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MINI-GRIDS FOR ENERGY ACCESS IN SUB-SAHARAN AFRICA

Status and Lessons from Tanzania - Webinar | 31 May 2016 | Lily Odarno, WRI; Estomih Sawe and Maneno Katyega, TaTEDO



Photo courtesy TaTEDO

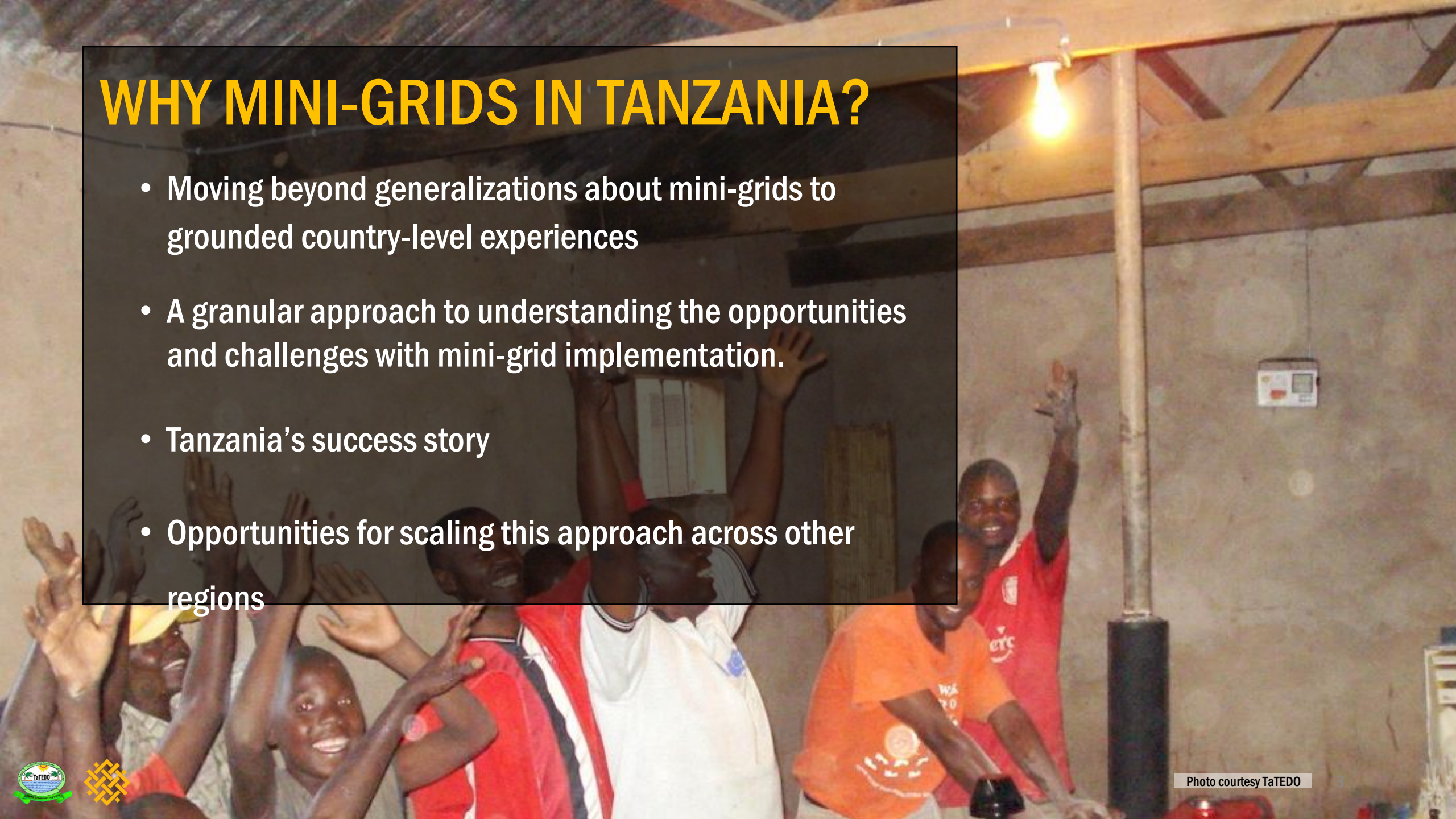
BACKGROUND

- 140 million of the 315 million rural people without electricity in Africa will gain access through mini-grids by 2040
- Between 100,000 and 200,000 mini-grids will be required to meet this need
- However, experience with mini-grids remains limited



WHY MINI-GRIDS IN TANZANIA?

- Moving beyond generalizations about mini-grids to grounded country-level experiences
- A granular approach to understanding the opportunities and challenges with mini-grid implementation.
- Tanzania's success story
- Opportunities for scaling this approach across other regions



PARTNERSHIPS

Working with local partners to conduct research and identify opportunities for impact.



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TANZANIA TRADITIONAL ENERGY
DEVELOPMENT ORGANIZATION
Centre for Sustainable Modern Energy Expertise



KEY AREAS OF FOCUS

Mini-grid development and operation

Mini-grid technologies

Policy and regulatory frameworks

Mini-grids and local development



MINI-GRIDS IN TANZANIA

Current Status



ELECTRIFICATION TARGET – 75% BY 2035



Currently...

Population (2015) – 49.4 million
25% urban; 75% rural

Electricity Access Rate – 24%
43% of those with access in urban areas; 6% in rural areas

Per Capita GDP (2014) – USD 1,047
100 kWh electricity consumption per capita

HISTORY OF MINI-GRIDS IN TANZANIA

First mini-grids (isolated diesel-based MGs) were developed in Dar es Salaam, Tabora and Kigoma townships from 1908.

