Solar for Health (S4H) innovative financing feasibility study

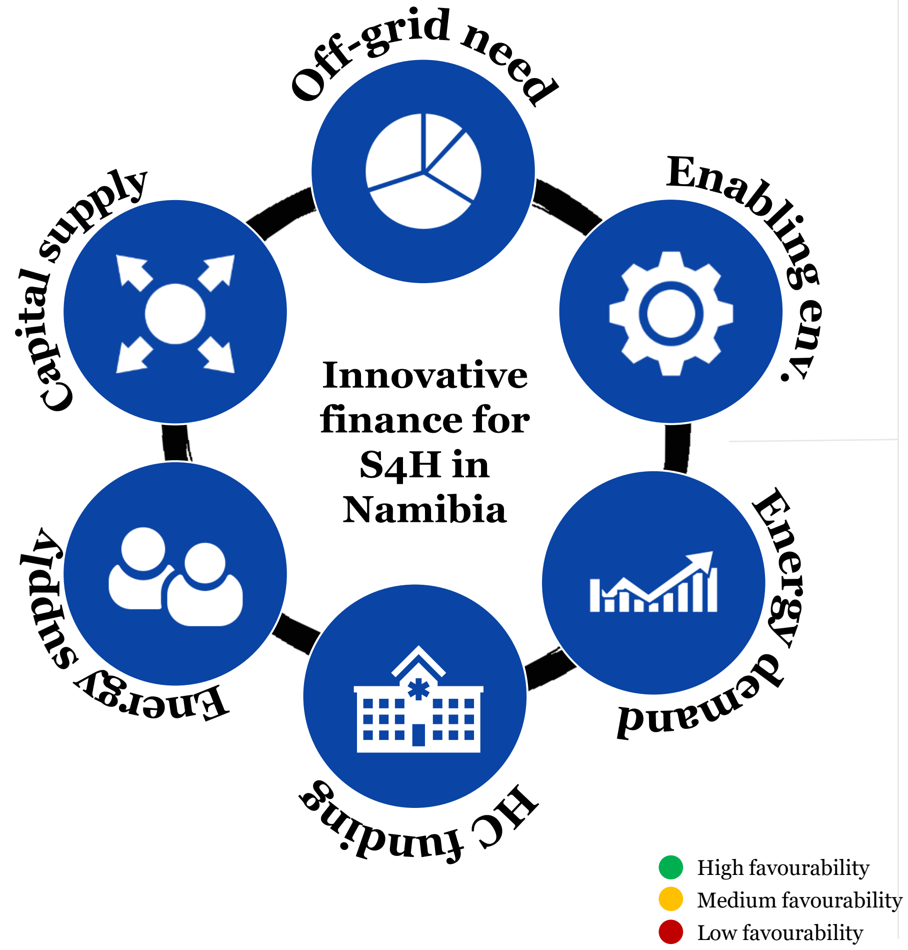
in Liberia, Malawi, Namibia, Zambia and Zimbabwe

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

Namibia – country report

September 2020

Namibia presents a favourable environment with good local companies and presence of local financing. However, the Government of Namibia (GoN) will need to secure funding to implement the S4H programme.



Where present, the grid is reliable with no load-shedding but the tariffs are relatively high. The low density and large distances make off-grid solutions more cost effective than grid extension.

Regulatory framework is relatively strict and biased toward grid solutions. However, regulations and processes are in place for Public Private Partnerships (PPPs) and S4H procurement could fit within this existing framework.

70% of the 350 public healthcare facilities have access to the grid and benefit from a generally reliable power supply. The remaining 103 healthcare facilities are mostly located in rural areas and need an off-grid solution.

Public budgets are constrained following a recession and donors provided very limited support. However, the GoN has access to the local capital market and is currently able to meet its key healthcare expenditures.

Local solar energy companies seem to have sufficient level of skills, possibility to cover the whole market and willingness to service the public sector.

The investment size is limited and local investment capital is available and could be mobilized for PPP type renewable energy project backed by the Ministry of Finance.

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Namibia has a 56% electricity access rate, 60% of electricity imported. A sparsely population and high income inequality has led to some regions being well connected with others remain off-grid and underserved.

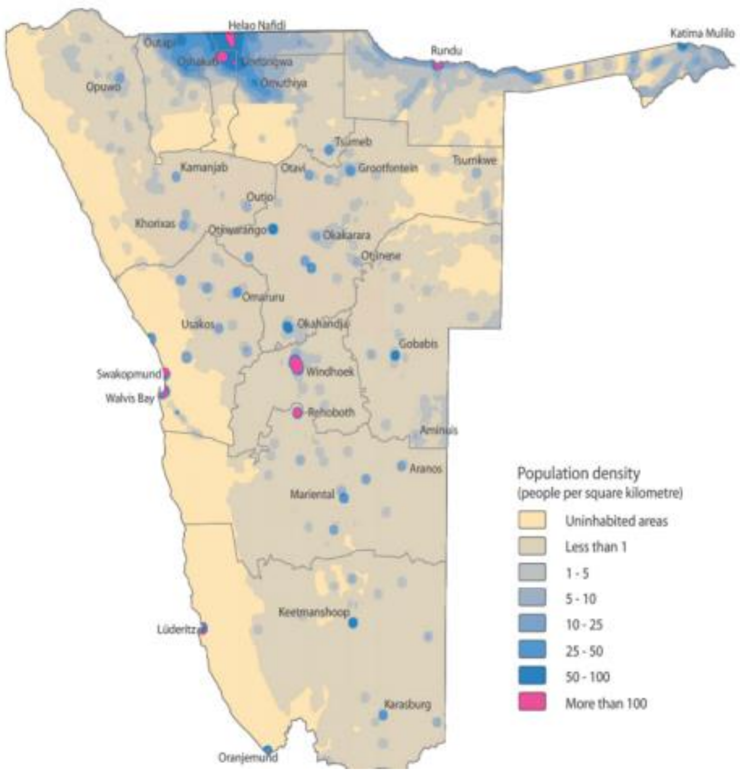
General figures[1]

Population	2.4 Million (50% rural)
Land size	825,615 km²
GDP/ Cap 2018	US$5800 (91/186)
Density	3ppl/km²
Ease of doing business ranking	104 /190

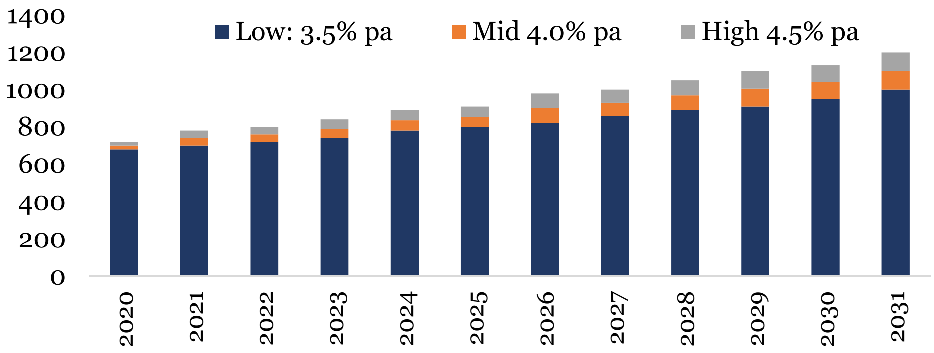
Electricity related figures[2]

Electrification	56%	77% Urban 29% Rural
Rural grid electrification	16%	
Electricity price	US$0.35/kWh	
Installed capacity	126 MW	

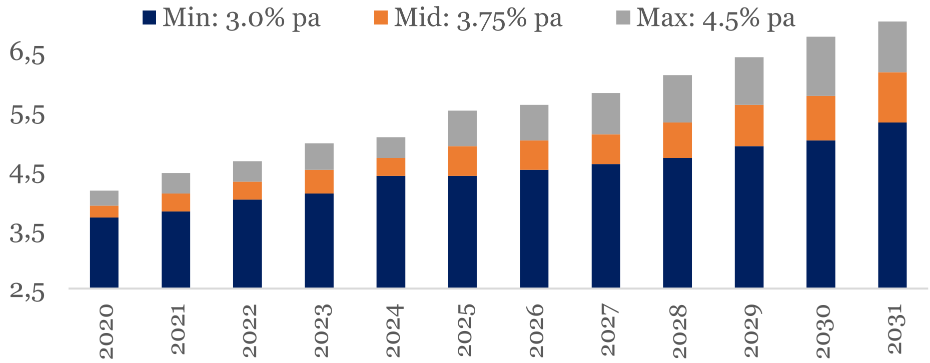
Population density by region[3]



Forecast peak electricity demand (MW)[4]



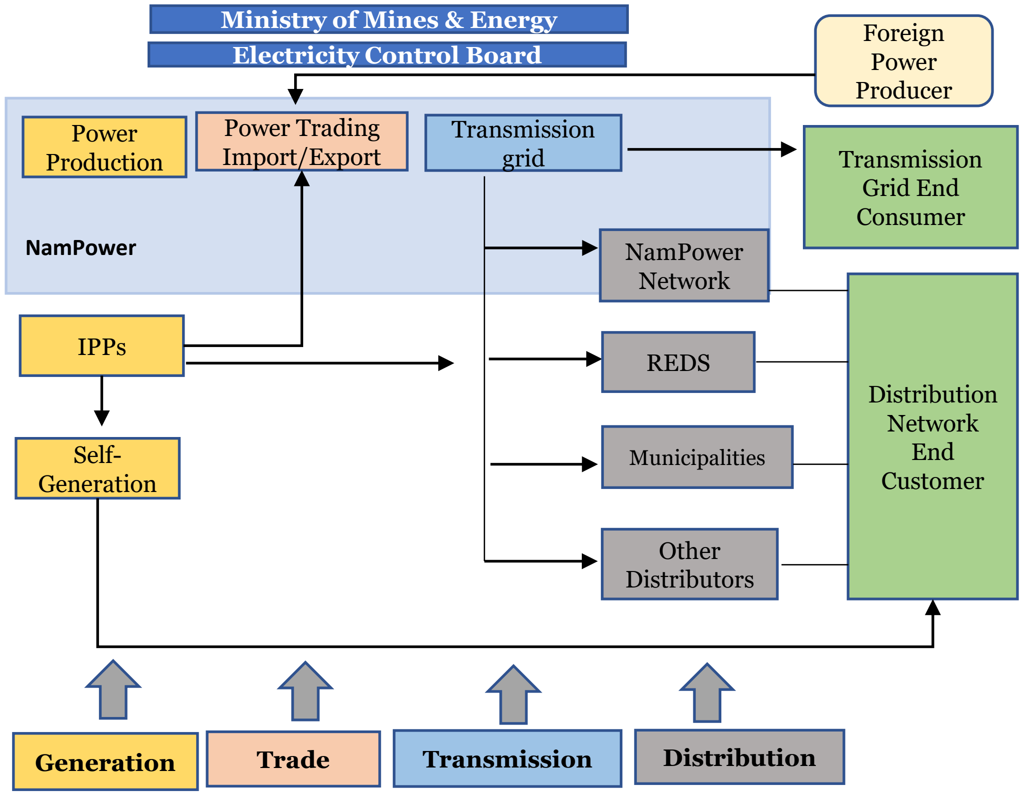
Forecast demand for electrical energy (TWh)[4]



[1] Worldbank database
[2] SADC Renewable Energy and Efficiency Status Report, 2018
[3] Namibia Statistics Agency (NSA) 2013
[4] https://www.researchgate.net/publication/283715395_Namibia's_Energy_Future_-_A_Case_for_Renewables 2012

Namibian electrification strategy is geared towards grid extension, complemented by Independent Power Producers (IPP) favourable policies while off-grid solutions lack a strong regulatory framework.

Structure and actors of the Namibian electricity market[1]



The Electricity Act of 2007 established the regulatory provisions which are used to govern the Namibian electricity sector

- Generation : open market with NamPower managing the power supply
- Transmission: transmission lines are operated by NamPower
- Distribution: 5 regional distributors (REDS) are being established and responsible to run, operate and maintain the distribution lines in each region

Grid electrification is the MoME primary strategy for rural electrification even if it is not the most cost-effective solution:

- The Rural Electricity Distribution Master Plan established rural electrification targets for the next 20 years
- Grid extension is financed by a levy on electricity and implemented by NamPower
- Namibia being scarcely populated, grid extension is not cost effective for many areas and will likely take time to reach the most remote populations

Despite an Off-Grid Electrification Master Plan, initiatives and budget to support off-grid energy are limited resulting in an underdeveloped market

- The Off-Grid Energisation Master Plan is a 20 year programme aiming to provide access to appropriate energy technologies to communities living in off-grid areas, through:
    - Solar electrification of public institutions
    - Establishing of Energy Shops and
    - Credit financing of solar technologies
- The Solar Revolving Fund subsidises stand-alone solar systems for individual household use through loans to at a favourable interest rate of 5% on a loan period of 5 years. Uptake of the loans has been high, and the fund has not been able to keep up with the demand. There is currently a lack of fund
- There is no direct financing from the Ministry of Mines and Energy (MoME) or budget for off-grid electrification

[1] Ministry of Mines and Energy, Government of the Republic of Namibia
Source: : Namibia National Renewable Energy Document Rural Energy Strategy and Master Plan Document; European Union; Power Africa; UNDP; KOIS Invest analysis

In its effort to increase national generation capacity, the GoN has strengthened its regulatory framework to enable IPPs to enter the market and develop Public Private Partnerships.

Process for PPP or PPA contract with the GoN

1. MHSS/MoME submit a feasibility study to the PPP Unit for a PPA with a Energy Service Provider to procure, install and maintain Solar Energy installation
2. PPP Unit to register and evaluate the agreement in light of affordability, risk allocation and value for money criteria
3. With PPP Unit support, a PPP committee shall approve the agreement
4. Treasury supporting the PPA will secure future budget line for the related payments and decrease off-taker risk
5. MHSS/MoME can launch a procurement process to award the PPA contract to a private energy service provider (ESP)

New regulation opened the generation market to IPPs and attracted foreign investors

- National Independent Power Producer Policy 2018: Builds on an initial IPP market framework that was developed in the early 2000's, aiming at IPP investments in new electricity generation capacity.
- New Modified Single Buyer framework opened the generation market to IPP as long as registered with ECB
- Since this new policy, 250MW were installed by IPPs on-selling to NamPower under a Power Purchase agreement (PPA)
- Renewable Energy Feed-in Tariff (REFIT) programme allowed 14 companies generating 5MW each to benefit from a standard feed-in tariff. The programme is currently on hold.

Local regulations set some limitations to IPPs to protect the interests of NamPower and support Previously Disadvantaged Namibians

- A company producing more than 1MW is considered an IPP and shall register and obtain a generation licence with the ECB
- IPPs can provide max 30% of power supply to a customer connected to the grid
- For an IPP project, it is often a requirement that Previously Disadvantaged Namibians (PDN) have a 30% stake in the project

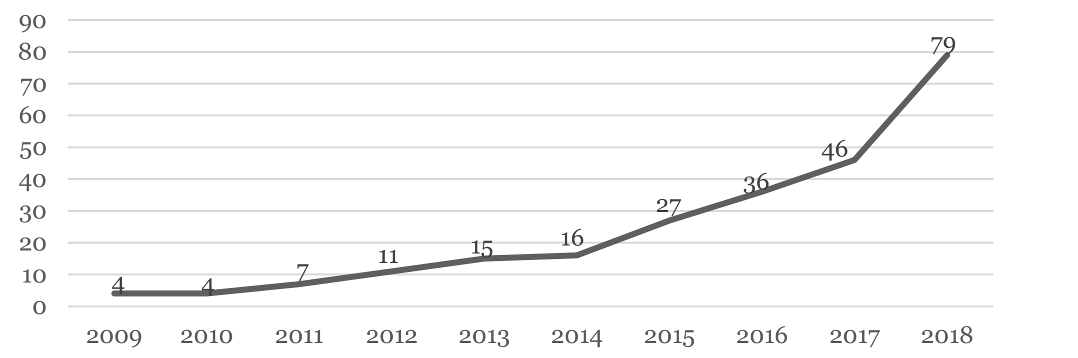
NamPower is a central player in this strategy even though they are also negatively impacted by it

- NamPower is the main off taker from IPPs that generate energy for the grid, several PPAs have been signed in recent years
- Investors and IPPs are very keen to collaborate with NamPower, considered as a trustworthy partner
- However, for NamPower energy purchased from IPPs under a PPA is often more expensive than energy purchased from the South African Power Pool or neighbouring countries
- Solar power plants create instability in the network producing power during day time but none after dark when private consumption increases

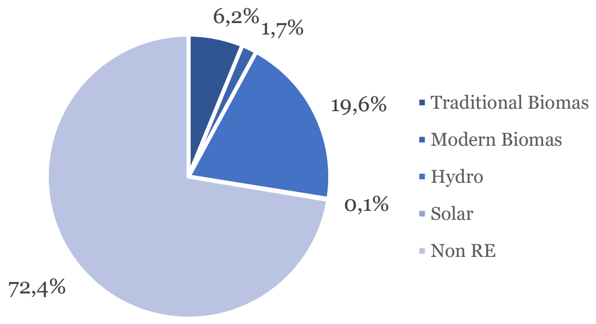
1 Ministry of Mines and Energy, Government of the Republic of Namibia
KOIS Invest analysis

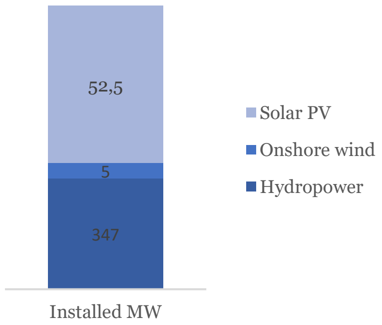
As part of this strategy, the GoN has taken favourable policies to promote project development and support growth of renewable energy (RE) share in the Namibian energy mix.

