



Benchmarking Mini-Grid DESCOS 2017 Update

Summary of Findings

May 2018

Strategic Context

IFC and Energy Access

- **Energy access remains a critical piece of the development agenda:**
 - Globally, over 1 billion people have no access to electricity.
 - Over half these citizens—an estimated 600 million people—live in Sub-Saharan Africa.
 - They spend significant resources on kerosene and candles for lighting and expensive charging services for devices such as cell phones.
 - In addition to a reduced quality of life (some 1 million people worldwide die each year due to indoor air pollution from wood and charcoal fuels used for cooking and heating), economic opportunities are constrained by a lack of access to modern energy services.
- The International Finance Corporation (IFC), a member of the World Bank Group, is the largest global development institution focused on the private sector in emerging markets.
- Within IFC, the **Energy & Water (E&W) Advisory Services Group** works to develop clean energy opportunities, as well as improve access based on a range of both grid- and off-grid technologies, and optimize energy usage across a wide range of sectors in emerging economies.

IFC is engaging with companies and governments in several markets to accelerate the scale-up of commercially-viable mini-grid business models as part of the energy access agenda.

IFC and Energy Access

- **Mini-grids (also commonly-known as “micro-grids” or “island grids”)** are power generation systems—typically 10kW to 10MW in size—based on solar, hydro, biomass, wind and/or diesel.
 - Mini-grids serve a wide range of customers, from households in small villages¹, to small businesses and larger anchor clients that off-take the bulk of the electricity produced.
 - Connected to an isolated distribution network, they can also serve as electricity storage systems or, if and when the central grid arrives, helps to strengthen “last mile” reliability.
- In January 2017, IFC released the results of a **benchmarking exercise distributed energy services companies (DESCOs) using mini-grid technologies**:
 - The objective of the analysis was to develop quantitative data on the sector to help refine interventions to catalyze the growth of, and increase investor interest in, mini-grid DESCOs.
 - In this context, IFC engaged with 20 mini-grid developers² and operators to better understand the range of business models that they are implementing, the outcomes of their operational experiences and their financial returns to date.

This document is an update of the 2017 results, and shares our latest findings and insights, with particular focus on residential customers

¹ Comprising no more than several hundred households

² Eleven of the 20 developers participated in both the 2016 and 2017 exercises. All the participants in 2016 are still in business

2016 vs 2017 Benchmarking Exercises: What's Changed¹?



Number of
Companies

2016

20

2017

20



Number of
Countries

7

12



Time to Overall
Profitability

5-7 years

>7 years



CAPEX²
Payback Time

≈5 years

>5 years



Average Capital
Invested by Each Firm

2016

\$4.2M

2017

\$7.9M



Average Demand
kWh/month

8

11



Average Distance
from Main Grid

22km

23km



% of Companies
24-hr Power

75%

95%

¹ Some of the discrepancies between 2016 and 2017 are due to participants that are not included in the 2017 study

² CAPEX Payback Time defined as the number of years for revenue to recover the initial investment in the mini-grid

Our Approach

Mini-Grid DESCOs were Analyzed at the Business and Value-Chain Levels to Provide Insights that Might Support Investor Due Diligence