Early mini-grids were usually developed to power mining and agro-industries.

After independence, the GoTZ still developed diesel based MGs for electrification of isolated townships for industrialization.

TANZANIA'S MINI-GRID POLICY AND REGULATORY FRAMEWORK

Electricity Act of 2008

Promotes a 'light-handed' approach to regulating small renewable energy projects

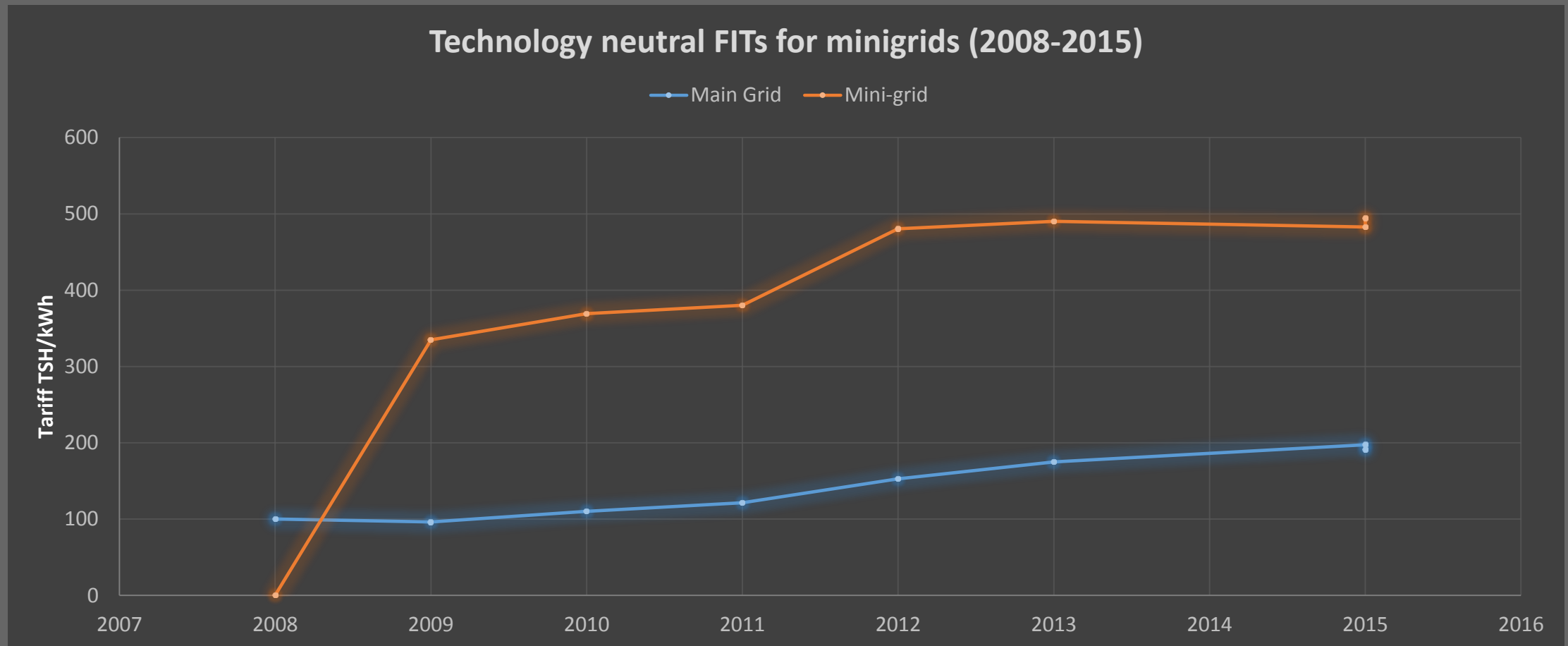
September 2008

Standardized Power Purchase Agreements (SPPAs) for main and mini-grids approved by EWURA

June 2009

Standardized tariff methodology for mini-grids.

FEED-IN TARIFFS (FITs): FIRST GENERATION TECHNOLOGY NEUTRAL FITs



FITs for main grid seasonally adjusted in dry and wet seasons



SECOND GENERATION FITs

Technology Specific/System size dependent

Hydro Power Plants		Biomass Power Plants	
Size (kW)	Tariff (USD/kWh)	Size (kW)	Tariff (USD/kWh)
100	0.155		
150	0.146	200	0.179
200	0.141	300	0.169
250	0.140	400	0.161
500	0.134	500	0.157
750	0.129	750	0.149
1,000	0.123	1,000	0.147
2,000	0.115	2,000	0.138
3,000	0.108	3,000	0.128
4,000	0.102	4,000	0.126
5,000	0.098	5,000	0.123
6,000	0.095	6,000	0.120
7,000	0.092	7,000	0.118
8,000	0.088	8,000	0.115
9,000	0.087	9,000	0.114
10,000	0.085	10,000	0.112

