force (ZOGTF), which is made up of 6 government representatives, 8 cooperating partners and 5 members representing the private sector. The purpose of ZOGTF is to coordinate and provide oversight on initiatives in the off-grid sector in Zambia.

**Weakness:** The country’s energy regulation has allowed private participation for more than two decades, yet IPPs have not been able to gain significant traction or mass adoption.

**Primary Focus Area:** Government of Zambia should undertake steps to diversify sources of energy generation (reduce dependence on hydro) and invite participation of IPPs.

### Zimbabwe

The institutional structure in the country responsible for control and monitoring of the electricity sector consists of the following key stakeholders:

**Table 27: Institutional Structure of Zimbabwe**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Energy and Power Development</td>
<td>is responsible for policy formulation, promotion of renewable sources of energy and overseeing the performance of state-owned utility.</td>
</tr>
<tr>
<td>Zimbabwe Electricity Regulatory Authority</td>
<td>was established in 2012 by the Energy Regulatory Authority Act of 2011 to regulates all energy sources</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>Rural Electrification Agency (REA), now known as Rural Electrification Fund (REF) was established by the Rural Electrification Act that was promulgated in 2002. It’s mission is to support the equitable electrification of all of Zimbabwe’s rural areas using the traditional grid network as well as renewable energy technologies such as solar and biogas</td>
</tr>
<tr>
<td>Renewable Energy Association</td>
<td>Renewable Energy Association Zimbabwe (REAZ) is an independent non-profit making organization which was constituted in 2014 to promote development of renewable energy technologies in Zimbabwe</td>
</tr>
</tbody>
</table>

**Source:** Deloitte Analysis

**Positive:** A Green Energy Fund has been established to extend financial credit for projects related to renewable sources of energy.

**Weakness:** Zimbabwe Electricity Supply Authority (ZESA) faces financial challenges to recover operating costs due to low tariffs

**Primary Focus Area:** Infrastructure Development Bank of Zimbabwe (IDBZ) should mobilize funds for Green Energy Fund through pension funds, insurance schemes and bond markets
The starting point for off-grid development is establishment of a strong policy framework which clearly state the intention by the governments to develop renewable energy through on-grid and off-grid technologies. This is followed by the legal and regulatory frameworks to set the rules and procedures for implementation of policies. A robust institutional framework is then put in place to implement the policies and enforce the regulations. Ministry responsible for Energy, Electricity Regulatory Authority, Rural Electrification Agency and Renewable Energy Association are four important institutions for development of energy sector in a country. Countries such as Kenya, Tanzania, Uganda, Zimbabwe have strong institutional structure with presence of key bodies responsible for efficient functioning of the electricity sector. Countries such as Eritrea, Libya and South Sudan have weak institutional structure and can learn lessons from their peers in the COMESA and TDB region for strengthening of Institutional Structure.

3. Mini-grid Development Framework

Scaling up of mini-grid development requires well defined policies around tariff setting, licensing requirements, quality standards, fiscal benefits, etc. to smoothen the installation and operating procedures for mini-grids. Appropriate provisions should be in place to safeguard the interest of the mini-grid operators in case of arrival/encroachment of Main-grid. Robust policy framework in place can make the mini-grids affordable for the consumers and provide adequate returns to the mini-grid operators.

*Figure 56: Key elements of Mini-grid Development Framework*
A total of 18 countries were analysed on key parameters for development of mini-grids such as licensing procedures for mini-grids, cost-reflective tariff setting procedures, rules regarding encroachment of the mini-grid, fiscal benefits for the development of the mini-grid and quality standards in place for mini-grids. Countries such as Burundi and Mozambique lack clear licensing norms for mini-grids. Countries such as Burundi, Djibouti, DR Congo, Eritrea, Kenya, Malawi, Mozambique, Somalia, South Sudan, Uganda and Zambia lack clear provisions in case of arrival/encroachment of Main-grid in areas of mini-grid operation. Countries such as Burundi, Djibouti, Madagascar, Malawi, Mozambique, Somalia and South Sudan lack quality standards for mini-grid operation.

Figure 57: Heatmap of Mini-grid Development Framework in COMESA and TDB countries

Source: Deloitte Analysis

Countries such as Burundi, Malawi, Mozambique, Somalia and South Sudan lack strong provisions for mini-grid development. Countries who have strong mini-grid development provisions have been covered in detail below:

**Ethiopia**

Mini-grid Directive No. 268 of 2020 guides the mini-grid sector in Ethiopia. The key provisions for mini-grid development are:

Table 28: Pillars for Mini-grid Development in Ethiopia
Licensing Procedures
- Private developers with any capacity are required to obtain generation, distribution and sale licenses. All projects except those that run by cooperatives require a license.
- Projects with capacity of < 50 KW are exempted from license but registration is mandatory.
- Projects greater than 50 KW but less than 1000 KW must obtain license.
- Projects above 1000 KW must obtain license. Concessions are awarded through competitive tender; unsolicited offers are allowed and evaluated on a case-by-case basis.

Tariff Setting
- Ceiling Tariffs are provided on project-to-project basis according to a generation capacity and development plan provided to Ethiopian Energy Authority (EEA) by the operators.
- Directives 19 to 26 of the Mini-grid Directive No. 268 of 2020 clearly defines the tariff methodology and approval process for setting mini-grid tariffs.

Arrival of Main grid
- Directive 16 of the Mini-grid Directive No. 268 of 2020, provides for customer and operator rights in the event of mini-grid encroachment by the main grid. The customer is not required to pay any additional fees.
- Directive 18 of Mini-grid Directive provides for the procedure for compensation in the event of mini-grid encroachment. The compensation shall equal the book value of the assets to be handed over.

Fiscal Benefits
- Import duty waiver exists for mini-grid equipment assembled in the country.

Quality Standards
- Directive 40 provides for technical standards to prescribe minimum design standards for electricity supply with mini-grids. IEC 61215 and IEC 61730 quality standards are prescribed in the country for solar PV models.

Source: Deloitte Analysis

Rwanda
In 2015, the Rwanda Utilities Regulatory Authority (RURA) adopted regulations that specify licensing requirements, tariff guidelines, and provisions for grid arrival. The key provisions for mini-grid development are:

Table 29: Pillars for Mini-grid Development in Rwanda

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensing Procedures</td>
<td>- The mini-grid operators need to obtain a license from RURA &lt;br&gt;- Very small operators (&lt; 50 KW) are exempt from licensing requirements &lt;br&gt;- Licenses are expected to be granted for 10 years to isolated mini-grids and 15 years for small power distributors</td>
</tr>
<tr>
<td>Tariff Setting</td>
<td>- The mini-grid operators are free to set their own tariffs &lt;br&gt;- RURA reviews tariff calculations by mini-grid licensees to ensure fair prices for end-users</td>
</tr>
<tr>
<td>Arrival of Main grid</td>
<td>The mini-grid operators have the below options in case of grid-arrival: &lt;br&gt;- Relocation of assets &lt;br&gt;- Sell assets to the utility &lt;br&gt;- Become a small power producer and sell electricity for a fixed renewable feed-in tariff</td>
</tr>
</tbody>
</table>
• Become a distributor of electricity purchased from the Main grid
• RURA provides mediation in case the utility and mini-grid operators cannot reach agreement

**Fiscal Benefits**
• Law No. 06/2015 of 28 March 2015 provides specific incentives such as preferential corporate income tax rates to investors in RE projects

**Quality Standards**
• The Ministry of Infrastructure released the Guidelines on Mini-grid Development in 2019 which clearly specifies that power distribution infrastructure must adhere to RURA’s technical requirements for mini-grids and generation assets must follow IEC and ISO standards

**Source: Deloitte Analysis**

**Sudan**
The key provisions for mini-grid development are:

**Table 30: Pillars for Mini-grid Development in Sudan**

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Licensing Procedures** | • The mini-grids with capacity less than 500 KW are exempted from requiring a license.  
                              • The mini-grids above 1000 KW require a generation license.  
                              • Projects of less than 1 MW are exempted from paying a license fee for 10 years  
                              The country has plans (by July 2023) to adopt a licensing model where the regulator  
                              shall grant a single license providing exclusivity to a service area |
| **Tariff Setting**       | • The mini-grid operators are free to set their own tariffs for projects below 1000 KW  
                              • The Electricity Regulatory Authority (ERA) reviews tariff calculations by mini-grid  
                              licensees to ensure fair prices for end-users |
| **Arrival of Main grid** | • The Mini-grid Protection Act adopted in 2010 protects mini-grid projects from grid power arrival  
                              • Main grid connection won’t be allowed in already developed mini-grid areas |
| **Fiscal Benefits**      | • Result Based Subsidy Grant is available for projects above 1000 KW of USD 100 per connection |
| **Quality Standards**    | • Sudan Bureau of Standards formulates quality standards, quality assurance system and product certification scheme for all mini-grid equipment |

**Source: Deloitte Analysis**

**Tanzania**
Small Power Producers (SPP) Framework oversees the mini-grid development in Tanzania and has laid down regulations for licensing, tariff setting, encroachment of the Main grid and quality standards. The key provisions for mini-grid development are:

**Table 31: Pillars for Mini-grid Development in Tanzania**

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Licensing Procedures** | • In 2014, mini-grids under 100 KW were exempted from the licensing process but this exemption was revoked in 2018  
                              • Mini-grid developers can hold single licenses for multiple sites |

© 2022 Deloitte Touche Tohmatsu India LLP
Tariff Setting

- SPP Framework allow small mini-grids (< 100 KW) to negotiate tariffs directly with future customer
- Small power projects must apply to EWURA for tariff approval

Arrival of Main grid

Mini-grid operators have the following options in case of grid arrival:
- Interconnect and operate as a Small Power Producer
- Interconnect and operate as a Small Power Distributor
- Interconnect and operate as both Small Power Producer and Small Power Distributor

In 2017, a compensation to mini-grid operators was introduced, if they chose not to interconnect

Fiscal Benefits

- The Value Added Tax Act of 2014 exempted solar panels, modules, solar charger controllers, solar inverter, solar lights, vacuum tube solar collectors and solar battery from VAT.
- The 2015 VAT Act and 2016 Customs Law amendments removed exemptions for some items such as wire/cables, switches, light emitting diode (LED) lights, and other solar energy system components

Quality Standards

- The mini-grids to be operated in accordance with applicable laws, “TZS 1373: Power quality – Quality of supply”, and “TZS 1374: Power quality – Quality of service and reliability”
- The Tanzania Bureau of Standards developed technical standards for mini-grid generation and distribution networks that address safety, reliability and performance issues

Source: Deloitte Analysis

Zimbabwe

Zimbabwe Mini-grid Development Framework, 2018 covers technical and financial requirements for mini-grids around the country to encourage private sector participation. The key provisions for mini-grid development are:

Table 32: Pillars for Mini-grid Development in Zimbabwe

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensing Procedures</td>
<td>• The mini-grids with capacity &lt; 100 KW are exempted from requiring a license&lt;br&gt;• The mini-grids above 100 KW require a generation license&lt;br&gt;• Projects of less than 1 MW are exempted from paying a license fee</td>
</tr>
<tr>
<td>Tariff Setting</td>
<td>• Mini-grid developers with capacity below 100 KW can determine their own tariff&lt;br&gt;• For mini-grid above the size of 100kW, tariffs have to be approved by ZERA&lt;br&gt;• ZERA has published a tariff code which provides guidance to developers on how to determine tariffs that are fair to both the consumer and licensee</td>
</tr>
<tr>
<td>Arrival of Main grid</td>
<td>• Mini-grid operators have the following options in case of grid arrival:&lt;br&gt;• Become a small IPP and sell to utility&lt;br&gt;• Buy power from the grid and sell to users&lt;br&gt;• Use Combination of above two options&lt;br&gt;• Act as a backup for power supply in case of grid power&lt;br&gt;Mini-grids can be incorporated into the main grid only if they meet relevant technical and safety standards</td>
</tr>
<tr>
<td>Fiscal Benefits</td>
<td>• Renewable energy developers can receive a 5-year tax holiday from paying corporate tax</td>
</tr>
</tbody>
</table>
Many countries in COMESA and TDB region can opt for mini-grid solutions to address their low electrification challenges. Mini-grid development requires seamless licensing process. There should be a threshold capacity (for example 100 KW) below which the mini-grids should be governed by light-handed regulations as red tape often hinders the development of mini-grids. The electricity regulators need to guide developers on tariff setting methodology while also making sure that the proposed tariffs are cost reflective and affordable for customers. The regulators shall also specify the scenario for the operation of mini-grid when main grid connection reaches the existing mini-grid area to prevent risk of stranded assets. To encourage private sector participation, the mini-grid developers can be extended tax holidays for early years of their operations. The import duty and VAT waivers on import of mini-grid components can reduce the cost of generating electricity resulting in lower cost for end users and faster adoption of these solutions. The regulators shall also specify technical standards such as operating voltage range, frequency range, wiring standards etc. for mini-grid operation to ensure safety for the end users. The service level for mini-grids shall also be defined to ensure reliability of electricity access for the population.

Source: Deloitte Analysis

| Quality Standards | • Zimbabwe Mini-grid Development Framework, 2018 provides technical standards for mini-grid |

Scaling up of mini-grid requires dedicated policies around tariff setting, licensing requirements, quality standards, fiscal benefits and arrival of Main-grid. Countries such as Ethiopia, Madagascar, Rwanda, Tanzania and Zimbabwe have strong provisions for mini-grid development. Countries such as Burundi, Malawi, Mozambique, Somalia and South Sudan lack clear rules for mini-grid development. These countries can learn from their peers in the COMESA and TDB regions to strengthen the regulations for mini-grid development.
E. Financing in Off-grid Solar Sector

The developed nations of the world have been supporting the developing nations by providing climate finance to mitigate and adapt to climate change. The developed countries have made a commitment of mobilizing USD 100 billion every year in climate finance for developing countries. The developed countries are confident of meeting this target by 2023. The major contributors of the climate finance have been countries such as UK, US, Germany, Japan, Norway and France. The major recipients of climate financing have been India, Brazil, Indonesia, Bangladesh and South Africa.

Figure 58: Global Climate Financing Trend

The highest recipient of Climate Finance has been Energy sector. Most funds are disbursed through loans followed by grants and equity. Green Climate Fund (GCF) is the world’s largest climate fund to support developing countries in realizing their NDCs. GCF provides financial support through a flexible combination of grant, concessional debt, guarantees or equity instruments for climate action in developing countries. The fund is mandated to invest half of its adaptation resources in climate vulnerable countries (SIDS, LDCs and African States).

46 Source: UK COP26
To achieve universal energy access by 2030, the off-grid solar sector needs to serve approximately additional 228 million people with products that provide a Tier 1 level of service or higher. This will require funding of about USD 6.6–11 billion in public and private financing.\textsuperscript{47} As per GOGLA investment database, the investments in the off-grid solar sector have seen an uptrend over the long term. The investment in the sector has grown from USD 21 million in 2012 to USD 316 million in 2020, becoming 15x times over a span of 8 years. The sector saw 43 investors making at least USD 1 million investment in 2020.\textsuperscript{48}

\textsuperscript{47} Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022

\textsuperscript{48} Source: GOGLA
The investments have been highest in the Eastern Africa region, accounting for nearly 60% of the total investment. Investment in East Africa was driven by enabling factors such as prevalence of PAYGO model, high financial inclusion, positive regulatory landscape and conducive business environment.
Top 10 companies with the highest investment commitments since 2012 have been Zola Electric, d.light, M-KOPA SOLAR, BBOXX, Mobisol, Nova Lumos, Greenlight Planet, Azuri Technologies, Kingo and SolarNow.\textsuperscript{50}

The different sources of financing in the off-grid sector are Governments/ DFIs, Impact Investors, Crowdfunding Investors, Commercial FIs and Family/ Foundations. The predominant role in financing has been played by DFIs, Impact Investors and Crowdfunding Investors.

The World Bank Group is playing an important role in financing of off-grid solar sector. It has approved over USD 800 million for off-grid solar projects across 25 countries in 2018–19 alone, with around USD 400 million approved in 2020 and 2021.\textsuperscript{51}

\textit{Figure 62: Sources of Capital in Global Off-grid Solar Sector}

The different DFIs have played a key role in financing the off-grid solar sector. The share of DFIs in the overall capital mix has increased over the years, constituting 40\% of total investment in 2018.\textsuperscript{52} DFIs invest in the off-grid solar sector through both direct and indirect investment, mostly through debt. DFIs are familiarizing financial institutions with the off-grid sector by co-financing. In 2017, Stanbic Bank, CDC, FMO, and Norfund offered a syndicated USD 55 million loan to M-KOPA in 2017 in Kenyan and Ugandan shillings.\textsuperscript{53}

\textsuperscript{50} Source: Off-grid Solar Market Trends Report, 2020
\textsuperscript{51} Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022
\textsuperscript{52} Source: GOGLA
\textsuperscript{53} Source: Off-grid Solar Market Trends Report, 2020
A wide range of bilateral and multilateral funds are available for off-grid solar sector. DFID’s Access to Clean Energy (ACE) program provides grants, loan support, and technical assistance to 14 countries in Africa. USAID’s Power Africa Beyond the Grid (BTG) program has a goal to provide around 20 million Solar Home System connections.

World Bank’s RIFF (Regional Infrastructure Financing Facility) project is aimed at developing the off-grid solar sector in the COMESA and TDB regions. The first component of the project is worth **USD 325 million** and is aimed to provide project finance to infrastructure projects. The second component of the project is worth **USD 75 million** and will provide debt financing to Small and Medium-sized Enterprise (SME) providing Solar Home Systems (SHS) in Southern and Eastern Africa. The third component of the project is worth **USD 25 million** and will provide Capacity Building and Technical Assistance to COMESA and TDB. The technical assistance to TDB will focus on project development and portfolio management. The technical assistance to COMESA region will focus on following activities:

- Harmonization of policies and regulations for cross-border infrastructure, trade and investment
- Regional integration activities in the off-grid energy sector
- Market development activities in the off-grid energy sector in Fragile Conflict and Violence (FCV) countries

Crowdfunding is another important source in the investing landscape in the off-grid solar sector. Crowdfunding is mainly employed for sourcing working capital by early-stage companies. There are several primary crowdfunding platforms such as Kiva, TRINE, Energise Africa, Lendahand, Bettervest, and Crowdcredit.

The capital from commercial banks is difficult to access in the off-grid sector. The banks are biased towards lending to larger off-grid solar companies and multinationals. The transactions mostly occur in the hard currency which exposes the local companies to currency risk due to currency depreciation.

Commercial funding instruments and consumer financing models are covered in this section. The commercial financing in the off-grid sector occurs primarily through three instruments: Grants, Debt and Equity. The consumer financing occurs in the off-grid sector mainly through four types of models: Retail/Cash, PAYGO, Partner FI and Fee as a Service.
Figure 63: Key Components of the Off-grid Financing Section

Source: Deloitte Analysis

1. Commercial Funding Instruments
The off-grid solar companies require different levels of financing depending on their growth stages. Acumen’s report on Accelerating Energy Access, the Role of Patient Capital (2018) defines various stages of an off-grid company and the capital requirements:

Figure 64: Different Stages of an Off-grid Solar Company

Source: Accelerating Energy Access, the Role of Patient Capital by Acumen (2018)
There are different funding rounds through which a start-up raises capital. The various milestones in the process of financing a company are:

*Figure 65: Different rounds of Funding for a Startup*

- **Pre-seed**
  Earliest stage of funding by founders, friends, families etc. to get the operations off the ground.

- **Seed Funding**
  Financing to fund a company’s initial activities like market research and product development.

- **Series A Funding**
  Funding secured to optimize user base and product offerings after developing a track record.

- **Series B Funding**
  Funding by well established firms for expanding sales, advertising, technology, support, and employees.

- **Series C Funding**
  Successful startups raising capital for developing new products, expanding into new markets or acquiring other companies.

*Source: Investopedia*

The funds in the off-grid solar sector are mainly raised through three instruments: Grants, Debt and Equity

**Grants**
Grant instruments are **non-payable funds, products or services** which are gifted by a government agency, foundation, corporation, or an individual. Grants are useful for off-grid solar companies in their **early stages of their development**. Grants play a catalytic role in nascent industry by accelerating of business models. In 2020, the global off-grid industry saw an investment of **USD 29 million in grants mostly through Governments and DFIs.**

---

54 Source: GOGLA
Grants are provided to fund specific activities. Grants can come in form of **grant window, grants, results-based financing (RBF) and crowdfunding**. RBF is a popular instrument used in the off-grid sector for market expansion.

**Sources of Grant Funding (2020)**

- 97% Government/DFI
- 3% Family Office/Foundation

Source: GOGLA

**Grant Instruments**

1. **Grant Window**
   A grant window awards funds to a company for achieving specific goals. It operates for a set time period, with a predetermined open and close date.

2. **Result-based Financing**
   Results-based financing (RBF) provides financing to the companies after they accomplish agreed quota of results. Governments in both developed and developing countries have used RBF to encourage the uptake of renewable energy and energy-efficient technologies.

3. **Reward-based Crowdfunding**
   Reward-based crowdfunding provides funds to a company through an online platform and offers funders a gift in exchange for their financial contribution.

Source: Deloitte Analysis
Grant Window

Grant window is used during the pre-seed and seed phases of the business lifecycle to formalize a proof of concept or to scale up operations. The ticket size for such an instrument can range from **USD 10,000 - USD 1 million** and funding can occur in both hard as well as local currency. The window is open for a set time, with predetermined open and close dates. There are grant windows which run on revolving basis, giving companies the opportunity to apply multiple times. Grand window facilities can be used to fund activities such as **product research and development, market research, capacity building, technical assistance, and development of regulatory frameworks**. The Grant facility may include specific restrictions on how the money is spent.

