Solar for Health (S4H) innovative financing feasibility study

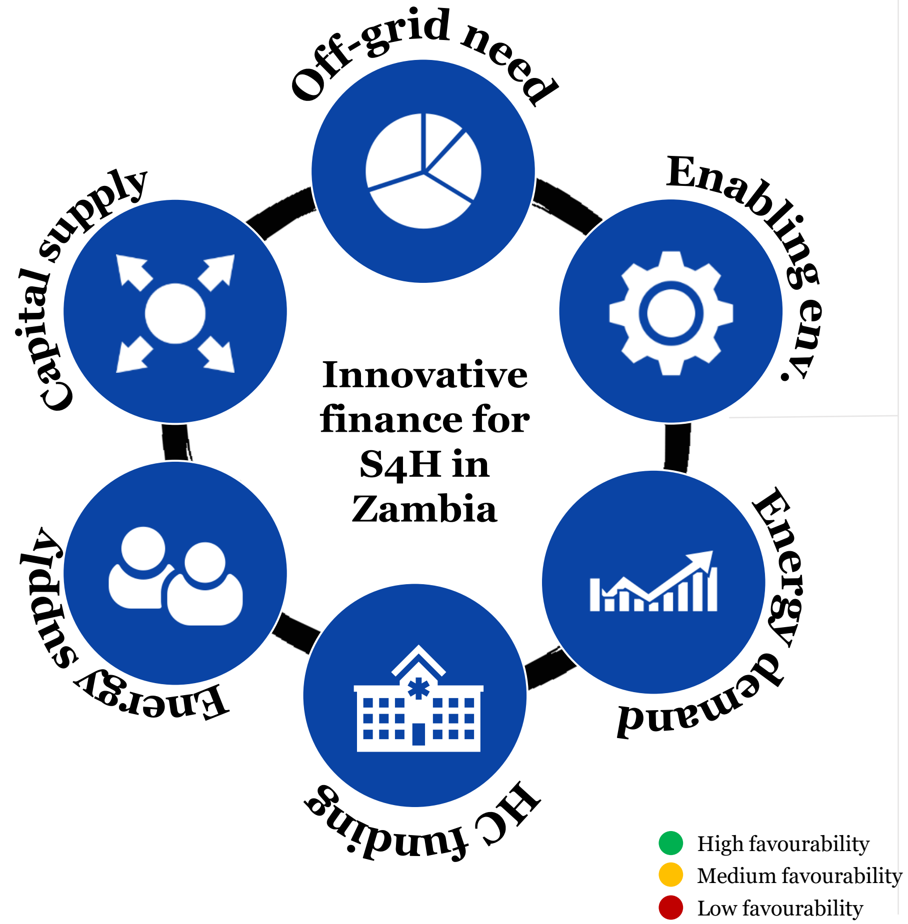
in Liberia, Malawi, Namibia, Zambia and Zimbabwe

UNDP PRC/ZWE/RFP/0008/7/8/2019

Zambia – country report

September 2020

Shifted focus on renewable solutions to address rural areas energy needs has resulted in several initiatives lead by the government and/or supported by international organizations which are a working progress



Only 31% of the population have electricity access and it falls to 4% in rural areas. Low ability of the national utility company to increase its generation capacity and extend the grid will require an off-grid solution in the medium term.

Underdeveloped regulatory framework, although several initiatives ongoing to support the development of a regulatory framework and incentives for renewable energy sector. Technical assistance will be needed to support the public sector.

Energy needs of most healthcare facilities are not fully met even though 50% already have some solar energy access and 40% of public health facilities are connected to the grid. The grid is however very unreliable.

Zambia is trying to contain its high debt level and limit public expenditure. Budgets for healthcare are insufficient and inefficiently spent. Support from donors is expected to decrease in the near future.

PAYG companies have been growing in Zambia but still require support to be able to service healthcare facilities. Splitting the market in regions will allow more local ESPs to bid for the tender and develop the local ESP market.

Lack of local capital, financial sector is reluctant to provide loans. Recent IPPs demonstrated interest from international companies and their ability to mobilize foreign capital.

Content

The Government of Zambia target 90% and 51% access by 2030 in urban and rural areas by 2030. In order to meet these targets, heavy reliance on off-grid solutions will be needed to complement grid electrification

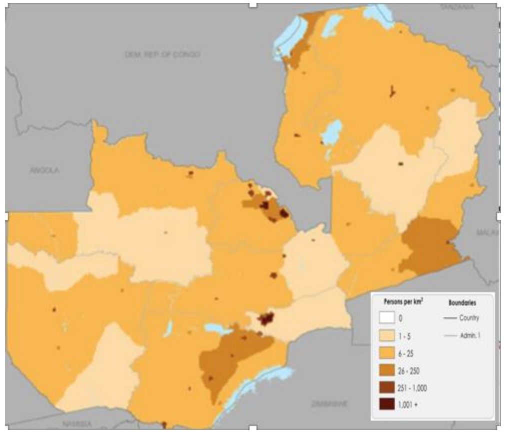
General figures[6]

Population	18 Million (56% Rural)
Land size	752,618 km2
GDP/ Cap 2018	$1300 USD (154/186)
Ease of doing business ranking	85 /190

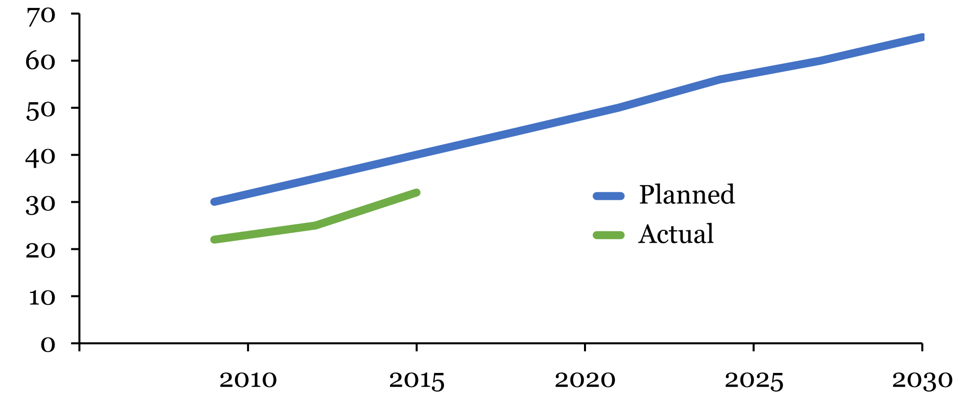
Electricity related figures

Access to electricity[4]	31%
Rural grid electrification[4]	4%
Electricity price[5]	$0.03 US Cents kWh
Installed capacity[4]	2878 MW
Total Final Energy Consumption	92 750 GWh (2014)

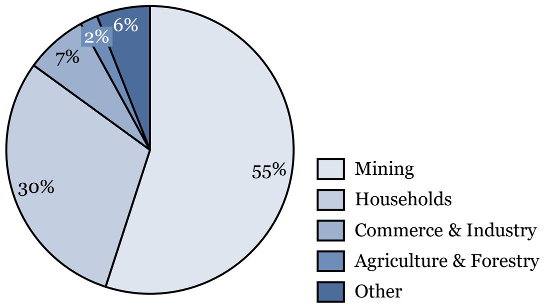
Population density by district [1]



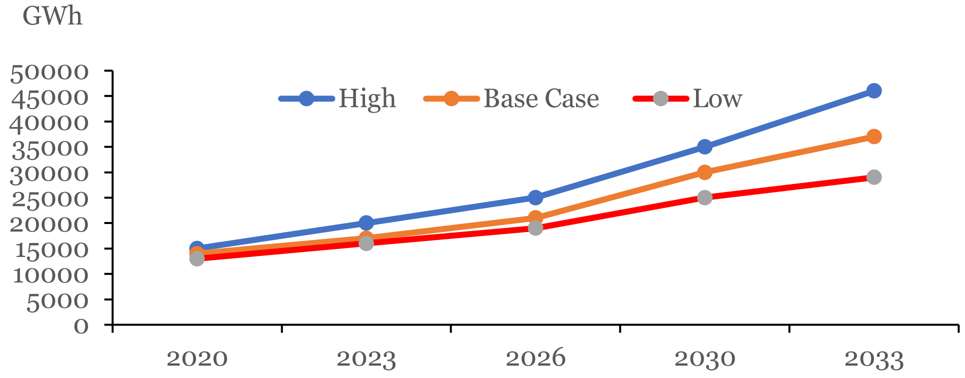
National Electrification Rate %- planned versus actual (2009-2030)[2]



Electricity consumption [4]



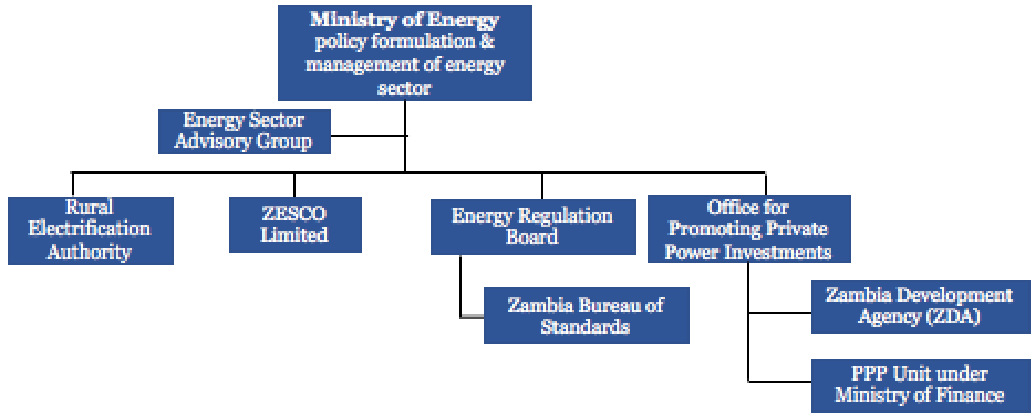
Electricity Demand Forecast (2017-33)[3]



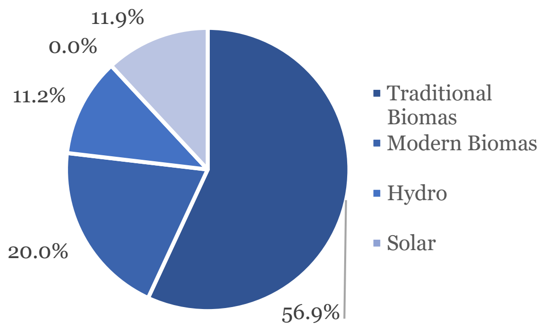
1 SEDAC- Columbia University 2000
2 http://projects.worldbank.org/P162760/?lang=en&tab=documents&subTab=projectDocuments
3 http://extwprlegs1.fao.org/docs/pdf/zam170109.pdf
4 SADC Renewable Energy and Energy Efficiency Status Report 2018
5 https://www.globalpetrolprices.com/Zambia/electricity_prices/
6 World Bank;

Despite existence of institutional framework and efforts to stimulate public- private partnerships in the energy sector, limited financial and human capital hinder the implementation of the Zambian electrification strategy

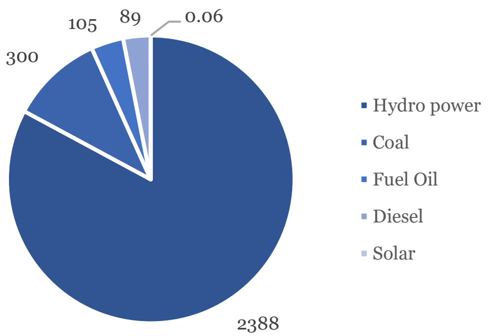
Institutional framework of Zambia energy sector [1]



Energy mix (2014)[2]



Installed capacity (in MW)[3]



MOE provides overall policy oversight and is responsible for strategic planning and management of the energy sector

- National Energy policy 2008 provides overarching sector policy framework and promotes use of RE and private sector participation.
- Rural Electrification Master Plan (REMP) 2008 guides systematically the rural electrification agenda in Zambia up to the year 2030 focusing on technology transfer

There is a willingness from the MoE to collaborate with the private sector and make use of PPP to faster scale up the generation capacity in Zambia and also move toward renewable energy sources.

- The Office for Promoting Private Power Investments is a key unit to support the MoE objective to increase the generation capacity by collaborating with the private sector.
- The PPP Unit lies under the Ministry of Finance and shall be directly involved in MoE initiatives.
- ZESCO, the national utility company, is the counterpart under PPP agreements that are being implemented with the assistance of the GetFit programme.

Rural Electrification Authority implements the Rural Electrification Master Plan

- Manages Rural Electrification Fund (REF) financed by a 3% levy on electricity
- Provides capital subsidy of up to 100% for public-led rural electrification projects and can support privately-driven rural electrification projects with up to 50% of their capital costs
- Responsible for financing project preparation studies for rural electrification and recommending to government policies for the enhancement of rural electrification
- Offers smart subsidies for capital costs on projects
- Support mini-grid projects by providing capital subsidy

The Energy Regulatory Board regulates the energy sector

- Establishment of feed-in tariffs with the Renewable Energy Feed In Tariffs (REFiT) Strategy 2017 providing an allocation of 200 MW of small- and medium-scale renewable energy projects up to a maximum size of 20 MW
- Promotion of new grid connections
- Design of standards on quality, safety and reliability of energy
- Other specific solar regulations, mainly targeting solar components

1 Energy Policy in Zambia Ministry of Mines, Energy and Water Development 2015
2 SADC Renewable Energy and Energy Efficiency Status Report 2018
3 SREP
Kapika and Eberhard 2013
https://www.gogla.org/sites/default/files/resource_docs/zambia_country_brief.pdf

Zambia Ministry of Mines, Energy and Water Development; Gogla; Kapika and Eberhard; Zambia Energy Regulation Board; Kois Invest Analysis
http://www.erb.org.zm/reports/esr2018.pdf

In the effort to increase energy access through renewable energy sources, several initiatives and favourable policies have been launched with the support of donors

7th Zambian National Development Plan guide the country strategy and set renewable energy as one of the priorities

The NDP outlines the need to improve energy production and distribution for sustainable development and sets 3 specific strategies :

- Enhance generation, transmission and distribution of electricity
- Promote renewable and alternative energy
- Improve electricity access to rural and peri-urban areas

GoZ has implemented a number of favourable policies for energy project development and to support the private sector

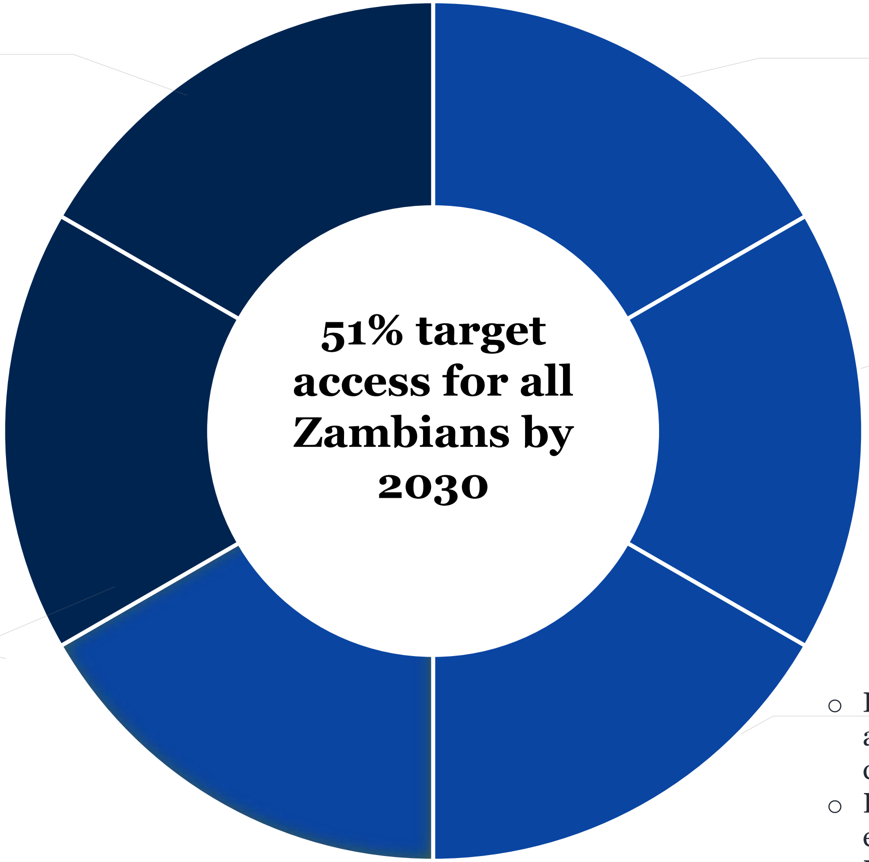
- GoZ introduced a zero rate VAT and exception from import duties on solar and battery technologies in 2008.
- Increased Access to Electricity and Renewable Energy Production (IAEREP) : €40 grant to scale up access to clean, reliable and affordable energy and promote renewable energy production and energy efficiency across Zambia
- Electricity Service Access Project–Off grid Electricity Access Expansion DBZ will be able to provide loans for players in the off-grid space
- Zambia targets to develop 600MW of on-grid solar generation with IFC Scaling Solar Program
  - In July 2015, tender for two solar plants showed lowest PV pricing bids seen in Africa with the first bid at US$ 6.02 cent/kWh for a 45 MW project and the second at US$ 7.84 cent/ kWh for a 34 MW
  - However the implementation faced some challenges mainly due to the lack of credit worthiness of ZESCO and bidders requesting for more securities
  - It also resulted in local ESP companies' disappointments as international consortia were selected. It resulted in smaller tenders been issued allowing local players to be more competitive.

Strategic Climate Fund Scaling-Up Renewable Energy Programme

- In 2014 Zambia was selected as a pilot country for Scaling-up Renewable Energy Programme in Low Income Countries which operates under the Strategic Climate Fund.
- It aims to demonstrate the economic, social, and environmental viability of renewable energy project, creating economic opportunities and increasing access to electricity
- SREP financing plan budget US$170M to electricity access to be financed by SREP grants leveraging additional funding from AfDB, IFC, WB, other donors and private sector investor

SREP

Despite GoZ having engaged in several initiatives to develop an enabling environment for electrification, gaps remain to achieve a successful implementation of the strategy



Zesco financial and management challenges

- Zesco having financial difficulties due to non-cost reflective tariffs and insufficient generation following drought and low rainfall
- Insufficient generation results in load shedding and frequent power cuts
- Low profitability puts ZESCO in an inability to implement new project and increase generation capacity

High reliance on hydro-power

- GoZ needs to diversify its generation mix
- Drought in recent years resulted in generation deficit and had a dramatic impact on the economy as a whole

Government investments focused on grid

- National Electrification Plan indicates least cost electrification technologies and identified Off-grid solution as more cost effective than grid given low population density
- Very limited measures to support electrification through off-grid solution

Regulatory framework remains weak

- GoZ strategy lacks clear targets and time-based plans
- Inadequate legislation to support RE technologies
- Insufficient/inadequate of standards on renewable energy technologies led to suboptimal products

Mini-grid projects difficult to implement

- Donors have supported mini-grid programmes but several challenges were identified
- High costs of mini-grid projects needing subsidy
- Need of an anchor client to be viable
- Complexity requiring high level of technical knowledge

Lack of capital to support energy sector

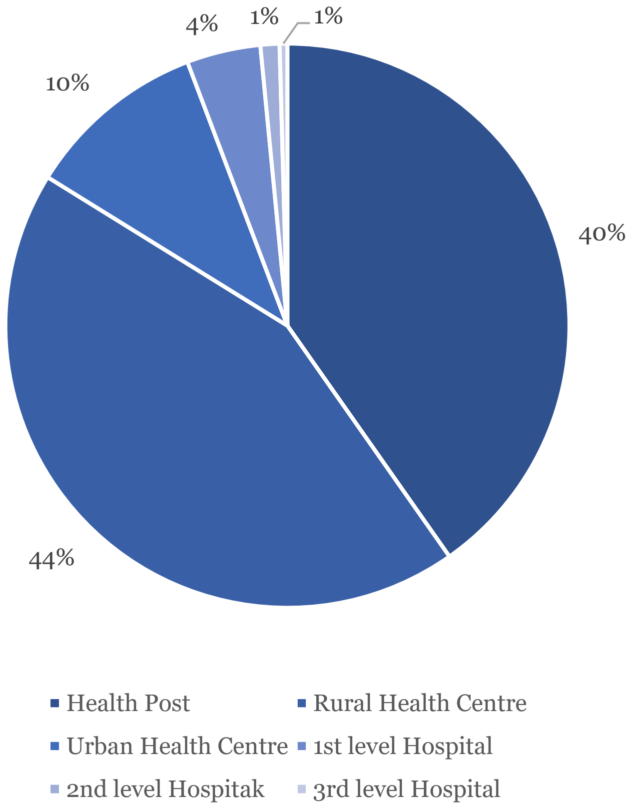
- IPPs generating for the grid have been successful in attracting investors but are now facing implementation challenges
- High capital cost and limited availability of long-term finance especially for small-and-medium scale enterprises
- Lack of appropriate and affordable credit and financing mechanisms
- High cost of resource assessment and feasibility studies

https://www.gogla.org/sites/default/files/resource_docs/zambia_country_brief.pdf
https://www.usaid.gov/sites/default/files/documents/1860/Malawi_-_November_2018_Country_Fact_Sheet.pdf
Source:GOGLA; ITC; Rocky Mountain Institute; Power Africa; KOIS Invest analysis

Content

More than 54% of the healthcare facilities are health centres, along with health posts they provide primary healthcare services to the population

Health facilities by type (2017)[1]



Healthcare facility classification

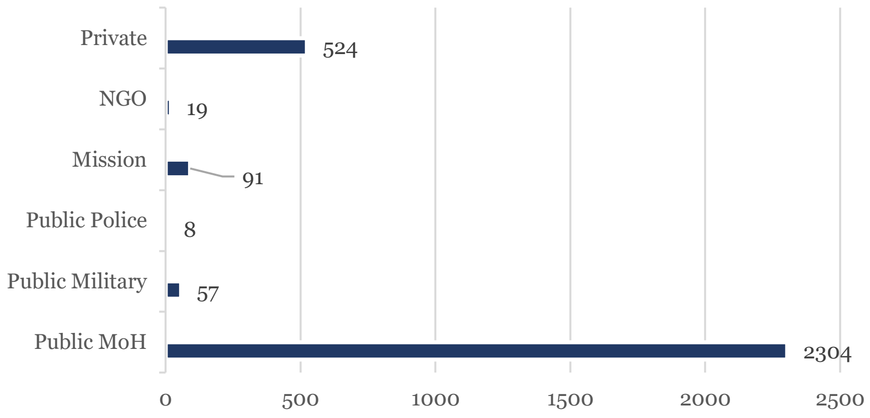
	Health Post	Health centre	Hospital
Healthcare facility characteristics			
General description	Basic HC facility in remote setting for primary health needs (i.e., periodic HC practitioner, storage of medication)	Provides vital services (e.g., obstetric and surgical services), and treatment of injuries and infections	Largest infrastructures for patient capacity (over 120 beds) and wide range of services
Local pop density	Very low	Low /Medium	Medium/High
Patient type	Rural and remote, low revenues	Rural/semi-urban, low revenues	Secondary cities, average to low revenues
Treatment capacity	0-20beds	20-80 beds	80 beds more
Staff size & type	No permanent doctor / full- or part-time primary HC provider	One or more full-time nurses and potentially a part-time physician	Full-time doctors, nurses, and other technical and maintenance staff
Services provided	Treatment of minor illnesses, prevalent diseases; basic immunisation services; first aid ; maternity services	Wide array of services & equipment for sophisticated diagnoses; treatment of injuries and infections; refrigerators for vaccine storage	First aid to surgery, non-communicable disease treatment and intensive care; medical analysis laboratories, diagnostic equipment and storage facilities for blood and vaccines
Healthcare facility energy needs			
Description of need	Lighting for limited overnight surgical procedures & maintaining the cold chain for blood, vaccines and drugs	Lighting for basic overnight surgical procedures & maintaining cold chain; using lab, medical equipment and communication	Similar to health centre plus communication with remote HC and hospitals, and using more sophisticated diagnostic devices
Energy need & equipment assumptions	10-20 kWh/day (e.g., microscope, lights & small refrigerator, hand-powered aspirator)	30-50 kWh/day (i.e., Health post + basic diagnostic medical equipment)	80-220 kWh/day (i.e., HC + communication, more sophisticated diagnostic medical devices)

Source: KOIS and Differ analysis

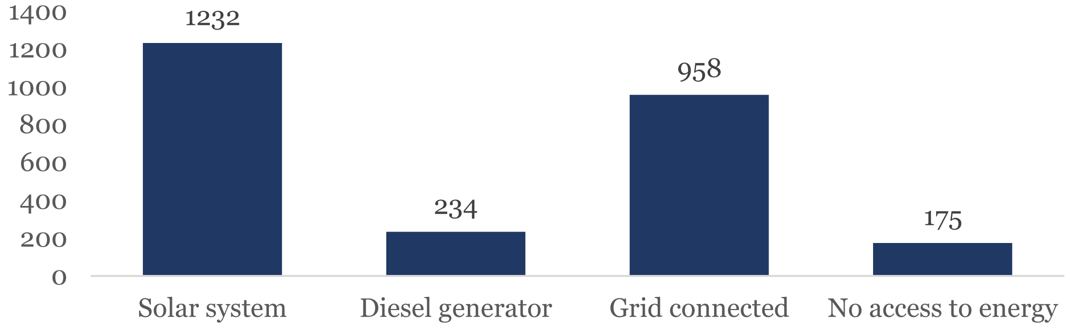
1 Ministry of Health, National Health Facility Census Analytical Report, 2019

Vast majority of healthcare facilities have an access to either grid, solar or diesel, however access is often unreliable or insufficient to cover all the energy needs of the facility

Number of health facilities in Zambia by ownership (2017)[1]



Energy access at public facilities



Healthcare services are primarily provided by the public sector mostly through health post and health centres throughout the country

- More than 75% of health facilities are public. The Government of Zambia is procuring for most of the population healthcare needs
- The Ministry of Health role is policy formulation, strategic planning and delivery of health services
- Provincial health offices oversee a number of districts and are responsible for planning and budgeting, service delivery, financial management, procurement, as well as monitoring and evaluation
- Delivery of primary health services is undertaken at district hospitals, health centres, and health posts under the responsibility of district health offices
- Health post and rural health clinics represent more than 80% of the facilities and provide proximity basic health services. Those facilities of lack energy access or have a solar system.
- The private sector also operates some clinics especially through employer-operated clinics in the mining sector

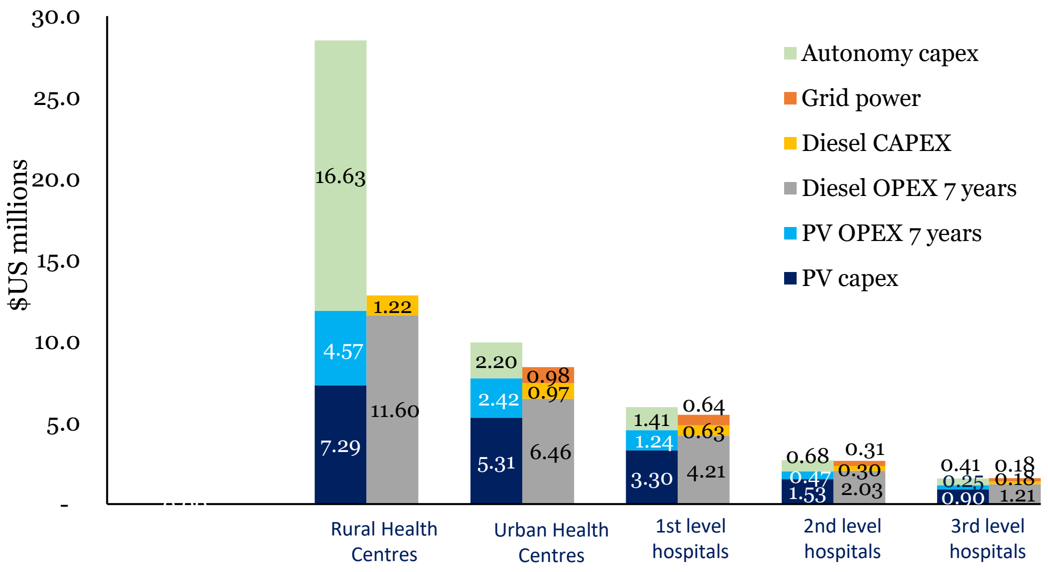
According to MoH data, only 1% of health care facilities have no access to energy. Those numbers are however misleading on the actual need.