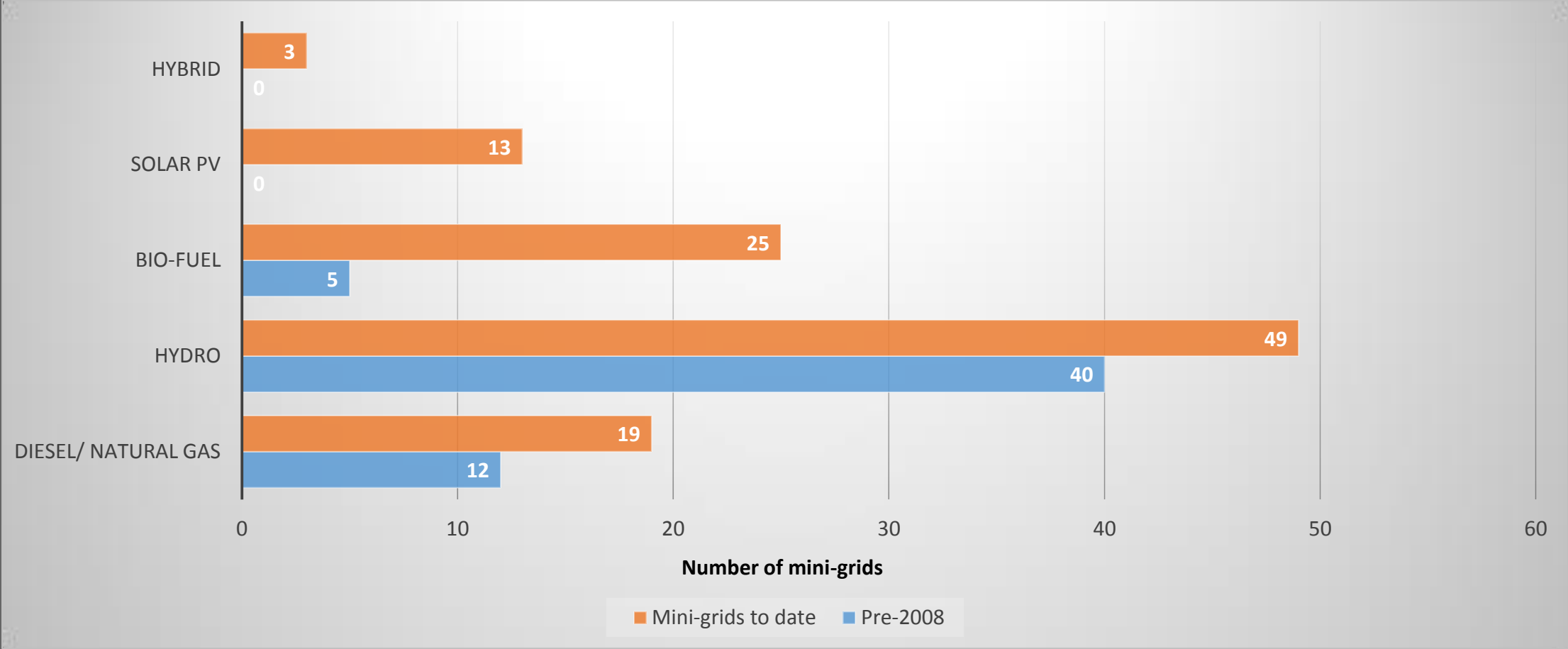
Solar and wind tariffs to be determined through competitive bidding.

MINI-GRIDS: CURRENT STATUS

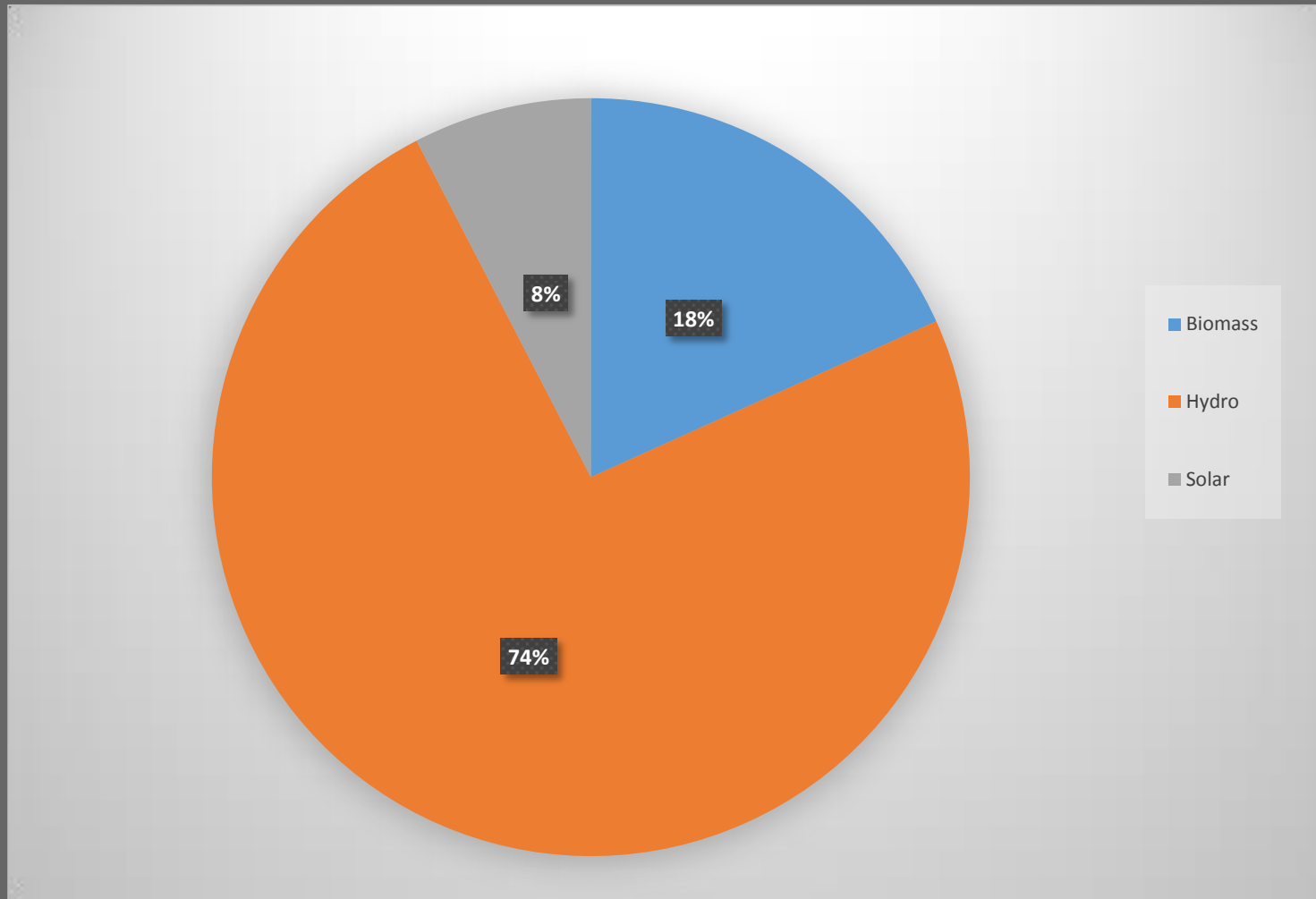
By early 2016, Tanzania Mainland had up to 109 existing MGs in 21 regions with total installed capacity of 157.7 MW connecting 183,705 customers.