Namibia's Installed Solar Capacity (MW) 2009-2018



Share of renewable energy





GoN has a strategic commitment to gradually increase Namibia energy generation capacity and to do so by developing renewable energy as part of its energy mix :

- National Renewable Energy Policy 2017: Aims to enable access to modern, clean, environmentally sustainable, and affordable energy series for all Namibians
- Renewable energy represents a limited portion of the Namibia energy mix, however, we can observe that its share is growing
- Within its off-grid strategy, the GoN targets 70% of RE share of off-grid electricity by 2030

As a result, the GoN has implemented a number of favourable policies to support Renewable Energy development :

- Rebates to promote installation of RE systems and energy efficiency measures
- Grants to decrease the cost of eligible systems or equipment, R&D, and project commercialization
- Production incentives to reward performance. Cash payments are given based on the number of kWh generated by a Renewable Energy system
- Industry support: Financial incentives to recruit or cultivate the manufacturing and development of Renewable Energy systems and equipment
- Corporate tax credit: Credit for the purchase and installation of green energy technology
- Personal tax credit: Tax credits on multiple years for the purchase of RE systems for personal use
- Sales tax: Exemption from the state sales tax for the purchase of a RE system
- Property tax: Exemptions, exclusions and abatements for RE equipment on property

However, there is still a lack of regulatory framework adapted to off-grid distributed energy models

- Mini-grids require a licence and tariff approval from ECB
- For a company charging a price per kWh, a license is required and tariff must be approved by ECB
- No specific licence for companies operating with a leasing model such as Pay-as-you go companies

Ministry of Mines and Energy, Government of the Republic of Namibia
Namibia Energy Situation, *Energypedia*, 2018: Energypedia
SADC Renewable Energy and Efficiency Status Report, 2018
Namibia National Renewable Energy Document Rural Energy Strategy and Master Plan Document; European Union; Power Africa; UNDP; KOIS Invest analysis

Low population density and prioritization of grid extension are among the challenges preventing Namibia from achieving its goals of universal access by 2030 and electrifying all health facilities by 2020.

High solar energy potential

- Namibia has the world's 2nd highest solar irradiation receiving up to ~7 kWh/m^2/day
- The southern region of Namibia experiences 11 hours of sunshine/day, and an average direct solar radiation of 3000 kWh/m2/year.

Conflict of interest for NamPower

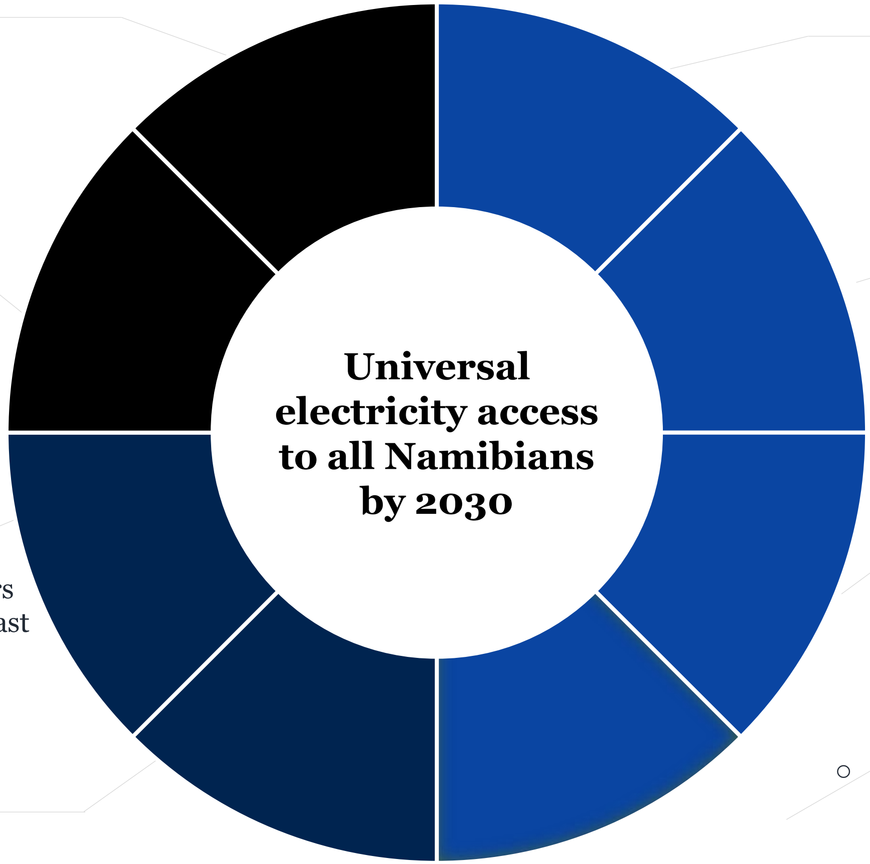
- Purchasing from the neighboring countries is often cheaper than generating own supply.
- Solar energy creates instability on the network as peak supply does not match peak demand.

Non-competitive conditions

- New unclear NEEB regulation put a risk foreign investors
- Public contracts are sometimes awarded in priority to least advantages citizens without sufficient due diligence on ability and capacity

Economies of scale

- Low density has led to absence of economies of scale in rural areas. Sparse population and distances between homesteads does negate the commercial viability of on and off-grid solutions.



Climate related issues

- Continuous droughts, have decreased the water dispatch in the Ruacana Station, consequently, the energy sector is often incapable of meeting electric demand

High currency risk

- Namibian Dollar is pegged to the South African Rand, any loan geared to foreign currency is challenging to service due to the devaluation of the South African Rand.

Lack of national investment

- Lack of national investments carried out during the past 3-4 decades, neither for developing the energy sector, nor for improving and increasing the country's electricity generation capacity.

High cost of energy supply

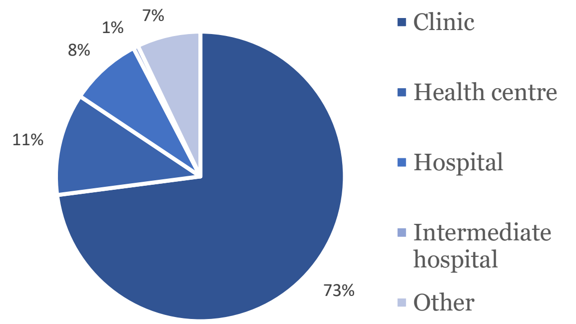
- Namibia has one of the highest electricity prices in Southern Africa due to high dependence on electricity imports from the Southern African Power Pool
- Namibia higher tariffs are covering the operating costs of the utility company and of the regional distributors

Source: World Bank ; Rural Energy Strategy and Master Plan Document; European Union; Power Africa; KOIS Invest analysis

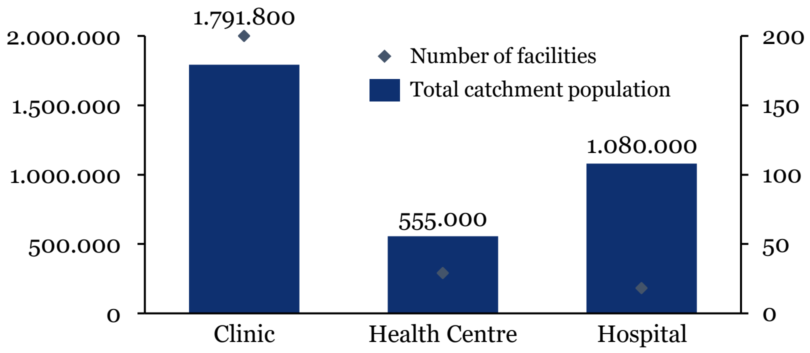
Content

More than 70% of the healthcare facilities are clinics, they provide primary healthcare services to the population and have the largest catchment population.

Health facilities by type (2018)[1]



Number of health facilities and total catchment population (2018)[2]



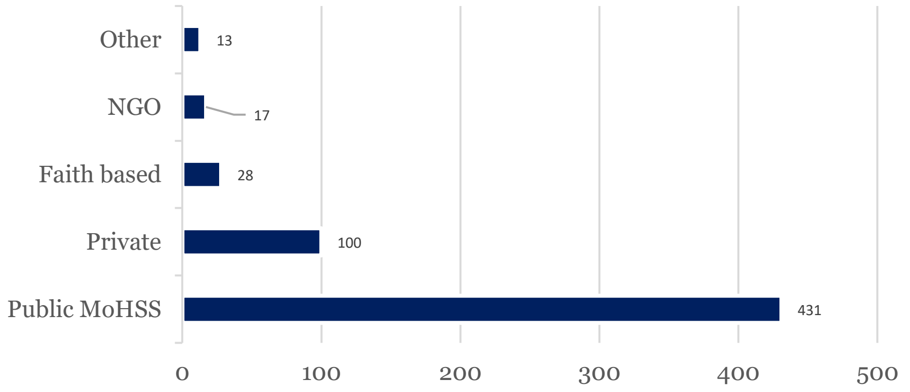
Healthcare facility classification

	Clinic	Health centre	District/regional/central 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	0-60beds	60-120 beds	120 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	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 complex overnight surgical procedures & maintaining cold chain; using lab, medical equipment and communication devices (radio)	Similar to health centre plus communication with remote HC and hospitals, and using more sophisticated diagnostic devices
Energy need & equipment assumptions	20 kWh/day; 3-5kWp power needs (e.g., lights & small refrigerator, microscope, incubator, hand-powered aspirator)	40 kWh/day; 7-10 kWp power needs (i.e., similar to rural clinic + diagnostic medical equipment)	200 kWh/day; 30-45 kWp power needs (i.e., communication devices, more sophisticated diagnostic medical devices)

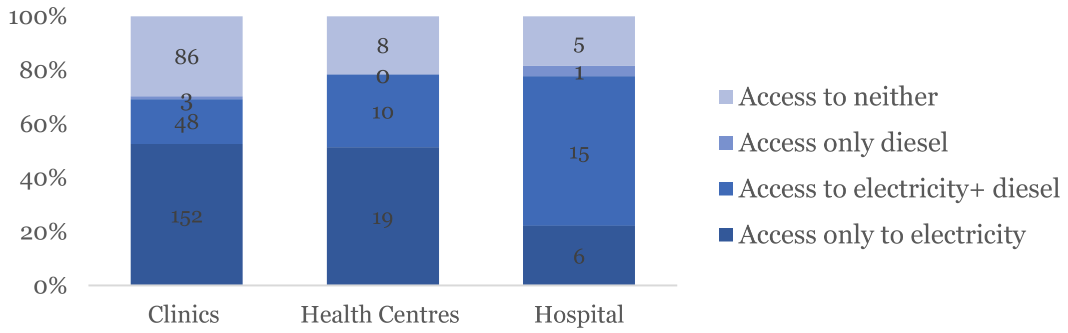
Source: KOIS and Differ analysis
1 World Bank;
2 Namibia Master Health Facility List, https://mfl.mhss.gov.na/home

Rural clinics represent the majority of health care facilities without any access to electricity, they also often service the poorest population. It is about 103 health facilities that have no access to a reliable energy source.

Number of health facilities in Namibia, by ownership (2018)[1]



Energy access at public facilities



Out of the 350 public healthcare facilities, 30% do not have unreliable access to energy.

- When available, the grid is generally reliable except for occasional power cuts due to maintenance of the distribution network
- It is mainly rural clinics that are not connected to the grid and lack access to electricity, only 14 of the 103 off-grid facilities rely on a diesel generator
- In those remote areas, other public facilities could also benefit from an off-grid solar system that could even provide energy to local businesses and communities

Public healthcare management is decentralised with each region having it's own budget based on its needs that is managed independently

- The central level main functions include policy formulation and review, policy planning and monitoring, strategic planning, resource mobilization and allocation, and standard setting
- There country is then divided in 13 regions in Namibia that are further divided into Districts that are responsible of regional implementation and resource management
- Utility bills are paid at the regional levels directly for all healthcare facilities within the region
- Diesel is purchased directly by the healthcare facilities when needed, health care facility requests a budget from the district when needed

O&M capacity and capabilities in solar systems is limited and outsourcing to a private company could prevent premature fail of the PV systems

- Each region has a maintenance unit responsible for general maintenance of all facilities but the budget, staff, equipment and skills are insufficient even for current maintenance needs
- Due to lack of capacity, equipment and financial means simple maintenance is not carried out resulting in out of order equipment
- Technical skills in solar systems are limited at the MoME and MHSS level, Namibia Energy Institute (NEI) is developing a training and able to support capacity building at health care facility level

Namibia Master Health Facility List, https://mfl.mhss.gov.na/home

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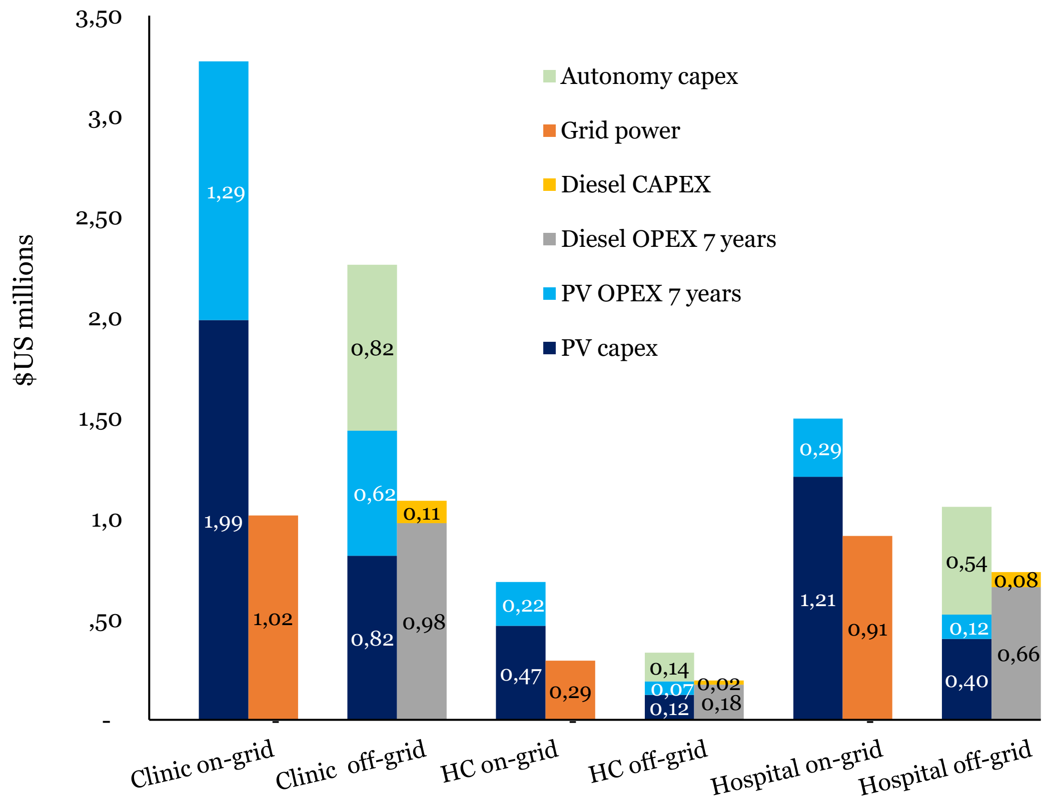
For grid connected facilities, a transition to solar energy would not be cost effective for the Ministry of Health but for off-grid healthcare facilities, solar systems generate savings compared to a diesel genset.

Solar PV investments vs. utility bills and diesel costs



The MHSS is having expenditures on utility and diesel. For every newly constructed off-grid healthcare facility, a budget for a solar standalone system is included

- Utility bills are paid at the regional levels directly for all healthcare facilities within the region
- Diesel is purchased directly by the healthcare facilities when needed, health care facility requests a budget from the district when needed
- Budget for solar PV is foreseen for new facilities not connected to the grid but the high investment cost to purchase hardware does not allow the MHSS to equip the existing facilities that lack energy access
- However budgets are constrained and some less urgent needs are often not covered : for example regular maintenance, small repairs,… While donor support is very limited if any

Savings made diesel costs could be redirected to leasing/fee-for-service payment under a solar energy contract

- Electrification of all public off-grid healthcare facilities excluding health posts using solar PV standalone solution would require an investment of US$3.6m (incl. pre-financing of 7 years of operations and maintenance (O&M))
- Assuming autonomy of 1 day for health facilities not connected to the grid. To be noted that in a country with year round solar radiance as in Namibia, autonomy could be further reduced.
- Estimated amount of initial investment necessary to electrify different-sized healthcare facilities via PV solar standalone systems is based on the following cost assumptions:
    - Hospital off-grid: 46kWp installed capacity → US$157k turnkey cost + US$3.8k annual O&M cost
    - Health centre off-grid: 9kWp installed capacity → US$33k turnkey cost + US$1.6k annual O&M cost
    - Clinic off-grid: 5kWp installed capacity → US$18k turnkey cost + US$1.3k annual O&M cost
- Hypothetical savings of cost of diesel consumption amount up to US$1.8m, assuming:
    - Diesel consumption is based on all-in cost estimate of US$0.28/kWh
    - Diesel generators CAPEX is omitted – its addition would result in US$0.2m of extra savings
    - Negative externalities linked to diesel usage (e.g. carbon emissions) are not considered
- For on-grid facilities, the cost of grid electricity assuming a tariff of US$0.13/kWh is lower than the investment that would be required for PV solar standalone systems even assuming minimal 0.25days autonomy
    - Hospital on-grid: 33kWp installed capacity → US$67k turnkey cost + US$3k annual O&M cost
    - Health centre on-grid: 7kWp installed capacity → US$16k turnkey cost + US$1.4k annual O&M cost
    - Clinic on-grid: 3kWp installed capacity → US$10k turnkey cost + US$1.2k annual O&M cost

Interview with MHSS and MHSS regional office representative
Namibia Master Health Facility List, https://mfl.mhss.gov.na/home
Kois & Differ analysis

The cost per patient decreases and the size of the facility increases, however the bulk of the need is for off-grid clinics. To address the need of the 103 off-grid facilities an investment of US$3.65 millions would be required.