- If 50% of healthcare facilities are recorded has having solar energy, the size of the system is often insufficient or only covers specific needs (refrigeration, lighting) moreover a number of those systems are out of order but to lack of proper maintenance
- Similarly, about 40% of health facilities are connected to the grid. However, in Zambia the grid is highly unreliable with frequent power cuts leaving those health facilities in need of a strong back-up solution.
- Reliance on diesel is limited with only 1% of health facilities having diesel generators, therefore installing solar systems will have limited cost savings

Ministry of Health, National Health Facility Census Analytical Report, 2019
Ministry of Health, National Health Capital Investment Plan 2019-2021

*The all-in cost of electrification of all public health centres and hospitals via solar PV standalone systems amounts to US$49m over 7 years, partly offset by cost savings on diesel and utility bills (c.US$25m)**

Solar PV investments vs. estimated diesel and grid savings over 7 years
$mil



Autonomy of the systems is a key question when calibrating size and assessing cost of PV systems
Size of batteries, representing a significant part of the initial investment, varies based on required autonomy of a system. For Rural Health Centers autonomy selected was 2-days while it was only half a day for others. The decision about required autonomy should be made with regards to the investment available as well as reliability of back up and meteorological conditions.

Moving to solar will ensure reliable energy access and but generate an extra cost compared to diesel or grid solution

- Electrification of all public healthcare facilities excluding health posts using solar PV standalone solution would require an investment of US$49m (incl. pre-financing of 7 years of O&M)
- Assuming autonomy of 2 days for Rural Health Centers and a half day for other health facilities that are mostly connected to the grid– it is to be noted that the cost of battery is high resulting in less cost-effective scenario for rural Health Centers.
- Estimated amount of initial investment necessary to electrify different-sized healthcare facilities via PV solar standalone systems is based on the following cost assumptions:
  - 3rd level Hospital: 55kWp installed capacity → US$120k turnkey cost + US$4.3k annual O&M cost
  - 2nd level Hospital: 38kWp installed capacity → US$82k turnkey cost + US$3.3k annual O&M cost
  - 1st level Hospital: 20kWp installed capacity → US$45k turnkey cost + US$2.2k annual O&M cost
  - Urban Health Center: 13kWp installed capacity → US$30k turnkey cost + US$1.8k annual O&M cost
  - Rural Health Center: 10kWp installed capacity → US$44k turnkey cost + US$1.6k annual O&M cost
  - Health Post (excluded): 2kWp installed capacity → US$7k turnkey cost + US$1.1k annual O&M cost
- Hypothetical savings of cost of diesel consumption amount up to US$25.5m, assuming:
  - Diesel consumption is based on all-in cost estimate of US$0.38/kWh
  - Diesel generators CAPEX is omitted – its addition would result in US$3.3m of extra savings
  - Negative externalities linked to diesel usage (e.g. carbon emissions) are not considered
  - Transport costs and maintenance of diesel generators is excluded
- Hypothetical savings on grid electricity bills is an additional US$1.5M, assuming:
  - Grid electricity rate of US$0.027/kWh, to be noted that tariffs are not cost reflective and likely to increase
  - 30% of load shedding, meaning that grid connected facilities only have electricity 70% of the time and have to rely on diesel as back up

*Please refer to the cost model and extracts in annex for more details on assumptions
Ministry of Health, National Health Facility Census Analytical Report, 2019
Kois and Differ analysis

Tailored larger solar PV standalone systems can cover hospitals (20% of total energy demand), while standard PV standalone systems can electrify 85% of the facilities and enable economies of scale

	Relevant energy solution	Rationale for healthcare facility	Market size			Energy solution cost	
			# facilities	*Need per facility*	*Capacity need*	*Turnkey cost*	*Annual O&M*
Hospitals	Tailored PV standalone system with grid back-up and a half day battery autonomy.	Customized size of the system based on the specific needs of a hospital. Usually on-grid but back up is needed given frequent power cuts.	143	-1st level hospital : 20kWp -2nd level hospital: 37.5kWp -3rd level hospital : 55kWp	3.7MWp	$8.2m	$366k/ year
Urban Health Centers	Standard 12.5kWp solar PV standalone system with grid back-up and a half day battery autonomy	Economies of scale in procurement, installation and O&M with standardisation. Usually on-grid but back up is needed given frequent power cuts.	258	- 12.5kWp	3.3MWp	$7.5m	$450k/ year
Rural Health Centers	Standard 10kWp solar PV standalone system with 2 days of battery autonomy	Economies of scale in procurement, installation and O&M with standardisation. Usually off-grid, requiring longer autonomy.	540	- 10kWp	10.5MWp	$23.9m	$850k/ year

Total cost : US$49 million (present value including 7 years O&M contract)

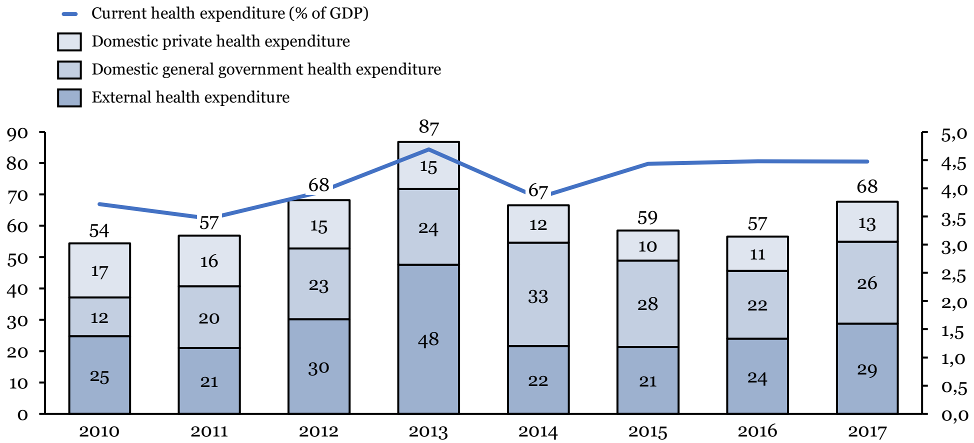
[1] Healthcare facilities considered exclude Health Posts and facilities already having PV solar in place.
[2] PV solar is selected as a base case because of its ability to focus specifically on healthcare facilities, though is some distinct cases, the mini-grid model might be more optimal.

Sources:
Ministry of Health, National Health Facility Census Analytical Report, 2019
Kois and Differ analysis

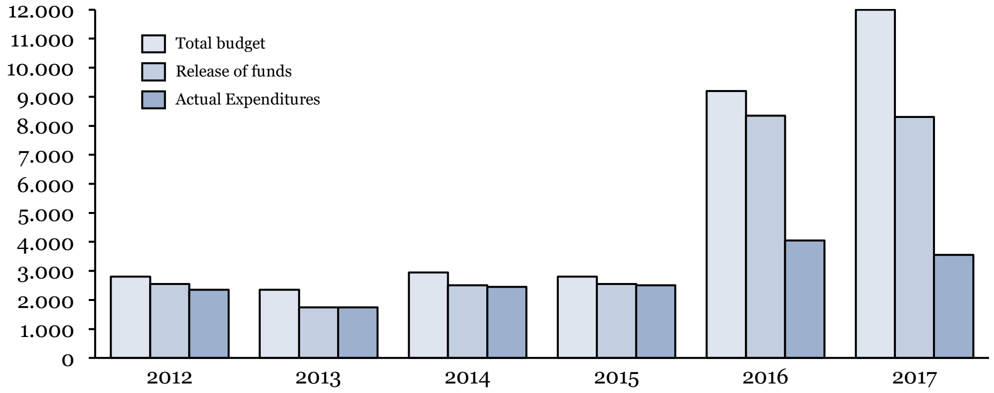
UNDP DIFFER KOIS CARING FINANCE

Government budget for healthcare is insufficient and adversely impacted by management inefficiencies thus hampering the quality of healthcare services available for the Zambian population

Health Expenditure per capita ($ current)[2]



Budget, funding and expenditures [3]



Budget for health are insufficient and unlikely to increase given fiscal constraints the country is facing

- GHE as a share of total government spending was 7.1 % in 2016 (~US$302 million)
- Total health spending as a share of GDP stood at 4.5 %
- Level of total current health expenditure (CHE) per capita in Zambia (US$59) is below the estimated minimum required and would need to double to more than US$149 to meet the needs of the health sector
- Domestic financing for the health sector is provided by general tax and budget support
- Macroeconomic indicators suggest spending is unlikely to increase in the near future

Zambian government is aiming to expand public health coverage and further support the population health access

- Zambia has reduced household out of pocket expenses e.g. abolishing user fees at primary level of care
- Nevertheless, inadequate funding for the health sector has limited access to and quality of health service provision
- Zambia plans to introduce a National Health Insurance (NHI) scheme, providing the legal mandate to establish the NHI management authority, and the NHI scheme that will have a substantial effect on the financing and delivery of health programs and services

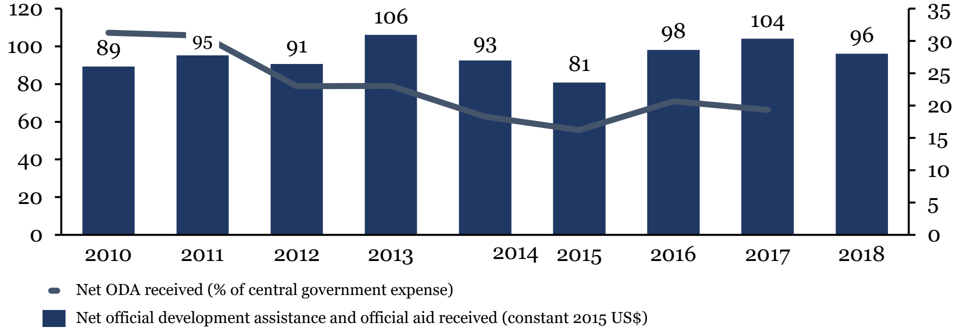
Health budget and management is highly decentralized to the district level creating inefficiencies in actual disbursements, exacerbating regional inequalities

- Budget is allocated at the national, provincial and district level based on the needs budgeted
- Each district then allocates to health facilities within their responsibility with a grant to manage all their current expenditures (except salaries being centralized)
- Significant differences in per capita expenditures at the provincial level suggest that public funding is exacerbating inequalities in health outcomes across provinces
- Utility bills and diesel costs are paid directly by the health facility
- In 2016 and 2017, the MoH had large variance between budget, disbursement and expenditure, with actual expenditure falling below half of budgeted amounts
- Bottlenecks in disbursements of funds between the various levels of administration in the public health system has resulted in unspent funds being returned to the treasury

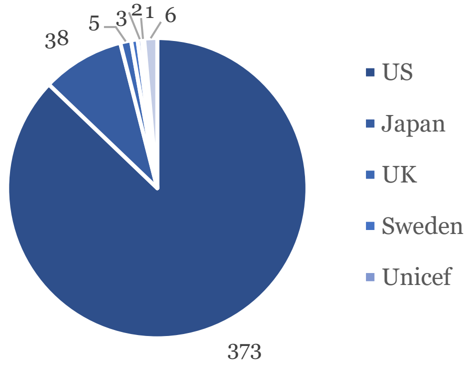
1 Health Financing Profile Zambia May 2016, Health Policy Project
2 World Bank Database
3 Felix Masiye and Collins Chansa, Health Financing in Zambia, May 2019

Zambia is heavily reliant on donor aid however incidences of fraud have significantly impacted the willingness of external donors to support the MoH directly and thus foreign aid is expected to decrease

Official Development Aid (in constant 2015 million USD)[2]



2017 commitments to health aid from top donors (in millions USD)[4]



International aid comes from different types of actors

GoZ strongly relies on external source to support health expenditure, this is a unsustainable model given that donor are decreasing their support[1]

- Expenditures on healthcare per capita are about 60-70$ with external donors providing significant on- and off-budget support. The costs are covered at 40% by the government, 40% by external funds (donors) and 20% by private (out-off-pocket/private sector) contributions on average
- Between 2013 and 2016, donor health expenditure declined by nearly 50 % (average of 13 % per year)
- Excessive reliance on external funding is unsustainable as Zambia being a lower middle-income country, is expected to transition from dependency on donor financing
- No strategy in place to transition from donor support even though several donors have indicated that they will wind up their support in the near future

International organisations and donors implement programmes in Zambia following their mandate and priorities but are reluctant to directly support the MoH[3]

- Perceptions about weaknesses in the country's public finance management and accountability systems caused uncertainty among donors
- Cases of fraud when support was given to the government resulted in freeze of aid in 2018
- About 30 % of the total Current Health Expenditures in Zambia is channelled through aid agencies and nongovernmental organizations (NGOs) while government institutions only handle about 50% of those
- About 70% of the funding from donors in the health sector is going to HIV/AIDS and STIs
- A quarterly coordination meeting is organized with donors but the planning processes need to be harmonized with local health offices to ensure resource allocation effectiveness and sustainability of donor programs

The private sector is also supporting the health system but private insurance remains marginal

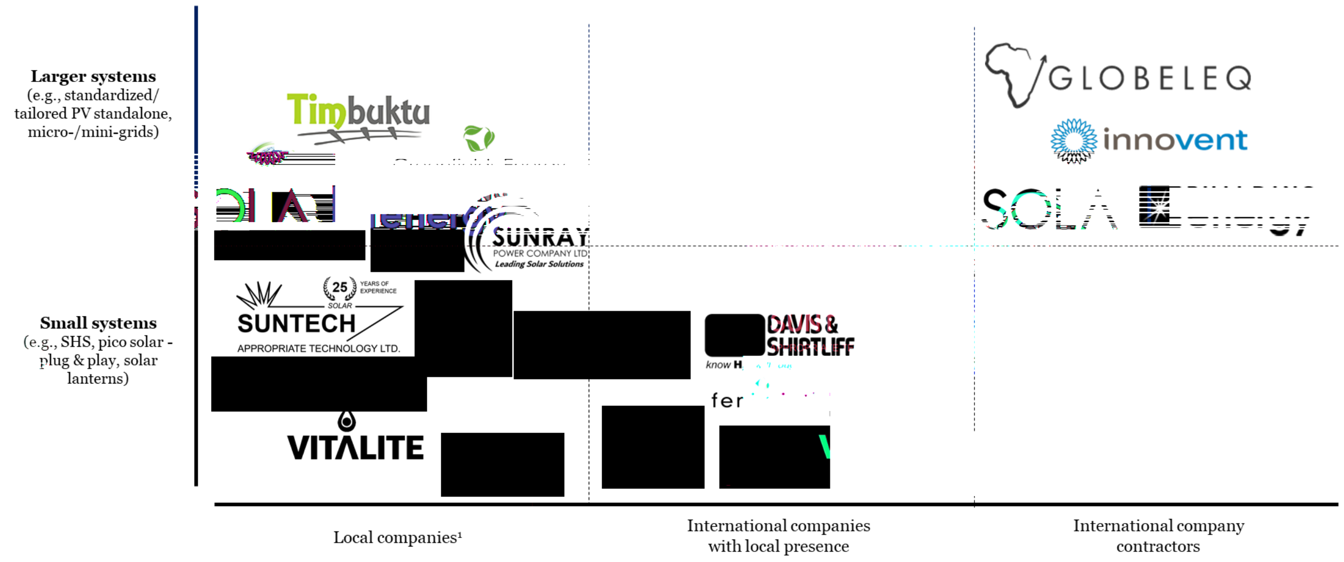
- Particularly in mining areas, the private sector operates clinics for its employees
- Private health insurance coverage in Zambia is extremely low, with estimates ranging from 0.5% to 3%

1 Health Financing Profile Zambia May 2016, Health Policy Project
2 World Bank Database
3 Felix Masiye and Collins Chansa, Health Financing in Zambia, May 2019
4 OECD
5 Interviews

Content

The off-grid market is growing but facing some challenge especially a lack of access to capital to support expansion

Landscape of solar off-grid companies present in the market



SIDA Beyond the Grid Fund

- Launched in January 2016, financed by Sida, the Swedish International Development Cooperation
- Key initiative supporting development private actors in the off-grid space
- Supporting ESPs for installing and operating off-grid Energy Service Subscriptions to provide access to clean electricity in rural areas
- $20 million fund providing result-based grants to selected companies

The Zambian solar market is growing but still relatively young

- There are about 30 local licenced solar companies
- They can be divided in 4 market segments : Off-grid/commercial, Solar Home Systems, Utility scale and Retail/wholesale
- Growth is mainly in off-grid solutions, with 7.4% of solar use in rural areas compared to only 0.8% in urban areas

Solar companies are facing some challenges to scale up and be able to bid for large contracts

1) Lack of access to capital

- High investments costs limit the sector growth especially for small and medium RE enterprises
- Local financial sector is underdeveloped and reluctant to provide financing to energy companies
- Local interest rates are very high (above 20% interest rate)
- High inflation and currency volatility further drive away potential foreign investors
- Larger contract are therefore more accessible to international companies bidding with local partner

2) Regulatory framework

- Inadequate standards for the off-grid sector lead to the circulation of sub-standard products
- Since 2017, the licensing process, especially for imported products, became more rigorous in the solar sector

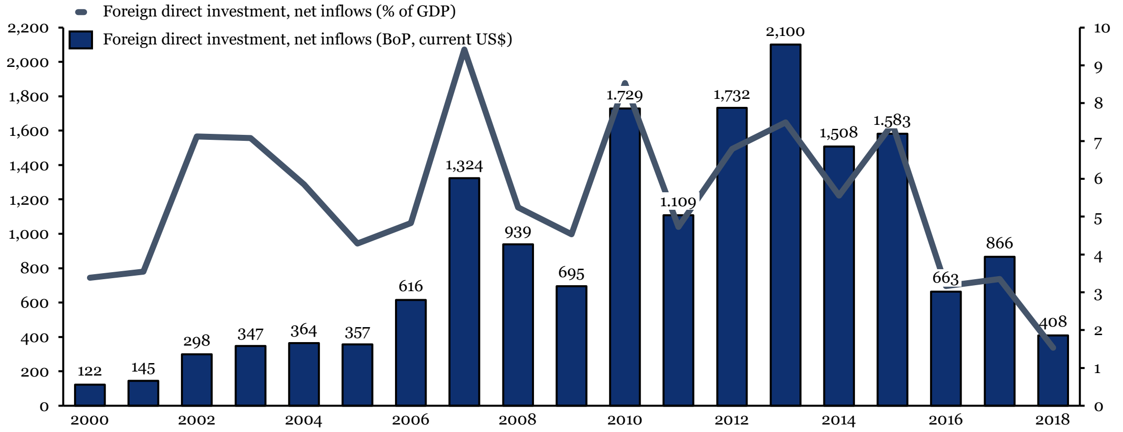
3) Technical and maintenance capacity

- Low population densities result in maintenance issues in rural areas
- Most SE companies are present in larger cities but do not cover rural or more remote areas

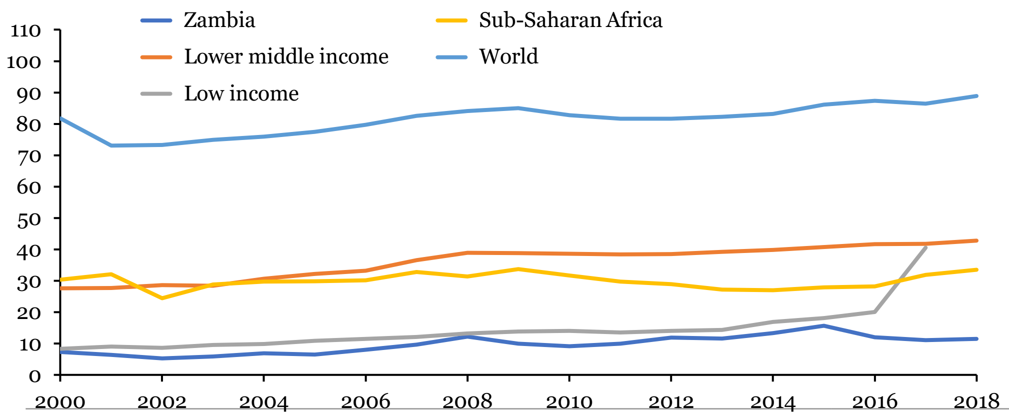
Source: KOIS Invest analysis
*This is not a comprehensive summary of local companies active in the Zambian energy sector

Zambia has a favourable environnent for FDI but capital flows mostly in large investments. For medium size companies access to capital remains a siginificant issue.

Foreign Direct Investment 2000-2018



Domestic credit to private sector by banks (% of GDP)



Zambia has a relatively favourable environment for FDI in the region but the outlook is not optimistic

- FDI is dominated by large mining investments and some large infrastructure projects
- FDI flows stood at USD 1,1 billion in 2017, but significantly decreased to USD 569 million in 2018
- Zambian law does not restrict foreign investors in any sector and even grants several tax incentives, having one of the lowest profit taxes in the region.
- GoZ plans to reduce tax deductions on investment expenses in 2020, that coupled with the uncertainties concerning the tax framework and the high level of Interest, could have a negative impact on FDI
- Zambia ranks 85th out of 190 countries in the World Bank Doing Business 2020 report. However, protection of property rights and the enforcement of contracts are still weak. Moreover, the requirements for commercial licenses being long and costly, and the application of regulations not being uniform

Domestic credit is low and below average compared to other countries in SSA making access to credit difficult for local RE companies

- Local energy companies experience difficulty raising capital from local banks
- Nearly all commercial lending goes to large companies, with only 4% going to MSMEs
- Banks requirements for MSMEs are aften to burdensome or the interest rates often above 20% unaffordable
- Few private equity providers are also present in Zambia but require a high minimum transaction size

Technical Assistance for Renewable Energy Financing Framework

- GoZ received funds from the AfDB through the Sustainable Energy Fund for Africa (SEFA), and the Green Climate Fund (GCF) toward the cost of the Renewable Energy Financing Framework
- Part of this grant will be allocated for the Capacity Building on Renewable Energy Project Development and Funding for Zambian Financial Intuitions
- The objective is to build the capacity of local commercial banks, institutional investors and the Zambian financial industry in renewable energy and infrastructure financing

World Bank data base
https://www.inclusivebusiness.net/ib-voices/access-finance-inclusive-businesses-zambia
https://santandertrade.com/en/portal/establish-overseas/zambia/investing

Concessional financing will need to be raised to finance the US$30m of investment needed, sufficient guarantees and risk mitigation instruments will be required in the Zambian context

Climate finance could be mobilized by local energy companies to implement the contract :

- We have identified several initiatives that provide concessional loans, equity or grants for RE projects. They are providing financing to private sector directly and could be mobilized for this type of project.
- The Green Climate Fund in partnership with AfDB has a US$154M programme to support the Government of Zambia's Renewable Energy Feed-in Tariff (REFIT) policy to develop 100 MW of renewable projects
  - GCF financing of US$50 M in the form of loans and US$2,5M of grants
  - Co-financing in the form of loans, equity and grants
  - The project has an estimated lifespan of 23 years
- While commercial banks have been reluctant to investment into the renewable energy sector, it might be possible to get a commercial loan under a co-financing agreement if the right securities are in place
- PAYG companies are managing to attract some private investors to support their growth in the retail sector and could potentially mobilize co-financing to implement a large project with the right guarantees and secured cash flows for repayment
- Scaling off-grid provides grant financing to selected RE companies supporting off-grid electrification, RBF component and established due diligence process set best practice for future private sector financing initiatives

However, risk mitigation instruments will be necessary to obtain sufficient financing for S4H

- Currently private investors are reluctant to invest in Zambian energy sector and any exposure on GoZ/MoH will need to be backed by guarantees to give sufficient comfort
- Additional securities related to business risk taken on RE companies could include setting up a project finance vehicle, securities on the assets and/or escrow account for the collections.