Energy source	Existing No of plants	Regions	Grid	Isolated	Total kW	Connections
Hydro	49	14	9	40*	32,920.9	11,925
Bio-fuel	25	11	7	18	51,714.0	562
Solar	13	5	0	13	234.0	1,153
Wind	0	0	0	0	0.0	0
Diesel/natural gas	19	10	0	19	72,700.0	170,065
Hybrid	3	3	0	3	176.8	
All sources	109	21	16	93	157,745.7	183,705

TRENDS IN MINI-GRID DEVELOPMENT POST 2008 SPP REGULATION



MINI-GRIDS WITH SIGNED SPPAS SINCE 2008

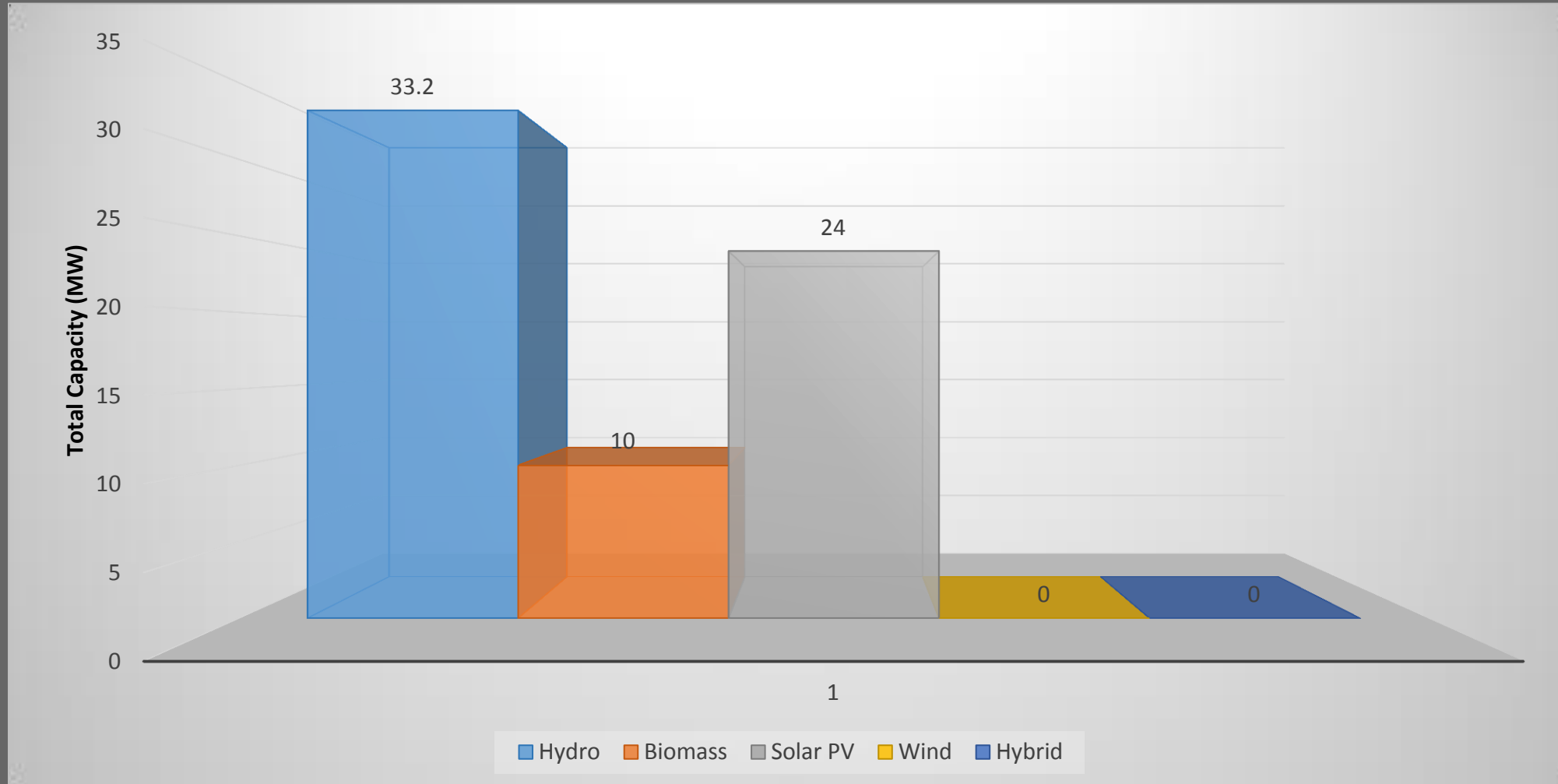


15 mini-grid projects
with a total capacity of 53.5MW
have signed SPPAs

**This includes commissioned projects as well as those yet to be commissioned*

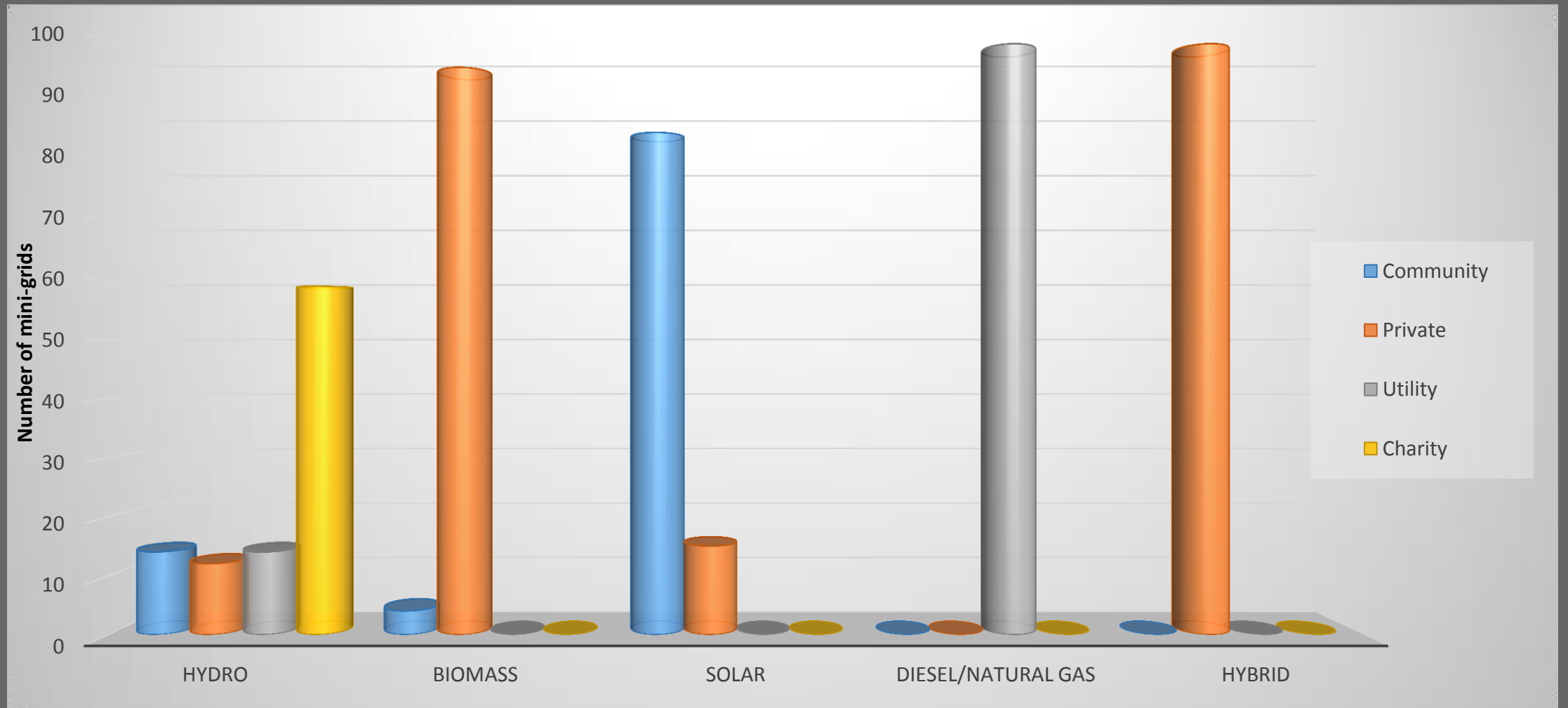


MINI-GRIDS UNDER PLANNING (WITH LoIs)