Business Overview

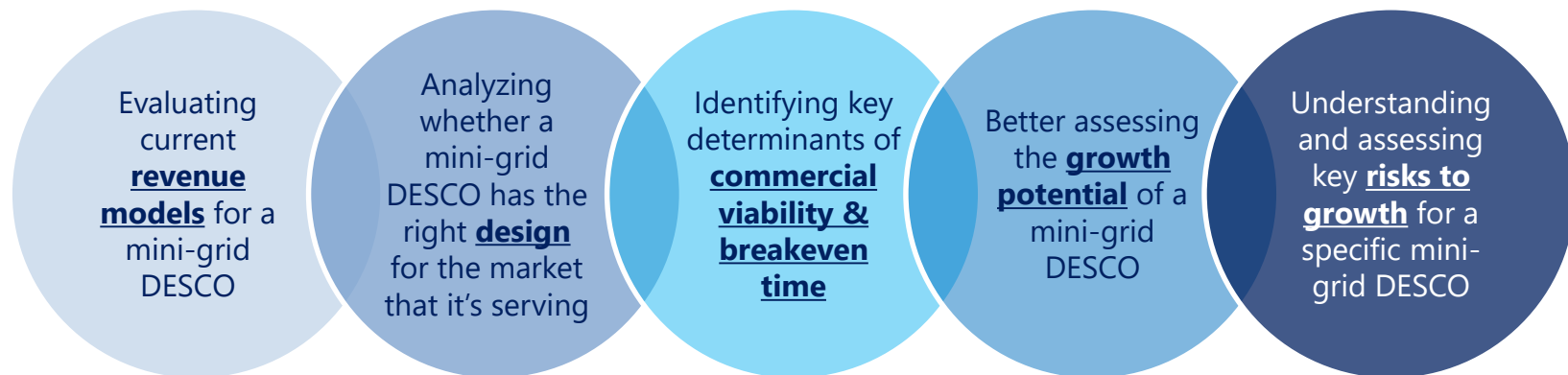
- Number of grids in operation
- Number of new grids planned
- Time since initial service launch
- Business stage
- Years to overall breakeven
- Years to capex breakeven
- Overhead costs as % of revenue
- Op. model (in-house vs. outsource)
- Sources & sums of financing



Value-Chain Analysis



Due Diligence Insight



This Benchmarking Exercise Covered a Sample of 20 Mini-Grid DESCOs* Operating Across 12 Countries



* The number of DESCOs included in the Benchmarking Exercise from each country is noted in brackets.

Data were collected with written surveys, followed up by interviews

Insights from the Benchmarking Data

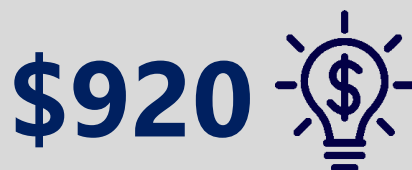
Benchmarking Data: High-Level Facts and Figures



\$7

ARPU

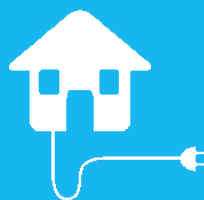
Average Revenue
per User¹
(Monthly)



\$920

AIPU

Average Investment
per User¹



11

kWh/mo.

Tier 2
Average residential
consumption²

Average generation
capacity²

34

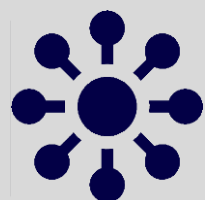
kW



85% vs **15%**

A/C

D/C



≈ 109

Average
Number of
Connections³



3 Years

Average Number
of Years in Business
(Range of <1 year to 6 years)

OPEX as a % of Revenue⁴

58%



95%

Provide 24/hr Power

¹ Includes the sole Hydro DESCO in the sample (\$7 ARPU and \$920 AIPU)

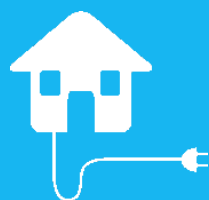
² Excludes the sole Hydro DESCO in the sample, which is an outlier for average residential consumption and generation capacity

³ Excludes 2 Outliers

(one hydro DESCO & one PV with higher connections)

⁴ Only 13 respondents

Benchmarking Data: Spotlight on Tanzania Mini-grid DESCOs



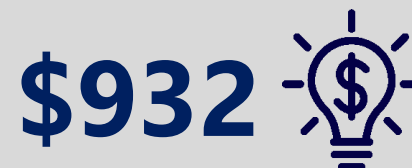
5
Average residential
consumption²
kWh/mo. (vs 11 kWh/mo. global average)

Developers are planning to double the current
number of systems in the next 12 months

(Consistent with global average)



\$6
ARPU
Average Revenue
per User¹
(vs \$7 global average)