A strong focus of donor programmes so far has been on capacity building, something S4H can leverage upon:

- GetFit Programme assisted the MoE in an IPP procurement process and provided Technical Assistance for drafting of legal agreements. Those could be used as a basis for future renewable energy procurements and PPAs
- Electricity Services Access Programme (ESAP) of the World Bank has also supported institutional capacity building for increased energy access in rural areas
- Increased Access to Electricity and Renewable Energy Production (IAEREP) Project of the EU is focused on Enhancement of Policy, Legal Regulatory Environment and Capacity Building for Renewable Energy and Energy Efficiency
- Renewable Energy Financing Framework is building capacity of local financial institutions *(see previous slide)*

Source: KOIS analysis
Interviews
Ministry of Energy, "SCALING-UP RENEWABLE ENERGY PROGRAMMES (SREP) INVESTMENT PLAN FOR ZAMBIA", 2018

UNDP DIFFER KOIS CARING FINANCE

No private investors present in the market due to extremely high perceived macroeconomic risk; energy investments done predominantly by bilateral/multilateral donors; banks reluctant to lend to RE sector

Table of investment initiatives in the sector in Zambia

Investment initiative	Funder	Objective	Fit with investment needs	Invested amount	Instrument
Increased Access to Electricity and Renewable Energy Production (IAEREP) Project	European Union	Increase access to clean, reliable, more equitable and affordable energy and promote renewable energy production and energy efficiency across Zambia	Enhancement of Policy, Legal Regulatory Environment and Capacity Building for Renewable Energy and Energy Efficiency	€40 million	Grant
Beyond the Grid Fund	USAID, Swedish Development Cooperation (SIDA)	Increase private- sector growth in off- grid renewable energy generation and distribution	De-risk commercially viable projects	$20 million	Grant
Electricity Services Access Programme (ESAP)	World Bank	Increase electricity access in Zambia's targeted rural areas	Enabling environments and building institutional capacity	$26,5 million	Loan
China- Zambia South-South Cooperation on Renewable Energy Technology Transfer Project	UNDP/ Government of Denmark	Strengthen the enabling environment for the transfer and use of priority renewable technologies in Zambia	Various	$2,7 million	Grant
Renewable Energy Resource Mapping Project	World Bank	Map solar and wind resource potential	Building energy infrastructure	$3,6 million	Grant
European Energy Efficiency Fund	European Union	Contribute to the mitigation of climate change; Attract private and public capital into climate financing	Enabling environments and building institutional capacity	€25 million	Grant
ElectriF	European Union	Support the national strategy by empowering investors and entrepreneurs active in the RE market	De-risk commercially viable projects	€40 million	Equity, quasi-equity, junior/senior debt, or guarantee

Source: KOIS Invest analysis

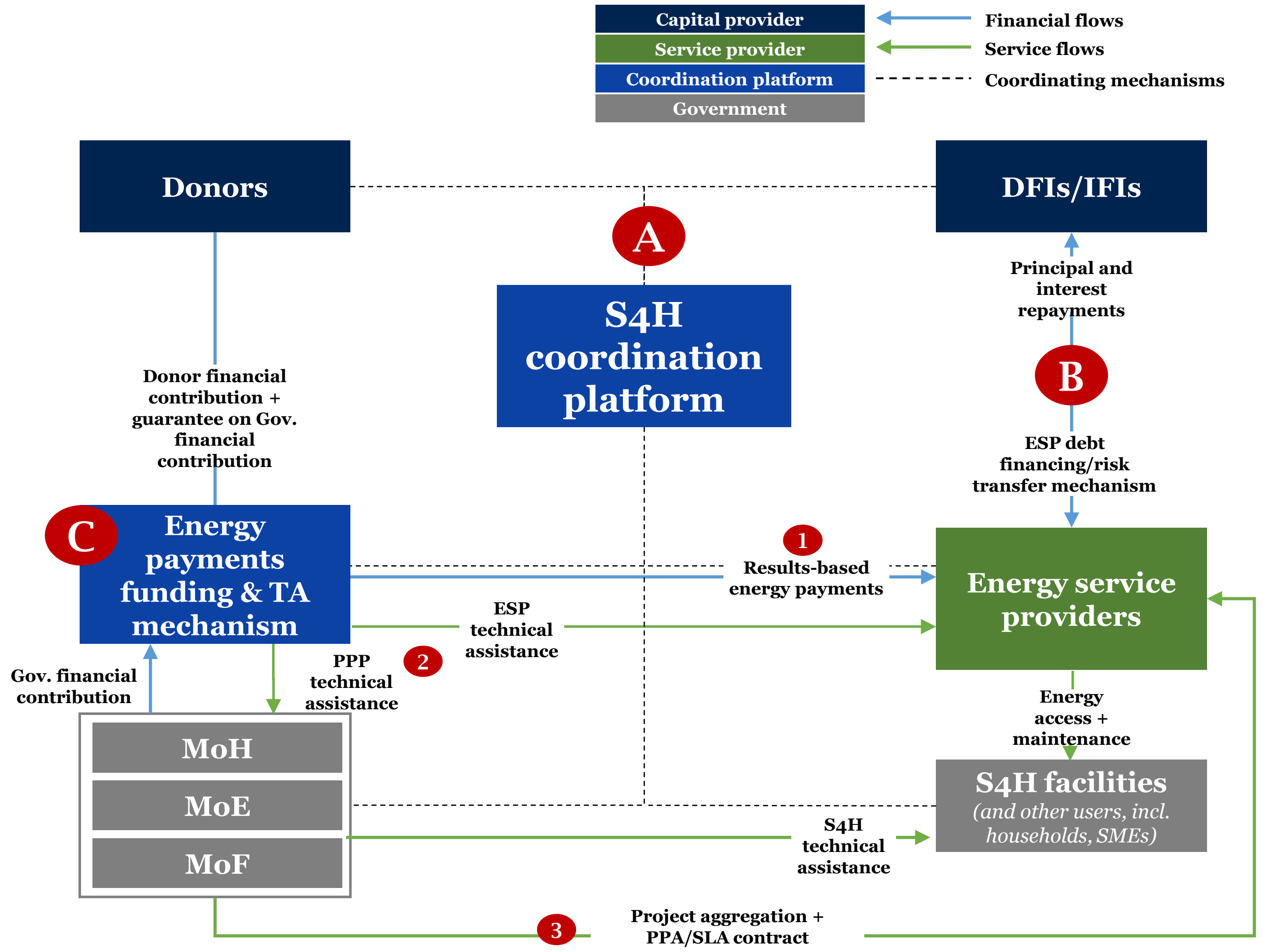
Additional climate finance facilities may also be relevant for Zambia off-grid solar energy context

Fund	Best fit	Who applies	Financing instruments	Application timeframe	Size of investment
The Global Innovation Lab for Climate Finance	Concepts that are in pre-pilot or early pilot stage	Private sector	Concessional loans, market rate loans	Open	Up to US$200 000
Energy 4 Impact	Early stage investment and de-risking of commercially viable projects	Private sector	Grants, Equity	Can only apply during rounds of call for proposals, currently closed	Up to US$2 million
Vital Capital Fund II	Ventures in all life-stages	Private sector	Equity	Rolling basis	Between US$10-50 million
Sustainable Energy Fund for Africa	Early stage investment and de-risking of commercially viable projects Enhancement of Policy, Legal Regulatory Environment	Private sector, Public entity	Grants, equity, In kind contribution	Rolling basis	Up to US$30 million
Zambia Renewable Energy Financing Framework	Green Climate Fund	Support the Government of Zambia's Renewable Energy Feed-in Tariff (REFIT) policy	Enabling environments and building institutional capacity	$150 million	Loan. equity and grant

Source: KOIS Invest analysis

Content

A S4H coordination platform allows to take more calculated risks and deploy more capital in the target markets that would not normally be addressed, while dynamising local private sector and earning a return



KEY BUILDING BLOCKS

A S4H coordination platform

- A national coordination mechanism to harmonize stakeholders' interventions (e.g. UN agencies, donors, DFIs/IFIs, private sector and government entities) to electrify health facilities, and combine efforts to achieve efficiency and sustainability, as well as to link energy and health sectors.

B ESP access to finance

- DFIs/IFIs will provide access to affordable financing and risk transfer mechanism for ESPs.

C Energy payments funding & TA mechanism

1 Funding mechanism for PPA leasing payments

- Donor and Gov, financial contributions to support results-based energy payments to ESPs.
- Contingent grants/guarantees provided by donors can additionally transfer Gov. counterparty risk on its share of financial contributions towards energy payments.

2 Capacity-building of ESPs, government stakeholders, and S4H facilities

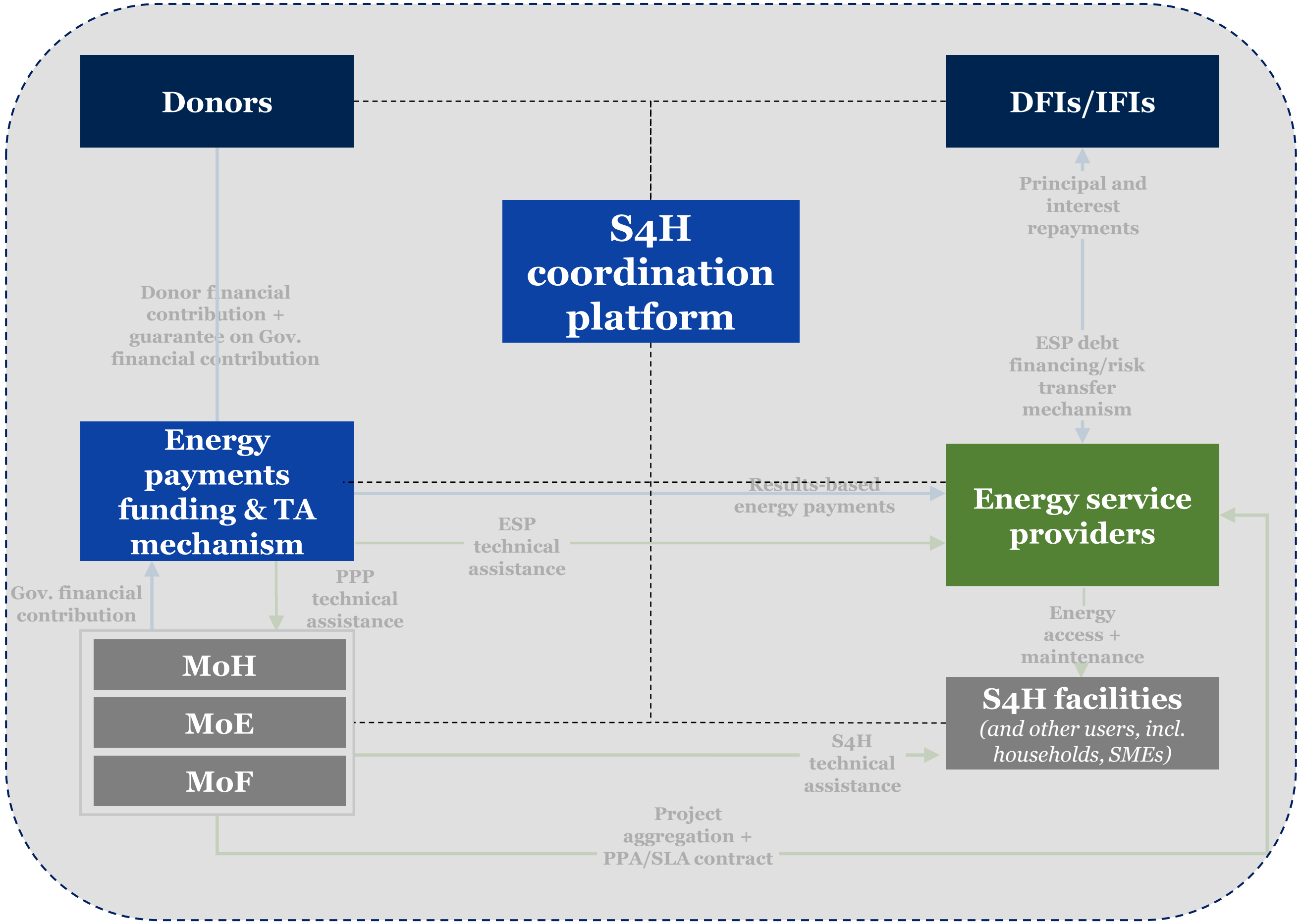
- Donor-funded technical assistance to strengthen (i) PPP procurement/ tendering, energy assessments, project development, and contractual/regulatory frameworks; and (ii) local ESP market development.

3 Project aggregation and PPA/leasing mechanism

- Pooled procurement/tendering for demand aggregation to develop investable ticket sizes for ESPs and DFIs/IFIs.
- PPA/leasing framework between Gov and local ESPs to ensure: (i) long-term sustainability of energy service; (ii) stable revenue streams for ESPs and market development; and (iii) reduced upfront capital expenditure costs for Gov.

The objective of the S4H coordination platform is to facilitate the interactions between the key stakeholders and oversee contractual relationships to align their incentives and activities

Zoom on S4H coordination platform



The S4H coordination platform plays a central role in bringing together all key stakeholders and coordinating their interactions and their contractual relationships.

- Facilitate access to capital for ESPs: the S4H coordination platform will ensure alignment of DFIs/IFIs, requirements with the terms of the PPP contract, facilitating access of ESPs to that capital. The S4H coordination platform also connects the ESPs with relevant DFIs/IFIs
- Support access to donor funding: the S4H coordination platform also mobilise donor funding to support the programme costs including energy payment, TA grants and guarantees
- Coordinate and align the objectives of the different stakeholders: different ministries, development partners and private sectors players need to be involved in the project implementations. The S4H coordination platform will ensure alignment between all the parties and coordinate their roles and responsibilities before and during the project implementation.

Specificities of the Zambian context

- Lack of local capital available, high interest rates and high inflation
- Relatively favourable environment for FDIs

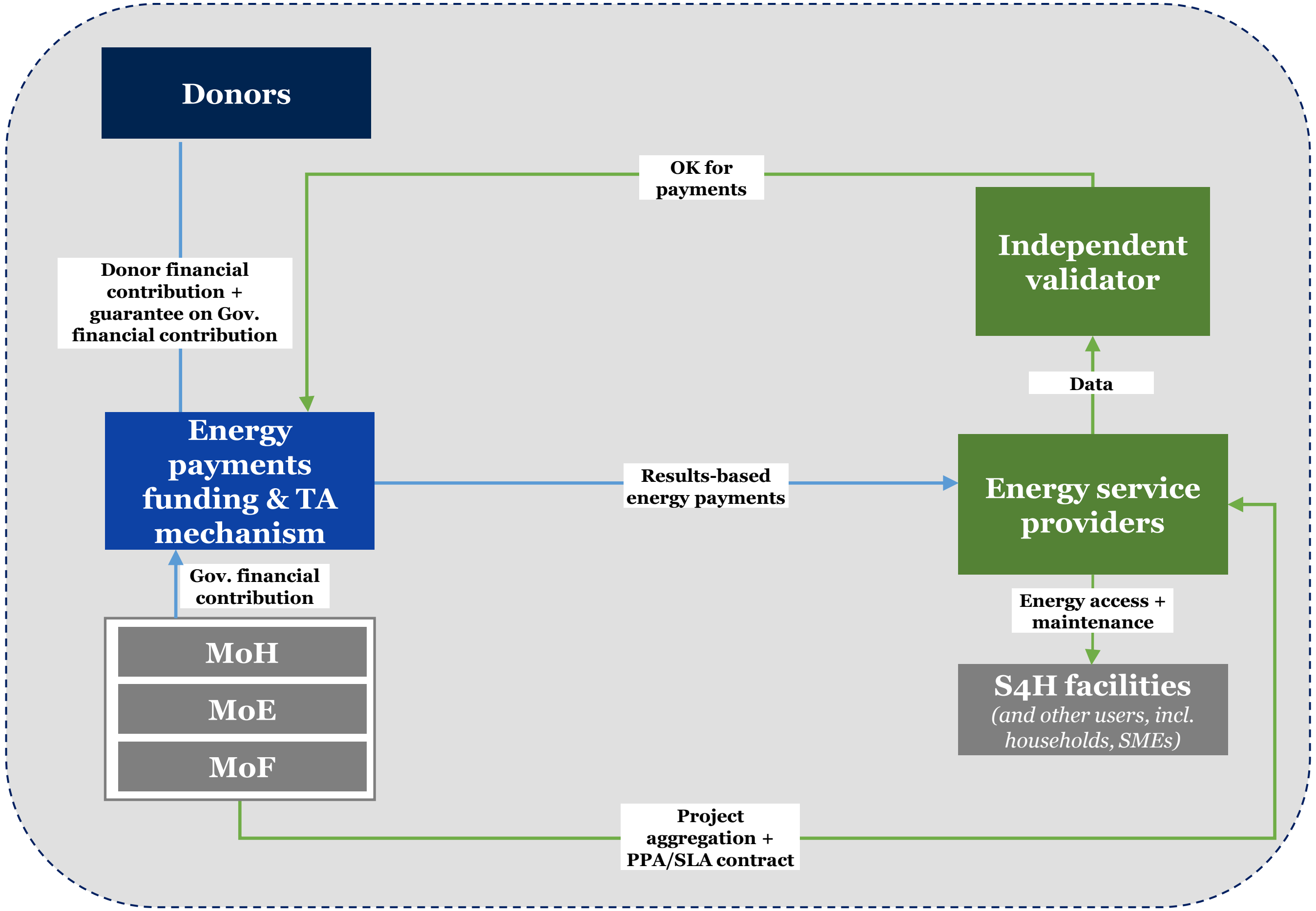
Recommendations for implementation

- Capital to be raised from international DFIs/IFIs
- Guarantees required might be challenging to obtain or costly

Source: KOIS analysis

Long term contract between the MoH and the ESP is a key element to ensure sustainability of the solar systems by aligning financial incentives for ongoing O&M

Zoom on PPA leasing payments



Long-term contractual agreements between the MoH and the ESP should contain features **supporting sustainability**:

- Payments spread over the contract duration give the ESP financial incentives to operate and maintain the solar installations
- SLA further sets contractual obligation for up to standard performance and incentivises the use of higher quality hardware
- Result-based payments ensure the ESP is providing an ongoing quality energy service over the full contract duration
- At the end of the contract asset, ownership could be transferred to the MoH and a new O&M contract tendered out
- ESP is contractually liable for the proper disposal of the hardware

Specificities of the Zambian context

- High number of healthcare facilities
- Local ESPs mainly present in urban areas and with limited staff
- Insufficient resources for O&M within the MoH requires the outsourcing of O&M

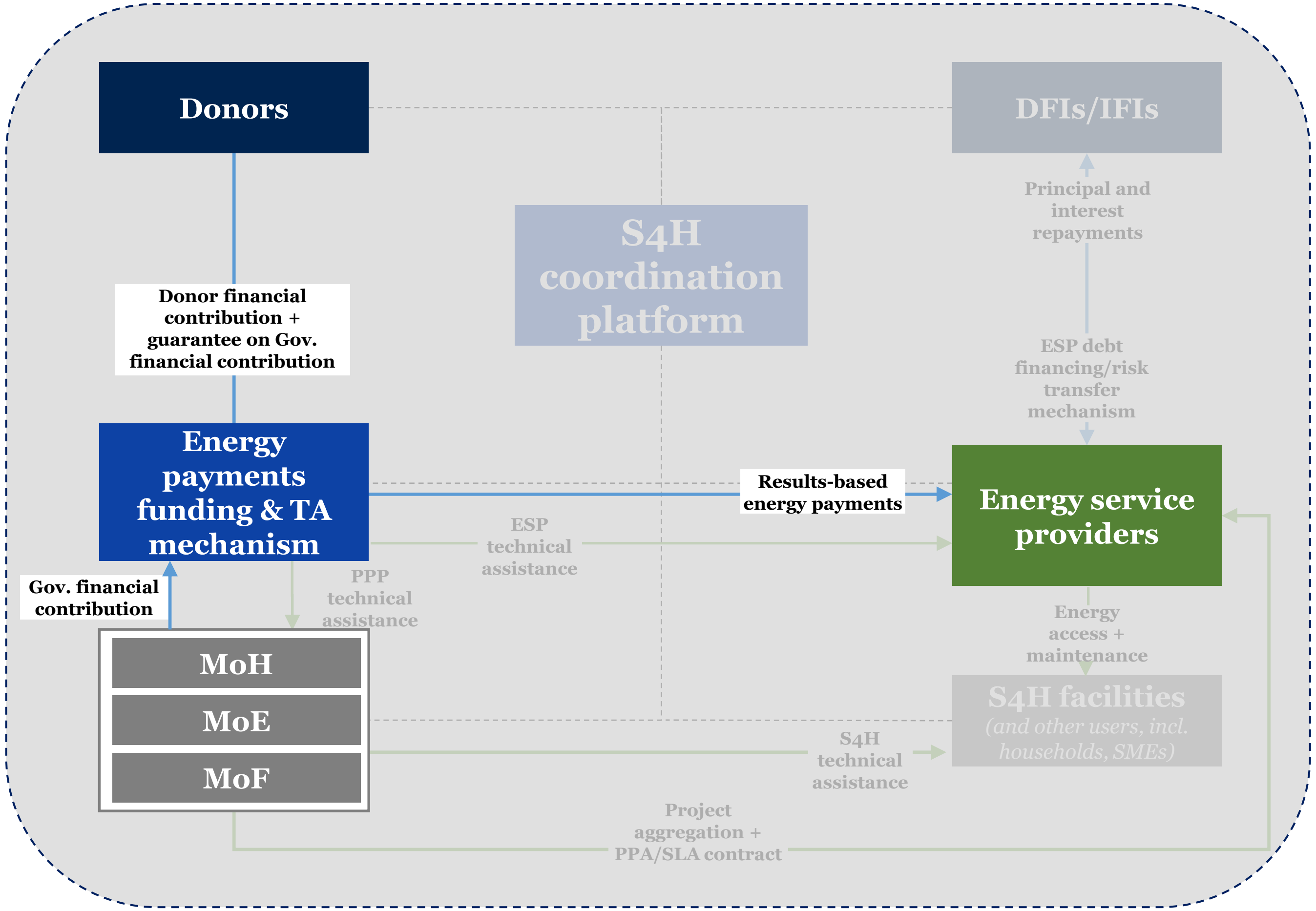
Recommendations for implementation

- MoH will be the off-taker responsible for energy payments under the PPA and shall be supported by donor funding
- Coordination with MoH district representatives to ensure buy-in at local level, consolidation of energy payments at the centralized MoH level and contract management with local support to monitor SLA
- Coordination with MoE to select healthcare facilities in scope and benefit from their expertise and technical knowledge including in IPP contracts
- Several regional contracts will be necessary to address the total market
- Potential need for a consortium with larger international ESP as a partner
- The ESP is responsible for the sustainability of the systems including regular maintenance, repairs, replacement over the contract period and provide O&M services directly or through local contractors

Source: KOIS analysis

The energy payment funding addresses the limited ability to pay of the MoH and reduces the repayment risk for the investors

Zoom on energy payments funding



The energy payment funding is an **essential component** of the proposed model as it **manages grants for technical assistance** and **supports the low ability to pay of MOH** and largely **mitigates investors' risks** via:

- Transfer of the risk of GoM as a payer are transferred to donors, to the extent of their respective contributions to the energy payments
- Partial FX risk mitigation as donors' budgets are typically denominated in a hard currency (e.g., USD, EUR) and the investor payments can be matched to their revenue streams to the extent of donors' contribution to the energy payments
- Buy-in and long-term ownership of MoH is ensured via MOH's (limited) financial participation and the long-term commitments, leading to a better sustainability of the systems beyond the investment period

However, there are **several challenges** that are yet to be addressed

- Long-term donor commitments are complicated as donors typically work with shorter budget periods (i.e., 2-3 years, exceptionally up to 5 years)
- Increased coordination of donors limiting suboptimal funding allocations
- Capacity and proactivity of MoH is required as it is best positioned to coordinate the donors and align their funding with national health priorities

Specificities of the Zambian context

- Very low ability to pay, lack of credit-worthiness and high public debt
- Limited donor funding as a result of past fraud cases, raising sufficient funding (from MoH and donors) might be a challenge

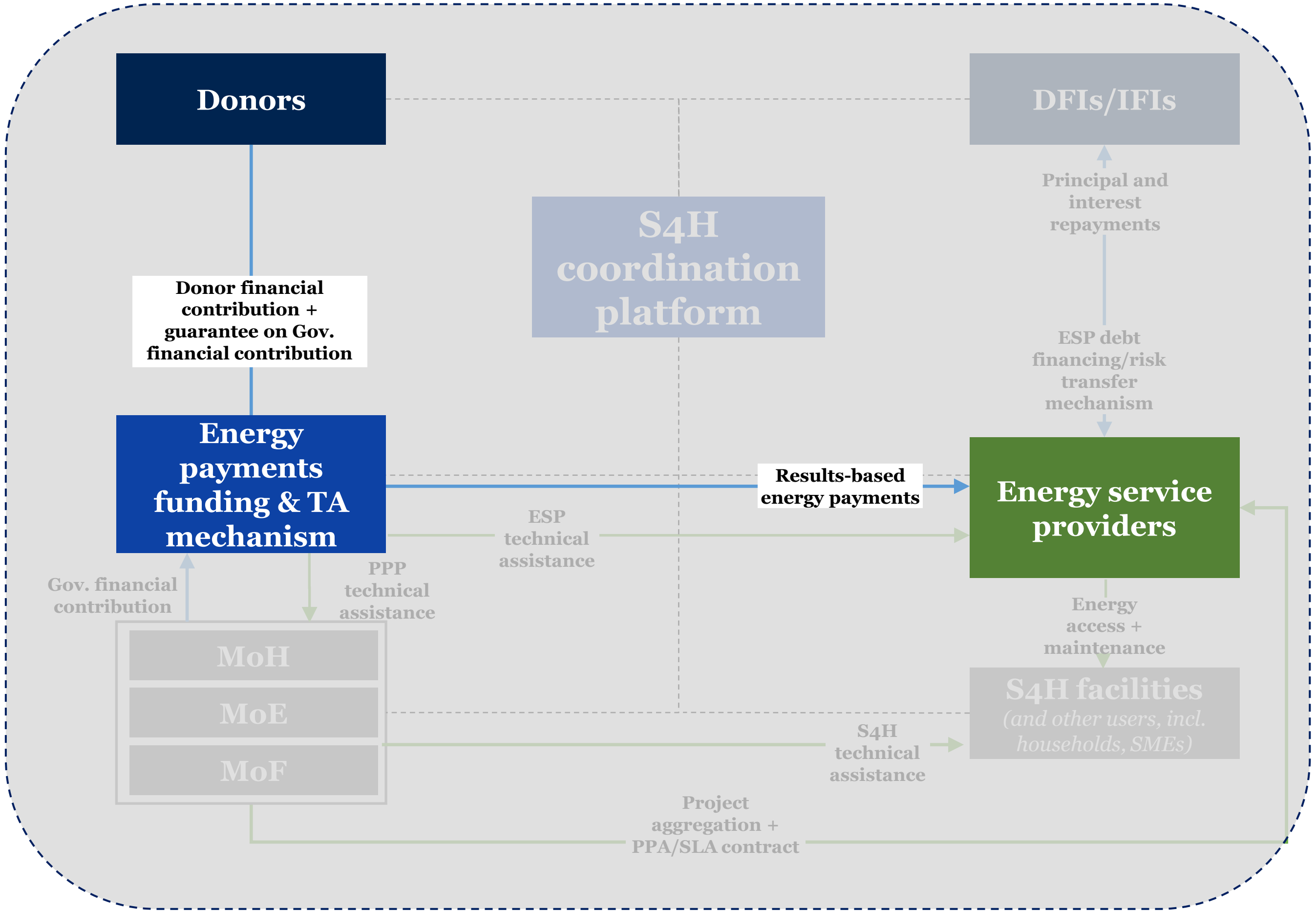
Recommendations for implementation

- Donor funding should not be channelled through the MoH
- UNDP to support MoH in raising donor support for the programme

Source: KOIS analysis

The credit worthiness of the MoH and the difficulty to secure donor funding for the full length of the investment will make guarantees paramount to provide comfort to DFIs/IFIs in financing S4H contracts

Zoom on guarantees



Guarantees could **support the low credit worthiness** of the MoH and **help bridge the difficulty to secure donor funding** for the full length of the investment at two levels:

- Payment guarantee to backstop energy payment obligation of MoH to the ESPs under the PPA
- Partial loan guarantee to provide credit enhancement to facilitate financing of the ESP at more favourable terms

Specificities of the Zambian context

- Low credit-worthiness
- High level of debt
- No sovereign guarantees available

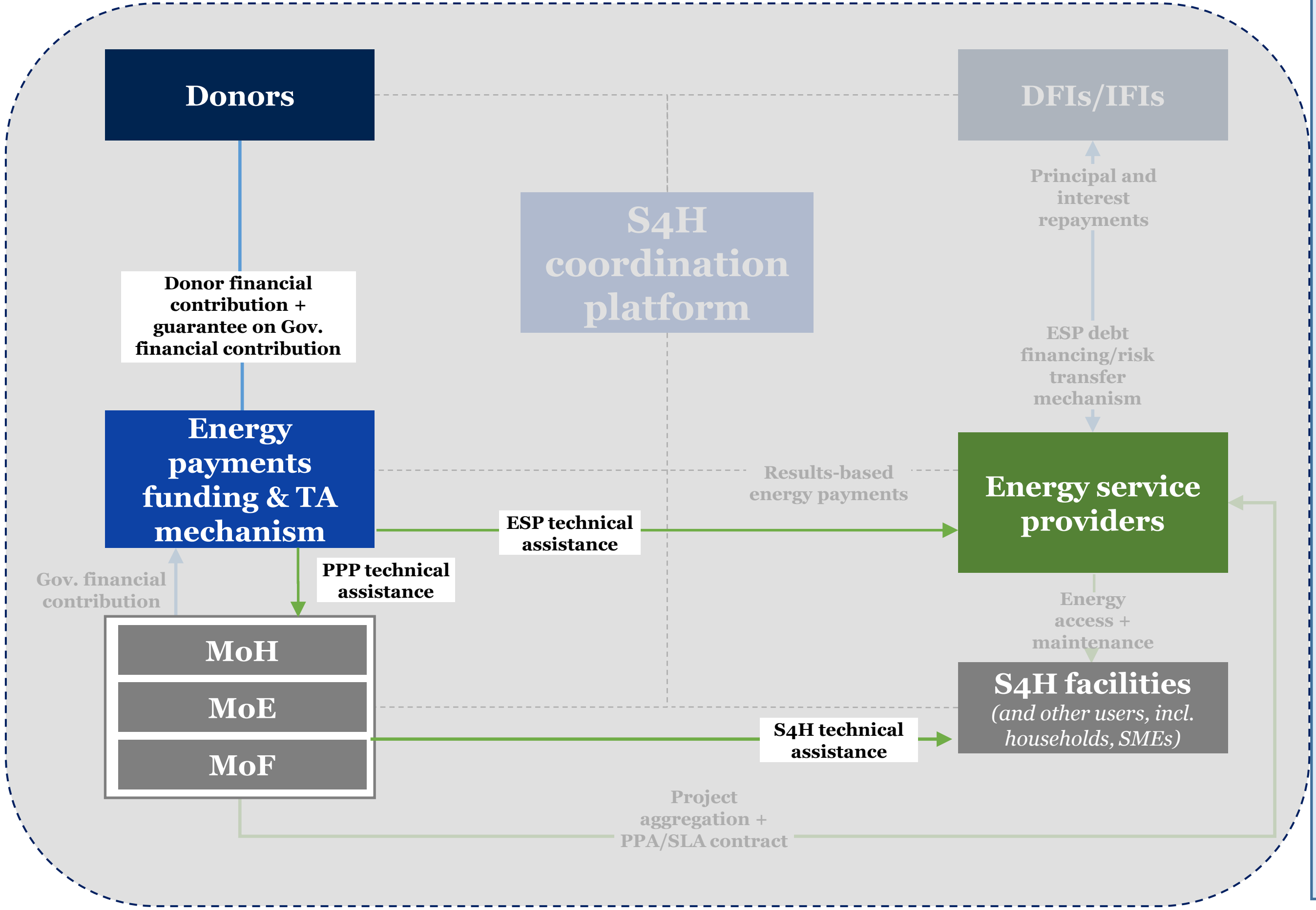
Recommendations for implementation

- Guarantees will be required and cover a high percentage of MoH obligation
- Appetite of guarantee providers will be limited and likely costly but will be necessary

Source: KOIS analysis

The S4H programme aims to develop local capabilities and technical assistance will be required to support the MoH and the local ESP market in its ability to implement the S4H contracts

Zoom on technical assistance



TA will be required to **further enhance long-term sustainability** at two levels:

- TA to the ESPs
  - Project grants of 10% to 30% of investment cost to support project development costs and increases local ESPs competitiveness
  - Capacity building and training for sizing, installation and O&M
- TA to MoH
  - Tender preparatory phase including need assessment, definition of tender terms and quality standard
  - Tender process including drafting of the contractual agreement, evaluation of proposal, support with due diligence
  - Contract negotiation, management and evaluation post tender

Specificities of the Zambian context

- MoE has expertise with energy PPAs and benefited from GetFit TA for the full procurement process
- Local ESPs concentrated in urban areas
- Although dynamic and growing missing critical size to bid for large contracts

Recommendations for implementation

- TA to support the MoH will be needed but can build upon previous GetFit initiative
- Market might need to be split in smaller regional contracts to allow local ESPs to participate
- Consortia with international companies have potential to build local capabilities
- TA will be needed to support local ESPs

Source: KOIS analysis

The Zambian context provides a challenging environment to mobilise donors support and to the guarantee mechanism necessary for the S4H scale up feasibility.