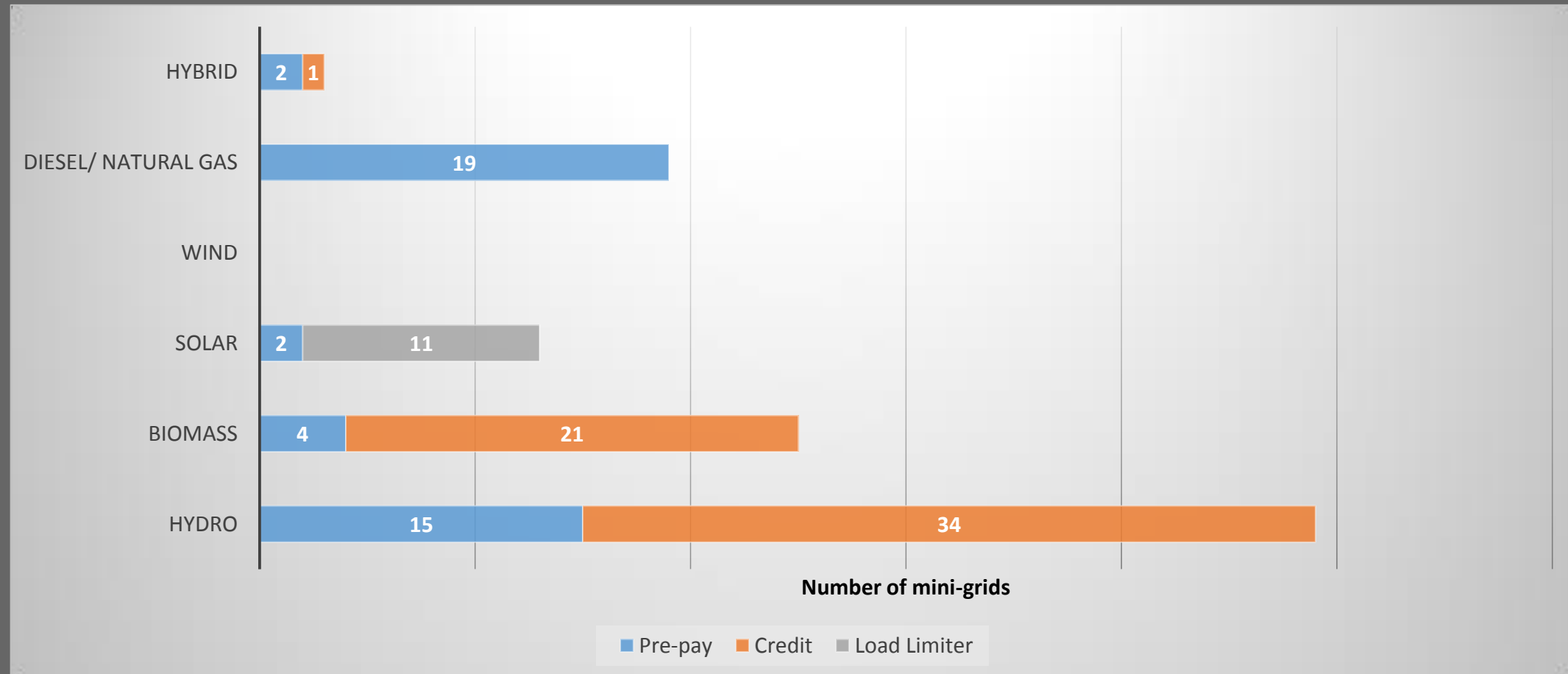


A total of 16 mini-grids are under planning with a total capacity of 67.2MW

MINI-GRID OWNERSHIP TRENDS

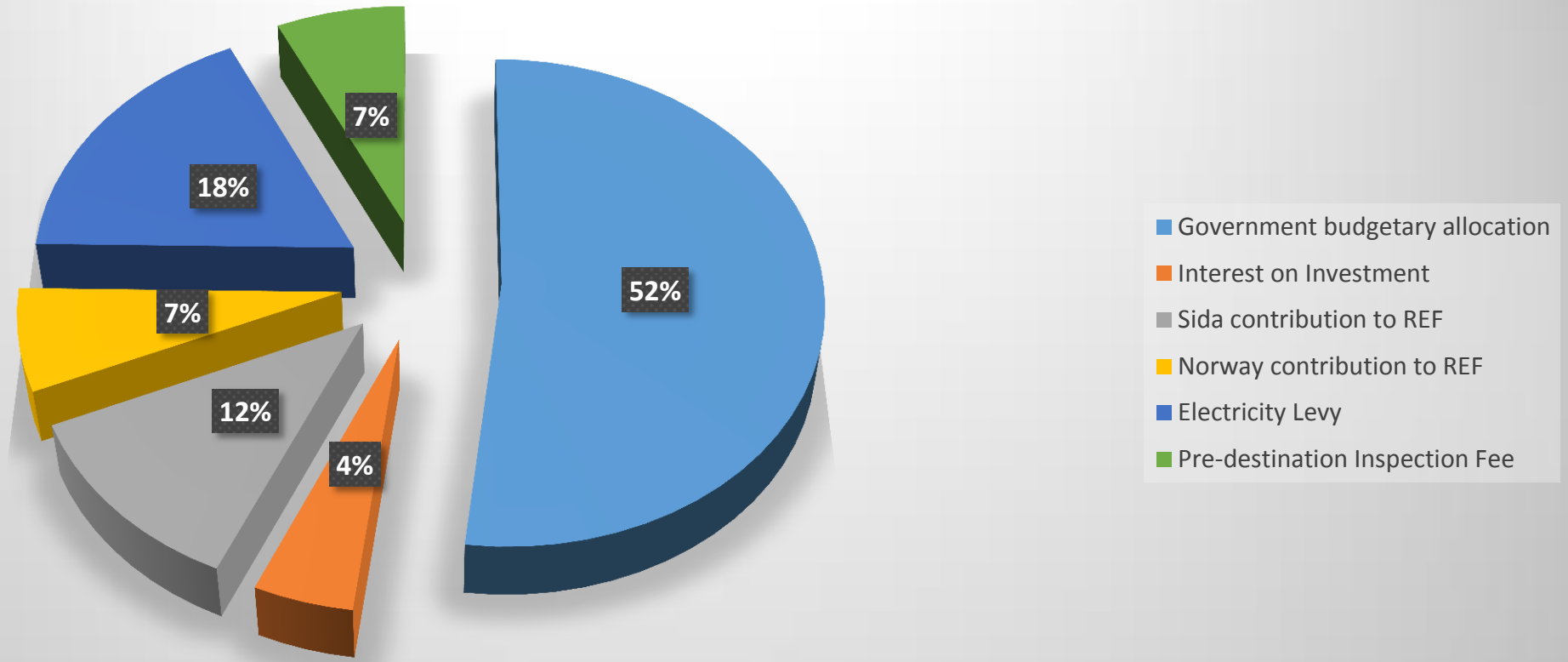


CURRENT METERING/PAYMENT APPROACHES



FINANCING MINI-GRIDS

REF Financing Sources 2007/08 - 2013/14



REF financing for grid extension and mini-grids totaled **USD 255 million**
This excludes funds from Faith Based Organizations and some development partners

GOTZ/WORLD BANK TEDAP PROGRAM

MATCHING GRANTS

Up to \$100 000 provided per project for feasibility studies, business plan development and impact assessments. \$3.1million has been disbursed for 30 RE projects with a total capacity of 94MW from 2010-2014.