	Relevant energy solution	Rationale for healthcare facility	Market size			Energy solution cost	
			# facilities	*Catchment pop.*	*Capacity need*	*Total cost*	*Per patient avg.*
Hospitals	Tailored PV standalone system with with 1 day battery autonomy	Customized size of the system based on the specific needs of a hospital	6	550,000	275kWp	US$1.06mil	US$3.92
Health centres	Standard 9kWp solar PV standalone system with 1 day battery autonomy	Economies of scale in procurement, installation and O&M with standardisation	8	120,000	70kWp	US$335k	US$2.78
Clinics	Standard 5kWp solar PV standalone system with 1 day battery autonomy	Economies of scale in procurement, installation and O&M with standardisation	89	270,000	450kWp	US$2.26mil	US$4.10

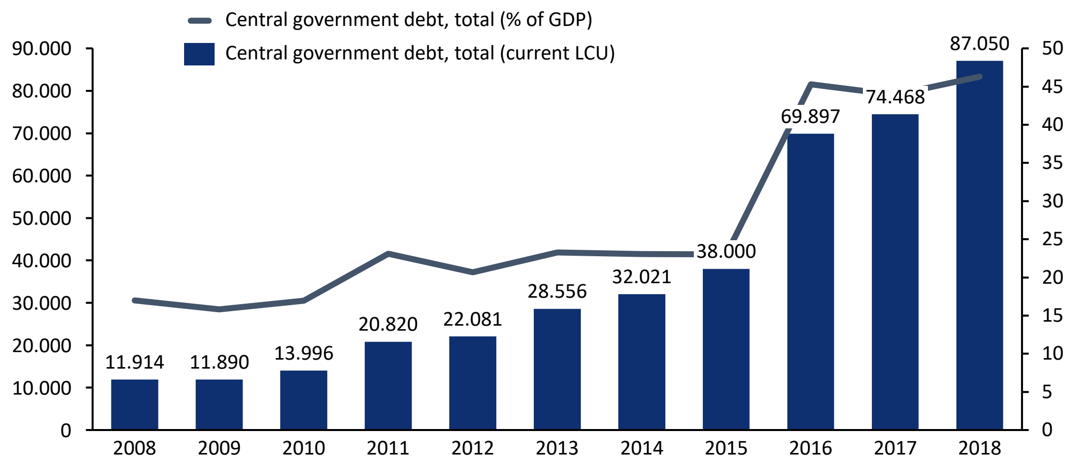
Total cost : US$3.65M (present value including 7 years O&M contract)

On-grid facilities have been excluded from the scope as the grid is considered generally reliable and a more cost-effective alternative
The Ministry of Health and Social Services (MHSS) has expressed interest in scaling the S4H programme more broadly to also include on-grid facilities; a further assessment during programme implementation, however, will be needed to determine if such an off-grid solar solution would indeed be cost-effective for these specific facilities.
We estimate the additional cost for on-grid facilities to be approximately US$5m assuming minimal autonomy.

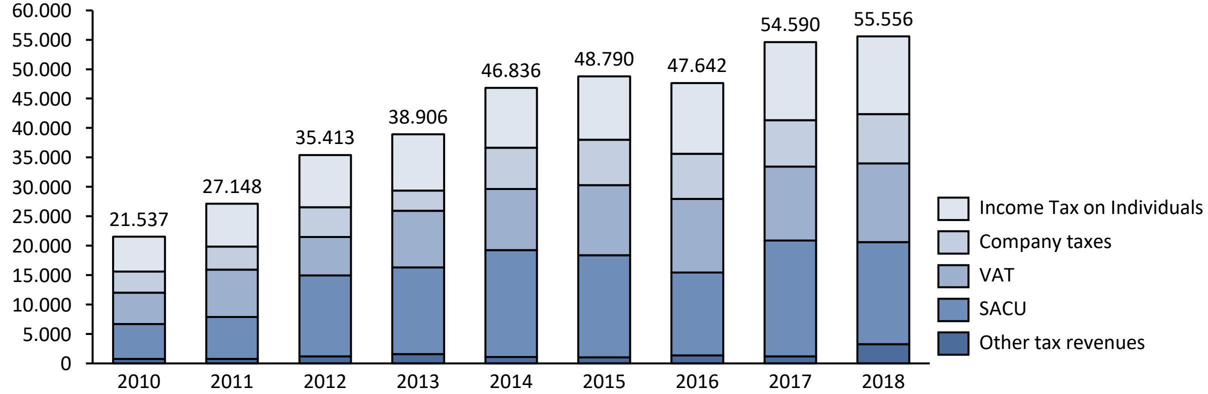
Namibia Master Health Facility List, https://mfl.mhss.gov.na/home
Kois and Differ analysis

Domestic public financing in recent years has significantly been impacted by the slowdown of growth coupled with increased public debt. GoN is committed to reversing this trend by introducing austerity measures.

Central Government Debt [1]



Domestic public sector revenues[1]



93% of Namibia's domestic public sector revenues come from taxes, the ratio to GDP being among the highest in the world

- SACU receipts account for around a third of total revenue.
- Revenue collected from individuals is the second largest revenue source although the taxable population base is limited
- Followed by VAT as third largest revenue source for the Government

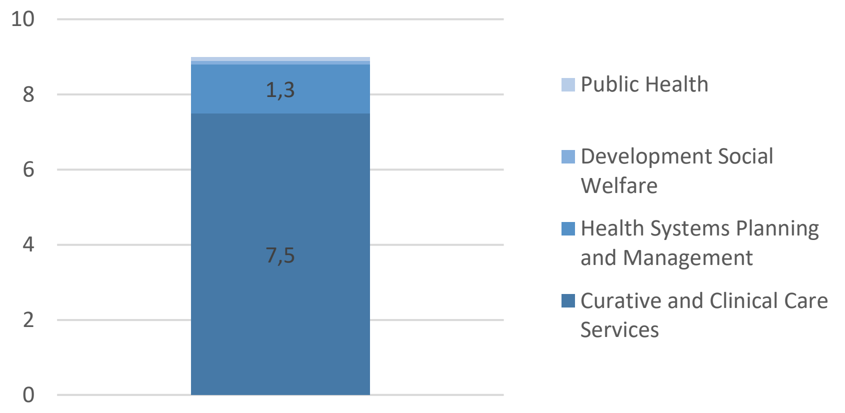
Namibia going through a recession, revenue growth has slowed significantly in recent years and debt has been growing. GoN is aiming to reverse that trend with fiscal and austerity measures

- Total public debt is expected to surpass the N$100 billion (51% of GDP) level in FY2020/21 and hit N$112.3 billion (52.3% of GDP) by the end of FY2021/22 with interest payments that will surpass the 10% of revenue threshold in 2020
- GoN including MHSS are supported by local and development banks for their financing needs
- Namibia has not run a substantial budget surplus in over a decade, to counter that growing deficit, GoN embarked on a process of "fiscal consolidation" with moderated growth, supported by balancing between revenue and expenditure and reduce public debt through modest deficit reduction
- Those efforts are paying out and the deficit decreased from 8.9% of GDP in FY2015/16 to a projected 2.7% of GDP in FY2020/21.
- The Government of Namibia has made use of guarantees as an off-balance sheet support instrument
- Guarantees were used to support Public Enterprises (PEs) and infrastructure development and leveraging public private partnerships.

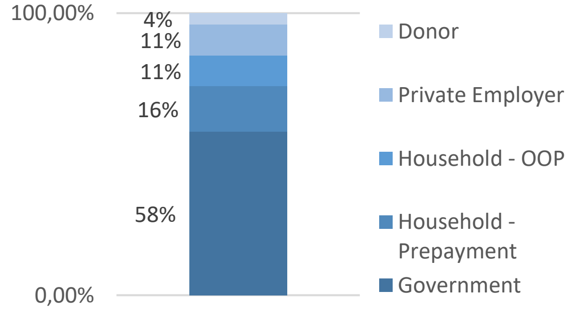
World Bank databank
Ministry of Finance

Healthcare system is mainly funded by government (58%) and household contributions (27%)[4]. Despite being higher than the region average, healthcare budget remains insufficient to cover health needs of the population.

Budget allocation to Health Programmes
(%) of national budget



Shares of Total Health Expenditures
(%) of GPD



Government General Healthcare Spending

- Government's overall commitment to investing in health is strong at 11% of total budget, but still remains far below minimum international spending benchmarks[4]
- The MHSS runs four programmes: "Public Health", "Clinical Health Services", "Health System Planning and Management", and "Development Social Welfare" [4]
- MHSS's budget grew by 206% over the past ten years and by 24% over the past five years, exceeding the cumulative effect of inflation. The allocation represents 9% of GDP in 2016, the highest rate in Eastern and Southern Africa[4]
- The overall health budget is primary geared toward supporting curative services with limited resources allocated towards supporting prevention of key health issues[3]
- The main share of government funding is on hospital care, HIV/AIDS. and the health wage bill, but the healthcare system is very distressed, with frequent power failures in hospitals and pharmacies[2]
- Budget execution is high at 97%, but the execution rate for development (capital) projects is low at 69%[3]
- Even though the budget is constraint, the MHSS is seen as a relatively credit worthy counterparty although payments are sometimes delayed

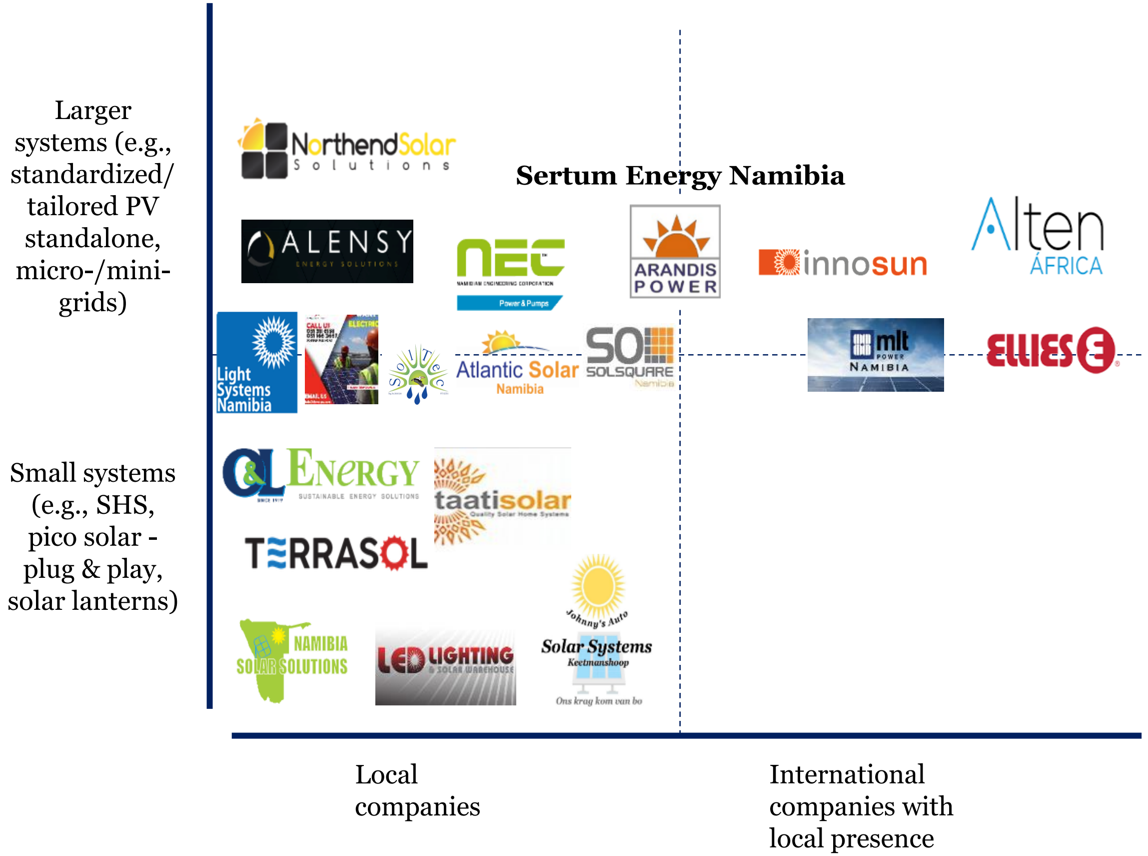
Donor and Private Sector Healthcare Funding

- The proportion of urban and rural households with access to improved sanitation facilities is 53%[3]
- Donor funding has decreased significantly over recent years[1] when Namibia became a low middle-income country.
- Private sector spending has increased over years, primarily through prepayment schemes, but is still relatively low[1]
- The inequalities are very high and the growth of private contribution and decrease of donors' support is putting more pressure on the already fragile and disadvantaged communities

[1] Namibia Public Expenditure Review, *HNP*, 2019
[2] Namibia's healthcare crisis, *The Patriot*, 2018: Namibia Healthcare Crisis
[3] Namibia Health Budget, *UNICEF*, 2017
[4] Namibia Health Financing, *HPP*, 2016
[5] Namibia Health Account Report, *Republic of Namibia*, 2015

Content

There are about 50 solar energy companies active in Namibia, several would have the right capabilities and the appetite to equip and service public healthcare facilities.



There about 50 renewable energy companies servicing different market segments

- IPP projects attract investors and larger companies, NamPower being considered as a credit-worthy partner
- Mines and large businesses are the second most attractive segment
- Pay as you go (PAYG) and off-grid solutions are in an earlier development stage due to relatively high level of grid electrification in the wealthiest areas

The bigger players have sufficient access to capital locally to implement large projects:

- Several companies are part of an international group able to raise capital locally and internationally
- Local banks support RE companies in particular through the Sunref initiative or under co-financing agreement with development partners for RE projects

Several local energy companies have a presence in different regions of the country and are able to provide a service country wide

- Company representatives in bigger cities provide services to local customers
- Partner network of technicians country wide can provide operations and maintenance services on behalf of the energy company
- Large scarcely dense population can drive up O&M costs in more remote locations

However the level of technical skills in solar technology is not always sufficient depending on the providers

- There is no professional training for solar energy technicians available in schools or universities in Namibia
- Trainings are usually provided by the company itself and therefore more focused on sale and commercial skills

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

The panel of energy companies interviewed demonstrated sufficient expertise and appetite to equip and service public healthcare facilities.

Panel of companies interviewed for this feasibility study

innosun

- **Products**: Wind and solar power plants
- **Services:** develop, finance, construct, operate and maintain renewable energy power facilities
- **Projects:** 20MW under operation, 40MW obtained in Namibia
- **Geographical reach:** Subsidiary of Innovent in France, project in a number of countries in Africa and presence in Namibia since 2008
- **Healthcare/pulic sector experience:** Solar power plants in collaboration with NamPowerwiththe first PPA in Namibia. Erly stage discussions with MoME regarding public facilities electrification

SOLSQUARE Namibia

- **Products**: Solar Water Pumps, Solar heating, on-grid and off-grid PV systems for commercial and residential projects
- **Services:** Consulting, Planning, Projecting & Engineering Procurement, Supply & Distribution Installation, Operation & Maintenance
- **Geographical reach:** Southern Africa
- **Healthcare/pulic sector experience:**

SolTec

- **Products:** Solar Water Pumps, Solar heating, on-grid and off-grid PV systems, Wind turbines
- **Services:** System design, Manufacturing, Installation and Maintenance
- **Geographical reach:** Namibia
- **Healthcare/pulic sector experience:** Soltec has been contracted to provide O&M for S4H facilities

Ohlthaver&List Group

- **Products:** Large-scale solar power, solar water heating and bio energy systems
- **Services:** Developement, design, procurement and implementation of all sorts of renewable energy, especially
- **Geographical reach:** Namibia

The panel of companies met during the feasibility study have strong interest in providing a solar solution to the health care sector and to enter into a contract with the MHSS/MoME following a process similar to IPPs power plants

- A PPA for the approximate lifetime of the project between the ESP and the MHSS or the MoME
- An Service Level Agreement (SLA) to define ESP obligations and link payments to results ensuring the needs of healthcare facility are met
- A transfer of ownership at the end of the contract to ensure the maintenance remains the responsibility of the ESP over the PPA period
- The ESPs had sufficient access to capital to bid for this type of contract and provide a leasing/fee-for-service type of model

However, solar energy companies pointed out some challenges with the GoN procurement and tendering process

- As this is something rather new in Namibia, the GoN lacks the right policies and experience to conduct tenders efficiently
- The selection of contractor is perceived as not being sufficiently transparent and in accordance with the company capabilities.