The S4H coordination platform coordinates contractual relationships to align incentives and activities of key stakeholders

S4H coordination platform brings together all stakeholders and defines their roles and responsibilities. Its role is also to facilitate local ESPs access to DFI/IFI capital

Medium feasibility

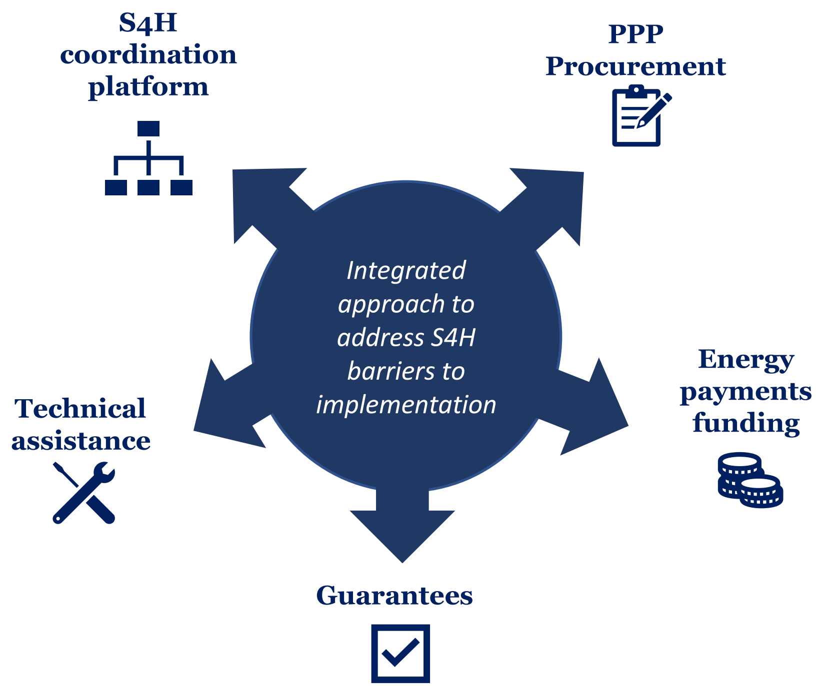
- Large number of facilities requiring prioritization and selection of healthcare facilities to be in scope
- Decentralized management increasing complexity
- Existence of funds providing concessional financial to ESPs locally

Technical Assistance to MoH and to the ESPs in line with S4H coordination platform requirements and PPP contract requirements supporting sustainability

Support the procurement process and alignment with DFIs requirements as well as ESPs in their access to financing throughthe platform. Further ensure the sustainability by building technical capacity limiting operational risk

High feasibility

- Existence of TA projects supporting the development of the RE sector
- REA and University of Zambia can support technical CB of the MoH and of the ESP
- Possibility to leverage on GetFit TA to the MoE



Guarantees over the payment obligation of the MoH under the PPP or the loan repayment obligation of the ESPs

Mitigate investors' credit risk on public exposure to raise sufficient capital under the S4H coordination platform, provide risk coverage in case of default of the MoH or ESP(s)

Low feasibility

- Low credit worthiness of the MoH making the issue of guarantees difficult
- High level of debt making sovereign guarantees unavailable

Tender process for S4H PPP contract conducted by the MoH to award a PPP contract

Long-term payment commitment of MoH, and ESP's commitment to deliver pre-defined services to a contractual remuneration (used to repay the investors).

Medium feasibility

- Previous expertise with procurement process for IPPs (GetFit) although MoH is less familiar with energy PPPs
- Appetite from local companies but tenders should be of limited size to be accessible to local companies and support market development

Donors support energy payments funding from MoH to the ESP

The energy payments funding of the facilities in scope shall be covered by both MoH and donors. Due to donors' constrained time horizons, guarantees supporting MoH payment obligation over time might be necessary

Low feasibility

- Heavily constrained MoH budget to finance the programmes
- Decentralized budgets requiring local buy in
- Limited number of donors identified to support the programme
- Support from UNDP will be required to raise donor funding

Content

The S4H coordination platform might take approx. 1-1.5 years to launch, following the indicative structuring roadmap, the timeline could be further shortened by running some phases in parallel

1. ECOSYSTEM ANALYSIS
Engage with and interview relevant stakeholders on national level

2-3 months

Deliverable
- Comprehensive ecosystem analysis of S4H in Zambia

2. FUNDING MECHANISM
Obtain funding commitments from the Government of Zambia (i.e., MoH) and donors

2-3 months

Deliverable
- MoU between the MoH, donors and UNDP

3. OPERATIONAL DESIGN
Select specific HC facilities; reach out to potential ESPs

2 months

Deliverable
- Selected portfolio of healthcare facilities with defined energy requirements

4. FINANCIAL MODEL
Quantify the investment size; set initial hypotheses on investment terms

1 month

Deliverable
- Financial model with preliminary investment terms

5. PROCUREMENT
Pre-select and conduct due diligence on local energy service providers

3-6 months

Deliverable
- Formal evaluation of ESPs proposals
- Selection of ESPs for PPP contract

6. FUNDRAISING
Engage with potential investors (i.e., DFIs) and obtain their soft commitments

6-9 months

Deliverables
- Financial model with final investment terms
- Investment LoI signed

7. FIRST CLOSE AND LAUNCH
Finalise contracting and disburse funds for programme implementation

~1.5 years after the beginning of structuring[1]

[1] Timeline assuming sequencing of activities, activities 3 and 4 or 4-5 could partially run in parallel reducing the implementation timeline
Source: KOIS analysis

Procurement process under the S4H coordination platform will require TA to ensure all parties are aligned for a successful financing of the S4H programme

	1 Preparatory phase	2 Call for proposal	3 Proposal submission & evaluation	4 Award of contract and financing	5 Implementation
UNDP Coordination of key stakeholders In collaboration with TA advisors	- Supports national government in drafting the tender, need assessment and technical requirements setting - Aligns with financiers' requirements and with involved government entities mandates and strategy - Sets contractual relationship between the different parties	- Supports national government in conducting tender process - Supports ESPs and national government in proposal preparation (Q&A,…)	- Supports national government in evaluation of proposal - Supports/conducts due diligence process - Submits pre-selected bids for financiers' approval	- Coordinates financing agreement between financiers and ESP(s) - Provide TA to ESP(s) in fulfilling requirements to access financing from DFIs/IFIs	- TA to the national government for legal and financial aspects - TA to ESP(s) throughout implementation
National government MoH/OPPPI/PPP Unit/MoE	- Defines need, quality standards and PPP terms in collaboration with UNDP	- Issues tender for a group of healthcare facilities	- Evaluates and select ESP in collaboration with UNDP/the S4H coordination platform	- Awards the contract to selected ESP - Validates internal budget lines for the PPP contract	- Contracts drafting with TA support
Energy service provider Local ESP/Joint-Venture/…	n/a	- Interaction with UNDP/ national government to develop their proposal	- ESPs submit their technical and financial proposal - Provide additional information as needed	- Introduce financing request to financiers with the support of the S4H coordination platform	- PPP and financing contract negotiation with the support of the S4H
Financiers DFI/IFIs	- Provide input on financing terms and requirements (tenor, size, risk mitigants required, …) to UNDP	n/a	- Evaluate proposals and conduct financial due diligence - Pre-approve financing of projects (fund, bilateral or club deal)	- Negotiate financing terms with the support of the S4H - Validate financing to selected ESP	- Financial contract negotiation with ESPs with the support of the S4H

Source: KOIS analysis

Operations at country level during and after implementation requires clear accountability and distribution of roles and responsibilities among stakeholders

At inception

Contractual

- Procurement process (supervised by UNDP) to select the ESP for a long-term PPA to procure, install and maintain solar systems for a group of healthcare facilities (regional/national)
- PPA contracts are drafted by legal advisors in collaboration with MoH and UNDP

Installation

- ESP is responsible for the procurement, the installation and precise need assessment
- MoH provides contractual guidelines for the quality requirements and standards as well as required service level

Financial

- ESP can get a loan from DFIs/IFIs at an advantageous interest rate
- ESP is responsible for repayment of the loan
- Leasing payments from the MoH and donors to the ESP are defined in the PPA and paid to the ESP or to an escrow account pledged to the lender or go through UNDP

During implementation

Contractual

- PPA between MoH and ESP who shall ensure access to energy for healthcare facilities – an SLA defines the contractual level of service required from the ESP
- MoH is responsible for contract management and coordination through district/regional representatives to verify the systems are working and are operated properly
- Technical assistance can be foreseen to support the MoH in contract management

Operations and maintenance

- ESP is responsible for the sustainability of the systems including regular maintenance, repairs, replacement over the contract period
- ESP through their own teams or network or a subcontractor will be responsible of the O&M under the PPA
- ESP is responsible and liable for proper disposal of the hardware
- An independent evaluator monitors the performance to authorise result-based energy payments

Financial

- UNDP supervises energy payments from MoH and manages donor contributions
- MoH and donors make result-based energy payments to the ESP as long as the SLA is respected
- ESP repays its debt to the DFIs/IFIs (principal + interest)

Source: KOIS analysis

UNDP can leverage its in-house thematic expertise and broad network to play a strong coordinating role to support the launch and oversight of the recommended financing mechanisms[1]

Initial procurement of platform manager/ESP

- Leveraging UNDP's long experience with procurement processes, its geographical presence and ability to compare/assess proposals across countries to ensure a smooth and efficient procurement process as well as a good alignment with the S4H programme objectives

Coordination with donors and DFIs/IFIs

- UNDP coordinates with DFIs/IFIs to ensure alignment to successfully raise capital for S4H
- Building on UNDP's long-term established relationships with bilateral and multilateral donors present in each country as well as local public institutions (such as MoH) in order to set up and coordinate the S4H coordination platform and the energy payments funding throughout the programme lifetime

Advocating national policy change

- Using UNDP's broad thematic knowledge as well as a unique position of an international organization to (i) aggregate best case practices from different countries, (ii) facilitate exchanges between governments and (iii) promote RE policy change at a national level

Providing technical assistance to local ESPs

- Depending on the technical area, TA can be provided directly by UNDP or outsourced to an external TA provider
- In case of an outsourced TA, UNDP can play a role of procurement manager
- UNDP can connect ESPs and DFIs/IFIs and support them in the funding application process

Programme oversight and impact evaluation

- Benefitting from its geographical presence, UNDP can play a central role in defining the quality standards and their monitoring throughout the financed programme
- UNDP has the flexibility to leverage its in-house expertise or hire an external firm for a broader programme's impact evaluation

Monetising reductions of GHG emissions

- Acting as an intermediary between national governments and emission markets would reduce overall transaction costs, ensure comprehensiveness of the emission reduction efforts and create a new source of funding to the programme and national governments

[1] UNDP activities related costs will most likely be covered by their standard [8%] fee
Source: KOIS analysis

MoH together with UNDP can investigate additional revenue streams to support S4H implementation cost

Potential revenue stream	Opportunities	Challenges	How to mobilise those revenues
Diesel/utility bills reallocation	• Currently the MoH has a budget for energy expenditures that can be reallocated • Solar energy is cost effective compared to diesel in a long run, especially as diesel costs are likely to grow over time	• Long term sustainability is critical to ensure cost-effectiveness compared to diesel • Decentralised management requires alignment at all levels to facilitate reallocation of budgets	• Involvement and buy-in of at local levels
Connecting other users (public facilities, businesses, households)	• In off-grid areas, other users might benefit from a new energy access • Economies of scale can be reaped by connecting other public facilities • Dense areas with commercial clients are likely the best opportunity of business for ESPs	• If a mini-grid is set up with many connections, the complexity and the operational costs are likely to increase • Without substantial grant funding, mini-grid are not commercially viable • For public facilities only, greater coordination will be needed	• Mobilise rural electrification grants (in collaboration with MoE/REA) • Analyse potential for bankable anchor client • Mobilise other ministries (such as Ministry of General Education) to support the cost of a network for public facilities
Feed-in tariff	• GoZ's Renewable Energy Feed-in Tariff (REFiT) policy to develop 100MW of renewable projects	• Feed-in tariffs with financial compensation are being tendered to larger IPPs	• Assess if feed-in tariffs could be extended for the pool of S4H healthcare facilities similar to an IPP
Carbon credit	• Article 6 of the Paris Agreement introduces a mechanism for transferable emissions reductions ("carbon credits"), so called Internationally Transferred Mitigation Outcomes (ITMOs) • ITMOs/climate finance could potentially cover a good share of the operational cost budget, and insure steady income over time	• Relatively complex procedure, MoH might require TA to implement it • Probably non-cumulative with Green Climate Fund funding	• UNDP is in unique position to negotiate ITMO transfers with governments

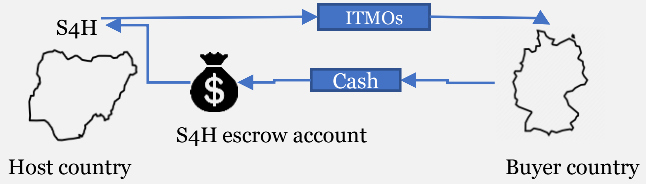
Carbon financing could be a clever way for national government to finance the S4H initiative and UNDP is well placed to support that process

- S4H can both reduce and avoid emissions and UNDP are in a very good position to monetize emission reductions under the Paris agreement. The UNDP can bring a solid project portfolio to the table with S4H, with good environmental and social benefits.
- ITMOs could be a "free" contribution to MHSS payment obligation under the PPP
  1. HC government can commit with "funds they did not have"
  2. S4H sells ITMOs from HCs
  3. HC Government gets health services in return
  4. UNDP manages programme
- It is possible to get upfront financing for the project. We recommend the UNDP to assess the potential for selling carbon and receiving upfront financing support from Korea, Sweden and Switzerland or even the Green Climate Fund could be a source of financing for the scheme.
- UNDP portfolio with mix of Least Developed Countries and low income countries health sector would be an interesting profile for buyers
- ITMOs/Climate finance could potentially cover a good share of the operational cost budget, and insure steady income over time.
- Assuming 42 ktoCO_2/year reduction could be achieved for the 5 countries in scope, the total income from credits is estimated to €1.1M over 7 years, discounted at 10%, using a scenario where 75% of the ITMOs go to UNDP for sale at €10.

7 years, 1-year ramp-up, 3 issuances over period, 10% discount	EU/CDM	Article 6 - 75% ITMOs	Article 6 - All ITMOs to UNDP	Korea/CDM
	€ 0.20	€ 10	€ 10	€ 20
Admin cost	-350 000	-450 000	-450 000	-340 000
CDM std emission factor	-325 252	478 043	787 391	2 134 782
Main scenario	-308 840	1 093 497	1 607 996	3 775 991
Use pool EF	-296 942	1 539 658	2 202 878	4 965 755

What is Article6/ITMOs?

- Article 6 of the Paris Agreement introduces a mechanism for transferable emissions reductions ("carbon credits"), so called Internationally Transferred Mitigation Outcomes (ITMOs)
- Article 6/ ITMOs (Paris Agreement) are still in negotiations.
  - The new system will involve G2G deals. It is expected to be hard to get signatures from host countries (UNDP has advantage)
  - Still discussions on ambition, baseline approaches, etc
  - Article 6 emissions reductions projects are in piloting stage (Sweden, Switzerland)
  - Expected deals to be done with governments in the beginning at prices a bit away from zero, with relatively round figures. (€5, €10, €15?)



Source: Differ analysis

Following this feasibility study, a number of steps would facilitate the successful launch of the implementation phase.

Regulatory framework

- **Support the development of the REA and the implementation of its mandates**
  - REA is developping several initiatives that can support the development of off-grid projects such as S4H
  - The implementation of those incentives is ongoing and still requires further development
- **Build upon the GetFit programme and lessons learned in the on-grid RE space**
  - Scalling solar is supporting the development of solar power plants
  - Standard documents and a process for PPPs has been established and S4H should leverage on this experience

→ **UNDP CO can lobby development of regulations and incentivise for the off-grid space.**
→ **UNDP shall collaborate and build upon other initiatives already present in Zambia**

Government bodies buy-in

- **Enrolment of UNDP concept note for GCF funding**
  - MoH to provide green light to move to project implementation
  - MoH/GoZ/NDA to endorse concept note to request GCF financial support for the implementation
- **Establish the priorities for the project**
  - Budget allocation of the MoH
  - Selection of facilities in scope
- **Coordination and alignment of stakeholders**
  - MoH and regional levels to select the facilities
  - MoE, REA align with the electrification plan
  - MoF/Treasury to ensure budget availability and support the PPP process

→ **UNDP CO shall facilitate that process, bring all the parties around the table to ensure a timely decision making**
→ **UNDP to engage with NDA and GCF post validation by GoZ**

Donors/DFIs mobilization

- **Mobilization of investment capital**
  - Preliminary discussions with identified potential financiers (DFIs, banks, pensions funds, other private investors)
  - Identification of investment terms and conditions to align procurement terms
- **Mobilization of donor support**
  - MoH will need support to meet its obligations under the PPP, it shall seek donor support to bring granst or guarantees
  - A pilot for a smaller group of facilities can demonstrate the programme value
- **Mobilization of climate finance and monetization of carbon credit**
  - Investigate the potential for additional climate related revenues of grants
  - Development of procedures to ensure those can be mobilized at implementation

→ **UNDP has expertise in carbon credit and can facilitate that process**
→ **UNDP is well connected and can provide comfort to potential lenders by supporting the S4H programme implementation and fundraising**

Indicative budget for implementation

Illustrative costs model details of assumptions and cost estimates provided separately

Illustration of initial costs

	Indicative costs in US$
Set up costs	
S4H set-up costs	[US$700k]
- S4H coordination platform structuring cost	*[US$500k]*
- Selection of the S4H coordination platform manager	*[US$100k]*
- Energy payment funding set up cost	*[US$25k] per country*
Technical assistance	
Technical assistance to MOH	[US$3m]
- Procurement, quality standards, legal assistance	*[US$600k] per country*
Technical assistance to energy service providers	[US$500k-1m]
- Training and capacity building (disbursed over ~3 years)	*[US$100-200k] per country*
CAPEX lending portfolio	
Lending portfolio[1]	[US$100m]
- Liberia	[US$23m]
- Malawi	*[US$21m]*
- Namibia	[US$2m]
- Zambia	[US$30m]
- Zimbabwe	[US$24m]

Set up costs

- Costs of setting-up the S4H coordination platform will depend on how UNDP will implement this platform and the potential outsourcing of structuring and fundraising activities
- We assume that the initial set up costs (i.e., structuring of the S4H coordination platform and funding mechanism in different countries, platform manager procurement) and cost of technical assistance will be paid independently by donors, prior to the S4H coordination platform launch

Technical assistance

- Technical assistance will be sized according to the need of each country
  - For the MOH consist of (i) tender preparatory phase including need assessment, definition of tender terms and quality standard and (ii) tender process including drafting of the contractual agreement, evaluation of proposal, support with due diligence, etc.
  - For the ESP contractor consist of (i) project grants of 10% to 30% of investment cost and (ii) capacity building and training for local operator
- Technical assistance will be financed by grants from donors or concessional investors and will likely be disbursed over the first years of the programme

CAPEX lending portfolio

- Lending book will be constituted as PPA contracts are awarded to ESPs. The loan shall cover the hardware cost to the ESP
- Financed by commercial and concessional investor over a period of min. 7 years
- Interest rate depending on the investor mix and portion of concessional capital

[1] Based on high level analysis of each country overall health care facilities energy need, actual numbers will be refined by UNDP in collaboration with the MOH
Source: KOIS analysis

Cash flows after implementation

Illustrative costs model
details of assumptions and cost estimates provided separately

Illustration of cash flows after implementation

	Indicative annual cost in US$	
Operating cash flow		
S4H coordination platform administration fee *[0,5%] of assets under management*	[US$500k]	• S4H coordination platform administration fee includes for instance coordination of the involved stakeholders, oversight of the payments, management of the technical assistance • S4H annual energy payments cover to the repayment of the CAPEX as well as operations and maintenance services provided by the ESP and the ESP margin, they are paid directly by the MoH/donors to the ESP on a monthly basis
S4H annual energy payments	[US$28m]	
- Liberia	*[US$6.2m]*	
- Malawi	*[US$5.7m]*	
- Namibia	*[US$630k]*	
- Zambia	*[US$8.4m]*	
- Zimbabwe	*[US$6.7m]*	
Financing cash flows[1]		
ESP repayment of debt + interest to the lenders	[US$20.5m]	• Annual repayment will depend on the tenor of the loan, interest rate and overall fund operating costs
- Liberia	*[US$4.8m]*	
- Malawi	*[US$4.3m]*	
- Namibia	*[US$435k]*	
- Zambia	*[US$6.2m]*	
- Zimbabwe	*[US$4.9m]*	
Disposal		
Disposal fee	[US$5.3m]	• Disposal cost is paid at the end of the hardware lifetime
- Liberia	*[US$1.2m]*	
- Malawi	*[US$1.1m]*	
- Namibia	*[US$110k]*	
- Zambia	*[US$1.6m]*	
- Zimbabwe	*[US$1.2m]*	

[1] Based on high level analysis of each country overall health care facilities energy need, actual numbers will be refined by UNDP in collaboration with the MOH
Source: KOIS analysis

Content

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By promoting the use of renewable energy solutions, S4H not only improves healthcare quality via increased energy access, but also reaps other additional indirect benefits for Zambia

Improved healthcare quality

In spite of great progress, HIV/AIDS remains the leading cause of death in Zambia. Neonatal mortality rates are 24 deaths per every 1 000 births (i.e., ranking 35/ 193 for highest incidences). Inadequate infrastructure and services are key factors hindering stronger progress for vulnerable groups such as women and children.

40% of public health facilities are connected to the grid, however electricity sourced from the grid is highly unreliable with frequent load shedding.

- **Ensuring quality:** S4H will provide health facilities with access to reliable energy, leading to strengthened resilience of the facilities as well as improved health outcomes, such as reduced HIV/AIDS infection rate and neonatal mortality rates.
- **Reduce inequalities in health services**: Rural health facilities are the ones that are often not connected to the grid where poorest population lives, bringing reliable energy access in rural areas will reduce the gap between rural and urban communities in terms of healthcare quality

Environmental benefits

Reliance on diesel generators is limited, with only 1% of health facilities using generators.

However, changes in climate pose serious challenges to Zambia's development. Droughts and floods have increased in frequency and intensity over the last two decades and adversely impacted energy generation, notably reducing hydropower generation capacity, which accounts for 80% of Zambia's electricity generation.

- **Increasing resilience to climate change:** Renewable energy can increase resilience to climate change challenges, such as droughts and reduce reliance on hydropower.

Development of local SE market

FDI in Zambia was US$408,4 million or 1,53% of the GDP, as of 2018, (vs. 1,9% in Sub-Saharan Africa). Zambia's economy is strongly dependent on copper mining – which alone accounts for around 70% of export revenue.

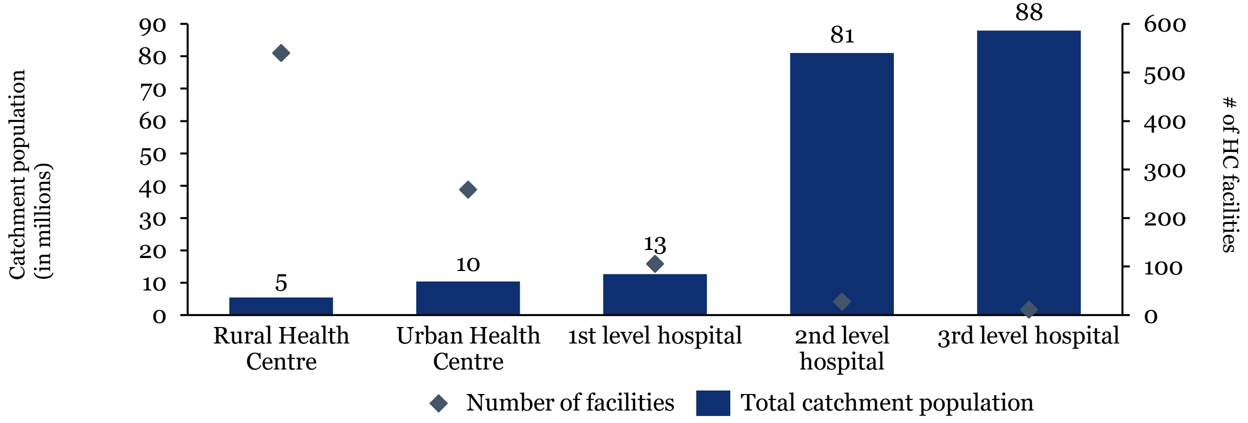
Approx. 25 local private off-grid energy companies operating in the market servicing different segments.