\$932
AIPU
Average Investment
per User
(vs \$920 global average)



5 Years

To Operational
Profitability

(Consistent with global average)



8 Years

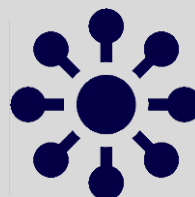
CAPEX Payback
Period

(vs 7 years global average)

OPEX as a % of
Revenue

63%

(vs 58% global average)



≈ 117

(vs 100 global average)

Average
Number of
Connections³

¹ Monthly

² Data from 5 participants only; Excludes one hydro DESCO.
Increases to 12 kW/month when hydro DESCO is included

³ Excludes 2 Outliers

(one hydro DESCO & one PV with higher connections)

1

High CAPEX and Low Electricity Demand Push the Payback Period to Over 7 years



DESCOs typically oversize generation systems to allow for growth in demand. But low consumption, creates an imbalance between **ARPU** and **AIPU**.

**\$920
AIPU***



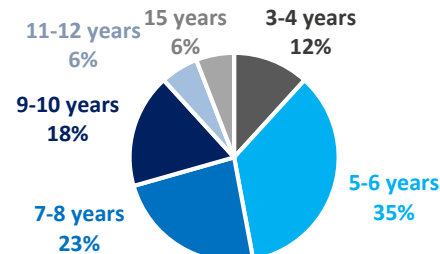
**\$7
ARPU***



Average CAPEX
Payback Period

**>7
Years**

Split of Average Timing for CAPEX Payback at the Project-Level



Average Split of CAPEX Spending on Distribution vs Generation



Reducing mini-grid CAPEX key to improving overall financials for DESCOS. Bulk procurement could also potentially help to drive down prices.

Targeting areas with higher consumption and **productive uses, and create revenue streams** from complementary activities (appliance sales, internet, entertainment devices) is critical for increasing ARPU.



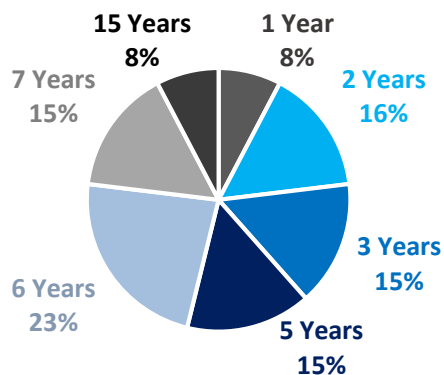
2

High OPEX Extends Average Period to Profitability Beyond 5 years



Operational and administrative expenses absorb the entirety of DESCO revenues, with most firms projecting **operational break-even that extends beyond 5 years** of operations.

Average Number of Years to Profitability



OPEX/Revenue*

58%

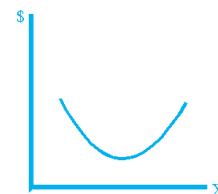
OPEX+Admin/
Revenue*

128%



Recruiting local staff across management levels could significantly lower cost base.

Seeking economies of scale and scope by **clustering sites** to better leverage staff could reduce OPEX.