The grant facility can enable early-stage companies to develop and scale their business models. It has been used extensively in the off-grid solar industry by companies in the COMESA and TDB regions.

The various benefits and challenges of this instrument are:

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grant Window</strong></td>
<td>• Provide necessary funding to develop sustainable business models</td>
<td>• Small ticket size to make a substantial impact</td>
</tr>
<tr>
<td></td>
<td>• Can be used by early-stage companies lacking track record</td>
<td>• Introduces market distortion by subsidizing certain companies</td>
</tr>
<tr>
<td></td>
<td>• Cost free financing as lack of repayment</td>
<td>• Time consuming and inflexible source of funding</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Figure 68: Case Study of Grant Window

**Case Study: Solarworks!, Mozambique**

In May 2017, SolarWorks! received a seed grant from the GSM Association (GSMA) to test machine learning optimization in their SHSs. The system employed weather forecasting and user data for minimizing system downtime. SolarWorks! aimed to improve customer satisfaction and reduce energy cost through this technology. The technology was instrumental in increasing SHS sales of the company.

Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020

Results-Based Financing

Results-Based Financing (RBF) refers to a financing structure in which **payments made to companies or customers are tied to certain milestones** or deliverables (for example, kilowatts installed). They are mostly used to finance companies with series A-C funding. Governments in both developed and developing countries have used RBF to encourage the uptake of renewable energy technologies. In the SHS market, quotas can be set to trigger financing disbursements.
based on results such as the number of SHS installed, the number of households or businesses electrified etc.

Results-Based Financing is suitable when high costs prevent companies from entering an underserved area but there is a need to rapidly provide electricity access to large number of people in a short span of time. For a Results-Based Financing scheme to be successful, the funders must have significant capital. The implementers need to be aware of the national guidelines regarding subsidies which might help in designing the structure of the RBF program. In order to reach scale, the program might require buy-in from the national environment.

The various benefits and challenges of this instrument are:

**Table 34: Benefits and Challenges of Results-based Financing**

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| **Result-based Financing** | • Fosters market competition and triggers fast development of off-grid solar market  
• Flexible source of funding  
• Lower risk of fund misuse as financial risk lies with recipient. | • Determining right level can be challenging  
• Can prove to be expensive for funder in absence of any cap on incentives  
• Not suitable for early-stage companies who cannot prefinance delivery of SHS  
• Tracking and verification may be daunting |

Source: Deloitte Analysis

The Results-Based Financing has been used in COMESA and TDB countries such as Kenya, Tanzania and Zambia.

In Tanzania, the scheme has been used extensively in the healthcare and energy sector. The Rural Energy Agency has established a number of results-based financing (RBF) programs to financially support mini-grids. REA disbursed USD 500 and USD 600 grants per new connection for a Hydro mini-grid and a Solar Hybrid mini-grid respectively under the Tanzania Energy Development and Access Expansion Project (TEDAP) administered by the World Bank in FY 15.

In Zambia, RBF reverse auction scheme was used to fund energy providers. Bidders with lowest value of subsidy to scale their operations received financing through RBF grants. Through RBF mechanism, 4 firms having different business lines like SHS, micro-grids, bioenergy and solar cooking products leveraged RBF mechanism to provide variety of energy services to the population. 56

56 Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022
Figure 69: Case Study of Results Based Financing

**Case Study: Kenya Off-grid Solar Access Project (KOSAP)**

KOSAP is a World Bank-funded project operated by the Kenyan government which intends to improve power availability in Kenya’s underserved regions through Off-grid solar products and solar Mini-grids. Project included a $42 million Off-grid solar financing component, which had a $12 million RBF facility. The Kenyan government selected SNV and SunFunder as implementation partners.

The financing facility provides corporations with financial incentives for electrifying unserved counties. Counties are partitioned into service territories and tenders are held for each service territory. Companies bid on a finance amount per household that they estimate will be needed to electrify the household and a sales objective that they believe can be met. Companies with the smallest finance requirements win if they meet eligibility conditions and have a demonstrated track record.

**Reward-based Crowdfunding**

In reward-based crowdfunding, a company raises funds through an online platform and offers funders a gift as a goodwill gesture in acknowledgment of their financial contribution. It is mainly used in to raise *pre-seed to seed funding*. The *ticket size* for such grants may range from **USD 5000 – USD 500,000**. This instrument formalizes the fundraising process from family and friends. The off-grid companies such as *Kenya Green Supply, EcoCharcoal and Kitui Industries have used M-Changa*, a Kenya-based donation crowdfunding platform, to raise early-stage seed capital.

The various benefits and challenges of this instrument are:

---

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| **Reward-based Crowdfunding** | • Builds product awareness and attracts talent  
• Faster than applying for a grant window  
• Light on due diligence | • Entrepreneurs lacking suitable networks, technical and marketing sophistication unable to tap this source  
• Difficult to find right platform fit due to currency and functionality issues |

---

*Source: Deloitte Analysis*

---

57 *Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020*
Figure 70: Case Study of Reward Based Crowdfunding

Case Study: Gravity Light Kenya

GravityLight is a low-cost, kinetic-energy-powered light whose designers launched a $55,000 reward-based crowdfunding campaign in 2013. Gifts ranged from a “thank you” on the GravityLight website to the light itself. On the Indiegogo site, the campaign raised $400,000 in 40 days (727% of its goal) which allowed the company to pilot the product in 26 countries.

In 2015, the company launched a second reward-based crowdfunding campaign on Indiegogo and raised an additional $400,000 (128% of its goal), which it utilized to conduct a commercial pilot in Kenya. In June 2018, GravityLight began their third Indiegogo campaign and raised $115,000 (147% of the goal).

Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020

Grant Financing in COMESA and TDB region

Grant support has been used extensively by off-grid entities operating in COMESA and TDB in regions.

Figure 71: Grant Financing from Official Donors for Solar Isolated Grids and Standalone Systems in 2019

Grants from Official Donors for Solar Isolated Grids and Standalone Systems in 2019 (‘000 USD)

<table>
<thead>
<tr>
<th>Country</th>
<th>Grants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunisia</td>
<td>387</td>
</tr>
<tr>
<td>DRC</td>
<td>262</td>
</tr>
<tr>
<td>Uganda</td>
<td>181</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>147</td>
</tr>
<tr>
<td>Kenya</td>
<td>117</td>
</tr>
<tr>
<td>Malawi</td>
<td>85</td>
</tr>
<tr>
<td>Rwanda</td>
<td>79</td>
</tr>
<tr>
<td>Somalia</td>
<td>58</td>
</tr>
<tr>
<td>Zambia</td>
<td>40</td>
</tr>
<tr>
<td>Djibouti</td>
<td>27</td>
</tr>
<tr>
<td>South Sudan</td>
<td>10</td>
</tr>
<tr>
<td>Burundi</td>
<td>5</td>
</tr>
<tr>
<td>Madagascar</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: OECD Creditor Reporting System

As per OECD’s Creditor Reporting System, Tunisia was the highest recipient of grants for solar isolated grids and standalone systems in the COMESA and TDB region in 2019. DRC, Uganda, Zimbabwe and Kenya were other countries who received substantial grant funding in the region. Grant support from Shell Foundation, USAID, DFID, USADF, AFD, AFDB has played a key role in facilitating market entry of off-grid players.
The countries in the COMESA and TDB regions can tap the below DFIs, NGOs, Strategic Investors for grant funding in the off-grid sector:

### Table 36: Potential Sources of Grant Financing in COMESA and TDB region

<table>
<thead>
<tr>
<th>Investor</th>
<th>Investor Type</th>
<th>Fund Manager</th>
<th>Ticket Size</th>
<th>Countries Eligible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alphamundi Foundation</td>
<td>Foundation/ NGO</td>
<td>AlphaMundi Foundation</td>
<td>5,000 - 50,000 (USD)</td>
<td>Kenya, Rwanda, Tanzania, Uganda and Zambia</td>
</tr>
<tr>
<td>Beyond the Grid Fund for Africa</td>
<td>Development Finance Institution</td>
<td>Nordic Environment Finance Corporation (NEFCO)</td>
<td>&gt; 1,000,000 (EUR)</td>
<td>Mozambique, Uganda and Zambia</td>
</tr>
<tr>
<td>DOEN Foundation</td>
<td>Foundation/ NGO</td>
<td>Stichting DOEN/ DOEN Foundation</td>
<td>200,000 - 500,000 (EUR)</td>
<td>Ethiopia, Kenya, Rwanda, Tanzania and Uganda</td>
</tr>
<tr>
<td>EDP Access to Energy CSR Fund</td>
<td>Strategic Investor</td>
<td>Energias de Portugal (EDP)</td>
<td>50,000 - 200,000 (EUR)</td>
<td>Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Sudan, Tanzania, Uganda, Zambia, Zimbabwe</td>
</tr>
</tbody>
</table>
Grant financing is important for funding early-stage funding companies who lack track record for R&D, market research, etc. DFIs such as USAID, AfDB have been major sources of grant financing in off-grid solar sector in the COMESA and TDB regions. Grant financing has enabled companies such as BBOXX to penetrate tough markets such as DRC, hence it is an important source of capital for implementing pilots. Grant financing poses challenges in form of inflexibility, long lead time for disbursement, small ticket size, etc.

**Debt**

Growth-phase companies (Series A–C) use debt to raise working and investment capital. In secured debt financing, the borrower pledges collateral (such as land or inventory) that may be repossessed by the lender in the event of default. In unsecured debt financing, a loan is issued based only on the borrower’s creditworthiness.

Debt financing in the global off-grid solar sector in 2020 was nearly USD 206 million, a 23% increase from 2019. Debt sources were dominated by DFIs and impact finance that together accounted for almost 90% of the total debt commitments. The level of crowdfunded debt was also substantial, representing USD 21 million, 10% of the total debt in 2020.58

**Figure 73: Sources of Debt Financing in Global Off-grid Solar Sector**

![Sources of Debt Financing (2020)](image)

Source: GOGLA

---

58 Source: GOGLA
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

Debt can take many forms, from traditional instruments, such as term loans and lines of credit, to innovative instruments, such as securitization of accounts receivable and peer-to-peer (P2P) business lending.

There are 10 broad debt instruments most of which have been used by off-grid solar companies:

**Figure 74: Types of Debt Instruments**

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Term Loan</strong></td>
<td>• Widely employed by FI in all economies</td>
<td>• Lenders are unfamiliar with off-grid solar sector</td>
</tr>
<tr>
<td></td>
<td>• Match the needs of off-grid solar Players</td>
<td>• Lack of track record among borrowers</td>
</tr>
<tr>
<td></td>
<td>• Reduce reliance on grants</td>
<td>• Unwillingness to take SHS as collateral</td>
</tr>
</tbody>
</table>

59 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
Line of Credit

A line of credit is a flexible revolving loan that can be **drawn down, repaid, and redrawn on as required** within a specific time frame. The lender charges a maintenance fee on amount that remain undrawn. The borrower is able to adjust repayments based on his needs which offers flexibility. The line of credit facility is used by companies who are raising **Series A - Series C funding**. The ticket size for such instrument is usually between **USD 100,000 – USD 55 million**. 60

Line of credit is typically used to **fund working capital needs**.

The various benefits and challenges of this instrument are:

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| **Line of Credit**    | • Brings in flexibility for working capital requirements  
                        • Reduce reliance on soft loans enabling sustainability | • Limited hard currency financing  
                                                                 • off-grid sector borrowers lack positive operating cashflows  
                                                                 • Require careful design to support small companies  
                                                                 • Slow to adapt to rapidly changing market dynamics |

Regional Off-grid Electricity Access Project (ROGEAP) offers small off-grid enterprises with credit lines. ROGEAP has the objective to increase electricity access in 15 ECOWAS member countries and 4 additional countries (Cameroon, Chad, Mauritania, and Central African Republic).
project provides credit line managed by the West African Development Bank (BOAD) to small off-grid enterprises. The project offers several complimentary support measures like consumer awareness campaigns, private-sector technical assistance, market intelligence studies and quality assurance framework.  

**Venture Debt**

Venture debt is a senior term loan which is typically used by emerging growth companies who are backed by venture equity capital. The instruments include *warrants that gives the holder the right to buy the borrower’s equity shares at a certain price, quantity, and time* in the future. Venture debt is *more common in developed markets* than in emerging economies. The instrument can be used by companies right from *Seed Stage funding to Series C funding*. The ticket size for this instrument can range from *USD 50,000 to more than USD 5 million*. The instrument can be for *purchasing capital assets* and usually has a tenure of *1-5 years*. The various benefits and challenges of this instrument are:

**Table 39: Benefits and Challenges of Venture Debt**

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Venture Debt and Bridge Round</em></td>
<td>• Attractive mix of cost and flexibility</td>
<td>• Companies do not generate sufficient cash to attract lenders</td>
</tr>
<tr>
<td></td>
<td>• During worst performance, buys time for the companies to avoid down round</td>
<td>• Companies face high borrowing costs</td>
</tr>
<tr>
<td></td>
<td>• Can complement equity round and avoid dilution</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*

**Account Receivable Financing**

Accounts receivable financing is a type of asset-backed lending which is secured by expected future payments from customers. In this lending instrument, *Individual or institutional investors purchase invoices or receivable notes* from a company at a discount. Small and medium firms can *use online invoice trading to meet their working capital needs*. This instrument can be used by companies raising *Series A – Series C funding*. The ticket size for such an instrument ranges from *USD 1,000 to more than USD 1 million*. The various benefits and challenges of this instrument are:

**Table 40: Benefits and Challenges of Accounts Receivable Financing**

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Accounts Receivable Financing</em></td>
<td>• Diversifies sources of funding for borrowers</td>
<td>• Obtaining verifiable data on off-grid borrowers</td>
</tr>
</tbody>
</table>

61 Source: Designing Public Funding Mechanisms in Off-grid Solar Sector, 2022
62 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
63 Source: Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
Securitization

Securitization is a structured finance technique in which a special purpose vehicle (SPV) is created to raise funds by issuing debt securities, which are sold to investors. The proceeds raised are then used to fund receivables. In the off-grid sector, accounts receivable securitization is the most relevant form of securitization. If a bankruptcy remote SPV is used to raise financing, investors do not have recourse to the borrower if the receivables do not perform. The deal could be structured in such a way that it allows fraction of recourse to the borrower if the receivables do not perform.

Securitization is used for raising ticket sizes of more than USD 500,000. It is mostly employed by firms post their Series C funding when they have clear profitability path and a receivable track record. Securitization is widely used in developed countries in home mortgages and automobiles. The off-grid solar sector is in nascent stage with only few companies who have track record of financial profitability therefore securitization is not much viable option of raising capital. There is also the need to engage credit rating firms such as Moody’s, Standard and Poor’s and Fitch Ratings to rate securities after the off-grid solar sector proves its business and revenue models.

The various benefits and challenges of this instrument are:

Table 41: Benefits and Challenges of Securitization

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Securitization</strong></td>
<td>• Can be used for large ticket sizes</td>
<td>• Lack of secondary market</td>
</tr>
<tr>
<td></td>
<td>• Does not negatively impact the balance sheet</td>
<td>• Lack of credit rating agencies</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

64 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

Figure 78: Case Study of Securitization

Case Study: BBOXX, Kenya

In 2015, SHS manufacturer and distributor BBOXX raised USD 500,000 from Dutch investor Oikocredit through the securitization of 2,400 receivables from Off-grid households in Kenya. The company used 12 years of data it had collected from customers to structure notes called Distributed Energy Asset Receivables (DEARs), which represented a pool of receivables with an average value of $300. The notes were rated by a Kenyan-registered credit rating agency. The collateral offered was worth $1 million, that was twice the value of the principal.

Due to external circumstances like prohibition on fishing in Lake Victoria and the influence of the 2017 Kenyan elections the default rate on the receivables ended up being substantially higher than the predicted rate of 3-4% (greater than 10% predicted by World Bank) BBOXX has since raised debt financing using other financing instruments, such as P2P business lending and term loans from local banks.

Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020

Convertible Note

A convertible note is a debt that can be converted into company equity in the future. Notes usually carry a low interest rate. They can be used by early-stage companies to raise Seed and Series A funding. The ticket size for this instrument may range between USD 50,000 – USD 5 million. Convertible notes provide company founders with access to cheap capital and also rewards early investors for taking risk.

The various benefits and challenges of this instrument are:

Table 42: Benefits and Challenges of Convertible Note

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convertible Note</td>
<td>• Access to cheap capital</td>
<td>• Lack of investor exits</td>
</tr>
<tr>
<td></td>
<td>• Low transaction time</td>
<td></td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Figure 79: Case Study of Convertible Note

Case Study: Nuru, DRC

Nuru, formerly known as Kivu Green Energy (KGE), is a Mini-grid developer based in the Democratic Republic of the Congo (DRC). On 4 February 2020, Nuru commissioned a 1.3MW solar hybrid Mini-grid in Goma’s Ndosho community, where only 3 percent of the 12,000 households had access to electricity. This project is the largest isolated mini grid in Sub-Saharan Africa region. The project had received convertible notes of USD 2.45 million and USD 0.35 million on 3 May, 2019 and 2 September, 2019 respectively from Energy Access Ventures and Electrification Financing Initiative.


Revenue-Based Mezzanine Debt

Revenue-based mezzanine debt is a loan with flexible repayment schedules that is convertible into equity at a capped multiple. The instrument is created to allow investors to progressively exit as revenue increases and the borrower pays down principal and interest. This instrument incentivizes the borrower to repay the debt as quickly and simultaneously gives flexibility to adjust repayments in line with the business performance (revenue). This instrument is employed

65 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
by firms between Series B – Series C funding cycle. The ticket size for this instrument can range from **USD 500,000 – USD 1.5 million**.  

The limited track record of the off-grid solar companies is a challenge to access this instrument. It can be used by those firms to attract financing who have demonstrated their market performance over the years. For off-grid solar companies, **repayments could be tied to cashflows rather than the revenue as there is mismatch between revenue recognition and actual cash inflow due to credit sales, PAYGO model** etc. The flexible repayment feature is particularly suited for the COMESA and TDB regions due to **income seasonality** caused by factors such as income dependency on agriculture.

The various benefits and challenges of this instrument are:

**Table 43: Benefits and Challenges of Revenue-based Mezzanine Debt**

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue-based Mezzanine Debt</td>
<td>• Flexibility of repayment in line with performance</td>
<td>• Limited upside to investors</td>
</tr>
<tr>
<td></td>
<td>• Mitigates risk of cashflow mismatch</td>
<td>• Limited track record of off-grid solar companies</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

**Peer to Peer (P2P) Business Lending**

In P2P business lending, a **business borrower receives loan (mostly unsecured) from a group of individuals or institutional lenders**, which is facilitated through a **P2P business lending platform**. The companies with a track record of sales can raise finance through this instrument. The ticket size for this instrument may range between **USD 10,000 – USD 1 million**.

The P2P lending can be both syndicated as well as unsyndicated. P2P lending has been a popular source to raise capital for established off-grid solar companies such as **BBOXX and Azuri Technologies** in the COMESA and TDB region.

The various benefits and challenges of this instrument are:

**Table 44: Benefits and Challenges of Peer-to-Peer Business Lending**

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer-to-Peer Business Lending</td>
<td>• Shorter and transparent due-diligence process</td>
<td>• Platform incentives create conflict of interest</td>
</tr>
<tr>
<td></td>
<td>• Syndication lowers transaction cost</td>
<td>• Cost of currency hedging is prohibitively expensive</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

---

66 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
67 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
Figure 80: Case Study of Peer to Peer Business Lending

Case Study: Azuri Technologies SPV, Kenya, Tanzania, Uganda, and Zambia
Azuri Technologies raised $4 million in March 2017 as part of a $20 million off-balance sheet loan deal. The company employed a SPV transaction to raise debt from Swedish P2P business lending platform TRINE and EU-related impact fund ElectriFI to support the installation of 20,000 SHS units in Kenya.

The financing structure consisted of a 20% first-loss loan from Azuri Technologies to the Azuri Technologies SPV, a 50% contribution from ElectriFI (junior debt), and a 30% contribution from TRINE. The transaction was one of its kind in the Off-grid solar sector due to the combination of public and private financing, participation of a P2P business lending platform and the off-balance sheet structure.

Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020

Online Debt-Based Securities
Online debt-based securities are typically company-issued bonds or debentures sold at a fixed interest rate to both retail and institutional investors via an online platform which functions as a SPV. Online debt-based securities are generally non-transferable due to absence of secondary market. These are mainly employed by companies who are in their Series A – C funding cycle and the ticket size for such instrument can range anything between USD 100,000 and USD 1 million. 68 Online debt-based securities are similar to P2P business lending except the fact that they are for longer duration and used for project finance.

The various benefits and challenges of this instrument are:

Table 45: Benefits and Challenges of Online Debt Based Securities

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online debt-based securities</td>
<td>• Raising capital from retail investors</td>
<td>• Lack of supportive legal framework</td>
</tr>
<tr>
<td></td>
<td>Investors may receive tax incentives</td>
<td>• High burden of due diligence</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Figure 81: Case Study of Online Debt Based Securities

Case Study: Energise Africa, DRC, Kenya, Mozambique, Rwanda & Uganda
The Energise Africa platform, an online impact investing platform was founded by two P2P business lending platforms: Lendahand and Ethex. Energise Africa helps SHS distributors in Sub-Saharan Africa to secure funding through the sale of "business bonds," which are predominantly purchased by investors in the United Kingdom. The average annual yield on these bonds is 5–7%, with a period of 18–36 months. Solatube (Kenya), BB0XX (DRC, Kenya, and Rwanda) and Alteh Group (DRC) are few solar companies that have partnered with Energise Africa. Each company develops a "project" (campaign) that is funded by investors.

Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020

Government Issued Mobile Bond
Governments and development finance institutions can issue retail bonds that can be purchased via mobile phones. These bonds are denominated in local currency with a low minimum threshold and the coupon payments are made to the investors’ phones via mobile money. These bonds could finance a portfolio of SHS companies, in partnership with the local...
government. This method of raising capital could be adopted for the off-grid solar sector in a way to send the proceeds to the local banks for lending to the off-grid companies/ distributors at much lower rates. Government issued mobile bond has only been tested in Kenya.

The various benefits and challenges of this instrument are:

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| Government-issued mobile bond | • Access to cheap source of capital  
                                 • Local currency debt therefore mitigates foreign exchange risk | • Large size of bond issue to justify transaction costs  
                                                                 ● Financing cross border investments is difficult |

Source: Deloitte Analysis

Figure 82: Case Study of Government Issued Mobile Bond

Case Study: M-Akiba, Kenya
The Kenyan government issued the world’s first mobile-only government bond (M-Akiba) in 2017 through the Central Bank of Kenya, aimed at Kenyan retail investors. The instrument was created to make it easier for ordinary Kenyans to save and invest in government bonds while also lowering the country’s borrowing costs for development projects. The K Sh 3,000 ($30) minimum investment requirement is significantly lower than the K Sh 100,000 ($990) requirement for other Kenyan Treasury bonds.

More than 5,000 investors contributed K Sh 150 million ($1.5 million) to the bond, which will be used to fund infrastructure and development projects. The government offered a tax-free 10% annual return on the three-year bond, which was around 3% points more than local commercial bank deposit rates. In October 2017, the first interest payments were made. Mobile money is used for all transactions including interest payments.

Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020

Debt Financing in COMESA and TDB region
The DFIs such as FMO, European Investment Bank, Proparco have played a key role in debt financing in off-grid sector in COMESA and TDB regions.
Figure 83: Debt Financing in COMESA and TDB countries

**Kenya**
- FMO made a loan of USD 5.76 million to M-KOPA Kenya Limited in 2017
- FMO lent USD 10.39 million to d. light in 2018
- US International Development Finance Corporation lent USD 7.3 million to Cloverfield Energy Services Solar Micro-grids

**Malawi**
- European Investment Bank provided USD 4.04 million in debt financing to Southern Sub-Sahara Africa Off-grid Solar Energy Roll-out Project aimed to distribute SHS in communities

**Mozambique**
- European Investment Bank lent USD 6.06 million in debt financing to Southern Sub-Sahara Africa Off-grid Solar Energy Roll-out Project aimed to distribute SHS in communities

**Tanzania**
- FMO lent USD 12.21 million to Zola Electric in 2018.

**Uganda**
- European Investment Bank provided USD 11.74 million loan for Off-grid Solar Uganda Acceleration aimed at financing Fenix International’s deployment of SHS in Uganda.

**Zimbabwe**
- Proparco lent USD 13.22 million to support Econet Global Limited’s mobile banking facility for Off-grid solar sector.

Source: IEA

The countries in the COMESA and TDB regions can tap debt facility from the below list of Impact Investors, Crowdfunders, Foundations and DFIs:
### Table 47: Potential Sources of Debt Financing in COMESA and TDB region

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Financing Entity Type</th>
<th>Fund Manager</th>
<th>Average Ticket Size</th>
<th>Interest rate</th>
<th>Eligible Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHL Venture Partners Bridge Debt</td>
<td>Impact Investor</td>
<td>AHL Venture Partners</td>
<td>500,000 - 1,000,000 (USD)</td>
<td>10-15%</td>
<td>Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe</td>
</tr>
<tr>
<td>Ariya Finergy</td>
<td>Impact Investor</td>
<td>Ariya Capital Group</td>
<td>100,000 - 500,000 (GBP)</td>
<td>10-15%</td>
<td>Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Tanzania, Uganda</td>
</tr>
<tr>
<td>bettervest</td>
<td>Crowdfunder</td>
<td>bettervest GmbH</td>
<td>1,000,000 - 3,000,000 (EUR)</td>
<td>Varies</td>
<td>Kenya, Rwanda, Uganda</td>
</tr>
<tr>
<td>Debt Facility</td>
<td>Impact Investor</td>
<td>AlphaMundi Group Ltd.</td>
<td>500,000 - 1,000,000 (USD)</td>
<td>10-15%</td>
<td>Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe</td>
</tr>
<tr>
<td>Debt Facility</td>
<td>Foundation/ NGO, Impact Investor</td>
<td>Stichting DOB Equity</td>
<td>3,000,000 - 10,000,000 (EUR)</td>
<td>Varies</td>
<td>Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania, Uganda</td>
</tr>
<tr>
<td>DI Frontier Fund II</td>
<td>Impact Investor</td>
<td>Frontier Investment Management (FIM)</td>
<td>more than 10,000,000 (EUR)</td>
<td>Varies</td>
<td>Kenya, Rwanda, Tanzania, Uganda</td>
</tr>
<tr>
<td>DOEN Foundation - Loans</td>
<td>Foundation/ NGO</td>
<td>Stichting DOEN/ DOEN Foundation</td>
<td>100,000 - 500,000 (EUR)</td>
<td>Varies</td>
<td>Ethiopia, Kenya, Rwanda, Tanzania, Uganda</td>
</tr>
<tr>
<td>EEP Africa Catalyst Window</td>
<td>DFI</td>
<td>Nordic Development Fund (NDF)</td>
<td>1,000,000 - 3,000,000 (EUR)</td>
<td>5 - 10%</td>
<td>Burundi, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia and Zimbabwe</td>
</tr>
<tr>
<td>GroFin SME/ Business Loans</td>
<td>Impact Investor</td>
<td>GroFin</td>
<td>100,000 - 500,000 (USD)</td>
<td>Varies</td>
<td>Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe</td>
</tr>
</tbody>
</table>

Source: GET.invest

Debt is a critical component in financing for late-stage companies and can be used for financing capital assets, working capital, etc. DFIs such as FMO, European Investment Bank, Proparco, etc. have been an important source of debt finance in absence of financing from local commercial banks. Innovative debt instruments such as revenue-based mezzanine debt, P2P...
lending can trigger fast development of off-grid market. Debt financing is hard to avail in off-grid solar sector due to lack of track record, secondary market and credit rating agencies. Debt from specialised debt providers such as responsAbility, SunFunder, and SIMA and crowdfunding platforms such as Trine and Lendahand has become popular in recent times in off-grid solar industry.

**Equity**

Equity financing involves **buying the ownership in underlying company** itself. Equity financing is the riskiest form of financing. The equity financing in the off-grid solar sector has been constrained due to perceived risk, lack of proven business models, high valuations and lack of exit strategies.

Equity investment in the global off-grid solar industry was **USD 132.51 in 2019** which dropped to **USD 81 million in 2020**. The equity financing was dominated by **impact investors** who constituted nearly 60% of the total equity investment. The **strategic corporates were second popular source of equity** financing globally in 2020. Strategic investors such as Engie, Mitsubishi, Shell New Energies, Sumitomo have made large equity investments in first generation companies in the recent times.

*Figure 84: Sources of Equity Financing in Global Off-grid Solar Sector in 2020*

![Sources of Equity Financing (2020)](image)

*Source: GOGLA*

Equity financing can come in 3 different forms:

---

69 Source: GOGLA
Common Stock
Common stock can be used by off-grid solar companies to raise capital right from the pre-seed stage up-to Series C stage funding. It is an instrument typically used by companies in the early stages of the company lifecycle. The proceeds from the common equity can be used for funding capital assets.

The various benefits and challenges of this instrument are:

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| Common Stock         | Provides the funds required to launch a company, fund product development, carry out proof of concept, launch the product, and secure sales | • Profit and growth prospects of off-grid enterprises are unproven  
                       |                                                                          | • Lack of hard currency and restrictions on foreign currency transactions in some countries |

Preferred Stock
Preferred stock can be used to raise capital by companies right from Seed funding up-to Series C funding cycle. The preferred stock is mostly issued to investors such as angel investors, venture capital firms and impact investment funds.
Attractive exit opportunities are required to attract large scale equity investors. Countries in the COMESA and TDB regions such as Burundi, DRC, Djibouti, South Sudan do not have developed financial markets which restricts the exit opportunity of the potential investors.

The various benefits and challenges of this instrument are:

Table 49: Benefits and Challenges of Preferred Stock

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| Preferred Stock      | • Investment from venture capital firms increases rigor of strategy, planning and execution  
|                      | • Helpful for scaling and growing business | • Lack of attractive exit opportunities  
|                      | | • Few investors familiar with off-grid solar sector |

Source: Deloitte Analysis

Figure 86: Case Study of Preferred Stock

Equity Crowdfunding
Equity crowdfunding can be another avenue of raising capital for off-grid solar companies. It can be used to raise capital right from the Seed funding up-to Series C funding cycle. The ticket size can vary anything between USD 250,000 and USD 1 million.  

The mechanism of equity crowdfunding has been successful to raise capital in developed countries. The COMESA and TDB region pose challenges to equity crowdfunding due to lack of regulations and absence of secondary markets in the region.

The various benefits and challenges of this instrument are:

Table 50: Benefits and Challenges of Equity Crowdfunding

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| Equity Crowd Funding | • Fast due-diligence process reducing time to fund  
|                      | • Crowd investors can benefit from tax incentives | • Platform revenue models create conflict of interest  
|                      | | • Lack of enabling regulatory environment |

70 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
Equity Financing in COMESA and TDB regions

The equity financing in the off-grid solar sector has been limited due to various reasons. The sector hasn’t been able to attract many new investors because there has been lack of exit strategies for early-stage investors which has discouraged the new investments. Private equity investors require larger ticket sizes to invest but only few off-grid solar companies have achieved that scale. To attract new equity investments, the companies need to demonstrate strong track performance of profitability as investors expect high returns over short period of time. The investors are not able to find positive cashflows in short period as the off-grid solar sector requires higher risk tolerance and patient investments.

One positive sign in the off-grid solar investing landscape has been the trend of Japanese conglomerates investing in the sector to diversify their holdings. Sumitomo invested in M-KOPA, Mitsui invested in both M-KOPA and OMC Power, Mitsubishi invested in BBOXX and NEoT Capital, and Marubeni led an equity investment in Azuri Technologies. These investors can facilitate exits for early-stage investors providing them with liquidity to reinvest in the sector.

In the past DFIs such as FMO, PE firms such as Helios Investment Partners and Africa Infrastructure Investment Managers and impact investing platforms such as Symbiotics have invested equity in off-grid solar companies such as Zonful Energy, Zola Electric, BBOXX operating in the COMESA and TDB region.

Figure 87: Equity Financing in Off-grid Solar Companies operating in COMESA and TDB region

The off-grid solar sector players (Pico/SHS companies and mini-Grids developers) operating in COMESA and TDB region can tap the equity investment from below Private Equity funds and Impact Investors for market development:
Table 51: Potential Sources of Equity Financing in COMESA and TDB region

<table>
<thead>
<tr>
<th>Financial Instrument Name</th>
<th>Financial Entity Type</th>
<th>Fund Manager</th>
<th>Average Investment Size</th>
<th>Eligible Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actis Equity Fund 4</td>
<td>Private Equity Fund</td>
<td>Actis LLP</td>
<td>more than 10,000,000 (USD)</td>
<td>Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, South Sudan, Sudan, Tanzania, Uganda</td>
</tr>
<tr>
<td>Equity Facility</td>
<td>Foundation/ NGO, Impact Investor</td>
<td>Stichting DOB Equity</td>
<td>3,000,000 - 10,000,000 (EUR)</td>
<td>Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania, Uganda</td>
</tr>
<tr>
<td>Infrastructural, Developmental and Environmental Assets Managed Fund (IDEAS Fund)</td>
<td>Private Equity Fund</td>
<td>African Infrastructure Investment Managers (AIIM)</td>
<td>more than 10,000,000 (USD)</td>
<td>Malawi, Mozambique, Zambia, Zimbabwe</td>
</tr>
<tr>
<td>KawiSafi Ventures</td>
<td>Impact Investor</td>
<td>Acumen Capital Partners</td>
<td>1,000,000 - 3,000,000 (EUR)</td>
<td>Kenya, Rwanda</td>
</tr>
<tr>
<td>Oikocredit International</td>
<td>Impact Investor</td>
<td>Oikocredit International</td>
<td>3,000,000 - 10,000,000 (EUR)</td>
<td>Kenya, Malawi, Rwanda, Uganda, Zambia</td>
</tr>
<tr>
<td>Ascent Rift Valley Fund</td>
<td>Private Equity Fund</td>
<td>Ascent Capital</td>
<td>3,000,000 - 10,000,000 (USD)</td>
<td>Ethiopia, Kenya and Uganda</td>
</tr>
</tbody>
</table>

Source: GET.invest

Equity financing can be used during any stage of company lifecycle and is essential for off-grid enterprises as it gives confidence to debt investors. Equity crowdfunding can trigger fast development of the off-grid market in presence of conducive regulations. Equity financing poses challenges due to lack of secondary market and lack of attractive exit strategies. The off-grid solar sector has attracted interest from Japanese conglomerates such as Sumitomo, Mitsui, Mitsubishi, Marubeni for equity investment.

Investment Trend

Globally the investment trend has seen a shift from equity financing to debt financing as the most popular financing instrument in 2020. This is because most of the investments in the off-grid solar sector are concentrated in the top 10 recipient companies receiving nearly 80% of the total investment. These companies which were the first movers in the off-grid solar industry used equity investment in the initial phases of company lifecycle for development of their business models but now use debt financing from specialized debt providers such as responsAbility, SunFunder, and SIMA and crowdfunding platforms such as Trine and Lendahand to finance their working capital needs.

The off-grid solar companies need to use a blend of different traditional and innovative financing instruments depending on their specific financing needs. The off-grid solar enterprises need to clearly evaluate what stage of company lifecycle they are and what funding options are available to them depending on their lifecycle stage.

Source: GOGLA

The off-grid solar companies need to use a blend of different traditional and innovative financing instruments depending on their specific financing needs. The off-grid solar enterprises need to clearly evaluate what stage of company lifecycle they are and what funding options are available to them depending on their lifecycle stage.

Source: GOGLA
Key Challenges in Access to Finance in COMESA and TDB region
Financing in off-grid solar sector from different sources of finance comes with its own set of challenges:

Financing from Foreign DFI/ Impact Investors/ Crowdfunding
The foreign Development Financing Institutions, Impact Investors and Crowdfunding Platforms support the development of off-grid solar sector in the emerging and poor economies. These financiers can raise capital at low cost which enables them to provide financing at competitive rates. These financiers offer finance for long tenors which suits the project cashflows in off-grid solar sector.

The key challenge associated with financing from foreign Development Financing Institutions, Impact Investors and Crowdfunding Platforms is that the financing usually occurs in hard currency whereas the revenue of most of the off-grid enterprises is in local currency (barring those which export). This currency mismatch exposes the borrowers to currency risk. The past trends reveal that African currencies have been greatly volatile and depreciated in relation to USD which makes foreign exchange risk a significant threat to the functioning of the off-grid enterprises. In order to address the cost increase caused due to currency depreciation, the off-grid enterprises are forced to increase the price/ tariff for end-users which impacts the affordability of end-consumers. The enterprises who don’t increase the prices/ tariffs have to take the fall themselves which hurts their profit margins.

One of the possible ways to mitigate the foreign exchange risk is through use of currency hedging solutions which has been discussed in detail in recommendations section.

Financing from Local Commercial Banks
The off-grid solar sector receives lack of financing from local commercial banks. There have been only few instances of local currency lending in the off-grid solar sector:

- **M-KOPA** availed local currency financing facility with **Stanbic Bank** through investment from the **Commonwealth Development Corporation, the UK’s DFI (UK CDC), Norfund and the Netherlands Development Finance Company (FMO)** for approximately USD 55 million local currency equivalent in Kenyan (USD 40 million) and Uganda shillings (USD 15 million).
- **BBOXX** availed a USD 2 million equivalent debt facility with **Banque Populaire du Rwanda** by securitization of consumer receivables portfolio. The loan had a tenor of 36 months.
- **AfDB** approved a proposal to support **Zola EDF** (an SPV 50:50 owned by Off-Grid Electric and EDF) with a **Partial Risk Guarantee** to mobilize a **local currency loan** of approximately €24 million equivalent arranged by **Société Générale de Banque, Credit Agricole Corporate and Investment Bank**
There are both demand and supply-side challenges in accessing local currency finance from local commercial banks.

On the demand side, the **demand for local currency lending is low** because local currency is expensive due to **high wholesale rates as well as high lending margins**. The local currency financing is usually **available on floating rates rather than fixed rates**, so changes in monetary policies can lead to changes in interest rates which can hurt the borrowers. Increase in interest rates will lead to increase in cost of doing business that will either result in businesses taking a **hit on their profit margin or increasing tariffs for end consumers**. The local currency loans from local commercial banks are available on low tenors as the banks have competing priority sectors to lend such as agriculture, education, housing etc. This does not suit the cashflow profile of off-grid projects. All these factors result in low demand for local currency financing from local commercial banks.

**Figure 90: Lending Interest Rates in COMESA and TDB countries**

![Lending Interest Rates (2012-20)](source: World Bank)

On the supply side, the **local banks lack liquidity for lending due to low deposits and stringent Basel Pillar III requirements**. The commercial banks generally **favour lending to government institutes** as these transactions are risk free. Most of the local commercial banks do not **understand the off-grid solar sector** as the business models are yet to be proven and the companies are yet to generate a track record of profitability. The local commercial banks are also unwilling to take SHS units as collateral as these assets are not liquid in absence of a secondary market. All these factors result in low supply of local currency financing from local commercial banks.
The demand and supply for local currency lending is low in the off-grid solar sector. Nevertheless, the **local currency lending is important** for a variety of reasons. The foreign exchange risk associated with the hard currency lending can lead to enterprises defaulting on their loans and going out of business, which makes **local currency lending a safe option**. The local currency financing in the off-grid solar sector **can lead to diversification** in existing lending portfolio of local FIs reducing their overall risk. The local currency financing can also lead to **developing of secondary markets for finance**.

In order to stimulate local currency lending, the usage of credit enhancement instruments such as **credit guarantees can be explored**. The credit guarantees can mitigate risk for the lenders and make **lending profile of borrower more attractive**, however there have been certain limitations with the usage of these credit guarantees. The credit guarantees are **viewed by banks as a collateral substitute** to make the projects bankable so there have been **limited pricing benefits** of these credit guarantees in form of lower interest rates. Since, the banks lack the appetite for investing in the off-grid solar sector these **credit guarantees can be targeted at capital market issues** i.e. securities backed by receivables or the financial intermediaries raising capital for local currency debt to off-grid solar enterprises. These credit guarantees can improve credit profile of borrowers and make the projects bankable. The **pricing of these credit guarantees is important** as it is cost for the lenders.

**Financing from Local Institutional Investors**

Institutional investors encompass pension funds, insurance funds, national sovereign wealth funds, etc. The size of institutional investment market in Africa is small. The off-grid solar sector has failed to attract financing from institutional investors.

The key challenge here is that institutional investors look for an investment of certain scale and profitability and such opportunities are scarce in the nascent off-grid solar sector. The sector lacks track record of cashflow performance to attract investment from local institutional investors. There is also the issue of lack of awareness of off-grid solar sector to the current local institutional investors. The capital markets in the COMESA countries are not mature enough to attract investment through securitization.

To attract investment by foreign institutional investors in infrastructure projects in Africa, USAID has implemented initiatives such as INVEST and Prosper Africa. Through these programs institutional investors across US can invest in energy projects in Africa and get high returns compared to developed markets.

**Summary of Identified Challenges**

The key challenges identified in financing in off-grid solar sector in COMESA and TDB region are **foreign currency risk associated with hard currency financing, high interest rates in local currency financing, low repayment periods in local currency financing, lack of bankable projects for institutional investors and lack of sector awareness by Financial Institutions.** The key
challenges and proposed solutions to mitigate those challenges have been summarized in the below diagram:

**Figure 91: Key Challenges and Solutions in Access to Finance in Off-grid Solar Sector in COMESA and TDB region**

The proposed solutions have been discussed in detail in the Financing Recommendations section.

The high interest rates, high collateral requirement, low repayment period, foreign exchange risk associated with hard currency loans, lack of bankable projects and lack of sector awareness pose challenges for financing off-grid solar sector. The local currency lending has low demand (high interest rates, low tenures, floating rates) and low supply (low liquidity, lack of track record, high risk perception) due to which most of the financing happens in the hard currency that exposes borrowers to risk of currency depreciation.

**Designing Public Funding Program**

The off-grid solar sector has an important role to play in achievement of SDG 7 goal of providing universal access to affordable, reliable, sustainable, and modern energy for all by 2030. Public funding has an important role to play for scaling up off-grid technologies due to scarce funding by commercial banks. The public funding program should include both demand and supply side measures. The demand side measures should focus on increasing affordability of off-grid solutions for end-users to increase the consumer demand. The demand side measures consist of demand-side subsidies and public procurement. The supply side measures should ensure supply of low cost off-grid by financing off-grid enterprises. The supply side measures consist of funding instruments and tax incentives.
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

*Figure 92: Demand and Supply Side Measures of Public Funding Program*

Demand-side Subsidies
Demand-side subsidies are funds provided to end-users to make off-grid products more affordable. The demand-side subsidies support vulnerable households to gain access to electricity. It also helps to lower the default rate on PAYGO sales. Despite all these advantages, the implementation of demand-side subsidies is challenging due to considerations such as setting appropriate subsidy amount and targeting right households.