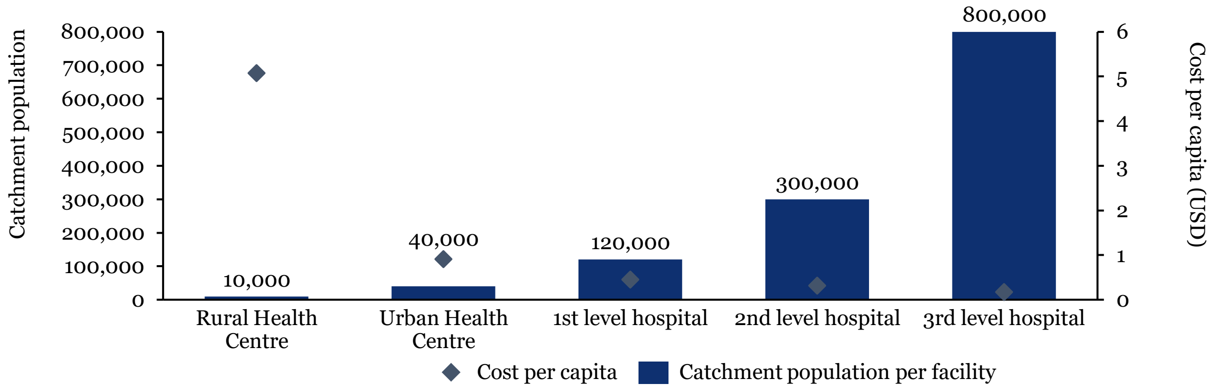
- **Stimulating local economy:** S4H can help catalyse FDI inflows, contributing towards development of energy sector, as well as create additional green jobs, especially for rural populations.
- **SE sector capacity-building:** S4H can help increase technical capacity of local ESPs, contributing towards further market transformation and uptake of solar technologies.
- **Generate new value chains** : The lifecycle of PV solar systems can create new value chains and develop local businesses especially for the replacement and recycling of batteries. Zambia is extracting cobalt for battery production and is therefore well placed to develop value added activities in that sector

https://www.climatelinks.org/sites/default/files/asset/document/2016%20CRM%20Fact%20Sheet%20-%20Zambia.pdf
https://www.bloomberg.com/graphics/2019-new-economy-drivers-and-disrupters/zambia.html
https://tcdata360.worldbank.org/countries/ZMB?indicator=1541&countries=BRA&viz=line_chart&years=1970,2018&country=ZMB
Source: World Bank; Bloomberg; USAID; UNICEF Zambia; UNDP Solar for Health Strategy Overview; KOIS analysis

Solar for Health has the potential to increase the healthcare quality for more than 900.000 people close to a facility not connected to the grid.

- By electrifying all rural health centres, that are most often off-grid, it is about than 5.4 m people getting access to better healthcare quality especially in poorest rural areas
- Even though 1st level hospitals have the largest catchment population they are often connected to the grid, prioritizing off-grid health centres will have a stronger impact in level of care for off-grid facilities
- However, for those facilities the cost per capita is the highest as all other things equal, the cost is higher for smaller facilities and for off-grid facilities
- It can be considered that electrifying remote rural clinics will have a stronger impact on the level of care than in larger on-grid facilities having alternative power supply
- There could be a trade-off between the number of patients that can benefit from the programme and the marginal difference of healthcare quality a patient can benefit from depending on the budget and the type of facilities selected

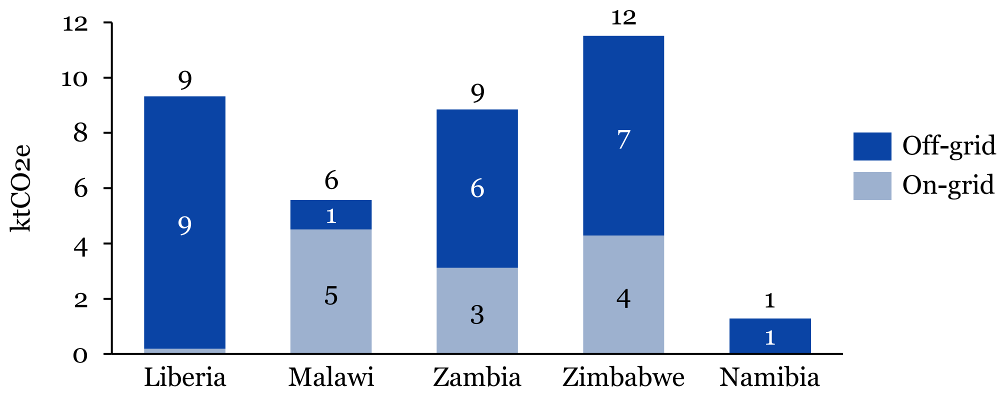




Sources : Republic of Zambia report of the committee on health, community development and social services for the third session of the twelfth national assembly

Assuming solar solutions are installed at all facilities, S4H could achieve a reduction of 42 ktCO2e/year for the five countries together and about 10 ktCO2/year in Zambia.

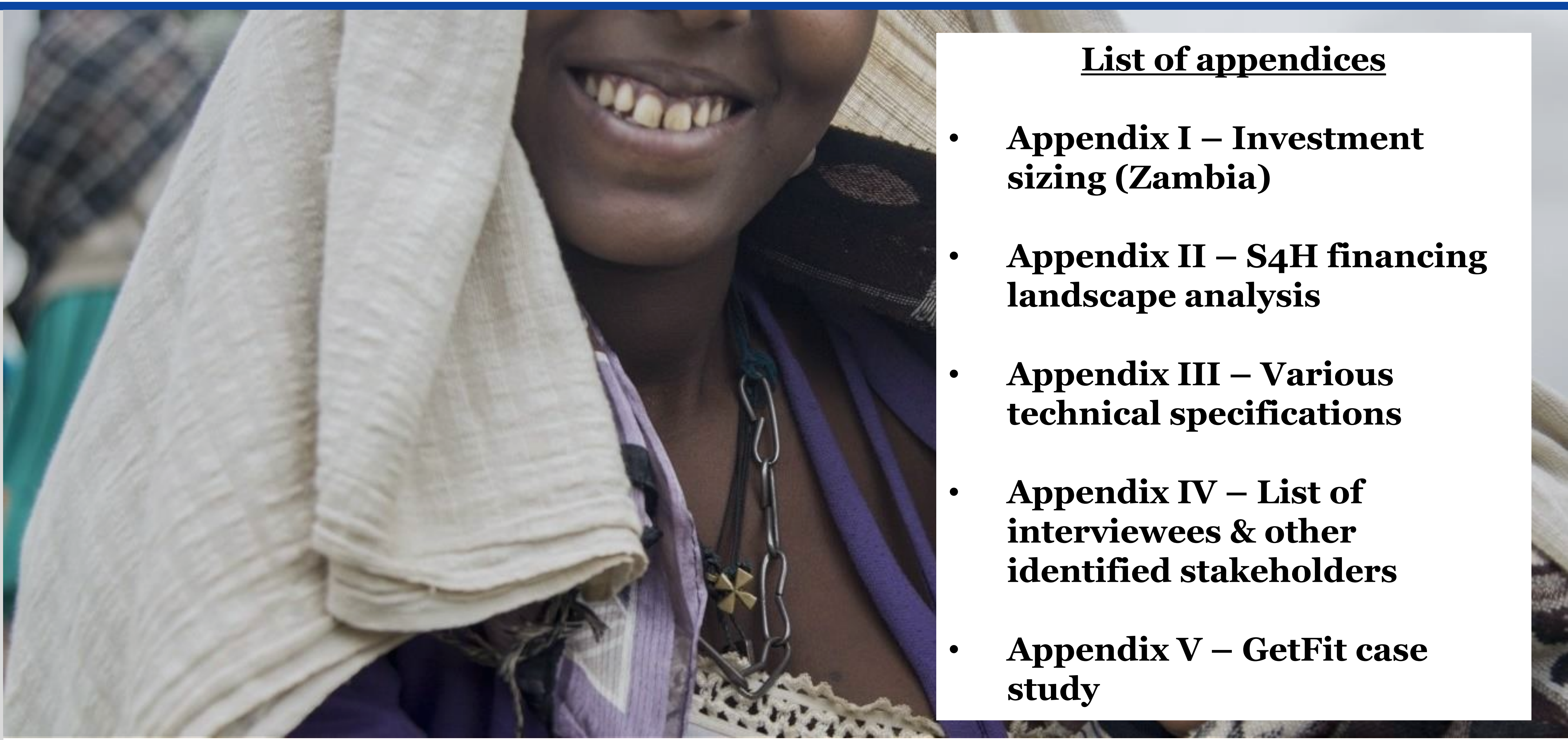
Annual emissions reductions per country



Annual emissions reductions in Zambia

Zambia	Total	Rural Health Centre	Urban Health Centre	1st level hospital	2nd level hospital	3rd level hospital
Diesel efficiency	24%	20%	25%	30%	30%	30%
Diesel MWh	5 997	2 957	1 413	920	443	265
Grid MWh	10 052	2 957	3 296	2 146	1 035	618
tCO2/year	9 994	4 848	2 524	1 481	714	427

- Given limited access and low reliability of the grid, majority of CO2 emissions savings will be gained by choosing solar over diesel, some savings of grid emissions can also be achieved.
- Mainly rural health centres are off-grid but for on-grid facilities the unreliability of the grid also require frequent back-up solution. For diesel genset the performance can be uneven and small systems are particularly inefficient.
  - For this analysis, we have assumed that the rural health centres are least effective (20%), urban health centres run at 25% and that hospitals can reach efficiencies up to 30%.
  - We have assumed that 30% of urban facilities and 50% of rural facilities are using diesel
- Rural health centres are potentially relying more on diesel and therefore they have the highest potential for CO2 reduction.
- Solar PV is an environmentally friendly technology with zero emissions. Hence, installation of solar PV completely removes CO2 emissions from power production at the healthcare facilities.



List of appendices

- **Appendix I – Investment sizing (Zambia)**
- **Appendix II – S4H financing landscape analysis**
- **Appendix III – Various technical specifications**
- **Appendix IV – List of interviewees & other identified stakeholders**
- **Appendix V – GetFit case study**

Appendix I – Investment sizing (Zambia)

Investment sizing (1/3)

Zambia settings			
Bad days/year	24	Period (years)	7
Built-in autonomy	25%	Discount rate (% p.a.)	10%
Diesel cost/kwh	0,32	Diesel budget shortfall	0%
Diesel cost/kwh incl. O&M	0,37	Reserve for back-up	0%
Grid cost	0,03	Annualisation factor	5,36
Sun hours/day	5,00	Power source for autonomy	PV

Number of healthcare facilities by type							
Size	1	2	3	4	5	6	Total
County	Health Post	Rural Health Centre	Urban Health Centre	1st level hospital	2nd level hospital	3rd level hospital	Per county
Central	120	99	31	8	2	0	260
Copperbelt	89	56	91	9	6	2	253
Eastern	134	147	13	10	1	1	306
Luapula	75	133	3	9	2	0	222
Lusaka	96	60	39	17	2	7	221
Muchiga	58	67	8	5	2	0	140
North Western	60	144	12	13	2	0	231
Northern	80	93	10	8	2	0	193
Southern	147	153	38	13	5	1	357
Western	139	128	13	13	3	0	296
TOTAL	998	1080	258	105	27	11	2 479
Programme coverage by facility type							
% covered		50%	100%	100%	100%	100%	
# installations covered	0	540	258	105	27	11	941

Source: Differ and Kois analysis

Investment sizing (2/3)

Assumptions
*0. Only **public** HC facilities are covered*
1. Health post and 50% of rural health centre are not connected to the grid
2. Most of health post and rural health centres mainly have solar energy but only 50% of them get their full need covered
3. Generators are back-ups for hospitals and some urban health centres (30%) given unreliable grid
4. Health posts are out of scope

Total hardware (CAPEX) cost	29 966 785

Need by HC facility type (in terms of installed capacity)	Zambia					
	1	2	3	4	5	6
	Health Post	Rural Health Centre	Urban Health Centre	1st level hospital	2nd level hospital	3rd level hospital
Required autonomy (days)	0,25	2,00	0,50	0,50	0,50	0,50
Days to fully charge	0,25	2,00	0,50	0,50	0,50	0,50
% of equipment included in autonomy	0,80	0,70	0,50	0,50	0,50	0,50
Daily consumption (kWh)	10,00	30,00	50,00	80,00	150,00	220,00
Installed capacity for daily load (kW)	2,0	6,0	10,0	16,0	30,0	44,0
Extra capacity for autonomy (kW)	0,0	3,7	2,5	4,0	7,5	11,0
Installed capacity need (kW)	2,0	9,7	12,5	20,0	37,5	55,0
Margin on equipment	20%	20%	20%	20%	20%	20%
Cost components						
Base kit	$2 309	$5 280	$8 200	$12 580	$22 800	$33 020
Battery	$1 562	$27 000	$11 250	$18 000	$33 750	$49 500
Extra panels	$0	$2 040	$1 388	$2 220	$4 163	$6 105
Total hardware cost	$3 871	$34 320	$20 838	$32 800	$60 713	$88 625
Margin on equipment	$774	$6 864	$4 168	$6 560	$12 143	$17 725
Design	$1 200	$1 600	$2 000	$2 600	$4 000	$5 400
Install	$640	$1 120	$1 600	$2 320	$4 000	$5 680
Ship	$300	$400	$500	$650	$1 000	$1 350
Cost budgeting						
Initial investment outlay ($)	$ 6 785	$ 44 304	$ 29 105	$ 44 930	$ 81 855	$ 118 780
Annual O&M cost ($)	$ 1 120	$ 1 581	$ 1 750	$ 2 200	$ 3 250	$ 4 300
Hypothetical initial cost of genset ($)	$ 750	$ 2 250	$ 3 750	$ 6 000	$ 11 250	$ 16 500
Hypothetical annual diesel cost ($)	$ 1 671	$ 3 487	$ 5 812	$ 9 299	$ 17 435	$ 25 572
Hypothetical annual grid cost ($)	$ 99	$ 296	$ 493	$ 788	$ 1 478	$ 2 168
Cost splits (autonomy)						
PV cost	$ 6 785	$ 13 506	$ 20 567	$ 31 466	$ 56 610	$ 81 754
Extra autonomy cost	$ -	$ 30 798	$ 8 538	$ 13 464	$ 25 245	$ 37 026
0.25 day battery autonomy system	$ 6 785	$ 44 304	$ 29 105	$ 44 930	$ 81 855	$ 118 780
0.25 day autonomy system + diesel	$ 8 238	$ 17 865	$ 27 833	$ 43 091	$ 78 407	$ 113 723
0.25 day autonomy system + grid	$ 6 785	$ 13 662	$ 20 826	$ 31 881	$ 57 388	$ 82 894

Source: Differ and Kois analysis

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Investment sizing (3/3)

TOTAL COST with pure PV autonomy							
	Health Post	Rural Health Centre	Urban Health Centre	1st level hospital	2nd level hospital	3rd level hospital	TOTAL
Initial inv.	$ -	$ 23 923 917	$ 7 509 090	$ 4 717 650	$ 2 210 085	$ 1 306 580	$ 39 667 322
Annual O&M (pre-markup)	$ -	$ 568 980	$ 301 000	$ 154 000	$ 58 500	$ 31 533	$ 1 114 013
Annual O&M	$ -	$ 853 470	$ 451 500	$ 231 000	$ 87 750	$ 47 300	$ 1 671 020
PV	$ -	$ 7 293 240	$ 5 306 241	$ 3 303 930	$ 1 528 470	$ 899 294	$ 18 331 175
Battery	$ -	$ 16 630 677	$ 2 202 849	$ 1 413 720	$ 681 615	$ 407 286	$ 21 336 147
kW	1996	10449	3225	2100	1013	605	19388
%	0,00%	36,84%	29,34%	19,10%	9,21%	5,50%	100,00%

Chosen autonomy mix							
Power source	Health Post	Rural Health Centre	Urban Health Centre	1st level hospital	2nd level hospital	3rd level hospital	TOTAL
PV	100%	100%	100%	100%	100%	100%	100%
Diesel	0%	0%	0%	0%	0%	0%	0%
Grid	0%	0%	0%	0%	0%	0%	0%

Total cost (present value of inv & annuity)							
	Health Post	*Rural Health Centre*	*Urban Health Centre*	*1st level hospital*	*2nd level hospital*	*3rd level hospital*	TOTAL
Catchment population							
Total hardware cost	$ -	$ 18 532 598	$ 5 376 075	$ 3 444 000	$ 1 639 238	$ 974 875	$ 29 966 785
Turnkey cost	$ -	$ 23 923 917	$ 7 509 090	$ 4 717 650	$ 2 210 085	$ 1 306 580	$ 39 667 322
O&M cost	$ -	$ 853 470	$ 451 500	$ 231 000	$ 87 750	$ 47 300	$ 1 671 020
Total outflows	$ -	$ 24 777 387	$ 7 960 590	$ 4 948 650	$ 2 297 835	$ 1 353 880	$ 41 338 342
PV of total commitment	$ -	$ 28 494 471	$ 9 926 990	$ 5 954 715	$ 2 680 009	$ 1 559 884	48 616 070
Total commitment	$ -	$ 29 898 207	$ 10 669 590	$ 6 334 650	$ 2 824 335	$ 1 637 680	51 364 462
%	0,00%	58,61%	20,42%	12,25%	5,51%	3,21%	100,00%
Cost/capita	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

Savings of diesel/grid costs (est., ignoring autonomy)	Health Post	Rural Health Centre	Urban Health Centre	1st level hospital	2nd level hospital	3rd level hospital	TOTAL
Initial cost of gensets	$ -	$ 1 215 000	$ 967 500	$ 630 000	$ 303 750	$ 181 500	$ 3 297 750
Annual diesel savings (est.)	$ -	$ 1 882 995	$ 1 499 422	$ 976 368	$ 470 749	$ 281 287	$ 5 110 822
PV of Annual diesel savings (est.)	$ -	$ 10 083 932	$ 8 029 797	$ 5 228 705	$ 2 520 983	$ 1 506 365	$ 27 369 782
Annual grid savings (est.)	$ -	$ 47 895	$ 120 773	$ 78 643	$ 39 913	$ 23 849	$ 311 073
PV of Annual grid savings (est.)	$ -	$ 256 492	$ 646 771	$ 421 153	$ 213 743	$ 127 718	$ 1 665 877

Initial cost of basic PV system	$ -	$ 7 293 240	$ 5 306 241	$ 3 303 930	$ 1 528 470	$ 899 294	$ 18 331 174,90
Initial cost of autonomy	$ -	$ 16 630 677	$ 2 202 849	$ 1 413 720	$ 681 615	$ 407 286	$ 21 336 147,10

Source: Differ and Kois analysis

Appendix II – S4H financing landscape analysis

Lack of energy supply and access is a major issue for healthcare quality in Sub-Saharan Africa, solar energy could be a sustainable solution

Inadequate access to power is a major obstacle to quality healthcare in Sub-Saharan Africa (SSA)

Most health facilities in SSA have inadequate access to power

- 25% of health facilities in sub-Saharan Africa have no access to electricity
- Only 28% of health facilities and 34% of hospitals have "reliable" access to electricity
- Off-grid facilities often rely on stand-alone powered generators, most of which are not functional

This is a critical obstacle to the realisation of universal access to quality healthcare

- Unreliable power affects lighting for emergency night-time care (e.g. births), refrigeration (e.g. vaccines), use of medical technology (e.g. sterilisation) and communication (e.g. contacting emergency care personnel)
- Facilities that have access to electricity may be better positioned to attract and retain skilled health workers, especially in rural areas
- High cost of power (e.g. diesel for generators) weigh on constrained health budgets

Solar energy could be a solution, but barriers exist

Solar energy could provide a reliable power supply in remote areas or a backup for grid-connected facilities

- Price of solar panels have significantly decreased in the past decade
- SSA has ideal solar conditions
- Although a larger initial investment is necessary compared to other solutions (e.g. diesel generator), it is a cost effective

But there are several barriers to electrifying health facilities

- Weak enabling environments due to:
  - lack of policies, regulation and technical standards
  - lack of awareness and information
  - underestimation of the potential impact of electricity access on healthcare
  - underdeveloped local energy sector and infrastructure
- Premature fail of solar installation due to:
  - insufficient human capacity resulting in inadequate management and maintenance of the power system
  - lack of data resulting in poor system sizing and poor installation
- Insufficient investment capital and financial means due to:
  - lack of monetisation of environmental and healthcare benefits
  - high upfront capital needed

WHO, Modern Energy Access and Health, 2017
WHO, Access to Modern Energy Services for Health Facilities in Resource-Constrained Settings, 2015

UNDP Solar for Health (S4H) has been piloting a donor-funded initiative to install solar systems in health centres in rural areas to provide clean energy services and quality healthcare to underserved communities

Key features

Solar for Health programme was launched in 2016

- 7.7 MWp of installed capacity in Zimbabwe, Zambia, Libya, Namibia, Sudan and South Sudan
- Financed by donors including the Global Fund and Innovation Norway

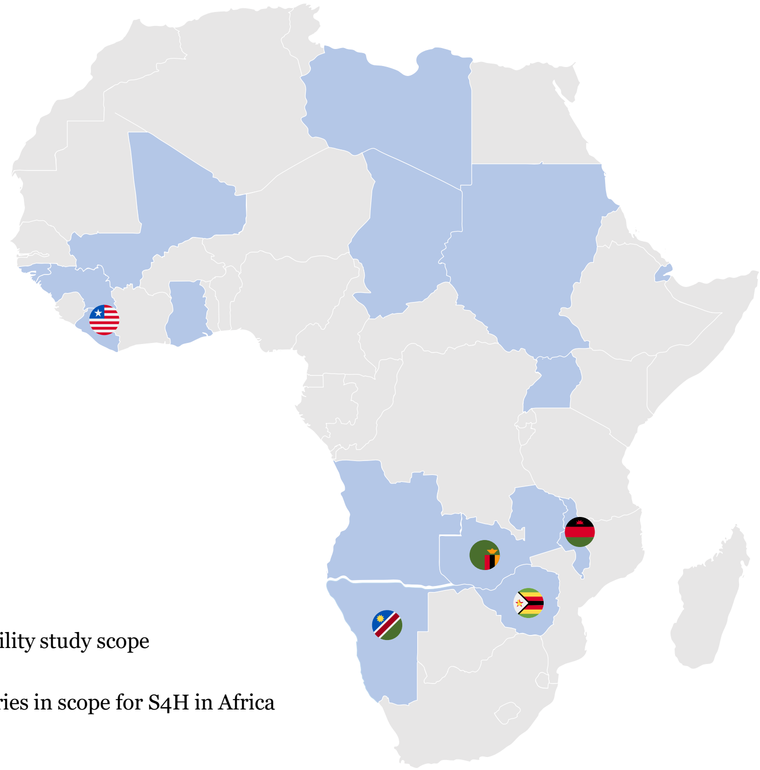
6 objectives contributing to multiple SDGs

1. Access to quality health services for all
2. Reduced environmental footprint of the healthcare sector
3. Cost savings on energy bills for health facilities and local government
4. Climate resilient health systems
5. Local green jobs, training of solar technicians and regulatory capacity development
6. Proof of concept for solar energy in healthcare and beyond

Facilities in scope

Rural health centre/clinic	Urban health centre/hospital	Warehouse
Problem: Off-grid centres using polluting and costly diesel generators or without any energy source **Solution:** complete power solution for lighting, medical equipment, drug preservation and electricity for staff housing. Energy need range from 10 kWh/day **Impact:** improved quality and access to health care for the most underserved communities	**Problem**: Non reliable energy supply due to frequent power cuts **Solution:** steady power supply reducing energy costs and securing key services such as surgery, maternal, ER, pharmacy and lab at all times in case of power cuts. Energy need range 50-500 kWh/day **Impact:** a greater healthcare quality for a large number of patient	**Problem**: Suboptimal drug preservation and stock management **Solution:** steady power supply for supply chain preservation (cold chain) and IT system for stock management **Impact:** better drug efficiency and better stock management

Solar for Health is targeting least developed countries



Feasibility study scope

Countries in scope for S4H in Africa

“Solar for Health Call for Private sector support,” UNDP (2017)
“Solar for Health 5 ways solar power can make universal healthcare a reality,” UNDP (2018)
Source: UNDP; KOIS analysis

S4H programme made substantial achievements, nevertheless challenges remain to reach its ambitions

Achievements and scale up

Achievements

- 7.7 MWp of installed capacity in 8+ countries
- Providing power to more than 650 health facilities and the biggest medical warehouse in Zambia (300 kWh/day)
- Plug and play, 5-15 kWp solar PV units installed, meeting all power needs of small healthcare facilities and approx. 30% for a hospital

Path to scale up

- UNDP creates the governance, harmonisation, capacity development and sustainability conditions necessary
- UNDP provides a standardised S4H equipment list and first health sector specific solar energy pre-qualified suppliers
- In collaboration with local ministries of health, UNDP identifies the health centres and facilities in scope
- UNDP builds local technical capacities and enables market transformation by partnering with local and national providers

Risks and challenges

Governance and regulation

- Insufficient regulatory framework prevents investments and long term contracts
- Political and economic stability is needed to secure long term funding for the solar installation
- High number of stakeholders involved with different objectives can block the expansion of the programme
- No clearly identified counterpart under a potential public-private agreement

Financial and economic

- UNDP estimates that US$690m is needed to equip the 18,000 healthcare facilities in scope of S4H
- Perceived risk and relatively high upfront costs hampers the scale-up of the programme
- Recurrent maintenance and replacement costs have to be born in the long term (e.g., by healthcare facilities or government or donors)

Operational

- Maintenance and monitoring of panel breakdowns and tampering is crucial as PV systems often become inoperative after 3–5 years without proper maintenance and repair.
  - Need for local buy in and long term commitment to maintain the installations
  - Need for human capital development and local technical knowledge
- Theft of solar panels requires security and surveillance of the solar installation
- Disposal of batteries (5- to 15-year lifetime) and panels (25- to 30-year lifetime) has to be addressed

UNDP, Solar for Health 5 ways solar power can make universal healthcare a reality, 2018

Scaling up off-grid solar energy solutions for healthcare will require both increasing demand-side potential and supply-side project bankability

Demand-side potential	Supply-side project bankability
Off-grid energy need (# facilities/total kWp)	**Policy and regulatory environment**
Affordability/ability to pay	**Market attractiveness:** - *Market size* - *Density of population/economic activity:* population demographics (i.e., population, poverty rates, mobile phone penetration, household incomes, etc.); social and productive uses (i.e., education, health, agriculture, mines, SMEs, public institutions, etc.) - *Distance from the national grid/infrastructure*
Availability of relevant options	
Acceptability of energy solution: adequate capacity and duration of energy; electricity quality; sustainability	**Access to capital**

https://www.energyaccessexplorer.org/methodology/
Source: KOIS analysis

A number of solar solutions can address the energy needs of a healthcare facility and their appropriateness shall be assessed in line with the specificities of each facility

	Solar lighting kits	Solar suitcase	Off-grid stand-alone or hybrid system	Mini-grid (stand-alone or hybrid)	On-grid
Description	• A solar lighting kit uses a solar panel to power a single or several bulbs.	• Portable and self-contained solar power generation and lighting system	• Off-grid electricity system providing power to one customer	• Off-grid electricity distribution network serving limited number of customers	• Solar installation connected in combination with power grid
Power capacity	• Max. 10 Wp	• Max. 80 Wp	• From 5 kWp to 1 MWp	• From 10 kWp to 10 MWp	• Above 1 MWp
Application in health facilities	• Provides lighting in the health centre	• Provides lighting in the health centre • Possibility to charge small devices (phone, tablet)	• All power uses if sized correctly • Possibility to charge devices • Emergency power	• All power uses if sized correctly • Possibility to charge devices • Emergency power	• All power uses • Reliable supply of energy with hybrid solutions • Emergency power
Advantages	• Portability • Easiness of installation • Low cost	• Portability • Easiness of installation • Low cost	• High energy levels provided • Good storage levels • Complete solution • Allows empowerment and self-sufficiency • Possibility of revenues from on-sell of power to local community	• High energy levels provided • Good storage levels • Complete solution • Allows empowerment and self-sufficiency • Possibility of revenues from on-sell of power to local community (anchor model)	• Very high energy levels provided • With or without storage • Possibility of revenues from feed-in tariffs
Disadvantages	• Extremely low energy levels provided • Low to zero storage levels • Very limited needs are met • Not a long-term sustainable solution	• Low energy levels provided • Low to storage levels • Limited needs are met • Not a long-term sustainable solution	• Requires professional installation • High investment costs (depending on size installed) • Higher need for local maintenance	• Requires professional installation • High investment costs (depending on size installed) • Higher need for local maintenance • Depends on the rest of the community • Needs high density of users • Increased complexity	• Requires professional installation • Technical integration required • Structured O&M required • Needs very high density of users

IRENA, Solar PV In Africa: Costs and Markets, IRENA Report, 2015

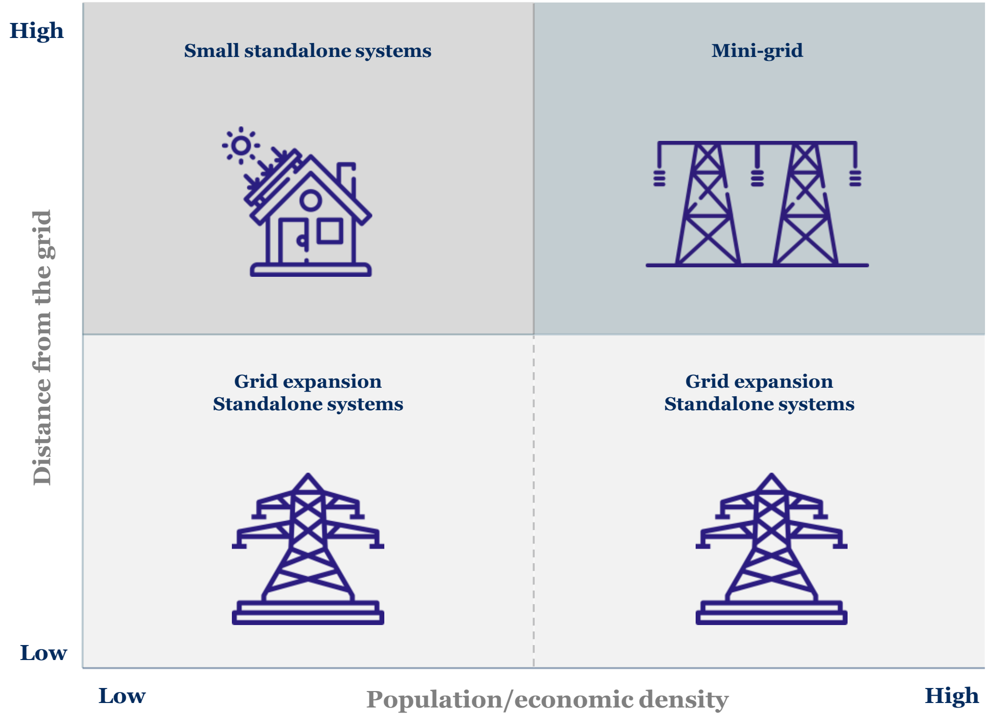
There are three main business models when it comes to solar energy service providers

	Purchase	Financial or operational lease	Fee-for-service
Adequate operational model	• Solar appliances	• Off-grid stand-alone • Solar appliances • Power plant	• Off-grid stand-alone • Mini/Micro-grid • On-grid
Adequate market	• Low energy needs • Very remote areas where providers have low incentive to invest	• Average to high energy needs • Low density settings where providers have no incentive to invest in the installation	• Higher energy need • Higher density of users
Advantages	For the user: • Ownership • Lower overall cost in the long term For the provider: • Risks and responsibilities are transferred to the user • No upfront investment required	For the user: • Low upfront cost • Ownership transferred at the end of the leasing period for financing leases • Maintenance and after sale is provided For the provider: • Contractual payback period for the user	For the user: • Lowest cost for users • Maintenance and after sale is provided For the provider: • Retains ownership of the installation • Can grow the capacity and connect new users (economies of scale)
Challenges	For the user: • Not affordable for larger installation • Provider has no incentive for proper maintenance/after-sale service • Potential poor quality or counterfeit products	For the provider: • Repayment risk although usually mitigated by contractual obligation for the user • For larger installation, local technicians must be deployed	For the provider • Need critical volume to generate sufficient revenues and make the investment sustainable • Revenue fluctuation and uncertainty on future usage • Local technicians need to be deployed • All risk and responsibilities lie with the provider
Potential for financial support	• Incentives to support and grow distribution networks • Identification, training, recruitment and support of rural based staff providing sales or after sales services	• Incentives to support and grow distribution networks • In new markets soft funding to establish an initial portfolio of customers • Soft funding for innovations delivery models and/or to reduce the repayment fees • Identification, training, recruitment and support of rural based staff providing sales or after sales services	• Subsidy for high investment requirements and to attract private capital • In new markets soft funding to establish an initial portfolio of customers • Concessional financing

EEP S&EA, Solar PV business models in East Africa: lessons learnt from EEP supported projects, 2016.