Nevertheless, they considered the GoN a relatively trustworthy counterpart and limited additional securities would be required from an energy company entering into a PPA with the MHSS

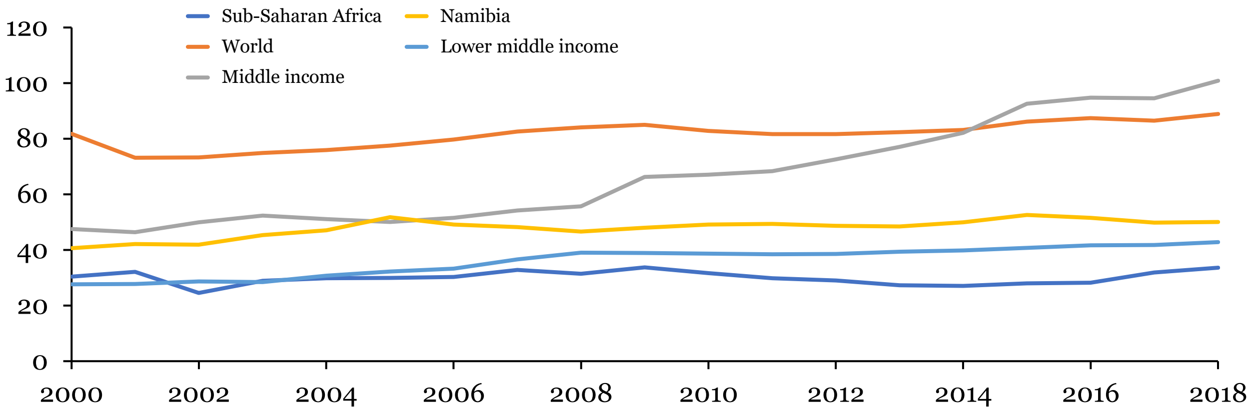
- Treasury support or escrow account to cover for potential late payments would bring additional comfort to local ESPs
- The GoN often sees electrification of healthcare facilities as a CSR matter and a change of mindset will be needed for MHSS to bear those costs

The panel of ESPs interviewed had the means to also provide O&M services nationwide either directly or through local partners

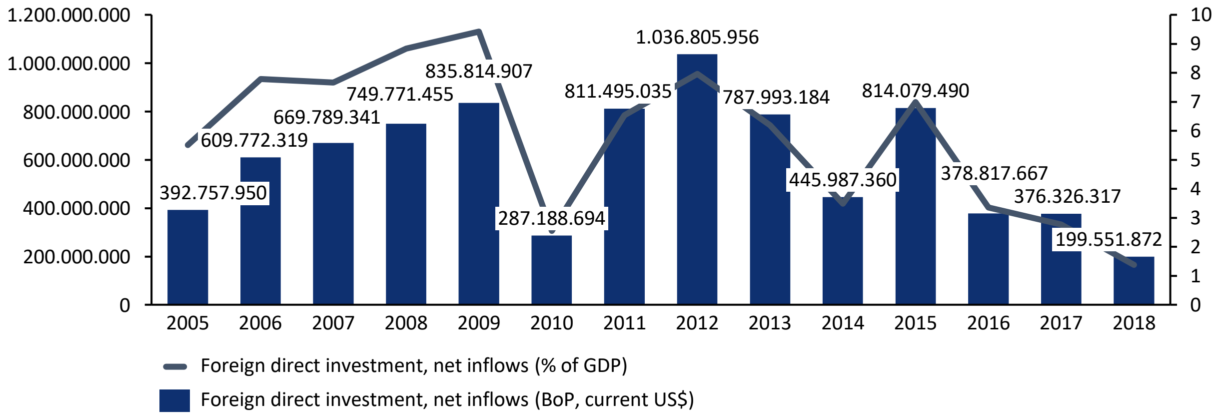
- O&M can be performed by ESPs own staff or a network of partners
- O&M cost will depend on healthcare facility location, the country is scarcely populated limiting potential for economies of scale.

Local and international private investments have been impacted by the recent economic slowdown. Nevertheless, opportunities for renewable energy financing remain available.

Domestic credit to private sector by banks (% of GDP)[1]



Foreign Direct Investment (% of GDP) [1]



Local commercial banks have reduced the credits disbursed as a result of the weaker economic environment and private investments followed the same trend

- At the end of February 2019, total private credit outstanding amounted to N$97.7 billion, of which N$57.4 billion belonged to households and N$39.1 billion to businesses.
- Private investment and growth in the private credit in the past decade were very volatile going from double digit at the beginning to a sharp decrease since 2014
- The private investment contraction was due to the overall state of the economy but also policy uncertainty relating to investment with the Namibian Investment Promotion Act and the New Equitable Economic Empowerment Bill (NEEB) creating uncertainty for investors
- Sunref initiative incentivize local commercia banks to support the RE sector

Fortunately, pension funds still have large capital to be invested in domestic assets

- The largest single source of domestic development funding is the contractual savings pool made up of pension and life insurance assets.
- Pension fund assets are around N$290b, more than double of the banking sector
- Regulation requires that 45% of these assets must be invested in domestic assets,
- This has brought the creation of a number of investment vehicles and the issuance of a number of infrastructure investment mandates

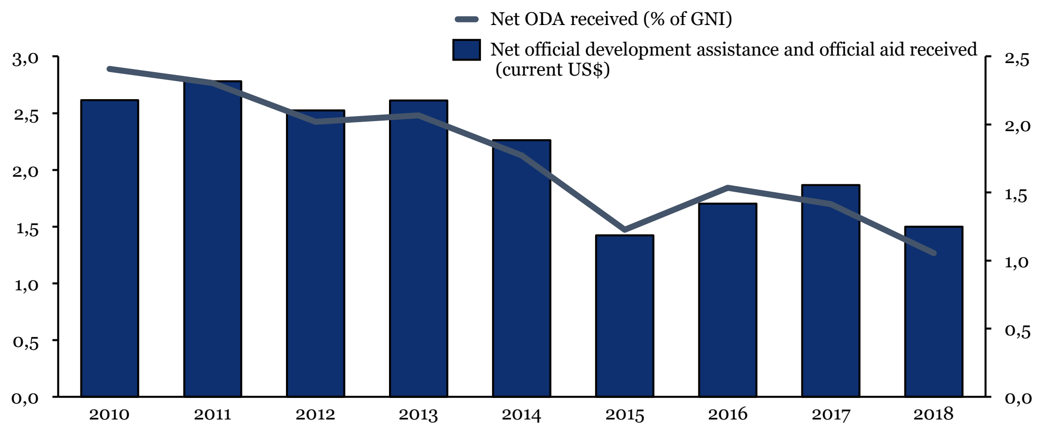
International private finance has followed the same trends as the overall economy with foreign direct investments (FDI) on a downward trends over the past few years

- International private resources have increased from US$49.4 (N$425.8) billion in 2009 to US$83 (N$1104.3) billion in 2017 or by 6.7% per year on average.
- FDI however started to decrease substantially in 2016 as a consequence of the recession

[1]World Bank data base
Sources: Republic of Namibia, Namibia Development Finance Assessment Report 2019
Interviews

The local financial sector is fairly developed and several initiatives further support access to capital for renewable energy companies. Fully concessional capital is hardly available.

Official Development Assistance[1]



Development assistance has decreased and shifted from grant aid to less concessional financing

- Development assistance such as grants, loans and technical assistance have historically been an important source of financing but have been on a downward trajectory in line with Namibia's economic development.
- On the other side, less concessional international official flows have increased since 2015 targeting social infrastructure and services such as transport, communications and energy.
- Government borrowing from international sources has also increased as a result of the decrease of donor support.

Local commercial banks such as Sunref and Development Banks provide concessional loans to finance renewable energy projects

- Agence Francaise de Development (AFD) financed SUNREF initiative made €150M fund available to be disbursed by 3 local commercial banks : FNB, Nedbank or Bank Windhoek. The interest rate are around the prime rate (~7.75%) + 1-2% p.a.
- Development Bank of Namibia (DBN) is supporting renewable energy projects and offers flexible and adaptive terms tailored to the project with aligned tenor and grace period for development phase. The interest rate is at or below the prime rate thanks to support from donors
- Development Bank of Southern Africa also has funds targeted to renewable energy and can take larger tickets

Namibia achievements in mobilizing climate finance as been modest and projects implemented were of a relatively small scale

- International climate finance receipts increased from N$1.1 million in 2013 to N$146 million in 2019 and were mainly disbursed as grants from the Special Climate Change, Green Climate Fund (GCF), Agence Francaise de Development and Readiness Financing.
- International climate finance requires high quality bankable projects and Namibia was able to mobilise some of that financing for small projects providing comfort to development partners. For instance, in 2017-2019, the Environmental Investment Fund (EIF) of Namibia mobilized additional N$584 million from GCF.
- Nevertheless, those projects remain relatively small scale and the EIF still needs support to become an organisation capable of setting up and implementing sizeable projects that will also allow EIF to raise more capital from climate funds.
- Namibia faces scalability and institutional capacity challenges to manage multiple or large-scale projects.

[1]World Bank data base
www.sunref. Org, « Sunref Towards a greener future »
Sources: Republic of Namibia, Namibia Development Finance Assessment Report 2019
Interviews

Several donor programmes are running in Namibia and supporting the growth of renewable energy.

Table of investment initiatives in the sector in Namibia

Investment initiative	Funder	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$10 million	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	€150 million	Loan
Adaption Fund	Desert Research Foundation of Namibia	Pilot the treatment by reverse osmosis of poor quality local groundwater to a level that complies with the national standards for drinking water, using sun and wind energy to power the process.	Improved resilience of vulnerable communities and groups to climate change impact.	US$5million	Grant
Promoting Renewable Energy for Climate Change Mitigation Initiatives in Namibia	European Union & Spanish Red Cross	Contribute to mitigate the negative impacts of climate change within rural vulnerable communities in Namibia.	Distribution of solar products	€5 million	Grant

SAEP total budget is US$73 million allocated across 11 countries in Southern Africa
SUNREF 2.5 billion euros in loans allocated in over 30 countries by AFD

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

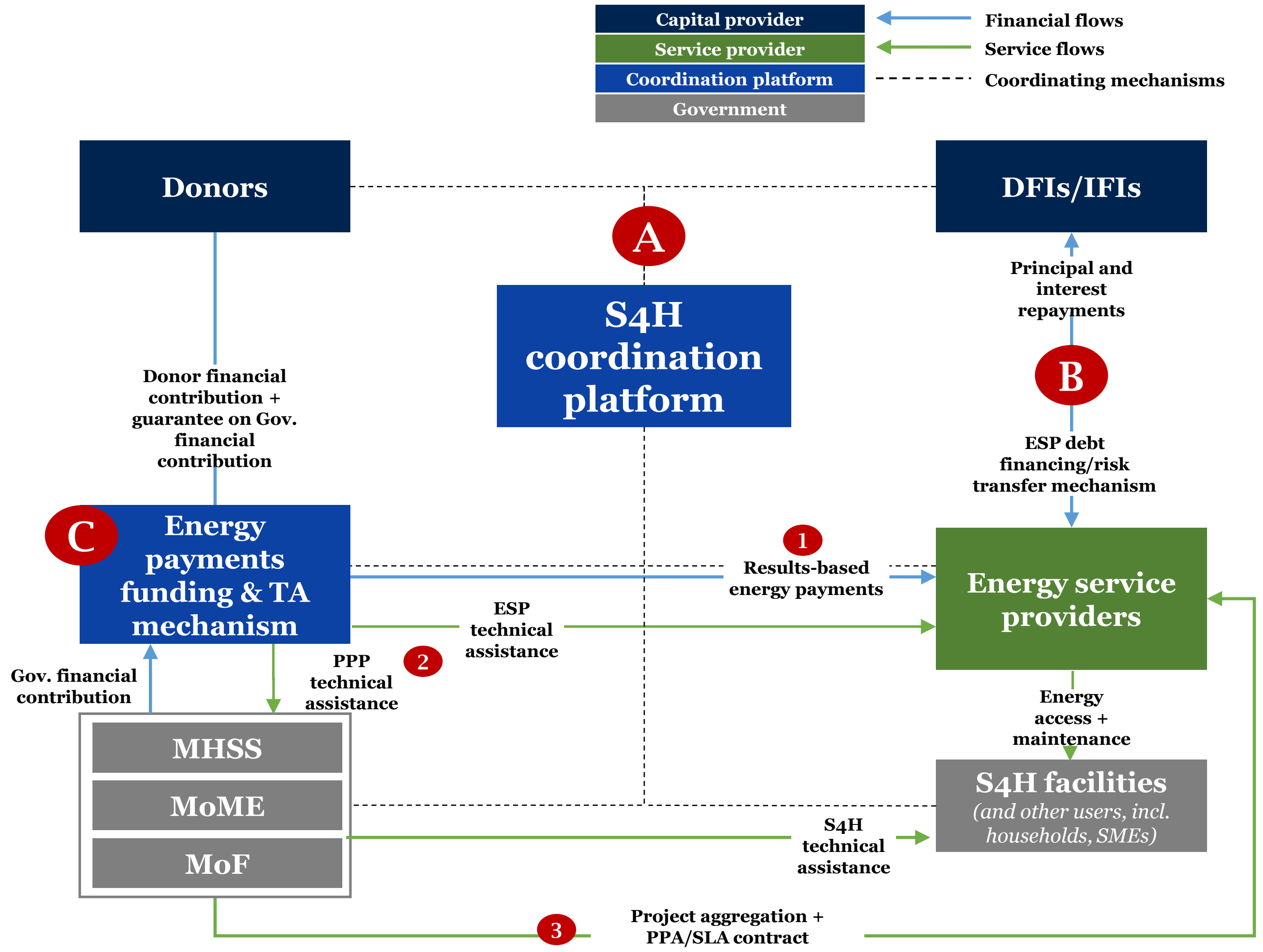
Fund	Best fit	Who applies	Financing instruments	Application timeframe	Size of investment
InsuResilience Investment Fund (IIF)	Reduces the vulnerability of MSM's and low-income households to extreme weather events	Private sector	Equity, insurance	Open	US$3-15 million
Energy 4 Impact	Early stage investment 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	Invests in ventures and businesses in all life-stages	Public sector	Equity	Open	US$10-50 million
Sustainable Energy Fund for Africa	Early stage investment and de-risking of commercially viable projects	Private sector	Grants, equity, In kind contribution	Rolling basis	Up to US$30 million

Source: KOIS Invest analysis

Content

UNDP DIFFER KOIS CARING FINANCE

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.

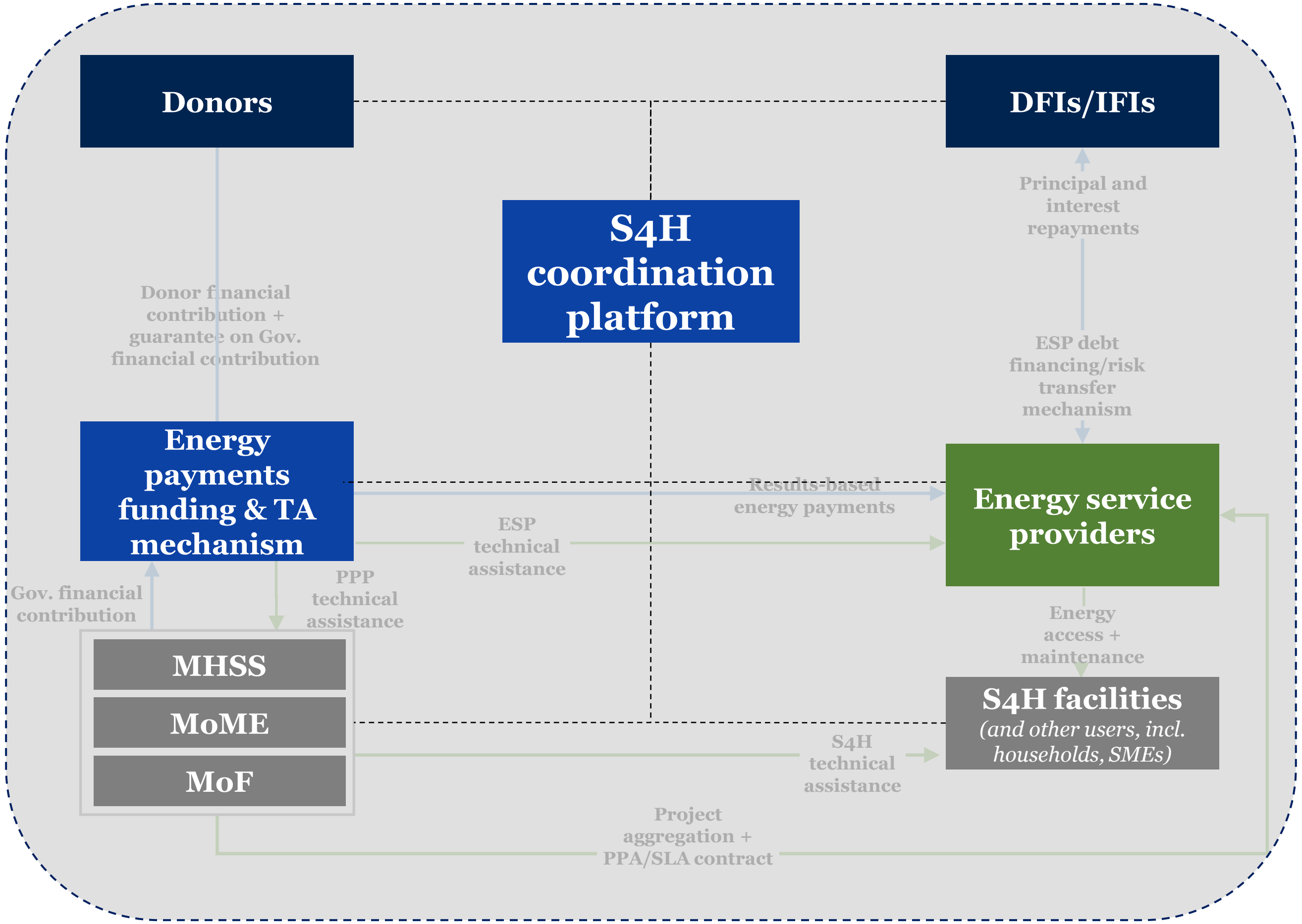
3 Project aggregation and PPA/leasing mechanism

- 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.