Kenya implemented a demand-side subsidy program, Kenya Energy and Cash Plus Initiative, through which subsidized off-grid solar products were offered to 1500 beneficiaries across households in counties of Kilifi and Garissa. Rwanda too implemented a Pro-Poor RBF program in which subsidies were provided to households based on their income level to purchase off-grid solar products.  

*Figure 93: Case Study of Demand Side Subsidy Program*

**Case Study: TOGO CIZO Program**

The CIZO Program is a government initiative to support unelectrified households to buy off-grid solar products. The scheme offers every rural household a subsidy of around USD 4 a month that can be used towards the purchase of off-grid solar products from suppliers who participate in the program. The national post office conducts eligibility checks and maintains a database of subsidized customers. Mobile network operators ensure all eligible customers are integrated into their database and send SMSs to inform them about availability of the subsidy. When an eligible customer makes a payment to an off-grid solar company, the mobile network operator automatically makes a subsidy payment from the government to the off-grid solar company.

*Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022*

**72 Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022**
**Public Procurement**

Public procurement is a strategy whereby government agencies purchase off-grid products through a tender, before arranging for distribution, installation, and maintenance services either directly or through contractors. Public procurement is a useful strategy to reach poor and remote community in humanitarian or disaster relief setting where market-based solutions are not feasible.

Public procurement can reduce costs through bulk tendering of the equipment and can be used to reach large number of people in a short time. Despite the various advantages of the public procurement, this strategy faces challenges due to unavailability of long-term public finance and high risk of misuse of funds due to inefficient tender design.  

*Figure 94: Case Study of Public Procurement in Off-grid Sector*

---

**Funding Instruments**

A variety of commercial funding instruments as discussed in this report can be included in the public funding program. Grants are a strong tool to finance off-grid companies in nascent markets. BBOXX used grant funding from the Shell Foundation, the UK Foreign, Commonwealth and Development Office, and the US Agency for International Development (USAID) to pilot its PAYG business model in the Democratic Republic of the Congo. As the markets gradually mature, Results-based Financing can be used to further accelerate market growth. Results-based Financing has been used to finance off-grid technologies in mature economies such as Kenya, Tanzania and Rwanda. Credit line instruments can be used to meet working capital needs of off-grid enterprises.

Design of public funding program need to consider following key factors:

- **Flexibility:** Public funding mechanism must be flexible to adapt to the off-grid market’s ever evolving financing needs. Over time new funding instruments might be introduced or existing instruments might be clubbed for better serving the financing requirements
- **Targeting:** The public funding program should be targeted in such a manner to ensure inclusivity and diversity
- **Proportionality:** Appropriate ticket sizes must be disbursed to ensure efficiency in usage of funds for making an impact

---

73 Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022

74 Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022
• Efficient Fund Management: Fund management must be streamlined to reduce risks, transaction costs and time for disbursement
• Verification: It is important to monitor that public funding is used appropriately for achievement of specific objectives

**Tax Incentives**

Tax incentives are a strong policy tool which lowers the cost of off-grid solar products. Tax incentives are used to attract companies and investors which increases competition and promotes market growth. Despite various advantages of tax incentives, there are limitations in providing tax incentives due to loss of revenue of govt. due to which tax incentives are politically contentious.

Tax incentives have been extensively used by COMESA countries such as Kenya, Tanzania, Uganda and Rwanda to drive market growth of off-grid products. Tax incentives can be used to promote quality standards in off-grid products. To link tax exemptions with quality products, strong processes for qualification, importation and verification are required. 75

### 2. Consumer Financing Models

The consumer affordability is a big constraint in the COMESA and TDB regions for uptake of off-grid solar technologies. Countries like **Madagascar, South Sudan, DRC, Malawi, Burundi, Somalia and Mozambique** where **majority of population is poor** offer great demand for consumer financing.

---

75 Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022
The Off-grid Energy Fund, launched by the African Development Bank, the Nordic Development Fund, the Global Environment Facility, Calvert Impact Capital, and All On, has committed capital of nearly USD 60 million to provide flexible debt instruments in local currency to companies providing consumer finance. There is need for consumer financing mechanisms to bring the off-grid solar technologies within the reach of consumers.

**Source:** World Bank

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Poverty Headcount Ratio at USD 1.9 (% of population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Madagascar</td>
<td>2019</td>
<td>79%</td>
</tr>
<tr>
<td>South Sudan</td>
<td>2015</td>
<td>77%</td>
</tr>
<tr>
<td>DR Congo</td>
<td>2019</td>
<td>77%</td>
</tr>
<tr>
<td>Malawi</td>
<td>2018</td>
<td>74%</td>
</tr>
<tr>
<td>Burundi</td>
<td>2014</td>
<td>73%</td>
</tr>
<tr>
<td>Somalia</td>
<td>2016</td>
<td>69%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>2017</td>
<td>64%</td>
</tr>
<tr>
<td>Zambia</td>
<td>2016</td>
<td>59%</td>
</tr>
<tr>
<td>Rwanda</td>
<td>2014</td>
<td>57%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>2019</td>
<td>49%</td>
</tr>
<tr>
<td>Uganda</td>
<td>2012</td>
<td>41%</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>2015</td>
<td>40%</td>
</tr>
<tr>
<td>Kenya</td>
<td>2015</td>
<td>37%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2012</td>
<td>31%</td>
</tr>
<tr>
<td>Djibouti</td>
<td>2017</td>
<td>17%</td>
</tr>
<tr>
<td>Sudan</td>
<td>2013</td>
<td>12%</td>
</tr>
<tr>
<td>Sudan (2013)</td>
<td></td>
<td>12%</td>
</tr>
<tr>
<td>Djibouti (2017)</td>
<td></td>
<td>17%</td>
</tr>
<tr>
<td>Ethiopia (2012)</td>
<td></td>
<td>31%</td>
</tr>
<tr>
<td>Kenya (2015)</td>
<td></td>
<td>37%</td>
</tr>
<tr>
<td>Zimbabwe (2015)</td>
<td></td>
<td>40%</td>
</tr>
<tr>
<td>Uganda (2012)</td>
<td></td>
<td>41%</td>
</tr>
<tr>
<td>Rwanda (2014)</td>
<td></td>
<td>57%</td>
</tr>
<tr>
<td>Zambia (2016)</td>
<td></td>
<td>59%</td>
</tr>
<tr>
<td>Mozambique (2017)</td>
<td></td>
<td>64%</td>
</tr>
<tr>
<td>Somalia (2016)</td>
<td></td>
<td>69%</td>
</tr>
<tr>
<td>Burundi (2014)</td>
<td></td>
<td>73%</td>
</tr>
<tr>
<td>Malawi (2018)</td>
<td></td>
<td>74%</td>
</tr>
<tr>
<td>South Sudan (2015)</td>
<td></td>
<td>77%</td>
</tr>
<tr>
<td>DR Congo (2019)</td>
<td></td>
<td>77%</td>
</tr>
<tr>
<td>Madagascar (2019)</td>
<td></td>
<td>79%</td>
</tr>
</tbody>
</table>

**Source:** AfDB
Retail/Over the Counter/Cash Sales Model

The companies using retail model employ a vast country-wide network of distributors and merchants to reach consumers in every nook and corner of the country. Retail model is used for distribution of illumination lamps and basic necessities such as phone charging. The transaction sizes are small therefore customers make the payments in cash. Customers purchase a replacement light every two to three years because most devices have a two-to-three-year life cycle and just a handful include a battery replacement option. As a result, the repeat customers play a significant role in product sales.

Local players such as Electrosales & Solar Shack in Zimbabwe, Solinc East Africa & Solar Kiosk in Kenya and Biftu Adugna & Sun Transfer in Ethiopia employ cash-based model for selling off-grid products.²⁷

PAYGO Model

Under the PAYGO model, a company offers a solar product for which a customer makes a down payment which is followed by regular payments for a term ranging from six months to eight years. Payments are usually made via mobile money, though alternative methods include scratch cards, mobile airtime, and cash.

²⁷ Source: ACE TAF Reports
Figure 97: Working of PAYGO Model

The effectiveness of the PAYGO model depends on the daily/weekly/monthly repayment cost and the target market segment's disposable income. Azuri, BBOXX, d.light, Fenix, M-KOPA and Off-grid Electric are leading PAYGO solar providers in COMESA and TDB region.

The PAYGO business model encompasses four business functions: product design/assembly, distribution, platform software, and banking into one business. The companies can choose to manage all the four functions themselves and invest heavily in all stages of the value chain or outsource few of the functions to the specialist organizations to operate in some stages of the value chain.

The successful implementation of PAYGO model requires various growth drivers such as financial inclusion, domestic credit, mobile internet subscribers, presence of credit bureaus, secure internet servers and consumer education.
Figure 98: Financial Inclusion Comparison of COMESA and TDB countries

Account ownership with FI/ Mobile Money Provider (2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>Financial Inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>81.57%</td>
</tr>
<tr>
<td>Libya</td>
<td>65.67%</td>
</tr>
<tr>
<td>Uganda</td>
<td>59.20%</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>55.29%</td>
</tr>
<tr>
<td>Rwanda</td>
<td>50.02%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>46.75%</td>
</tr>
<tr>
<td>Zambia</td>
<td>45.86%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>41.67%</td>
</tr>
<tr>
<td>Somalia</td>
<td>38.66%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>34.83%</td>
</tr>
<tr>
<td>Malawi</td>
<td>33.71%</td>
</tr>
<tr>
<td>DR Congo</td>
<td>25.83%</td>
</tr>
<tr>
<td>Madagascar</td>
<td>17.87%</td>
</tr>
<tr>
<td>Sudan</td>
<td>15.27%</td>
</tr>
<tr>
<td>Djibouti</td>
<td>12.27%</td>
</tr>
<tr>
<td>South Sudan</td>
<td>8.57%</td>
</tr>
<tr>
<td>Burundi</td>
<td>7.10%</td>
</tr>
</tbody>
</table>

Source: World Bank

DRC, Madagascar, Sudan, Djibouti, South Sudan and Burundi have very low financial inclusion which needs to be addressed to scale PAYGO model in these countries.

Figure 99: Analysis of Domestic Credit to Private Sector in COMESA and TDB countries

Domestic Credit to Private Sector as %age of GDP (2020)

<table>
<thead>
<tr>
<th>Country</th>
<th>Domestic Credit as %age of GDP (2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
<td>33%</td>
</tr>
<tr>
<td>Kenya</td>
<td>32%</td>
</tr>
<tr>
<td>Rwanda</td>
<td>25%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>25%</td>
</tr>
<tr>
<td>Burundi</td>
<td>22%</td>
</tr>
<tr>
<td>Djibouti</td>
<td>20%</td>
</tr>
<tr>
<td>Madagascar</td>
<td>16%</td>
</tr>
<tr>
<td>Zambia</td>
<td>15%</td>
</tr>
<tr>
<td>Uganda</td>
<td>14%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>13%</td>
</tr>
<tr>
<td>Sudan</td>
<td>8%</td>
</tr>
<tr>
<td>DR Congo</td>
<td>7%</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>6%</td>
</tr>
<tr>
<td>South Sudan</td>
<td>2%</td>
</tr>
</tbody>
</table>

Source: World Bank
Private Sector in Sudan, DRC, Zimbabwe and South Sudan face challenges to access credit which poses a hinderance for adoption of PAYGO.

Figure 100: Mobile Cellular Subscriptions in COMESA and TDB countries

Mozambique, DRC, Djibouti, Madagascar, Ethiopia, South Sudan and Eritrea have very low SIM (Subscriber Identity Module) penetration which needs to be increased for enabling mobile money for PAYGO payments.
Figure 101: Information and Communication Technology Assessment in COMESA and TDB countries

Secure Internet Servers per 1 million (2020)

<table>
<thead>
<tr>
<th>Country</th>
<th>Secure Internet Servers per 1 million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
<td>741.00</td>
</tr>
<tr>
<td>Kenya</td>
<td>239.00</td>
</tr>
<tr>
<td>Rwanda</td>
<td>82.00</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>74.00</td>
</tr>
<tr>
<td>Djibouti</td>
<td>50.00</td>
</tr>
<tr>
<td>Zambia</td>
<td>41.00</td>
</tr>
<tr>
<td>Tanzania</td>
<td>38.00</td>
</tr>
<tr>
<td>Uganda</td>
<td>34.00</td>
</tr>
<tr>
<td>Mozambique</td>
<td>29.00</td>
</tr>
<tr>
<td>Malawi</td>
<td>17.00</td>
</tr>
<tr>
<td>Madagascar</td>
<td>10.00</td>
</tr>
<tr>
<td>Burundi</td>
<td>9.00</td>
</tr>
<tr>
<td>Sudan</td>
<td>6.00</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>6.00</td>
</tr>
<tr>
<td>South Sudan</td>
<td>4.00</td>
</tr>
<tr>
<td>Somalia</td>
<td>4.00</td>
</tr>
<tr>
<td>DR Congo</td>
<td>4.00</td>
</tr>
<tr>
<td>Eritrea</td>
<td>1.00</td>
</tr>
<tr>
<td>South Sudan</td>
<td>4.00</td>
</tr>
<tr>
<td>Somalia</td>
<td>4.00</td>
</tr>
<tr>
<td>DR Congo</td>
<td>4.00</td>
</tr>
<tr>
<td>Eritrea</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Source: World Bank

Countries such as Madagascar, Burundi, Sudan, Ethiopia, South Sudan, Somalia, DRC and Eritrea need to **strengthen Information and Communication Technology** to enable deployment of PAYGO.

In a study conducted by Lighting Africa, countries such as Kenya, Uganda and Tanzania were identified as **attractive destinations for PAYGO** implementation.

**Consumer Financing through Partner FI Model**

Consumer financing through partner financial institution is the separation of roles, in which the solar PV supplier provides products and related services while the partner Financial Institution (FI) provides consumer financing and collects repayments. The FIs have the financial history of the consumers they are lending to, therefore this model minimizes the risk of default. FIs are also skilled at screening applicants and utilizing various forms of collateral devices. As a result, FIs can provide financing at cheaper interest rates and for longer periods of time than PAYGO businesses. Countries such as Zimbabwe and Madagascar have used this model for consumer financing. In Madagascar, MFIs such as Baobab+ have launched customer loans for Solar Home Systems. In Zimbabwe, GetBucks Bank has partnered with distributors of SHS such as Elaine Solar Africa and provides consumer finance to their end consumers to boost affordability.

**Fee for a service Model**

Fee for a service model is a **form of a lantern rental model**, in which consumers are given a rechargeable lantern and pay a price to charge it. The customer does not receive ownership of
the systems, and the business/project is solely responsible for their maintenance and replacement.

The model is particularly suited to providing power to remote areas when mini-grid/micro-grid are unviable due to dispersed population. In countries such as Madagascar, suppliers such as Heri and Jiro-Ve rent small solar lanterns. The Fee for a service model can be implemented in other countries too such as Burundi, DRC, Libya, Malawi, Mozambique, Somalia and South Sudan where majority of the population is poor and cannot afford upfront cost of the off-grid products but lack access to electricity even for basic needs.

The key challenges in each of the consumer financing model are described below:

**Figure 102: Key Challenges in Consumer Financing Models**

<table>
<thead>
<tr>
<th>Retail / Over the Counter / Cash Sales</th>
<th>Pay-As-You-Go (PAYGO) Consumer Financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Price war at the retail level leads to consumer distrust</td>
<td></td>
</tr>
<tr>
<td>• Counterfeit Products hurt consumer confidence</td>
<td></td>
</tr>
<tr>
<td>• Lack of credit history poses default risk</td>
<td></td>
</tr>
<tr>
<td>• The PAYGO model creates a significant cash flow burden on the business.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumer Financing (through Partner FI) Model</th>
<th>Fee for a Service Model / RESCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Responsive customer service system required to register customers</td>
<td></td>
</tr>
<tr>
<td>• Financial and reputational risk for FIs</td>
<td></td>
</tr>
<tr>
<td>• Model requires large clusters of customers in a given area of operation.</td>
<td></td>
</tr>
<tr>
<td>• Significant upfront cost to be borne by the developer and the payback periods are long</td>
<td></td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Most of the countries in COMESA and TDB regions are low income with poor population hence affordability of off-grid solar products is a challenge. Innovative Consumer Financing models such as PAYGO and Fee for a Service can increase the affordability of off-grid solutions for the target market. Financial inclusion, mobile internet penetration, access to finance, secure internet servers and consumer education are some of the key drivers for PAYGO model adoption. Countries such as Kenya, Tanzania and Uganda are attractive destinations for PAYGO deployment and companies such as BBOXX, Greenlight and M-KOPA are pioneers in PAYGO model.
F. Gap Assessment in Off-grid Solar Sector

1. Key Challenges faced by the Off-grid Solar sector

The COMESA and TDB region faces political, economic, financial, regulatory, social, and business challenges which hinder the development of off-grid solar sector.

Figure 103: Key Challenges faced by Off-grid Solar Sector in COMESA and TDB region

- **Political**
  - Countries facing political instability due to armed conflicts/ civil wars
  - Burundi, DRC, Eritrea, Ethiopia, Libya, Mozambique, Somalia, South Sudan, Sudan

- **Economic**
  - Countries characterized with negative GDP growth/ unemployment/ inflation/ huge debt/ poverty/ currency devaluation
  - Burundi, DRC, Eritrea, Libya, Malawi, Mozambique, Somalia, South Sudan, Sudan, Zambia, Zimbabwe

- **Financial**
  - Low commercial financing/ high interest rates/ low liquidity/ low financial inclusion
  - Burundi, Djibouti, DRC, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Sudan, Tanzania, Uganda, Zambia, Zimbabwe

- **Regulatory**
  - Lack of enabling policies for Pico/SHS and Mini-grids
  - DRC, Eritrea, Libya, Mozambique, Somalia, South Sudan, Sudan

- **Social**
  - Low consumer affordability/ awareness/ confidence/ willingness to pay
  - Burundi, Djibouti, DRC, Eritrea, Libya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Sudan, Zambia, Zimbabwe

- **Business**
  - Challenges in starting a business, dealing with construction permits, registering property, getting credit, taxes, trading
  - Burundi, Eritrea, DRC, Ethiopia, Libya, Madagascar, Mozambique, Somalia, South Sudan, Sudan, Tanzania, Zimbabwe

Source: Deloitte Analysis

- **Political Challenges:** Countries such as Burundi, DRC, Eritrea, Ethiopia, Libya, Mozambique, Somalia, South Sudan and Sudan face political turmoil due to conflicts, hence these are difficult markets for off-grid players to penetrate. These countries constitute the bottom quartile in the Political Stability ranking of 194 countries by the Global Economy.

In order to accelerate market development of off-grid sector in such tough economies, there is need to establish trust for catalysing private sector investment. The countries need to ensure autonomy of their institutions to ensure efficient discharge of responsibilities without disruption. The legal risks can be mitigated by adoption of stable policies for long duration. The political risks for investors can be mitigated by use of instruments such as sovereign guarantees and political risk insurance. Suitable dialogues must be explored between governments and private sector to sign off MOU.
(Memorandum of Understanding) or comfort letters to acknowledge importance of off-grid projects to economy. Assurance must be provided to private sector regarding indemnification by host government in case of any breach of agreement by host government.

- **Economic Challenges:** Countries such as Zimbabwe and Sudan were in recession even before the pandemic stuck. Inflation (consumer prices) in Zimbabwe and Sudan was 557% and 150% in 2020. Burundi, DRC, Eritrea, Ethiopia, Madagascar, Malawi, Mozambique, Somalia and Sudan are heavily indebted poor countries. Unemployment is a serious issue in countries such as Djibouti, Libya, Somalia, South Sudan and Sudan and Zambia (more than 10% of total labour force in 2020). Countries such as DRC, South Sudan, Zambia and Zimbabwe experience volatile exchange rates which poses a challenge for economic development. All these economic issues hinder the development of off-grid solar sector in the COMESA and TDB region.

- **Financing Challenges:** Lending rates are exorbitant in DRC, Madagascar, Malawi and Zimbabwe (greater than 20% lending rate in 2020 as per World Bank Open Data) which make them unattractive destinations for private sector participation. Local banks in COMESA and TDB regions are unwilling to lend to the off-grid solar sector because of the perceived risk due to unproven business models therefore there is limited commercial financing in the off-grid solar sector. The financial inclusion in countries such as DRC, Madagascar, Sudan, Djibouti, South Sudan and Burundi is low (less than 30% account ownership with FI/ Mobile Money Service Provider in 2017 as per World Bank Open Data) which limits the liquidity of banks in these countries to lend to off-grid companies/developers.

- **Regulatory Challenges:** Countries such as Libya, Somalia, Sudan and South Sudan lack enabling policies for development of off-grid sector. Countries such as Eritrea, Libya and South Sudan lack PPP laws to encourage the private sector participation in economic development these countries.

- **Social Challenges:** The per capita income of people in countries such as Ethiopia, Uganda, Rwanda, Malawi, DR Congo, Sudan, Madagascar, Mozambique, Somalia, Burundi (GNI/capita less than USD 1000 in 2020 as per World Bank Open Data) is low. The awareness of off-grid solutions is very low in countries such as South Sudan, Somalia and Sudan. People in countries such as Madagascar and Zimbabwe have lost trust on off-grid products due to low quality.