PERFORMANCE GRANTS

\$500 for each connection. 5.3million has been disbursed for 7 projects from 2010-2014.

CREDIT LINE FACILITIES

\$23 million credit line established for long-term loans of up to 15 years through the local Tanzania Investment Bank.

NEW FINANCING: RERE PROGRAM

World Bank support of \$200 million for grid extension and \$75 million for mini-grid projects during 2015-2019

GOTZ / SIDA / DFID FINANCING

SIDA COMMITMENT TO REF SEK 600 MILLION DURING 2016-2019

- SEK 500 million is for grid extension
 - SEK 100 million is for mini-grids
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DFID COMMITMENT TO REF GB£ 30 MILLION FOR GREEN MINI-GRIDS

FINANCING DURATION 2015-2019

FINANCING SOURCES FOR COMPLETED PROJECTS UNDER SPP FRAMEWORK

SPP Name	Energy source	Capacity (MW)	Connection	Sources of funding
TANWAT - Njombe	Biomass	2.5	Grid	CDC/DfID, WB
TPC - Moshi	Biomass	17.5 of which 9.0 is for export	Grid	DANIDA, WB
LUMAMA Mawengi	Hydro	0.3	Off Grid	Italian Govt/EU, Intervita, WB via REA
Mwenga - Mufindi	Hydro	4.0	Grid	ACP-EU, REA, Rift Valley Energy Company, WB via REA
Ngombeni - Mafia Island	Biomass	1.5	Off Grid	DfID, WB via REA
Andoya -AHECO Mbinga	Hydro	1.0	Off Grid	WB via REA
Tulila St Agness Chipole Songea	Hydro	7.5	Off Grid	WB via REA
Yovi hydro - Kilosa	Hydro	0.9	Grid	EU
Maguta power project - Kilolo	Hydro	2.5	Grid	WB via REA
Ikondo Njombe	Hydro	0.4	Grid	Italian Govt./EU, CEFA

FINANCING SOURCES FOR PROJECTS UNDER CONSTRUCTION

SPP Name	Energy source	Capacity (MW)	Connection	Sources of funding
Ninga - Njombe	Hydro	4.0	Grid	EU
Darakuta - Manyara	Hydro	0.24	Grid	WB via REA
EA Power Ltd - Tukuyu	Hydro	10.0	Grid	WB via REA
Mapembasi - Njombe	Hydro	10.0	Grid	WB via REA
Nkwilo - Sumbawanga	Hydro	2.9	Off Grid	WB via REA
Luswisi project - Ileje, Mbeya	Hydro	4.7	Grid	WB via REA

MINI-GRIDS AND DEVELOPMENT

- Establishing links between mini-grids and local development is key to long-term sustainability
- e.g. LUMAMA mini-grid project
- 300 kW mini hydro plant in Ludewa District
- Run as a community-owned social enterprise



LUMAMA: SUCCESS FACTORS

DEVELOPMENT + PRODUCTIVITY

Mini-grid development was coupled with efforts to promote productive activities in the local village (sunflower production, mechanical workshops, poultry farming) and links to financing institutions

FUNDING

The development of productive activities was funded by Italian donor, ACRA-CCS

COST-REFLECTIVE TARIFFS

LOCAL OWNERSHIP

Locals have ownership in the social enterprise.

MANAGEMENT STRUCTURES

Well established local management and accountability structures.

ADDRESSING KEY BARRIERS TO MINI-GRID DEVELOPMENT

Challenges/barriers	How they were resolved	Duration	Results
Inadequate policy on SPP	No MG specific policy, but incorporated in Electricity Act	2003-2008	Electricity Act
Lack of regulatory framework for SPPs	Electricity Act, EWURA Act, REA Act, SPP regulatory framework	2001-2008	SPPA & SPPT regulatory framework
Lack of SPP tariffs for SPP projects	Established Tariff Setting Mechanism	2008-2009	Technology neutral FITs
Lack of technology specific FITs	Revised Tariff Setting Mechanism	2009-2012	Technology Specific FITs
Economies of scale in technology specific FIT	Revised Tariff Setting Mechanism	2012-2015	Technology size specific FITs
High inflation and TSH currency fluctuations	Revised Tariff Setting Mechanism	2012-2015	FITs in USD
High taxes/duties on renewable equipment	Tax exemption for solar equipment	2000	No taxes/ duties on solar PV and wind

ADDRESSING KEY BARRIERS TO MINI-GRID DEVELOPMENT

Challenges/barriers	How they were resolved	Duration	Results
Lack of financing for private SPPs	Established subsidies	2008-2014	Matching & performance grants
Lack of credit line facilities	Established credit and loan guarantee facility via TIB disbursed by local banks	2008-2014	Commercial loans for SPP projects
Inadequate local capacity to develop, O&M SPP projects	REA established a fund for capacity building	2010-2015	Tool kit and training of local investors and commercial institutions in SPP financing incentives
Poverty of potential customers	Connection costs were waived for specific periods for new REA projects	2010-2012	Customers pay only VAT costs (18%) of connection costs

MINI-GRIDS IN TANZANIA

Lessons Learned



KEY LESSONS

TECHNOLOGY

Technology specific FITs are more attractive to MG investors than technology neutral FITs.