[1] Donor financial contributions may be less relevant in Namibia, given its upper middle-income country designation. To the extent that donor capital is available, it may cover a small portion of the payment

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 Namibian context

- ESPs are able to raise sufficient capital from DFIs or financial institutions locally or internationally
- Development Bank of Namibia and local commercial banks have funds available to finance RE projects
- Donors are more likely to provide concessional loans rather than grants

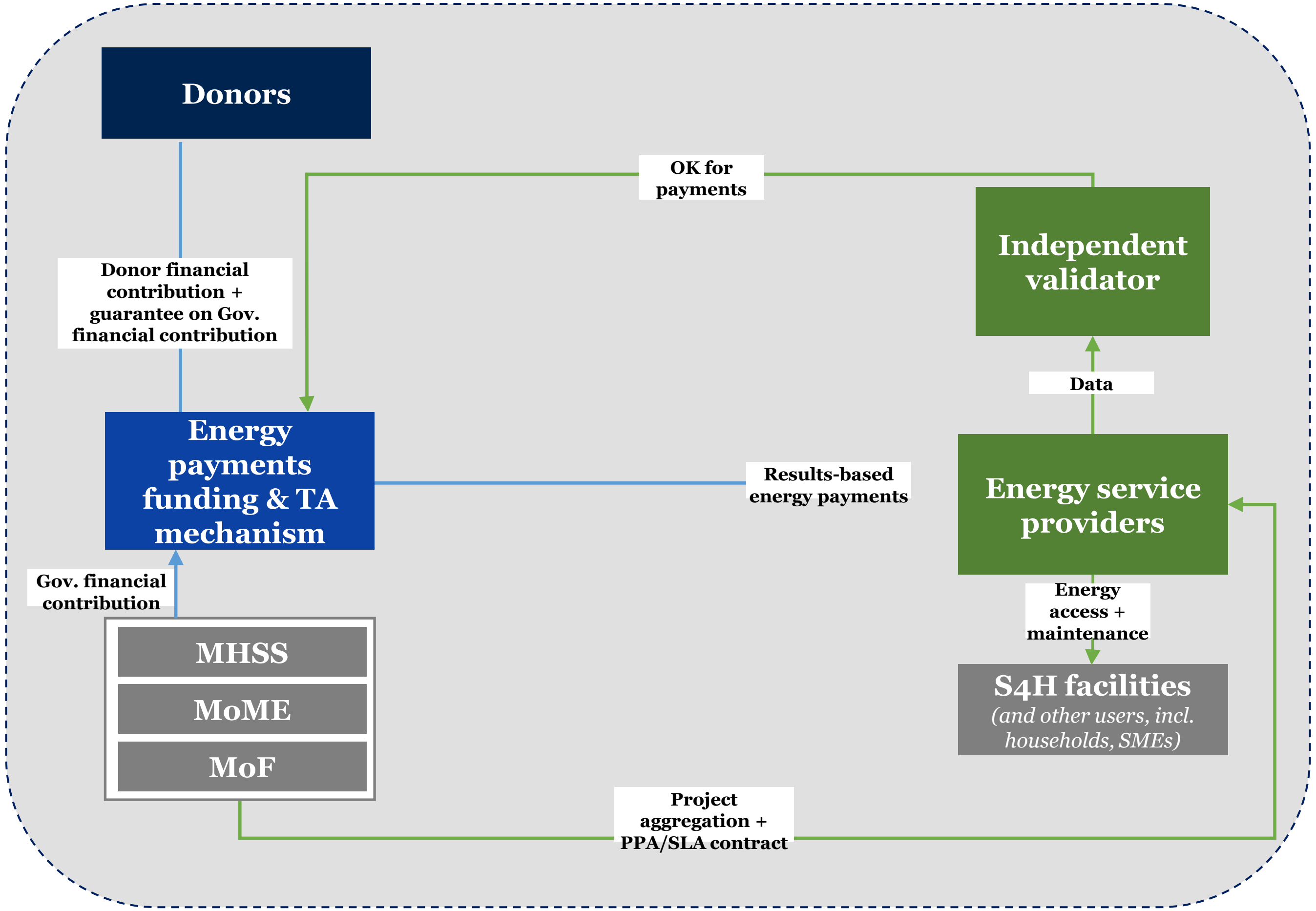
Recommendations for implementation

- Presence of local capital and defined procedures to apply for financing for energy projects making the fundraising role less relevant in Namibia
- The S4H coordination platform along with UNDP will have a coordinating and alignment role within the broader S4H Programme supporting the quality and credit of the project

Source: KOIS analysis

Long term contract between the MHSS and the ESP is a key element to ensure sustainability of the solar installation by aligning financial incentive for on-going O&M.

Zoom on PPA leasing payments



Long-term contractual agreements between the MHSS 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, an independent validator will be appointed to monitor the performance and authorise payments
- At the end of the contract asset, ownership could be transferred to the MHSS and a new O&M contract tendered out
- ESP is contractually liable for the proper disposal of the hardware

Specificities of the Namibian context

- MHSS currently covering health expenditures (CAPEX and OPEX)
- PPPs are approved by the MoF securing future budget
- Scarcely populated country with high distance results in high O&M costs
- Insufficient resources for O&M within the MHSS requires the outsourcing of O&M
- Local ESPs have appetite and capabilities for the contract

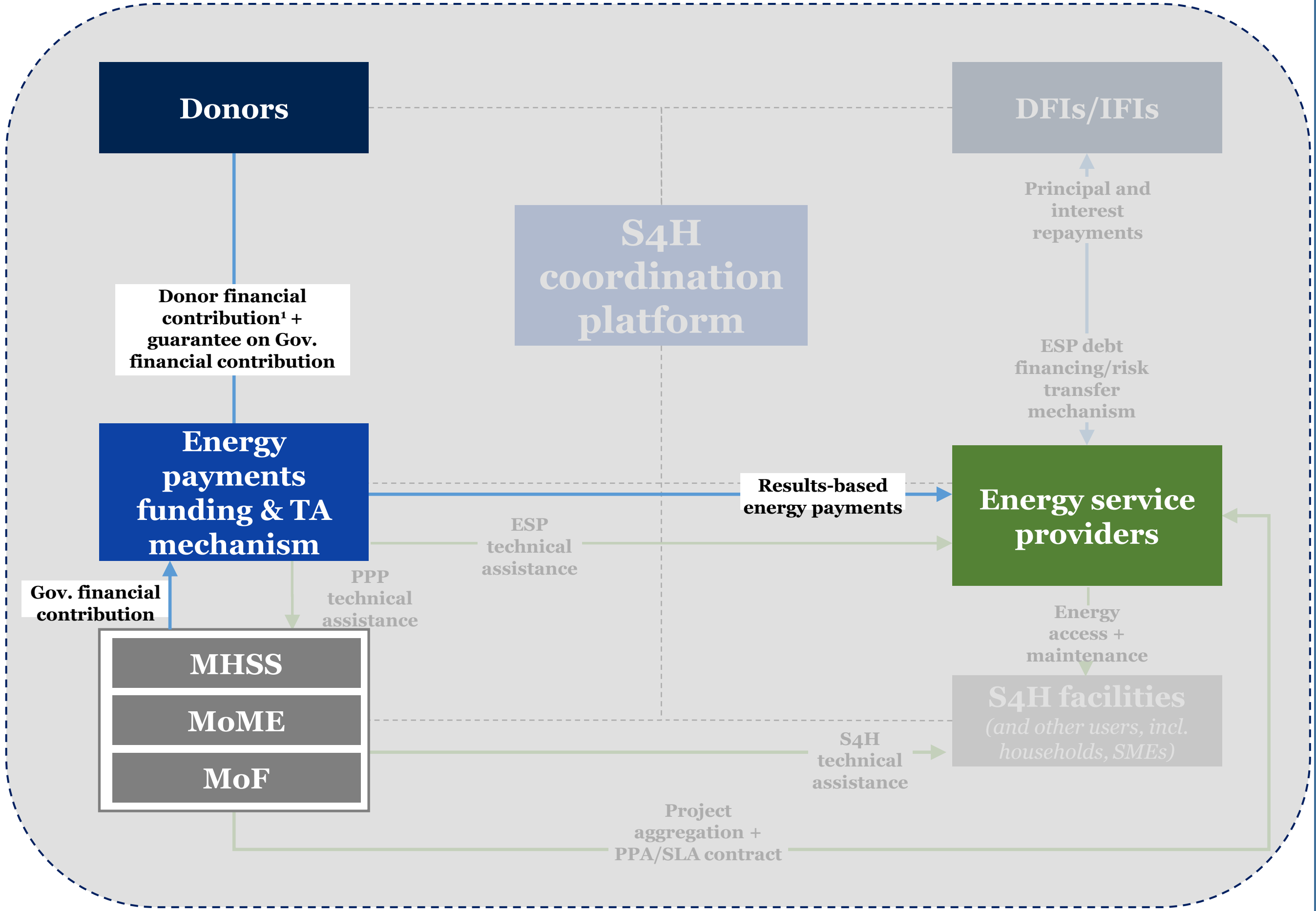
Recommendations for implementation

- MHSS shall initiate the procurement process for the PPP in cooperation with relevant stakeholders
- Coordination with MHSS district representatives to ensure buy-in at local level, consolidation of energy payments at the centralized MHSS level and contract management with local support to monitor SLA
- Potential to collaborative with REDS could be investigated as they have a good coverage and skilled technician (specific solar technology trainings would be needed)

Source: KOIS analysis

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

Zoom on energy payments funding



The energy payments funding is an **essential component** of the proposed model as it **manages grants for technical assistance** and **supports MHSS payment obligation under the PPP** and **mitigates investors' risks** via:

- Partial transfer of the risk of GoN 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 fund
- Buy-in and long-term ownership of MHSS is ensured via MHSS's 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 MHSS is required as it is best positioned to coordinate the donors and align their funding with national health priorities

Specificities of the Namibian context

- Relatively good credit-worthiness and sufficient ability to pay of the MHSS
- Limited donor grants availability given Namibia upper middle-income country designation

Recommendations for implementation

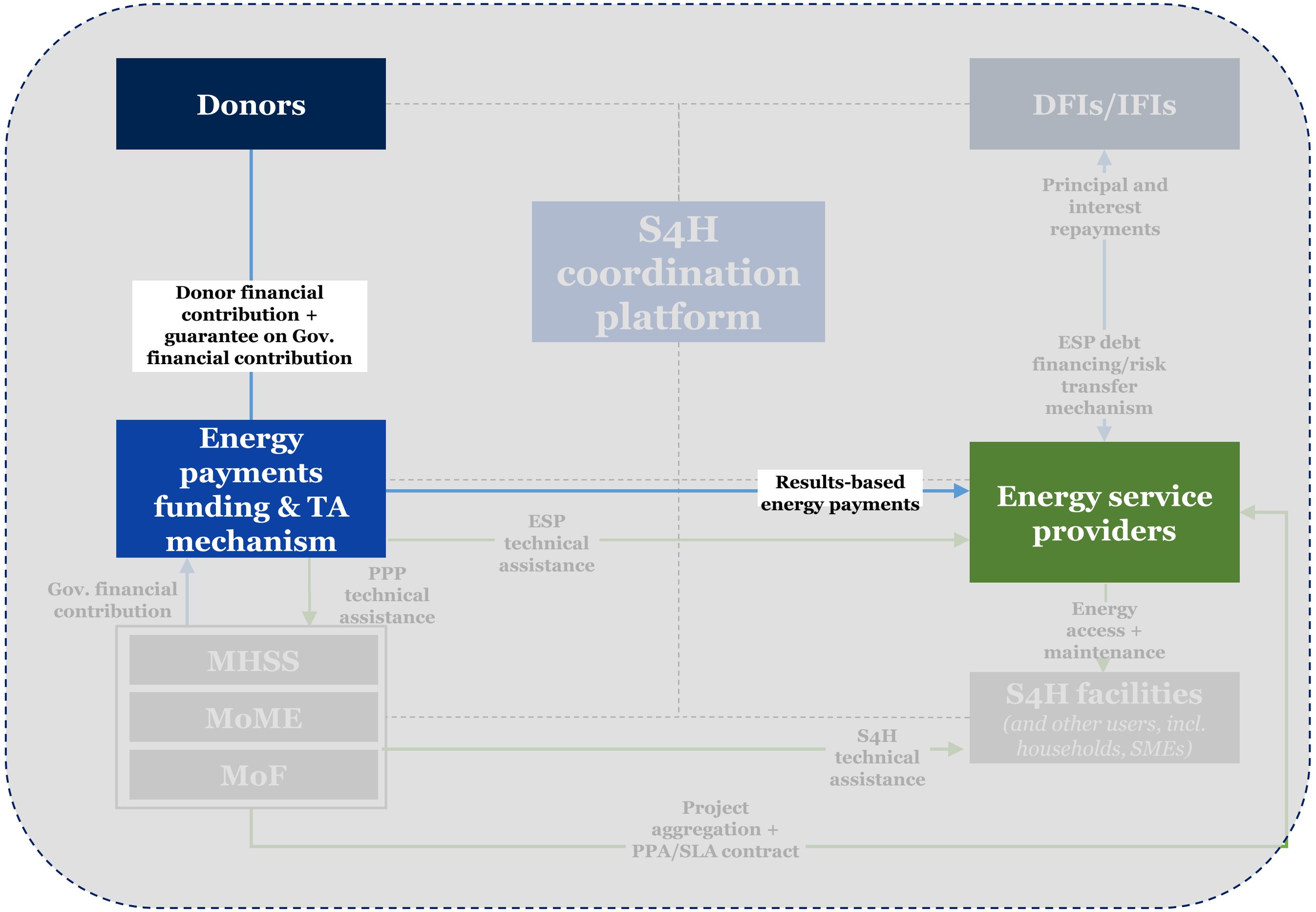
- Donor grants should be mobilized in priority for technical assistance and/or for programme implementation costs
- MHSS will be the main off-taker responsible for energy payments under the PPA and Treasury approval further secures availability of budget to meet payment obligation of the MHSS

[1] Donor financial contributions may be less relevant in Namibia, given its upper middle-income country designation. To the extent that donor capital is available, it may cover a small portion of the payment

Source: KOIS analysis

The use of sovereign guarantees by the Namibian government has showed being a efficient tool to support PPPs especially in the energy sector.

Zoom on guarantees



Guarantees could **support the credit worthiness** of the MHSS 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 MHSS 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 Namibian context

- GoN has been using sovereign guarantees to stimulate PPPs
- MHSS is considered as a relatively good payer and a PPA approved by the Treasury might already provide sufficient comfort to local ESPs to bid for the contract
- There is limited donor presence however the credit worthiness being higher than in other countries of the region, it might be easier to secure donor guarantees if required

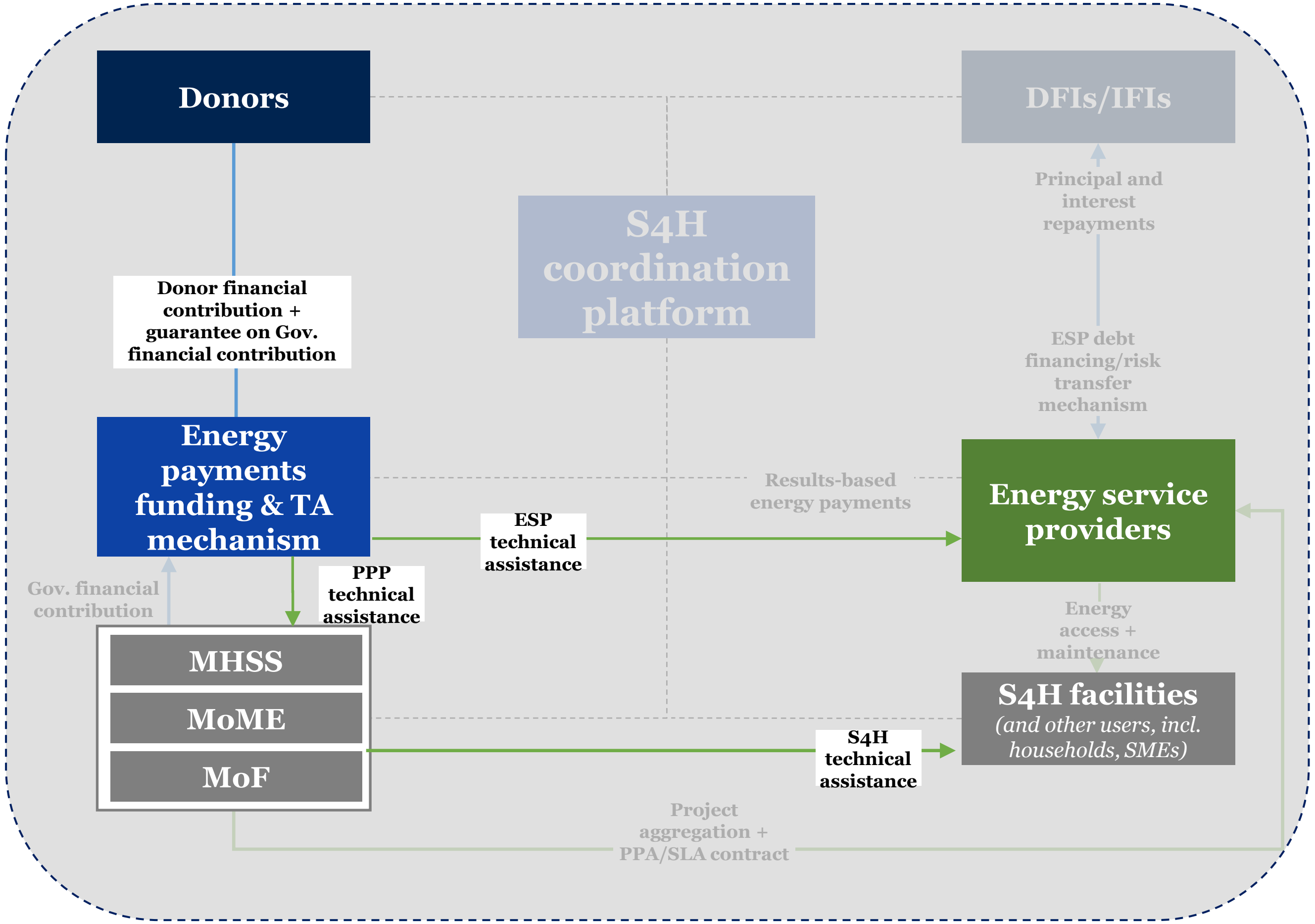
Recommendations for implementation

- Sovereign guarantee to backstop payment obligations of the MHSS is recommended (but not indispensable) to provide additional comfort to ESPs candidates and facilitate project financing

Source: KOIS analysis

Technical Assistance would be beneficial to support the MHSS with technical aspects related to energy contract while some TA could also support further training in SE technologies for local ESP staff.