---

78 Source: World Bank
• **Business Challenges:** It is difficult to start business in Tanzania, Libya, Ethiopia, Zimbabwe, Mozambique, Eritrea and Somalia. Obtaining access to credit is a major problem to doing business in Burundi, Eritrea, Ethiopia, Libya, Mozambique, Somalia, South Sudan and Sudan. Cross border trade is unfavourable in countries such as Burundi, Eritrea, DRC, Somalia, South Sudan, Sudan and Tanzania. ⁷⁹

2. **Categorization of Countries**

The successful deployment of off-grid in the COMESA and TDB regions require various enabling factors. The countries in the COMESA and TDB regions (having less than 40% rural electrification except Kenya) were analysed on different parameters such as economic strength, ease of doing business, current off-grid market, institutional structure, regulatory landscape, mini-grid policies, financial inclusion and consumer affordability. Based on these factors, the countries were assigned advanced, evolving and underdeveloped status for development of off-grid solar sector.

*Figure 104: Country wise comparison on enabling factors for Off-grid Solar Sector development*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>Advanced</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Kenya</td>
<td>Advanced</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Rwanda</td>
<td>Advanced</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Advanced</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Uganda</td>
<td>Advanced</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>DRC</td>
<td>Evolving</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Eritrea</td>
<td>Evolving</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Madagascar</td>
<td>Evolving</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Malawi</td>
<td>Evolving</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Evolving</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Zambia</td>
<td>Evolving</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Evolving</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Burundi</td>
<td>Underdeveloped</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Djibouti</td>
<td>Underdeveloped</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Libya</td>
<td>Underdeveloped</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Somalia</td>
<td>Underdeveloped</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>South Sudan</td>
<td>Underdeveloped</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Sudan</td>
<td>Underdeveloped</td>
<td></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis of World Bank, RISE ESMAP, Doing Business data*

Countries such as **Ethiopia, Kenya, Rwanda, Tanzania and Uganda** have been categorized as **advanced countries** based on their current off-grid solar market and the presence of enabling factors to scale the off-grid solar sector. These countries have **high sales of off-grid products, robust regulations, high mobile money penetration and decent consumer affordability.** These countries should focus on **boosting local currency lending through local FIs, local manufacturing of Pico/SHS solutions and developing grid-connected mini-grids.**

⁷⁹ *Source: Doing Business*
Countries such as DRC, Eritrea, Madagascar, Malawi, Mozambique, Zambia and Zimbabwe have been categorized as evolving as most of these countries have a reasonable market for off-grid with decent sales of Pico/SHS products (Tier 1-3 of electricity access). These countries should focus on strengthening mini-grid (Tier 2-5 of electricity access) regulatory framework, attracting investment from private sector and consumer financing.

Countries such as Burundi, Djibouti, Libya, Somalia, South Sudan and Sudan have been categorized as underdeveloped as the market for off-grid solar technologies is at a very nascent stage in these countries. Most of these countries are fragile economies with weak regulatory landscape, low financial inclusion, low consumer affordability and high barriers to doing business. These countries should focus on strengthening of institutions, development of policies, providing fiscal benefits, improving business environment, increasing financial inclusion and boosting consumer financing to develop their off-grid solar sector.

Unstable political environments, weak economic scenario, low consumer affordability, lack of favorable policies and lack of access to finance are few of the factors which hinder the development of off-grid sector in COMESA and TDB region. Ethiopia, Kenya, Rwanda, Tanzania, Uganda are advanced countries with vibrant presence of off-grid industry and these countries should focus on boosting local currency lending, local manufacturing of Pico/SHS solutions and developing grid-connected mini-grids to further upscale the electricity access in these countries. Countries such as DRC, Malawi, Mozambique, Zambia, Zimbabwe are gradually evolving off-grid markets with good adoption rate of off-grid solutions such as Pico/SHS. These countries should focus on strengthening mini-grid regulatory provisions, attracting private sector investors and boosting consumer financing. Countries such as Burundi, Djibouti, Libya, Somalia, South Sudan, and Sudan have underdeveloped off-grid market and require most interventions for scaling of off-grid market. These countries need to focus on strengthening of institutions, development of regulations, implementation of fiscal benefits, increasing financial inclusion and boosting consumer financing for off-grid sector development.
G. Recommendations to scale Off-grid Solar Sector

Six-step approach has been analysed to recommend solutions to scale off-grid solar sector in the COMESA and TDB regions:

1. **Off-grid Solutions**

Countries can adopt a host of off-grid solutions for electrification based on their current electricity access rates, prevailing policy and regulatory framework, access to finance, mobile money penetration and affordability of the population.
The mini-grid technologies serve the electrification needs of the community and go a long way in improving the lifestyle of population as people get access to higher service level of electricity (Tier 2 – Tier 5). The mini-grids are suited for the regions within a country where population density and purchasing power is high.

The Pico/ SHS solutions serve the needs of individual customers/ households and provide lower service level of electricity (Tier 1 – Tier 3). The Pico/ SHS solutions are more suited for the regions within the country where there is low population density and low affordability. The households can choose between different kinds of off-grid products (ranging from basic lighting lantern to high end SHS kits comprising of appliances such as fans, radio, television, etc.) based on their purchasing power.

The countries in the COMESA and TDB region can adopt a blend of off-grid solutions (i.e. mini-grids in areas with high population densities and high purchasing power and Pico/ SHS in areas with dispersed population and low affordability). The countries should undertake a Multi-Tier Framework survey to measure energy access for households, businesses and institutions. Electricity access shall be measured in terms of availability, quality, reliability, safety and...
affordability to track the SDG 7 goal. After tracking the unelectrified areas, it is important that countries use geospatial least-cost electrification planning tool to model optimal electrification pathway. The least-cost electrification tool shall provide a guiding framework for the role of grid and off-grid (mini-grid and standalone solar systems) electrification for achieving universal access.

FCV (Fragile, Conflict and Violence) countries where electricity access is low may start with adoption of standalone solar solutions as these are cheap and easy to scale in a short span of time. Public procurement strategy can be used to reach community in humanitarian and disaster relief regions.

Countries where favourable policies for development of mini-grid and necessary technical skills for construction & operation of mini-grids exist, may adopt for these solutions for providing higher level of electricity service to their population.

2. Business and Distribution Models
Successful businesses have business models that allow them to fulfill consumer needs at a competitive price and a sustainable cost. There cannot be any predefined framework for business models, and it must be tailored to the specific project’s local circumstances and risk profile. Different business models for the operation of mini-grids and distribution models for Pico/ SHS segment is discussed below:

*Figure 108: Business Models for Off-grid Solar Sector*

**Mini-grid Operator Models**
Mini-grid business models vary according to who owns and operates the mini-grid assets, including the generation and distribution assets. The mini-grid systems can be owned, installed, managed and operated by three main actors: governments/utilities, private enterprises, and local communities. Two or more actors may share ownership in various instances. **Utility, Private, Hybrid and Community** are the four most popular mini-grid ownership models. The table below showcases the difference between these models in terms of ownership and operation:
Table 52: Different Mini-grid Operator Models

<table>
<thead>
<tr>
<th>Operations Model</th>
<th>Owner</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility</td>
<td>Utility</td>
<td>Utility</td>
</tr>
<tr>
<td>Private</td>
<td>Developer</td>
<td>Developer</td>
</tr>
<tr>
<td>Hybrid (PPP)</td>
<td>Government</td>
<td>Developer</td>
</tr>
<tr>
<td></td>
<td>Government</td>
<td>Utility</td>
</tr>
<tr>
<td>Community</td>
<td>Community</td>
<td>Community</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Utility Operator Model

Under a utility operator model, the national utility normally owns and operates the mini-grids. The installation and operation of the mini-grids is the responsibility of a big or medium-sized state-owned or commercial utility firm. The mini-grid is managed in the same way as the Main grid by the utility involved. The government subsidizes commercial utility businesses, and this is the most typical strategy for rural electrification in developing nations. This model should be considered when the government’s rural electrification strategy or program lays down plans to support utility based mini-grid model.

Table 53: Pros and Cons of Utility Operator Model

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Relevant experience</td>
<td>• Utilities can be inefficient</td>
</tr>
<tr>
<td>• <strong>Strong technical expertise</strong>, maintenance capacity and financial management systems</td>
<td>• <strong>Short-term political agendas</strong> may drive the project and can change with change in political situations</td>
</tr>
<tr>
<td>• Can more easily connect mini-grids to main grids</td>
<td>• Sometimes mini-grids are not utility’s core business, and might not receive the attention it needs</td>
</tr>
<tr>
<td>• Able to <strong>provide subsidies</strong> for mini-grid consumers through tariffs collected from grid-connected customers</td>
<td>• Utilities might lack the financial capacity due to insolvency</td>
</tr>
<tr>
<td></td>
<td>• Cost of meeting regulations can strain limited budgets</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

The Utility Performance and Behavior in Africa Today (UPBEAT) data platform studied 76 utilities in 45 countries of Sub-Saharan Africa region on their financial and operational performance from 2012-2018. The study diagnosed different challenges being faced by utilities. Out of the utilities studied, only 33% of them could recover their operating and debt-service costs impacting the sustainability of their operations.

Barring few countries such as Kenya, Mauritius, Uganda, most of the COMESA and TDB countries have utilities that are in a state of financial and operational distress for eg. DR Congo and Sudan.
The utilities in these countries face liquidity problems, high distribution losses, rising debt and lack of funds for infrastructure maintenance. To add to the existing woes, the economic shocks caused by pandemics such as COVID-19 has further deteriorated balance sheets of the utilities and made their economic revival more challenging. All these factors makes the implementation of utility operator model challenging due to lack of bankability of utilities in majority of COMESA and TDB countries.

The utility operator model for mini-grids has been successful in few countries such as Kenya and Tanzania. Tanzania’s national utility, TANESCO uses cross-subsidization to make the tariffs affordable for remote communities. In Kenya, Rural Electrification Authority develops the mini-grid sites throughout the country which are operated, managed and maintained by their national utility, Kenya Power and Lighting Company. For the utility operator model to be successful, utility creditworthiness and transparency is of utmost importance.

Private Operator Model

In a private operator model, a private developer builds, owns and operates the mini-grids. Private-sector models are most suitable for nations with favorable legislations for licensing norms, tariff setting, grid interconnection, quality etc. For the private operator model to be successful, a vibrant business environment is required where norms for acquisition of land, construction permits, access to credit and paying taxes is favorable.

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Operations, maintenance and management tends to be more efficient</td>
<td>• Might not make rural electrification their priority without supportive policies, as it may not be cost effective and is too risky</td>
</tr>
<tr>
<td>• Political motivations, which can influence utilities, are less likely to influence private-sector actors</td>
<td>• Changes in regulations or fixed tariffs can jeopardize project success</td>
</tr>
<tr>
<td>• Scaling up of operations become easier if the investment is profitable</td>
<td>• Lengthy approval times can delay projects</td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*

The cost of meeting regulations can make the private operator model financially unviable. Countries such as Zimbabwe have light handed regulations for mini-grids below 100 KW where mini-grids below 100 KW do not require a license.

The experience of deregulation in countries such as Somalia has shown that it can result in negative impacts. In Somalia, where there is absence of regulations, private companies charge cost-reflective tariffs which are very high for the consumers.

The private operator model has been implemented successfully in Rwanda by private companies such as ECOS, MeshPower, Absolute Energy and Equatorial Power with funding from EnDev. Powerhive in Kenya has also been successful with the private operator model.
Hybrid Operator Model
In a hybrid model, different organizations are in charge of ownership, generation and distribution. Many of the projects created under this model are public-private partnerships, in which the government finances and owns the mini-grid while a private entity manages it. When one stakeholder lacks specific capacity or knowledge, project developers frequently adopt hybrid techniques.

The private sector needs to charge cost reflective tariffs to consumers for financial feasibility of the projects. The governments have the social obligation to protect consumers. This is where government support in form of tax concessions and subsidies can provide an impetus for private sector participation while safeguarding the interests of the consumers.

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Multiple partners combines the advantages of other ownership models</td>
<td>• Differences in management systems across partners can increase transaction costs</td>
</tr>
<tr>
<td>• Collaboration leverages each partner’s strengths and decreases the need for capacity building</td>
<td>• Conflicts between partners can lead to non-fulfilment of contracts</td>
</tr>
<tr>
<td>• Well-designed, hybrid ownership maximizes effectiveness and efficiency</td>
<td>• One partner’s financial problems could put the whole venture at risk</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

The hybrid mini-grid model has been successful in West African country such as Senegal. The countries in COMESA and TDB regions can also implement hybrid model by learning lessons from their neighbouring regions.

Figure 109: Case Study of Hybrid Mini-grid Model

Case Study: Senegal’s Hybrid Mini-Grid Model (Public Private Partnership)
Senegal boosted rural electrification through the PPP model in which the government retained the ownership of the mini-grid and private company was awarded with a 15-year concession to operate and maintain it. Under the Renewable Energy for Senegal (ERSEN) Off-grid Solar Energy Program, PPP model was followed for 18 mini-grids which were powered by solar PV and diesel generators. These mini-grids supplied electricity to over 38,000 households, 88 schools and 88 clinics, as well as businesses and public buildings.


Community Operator Model
The community operator model refers to a mini-grid that is owned and operated by the local community. This covers situations where the developer transfers assets to the community after the installation is completed. Community-based ownership models are common in developing countries where private companies and utilities lack the capacity or incentive to electrify remote communities.
The local communities may not have the necessary technical expertise to install, maintain and/or operate complex mini-grid systems therefore may require technical training and regular capacity building refresher programs for upskilling.

Table 56: Pros and Cons of Community Operator Model

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Can electrify remote areas where it is not cost-effective for utilities and private investors</td>
<td>• Often lack the financial and technical capacity to install, operate and manage mini-grids</td>
</tr>
<tr>
<td>• Can facilitate proper management and delivery of high-quality services, which benefits the local community</td>
<td>• Set tariff levels too low, compromising the financial viability of the project</td>
</tr>
<tr>
<td>• Can create local jobs and training opportunities</td>
<td>• Local politics can impede the project</td>
</tr>
<tr>
<td>• Can use profits from mini-grid projects to support other community development projects</td>
<td>• Enforcement and ensuring payment can be challenging</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

In Zimbabwe, pilot-hydro mini-grids were developed by Practical Action and owned by Community Cooperatives. The community operator model has been quite successful in developing countries of Asia such as India and Indonesia. The community model from these countries can be replicated in COMESA and TDB countries.

Figure 110: Case Study of Community based Mini-grid Model

**Case Study: Community based Mini-Grid Model in West Bengal, India**

West Bengal Renewable Energy Development Agency (WBREDA) developed a community-based model for mini-grid development in the state. WBREDA developed 23 mini-grids ranging in size from 25 kWp and 100 kWp which were based primarily on solar PV technology to serve over 10,000 customers. Public funds covered the capital costs for these mini-grids and consumer tariffs covered O&M expenses. Under India’s Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) Plan, WBREDA and the Ministry of New and Renewable Energy (MNRE) each contributed 50 percent of the capital costs for mini-grids. WBREDA helped to form a local cooperative or beneficiary committee to manage the mini-grid. The local cooperative or beneficiary committee is actively involved in determining and collecting tariffs, selecting customers, planning distribution lines and handling grievances. They are instrumental in educating communities about the project and responsible use of electricity.

Source: USAID

The mini-grids can be owned and operated by different entities. Different kinds of mini-grid operator models are suited for different countries. The utility and private operator models have been successful in countries such as Kenya, Tanzania and Rwanda. The hybrid and community operator models have been successful in Senegal and India respectively and can be explored in COMESA and TDB regions.

**Distribution Models for Pico/ SHS**

The distribution networks are of utmost importance for last mile delivery of Pico/ SHS. The following distribution models can be explored for marketing of Pico/ SHS to the end consumers in COMESA and TDB regions:
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

Figure 111: Distribution Models for Pico/ SHS

**Community Agent Network**
Community agent network distribution model outsources sales and service to third party distributors i.e. agents who earn a per-unit commission. These agents can be farmers, housewives and teachers. This distribution model can prove to be incredibly effective and result in lower administrative expenditures, stronger community links, improved solar education and higher brand awareness.

This model has been very common with companies in COMESA and TDB regions. In Uganda, the SHS suppliers distribute the SHS kits through freelance upcountry sales agents and installers who are paid commissions for sales. The companies in Malawi distribute through last-mile entrepreneurs such as schoolteachers.

**Rural Franchisee Model**
Rural franchisee model involves distribution through existing rural retail points and a new network of franchisee entrepreneurs. This model leverages existing supply chain of local entrepreneurs for distribution hence the capital investment in owning retail stores is significantly reduced. The organization has a revenue-sharing agreement with the retail store owner and the franchisee entrepreneur. The model results in exploiting synergy between the market participants for the greater good and unlocking higher revenue potential.

The model has been used by companies in COMESA and TDB regions to sell to customers. D.light sells its off-grid products through Total’s filling stations in countries such as Uganda and Zimbabwe. Importers in Malawi such as Kumudzi Kuwale and Zuwa Energy have established partnerships with retailers and promote franchisee model.
Civil Society Organizations (CSO)
The CSO distribution model is focused on establishing partnerships between off-grid enterprises and existing CSOs/NGOs for last mile distribution. This distribution model helps to establish awareness of Pico/SHS as the CSOs are deeply rooted in the communities. The CSOs can also help the companies with market intelligence on the potential customers and reduce market entry costs for private players.

In Zimbabwe, last mile distribution of Pico/SHS through NGOs is very popular. Alight Little Sun Zimbabwe (ALSZ) is a community-based trust formed by workers who were sponsored by the NGO Plan International. The trust is the distributor of Little Sun’s solar lanterns in Zimbabwe. ALSZ has created jobs for people in the country. The sales agents receive training through Little Sun Micro-entrepreneurial intro-course.

Figure 112: Case Study of CSO Distribution Model

The Pico/SHS companies could target the market through different distribution models such as Community Agent Network, Rural Franchisee Model or Civil Society Organizations. Successful application of these models can be found in countries such as Uganda and Zimbabwe and is a lesson for other COMESA and TDB countries for enabling last mile distribution of Pico/SHS solutions.
**Advanced Countries**

**Ethiopia**

Ethiopia is a low-income country with decent rural electrification rate of 39% in 2020 and high population density of 102 people/square km in 2020.\(^{80}\) The country has established strong institutions and policies for off-grid development. The country has a target of 9 million off-grid connections in its updated National Electrification Programme. The potential market for PULSE products is also high in the country. The Ministry of Agriculture has a plan for small scale irrigation technology and services between 2020 and 2025 that will see over one million hectares developed using over 400,000 pumps. The country has already established a name in Pico/SHS market and has the second highest sale of off-grid lighting products after Kenya in Sub-Saharan Africa region as per GOGLA estimates. Renowned brands such as Greenlight Planet and d.light are active in the market. To meet the National Electrification Programme target, the country needs to further increase the supply of standalone solar products.

Mini Grid Market Opportunity Assessment: Ethiopia report, 2017 estimates market potential of 13 million people for mini-grid (taking into account planned grid extension). Ethiopian Electric Power (EEP) and the Ministry of Water, Irrigation and Electricity (MoWIE) has plans to commission 550 mini-grids. Private players such as Beshah International Solar & Information Technology, Ethio Resource Group, General Electric, GFM Fotovoltaica and Solar Tech are active in the mini-grid space.

The country’s off-grid market faces challenges due to low mobile money penetration, restriction on distribution by foreign companies, high cost of consumer loans by MFIs and low foreign exchange reserves for import of off-grid products. The country should focus on addressing these barriers for wide-scale adoption of off-grid products.

**Kenya**

Kenya is a lower-middle income country with good rural electrification rate of 63% in 2020.\(^{81}\) The country enjoys good economic growth and is ranked high on the ease of doing business index. The country has established strong policies and institutions for off-grid development. The nation is a leader in off-grid lighting products with highest sales in Sub-Saharan Africa region as per GOGLA estimates. All major players of Pico/SHS such as BBOXX, Azuri Technologies, d.light, Greenlight Planet etc. operate in the country. The country has excellent penetration of mobile money and has pioneered PAYGO model for consumer financing. REREC’s (Rural Electrification and Renewable Energy Corporation) strategic plan calls for construction of 450 mini-grids in the country. Mini-grid developers such as PowerHive and PowerGen operate in the country. The utility operator and private operator model for mini-grids has been quite successful in the country. The country has received ample support from development institutions such as World Bank, AfDB, USAID, EU, UNIDO etc. for market development of off-grid solutions. A number of Microfinance Institutions such as Choice Microfinance Bank, Musoni, Bimas kenya, Sumac Micro

---

\(^{80}\) Source: World Bank  
\(^{81}\) Source: World Bank
Finance Bank etc. in the country provide loans to end-users for Pico/SHS solutions. The country has established dedicated institutions such as Solar Academy (University of Nairobi), Jomo Kenyatta University of Agriculture and Technology (JKUAT), Strathmore University Energy Research Centre for training. The country has aspiration of becoming a middle income by 2030 for which it is imperative to provide electricity access to its entire population. The country should continue with its existing focus on off-grid solutions and promote local currency financing and private sector participation in the off-grid sector.

Rwanda
Rwanda is a low-income nation with a rural electrification rate of 38% in 2020. Out of all the COMESA and TDB countries, Rwanda has the second highest population density after Mauritius. The country has very robust institutions and policies for off-grid development. The government has set an ambitious target of achieving universal electricity access by 2024 through the provision of off-grid connections (48 per cent) and on-grid connections (52 per cent). The country is also implementing usage of OMIC (Off-grid Monitoring Information System) to track all SHS installed in the country. The mobile money plays a significant role for financial inclusion in the country and has helped establish players in Pico/SHS industry such as BOXX, Ignite, Mobisol and Zola Electric to expand their operations in the country. The country has various market development programs from development partners such as AfDb, USAID, World Bank, SIDA, FCDO for scaling off-grid solutions. The country is an attractive business destination and ranks second highest in COMESA and TDB regions in Ease of Doing Business Index. The private operator model for mini-grids has been quite successful in the country up to now.