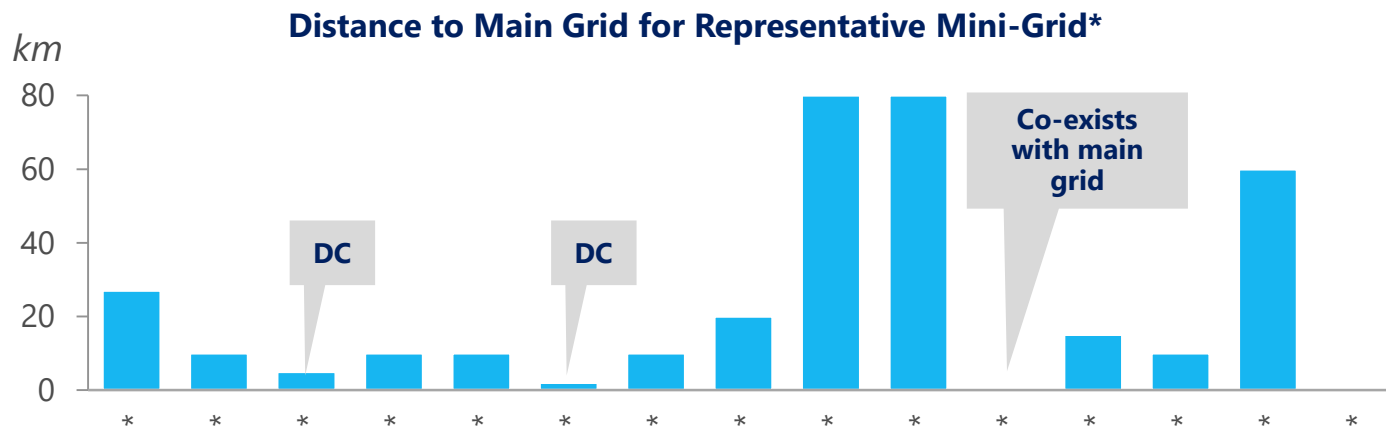
* Respondents own estimates; Different methodologies likely applied by each respondent
(Only 13 DESCOs provided data for OPEX/Revenues and 11 respondents for (OPEX + Admin) /Revenues)

3

Lack of Clarity on Grids Expansion Leads to Focus on Generally Less-Profitable Last Mile Segment



Potential **grid extension** is a key factor adversely affecting the growth prospects of mini-grid DESCOs (particularly in East Africa). Even for DESCOs that could be interconnected with the main grid, uncertainty surrounding grid connection standards, compensation arrangements and uniform tariffs have driven most DESCOs to operate at least 10-20km away from the boundaries of the national grid to what is often seen as the “last mile”—driving up development costs and reducing ARPU, given relatively lower income levels in these areas.



A

**Average Distance
from National Grid**

23 km



Increased transparency into roll-out plans for the central grid (which is typically heavily subsidized) will be key to help mini-grids identify opportunities and operate in areas that are more commercially viable, due to density and load.

4

Optimistic Growth Estimates suggesting Substantial New Capital Requirements



DESCOs are projecting to **double their number of sites** within the next 12 months. To maintain current operations and support this growth, developers require 2-3 times the capital raised to date.

Number of Current vs Planned Grids within 12 months

Average # of Current Grids per DESCO

13

Average # of Planned Grids per DESCO

26

Total Capital Raised vs Future Capital Needs in the Next 3-4 Years (\$M)*

Total Capital Raised to Date (Average)

4.8

Future Capital Needs (Average)

17.3



Closer collaboration between governments and DESCOs (e.g. via structured **Public-Private Partnerships that ring-fence areas for mini-grid development, and provide public funding to reduce the length of time before mini-grids achieve payback, thus attracting private operators and financiers into the market**) could catalyze the sector.