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 MHSS
  - 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 Namibian context

- PPP Unit and framework for PPP contracts in place
- Procurement process perceived as cumbersome and not transparent
- MHSS has limited technical knowledge of energy related PPPs
- Several international companies present in Namibia with sufficient technical and human capacity to bid for large public contracts
- Trainings of ESP staff mainly provided on the job.

Recommendations for implementation

- TA during tender process necessary to ensure selection of ESP with right capabilities and limited TA for ESPs, it could potentially be supported by NEI
- Feasibility study required for PPPs might require TA to MHSS/ESP that could also be provided partly by the NEI sitting within the MoME
- Coordination with MoME/NamPower to benefit from their expertise and technical knowledge including IPP contract negotiation and management

Source: KOIS analysis

The Namibian context provides an enabling environment for the S4H PPP feasibility with the presence of qualified ESPs willing to enter into a long PPP with the MHSS and able to raise financing for the project.

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

High feasibility

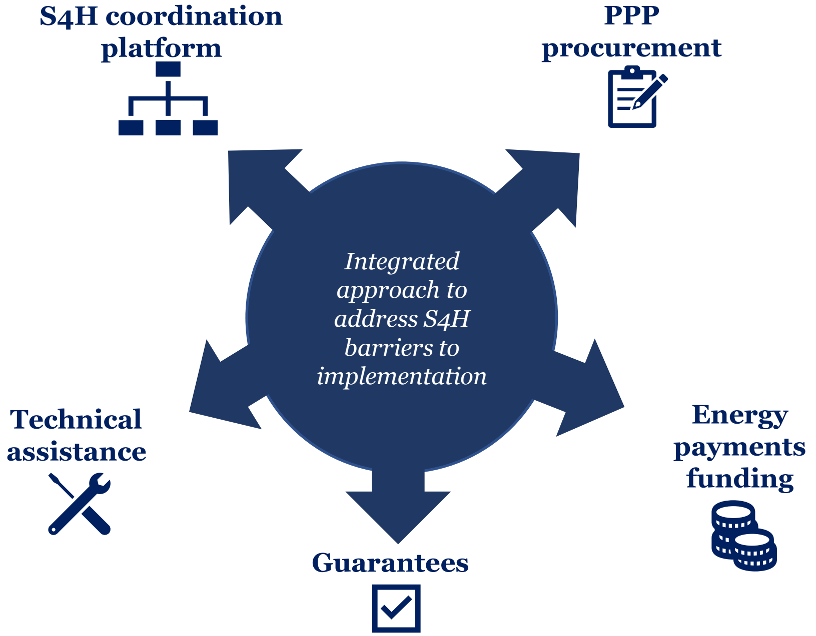
- Only 103 facilities off-grid and reliable grid limiting investment size
- Decentralized management can increase implementation complexity
- Ability of ESPs to raise concessional financing locally from DFIs or commercial banks

Technical Assistance to MHSS 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 through the platform. Further ensure the sustainability by building technical capacity limiting operational risk

Medium feasibility

- ESPs market sufficiently developed does not require TA
- Mobilizing donor funding to support TA could be more difficult in the Namibian context
- Collaboration with MoME, NamPower and NEI to leverage on specific energy related expertise



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

Address MHSS payment risk for the ESP and its ability to raise sufficient capital and as such supports the procurement process.

High feasibility

- MHSS credit worthiness considered acceptable
- Sign off from Treasury or Sovereign guarantee over the MHSS payment obligations can be mobilised for the PPP

Tender process for S4H PPP contract conducted by the MHSS to award it to ESP(s)

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

Medium feasibility

- Limited expertise of the MHSS in energy related PPPs but a framework and expertise lies within the MoME and could be leveraged upon
- Energy expenditures and solar installation investments currently covered by the MHSS
- Presence of local companies with sufficient capacity, capabilities and appetite to implement MHSS S4H contracts

Donors support energy payments funding from MHSS to the ESP

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

Medium feasibility

- Limited availability of donor capital to support the MHSS in the programme funding
- Potential to reallocate resources from existing diesels cost and investments in CAPEX into leasing payments for more facilities for MHSS

Source: KOIS analysis

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 Namibia

2. FUNDING MECHANISM
Obtain funding commitments from the Government of Namibia (i.e., MHSS, MoME) and donors
2-3 months
Deliverable
- MoU between the MHSS, 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

Public procurement process will be facilitated by the S4H coordination platform 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 MHSS/MoF/PPP Unit/MoME	- 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 to select the ESP for a long term PPA to procure, install and maintain solar systems for a group of healthcare facilities (regional/country wide). Procurement process is supervised by UNDP
- PPA contracts are drafted by legal advisors in collaboration with MHSS and UNDP

Installation

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

Financial

- ESP can get a loan from the DFIs/IFIs at advantageous interest rate
- ESP is responsible for repayment of the loan
- Leasing payments from the MHSS 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 MHSS and ESP who shall ensure access to energy for healthcare facilities. An SLA defines the contractual level of service required from the ESP.
- MHSS is responsible of 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 MHSS 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 valuator monitors the performance to authorise result-based energy payments

Financial

- UNDP supervises energy payments from MHSS and manages donors contributions
- MHSS 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.*

Initial procurement of fund 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 of the programme's requirements
- 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 MHSS) 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

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

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

Potential revenue stream	Opportunities	Challenges	How to mobilize those revenues
Diesel/utility bills reallocation	• Currently the MHSS or the districts have a budget for energy expenditures that can be reallocated • Solar energy is cost effective compared to diesel in the long term especially as diesel costs are likely to grow	• Long term sustainability is critical to ensure cost-effectiveness compared to diesel • Low percentage of facilities use diesel • Decentralized 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 energy access • Economies of scale can be reached by connecting other public facilities • Dense areas with commercial clients are most attractive 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, coordination between ministries will be needed	• Moblize rural electrification grants (in collaboration with MoME) • Analyze potential for bankable anchor client • Mobilize other ministries (education, MoME, …) to support the cost of a network for public facilities
Feed-in Tariff	• For grid-connected facilities, below 1MW, net metering credit system can decrease the yearly utility bill	• There used to be a feed-in tariff policy that was abolished, PPP are set up for large power plants • With the Net Metering System no revenues are generated but savings on utility bills • No cost-effectiveness of solar compared to grid	• Shall some on-grid facilities be in scope, support the development of the REFIT Programme in a way it can benefit the S4H Programme
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, MHSS 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

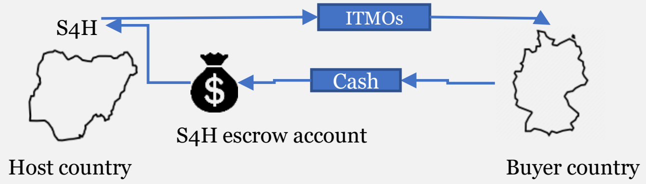
Carbon financing could be a clever way for national government to finance the S4H initiative and UNDP is well placed to support that process

- 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

- **Regulations and financial incentives for off-grid solutions**
  - Rural electrification is implemented through grid extension which is costly and takes time
  - A change of mentality to move from a grid only electrification perspective is needed
  - Grants for new connections created to support mini-grid is one example of potential regulatory and financial support

→ **UNDP CO can lobby for connection grants for off-grid solution and mobilize technical assistance to support regulatory changes**

Government bodies buy-in

- **Confirm interest for the S4H project implementation**
  - Letter of interest from the MHSS to confirm willingness to implement S4H
  - MHSS/GoN to endorse concept note to request GCF financial support for the implementation
- **Establishment the priorities for the project**
  - Establish the priorities for the project and definition of scope (e.g. selection of facilities)
  - Confirmation of MHSS budget that can be allocated to S4H
- **Coordination and alignment of stakeholders**
  - MHSS and DHOs to select the facilities
  - MoME, align with the electrification plan
  - MoF/Treasury to ensure budget availability

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

Donors/DFIs mobilization

- **Mobilization of local sources of capital**
  - Preliminary discussions with identified potential local financiers (DFIs, banks, pensions funds, other private investors)
  - Identification of investment terms and conditions to align procurement terms
- **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 payments 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

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 Namibia.

Improved healthcare quality

In recent years, the healthcare system has been largely consumed by the HIV/AIDS pandemic. HIV/AIDS remains the leading cause of death and premature mortality for all ages. HIV is the underlying cause of <35% of under-five mortality rate.

Healthcare facilities are unable to operate to maximum capacity as access to reliable energy remains a significant challenge, especially in rural areas. Approx. one third of health facilities have unreliable access to electricity.

- **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.
- **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 in healthcare but NamPower is running on diesel generators in case of power shortage.

Namibia is characterized by persistent droughts and stands a high risk to suffer from the impacts of climate change.

- **Increasing resilience to climate change:** Renewable energy can increase resilience to climate change challenges, such as drought.
- **Reduce CO2 emissions** : by choosing solar over grid and/or diesel, cleaner energy is being generated

Development of local SE market

FDI in Namibia stood at US$175.4 million or 1.37% of the GDP, as of 2018, (vs. 1.9% in Sub-Saharan Africa). Investments are focused in traditional sectors such as mining and fishing.

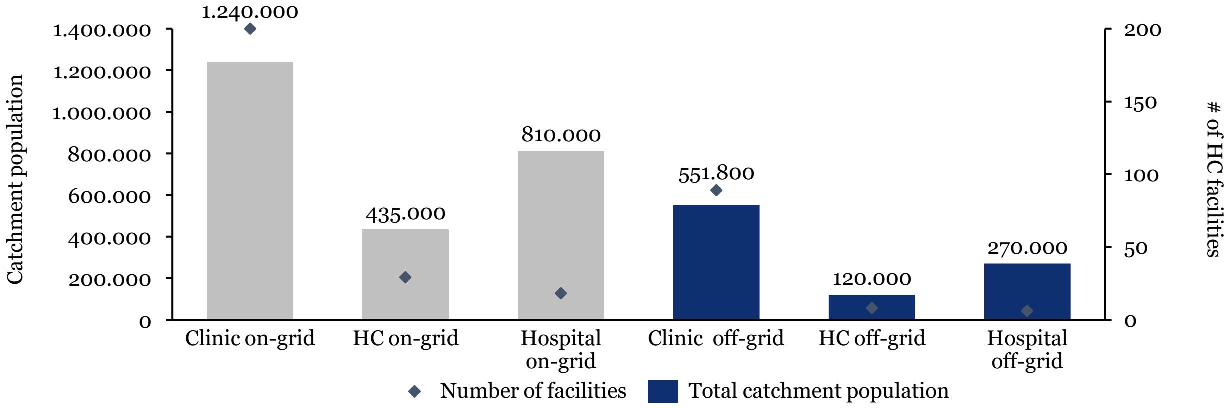
Approx. 50 local private off-grid energy companies operating in the market servicing different segments.

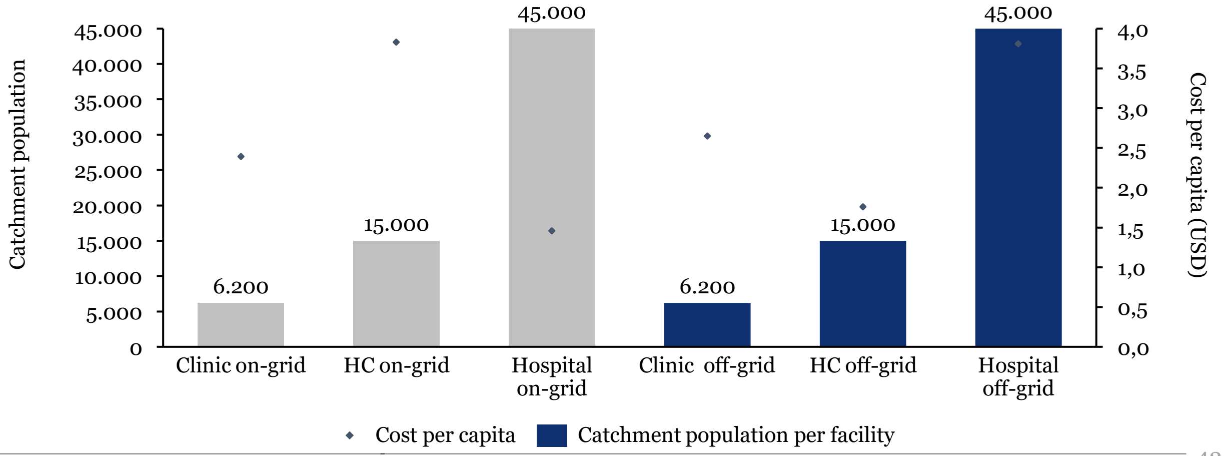
- **Stimulating local economy:** S4H can help catalyse FDI inflows, contributing towards development of energy sector, as well as create additional green jobs, especially for rural populations.
  - **Solar energy sector capacity-building:** S4H can help increase technical capacity of local ESPs, contributing towards further market transformation and uptake of solar technologies.

1 BAU (business as usual scenario): estimates carbon intensity of country under the present development path
https://climateknowledgeportal.worldbank.org/country/namibia
https://tcdata360.worldbank.org/countries/NAM?indicator=1541&countries=BRA&viz=line_chart&years=1970,2018&country=NAM
Namibia Health Budget, UNICEF, 2017
Source: World Bank; UNICEF Namibia; 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.

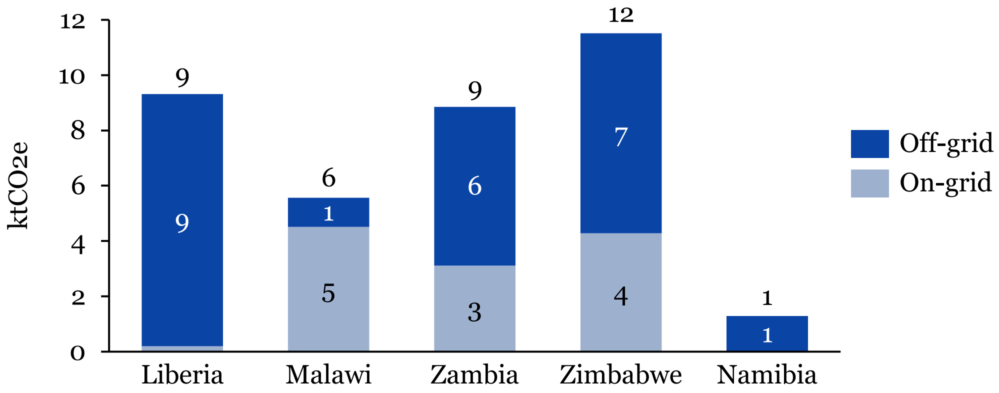
- By electrifying all off-grid facilities, it is more than 900,000 people getting access to better healthcare quality especially in poorest rural areas
- Prioritizing off-grid clinics will reach the most people that today lack healthcare services with grid power
- However, for those facilities the cost per capita is the highest as all other things equal, the cost is higher for smaller 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





Assuming solar solutions are installed at all facilities, S4H could achieve a reduction of approximately 42 ktCO2e/year for the five countries together and about 1.2 ktCO2/year for off-grid facilities in Namibia.

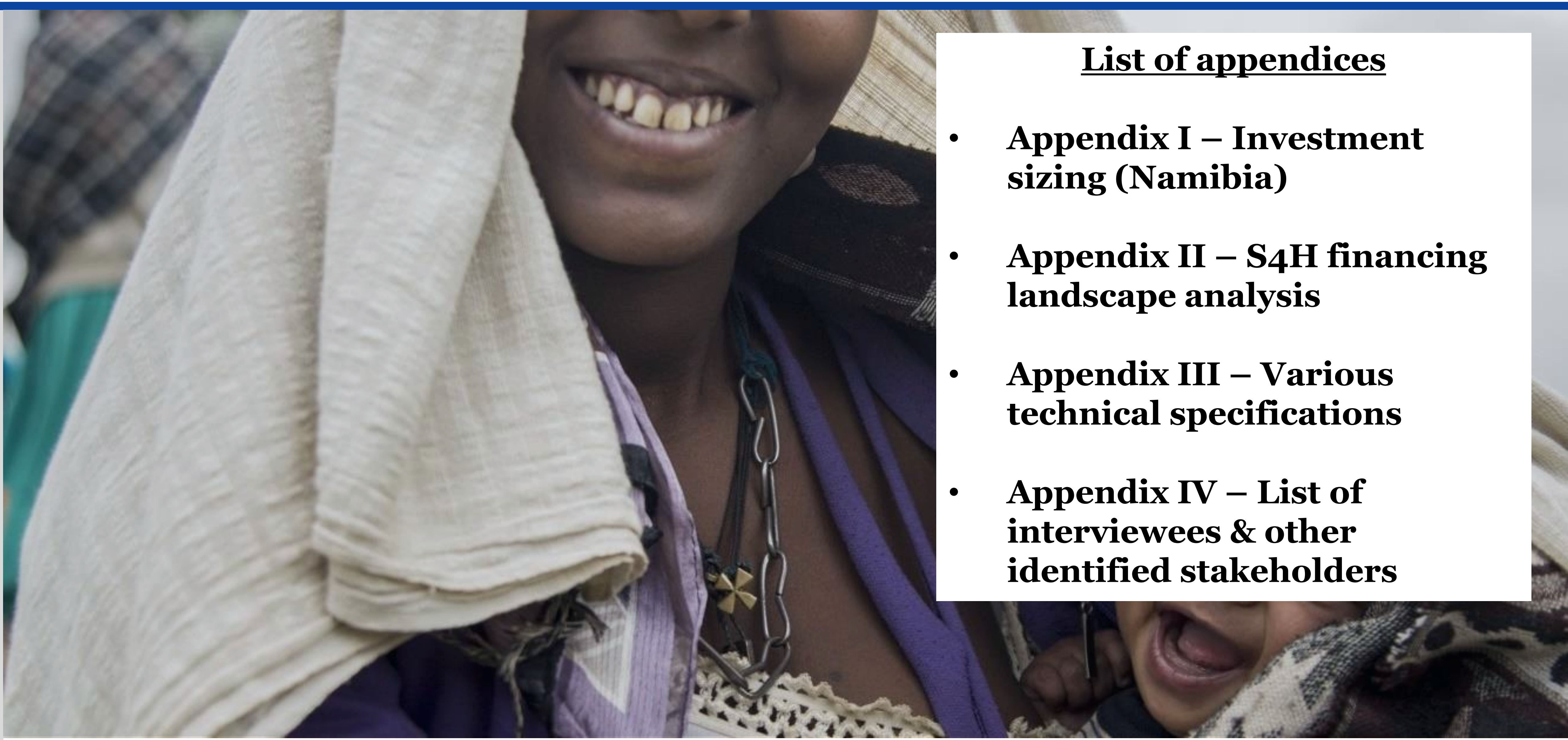
Annual emissions reductions per country



Annual emissions reductions in Namibia

Namibia	Total	Clinics and polyclinics	Health centres	Hospitals
Diesel efficiency	21 %	15 %	25 %	30 %
Diesel emissions in tCO2/year	1 205	650	116.8	438