The off-grid sector in the country faces challenges due to low consumer affordability. The country should continue with its existing focus on subsidies to address the hurdle of consumer affordability for adoption of off-grid solutions. The country should also promote local manufacturing and local currency financing for off-grid sector development.

Tanzania
The country is a lower middle-income country with a rural electrification rate of 22% as of 2020. The country has robust institutions and policies for mini-grid development. Tanzania is a pioneer in mini-grid technologies, having installed more than 200 mini-grids. The utility operator model of mini-grid has been successful in the country. The country also possesses enabling factors such as widespread mobile telecommunication services, training institutions, gender mainstreaming for scaling of Pico/SHS systems. Major Pico/SHS players such as Greenlight Planet, Azuri, Zola Tanzania, d. light and Mobisol have operations in the country. The country enjoys financing support from donors such as DFID, SIDA for development of off-grid technologies. The country should focus on improving quality standards for off-grid products and attracting financing from private sector to scale off-grid solutions for achieving its universal access target by 2033.

82 Source: World Bank
83 Source: World Bank
Uganda
Uganda is a low-income country with rural electrification access of 33% in 2020. The country has a high population density of 228 people/square km in 2020. The country has robust institutions and policies for off-grid development. The country also has presence of other enabling factors such as high financial inclusion and mobile phone subscription for scaling off-grid solutions. Different vertically integrated PAYGO companies such as Fenix International, M-KOPA, Solar Now and Greenlight Planet have operations in the country. Uganda’s Rural Electrification Agency identified 320 sites suitable for mini-grid deployment by 2030 to a total of 70,000 households. Mini-grid developers such as Absolute Energy and Engie have commissioned solar mini-grids in the country. Uganda receives financial support from donors such as UKAID, SIDA for scaling off-grid solutions. Several foreign organizations such as Bamboo Capital Partners, Oiko Credit, CrossBoundary Energy, Symbiotics, Cordiant Capital, CDC Group and Nordic Funds provide funds to Pico/SHS companies.

The country’s off-grid market faces barriers due to lack of last mile suppliers, lack of access to finance and limited consumer awareness. The country should work towards establishing market intelligence, financing of smaller companies and capacity building for stakeholders to further develop the off-grid sector.

Evolving Countries
DRC
DRC is a low-income nation with lowest electrification access rate of 1% in 2020 in COMESA and TDB region. The country has more than 10 million households without access to electricity and affordability is a big constraint. The recent establishment of institutions such as ARE (Authority for Electricity Regulation) and ANSER (Rural Electrification Agency) is expected to positively impact the rural electrification efforts in the country. Pico/SHS Companies such as BBOXX, Greenlight Planet, d.light have kickstarted the off-grid solar sector in the country and PAYGO model is also being implemented in the country. Market development programs such as EASE by World Bank and ESSOR by UKAID are supporting adoption of SHS and mini-grid solutions respectively in the country. The Scaling Mini-grid Initiative is a new World Bank initiative in the country to increase private sector participation in mini-grid sector. The program is expected to cover 21 provincial capitals with more than 200 megawatts of capacity, and aims to bring the population’s electricity supply rate to 30% by 2024, from the current 19%.

The country faces barriers due to political instability, weak policies, infrastructural issues (lack of road connectivity, lack of mobile reception), low consumer income & awareness, long importation process and low financial inclusion. The country needs to address these barriers for off-grid sector development.

84 Source: World Bank
86 Source: World Bank
88 Source: Africa Energy Portal
Eritrea
Eritrea is a lower middle-income country with decent rural electrification rate of 39% in 2020.99 The country has used mini-grids to successfully provide electricity access to its population. Solarcentury built Solar mini-grids to provide electricity to 40,000 Eritreans in 2019.90

The country’s off-grid market faces challenges due to weak policies, low financial inclusion and low mobile phone usage. The country should focus on strengthening its regulatory, financial and business environment for adoption of Pico/SHS solutions in the country.

Madagascar
Madagascar is a low-income country with only 11% rural electrification rate as of 2020.91 The population density and affordability of the country is low. The country has a huge electricity gap in the rural areas which needs to be bridged with off-grid solutions. The New Energy Policy of 2015 envisages energy mix consisting of 70% grid extension, 20% via mini-grids (50% will be hydro, 25% diesel, 20% from rice husk gasification and 5% solar PV) and 10% from standalone solar systems by 2030. Madagascar has players such as Jiro-Ve and Heri which distribute solar lanterns to rural population on rental basis. The mini-grid mode of electricity generation is not new in the country as the country has implemented large number of hydro mini-grids on utility operator model. Institutions like KfW, UNIDO and FONDEM support the development of mini-grids in the country.

The off-grid sector faces challenges due to low consumer income, low consumer awareness, lack of quality products and low financial inclusion. The country should address these barriers for scaling off-grid solutions in the country.

Malawi
Malawi is a low-income country with very low electrification rate of 7% in rural areas as of 2020.92 As per National Energy Policy of 2018, mini-grids and Pico/SHS solutions are expected to contribute to 45% of national electrification by 2035. The Malawi Rural Electrification Programme is mandated to expand electricity access through off-grid solutions like Pico/SHS and mini-grids. The country has a decent market for Pico/SHS products with presence of players such as Solar Works and Sunny Money. The Pico/SHS players use agent model of distribution by distributing products through school teachers and last-mile entrepreneurs. Importers like Kumudzi Kuwale and Zuwa Energy have established partnerships with retailers to promote franchisee models. The country’s off-grid market has received support from development partners like USAID, EU, EEP Africa, World Bank, UNDP etc. MFIs like FINCA, FINCOOP and CUMO provide loans to end-users for accessing Pico/SHS products.
The country’s off-grid market faces challenges due to weak mini-grid development regulations, low quality Pico/SHS products, lack of access to commercial finance and high cost of consumer financing by MFIs. The country needs to address these barriers for scaling off-grid solutions in the country.

**Mozambique**

Mozambique is a low-income nation with very low electricity access of 5% in rural areas as of 2020. The country has low population density and huge electricity gap. The National Electrification Strategy states that 70% of electrification will be achieved by means of grid extension, leaving 30% for a combination of mini-grids and standalone solar systems. The country’s off-grid sector is supported by development partners like FCDO, SIDA, GIZ, World Bank, EU etc. The new regulation on Access to Energy in Off-grid Zones is expected to mobilize funding from donors and crowd-in private investment. The BRILHO Programme, funded by the UK Government’s Foreign, Commonwealth and Development Office (FCDO) and implemented by SNV Netherlands Development Organisation aims to provide energy access through SHS, mini-grids and Improved Cooking Solutions in the country to benefit 1.5 million Mozambicans and 15,000 small businesses by 2024. Companies such as Fenix, Fosera, Greenlight Planet, SolarWorks supply Pico/SHS solutions in the country. The country’s national rural electrification agency, FUNAE has installed more than 100 mini-grids in the country. Although the country has presence of NGOs and private companies such as AKSM, Cronimet, Ecolibri, EDP Renewables, Hyosung, Palm Tree Power, Practical Action, RVE SOL and VSO, the private sector participation in the mini-grid sector has been slow.

The country’s off-grid market faces barriers due to weak mini-grid regulations, low mobile phone usage and lack of access to finance. The country should focus on addressing these barriers for scaling off-grid solutions in the country.

**Zambia**

Zambia is a lower middle-income country with low rural electrification rate of 14% as of 2020. Zambia Vision 2030 is a long-term strategic plan aimed at achieving prosperous middle-income status by 2030 by promoting a conducive environment for long-term socioeconomic development. The country has established strong institutions and policies for off-grid development. The country’s market for Pico/ SHS has companies such as Captain Electrical, Fenix, Greenlight Planet, Kakula Solar, Solar Village, Sunray, SunnyMoney and Vitalite Group serving the country’s population. Development partners such as World Bank, AfDB, USAID, GIZ etc. support the market development of standalone solar systems in the country. The government policies are supportive of mini-grids and the country has presence of Hydro and Solar PV mini-grids. Developers such as Muhanya Solar, Entiba Energy, PowerCorner have their operations in the country.

---

93 Source: World Bank
94 Source: SNV
95 Source: World Bank
The country’s off-grid market faces challenges due to lack of startup capital for off-grid enterprises and lack of consumer affordability (lack of MFIs providing loans). The country should focus on addressing these barriers for scaling use of off-grid technologies in the country.

Zimbabwe
Zimbabwe is a lower middle-income country with rural electrification access of 37% as of 2020. The analysis done in the Mini-grid Market Opportunity Assessment: Zimbabwe by SE4ALL Africa Hub and African Development Bank, 2018 report estimated that 2.2 million people and 1.1 million people will be best served by standalone systems and mini-grid solutions respectively in Zimbabwe. The country has strong institutions and policies in place for off-grid sector development. The country’s off-grid sector receives support from development partners like AfDB, ACE TAF, Isle of Man, SIDA, AECF React, UNDP, World Bank etc. The country has presence of both local suppliers such as Mukonitronics and international suppliers such as Greenlight Planet for Pico/SHS solutions. The recent reforms in the off-grid sector such as adoption of IEC quality standards for Pico/SHS, establishment of laboratory (ACE-TAF supported) to test Pico-solar, SHS and solar appliances for quality and amendment of import duty exemption to include lithium-ion batteries is expected to benefit the off-grid sector.

The country has developed favourable regulations for mini-grid development. Despite favourable regulations, complex administrative procedures pose hurdle for development of mini-grids. The existing mini-grids in the country have been donor funded and developed by NGOs. SNV Netherlands and Practical Action have implemented notable projects like Masaba solar PV mini-grid and Himalaya mini hydro project.

The country’s business environment faces challenges due to currency volatility and hyperinflation. The country should focus on bringing about economic stability, strengthening mobile-money regulations and promoting commercial financing to encourage private sector participation in off-grid sector.

Underdeveloped Countries
Burundi
Burundi is a low-income nation with lowest GNI per capita among all the COMESA and TDB countries. The rural electrification level in the country is extremely low at 4% in 2020 and the consumer affordability is a big challenge. The country has a potential market of approximately 2.1 million households for Pico/SHS, but only about 5-10% of that market has been tapped. The standalone solar market is still in its infancy. Bizisol, Greenbox Solar, ITCO, Little Sun, Nambiar, Solar Links and Virago are among the key actors involved in distributing and selling standalone solar products in Burundi. World Bank funded SOLEIL program is expected to provide grants to suppliers of Pico/SHS solutions. The country does not have many mini-grids currently but the government targets construction of 4 solar mini-grids in its National Development Plan 2018-

96 Source: World Bank
97 Source: World Bank
2027. The country should focus on **strengthening its policies, increasing financial inclusion and promoting access to finance** for off-grid sector development.

**Djibouti**

Djibouti is a **lower middle-income country with rural electrification access of 25% in 2020**. The country has a **low population density**. Djibouti’s vision 2035 established a target of 100% RE by **2020**. The country lags in the **per capita electricity consumption** which is one of the lowest in the world.

The country has **limited presence of off-grid technologies**. The country recently launched construction of solar mini-grid using support from UNDP. The country has **low financial inclusion and low usage of mobile phones**. The country also **lacks robust regulations** for development of off-grid. The country should focus on addressing these barriers for adoption of off-grid solutions in the country.

**Libya**

Libya is an **upper middle-income country with low rural access of electricity (8% in 2011)**. The country’s civil wars have restricted the economic development in the country. Libya has a **dispersed population with lowest population density** in the COMESA and TDB regions. The country has **low proportion of renewable energy in its energy mix** and has an aim to increase the proportion of RE to 22% of generation mix by 2030. The country has taken steps for deployment of renewable energy but most of these efforts have been for **large scale grid-connected projects**. The high financial inclusion, widespread mobile phone usage and high per capita income offers positive prospects for adoption of off-grid solutions. The country can adopt a host of off-grid solutions to electrify its underserved population by **strengthening its institutions, establishing political stability and promoting healthy business environment**.

**Somalia**

Somalia is a **low-income nation with 32% rural electrification rate as of 2020**. The Somali Electricity Access Project by World Bank has an objective of electrifying country’s households and small businesses with Solar Home Systems. Solar distribution companies such as TESCO Solargen, Delta Engineering, Tamarso, Recon Energy, Dalsan Power and Dayax Power serve large institutional customers such as hospitals and hotels. Fee-free and off-line mobile money transactions in the country is expected to benefit the standalone solar systems industry. Solar Gen is working towards construction of solar micro-grids in the country.

The country’s ongoing civil war poses a challenge to fulfilling electrification goals of the country. The country **lacks specific policies** for development of off-grid technologies. The country has a **difficult business environment** for attracting investors and private players. The population lacks
access to financial services and mobile cellular subscriptions. The country should focus on overcoming these barriers for development of off-grid sector.

**South Sudan**

South Sudan is a **low-income nation** with extremely **low rural electrification rate of 6% as of 2020**. The country is young, having achieved its independence in 2011. South Sudan need to make an effort to electrify its population, majority of whom stay in rural areas in extreme poverty. The country’s off-grid market is nascent with presence of few players such as Go Solar and Solar World.

The country’s **institutions are relatively young and the policies for electricity sector are not fully developed**. Financial inclusion and mobile phone usage in the country is **low** which makes implementation of PAYGO model challenging. The **consumer affordability and awareness of off-grid solar products is low** in the country. The country should focus on addressing these barriers for promoting off-grid technologies in the country.

**Sudan**

Sudan is a **low-income country with a rural electrification rate of 41% in 2020**. The country has experienced civil wars since its independence which has affected the economy negatively. Sudan has an excellent solar potential which is highly unutilized. The **majority of country’s population lives in rural areas (around 65%) and the population density of the country is quite low (around 24 people/square km)**.

The off-grid market in the country is underdeveloped with **limited presence of players such as Energicity and Easy Solar**. The off-grid market faces challenges due to **political instability, weak regulations, low financial inclusion, low consumer affordability and lack of access to finance**. The country should focus on addressing these barriers for development of off-grid sector.

**3. Proposed Policy Framework and Institutional Structure**

Countries are increasingly adopting off-grid renewable energy solutions within national energy access strategies. Integrated energy access strategies must be backed by strong institutional frameworks, dedicated policies and regulations designed for different off-grid solutions.

It is equally important to define the roles and responsibilities of major actors for efficient functioning of the sector. It is of utmost importance to cover all the gaps while defining the institutional structure. The institutional arrangement shall be conducive for the development and adoption of off-grid technologies in the countries of the COMESA and TDB regions.

Two facets of the Institutional Structure to promote off-grid technologies is discussed below:

---

101 Source: World Bank
102 Source: World Bank
Policy Planning and Development
The Governments and their various ministries shall work hand in hand to frame favorable policies to develop the off-grid sector in the country. They shall also be responsible for bridging the existing gaps in the legal framework. The policies need to **clearly set the targets and milestones for the development of off-grid solutions**. Electrification planning and strategies should clearly identify those areas of the country that will be reached by grid extension within a reasonable time frame, as well as those suitable for off-grid solutions. The framed policies should **inculcate confidence in the private sector and the investors** to develop the off-grid sector.

Central Government
The proposed roles and responsibilities that central governments are expected to perform are as follows:

- **Develop vision and goal** for the electrification of the unserved country population
- **Provide subsidies** according to the type and size of the project to make the off-grid projects financially sustainable in the initial years and attract funds from private investors
- Develop a favorable **investment environment** to attract FDI in the off-grid sector
• Issue risk mitigation instruments such as sovereign guarantees, letters of support etc. to mitigate political risk for developers and off-grid companies operating in the respective country

• Form partnerships with other countries for skills development and technology transfer in the renewable energy sector

• Set up training institutions and universities to educate consumers about RE technologies including off-grid

**Ministry responsible for Energy**

The Ministry responsible for Energy must play a pivotal role in the development of off-grid Renewable Energy sector. The ministry shall be responsible for development of legislations to promote the sector. The proposed functions of the Ministry are as follows:

• Undertake studies on potential for development of renewable energy technologies

• Formulate National Energy Policy with renewable energy targets

• **Formulation of a National Renewable Energy Policy** with specified RE targets in the short term and long-term considering greenhouse gas (GHG) emission targets set in the INDC objectives, demand-supply projections, adoption by population

• Coordinate with multi-lateral institutions and agencies to obtain grants, financial support, and technical expertise for development of solar off-grid technologies and projects

• Initiate appropriate skill development and technology transfer mechanism for community empowerment through job creation in the RE sector

• **Develop specific programs and awareness campaigns** in collaboration with NGOs, communities, and international agencies for promoting off-grid technologies

• Coordinate with Ministry responsible for promoting Industry and Commerce to provide impetus to indigenous manufacturing of solar off-grid equipment

• Coordinate and work with the Ministry of Finance to decide on the financial incentives and tax credits to be provided to local manufacturers of off-grid equipment to boost industry sentiment

• Design specific plans in collaboration with Universities and Training Institutions to promote Research and Development in the off-grid sector

**Unit responsible for Management of Ministry of Energy’s Projects**

The Unit responsible for Management and Coordination of Ministry of Energy’s Projects shall discharge duties such as identifying renewable energy sites, selecting and preparing medium power plant projects for public-private partnerships (PPPs), analyzing the regulations for the
implementation of such projects, and coordinating donor financing programs. It is further proposed that the unit should act as a Nodal Agency and be responsible for resource estimation, prepare pre-feasibility reports, information management, monitoring and evaluation of different solar mini-grid projects. It shall discharge the following functions:

- Play a consultative role to provide useful information and facilitate off-grid developers in obtaining all the necessary consents, approvals and clearances from several authorities including water extraction, forest, land, environmental clearances, and other necessary approvals
- Provide necessary information to developers regarding bidding process and land availability
- **Monitor the construction and development** of mini-grid projects

**Ministry responsible for Finance**

The Ministries responsible for Finance are expected to play a key role in the development of off-grid sector in the country. The ministry responsible for finance is expected to discharge the following responsibilities for development of the sector:

- **Dedicate a budget** for development of off-grid technologies in the respective country
- Develop a detailed **plan to enhance investor confidence** and value of sovereign guarantees in the market
- **Decide on the financial incentives and tax credits** to be provided to manufacturers to boost sentiment and promote local manufacturing of renewable equipment

**Department responsible for Revenue and Customs**

The Department responsible for Revenue and Customs under Ministry of Finance is expected to provide fiscal stimulus to trigger the development of off-grid sector. It is expected to discharge the following functions:

- **Provide tax and import duty exemptions** to the off-grid RE equipment imported into the mission country
- **Monitor the trade volumes** of off-grid equipment entering and leaving the mission country
- **Prevent the influx of low quality and counterfeit off-grid solar products** in the mission country

**Implementation Wing**

The operational set-up in the off-grid sector shall constitute electricity regulator, rural electrification agency, national investment promotion agency, Off-grid Solar Financing Facility, quality monitoring agency, financing institutions (international donors, commercial banks,
private equity players, venture capitalists, Micro-financing institutions etc.), off-grid companies and mini-grid developers who will carry out the daily activities in the off-grid sector in in the respective COMESA and TDB countries.