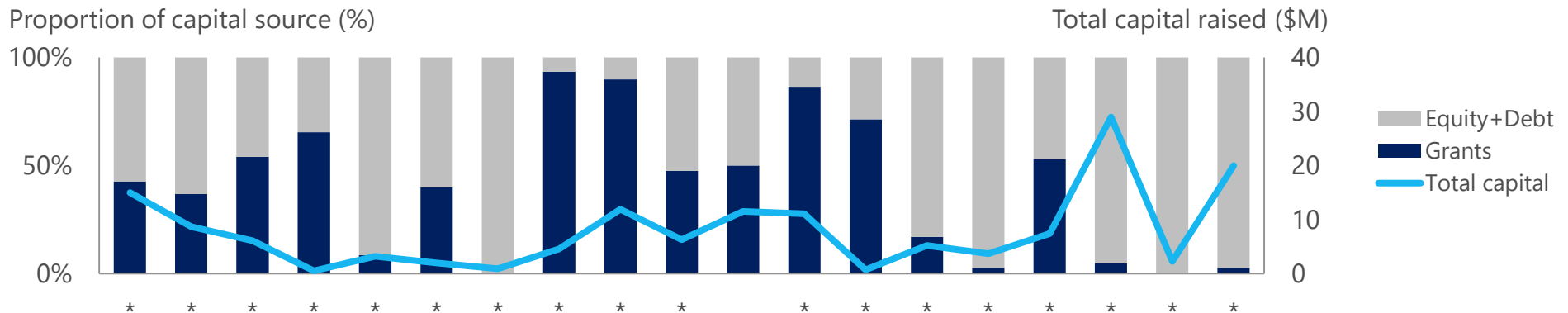
5

For Now, Heavy Reliance on Equity Investment and Grant Funding



DESCOs currently rely heavily on equity investment and grant funding. While this is not unusual for early stage companies (the average DESCO has been in operation for three years), a shift towards commercial lending will be needed to achieve scale.

Mini-Grid DESCOs Capital Raised-to-Date



DESCOs' ability to raise meaningful levels of commercial lending is likely to be challenging unless they can demonstrate the ability to access and develop sites at greater scale.

Conclusion

Summary of the insights from the analysis



Mini-grid developers need to do a better job in **forecasting the demand of their customer base** and picking sites with the right balance of residential and productive uses. Preference might be given to locations with potential for additional revenue streams (appliances, internet, entertainment devices).



Government authorities could do a better job at simplifying and/or **streamlining processes, procedures and regulations for developers** in the mini-grid space, and providing greater transparency into plans for future grid extension. In addition, **closer collaboration between governments and DESCOs** could strengthen the role of mini-grid (as well as solar home system) technology solutions as part of a least cost electrification planning approach.



DESCOs should explore combining **mini-grids and solar home systems** for different locations in the same village could reduce overall CAPEX per connection, particularly in sites with more dispersed populations and/or a broad range of electricity consumption patterns.



Commercial financial institutions should start looking at the sector, which is rapidly innovating in terms of technology options as well as exploring new business models, and eager to attract loans to support expansion plans. However DESCOs still need to **improve operational performance** and overall cost structures to make their mini-grids more “bankable”.



DESCOs could **improve cost structures** by hiring more local staff at the management levels, and seeking economies of through bulk procurement, where possible.

Mini-grids could become a viable option for energy access

...but three critical sets of issues must be resolved



Market: Mini-grids are best suited for larger electricity demands (with at least some productive uses). Current capital cost structure makes it unrealistic to generate profits with Tier 2 client base, and puts mini-grid connections in direct competition with generally less costly solar home systems.



Business model:



Technology flexibility: Where rural customers are the target, a technology agnostic approach recommended for DESCOS is key; e.g. partnering to combine mini-grid connections for larger end-users with solar home systems for smaller ones outside the core perimeter of the mini-grid.



Multi-utility opportunity: Given investment costs, as well as opportunity that deep customer touch-points provide, it is worth exploring cross-selling of broader products and services (e.g. internet access, entertainment content, health and educational services).

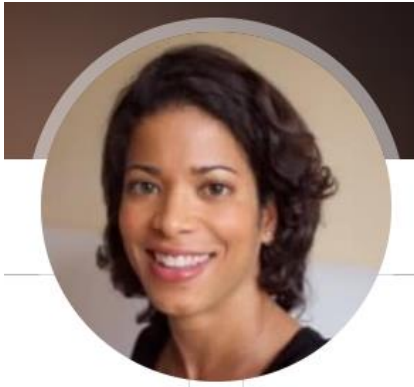


Local play: As with any base-of-the-pyramid business, strengthening involvement of local players—both conglomerates and SMEs—is critical to provide market insights, improve operational efficiency, reduce risks, access local capital and operate ventures for the long-term.



Ecosystem: Fundamentally, greater room for coexistence with the national grid and increased clarity on grid extension plans will be critical for mini-grid sector to thrive. Structured public-private partnerships can reduce unnecessary costs, allocate risk to appropriate parties and consider concessional financing options to help close the viability gap.

Who to Contact



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