Large standalone/mini-grids can meet the energy demand for facilities near the grid/with high economic density; small solar standalone systems are more relevant for low economic density facilities far from the grid

A growing role for off-grid solar solutions[1]



Various factors influence the most cost-efficient SE technology[2]

High-density areas near the grid

- Relevant technology: larger (tailored) solar PV standalone systems
- Power generation capacity: 10 kWp – 100 kWp
- Cost range: US$2-17/Wp

High-density areas far from grid

- Relevant technology: mini-grids
- Power generation capacity: 10 kWp – 10 MWp
- Cost range: US$3-15/Wp with battery (US$3-7/Wp without battery)

Low-density areas far from grid

- Relevant technology: smaller standardised solar PV standalone systems
- Power generation capacity: 1-10 kWp
- Cost range: US$2-17/Wp

Cost-effectiveness is a key consideration when setting electrification targets
Achieving the highest energy access targets (Tier 5 – uninterrupted power access; >22h/day) can be 50-100x more costly than achieving entry level targets (Tier 1 – basic power appliances; >4h/day) on a per connected household basis.

[1] GOGLA study is on household energy needs. We make assumption that rural healthcare facility needs are comparable to those of off-grid households. https://www.gogla.org/sites/default/files/resource_docs/energy_access_through_off-grid_solar_-_guidance_for_govts.pdf; https://assets.publishing.service.gov.uk/media/5af96657ed915d0df4e8cdea/Costs_Benefits_Off-Grid_Electricity_Lighting_Systems.pdf
[2] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_Africa_2030_REmap_2015_low-res.pdf ; https://www.usaid.gov/energy/mini-grids/economics/cost-effectiveness/tiers-of-service/
Source: GOGLA; IRENA; USAID; KOIS & Differ analysis

On-grid/near-grid: reliance on overstretched government budgets can reduce ability to pay; though an economic case can be made for facilities with existing diesel generator budgets (as a primary or backup source)

Objective	Demand-side characteristics and challenges
Affordability/ ability to pay	- **User fees:** usually no fees charged to the patient in public facilities even if in urban settings some patients have an ability to contribute to the cost - **Government budgets:** depending on the level of dependence on public budget (revenue mix), and for public facilities on (i) specific government's solvency and (ii) other government's spending priorities - **Grant capital:** prioritise remote facilities with no access to energy serving vulnerable populations - **Public/private:** some privately-owned facilities in urban areas (targeting wealthier users) - **Other revenues:** regulation on resale of surpluses, provision of extra services (on the top of what is covered by government) should favorise renewable energies - **Alternative energy cost:** partial replacement of generators can free up some budget
Awareness/ knowledge among stakeholders	- **Awareness of solar and its benefits:** tendency to stick to status quo (even if it means no/expensive electricity), limited awareness of local population of solar energy and its benefits - **In-house solar know-how:** limited ability to maintain the installations on their own, facilities might have to pay for an external operator (→ risk of omission) - **Solar energy image:** previous negative experiences can result in mistrust and a bad image of solar energy sustainability
Acceptability of the solution	- **Quality of products:** low financial means result in selection of cheapest products - **Installation sizing:** sizing assessment has to be done properly and foresee change of behaviours - **Number of systems:** challenging O&M when several different systems installed in parallel - **Ownership:** without proper owners, users do not always feel responsible for the proper O&M of the system or can over/misuse the systems - **After-sale service:** contract do not sufficiently incentivise the providers to fulfill their after-sale responsibilities

Source: KOIS analysis

High-density areas far from grid: high density of economic activity can incentivise off-grid energy market-building and reduce overall costs to end-user; however, high service costs can still constrain ability to pay

Objective	Demand-side characteristics and challenges
Availability of product/ service	- **Hardware:** limited availability, potentially less choice of products or additional transportation costs - **Sales and installation:** potentially no local sales representatives increasing costs - **Financing:** local banks are reluctant to provide credit, interest rates are very high - **O&M:** lack of O&M service providers; the offer is more limited than in the capital and technicians might need to travel increasing costs or be less trained - **Disposal:** lack of disposal services - **Mini-grids:** viable option in high density area where grid extension are not planned
Affordability/ ability to pay	- **User fees:** usually low revenues and limited ability to pay - **Government:** in case of limited budget, main hospitals will be prioritised. If no grid extension, subsidise mini-grids - **Grant capital:** can be attracted especially if it helps the wider local communities and increase health quality - **Public/private:** usually mainly public facilities but some private healthcare facilities might be present in wealthiest areas. Private facilities can steer away wealthiest clients - **Other revenues:** on-sale of extra power to local community can generate revenues - **Alternative energy cost:** replacement of generators can free up some budget
Awareness/ knowledge among stakeholders	- **Awareness of solar and its benefits:** tendency to stick to status quo (even if it means no/expensive electricity), limited awareness of local population of solar energy and its benefits - **In-house solar know-how:** inability to maintain the installations on their own, facilities might have to pay for an external operator (→ risk of omission) - **Solar energy image**: previous negative experiences can result in mistrust and a bad image of solar energy sustainability
Acceptability of the solution	- **Quality of products:** low financial means result in selection of cheapest products - **Installation sizing:** sizing assessment has to be done properly and foresee change of behaviours - **Number of systems:** challenging O&M when several systems installed in parallel - **Ownership:** without proper owners, users do not always feel responsible for the proper O&M of the system or can over/misuse the systems - **After-sale service:** contract do not sufficiently incentivise the providers to fulfill their after-sale responsibilities

Source: KOIS analysis

<u>Low-density areas far from grid</u>: low ability to pay, low economic activity/small market size, and high service cost provide little incentive for private sector market-building and few energy access options

Objective	Demand-side characteristics and challenges
Availability of product/ service	- **Hardware:** barriers to procure required HW in the country (e.g., trade barriers); lack of technical options due to limited facility size - **Sales and installation:** complicated due to high cost and long time necessary to reach remote locations (often not justified by the low population in the catchment area) - **Financing:** inability to absorb upfront CAPEX; local FIs reluctant to lend - **O&M:** lack of O&M service providers; after-sales service limited in remote locations (i.e., low-quality network coverage, high cost of travel) - **Disposal:** lack of disposal services; high distance (i.e., cost) to disposal facilities (if any) • **Mini-grids:** low density not allowing to reach the critical size of perimeter for a mini-grid
Affordability/ ability to pay	• **User fees:** usually no fees charged to the patient in public facilities, low ability of rural population to contribute to the cost • **Government budgets**: depending on the level of dependence on public budget (revenue mix), and for public facilities on (i) specific government's solvency and (ii) other government's spending priorities • **Grant capital:** remote facilities with no access to energy serving vulnerable populations tend to get more attention from international donors • **Public/private:** limited/no private ownership (i.e., mostly public or NGO-run facilities) • **Other revenues:** very limited ability to generate extra revenues (i.e., no businesses and typically poorer population in sparsely populated rural areas) • **Alternative energy cost:** mostly unelectrified facilities, therefore no economies are generated (and the new PV installations can often be seen as an extra cost)
Awareness/ knowledge among stakeholders	• **Awareness of solar and its benefits:** tendency to stick to status quo (even if it means no/expensive electricity), limited awareness of local population of solar energy and its benefits • **In-house solar know-how:** inability to maintain the installations on their own, facilities might need an external operator (generating additional cost) • **Solar energy image**: little/no previous experience with SE
Acceptability of the solution	• **Quality of products:** low financial means or lack of quality standards result in selection of cheapest products • **Installation sizing:** sizing assessment has to be done properly and foresee change of behaviours • **Number of systems:** max. one/very few different systems per facility (i.e., low complexity) • **Ownership:** without proper owners, users do not always feel responsible for the proper O&M of the system or can over/misuse the systems • **After-sale service:** limited in remote locations (i.e., low-quality network coverage, high cost of travel)

Source: KOIS analysis

In sum, standalone systems for near-grid facilities and discrete high value opportunities are quick win, while medium-term plays and long-term challenges will require targeted support to become attractive opportunities

High density of energy demand

High-density far from grid (i.e., regional hospitals/clinics near dense populations) - Mini-grid/large scale solar PV installations ***Medium-term plays***	***On-grid/near-grid facilities in areas of high density of economic activity (i.e., central hospitals/warehouses/urban clinics)*** - Large standalone systems for primary reliable or backup solution ***Quick-wins***
Low-density far from grid (i.e., rural health posts) - Small solar PV standalone system with low expectation of grid extension ***Long-term challenges***	***Individual off-taker opportunities: high economic value far from grid in otherwise low-density area (i.e., humanitarian clinics)*** - Large standalone systems for primary reliable or backup solution ***Discrete opportunities***

High market attractiveness for energy companies

Source: KOIS analysis

Channelling financing to energy companies can tap into quick-wins and support the development of the local economy, though the financing shall be targeted to solar installation assets for healthcare facilities

	Systemic support to the solar energy sector[1]	Direct financing of energy service providers	Direct financing of solar installation assets
Relevant challenge addressed	- Support sector capacity building with market feasibility studies and project preparation	- Increase access to lower cost of capital - Increase access to long-term/patient capital - Reduce risk of asset-liability currency mismatch - Support capacity building with specific company/project technical assistance - Align financial incentive for on-going O&M/disposal service provision	- Increase health facility ability to pay - Mitigates energy service provider business risk - Direct and lowest cost S4H financing
Relevant market segment	- Provide sector capacity building support to strengthen renewable energy enabling environment	- Support energy value chain actors to strengthen business/investment case for energy provision across all market segments - Value chain actors targeting quick-win opportunities may still require innovative financing support, but likely significantly less than those targeting longer-term challenges	- Support less commercially viable investments and longer-term opportunities - Though equally applicable to any healthcare facility with low ability to pay across market segments

[1] Due to their broad character and need for systemic support of various public institutions, these investments are considered out of scope of this study.

Source: KOIS analysis

A number of innovative financing tools are available to support energy companies and reduce the various risks for financiers such as public sector off-taker risk and ESP business risk

	Systemic support[1]	Direct financing of energy service providers	Direct financing of solar installation assets
Investment instruments		Concessional financing; First-loss capital; Repayable grants	
De-risking instruments		Guarantee; Local currency hedging; Pooling projects; Advance market commitment	Guarantee; Advance market commitment
Result-based financing		Performance-based contracts	Performance-based contracts
Non-financing support mechanisms	Technical assistance; Project preparation facilities	Technical assistance; Project preparation facilities	

[1] Due to their broad character and need for systemic support of various public institutions, these investments are considered out of scope of this study

Source: KOIS analysis

Direct financing of solar installation assets: grants will be required to address low ability to pay and affordability challenge while RBF can incentivise O&M service provision for S4H healthcare facilities

Challenge	Specific issues	Relevant IF instruments
Affordability/ ability to pay	➢ **Domestic revenues:** high dependency of public facilities on government budget (i.e., solvability risk, non-systematic changes in spending priorities); limited social insurance deployment; limited/no ability of end users to contribute to HC cost ➢ **Foreign transfers:** inflow of private capital limited to larger facilities in higher-income areas; vulnerable & more remote areas tend to get more attention from foreign donors (i.e., grants and in-kind support) ➢ **Optimisation of operations**: some economies possible by replacement of costly generators (for facilities that were previously equipped by them)	• Grants, • Concessional financing, • Pooling of investments • Technical assistance
Accessibility	➢ **Availability of quality hardware:** limited choice of products; barriers to procure required HW in a specific country; low financial means and/or lack of quality standards resulting in selection of cheapest (low-quality) products ➢ **Distribution:** long time & high cost of transportation to remote locations ➢ **O&M:** lack of providers leading to limited after-sales service in remote locations ➢ **Disposal:** lack of disposal facilities	• Concessional financing to energy company • RBF • Grants • Technical Assistance
Awareness & acceptability among stakeholders[1]	➢ **Awareness of solar and its benefits:** tendency to stick to status quo; low awareness of economic benefits of solar energy ➢ **Solar energy image:** previous negative experience resulting in mistrust to SE ➢ **Solar know-how:** limited in-house ability to maintain the PV installations; lack of ownership among the users often leading to misuse of the systems	• Project-preparation facility • Technical Assistance

[1] Out of scope as these challenges are mostly linked to external factors and can only be addressed by innovative financing instruments to a limited extent
Source: KOIS analysis

Direct financing of energy service providers: concessional financing terms can address the limited access to capital locally but risk mitigating instruments will be paramount to guarantee repayment

Challenge	Specific issues	Relevant IF instruments
Market size & profitability	➢ **Economies of scale:** difficult to reach the critical size allowing the economies of scale in smaller economies and/or more geographically dispersed areas ➢ **Market power:** high market concentration impedes ECs from exercising power over their suppliers (i.e., push on lowering COGS); low price elasticity of demand in poor areas limits their pricing power; strong substitution effect for poorer end users (i.e., preference for cheaper and lower quality products) ➢ **Payment risk:** high risk of payment default in credit-based models	• Direct financing instruments • Technical assistance • RBF/advance market commitments • Guarantees
Access to finance	➢ **Insufficient amount:** ECs often deemed too risky for an amount allowing to finance CAPEX ➢ **Unfavourable terms:** high perceived risk leads to overly high interest rates/short maturities, further decreasing already strained margins ➢ **Local currency:** unavailability of funding in local currency (i.e., banks often offering loans in USD) results in an asset-liability mismatch, exposing the EC to a FX risk	• Concessional financing • First-loss capital • Guarantee • Local currency hedging • Matching of cash flows
Enabling environment[1]	➢ **Regulatory/policy issues:** SE legislative vacuum/too stringent regulation; high prevalence of trade barriers imposed on SE products ➢ **Infrastructure:** insufficient infrastructure increasing the cost & quality of marketing, service delivery and O&M in more remote areas ➢ **Human & social capital:** lack of qualified & motivated local workforce	• Project-preparation facility • Technical Assistance

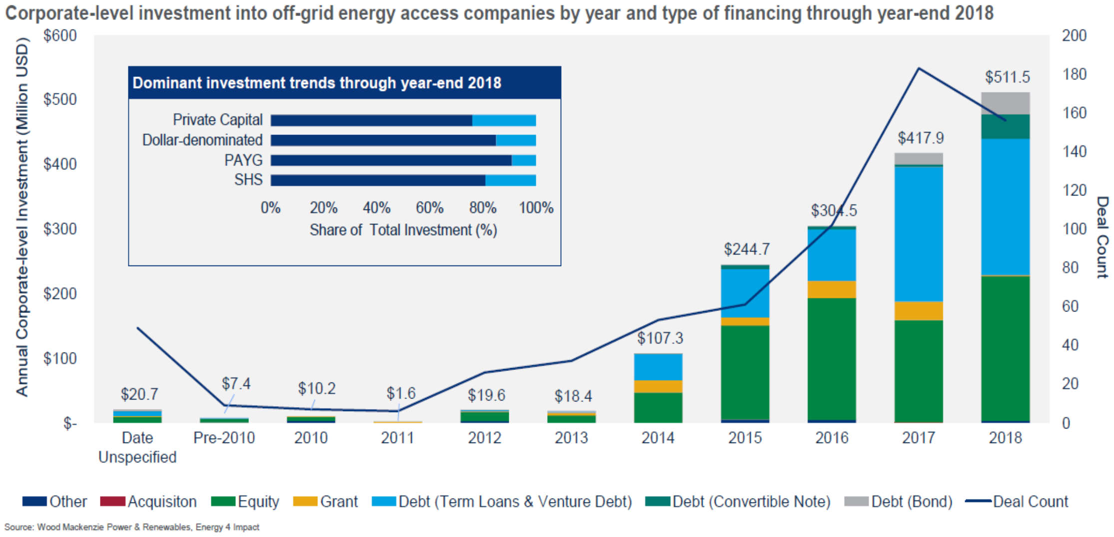
[1] Out of scope as these challenges are mostly linked to external factors and can only be addressed by innovative financing instruments to a limited extent

Source: KOIS analysis

There is significant pent-up private capital that can be unlocked for the proposed facilities, particularly for PAYG business models or large power plants where off-taker risk can be effectively mitigated

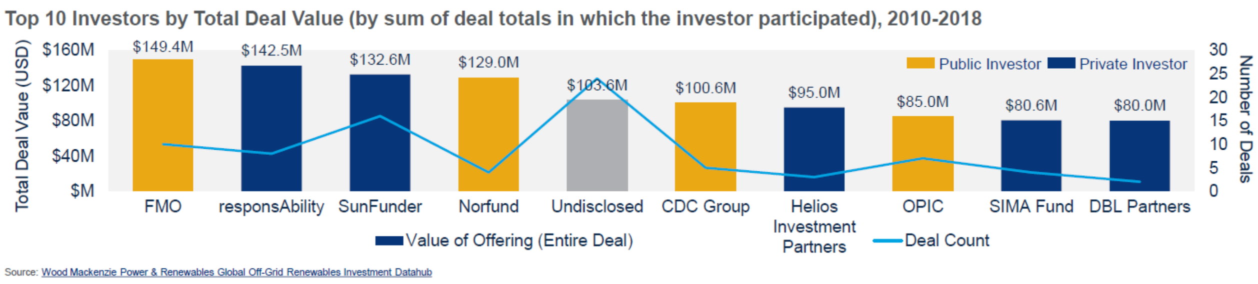
Growing investments

- >US$500m investments in 2018
- US$1.7b of cumulative investments in off-grid energy access compagnies (est. at US$2.3b in total with undisclosed investments)
- 50-50 debt-equity balance
- >20% YoY growth from 2017 to 2018
- 686 transactions, 426 investors, and 152 recipients in 2018
- 79% of investments go to Africa



Specialised public and private funds dominate the investment scene

- Top 10 dealmakers are a mix of public and private investors, leveraging specialised energy access focused funds
- Most strategic investors are looking to buy small (~20%) equity stakes in players with growth potential and learning opportunities
- Many transactions have a blended finance component
- Strategic investments take 3 forms: direct investments and M&A, commercial partnerships and joint ventures, indirect investment through funds or financial intermediaries
- PAYG is the preferred business model (91% of investments)
- SHS the preferred product (81% of investments) with mini-grids coming as second (15% of investments)



Source: Wood Mackenzie Power & Renewables Global Off-Grid Renewable Investment Datahub

Interviewed stakeholders recognise the need and importance of a sustainable energy access in healthcare, however some challenges to make such initiative investable remain

Donors

Development partners promoting economic development and welfare including official agencies (state and local governments, or their executive agencies) at concessional financial terms (if a loan, having a grant element of at least 25 per cent).

- **Health sector support:** In countries where donors are already heavily supporting healthcare expenditures, donors are interested in a more sustainable solution (solar) instead of financing diesel for instance.
- **Renewable energy support:** Support is provided to ESPs through concessional loans and grants.
- **Long term commitment:** Donors often have limited time engagement and often limit commitment to max. 5 years.
- **Coordinated action:** Donors run programmes in health and energy in parallel but effort to coordinate and join forces in conducting and funding common initiative is gaining ground. There is interest to contribute to an initiative managed by UNDP.
- **Risk mitigating instruments**: Donors can provide payment guarantees for the local government but that option is not always available or preferred in countries with high debt/low creditworthiness.

Concessional investors

Investors seeking impact first and offering below market interest rate or more concessional terms, includes DFIs, IFIs, foundations, impact investment funds. Investing in the form of debt or equity.

- **Support to local government:** Development finance institutions (DFI) have the mandate to support local government with concessional loans. Project financing of RE projects fall within their scope of action. Impact funds, even when providing more concessional financing, remain reluctant to take exposure on local governments.
- **Blended finance:** Objectives include catalysing additional financing and leverage the amount of concessional financial. Ready to take junior positions in similar funds.
- **Risk mitigation**: For this type of initiative, impact investment funds will require a very high level of security, indicative terms of 25% first loss tranche or minimum 50% guarantee on payments.
- **Covid-19 response:** Increased interest for investments that support the SSA healthcare system in view of the Covid-19 crisis.

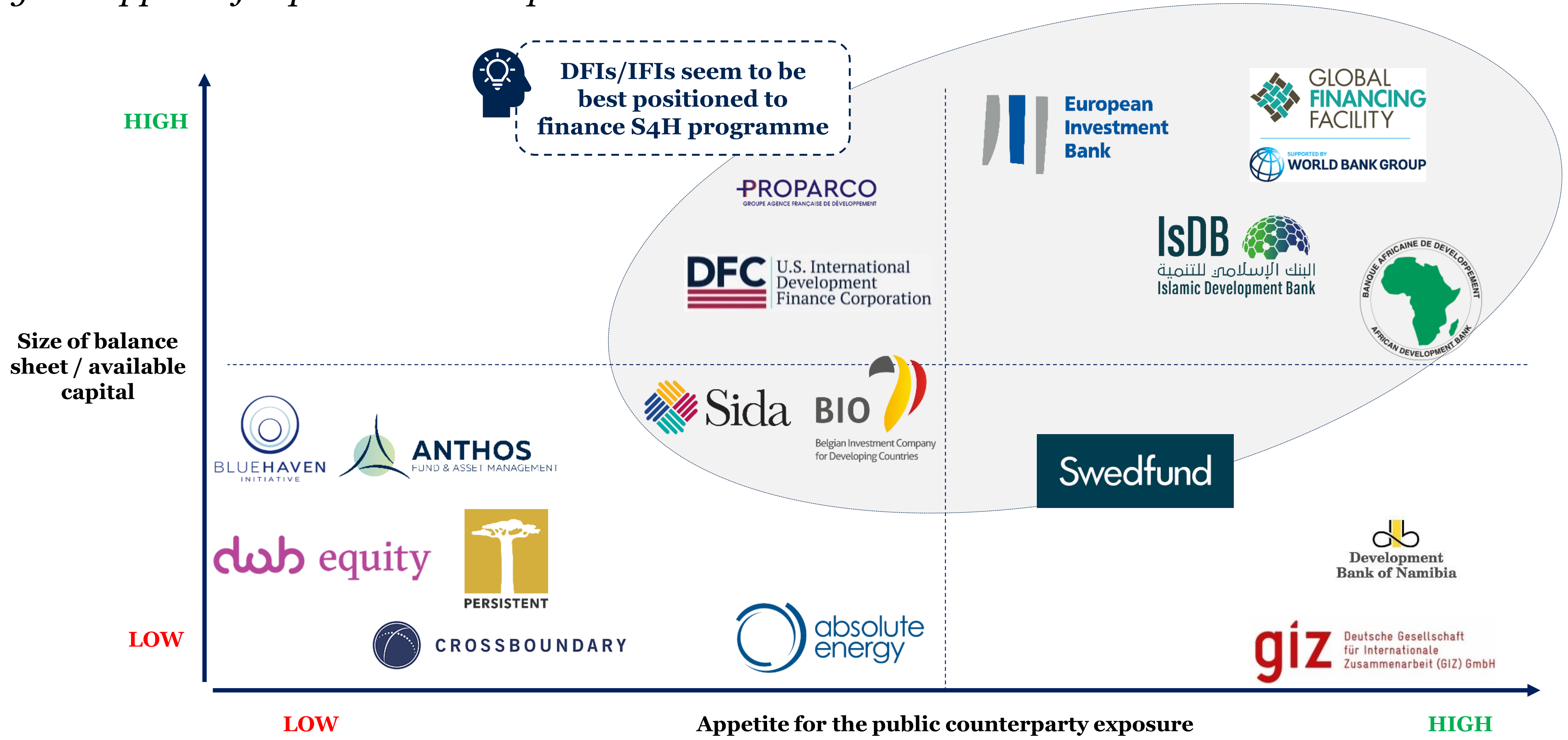
Commercial investors

Investors seeking a market return, includes impact investment funds, family offices, high-net-worth individuals, as well as commercial banks. Investing in the form of debt or equity.

- **Exposure on government entities:** Credit risk on the public sector is seen as high and payments difficult to enforce resulting in a reluctance to take any exposure on government entities.
- **Investments in renewable energy:** Investments typically target PAYG companies with strong track record and balance sheet or project finance vehicles with segregated cash flows to limit business risk on local ESPs.
- **Currency risk:** High volatility and inflation must be priced in or mitigated. Hedging is very costly and may not be available in the desired tenors or currencies. Some investors only take exposure in hard currency.
- **Expected return:** For long-term investments in SSA (i.e., 10 years and more), investors indicated an approximate required return of 30% for equity and 15% for debt (depending on the risk of a specific project).