Figure 115: Implementation Wing responsible for Day-to-Day Administration of Off-grid Solar Sector

Source: Deloitte Analysis

The key roles and responsibilities of the major actors responsible for functioning of the off-grid sector in in the respective COMESA and TDB countries are as follows:

Table 57: Key responsibilities of major actors involved in the Implementation Wing

<table>
<thead>
<tr>
<th>Actor</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Regulator</td>
<td>- Implement the policies drafted by the Ministry of Energy through its regulations</td>
</tr>
<tr>
<td></td>
<td>- Invite bids to perform detailed resource assessments on off-grid market technologies to determine their potential in the country and enhance investor confidence</td>
</tr>
<tr>
<td></td>
<td>- Grant licenses and determine licensing fees (preferably based on technology) for mini-grid developers</td>
</tr>
<tr>
<td></td>
<td>- Ensure all the mini-grid projects meet the EIA compliance</td>
</tr>
<tr>
<td></td>
<td>- Set the technical and operating parameters for mini-grids</td>
</tr>
<tr>
<td></td>
<td>- Provide a tariff setting framework for the mini-grid operators</td>
</tr>
<tr>
<td></td>
<td>- Ensure the off-grid products adhere to the appropriate quality standards and specifications set in the country</td>
</tr>
<tr>
<td></td>
<td>- Set guidelines regarding trade of off-grid equipment in the country</td>
</tr>
<tr>
<td>Rural Electrification Agency</td>
<td>- Design schemes to improve electrification levels in rural areas and achieve the renewable energy targets set in the policy</td>
</tr>
</tbody>
</table>
### Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

<table>
<thead>
<tr>
<th>Actor</th>
<th>Responsibility</th>
</tr>
</thead>
</table>
| **Off-grid Solar Financing Facility**                                | • Collaborate with the Ministry of Energy to **design and develop specific programs for promoting off-grid technologies** for electricity access  
  • Collaborate with the development partners (multi-lateral and bilateral DFIs, foreign institutional investors, NGOs, Foundations, Impact Investors, Private Equity Fund etc.) to **attract funds** for the off-grid Solar sector  
  • **Constitute an Off-grid Solar Financing Facility** within itself dedicated towards facilitation of financing in the off-grid Solar sector  
  • Conduct **aggregation of mini-grid projects and pooling of Pico/ SHS companies** to avail financing  
  • Assist the Pico/ SHS companies and mini-grid developers with the **financing applications**  
  • Develop a **credit grading tool to assist Fund Managers** to evaluate the Pico/ SHS companies and mini-grid developers for providing them with funding  
  • Facilitate **risk mitigation instruments such as sovereign guarantee, first loss guarantee etc.** for the investors to minimize the risk |
| **National Agency of Investment Promotion**                          | • **Provide tax exemptions** *(corporate income tax, property tax etc.)* to mini-grid developers willing to invest in mission country  
  • Promote **PPP projects in the off-grid sector** |
| **Agency responsible for Quality Assurance**                        | • **Perform quality control of all off-grid Solar products** imported in the mission country  
  • Ensure **compliance of the imported off-grid products** against the internationally adopted quality standards  
  • **Technical control and testing** of imported off-grid equipment in dedicated laboratories |
| **Development Partners**                                            | • **Provide financing support** for off-grid solar initiatives  
  • Monitor **the progress of off-grid solar projects** against set objectives |
| **Fund Manager**                                                    | • Design **financing instruments and terms for financing** off-grid enterprises  
  • **Work with Off-grid Solar Financing Facility** for due diligence of projects for financing |
| **MFIs (Micro-Financing Institutions)**                            | • **Develop solar specific micro-loan products for end users** to increase their affordability |
| **Mobile Money Providers**                                          | • **Tie-up with the solar off-grid companies** for providing digital payment options to customers for PAYGO transactions |
| **Pico/SHS Companies**                                              | • **Conduct extensive R&D** to develop off-grid products and appliances  
  • **Manufacture high quality products** which conform to the quality standards |
Needs and Market assessment of Off-grid Renewable Energy in the COMESA and TDB region

<table>
<thead>
<tr>
<th>Actor</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Increase visibility of their product portfolio by marketing and distribution through innovative channels</td>
</tr>
<tr>
<td></td>
<td>• Provide high quality of product and customer service to their customers at affordable prices</td>
</tr>
<tr>
<td></td>
<td>• Ensure disposal of electronic waste in safe and responsible manner</td>
</tr>
<tr>
<td>Mini-grid Developers</td>
<td>• Provide reliable supply of electricity access to consumers at affordable prices</td>
</tr>
<tr>
<td></td>
<td>• Ensure disposal of electronic waste in safe and responsible manner</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

**IDCOL SHS Program Bangladesh**

The World Bank along with other development partners financed a **SHS program** through **Infrastructure Development Company Ltd. (IDCOL)** which has been a game-changer for electricity access in Bangladesh. The program has accelerated the country’s development trajectory and is a **role model for the entire world**.

Figure 116: Case Study of IDCOL SHS Program in Bangladesh

---

**Case Study: IDCOL Operating Model for SHS Program in Bangladesh**

IDCOL is fully owned government owned development finance institution. It catalyzes private sector investment in renewable energy projects. IDCOL is an excellent example of PPP where the board comprises of senior government officials and prominent private sector entrepreneurs.

The operating model for their SHS program consists of the following bodies:

• The funding for the program flows from multilateral agencies/donors (World Bank, USAID, AFDB etc.) to the Government of Bangladesh and then to IDCOL

• Loans and grants are provided by IDCOL to Partner Organizations (POs), such as NGOs and private sector companies, that identify customers, provide micro-credit, install the SHSs, and provide after-sales service

• IDCOL also provides training and marketing and monitors the implementation of the program including quality assurance

• An independent technical standards committee defines the technical and warranty specifications that systems and components must meet in order to be financed under IDCOL SHS program

• Up till January 2019, roughly 4.13 million SHSs had been installed as part of the program in remote locations

Source: IDCOL
**Recommendations Policy Framework and for Institutional Structure**

Based on as is study of the institutions and policies analysed in the identified COMESA and TDB countries, following recommendations could be adopted for regulatory landscape strengthening for off-grid development.

*Table 58: Recommendations for Institutional Structure and Policy Framework in COMESA and TDB countries*

<table>
<thead>
<tr>
<th>Country</th>
<th>Institutional Structure</th>
<th>Policy Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burundi</td>
<td>Presence of all important institutions</td>
<td>Establish a Renewable Energy Policy</td>
</tr>
<tr>
<td>Djibouti</td>
<td>Establish an independent Regulator and a Renewable Energy Association</td>
<td>Expedite the draft Electricity Law and develop a dedicated Renewable Energy policy</td>
</tr>
<tr>
<td>DR Congo</td>
<td>Presence of all important institutions</td>
<td>Develop a Renewable Energy Policy and a Rural Electrification Master Plan</td>
</tr>
<tr>
<td>Eritrea</td>
<td>Establish an independent Regulator, a dedicated Rural Electrification Agency and a non-profit Renewable Energy Association</td>
<td>Develop a dedicated Rural Master Electrification Plan and PPP Laws in the country</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Presence of all important institutions</td>
<td>Presence of all important policies</td>
</tr>
<tr>
<td>Kenya</td>
<td>Presence of all important institutions</td>
<td>Presence of all important policies</td>
</tr>
<tr>
<td>Libya</td>
<td>Establish an independent regulator and a dedicated Rural Electrification Agency</td>
<td>Establish an Electricity Law and Rural Electrification Master Plan</td>
</tr>
<tr>
<td>Madagascar</td>
<td>Presence of all important institutions</td>
<td>Presence of all important policies</td>
</tr>
<tr>
<td>Malawi</td>
<td>Establish a dedicated Rural Electrification Agency</td>
<td>Presence of all important policies</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Set up a dedicated Rural Electrification Agency</td>
<td>Develop a Rural Electrification Master Plan</td>
</tr>
<tr>
<td>Rwanda</td>
<td>Presence of all important institutions</td>
<td>Presence of all important policies</td>
</tr>
<tr>
<td>Somalia</td>
<td>Establish a dedicated Rural Electrification Agency</td>
<td>Develop Electricity Law, Renewable Energy Policy and Rural Electrification Master Plan</td>
</tr>
<tr>
<td>South Sudan</td>
<td>Establish an independent Regulator and a dedicated Rural Electrification Agency</td>
<td>Develop a Renewable Energy Policy, Rural Electrification Master Plan and PPP laws</td>
</tr>
<tr>
<td>Sudan</td>
<td>Set up a Rural Electrification Agency</td>
<td>Develop a Rural Electrification Master Plan</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Presence of all important institutions</td>
<td>Develop a Renewable Energy Policy</td>
</tr>
<tr>
<td>Uganda</td>
<td>Presence of all important institutions</td>
<td>Presence of all important policies</td>
</tr>
<tr>
<td>Zambia</td>
<td>Presence of all important institutions</td>
<td>Presence of all important policies</td>
</tr>
</tbody>
</table>
Table 7.1: Evidence of Presence of Institutions and Policies

<table>
<thead>
<tr>
<th>Country</th>
<th>Presence of all important institutions</th>
<th>Presence of all important policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zimbabwe</td>
<td>Presence of all important institutions</td>
<td>Presence of all important policies</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

Policy Planning and Implementation Wing are two facets of Institutional Structure for efficient functioning of off-grid Solar sector. The Governments and their various ministries shall be responsible for bridging existing gaps in legal framework. The policies framed by the Government agencies should clearly define off-grid targets and fiscal benefits. The Implementation wing shall consist of bodies such as Regulator, Rural Electrification Agency, etc. responsible for implementation and ensuring compliance of the policies. An off-grid Solar Financing Facility shall be set up for aggregating projects, assisting off-grid entities with loan applications, aiding fund managers with due-diligence and facilitating risk mitigation instruments.

4. Financing Recommendations

As already discussed in the Financing section, the off-grid solar sector faces various challenges such as high cost of capital, collateral inadequacy, low repayment period, foreign exchange risk, lack of sector awareness, lack of bankable projects etc. To address these challenges and stimulate financing in the off-grid sector, certain recommendations have been given as below:

Figure 117: Key Components of the Financing Recommendations

- **Aggregation of Projects**
  Bundling of Mini-grid projects and pooling of SHS units to reduce transaction costs and diversify overall risk

- **Receivables Backed Financing**
  Bifurcation of business into operating and asset company; asset company to purchase right to receivables and pledge it as collateral for borrowing

- **Using Public Finance to Catalyse Private Finance**
  Exploring mechanisms like refinancing and blended finance to increase participation of local commercial institutions

- **Reducing Financing Intermediaries**
  Reduce the involvement of Participating Financing Institutions to reduce interest rate

- **Risk Mitigation Tools**
  Usage of risk mitigation tools like insurance, guarantees, hedging etc. to reduce risk and make projects bankable

Source: Deloitte Analysis
Aggregation of Projects for Risk Diversification

Off-grid projects are by their nature small. They therefore suffer from relatively high transaction costs to prepare them to bankability. In the case of mini-grids, those projects with low-risk correlation could be aggregated to reduce the overall risk and offset transaction costs. This bundling of projects will enable financing at lower interest rates and help in achieving affordability, sustainability and scalability. Aggregation of projects is a popular concept in other sectors of the economy such as real estate. The aggregation of mini-grids for attracting financing has been implemented in countries such as Uganda and Tanzania.

The proposed Off-grid Solar Financing Facility (part of Rural Electrification Agency) can aid with the aggregation of mini-grid sites for financing. This can make the small projects bankable, reduce transaction costs and result in favourable lending terms for borrowers.

Figure 118: Case Study of Aggregation of Mini-grids

The assets of multiple SHS companies can also be grouped under a pooled financing entity (through a special purpose vehicle SPV) to increase transaction size and reduce investor risk. The large transaction size will enable the financing institutions to widen investor base and cut down on transaction costs.

Reducing Financing Intermediaries to Lower Cost of Financing

The funding for off-grid projects usually flows from Development Partners to the Fund Manager which are routed through local commercial bank/ NGO (participating financial institutions/intermediaries) before finally being disbursed to the off-grid entity. This long financing chain
leads to **imposition of lending margins at every stage** which **increases the cost of financing** to the borrower.

It is important to **reduce intermediaries in the financing chain** to **reduce the interest rate**. The financing for off-grid projects should be directly through the Fund Manager without the involvement of participating financial institutions/ intermediaries. The Fund Manager will be responsible for bearing the credit risk in this case. The proposed **Off-grid Solar Financing Facility (part of the Rural Electrification Agency)** can assist the Fund Manager in due-diligence of projects/companies.

**Figure 119: Reducing Intermediaries in the Financing chain**

**Receivables Backed Financing for Collateral Adequacy**

In its Exploring the Role of Guarantee Products in Supporting Local Currency Financing of Sustainable off-grid energy projects in Africa report, *AfDB proposed a financing structure* to **isolate the lenders from the operational risk** in order to **stimulate local currency lending for off-grid enterprises**. The report suggests that business lines of **off-grid enterprises** should be **bifurcated into two separate legal entities**:

- **Operating Company** that will be responsible for importing/ assembling, selling and maintaining the Solar Home Systems; and
- **Asset Company** that will purchase the right to receivables (regular customer payments arising from the PAYGO model) of the Operating Company with a combination of debt raised through the FIs and equity from the investors

The set-up is expected to operate in such a manner that it will be the Asset Company that will seek debt from the FIs by pledging its right to receivables which it purchased from the Operating Company as collateral. The Operating Company is expected to sell its right to receivables to the Asset Company at a discount. The AfDB is expected to provide a partial credit guarantee to the lenders to de-risk their transaction for improved terms on the loan (lower interest rate, higher tenure, lower collateral etc.)
Such a structured finance mechanism is expected to provide lenders with adequate collateral through Operating Company’s receivables which will be assigned to the Asset Company. This structured finance mechanism will also insulate the lenders from the operational risks of the Operating Company. If in the future the operating company becomes insolvent due to operational risks, the debt will continue to be repaid from the customer receivables flowing into the Asset Company.

**Risk Mitigation Tools to make Projects Bankable**

The investors/companies in the off-grid solar sector in COMESA and TDB regions suffer from various risks such as political risk, default risk, currency risk, collateral risk which results in high cost of capital. Risk mitigation tools are the need of the hour to reduce some of these risks to increase investor appetite and enable lending at favourable terms for the borrowers. These risk mitigation tools can entice local commercial banks and institutional investors who are currently not lending to the off-grid solar sector to consider off-grid projects in their asset portfolios. These risk mitigation tools reduce the losses faced by the local commercial banks and institutional investors in event of default, therefore can be used to negotiate for lower cost of capital, long repayment periods, lower collateral, etc.

The different risk mitigation tools covered in this section are:
Political Risk Insurance

Political risk insurance provides financial protection to investors against political events such as expropriation, sovereign debt default, war, etc. The emerging markets in the COMESA and TDB regions offer great potential for business growth but the political instability in countries such as Burundi, DRC, Eritrea, Ethiopia, Libya, Mozambique, Somalia, South Sudan, Sudan due to armed conflicts act as a deterrent for private sector participation in the region. An instrument such as political risk insurance could bring in comfort to the investors in the region.

Multilateral Investment Guarantee Agency (MIGA) provides political risk insurance guarantees and credit enhancement to private sector investors and lenders. These guarantees protect investments against non-commercial risks such as breach of contract, currency interconvertibility & transfer restriction, expropriation, war and non-honouring of financing obligation. In addition to insurance, it benefits the investors and lenders by deterring harmful actions, resolving disputes, increasing tenors of loans and lowering borrowing costs. It provides guarantees to both mini-grids and SHS entities.

Most commonly, investors who are citizens of, or entities that are incorporated in, MIGA member countries—other than the country in which the investment is being made (called host country)—are the ones eligible for MIGA guarantees. MIGA can also insure an investment made by a national of a host country if the funds to be invested come from outside the country and the application for coverage is made jointly by the investor and the host country. The eligible COMESA and TDB countries in which investments are covered by MIGA guarantees are Burundi, Djibouti, DRC, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Tanzania, Uganda, Zambia and Zimbabwe.

Source: https://www.miga.org/political-risk-insurance
AEGF (African Energy Guarantee Facility) is part of an European Union platform of guarantees for renewable energy. AEGF’s lead financing institutions are KfW, EIB (European Investment Bank), Munich Re and ATI (African Trade Insurance Agency). AEGF offers dedicated guarantees to support reinsurers in the provision of investment and trade insurance services for eligible energy projects. The guarantees cover against sovereign or sub-sovereign non-payment under a power purchase agreement, expropriation and breach of contract, currency inconvertibility, war, civil unrest and arbitration award default. The projects eligible for AEGF guarantees shall be aligned with Sustainable Energy for All (SEforALL) principles, assessed by primary insurer according to European Investment Bank (EIB) guidelines and shall meet procurement standards of the European Union. The COMESA and TDB countries eligible for AEGF risk insurance are Burundi, DRC, Ethiopia, Kenya, Madagascar, Malawi, Rwanda, South Sudan, Tanzania, Uganda, Zambia and Zimbabwe. Projects in other countries are considered on case-by-case basis only.  

First Loss Guarantee

A first-loss guarantee is a credit enhancement tool provided by a third party who agrees to bear first losses in case of loan default. The instrument is used to catalyse the participation of lenders and investors that otherwise would not have entered the deal because of the perception of excessive risk. Guarantees are typically provided to a financial intermediary by donors or guarantee funds, who often charge a fee for guarantee. Most of the guarantees are partial for sharing of the risk.

Figure 122: Case Study of First Loss Guarantee

Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020

GreenMax Capital Advisors launched Green-for-Access First Loss Facility (G4A) which provides risk mitigation support to local lenders to encourage financing for energy access projects such as SHS, mini-grids, Agricultural Productive Use and Solar for Healthcare. The G4A facility intends to provide first loss protection for up to 20% of losses in portfolio of loans for energy access. G4A will provide first loss cover to FIs that create new loan portfolios under the structure: end-user financing (70%) and asset backed/project financing for mini-grids (30%). In future G4A intends to offer subordinated debt to specialized off-grid debt funds and mezzanine debt for PAYGO SPVs. The target COMESA and TDB countries for this facility are DRC, Malawi, Kenya, Rwanda, Tanzania and Uganda.

104 Source: https://www.aegf.net/home.html
105 Source: Funding the Sun: New Paradigms for Financing Off-grid Solar Companies by ESMAP, 2020
Foreign Exchange Hedge

A foreign exchange hedge is a tool used by companies or lenders to reduce or eliminate foreign exchange risk by locking in an exchange rate for a transaction that will occur in the future through a forward contract. A foreign currency swap is an agreement between two parties in which one party borrows one currency and simultaneously lends another to the counterparty. Quasi-hedge mechanisms distribute foreign exchange risk between the borrower and lender. In a typical quasi-hedge, the borrower absorbs local currency depreciation risk up to a certain threshold and the lender absorbs the depreciation risk above the threshold. Cryptocurrency borrowing is another tool that can be used to hedge foreign exchange risk but it leaves borrowers exposed to cryptocurrency volatility, which could be much higher than sovereign currency volatility.  

The financial markets in COMESA and TDB region are not so mature that they contain currency hedging products. Due to this the financing happens in hard currency rather than local currency. There is need for robust policies to develop financial markets to be able to handle these foreign exchange risks.

Collateral Buyback

In a collateral buy-back facility, a third party commits to buy back any repossessed SHS units from the lender at an agreed upon price. Different entities such as development financial institutions and foundations could provide the collateral buyback facility and redistribute the repossessed SHS systems in other communities. This mechanism of third-party contract to buy the repossessed units has not been implemented in the off-grid solar industry although companies such as Azuri Technologies have repossessed and redeployed units.

For a facility like collateral buyback to be possible in the COMESA and TDB regions, the regulatory environment and local institutions must support re-possession of SHS units. The product design also needs to support retrofitting and recycling of SHS units for redeployment.
The key benefits and challenges of each of the risk mitigation tool covered above have been discussed below:

**Table 59: Key Benefits and Challenges of Risk Mitigation Tools**

<table>
<thead>
<tr>
<th>Catalytic Tools</th>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| First-loss guarantees           | • Makes commercial funding lucrative by reducing the risk to lenders and investors  
                                  | • Enable the transfer and mitigation of risks to parties better able to bear them. They potentially reduce borrowing costs | • Insufficient sector/company track record makes it difficult for companies to obtain credit guarantees |
| Foreign Exchange Hedge          | • Remove or reduce uncertainty                                            | • The cost of a hedge can exceed 10 percent of principal (on top of the interest rate). This cost may be prohibitive for some borrowers, who are already paying 10–15 percent annual interest on hard currency debt |
| Collateral Buy-back facility    | • Has the potential to engage more lenders                                | • Lack of an established second-hand market for solar home system units or clear recovery/resale value |
|                                 | • Removes uncertainty about recovery value, reducing risk for the lender  | • Legal or licensing requirements may need to be met and local authority approvals obtained before units can be repossessed |
|                                 |                                                                          | • Repossession is expensive and can hurt a company’s reputation                                    |

*Source: Deloitte Analysis*

**Using Public Finance to Catalyse Private Finance**

The Development Finance Institutions need to develop strategies to enable collaboration and co-investment between public and private sector. The G20 Sustainable Finance Roadmap of 2021 defines actions to enhance the role of multilateral development banks, and public policy incentives for mobilizing private investment to support the implementation of the Paris Agreement. In order to scale up commercial finance in developing countries, the multilateral institutions are taking different steps:

- Establishing enabling environment for investment
- Developing scalable business models
- Financing early-stage projects
- Supporting country level PPP programs
- Providing resources for risk instruments and credit enhancements
In order to catalyse the private investment by local commercial banks and local institutional investors, the DFIs can promote refinancing and blended finance.

The local institutional investors look forward to investing in projects that are operational and produce a steady cashflow. DFIs could help to create demand from local institutional investors by recycling their operational renewable assets. They can do so by divesting the performing renewable loans on their balance sheet. The brownfield loans can be bundled and financed through local currency loans provided by local institutional investors. However, in practise refinancing of existing loans through local currency financing by local institutional investors is challenging because of cost and time taken to arrange the refinancing transactions.

Blended finance is another tool to facilitate private financing to contribute towards Sustainable Development Goals. Blended finance combines concessional financing from DFIs and commercial funding from commercial banks/ institutional investors. With the infusion of donor funding, the local investors are able to balance the project risk profile and make the investment more attractive. The projects require the right combination of debt, equity or grant financing, the right seniority of investors in terms of absorbing losses and earning returns, and appropriate risk-mitigation products. In 2021, blended finance represented an aggregated financing of over $160 billion. 108

Blended finance can address both perceived risks (risks caused due to lack of understanding or track record of off-grid technology and business models) and real risks (risks caused due to currency fluctuations, off-taker creditworthiness etc.). Blended finance seeks to reduce perceived risks and transfer real risks. The different blended finance instruments which can be used in off-grid sector are:

Table 60: Blended Finance Instruments for Off-grid Sector

<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Examples</th>
<th>Specific Risks Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercially oriented preparation support</td>
<td>Project preparation funding or technical assistance</td>
<td>Administrative risks, Access to capital, capacity at local level</td>
</tr>
<tr>
<td>Direct Investment</td>
<td>Junior/ subordinated capital (e.g., concessional equity &amp; debt)</td>
<td>Off-taker risks, construction risks, revenues attractiveness, etc.</td>
</tr>
<tr>
<td></td>
<td>Commercial capital (catalytic when used for demonstration effect, also known as “anchor capital”)</td>
<td>Access to capital</td>
</tr>
<tr>
<td>Guarantees</td>
<td>Loan guarantees</td>
<td>Access to capital, counterparty / off-taker / credit risk</td>
</tr>
</tbody>
</table>

108 Source: World Bank
The off-grid solar sector faces financing challenges such as high cost of capital, collateral inadequacy, low repayment periods, foreign exchange risks associated with hard currency financing, lack of sector awareness among FI, lack of projects bankability etc. These risks need to be mitigated for market development. Aggregation of Projects and Pooling of SHS units can make the projects bankable and affordable by diversifying risks and reducing transaction costs. Reducing the intermediaries in the financing value chain can also lead to lower project cost of capital. Bifurcation of borrower’s business into Operating Company and Asset Company can shield investors from operational risks and boost investor appetite by using receivables as collateral. Risk Mitigation Tools such as Political Risk Insurance, First Loss Guarantee, Collateral Buyback, etc. can reduce loss in case of default and stimulate local currency lending in the off-grid sector. Mechanisms such as refinancing and blended finance can be used to encourage participation of local commercial financing institutions.