- Some rural health centres or clinics have a diesel generator. For diesel genset the performance can be uneven and small systems are particularly inefficient.
  - For this analysis, we have assumed that the smallest facilities/clinics deliver least effective (15%), rural/urban health centres run at 20%/25% and that hospitals can reach efficiencies up to 30%.
  - We have assumed that 30% of facilities are using diesel
- Clinics representing the largest number of healthcare facilities, 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 (Namibia)
- Appendix II – S4H financing landscape analysis
- Appendix III – Various technical specifications
- Appendix IV – List of interviewees & other identified stakeholders

Appendix I – Investment sizing (Namibia)

Investment sizing (1/3)

Assumptions

0. Only **public** HC facilities are covered
1. Only off-grid facilities are in scope
2. All off-grid facilities (regardless of their current access) will pass to solar standalone as a main source
3. Energy capacity needs as listed on next page

Namibia settings			
Bad days/year	24	*Period (years)*	7
Built-in autonomy	25%	*Discount rate (% p.a.)*	10%
Diesel cost/kwh	0,24	*Diesel budget shortfall*	0%
Diesel cost/kwh incl. O&M	0,28	*Reserve for back-up*	0%
Grid cost	0,13	*Annualisation factor*	5,36
Sun hours per day	6,00	*Power source for autonomy*	PV

Number of healthcare facilities by type							
Size	1	2	3	4	5	6	Total
County	*Clinic on-grid*	*Clinic off-grid*	*HC on-grid*	*HC off-grid*	*Hospital on-grid*	*Hospital off-grid*	*Per county*
Erongo Region	18.0	0.0	1.0	1.0	3.0	1.0	24
Hardap Region	13.0	0.0	3.0	0.0	1.0	0.0	17
Karas Region	13.0	0.0	2.0	0.0	2.0	1.0	18
Kavango East Region	1.0	24.0	0.0	0.0	0.0	0.0	25
Kavango West Region	0.0	19.0	0.0	3.0	0.0	0.0	22
Khomas Region	6.0	6.0	2.0	0.0	1.0	0.0	15
Kunene Region	21.0	5.0	3.0	0.0	3.0	1.0	33
Ohangwena Region	30.0	1.0	2.0	0.0	0.0	0.0	33
Omaheke Region	14.0	0.0	0.0	1.0	1.0	0.0	16
Omusati Region	25.0	14.0	3.0	3.0	2.0	1.0	48
Oshana Region	14.0	0.0	4.0	0.0	0.0	0.0	18
Oshikoto Region	17.0	4.0	3.0	0.0	2.0	0.0	26
Otjozondjupa Region	7.0	11.0	3.0	0.0	2.0	2.0	25
Zambezi Region	21.0	5.0	3.0	0.0	1.0	0.0	30
TOTAL	200	89	29	8	18	6	350
Programme coverage by facility type							
%	0%	100%	0%	100%	0%	100%	
# installations covered	**0**	**89**	**0**	**8**	**0**	**6**	**103**

Source: Differ and Kois analysis

Investment sizing (2/3)

Base case scenario: For all public off-grid facilities	Total 7y cost	3 655 625

Need by HC facility type (in terms of installed capacity)	Namibia					
	1	2	3	4	5	6
	Clinic on-grid	Clinic off-grid	HC on-grid	HC off-grid	Hospital on-grid	Hospital off-grid
Required autonomy (days)	0,25	1,00	0,25	1,00	0,25	1,00
Days to fully charge	0,25	1,00	0,25	1,00	0,25	1,00
% of equipment included in autonomy	0,80	0,70	0,50	0,50	0,50	0,50
Daily consumption (kWh)	20,00	20,00	40,00	40,00	200,00	200,00
Installed capacity for daily load (kW)	3,3	3,3	6,7	6,7	33,3	33,3
Extra capacity for autonomy (kW)	0,0	1,8	0,0	2,5	0,0	12,5
Installed capacity need (kW)	3,3	5,1	6,7	9,2	33,3	45,8
Margin on equipment	20%	20%	20%	20%	20%	20%

Cost components						
Base kit	$3 333	$3 333	$5 767	$5 767	$25 233	$25 233
Battery	$2 891	$9 000	$4 951	$18 000	$22 500	$90 000
Extra panels	$0	$971	$0	$1 388	$0	$6 938
Total hardware cost	$6 224	$13 305	$10 718	$25 154	$47 733	$122 171
Margin on equipment	$1 245	$2 661	$2 144	$5 031	$9 547	$24 434
Design	$1 333	$1 333	$1 667	$1 667	$4 333	$4 333
Install	$800	$800	$1 200	$1 200	$4 400	$4 400
Ship	$333	$333	$417	$417	$1 083	$1 083

Cost budgeting						
Initial investment outlay ($)	$ 9 936	$ 18 432	$ 16 145	$ 33 468	$ 67 097	$ 156 422
Annual O&M cost ($)	$ 1 200	$ 1 305	$ 1 400	$ 1 550	$ 3 000	$ 3 750
Hypothetical initial cost of genset ($)	$ 1 250	$ 1 250	$ 2 500	$ 2 500	$ 12 500	$ 12 500
Hypothetical annual diesel cost ($)	$ 2 565	$ 1 784	$ 3 568	$ 3 568	$ 17 841	$ 17 841
Hypothetical annual grid cost ($)	$ 949	$ 949	$ 1 898	$ 1 898	$ 9 490	$ 9 490

Cost splits (autonomy)						
PV cost	$ 9 936	$ 9 167	$ 16 145	$ 15 603	$ 67 097	$ 67 097
Extra autonomy cost	$ -	$ 9 266	$ -	$ 17 865	$ -	$ 89 325
0.25 day battery autonomy system	$ 9 936	$ 18 432	$ 16 145	$ 33 468	$ 67 097	$ 156 422
0.25 day autonomy system + diesel	$ 12 265	$ 11 496	$ 20 803	$ 20 262	$ 90 389	$ 90 389
0.25 day autonomy system + grid	$ 9 936	$ 9 666	$ 17 143	$ 16 602	$ 72 089	$ 72 089

Source: Differ and Kois analysis

Investment sizing (3/3)

	Clinic off-grid	*HC off-grid*	*Hospital off-grid*	TOTAL
Initial inv.	$ 1 640 463	$ 267 747	$ 938 530	$ 2 846 740
Annual O&M (pre-markup)	$ 77 430	$ 8 267	$ 15 000	$ 100 697
Annual O&M	$ 116 145	$ 12 400	$ 22 500	$ 151 045
PV	$ 815 833	$ 124 827	$ 402 580	$ 1 343 240
Battery	$ 824 630	$ 142 920	$ 535 950	$ 1 503 500
kW	452	73	275	2261
%	53,94%	9,70%	36,36%	100,00%

Chosen autonomy mix				
	Clinic off-grid	*HC off-grid*	*Hospital off-grid*	TOTAL
PV	100%	100%	100%	100%
Diesel	0%	0%	0%	0%
Grid	0%	0%	0%	0%

Total cost (present value of inv & annuity)				
	Clinic off-grid	*HC off-grid*	*Hospital off-grid*	TOTAL
Catchment population	551 800	120 000	270 000	941 800
Total hardware cost	$ 1 184 108	$ 201 233	$ 733 025	$ 2 118 366
Turnkey cost	$ 1 640 463	$ 267 747	$ 938 530	$ 2 846 740
O&M cost	$ 116 145	$ 12 400	$ 22 500	$ 151 045
Total outflows	$ 1 756 608	$ 280 147	$ 961 030	$ 2 997 785
PV of total commitment	$ 2 262 450	$ 334 152	$ 1 059 023	3 655 625
Total commitment	$ 2 453 478	$ 354 547	$ 1 096 030	3 904 055
%	61,89%	9,14%	28,97%	
Cost/capita	$ 4,10	$ 2,78	$ 3,92	

Source: Differ and Kois analysis

Appendix II – S4H financing landscape analysis

UNDP DIFFER KOIS CARING FINANCE

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

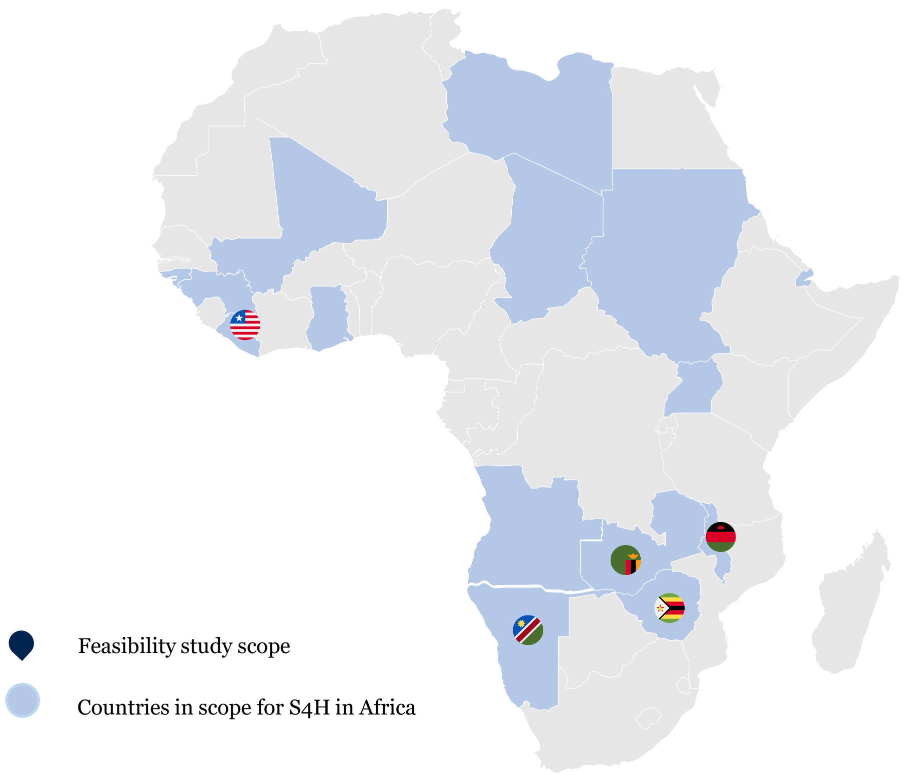
6 objectives contributing to multiple SDGs

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



"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 **Availability of relevant options**	**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*
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

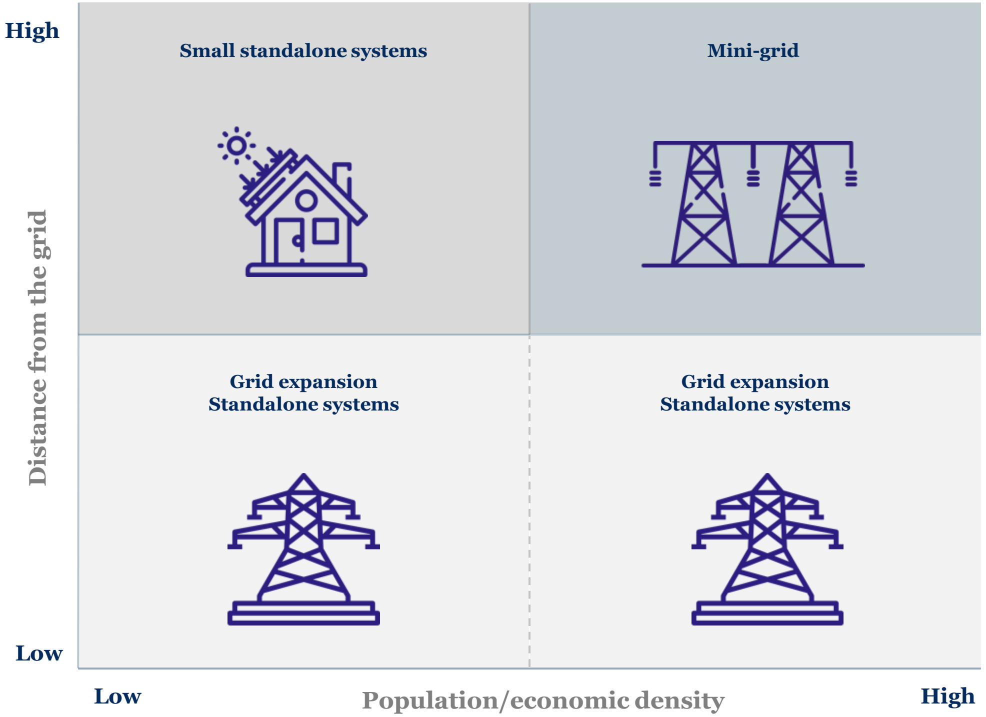
There are three main business models when it comes to solar energy service providers

	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

<u>High-density areas far from grid</u>: 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

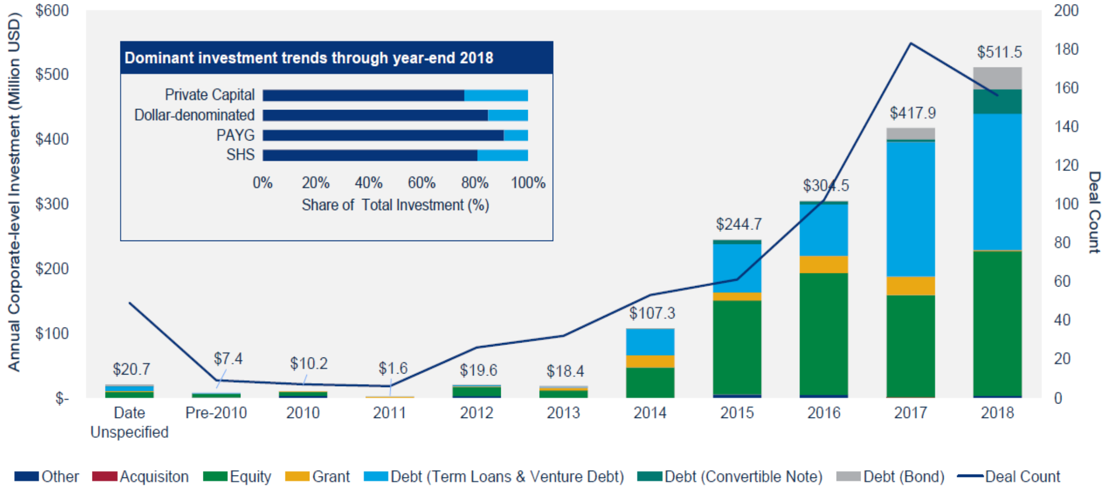
Source: KOIS analysis

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

Corporate-level investment into off-grid energy access companies by year and type of financing through year-end 2018

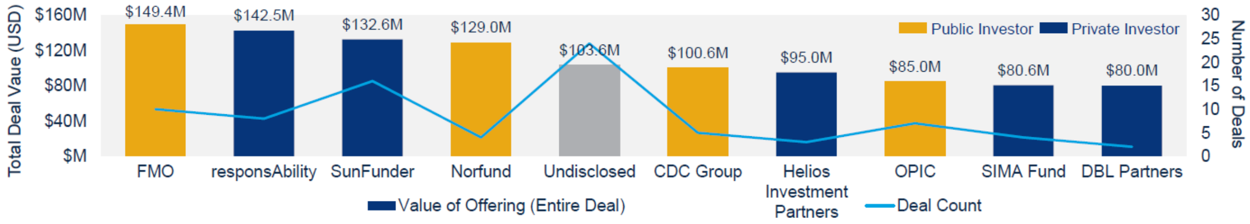


Source: Wood Mackenzie Power & Renewables, Energy 4 Impact

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)

Top 10 Investors by Total Deal Value (by sum of deal totals in which the investor participated), 2010-2018



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

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

UNDP DIFFER KOIS CARING FINANCE

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.