Source: KOIS analysis

Indicative interest of potential financiers to participate in a S4H financing mechanism – DFIs/IFIs have the highest appetite for public sector exposure



Assessment based on interviews and desk research – further discussions and analysis required to confirm the interest and the investment terms of the listed organisations
Source: KOIS analysis

We have interviewed a number of DFIs during the first phase of the study with whom we have touched upon the different aspects of off-grid energy financing in Sub-Saharan Africa (1/3)

Development Finance Institution	Investment initiative	Investment focus	Geographical focus	Financing instrument	Who applies/ Application timeline	Size of investment	Fit with model
World bank	**Green Climate Fund (GCF) - Readiness Programme**	Creating enabling environments and building institutional capacity	Developing countries	Grants, in-kind contributions	Public entity at national level, Private sector & NGOs at regional level / Proposals may be submitted at any time	Up to US$1m/country/year for capacity building Up to US$3m/country for formulation of national adaptation plans	TA provider, TA to MOH/ESPs
	The Carbon Fund- The Carbon Initiative for Development	Performance-based payments for the purchase of certified carbon emission	ODA eligible countries	Results-based financing	Public entity, Private sector / Application accepted on rolling basis	N/A	Energy payments to ESPs
	Clean Technology Fund of Climate Investment Funds	Financing for of low-carbon technologies for long-term greenhouse gas emission savings	Emerging countries	Grants, concessional loans, subordinated debt, market-rate loans, equity, guarantees	Public entity at national level, private sector & NGOs at regional level Approval may take up to 2 years	Cumulative pledges: US$5.5bn	S4H coordination platform providing loans to ESPs TA provider, TA to MOH/ESPs
	Least Developed Countries Fund (LDCF)	Project and program implementation	Several LDCs incl. Malawi, Zambia and Liberia	Grants	Public entity	Full-sized projects: +US$2m Medium-sized projects: Less than or equivalent to US$2m	TA provider, TA to MOH
IFC	**International Finance Corporation (IFC) - Canada Climate Change Program**	Project and program implementation	Developing countries that are IFC members	Concessional loans and guarantees	Private sector	CA$286m for concessional investments CA$6m for advisory services and TA projects Applications accepted on rolling basis	S4H coordination platform providing loans to ESPs

The Carbon Fund has an investment budget of US$267m

We have interviewed a number of DFIs during the first phase of the study with whom we have touched upon the different aspects of off-grid energy financing in Sub-Saharan Africa (2/3)

Development Finance Institution	Investment initiative	Investment focus	Geographical focus	Financing instrument	Who applies/ Application timeline	Size of investment	Fit with model
AfDB	**Sustainable Energy Fund for Africa (SEFA)**	Project preparation, and enabling environment support	Developing counties in MENA/SSA	Grants, equity, in-kind contributions	Private sector Proposals are accepted on a rolling basis (turn around process approx. 5-9 months)	US$30-200m	TA provider, TA to MOH/ESPs
	NEPAD Climate Change Fund	Project and program implementation	AU member states	Grants	Public entity	N/A	TA provider, TA to MOH
	Green Bonds Program	Project and program implementation	Africa	Concessional loans	Project sponsors, governments, and government-guaranteed entities	N/A	MOH financial contribution to energy payments
	Africa Renewable Energy Initiative (AREI)	Project and program implementation	Africa	Grants, concessional loans, guarantees, in-kind contributions	Public entity at national level, Private sector & NGOs at regional level	US$10bn pledged during COP21 for phase 1, 2017-2020	S4H coordination platform proving loans to ESPs/TA provider, TA to MOH/ESPs
	African Renewable Energy Fund (AREF)	Development stage renewable energy projects. Small to medium scale IPPs	SSA	Grants, concessional loans, guarantees, in-kind contributions	IPPs with size of 5-50 MWp	US$30-200m	TA provider, TA to IPPs S4H coordination platform providing loans to IPPs

NEPAD Climate Change Fund has a fund size of EUR 3.6 million
AfDB is a repeat issuer of green bonds (USD2.6bn in total)

We have interviewed a number of DFIs during the first phase of the study with whom we have touched upon the different aspects of off-grid energy financing in Sub-Saharan Africa (3/3)

Development Finance Institution	Investment initiative	Investment focus	Geographical focus	Financing instrument	Who applies/ Application timeline	Size of investment	Fit with model
FMO	**Access to Energy Fund**	Project and program implementation	SSA	Grants, concessional loans, equity	Private sector	Up to €7m	S4H coordination platform proving loans to ESPs
AFD	**Le Fonds Français pour l'Environnement Mondial**	Project and program implementation	ODA eligible countries	Grants	Public entity at national level, Private sector & NGOs at regional level	€0.5-2m	TA provider, TA to MOH
European Investment Bank	**Climate Change Technical Assistance Facility**	Scoping and project preparation	Developing countries	Contingent grants	Public entity	N/A	TA provider, TA to MOH
	Interact Climate Change Facility (ICCF)	Project and program implementation	OECD DAC countries	Senior loans, mezzanine debt, equity, quasi-equity and guarantees	Private sector	€1-25m	S4H coordination platform proving loans to ESPs
Nordic Development Fund	**Energy and Environment Partnership in Southern and East Africa**	Project and Program implementation	SSA	Grants, market-rate loans, guarantees	Private sector	Varies on financing window- up to US$2m	S4H coordination platform proving loans to ESPs
	Nordic Climate Facility	Scoping and project preparation Project and program implementation	Several SSA countries incl Malawi & Zambia	Grants, Concessional loans, Equity	Public entity at national level, Private sector at regional level	€250-500k	TA provider, TA to MOH

Climate Change Technical Assistance Facility has a fund size of 10 million EURO

Two approaches can be followed to implement the S4H programme and mobilise financing for local ESPs – DFI/IFI preferences shall be considered when selecting the appropriate approach

Direct financing (platform)

Financiers provide capital to ESPs directly under a coordinated process

- A platform is set up to link DFIs/IFIs with ESPs awarded S4H contracts
- A coordinating unit ensures investors requirements are integrated in the procurement process to facilitate eligibility for financing
- Investors are presented S4H financing request and can finance directly alone or in a club deal

Advantages

- Each DFI/IFI can select investment opportunities, set its own investment terms and follow its standard procedure
- DFI/IFIs have specific mandates and less flexible processes making direct investments tailored to them more feasible

Disadvantages

- Each contract must reach a critical ticket size to justify the transaction costs
- Necessity to comply with specific terms for each project increases complexity
- No cross-subsidy between projects

Indicative DFIs/IFIs fit

IsDB, African Development Bank, BIO (Belgian Investment Company for Developing Countries), Development Bank of Namibia, PROPARCO (Groupe Agence Française de Développement)

- Mandate for specific countries only
- Financing provided to private sector directly for specific projects
- Investment in funds are not common practice

Fund structure

A fund is created to pool investments in S4H programme

- A dedicated S4H fund is created and managed by a fund manager (selected by UNDP through a procurement)
- The fund pools investments from different types of investors and conducts due diligence on their behalf before investing (i.e., providing financing) to ESPs awarded S4H contracts
- The fund centralises cash flows, repayments from ESPs and to investors

Advantages

- Investing in several projects/countries/ ESPs diversify the risks for DFI/IFIs
- Due diligence is partly outsourced to the fund manager
- Ensures flexibility in desired ticket size for investors
- Can be structured as a revolving fund

Disadvantages

- Requires a due diligence on the fund and potentially on the investments
- Limits the possibility for investors to select specific investments (according to their specific mandates)
- Fund manager charges a fee for its services increasing the costs

Indicative DFIs/IFIs fit

Swedfund, African Development Bank, The World Bank, DFC (U.S. International Development Finance Corporation)

- Preference for a simplified due diligence
- Requirement for minimum ticket size
- Cooperation with other large organisations such as UNDP

Source: KOIS analysis

According to the DFIs/IFIs we have spoken to, the large majority have the capacity to provide financing to the S4H coordination platform through providing loans to ESPs and technical assistance to MOH/ESPs

Energy payments

Green Bonds Program

Ci-Dev Carbon Initiative for Development

DFID Department for International Development

Norad

KFW

USAID From the American People

Guarantees

European Investment Bank

ICIEC

GuarantCo Guarantees for Development

Africa Greenco

ati aca

MIGA

The World Bank

AFD Agence Française de Développement

Energise Africa

Munich RE

African Guarantee Fund

Technical assistance

To the MOH

AREF Africa Renewable Energy Fund

European Investment Bank

FMO

AFD Agence Française de Développement

USAID

The World Bank

IDB Lab

Least Developed Countries Fund (LDCF)

BMZ Federal Ministry for Economic Cooperation and Development

Green Climate Fund

NEPAD Climate Change Fund

NDF Nordic Development Fund

IFC International Finance Corporation

CTF Clean Technology Fund

To the ESPs

BIO

Sida

AREI

Sustainable Energy Fund for Africa

Proparco Groupe Agence Française de Développement

Financing

IsDB البنك الإسلامي للتنمية Islamic Development Bank

NDF Nordic Development Fund

IFC International Finance Corporation World Bank Group

Swedfund

DFC U.S. International Development Finance Corporation

Sida

African Development Bank

AREF Africa Renewable Energy Fund

CTF Clean Technology Fund

European Investment Bank

AREI

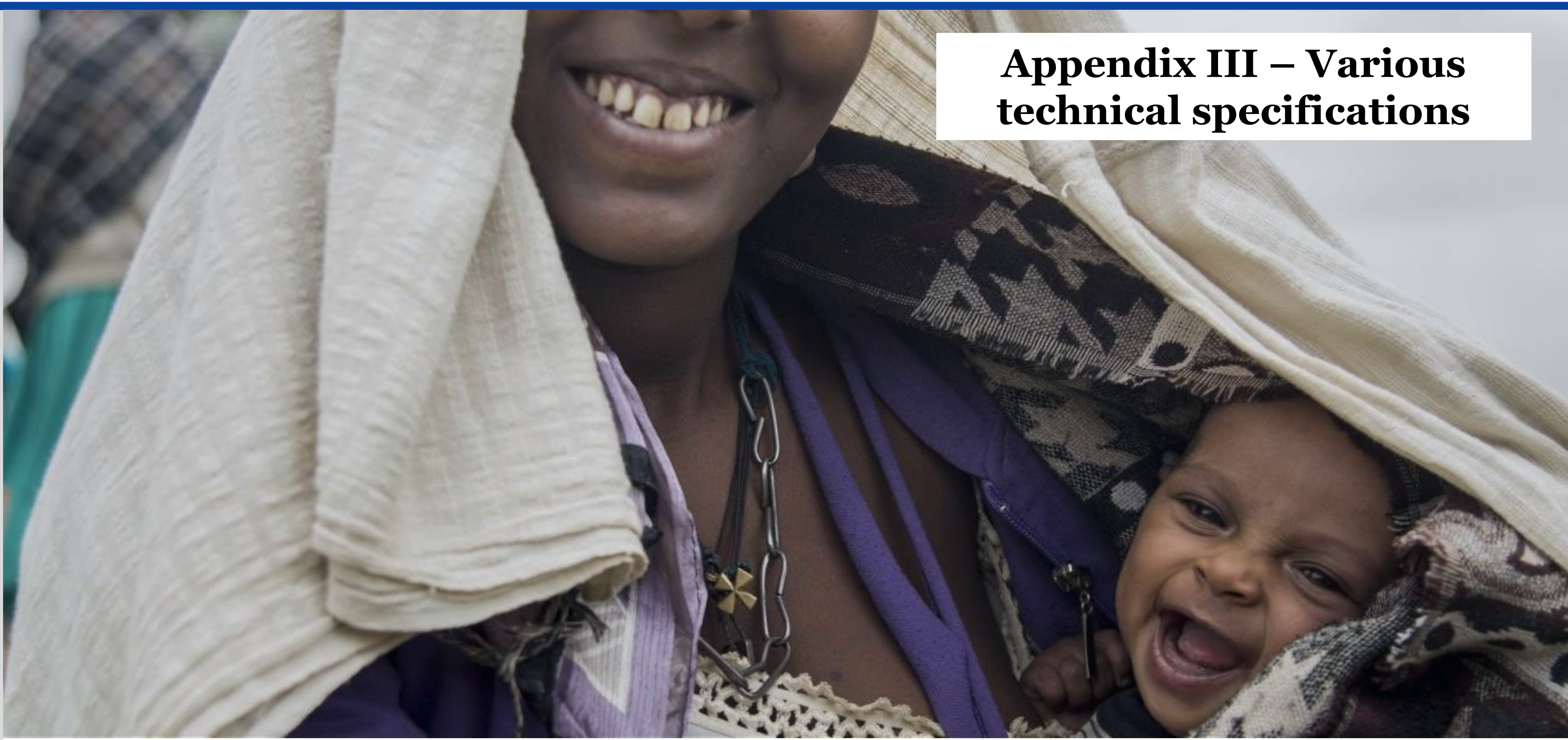
Development Bank of Namibia

FMO

Proparco Groupe Agence Française de Développement

This mapping is aligned with DFI's we have spoken to and their existing energy initiatives in SSA
The Carbon Fund- The Carbon Initiative for Development also provides financing for ESPs
Africa Renewable Energy Initiative (AREI) also provides financing for ESPs Climate Change Technical Assistance Facility- under the European Investment Bank also provides TA to MOH
Source: KOIS analysis

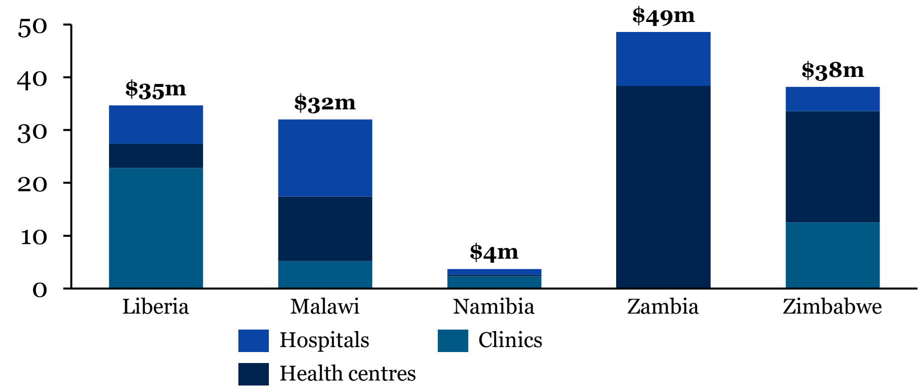
Appendix III – Various technical specifications



We estimate the total S4H programme initial investment in the 5 pilot countries to be approx. US$157m, depending on the MoH priorities and the technical requirements

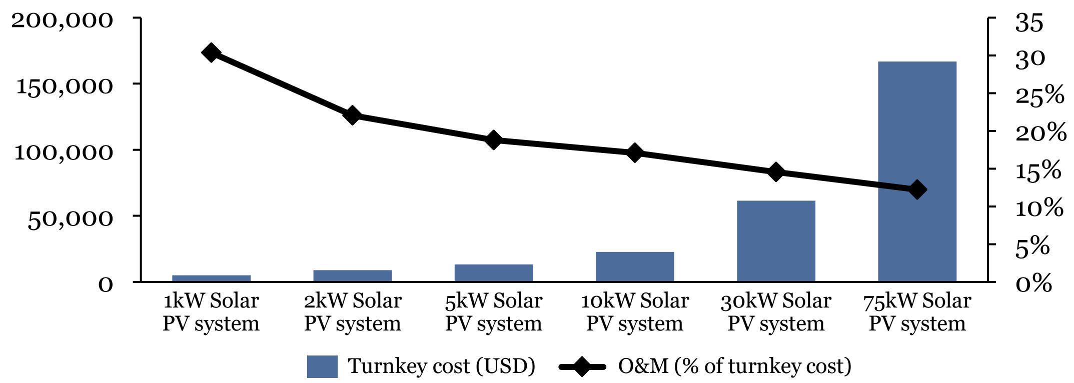
Market size: total energy solution cost[1]

US$m



Turnkey & O&M cost of standalone PV systems

US$



Market sizing assumptions

- For larger hospitals, a tailored PV system will be needed to respond to their specific needs and larger facility size
- For health centres and clinics, standardised systems are recommended to reduce the unit cost and allow for economies of scale
- Pre-financing of 7 years of O&M is included in the investment sizing

The impact of battery autonomy

- Battery autonomy represents a large portion of the installation cost, therefore the grid is used as a primary/back-up solution when available; diesel generators can be a cost-effective back-up solution for off-grid facilities
- Meteorological conditions also have a significant impact on the required autonomy (i.e., the more sunshine hours per day on average, the less autonomy needed)
- Additionally, prioritising critical load[2] is also a way to optimise battery size

Cost per patient versus need

- While the cost per patient depends on the exact catchment population of each healthcare facility, in general it is lower in larger facilities due to economies of scale (i.e., there is a certain amount of fixed costs that make larger installations more economical – typically hardware pieces but also service costs such as installation and periodic maintenance)
- The absolute need (i.e., in kWh) is larger in larger facilities, however, it is more urgent in rural facilities that often completely lack access to energy, therefore a prioritisation is necessary based on this trade-off

[1] The investment size includes the initial CAPEX, as well as present value of pre-financed 7 years of OPEX
[2] Critical loads are those loads to which power supply has to be maintained under any circumstances
Source: KOIS & Differ analysis

In dense off-grid areas, mini-grids could support a broader rural electrification objective and bring synergies compared to stand alone systems, however, the required investment would be much higher

Mini-grids are a sound path for rural electrification given the high costs of grid extension

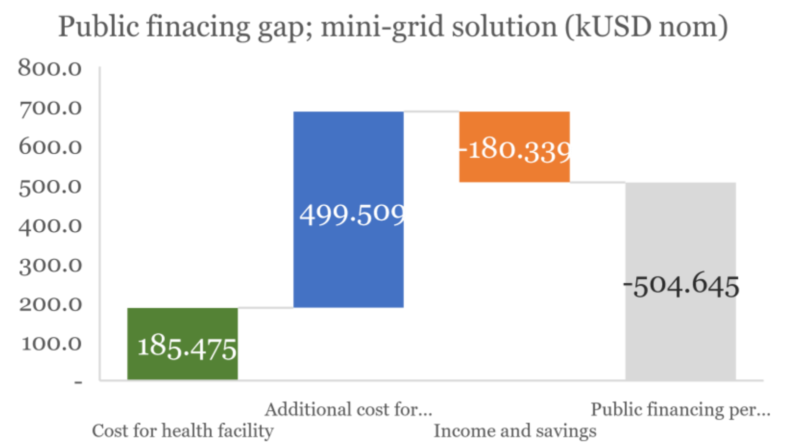
- When a country has a low population density and economic activities are concentrated in the urban areas, grid extension to bring electricity to the rural population is often not economical
- The electrification through grid extension is likely to take many years
- Setting up mini-grid would be a more cost effective path to rural electrification and require a lower investment cost

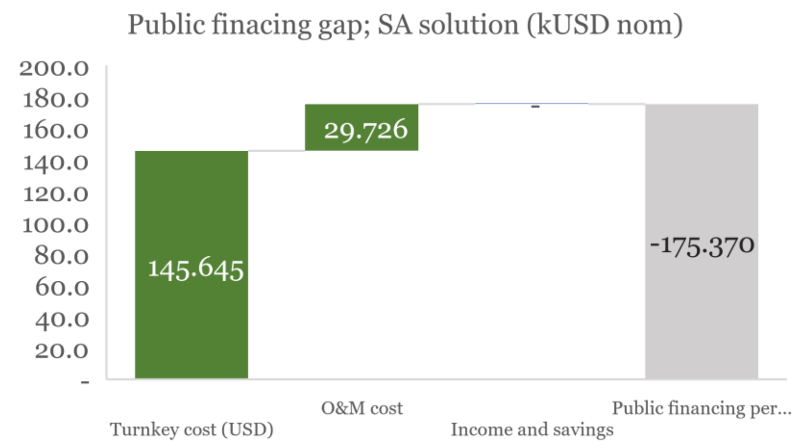
Rural electrification through mini-grids is however not economically viable to be implemented by the private sector, similar to the grid it requires public funding

- A mini-grid has high operational costs compared to a stand-alone system being a small network where the technical complexity is higher. Requiring:
    - A technician 24/7 on-site to ensure the proper operation of the system
    - A collection system to collect payments from all users and manage access
    - Security guards
- Public funding or grants are required to the investment cost and it is unlikely that that cost can be passed on to the customer especially given the low income level in rural areas

Given the need for grant funding, the higher costs and wider scope of a mini-grid solution, standalone systems are the least costly option for S4H

- For this study we have therefore limited the scope to stand-alone systems
- However, mini-grid can be considered in cooperation with the respective Ministry of Energy or rural electrification departments under a broader electrification strategy
- A hybrid mini-grid only for public buildings could however make sense and generate economies of scale in this project with the off-taker being the public sector



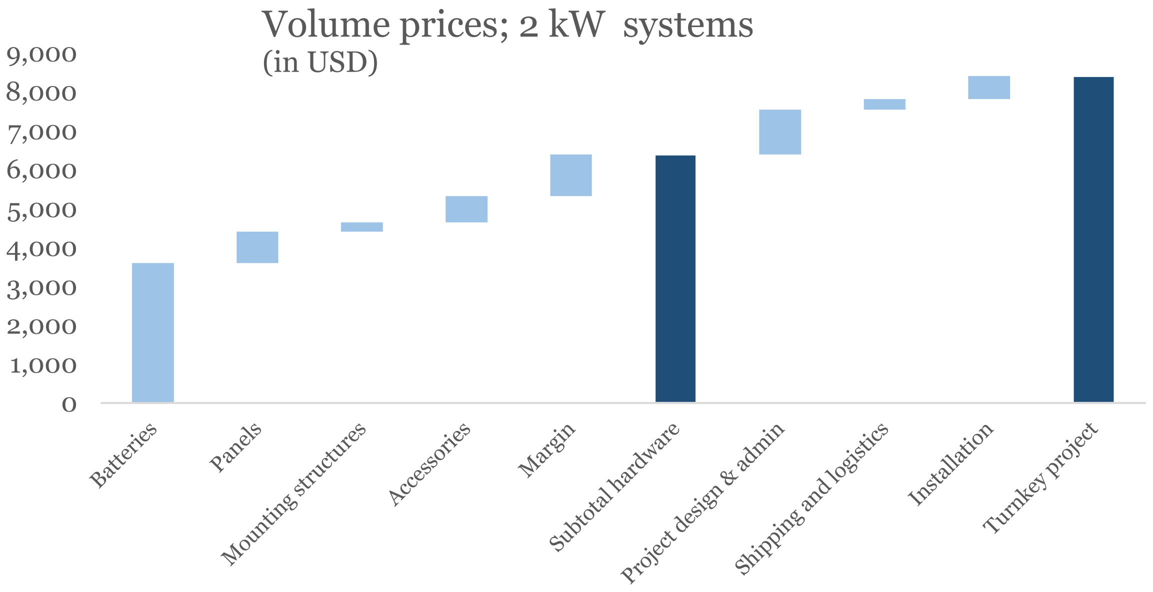


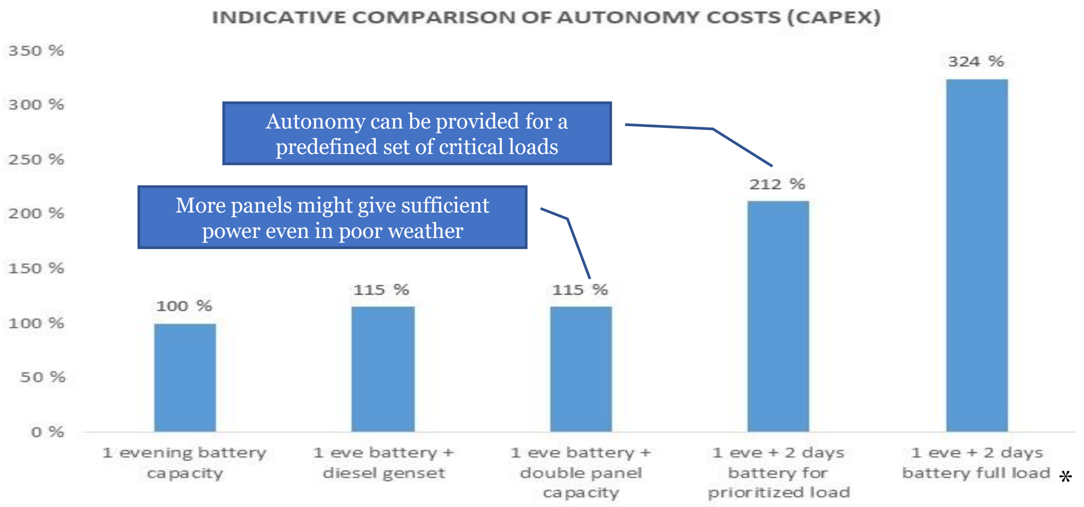
Source: Kois & Differ analysis

Autonomy can be obtained in different ways and to different degrees – costs of autonomy can be substantial

Battery prices vary significantly across manufacturers and specifications and they represent the largest portion of the investment cost

- We have used BYD's battery packs for the cost estimates, those are mid-range prices and cheaper or more expensive alternatives exist.
- We assumed that larger capacities approach US$450/kWh
- The BYD's batteries are Lithium LFP (LifePO4) that require limited maintenance and are recommended for back-up, solar storage and off-grid setting
- Those batteries have a 10 year warranty with a 60% EOL capacity





<u>* Assumptions on autonomy</u>

<u>Day 1: Normal day with battery used for evening use (25% of total daily usage)</u>

<u>Day 2: Limited or no generation of solar energy. 100% of daily load on battery</u>

<u>Day 3: Limited or no generation of solar energy. 100% of daily load on battery</u>

<u>The total battery size for this autonomy will be nine times that of a battery to cover regular evening use</u>

Source: Differ analysis

The CAPEX for one 30 kWp system with 2 days of additional autonomy equals that of 38 1-kWp systems with battery capacity for one evening only

ADDITIONAL NUMBER OF SMALLER FACILITIES ELECTRIFIED WITH LESS AUTONOMY, COMPARED TO ONE LARGE FACILITY WITH 1 EVE + 2 DAYS OF BATTERY AUTONOMY - WITH THE SAME BUDGET					
	Autonomy solution				
System Size (kWp)	**1 evening battery capacity**	**1 eve battery + diesel genset**	**1 eve battery + double panel capacity**	**1 eve + 2 days battery for prioritized load**	**1 eve + 2 days battery full load**
1	38,3	33,3	33,3	18,1	11,8
2	22,2	19,3	19,3	10,5	6,9
5	14,9	12,9	12,9	7,0	4,6
10	8,7	7,6	7,6	4,1	2,7
30	3,2	2,8	2,8	1,5	**1,0**

Source: Differ analysis

Achieving sustainability requires a payment structure providing incentives for proper O&M

Tender processes with donor financed CAPEX investments typically offer payments for O&M that are below the cost – leading to weak sustainability

- While experience indicates that sustainability requires an annual O&M cost of 5-10% (for systems of 2-30 kWp), traditional tenders often allocate only 10-20% of the total contract value for payment after commissioning.
- A leasing model can be mirrored to ensure that annual payments for O&M match the cost+margin of the ESPs
- A leasing structure will allocate an even higher payment per year of operation, as a substantial share of the CAPEX will also be paid back over time.

The top graph illustrates how payments after commissioning compare with the cost of the O&M for a 2 kWp system over a 3-year period.