5. Quality Assurance Framework

The off-grid solar sector entails products that have different levels of quality and durability. To gain access to a market, off-grid products must typically undergo a quality assurance process and demonstrate that they meet the appropriate standards, such as performance, safety, and durability, all of which are critical to ensure that the market, its customers, and indeed all stakeholders are protected from substandard products.
Need for Quality Standards
Quality standards are imperative to establish credibility in the market. The quality standards are important for off-grid solar sector as they:

- Increase the impact and cost-effectiveness of market development programs
- Ensures that products perform as advertised and meet consumers’ expectations for performance, durability, and safety
- Reduce the risk of consumer dissatisfaction and the cost of providing warranty service
- Facilitate the due diligence process of identifying and selecting suppliers of high-quality products
- Reduce the risk of products being delayed at the port of entry due to non-compliance with quality verification

Quality Standards
Lighting Global developed quality standards for off-grid products. The Lighting Global Quality Standards for Pico-PV products and Solar Home System kits are now referenced in IEC TS 62257-9-8. These standards define the minimum requirements for quality, durability, and advertising to protect the consumers. The quality verification process, now managed by VeraSol, confirms whether a product meets the Lighting Global Quality Standards or quality standards in the IEC TS 62257-9-8. \(^{109}\)

The adoption of Lighting Global Standards for off-grid products by IEC is a positive move as the governments already trust IEC standards for goods. This would enable widespread adoption of standards for off-grid solar products which would benefit millions of end users. The COMESA and TDB countries can adopt these quality standards for selecting suppliers, streamlining import process, meeting customer expectations and reducing the cost of providing warranty service.

Quality Assurance Framework - VeraSol
Lighting Global has supported the modern off-grid lighting industry through its Lighting Global Quality Assurance Framework. Over the past decade, this quality assurance program has grown to become the leading international framework for Pico-Solar products. The QA framework utilized by Lighting Global was adopted by countries such as Kenya and Ethiopia which have the highest sales of off-grid lighting products in the Sub-Saharan Africa region.

As the off-grid solar industry is growing, the demand for high end SHS, off-grid appliances and PULSE technologies is increasing. There was a need to expand quality assurance beyond the existing lighting products. To bridge this gap, Lighting Global, CLASP, and the Schatz Energy Research Center launched VeraSol, an evolved quality assurance program to respond to the market’s growing needs. VeraSol is built upon the existing foundation laid by Lighting Global and expands its Quality Assurance services to incorporate Component-based Solar Home Systems, off-grid appliances and PULSE technologies.

\(^{109}\) Source: https://verasol.org/
VeraSol works towards standardization of the process for testing and evaluation of off-grid solar products. It performs the following functions:

**Figure 125: Key functions performed by VeraSol**

VeraSol works with the IEC to improve and maintain test methods (IEC TS 62257-9-5) and standards (IEC TS 62257-9-8) for Pico-Solar products and SHS kits. The off-grid enterprises in the COMESA and TDB regions can get their products tested, quality verified and certified by VeraSol. Their products will get visibility on the quality verified products database listed by VeraSol and help them to attract more buyers and investors. The country governments in COMESA and TDB regions can collaborate with VeraSol to adopt the quality standards for off-grid products and provide fiscal incentives to quality verified products.

Rwanda has successfully used public funding to promote quality verified off-grid products. The country’s government introduced mandatory quality standards to ensure only quality verified products could benefit from public funding programs. The importers’ compliance with quality verified products has led to dominance of quality brands in the country such as BBOXX, Greenlight Planet and Ignite Power.  

---

Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022

---

110 Source: Designing Public Funding Mechanisms in the Off-grid Solar Sector, 2022
6. Technical Assistance and Capacity Building

The off-grid solar sector is a nascent sector therefore there is need to develop an ecosystem for its development. Barring few mature off-grid solar markets such as Kenya and Tanzania, most of the countries such as DRC and Madagascar lack specific training programs or curriculum for off-grid solar sector. The off-grid solar companies need to provide after sales service to their customers for which they need trained technicians specialized in off-grid technologies. The existing task of installation and repair is carried out by regular technicians who are new to off-grid products. It is therefore important to provide technical assistance and capacity building to off-grid enterprises to strengthen their internal capacities, improve their operational performance and make them investment ready.

Most of the financing institutions in the COMESA and TDB region lack the knowledge, awareness and understanding of the off-grid solar sector. Barring few local currency financing by banks in Kenya and Rwanda, most of the financing occurs in hard currency through DFIs and Impact Investors as local FIs are risk averse. There is need to provide technical assistance and capacity building to FIs so that they could develop understanding of project appraisal in off-grid sector, innovative instruments for financing, risk mitigation instruments for making projects bankable.

In order to become a pioneer, the off-grid solar sector needs to focus on customers. Currently, the population is unaware of the off-grid solar products available in the market and depend on other sources such as coal, kerosene, wood etc. for meeting their energy needs. Even in countries such as Zimbabwe where the population is aware of the off-grid solutions, the low-quality products cause negative customer perception. The affordability is a big constraint for countries such as Somalia, Madagascar, South Sudan etc. In order to address all these challenges, it is important to undertake technical assistance and capacity building for consumers to communicate benefits of off-grid solutions, usage of quality products and consumer financing mechanisms such as PAYGO to boost the market development.

The technical assistance and capacity building programs need to be customized according to needs of each stakeholder group. The training programs need to incorporate partnerships between key bodies and should be delivered through a mix of traditional and innovative channels.
Figure 126: Technical Assistance and Capacity Building for different stakeholder groups

Source: Deloitte Analysis

TA & CB for Off-grid Companies/ Mini-grid Developers

The technical assistance and capacity building programs for off-grid companies and mini-grid developers in COMESA and TDB regions should focus on the following common areas:

- **Technical Aspects**: Training on site identification, feasibility study, technical and operational standards, load forecasts, tariff models, product specifications, pricing models, pilot programs, quality standards, after-sales etc.

- **Managerial Aspects**: Training on business know-how, project management skills, financing procedures, investment models (NPV, IRR, Payback Period etc.), capital structure, valuation etc.

- **Regulatory Aspects**: Training on licensing/registration, availing concessions, tendering, regulatory clearances, approvals etc.

Countries such as Tanzania run a variety of programs for training Solar PV technicians. Arusha Technical College (ATC) offers a renewable energy course for technicians. REA, Tanzania also funds and implements short courses for Solar PV technicians. The Vocational Education Training Authority certifies Solar PV installers who do not have a formal education. Similar programs can be run in other COMESA and TDB countries such as DRC, Malawi and Madagascar where there is shortage of skilled technicians.

A variety of initiatives are in place in COMESA and TDB countries for capacity building of off-grid enterprises:
Figure 127: Training Initiatives for Off-grid Enterprises in COMESA and TDB region

<table>
<thead>
<tr>
<th>Country</th>
<th>Initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>GIZ provides training to youth Pico/SHS enterprises on installation, maintenance and after-sales service.</td>
</tr>
<tr>
<td></td>
<td>Ministry of Water, Irrigation and Energy has established solar manufacturing incubation centres equipped with workshops and laboratories.</td>
</tr>
<tr>
<td>Malawi</td>
<td>The Technical, Entrepreneurial and Vocational Education and Training (TEVET) Authority developed a solar PV apprenticeship program.</td>
</tr>
<tr>
<td></td>
<td>Chancellor College offers PV installations and maintenance course.</td>
</tr>
<tr>
<td>Somalia</td>
<td>Hayle Barise Technical Development Centre offers technical training in SHS and possesses well-equipped laboratories.</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Vocational Education Training Authority (VETA) has RE training curriculum which includes standalone systems.</td>
</tr>
<tr>
<td></td>
<td>NGO like TaTEDO offer courses for solar PV installers, operators and maintainers.</td>
</tr>
<tr>
<td>Zambia</td>
<td>Pumulani Renewable Energy Centre offers hands-on training and tailor-made courses for technicians and entrepreneurs in production, installation and maintenance of solar products.</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>ILO developed a curriculum for technical and vocational education and training (TVET) for SHS installers, sales and marketing agents. The curriculum was certified by National Manpower Advisory Council (NAMACO).</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis

**Modes of Delivery**

The following are some of the different modes of delivery for technical assistance and capacity building programs for off-grid companies/mini-grid developers that can be explored in COMESA and TDB region:

Figure 128: Modes of Delivery proposed in Capacity Building activities for Off-grid Companies/Mini-grid Developers

Source: Deloitte Analysis

**Training Courses:** The technical universities can design curriculum and impart off-grid renewable energy specific skills and knowledge to the off-grid companies/developers. The designed courses can be tailored to the **specific needs of the companies/developers** and should be comprehensive in terms of topic coverage. They must cover all the technical, managerial and regulatory aspects listed above for development of off-grid solutions. All these courses should be readily accessible at a **minimal fee.**
The Micro Grid Academy is a vocational capacity building platform launched by Renewable Energy Solutions for Africa to impart theoretical and practical technical skills related to decentralized renewable energy solutions to technicians, project managers, developers, engineers, and academic students in Ethiopia, Mozambique and Zambia.

**Workshops:** There should be periodic workshops organized by subject matter experts in collaboration with Ministry of Energy of respective countries and Technical Universities for capacity development of public and private sector. The workshops should include both pre-planned sessions and need-based trainings. The training to off-grid companies/mini-grid developers on managerial aspects should include a training committee consisting of experts from diverse fields such as lawyers, bankers, project management consultants etc.

Intersolar Europe organizes workshops for off-grid solar which focus on business models, PV smart solutions for agriculture, hardware & software for off-grid systems and training off-grid workforce. The workshops are open for manufacturers, system integrators and project developers.

**Field Teams:** The field teams should consist of engineers, R&D experts etc. They should be responsible for conducting regular trainings based on monthly schedules in remote areas. The field teams shall assist and train the staff of the mini-grids and start-ups on technical aspects.

**TA & CB for Financial Institutions**
The technical assistance and capacity building programs for financial institutions in COMESA and TDB regions should focus on the following common areas:

- **Sector Knowledge:** The programs should focus on enabling understanding of renewable energy sector and off-grid technologies with emphasis on technical, commercial and financing aspects.

- **Off-grid sector Financing:** The trainings should incorporate different types of financing and risk mitigation instruments for financing off-grid companies and mini-grid developers such as grants, results-based financing, convertible note, revenue-based mezzanine debt, first loss guarantee, etc. The trainings should also include project life cycles, project timelines, sales models to accurately model cashflows etc.

- **Due Diligence:** The trainings should include credit rating and evaluation frameworks to assess credit worthiness of borrowers. The training programs should also provide support to conduct financial business modelling of projects to evaluate potential gains and financing terms.

**Tanzania is taking the lead in training MFIs.** The Tanzania Association of Microfinance Institutions (TAMFI) in collaboration with Tanzania Renewable Energy Association (TAREA) and C.S. Mott Foundation provide training to MFIs on standalone solar solutions to stimulate end-user financing in the sector.
**Modes of Delivery**

The following can be different modes of delivery for technical assistance and capacity building programs for the financial institutions in COMESA and TDB region:

*Figure 129: Modes of Delivery proposed in Capacity Building activities for Financial Institutions*

1. **Web Based Platform:** These platforms should include training materials via videos and downloadable templates. The content can incorporate different financing instruments, risk mitigation instruments, project life cycle financing requirements, capital structure of mini-grids etc. The trainings can be availed at a minimal subscription fee. The online platform will possess the advantage of accessibility and will be available to financial institutions at any time convenient to them.

World Bank has designed Sustainable Training and E-Learning Program (STEP) for managers and staff of FIs such as banks, private equity funds, leasing companies and microfinance institutions. The aim of STEP program is to educate FIs on sustainable finance, risk management and exploration of business opportunities. Similar programs can be developed specific to off-grid sector financing for FIs in COMESA and TDB region.

2. **Workshops/ Conferences:** Suitable presentations can be made to the junior management on financing procedures and mechanisms due to their high mobility. The presentations can further be shared to the senior managers to win their confidence and trust.

3. **One-to-one Trainings:** Specific trainings can be done at the financial institutions’ premises to build an understanding of the off-grid sector. The trainings should incorporate successful financing case studies across the world in the off-grid sector. The training should also include practical aspects such as financial modelling for financing of off-grid/ mini-grid projects with important considerations such as return on assets etc.

**TA & CB for Customers**

The technical assistance and capacity building programs for customers in COMESA and TDB regions should focus on the following areas:
• **Electricity Access:** It is important to educate the customers on the needs, uses and benefits of electricity to increase their willingness to spend on electricity. The capacity building programs should also increase the consumer’s “energy education” on aspects such as reading the bill, maintenance, grievance handling, safety aspects, health benefits etc.

• **Off-grid Solutions:** It is important to educate the customer about the different off-grid solutions available in the market (solar lanterns, solar home systems, mini-grids etc.) and the level of electricity service provided by each of them (tier of access) to raise the awareness and adoption of off-grid solutions that match the consumer’s specific needs. It is also important to educate consumers about the productive use technologies available in the market to increase the offtake of PULSE appliances.

• **Payment Models:** It is very important to educate the customer regarding different payment models and consumer financing mechanisms available in the market such as PAYGO, Fee for a service etc. to increase their affordability and trigger higher market sales of such off-grid products and appliances.

The awareness of off-grid products is growing at a fast pace in countries such as Zimbabwe. In Zimbabwe, NGOs such as Humanist Institute for Development Cooperation, SNV, Practical Action, Zimbabwe Women Resources Centre and Network and Regional Environment Organization have been raising awareness through solar fairs, consumer awareness demonstrations and distribution of solar portable lights to communities.

**Modes of Delivery**
The following can be different modes of delivery for technical assistance and capacity building programs for the customers COMESA and TDB regions:

*Figure 130: Modes of Delivery proposed in Capacity Building activities for Customers*

1. **Digital Platforms:** Customers can be reached through digital platforms with impact videos highlighting benefits of off-grid products and mini-grids. Development Institutions such as European Investment Bank, NEFCO and USAID have leveraged digital platforms such as Youtube to raise awareness of off-grid solutions for electrification.

2. **Promotional Campaigns:** Customers can also be reached through promotional campaigns conducted at schools, hospitals etc. The promotional campaigns shall be aimed at raising the
awareness of off-grid solutions and shall include free demonstrations of off-grid products. The campaigns shall cover aspects such as uses, benefits, safety and quality of off-grid products. Such campaigns can be run in collaboration with NGOs. Companies such as Sunny Money has undertaken promotional campaigns in schools to demonstrate use and benefits of solar lanterns to school children in Tanzania and Kenya.

Community Learning Centers: Customers can be taught through classroom-based trainings at community learning centers. Vital information such as types of products, pricing, tariffs, payment models etc. can be disseminated to the community through these community learning centers.

Technical Assistance and Capacity Building Needs are different for each stakeholder group. Technical Assistance and Capacity Building for off-grid entities need to focus on Technical, Managerial and Regulatory aspects. Technical Assistance and Capacity Building for FIs need to focus on Sectoral Knowledge, Off-grid Financing and Due Diligence. Technical Assistance and Capacity Building for consumers need to focus on Electricity Access, Off-grid Solutions and Consumer Financing. Several COMESA and TDB countries such as Ethiopia, Kenya, Tanzania, Zimbabwe are taking lead for implementing initiatives for Technical Assistance and Capacity Building in off-grid sector.

### 7. Roadmap

The countries in the COMESA and TDB regions are at different levels of maturity when it comes to the off-grid solar sector. The countries such as Kenya, Ethiopia, Tanzania, Uganda and Rwanda are quite advanced when it comes to off-grid solar industry, countries such as DRC, Madagascar, Zimbabwe, Malawi, Mozambique, Zambia have a reasonable market for off-grid solar and are gradually evolving but have certain gaps which need to be bridged for scaling the industry, countries such as Burundi, Djibouti, Libya, South Sudan, Sudan and Somalia lag behind in the race for off-grid solar and require the most institutional, policy, financial, capacity building support for building their off-grid solar market.

We have identified certain pillars for off-grid solar market development based on our assessment of markets such as Kenya where the off-grid solutions have seen immense success. A common Roadmap has been designed for off-grid solar market development based on the assessment of needs and enabling factors for the development of the off-grid solar market. The Roadmap can be tailor made for each of the COMESA and TDB countries depending on their needs assessment.
Figure 131: Roadmap for development of Off-grid Solar Sector

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Stakeholder Responsible</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legal Framework</strong></td>
<td></td>
<td>Short Term</td>
</tr>
<tr>
<td>Establish a Renewable Energy Policy with targets for Off-grid RE</td>
<td>Ministry responsible for Energy</td>
<td></td>
</tr>
<tr>
<td>Design a Rural Electrification Master Plan</td>
<td>Ministry responsible for Energy</td>
<td></td>
</tr>
<tr>
<td>Licensing provisions, cost reflective tariff, grid connection provisions for Mini-grids</td>
<td>Electricity Regulator</td>
<td></td>
</tr>
<tr>
<td><strong>Institutional Structure</strong></td>
<td></td>
<td>Short Term</td>
</tr>
<tr>
<td>Set up an Independent Electricity Regulator</td>
<td>Ministry responsible for Energy</td>
<td></td>
</tr>
<tr>
<td>Establish Rural Electrification Agency</td>
<td>Ministry responsible for Energy</td>
<td></td>
</tr>
<tr>
<td>Create a Renewable Energy Association</td>
<td>Off-grid companies/ developers</td>
<td></td>
</tr>
<tr>
<td>Establish Off-grid Solar Financing Facility</td>
<td>Ministry responsible for Energy</td>
<td></td>
</tr>
<tr>
<td><strong>Commercial Financing</strong></td>
<td></td>
<td>Short Term</td>
</tr>
<tr>
<td>Attract funding from DFIs, commercial banks, PE/VC players etc.</td>
<td>Rural Electrification Agency</td>
<td></td>
</tr>
<tr>
<td>Facilitate risk mitigation tools like first loss guarantee, collateral buyback, political risk insurance etc.</td>
<td>Off-grid Solar Financing Facility</td>
<td></td>
</tr>
<tr>
<td>Aggregation, tendering and due-diligence</td>
<td>Off-grid Solar Financing Facility</td>
<td></td>
</tr>
<tr>
<td>Design financing instruments and terms for financing</td>
<td>DFIs, Commercial Banks, Impact Investors, NGOs, Foundations, Private Equity, Venture Capitalists etc.</td>
<td></td>
</tr>
<tr>
<td>Undertake Technical Assistance and Capacity Building for Fi</td>
<td>Ministry responsible for Finance, Off-grid Solar Financing Facility</td>
<td></td>
</tr>
<tr>
<td><strong>Consumer Financing</strong></td>
<td></td>
<td>Short Term</td>
</tr>
<tr>
<td>Development of affordable Off-grid Solar Loan Product for end-users</td>
<td>Microfinance Institutions</td>
<td></td>
</tr>
<tr>
<td>Adopt consumer financing models like PARIGO, Fee for a Service</td>
<td>Off-grid Companies</td>
<td></td>
</tr>
<tr>
<td>Forge Partnerships between Off-grid Companies and Mobile Money Service Providers</td>
<td>Telecoms and Off-grid Companies</td>
<td></td>
</tr>
<tr>
<td><strong>Trade Promotion</strong></td>
<td></td>
<td>Short Term</td>
</tr>
<tr>
<td>Adopt internationally recognised quality standards for Off-grid</td>
<td>Electricity Regulator</td>
<td></td>
</tr>
<tr>
<td>Develop an E-waste management strategy</td>
<td>Ministry responsible for Environment</td>
<td></td>
</tr>
<tr>
<td>Tax (import duty, VAT etc.) exemptions/ subsidies for Off-grid</td>
<td>Ministry responsible for Finance</td>
<td></td>
</tr>
<tr>
<td>Create an online supplier database and marketplace for Off-grid products</td>
<td>Renewable Energy Association</td>
<td></td>
</tr>
<tr>
<td><strong>Consumer Adoption</strong></td>
<td></td>
<td>Short Term</td>
</tr>
<tr>
<td>Setup Training Institutions and universities to impart skills and knowledge</td>
<td>Ministry responsible for Energy</td>
<td></td>
</tr>
<tr>
<td>Undertake Technical Assistance and Capacity Building for consumers</td>
<td>International donors/ NGO's/ COMESA</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Deloitte Analysis*

The COMESA and TDB countries need to critically analyse the existing off-grid Solar market landscape and identify the gaps in the existing set-up. The roadmap for market development is expected to provide clear strategies for execution to achieve the desired state of market development. Periodic Monitoring is essential to set accurate objectives and performance targets for each activity, measure gaps between planned and actual achievements, propose corrective measures and share information with stakeholders. The results of the proposed interventions can be measured using key metrics such as number of households electrified, creation of jobs, improvement in working hours, etc. Suitable amendments can be done in the implemented policies based on the feedback from the stakeholders.