COMPETITIVE BIDDING

Owing to falling prices over time, FITs for solar and wind can best be determined by competitive bidding.

HONORING FINANCIAL OBLIGATIONS

The inability of DNO (TANESCO) to honor its financial obligations affects the viability of grid-connected private SPPs. e.g. Mwenga, TANWAT, AHEPO

KEY LESSONS (CONTINUED)

EFFICIENT OPERATION, MANAGEMENT + REFLECTIVE COST

Irrespective of the ownership approach adopted the efficient operation and management of mini-grids coupled with cost reflective tariffs is key to long term sustainability.

JOINT EFFORT FINANCING

Financing of mini-grids should be a joint effort of governments, development partners, the private sector, faith based organizations and NGOs.

WHAT MORE IS NEEDED

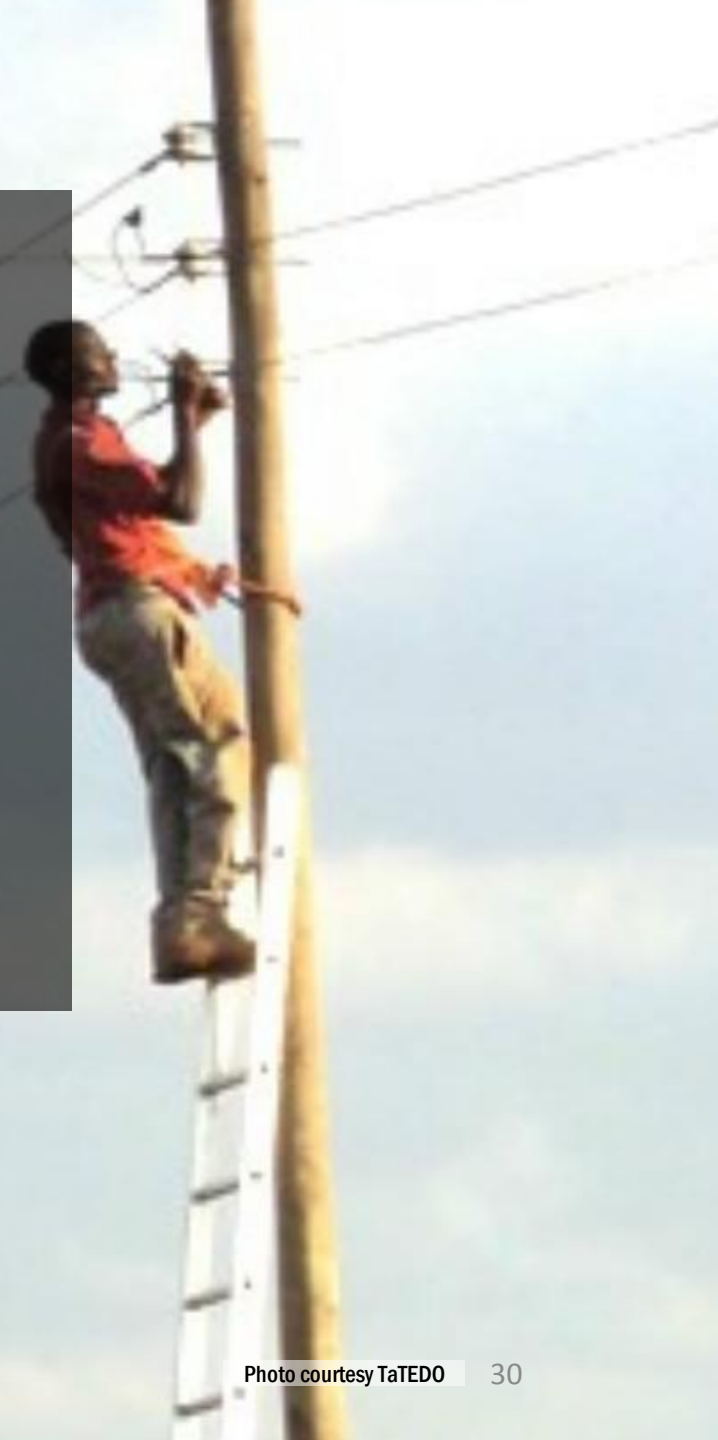
Dynamic SPP Framework

that evolves over time and responds to the needs of all actors – investors, DNO, retailers and end use customers.

Effective Monitoring and Evaluation

in mini-grid financing especially with matching grants.

Expand innovative metering and revenue collection
e.g. through pay-as-you-go systems



BRINGING MINI-GRIDS TO SCALE

RESOURCES

Increasing internal and external resources mobilization for MGs development.

CAPACITY BUILDING

Large scale capacity building of MG stakeholders in management, business, and technical aspects.

INTEGRATED PLANNING

Adopting an integrated approach to mini-grid planning, that incorporates other development initiatives and promotes community participation.

BRINGING MINI-GRIDS TO SCALE (CONTINUED)

IMPROVED COORDINATION

Improving coordination in site selection, feasibility studies, regulatory clearances, and project prioritization for implementation.

LOCAL MANUFACTURING

Incentivising local manufacturing of some of the basic electrification equipment.

COORDINATED DEVELOPMENT

Mini-grid development should be coordinated with rural development activities to stimulate and sustain demand.



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