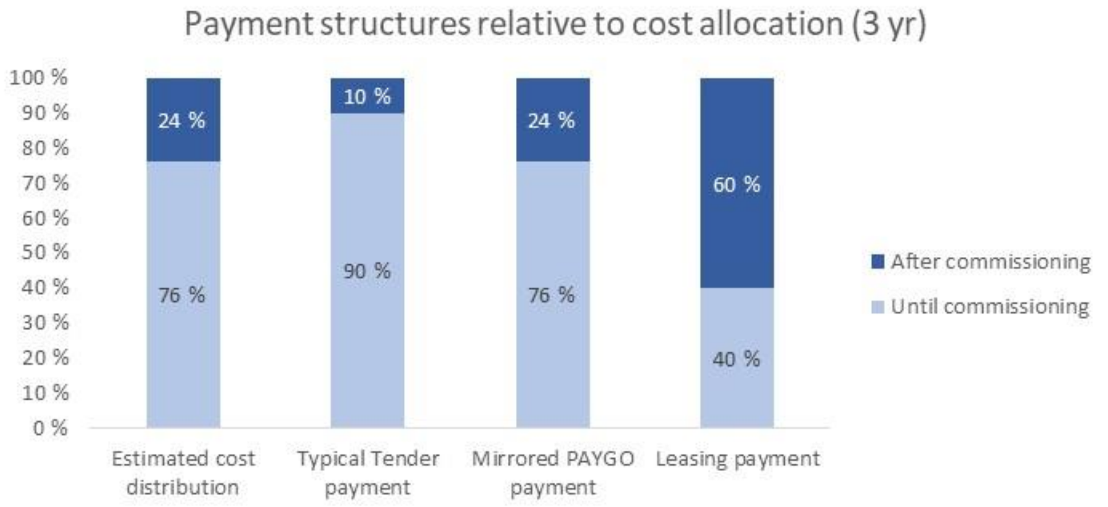
- There is an assumed down-payment of 40% of the total contract value in the leasing structure (i.e. more than 50% of the CAPEX)

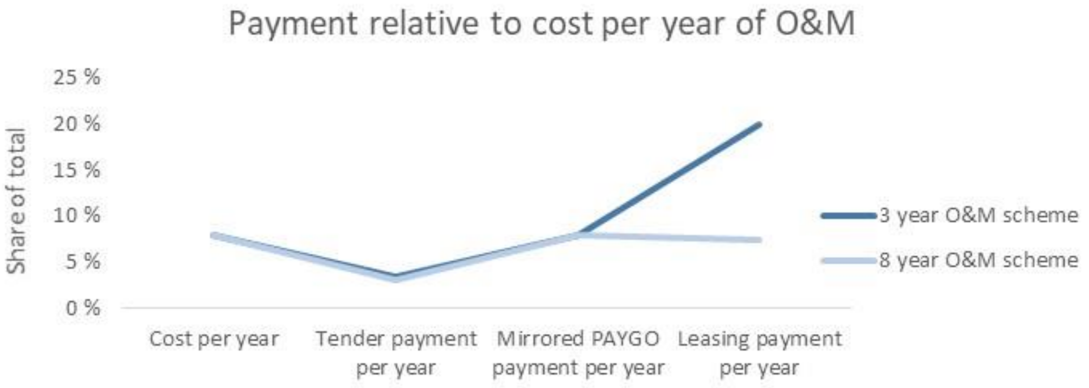
The bottom graph illustrates how the payment per year of operation compares with the annual cost of O&M (as a % of total contract value)

- We have not taken into account that leasing will have somewhat higher total cost, however, below is an assessment of the value of the additional costs.

As the share of the total payment is pushed out in time, the total cost per system also increases due to financing costs – but impact is expected to increase more

- There are two crucial impact gains that are expected to outweigh the additional cost
  i. Lower donor payment for each facility before commissioning means that more facilities can be electrified earlier - increasing the overall impact
  ii. With many systems empirically failing and contractors abandoning O&M obligations after a few years with traditional tenders, a limited increase on total cost will ensure that more systems work for longer – increasing the overall impact.





Source: Differ analysis

Disposal shall be thought of in the S4H project design, there is potential for a recycling value chain that will limit the net replacement cost of components

There is still little practical experience with disposal and recycling of components from medium to large scale solar energy systems, but…
…there are **no hazardous materials** in silicon PV panels and Lithium batteries (as opposed to lead acid batteries)
…**life-time expectancies are generally very long** for quality components, and aging can normally be met with adding more capacity as opposed to replacing components (for both Li batteries and PV panels)
…**net cost of replacement likely limited** and it is even possible that the **economics of disposal/recycling will play in S4H's favor** (i.e. have a positive net value)

Key components	Contents	Aging/end-of-life outlook	Economics of disposal/upgrade
Batteries	• **No hazardous materials** • Valuable materials: Lithium, copper, nickel, magnesium, cobalt, aluminum • Recycling of these materials is still not profitable, but can become so as scale • Plants for recycling of lithium batteries are in progress in Europe	• Quality Li-batteries expected to age slowly and more linearly (likely in the range of 5-20% over 5 years) • Technical lifetime might be more than 10 years for most quality Li-battery solutions (i.e. not the same waste challenges as for Lead Acid batteries) • Some batteries will fail earlier or deteriorate faster	• For most sites, the likely scenario for well-managed systems is a need for adding extra capacity to meet the required service level • For batteries that will need replacement, there will be value in recycling • At scale, the value of the replaced battery might even bring down the cost of a replacement
PV Panels	• **No hazardous materials in Si panels** • Valuable materials: aluminum, copper and silver • Silicon can be recycled but unlikely to be profitable • Plants for recycling of PV panels are in progress in Europe	• Quality panels age slowly and have a very long technical lifetime	• For most sites, the likely scenario for well-managed systems is the need for adding extra capacity to meet the required service level • For broken panels, valuable components can quite easily be recycled - also locally
Inverters	• **No hazardous materials** • Contains electronics with fewer valuable materials	• Likely the component that will need replacement first • Technical life-time could still be more than 10 years	• Not likely to be commercially viable to recycle • However, total volume will be limited with only 1 to 3 units per site
Appliances	• LED products are not environmentally hazardous • Refrigerators, fans, laptops, air conditioners	• Quality LED products have long life-times • Disposal of other appliances likely to pose larger challenges than the solar systems	

Source: Differ analysis

There is still little practical experience with disposal and recycling of components from medium to large scale solar energy systems, but…

Components

- Batteries
- PV panels
- Inverters
- Appliances

Insights

*…there are **no hazardous materials** in silicon PV panels, inverters or Lithium batteries (as opposed to lead acid batteries)*

*…**life-time expectancies are generally very long** for quality components, and aging can normally be met with adding more capacity as opposed to replacing components (for both Lithium batteries and PV panels)*

*…**net cost of replacement likely limited** and it is even possible that the **economics of disposal/ recycling will play in S4H's favor** (i.e. have a positive net value)*

Implementation

- *Even if there are no hazardous materials in most components to be installed, the LTA/PPA contractor should be responsible for waste management according to [global/OECD/EU] EE-regulations*
- *A (small) refund for documented safe disposal will additionally incentivise the ESPs to ensure 'no waste'*
- *The inclusion of lead acid batteries or certain appliances might require additional measures (also in case of replacement of old PV-systems under the program)*

Source: Differ analysis

Appendix IV – List of interviewees & other identified stakeholders

We have interviewed over 100 relevant organisations during the first phase of the study with whom we have touched upon the different aspects of off-grid energy financing in Sub-Saharan Africa (1/4)

Organisation	Role	Contact
Africa Mini-grid Developers Association	Expert	Daniel Kitwa
Beyond the Grid Fund for Africa	Donor	Esmeralda Sindou
CAA International	ESP	Nicole Plettenberg; Christopher Huys
CrossBoundary	Impact Investor	Gabriel Davis
Easy Solar	ESP	Nattie Davis
EnDev (GIZ)	Donor	Hans-Hartlieb Euler
European Commission	Donor	James Carey
Global Financing Facility (WB)	DFI	Sneha Kanneganti
Global Fund	Donor	Mehreen Khalid
Innosun	ESP	Tom Torne
inno: Africa	ESP	Genna Baron
Lib Solar	ESP	Nicholai Lidow
Norwegian Water Resources and Energy Directorate	Expert	Kirsten Westgaard

Organisation	Role	Contact
PEG Africa	ESP	Hugh Whalan
Pickering Energy Associates	ESP	Charles Pickering
Power Africa	Donor	Carolina Barreto
Rural Renewable Energy Alliance	Expert	Mary Jo Mettler; Muzalema Mwanza
Renewable Energy and Energy Efficiency Partnerships	DFI	Esmeralda Sindou
Rocky Mountains Institute	Expert	Edward Borgstein
Sustainable Energy for All	Donor	Jem Porcaro; Olivia Coldrey
Sida	DFI/Donor	Hanna Holmberg
SolarNow	ESP	Ronald Schuurhuizen
Tetra Tech	Expert	Ewan Bloomfield
USAID (Power Africa)	Donor	Katrina Pielli; Molly Dean
West Coast Energy Liberia	ESP	Samuel O. Simpson
World Bank	Donor	Rahul Srinivasan
independent consultant	Expert	Anil Cabraal

We have interviewed over 100 relevant organisations during the first phase of the study with whom we have touched upon the different aspects of off-grid energy financing in Sub-Saharan Africa (2/4)

Organisation	Role	Contact
Absolute Energy Capital	Impact investor	Alberto Pisanti Jesus Fernandez
Anthos Fund & Asset Management	Impact investor	Dimple Sahni
Blue Haven Initiative	Impact investor	Lauren Cochran
Ceniarth	Impact investor	Vince Knowles
DOB Equity	Impact investor	Hayo Afman
Energy MRC	Expert	Douglas Caskie
Empower Energy	Impact investor	Alexander Pedersen
Islamic Development Bank	DFI	Bandar Alhoweish Hussain Mogaibel
Kube Energy	Investor/ESP	Mikael Clason Hook
Persistent	Impact investor	Christopher Aidun
Shell Foundation	Foundation	Ashish Kumar
Sustainable Energy Fund for Africa (AfDB)	DFI	Rahul Barua

Malawi field visit

Organisation	Role	Contact
Community Energy Malawi	ESP	Edgar Kapiza Bayani
Department of Energy Affairs	Government	Saidi Jabu Banda
DFID	Donor	Desmond Whyms
JCM Power Malawi	ESP	Jonas Sani
Malawi Energy Regulatory Authority	Regulator	Wilfred Kasakula
Department of Strategic Planning (MFDP)	Government	Chippo Masina
Department of Data & Aid (MFDP)	Government	Anwai Mussa
Ministry of Health	Government	Rumbani Sidira; Grycian Massa
Solar Africa	ESP	David Dean
UNDP Malawi	Client	Shamiso Kacelenga; Emmanuel Mjimapemba; Andrew Spezowka
UNICEF	Donor	Samuel Chirwa
USAID	Donor	Andrew Spahn
World Bank	DFI	Kagaba Paul Mukiibi

We have interviewed over 100 relevant organisations during the first phase of the study with whom we have touched upon the different aspects of off-grid energy financing in Sub-Saharan Africa (3/4)

Liberia field visit

Organisation	Role	Contact
African Development Bank	DFI	Emmanuel Maniragaba
Ecobank	Commercial bank	Mohammed Dukuly
EcoPower	ESP	Vickson Korlewala
EnDev (GIZ)	Donor	Stephen Mulbah Freeman Godu
Environmental Protection Agency	Government	Nathaniel Blama
EU Delegation to Liberia	Expert	Stefania Marrone
Liberia Electricity Regulatory Commission	Regulator	Augustus Goanue
Ministry of Health	Government	Norwu Howard; Adrian Brown
Ministry of Mines and Energy	Government	Prince Nanlee Johnson
Rural & Renewable Energy Agency	Government	Stephen Potter
Sida	DFI/Donor	Jenkins Flahwor
UNDP Liberia	Client	Moses Massah
World Bank	DFI	Joseph Tawiah Quayson

Namibia field visit

Organisation	Role	Contact
Development Bank of Namibia	DFI	Hellen Amupolo
Electricity Control Board	Government	Foibe Namene
Environmental Fund	IFI	Pandeni Kapia
French Development Agency	DFI	Valentin Benoit
Hans Seidel Foundation	Foundation	Clemens von Doderer
Letshego	Expert	Jacques Bock
Ministry of Health and Social Services	Government	Thomas Mbeeli
Ministry of Mines and Energy	Government	Abraham Hangula
Namibia Energy Institute	Expert	Helvi Ileka
NamPower	Government	Fred Bailey
Private Financing Advisory Network	Expert	Harald Schütt
Soltech	ESP	Jason Sivertsen
Solsquare	ESP	Leonhard Eins
UNDP Namibia	Client	Alka Bhatia; Armstrong M Alexis
USAID	Donor	Randy Kolstad, David Jarrett
FNB	Commercial bank	Bolle Hans
University of Namibia	Expert	Prof. Chisale
SACREEE	Expert	Kudakwashe Ndhlukula
Ministry of Finance PPP Unit	Government	Rauna Mukumangeni
Namibia Biomass industry Group	ESP	Colin Lindeque
COMESA	Expert/Donor	Harrison Murabula, Samuel Mgweno
RERA	Regulator	Elijah C. Sichone

We have interviewed over 100 relevant organisations during the first phase of the study with whom we have touched upon the different aspects of off-grid energy financing in Sub-Saharan Africa (4/4)

Zimbabwe field visit

Organisation	Role	Contact
African Development Bank	DFI	Petronella Utete Laina Muguti
DPA Africa	ESP	Sindiso Ncube Taona Jakachira Edward Muchuchuti
Ministry of Health and Child Care	Government	Celestino Basera Clive Marimo
Stanbic Bank	Commercial bank	Lucia Siyavora Joshua Tapambgwa Blessing Manyeche
UNDP Zimbabwe	Client	Georges van Montfort Madelena Monoja Emmanuel Boadi Pfungwa Mukweza
UNICEF	Donor	Emelie Karre

Zambia field visit

Organisation	Role	Contact
Get Fit Zambia	Donor	Dailesi Njobvu
African Development Bank	DFI	Lewis Bangwe
USAID	Donor	David Mpundu
World Bank	DFI	Christopher Saunders
Delegation of the EU to the Republic of Zambia and COMESA	Expert/Donor	Davide Bixio
Buffalo Solar	ESP	Will Dryer
Embassy of Sweden	Donor	Magdalena Svensson
DFID	Donor	Magda Johansson
University of Zambia	Expert	Professor Prem Jain
Medical Stores Limited	S4H beneficiary	Timothy Sakala
Ministry of Health	Government	Jason Wamulume; Raphael L. Mwanaza
Vitalite	ESP	Russell Lyseight
Zambian Energy Corporation	ESP	Michael J. Tarney
UNDP Zambia	Client	Lionel Laurens; Winnie Musonda; Jan Willem van den Broek; Caoimhe Hughes

A number of stakeholder will intervene in the implementation of the S4H scale-up and shall have well defines roles and responsibilities

DFIs/IFIs

Financial role: provide upfront capital in exchange for financial returns
Operational role: conduct due diligence prior to and track its performance throughout the investment

MoH

Financial role: contributes to electricity payments
Operational role : PPP contract management, prepare O&M transition under MoH after the transfer of ownership

UNDP GO

Financial role: support the ESPs in raising capital for the project implementation
Operational role : coordinates the project implementation and the interactions among the different parties

International donors

Financial role: provide grants for energy payments, TA grants or guarantees to decrease the repayment risk. Support the project feasibility by decreasing risks for other parties and bringing funds

MoE
REA
Financial role: could provide subsidies within rural electrification plan, FiT
Operational role : support the MoH in the selection of site, need assessment and technical specifications

UNDP CO

Financial role: receive TA fees, monetize reductions of carbon emissions
Operational role : provide TA, support procurement process; champion policy change at national level, assist in M&E

Energy service provider

Financial role: bear financing risk and obtain installation & O&M fees
Operational role : purchase, install and maintain the installations throughout the contracted period

MoF
Treasury/PPP Unit
Financial role: guarantees the MoH obligation under the PPP
Operational role : support the MoH in the PPP process

TA provider

Financial role: receive TA fees, financed by donor grants
Operational role : provide TA to the local ESPs and to the MoH

Source: KOIS analysis

Due to very high perceived country risk, private investors and commercial banks are reluctant to invest in the energy sector (RE in particular), therefore energy investments are done predominantly by donors (1/6)

Investment initiative	Funder	S4H Country	Objective	Fit with investment needs	Committed/ invested amount	Instrument
Liberia National Adaption Plan	Green Climate Fund		Integrate climate change adaptation in agendas of key ministries and agencies	Strengthening enabling environment and building institutional capacity	US$2.2m	Grants
Rural Energy Strategy & Master plan	European Union		Develop Liberia's rural energy master plan	Enabling environments and building institutional capacity	US$2m	Grant
Liberia Renewable Energy Access Project (LIRENAP)	Strategic Climate Fund Grant & World Bank		Increase electricity access via decentralised electrification	Developing supply chain and addressing demand-side constraints	US$27m	Grants, loans
Beyond the Grid Fund for Africa (BFGA)	Government of Sweden		Build market for off-grid energy in rural & peri-urban areas	De-risk commercially viable projects	n/a	Grants
European Development Fund (EDF)	European Union		Increase rural electrification of south-east Liberia (mostly via grid and mini-grid)	Developing rural energy infrastructure (e.g., mini-grid)	€45m	Grants, sub-ordinate loans, (junior) equity
Light up Liberia (LUL) Program (*completed in 2019*)	European Union		Support local ESPs to deploy solar lamps and cook stoves, and later SHS and solar pico-grids in rural areas	Supporting local ESPs	US$2m	Grants
Renewable Energy for Electrification in Eastern Liberia (REEEL)	African Development Bank & Strategic Climate Fund		Develop hydropower power plant in Nimba County	Building energy infrastructure	US$34m	Grants, loans

BFGA Zambia program budget is US$20m, while Liberia's program budget is US$10m
Source: KOIS analysis

Due to very high perceived country risk, private investors and commercial banks are reluctant to invest in the energy sector (RE in particular), therefore energy investments are done predominantly by donors (2/6)

Investment initiative	Funder	S4H Country	Objective	Fit with investment needs	Committed/ invested amount	Instrument
Energising Development (EnDev) by GiZ	Germany, Netherlands, Norway, UK, Switzerland & Sweden		Strengthen SE sector and promote solar PV technologies	Developing local ESPs and increasing awareness of SE	n/a	Grants
AECF-REACT SSA Project	Government of Sweden		Incubate local ESPs via TA and seed funding	Early-stage ESPs	US$6.5m	Grants
Regional Off-Grid Electrification Project (ROGEP)	World Bank		Develop off-grid ESPs via TA and loans to support electrification of public institutions	Supporting local ESPs; focus on public institutions	n/a	Grants, loans, guarantees
Power Africa Beyond the Grid Initiative (BTG)	USAID		Increase electricity access via off-grid RE solutions	Increasing public awareness of benefits of solar energy	US$4.6m	Grants
Renewable Energy for Electrification in Liberia (REEL Project)	African Development Fund (ADF) , Scaling up Renewable Energy Program (SREP) & Transitional Support Facility (TSF)		Develop several hydro power plants in various locations across the country	n/a	US$25m	Grants
Liberia Energy Efficiency and Access Programme (LEEAP)	African Development Bank, European Union & Global Environmental Fund (GEF)		Extend the main grid and increase connections; strengthen project management capacity	Capacity building	€45m	Grants, concessional loans

EnDev total programme budget: €339m split across 21 countries; budget per country not available
ROGEP programme budget: US$200m for 15 ECOWAS countries
Source: World bank; KOIS analysis

Due to very high perceived country risk, private investors and commercial banks are reluctant to invest in the energy sector (RE in particular), therefore energy investments are done predominantly by donors (3/6)

Investment initiative	Funder	S4H Country	Objective	Fit with investment needs	Invested amount	Instrument
Southern Africa Energy Program (SAEP)	USAID		Increase the supply of and access to electricity in Southern Africa	Various	n/a	Grant
Climate Resilient Agriculture in three of the Vulnerable Extreme northern crop growing regions (CRAVE)	Green Climate Fund		Provide rural farmers with alternative sustainable access to off-grid solar energy technologies. promoting solar water pumping in the agricultural sector	Adapting off-grid solar energy technologies for agricultural sector	US$10m	Grant
SUNREF (Sustainable Use of Natural Resources and Energy Finance)	Agence Française de Développement (AFD)		Support financial institutions and their clients to boost financing for projects for sustainable natural resources management, focus on clean energy.	Enabling environments and building financial institutional capacity	n/a	Loan
Adaption Fund	Desert Research Foundation of Namibia		Pilot of poor quality local groundwater to a level that complies with the national standards for drinking water, using sun and wind energy	Improved resilience of vulnerable communities and groups to climate change impact	US$5m	Grant
Promoting Renewable Energy for Climate Change Mitigation Initiatives in Namibia	European Union & Spanish Red Cross		Mitigate the negative impacts of climate change in rural vulnerable communities	Distribution of solar products	€5m	Grant
Increased Access to Electricity and Renewable Energy Production (Project	European Union		Increase access to clean, reliable, more equitable and affordable energy and promote renewable energy production and energy efficiency across Zambia	Capacity building for renewable energy	€40m	Grant

Source: KOIS analysis

Due to very high perceived country risk, private investors and commercial banks are reluctant to invest in the energy sector (RE in particular), therefore energy investments are done predominantly by donors (4/6)

Investment initiative	Funder	S4H Country	Objective	Fit with investment needs	Invested amount	Instrument
Electricity Services Access Programme (ESAP)	World Bank		Increase electricity access in Zambia's targeted rural areas	Capacity building	US$26.5m	Loan
China- Zambia South-South Cooperation on Renewable Energy Technology Transfer Project	UNDP/ Government of Denmark		Strengthen the enabling environment for the transfer and use of priority renewable technologies in Zambia	Various	US$2.7m	Grant
Renewable Energy Resource Mapping Project	World Bank		Map solar and wind resource potential	Building energy infrastructure	US$3.6m	Grant
Africa Clean Energy (ACE) Business Programme	DFID		Catalyze market-based approach for private sector delivery of SHS products and services	Distribution of solar products Early stage investment and de-risking of commercially viable projects	n/a	Grant
Health Services Joint Fund	Royal Norwegian Embassy, DFID and KfW		Support of the government's priority budget lines, for the implementation of the Health Sector Strategic Plan	Capacity building	US$100m	Grant
Sustainable Energy for Rural Communities (SE4RC)	European Union		Enhance the socio-economic wellbeing of 30,000 rural men and women in Zimbabwe and Malawi through access to modern energy	Improved resilience of vulnerable communities	€7.3m	Grant

Africa Clean Energy (ACE) Business proramme has a total budget of £65m, of which £18.4m has been spent as of 2019 across 14 priority SSA countries
Sustainable Energy for Rural Communities (SE4RC) has a total budget of €7.3m split between Zimbabwe and Malawi
Source: KOIS analysis

Due to very high perceived country risk, private investors and commercial banks are reluctant to invest in the energy sector (RE in particular), therefore energy investments are done predominantly by donors (5/6)

Investment initiative	Funder	S4H Country	Objective	Fit with investment needs	Invested amount	Instrument
Solar Home System Kick-Starter Program for Malawi (under Power Africa initiative)	USAID		Catalyze increased investment and rapid growth in energy sector over a three-year period	Developing local ESPs	US$1.5m	Grant
Energy Sector Management Assistance Program (ESMAP)	Austria, DFID, Sida, SDC, World Bank et al		Mapping solar resource mapping	Capacity building	US$70m	Grant
Malawi Electricity Access Project	World Bank		Increase electricity access	TA and Capacity Building	US$150m	Grant, loan
Solar Energy for National Vaccine Store in Lilongwe	Gavi, the Vaccine Alliance		Electrify medical warehouses	Capacity building	US$1.2m	Grant
Standalone solar systems for rural health posts	Gavi, the Vaccine Alliance		Electrify 50 small rural facilities	Capacity building	US$935k	Grant
UNICEF Health section	UNICEF		Broad annual budget to implement various health projects	Capacity building	US$20m	Grant

Energy Sector Management Assistance Program has spent approx. US$70m in SSA countries
Source: KOIS analysis

Due to very high perceived country risk, private investors and commercial banks are reluctant to invest in the energy sector (RE in particular), therefore energy investments are done predominantly by donors (6/6)

Investment initiative	Funder	S4H Country	Objective	Fit with investment needs	Invested amount	Instrument
Zimbabwe Multi-Donor Trust Fund	Governments of Australia, Denmark, Germany, Norway, Switzerland, Sweden, and the United Kingdom		Water & sanitation and power projects	Infrastructure development	US$145m	Grant
Zimbabwe Reconstruction Fund (ZIMREF)	Governments of Germany, Norway, Sweden, Switzerland and the United Kingdom ; European Union, State and Peace Building Fund (World Bank)		Strengthening of Zimbabwe's systems for reconstruction and development	Infrastructure development	US$44.3m	Grant

Source: KOIS analysis

Appendix V – GetFit case study

Case study: GET FiT Zambia international solar PV tender, contributing towards development of Zambian power market by encouraging private sector participation from a wider range of stakeholders

Largest single solar PV tender implemented in sub-Saharan Africa

General context: GET FiT is the Government of Zambia's programme to facilitate private sector investment in small- and medium-scale renewable energy Independent Power Projects (IPPs) in Zambia. The solar tender represents the first phase of implementing the REFiT Strategy, launched in 2017.

Technical specifications: Six solar PV IPP projects, totaling 120MW; lowest successful bid came in at US$0,399/kWh and the weighted average of all six projects is US$4,41/kWh; first time a tariff below US$4c per kWh has been achieved through a public tender in SSA

Implementation: The programme is a partnership between the Department of Energy and the German Development Bank, KfW, and is implemented by the GET FiT Secretariat

Tender design

1st Stage	Interim Stage	2nd Stage
Request for Qualification	**Interim Rapid Grid Access**	**Request for proposal**

Successful consortiums

- 1st Award: Two Proposals of Joint Venture Building Energy & Pele Energy - Bulemu East & West– 20MWac each at USD c 3.999/kWh
- 2nd Award: Two Proposals of Joint Venture Globeleq & Aurora Power Solutions - Aurora Sola One & Two - 20MWac each at USD c 4.52/kWh
- 3rd Award – Two Proposals of Joint Venture of InnoVent & CEC - Garneton North & South Solar 20MWac each at USD c 4.80/kWh

Key takeaways

- No market distortions: No form of grant financing, but GET FiT facilitate bidders' access to competitive finance, including ATI"s* Regional Liquidity Support Facility which provides short-term liquidity backing for ZESCO's offtake commitment under the PPAs
- Ensuring grid integration: Interim Rapid Grid Assessment (IRGA) – was part of the tender procedure
- Promoting local support and capacity building: Partnerships with local ESP's, considered in proposal evaluation,

Key challenges

- Capacity building of the MoE: Substantial support was necessary to enable the MoE to conduct the tender successfully
- Low creditworthiness of ZESCO: the project ran into implementation hurdles as energy companies are asking for more securities over the payments that will be due by ZESCO
- Political unrest as large contracts were awarded to international companies and not local players, required new smaller tenders to be launched

*ATI: African Trade Insurance Agency

https://getfit-zambia.org/wp-content/uploads/2020/05/Annual-Report-GET-FIT-ZAMBIA-2019_FINAL.pdf

https://234878-www.web.tornado-node.net/wp-content/uploads/2019/08/GET-FiT-Zambia-Introduction-and-Overview_Pre-Bid-Meeting-Presentation_070218.pdf

Source: Get FiT Zambia; KOIS analysis

Case study: GET FiT Zambia has developed a set of tools designed to help create an attractive environment for private investors and systematically support the Zambian government and the utility, ZESCO

GET FiT Toolbox

PROCUREMENT & TRANSACTIONS	DEBT & RISK MITIGATION FACILITY	VIABILITY GAP FUNDING	GRID FACILTY	TECHNICAL ASSISTANCE
Competitive procurement of 100MW of Solar PV & 100 MW Small Hydro	Mitigating liquidity risk through ATI's Regional Liquidity Support Facility & financing support	Production- based top up for Hydro Projects determined through competitive bidding	Shallow and deep integration support of GET FiT projects & grid- related technical assistance	Procurement of tailored capacity building and TA programs for key sector stakeholders

https://www.getfit-zambia.org/
Source: GET Fit Zambia; KOIS analysis