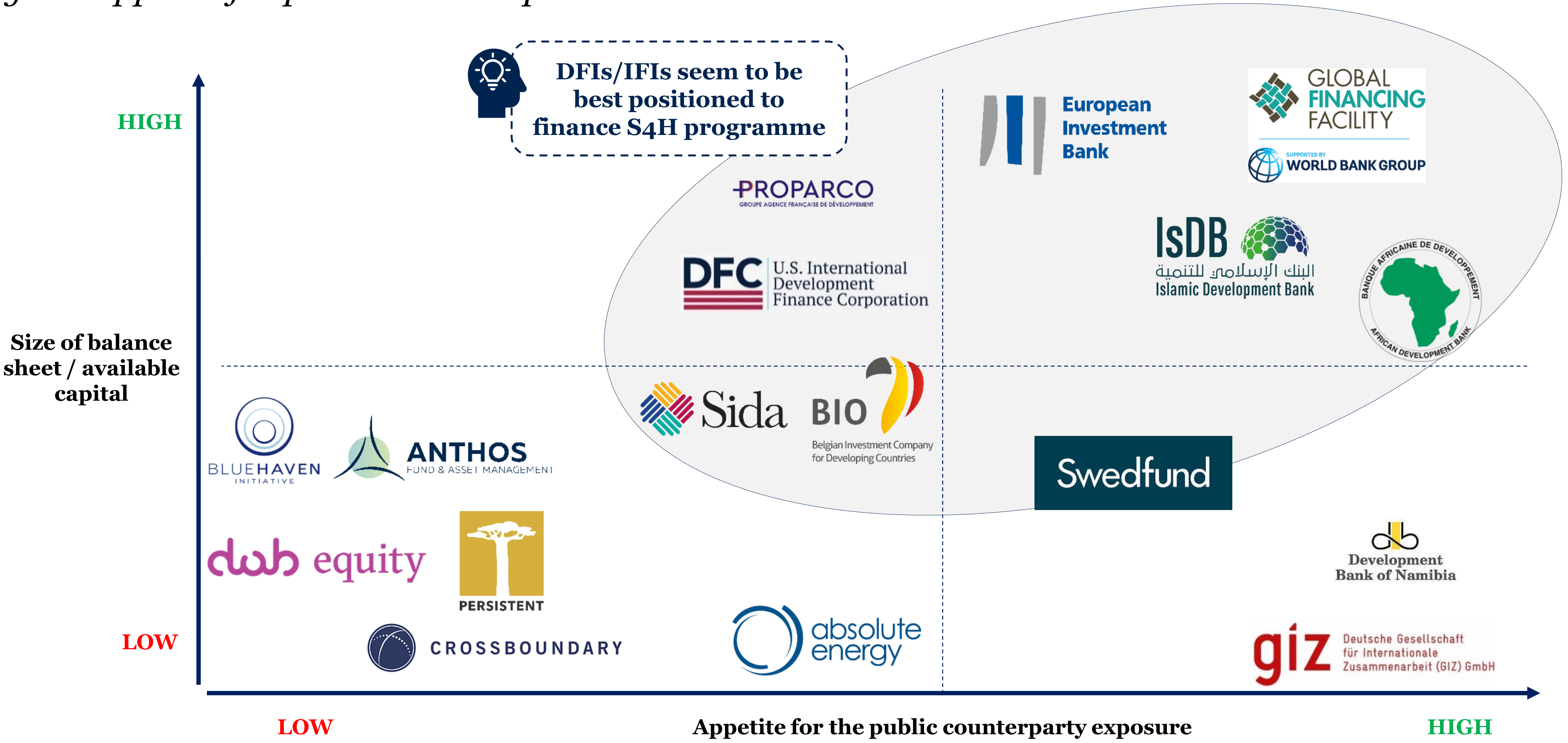
Commercial investors

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 funding

- 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 World Bank Group
- CTF Clean Technology Fund

To the ESPs

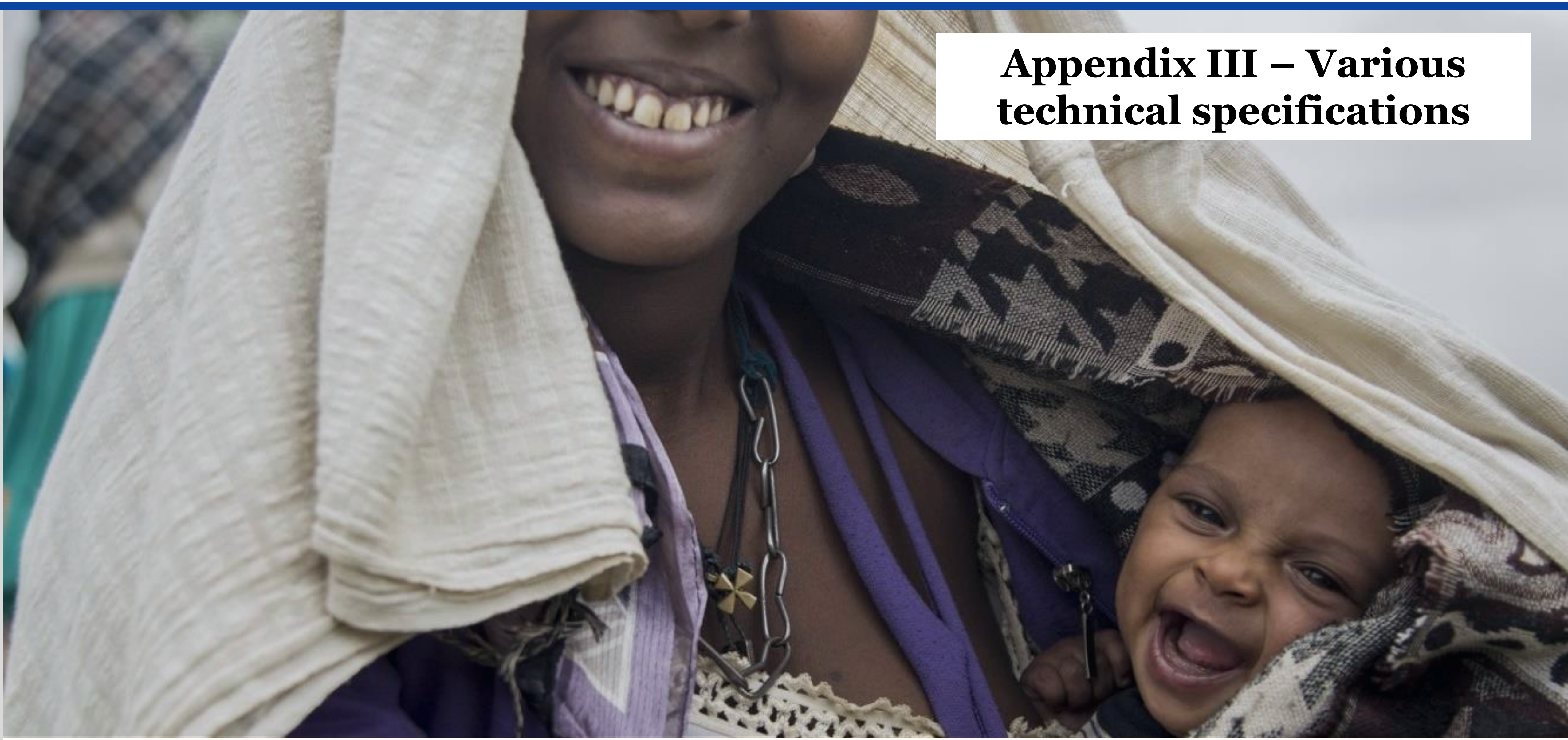
- BIO
- Sida
- AREI
- Sustainable Energy Fund for Africa
- Proparco Groupe Agence Française de Développement

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
- Banque Africaine de Développement / 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

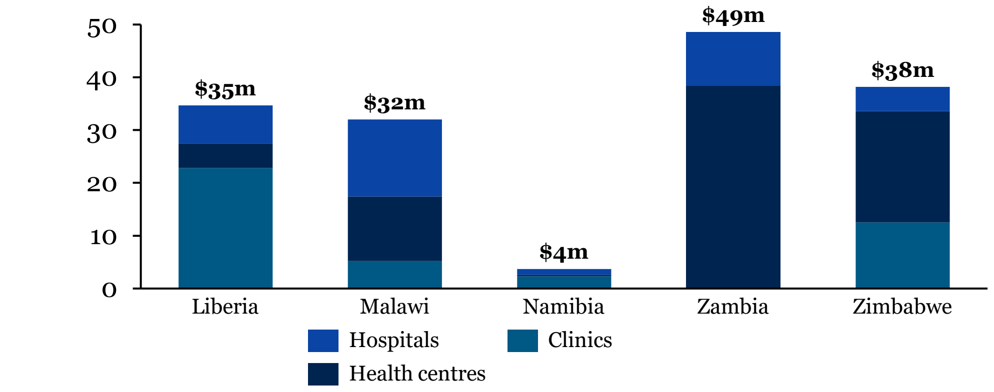
Appendix III – Various technical specifications



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

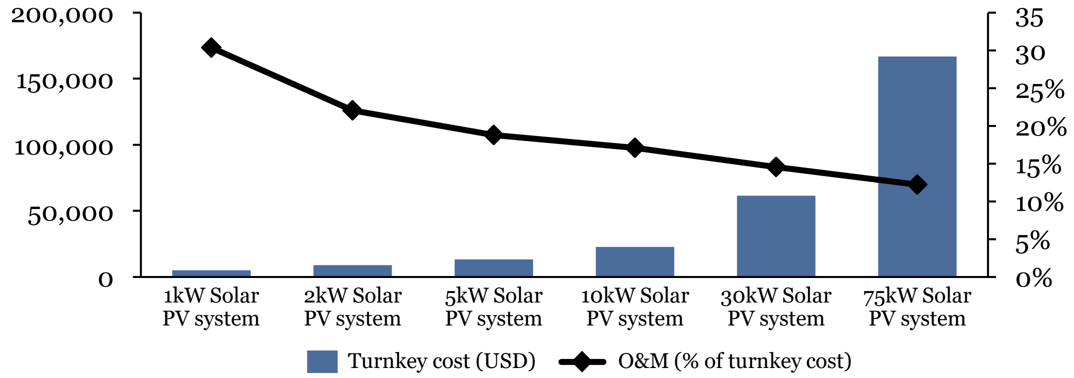
Market size: total energy solution cost[1]

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

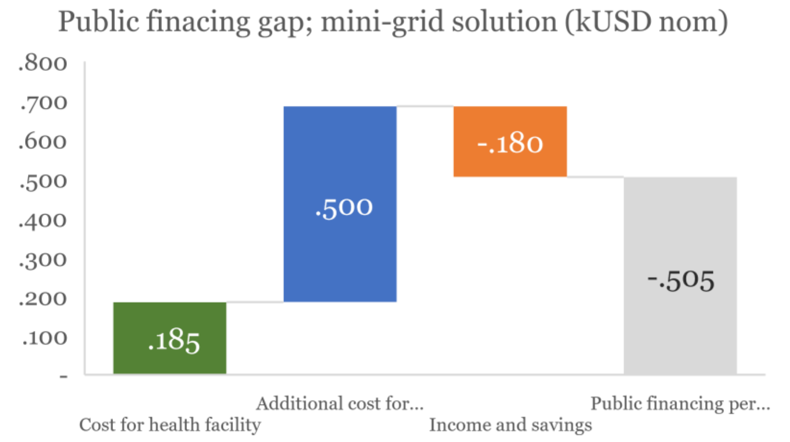
- When a country has a low population density and economic activities are concentrated in the urban areas, grid extension to bring electricity to the rural population is often not economical
- The electrification through grid extension is likely to take many years
- Setting up mini-grid would be a more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

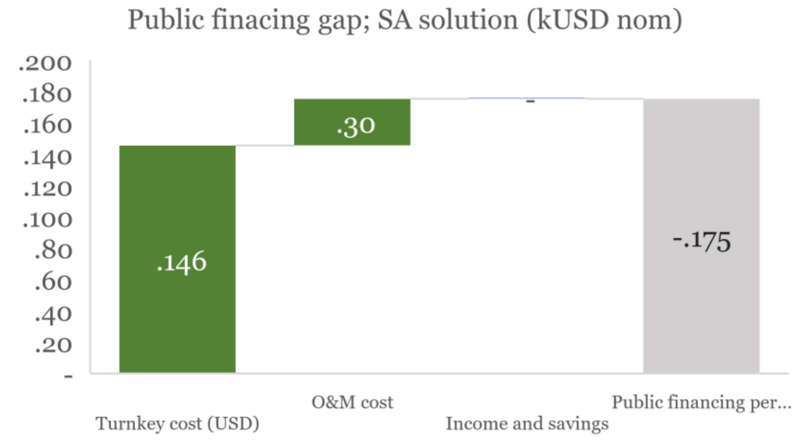
Rural electrification through mini-grids is however not economically viable to be implemented by the private sector, similar to the grid it requires public funding

- 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



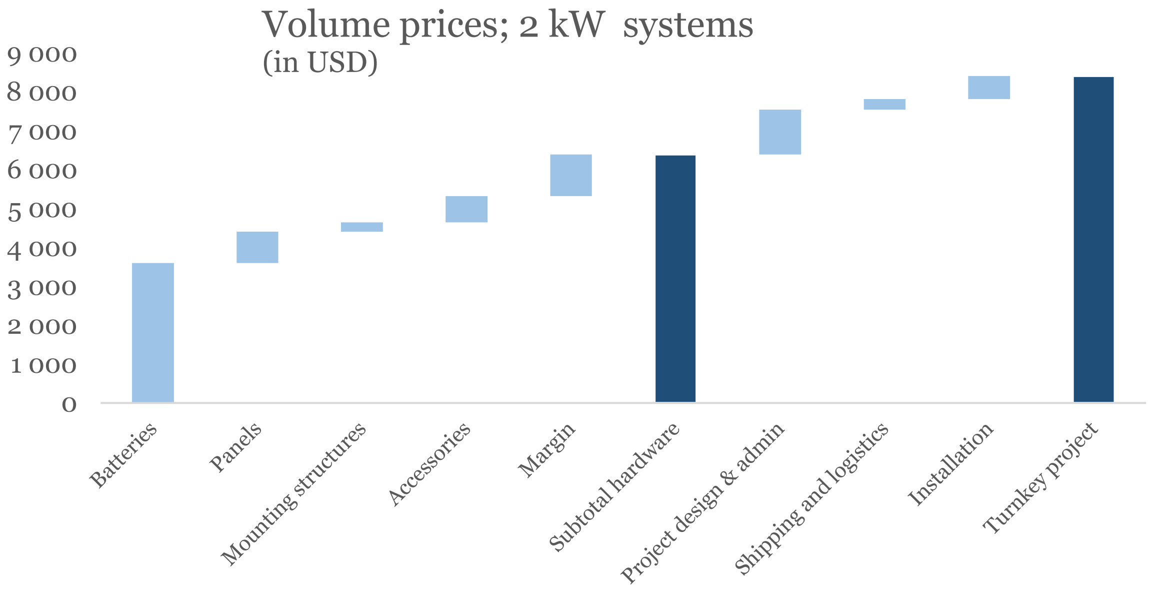


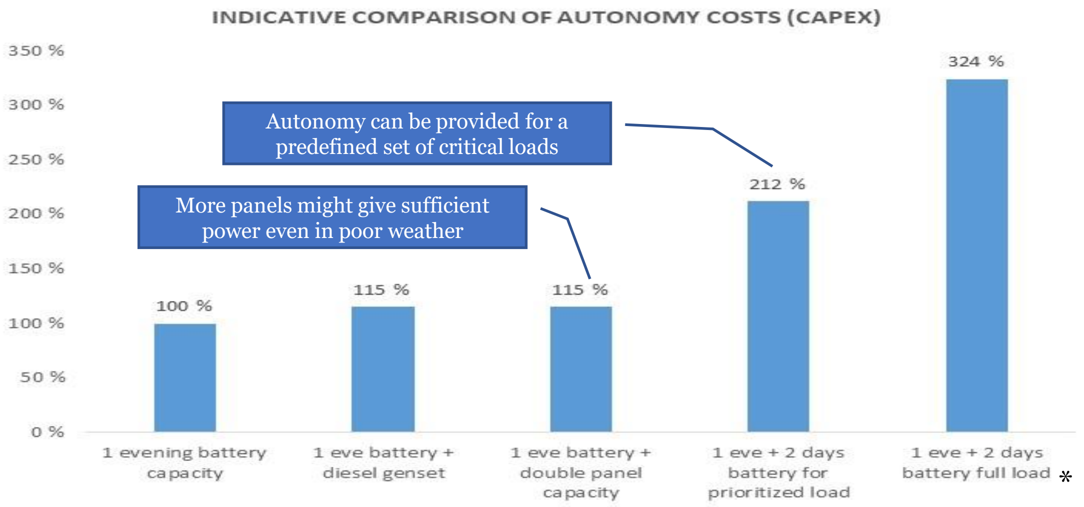
Source: Kois & Differ analysis

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





*** Assumptions on autonomy**

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

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

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

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

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.

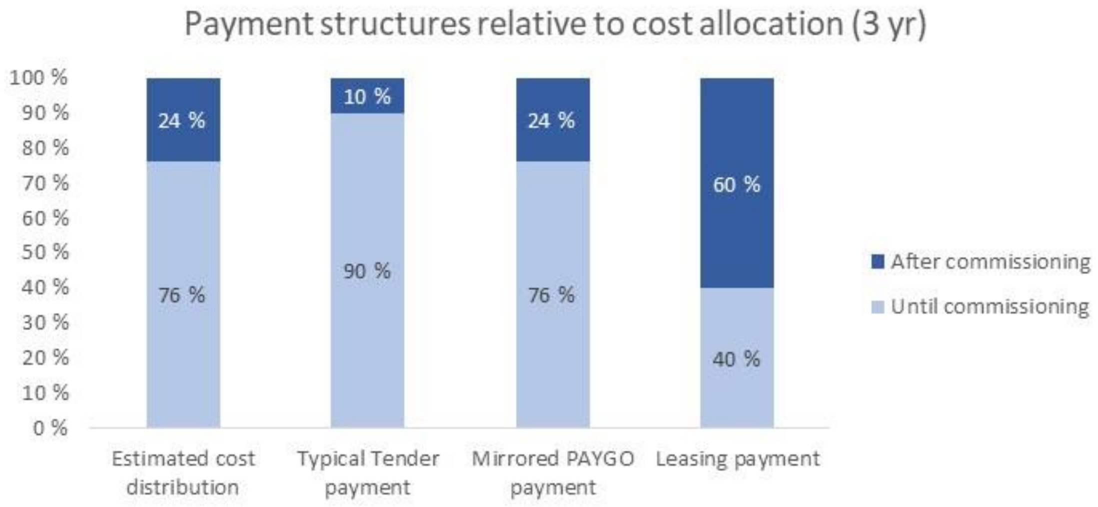
- There is an assumed down-payment of 40% of the total contract value in the leasing structure (i.e. more than 50% of the CAPEX)

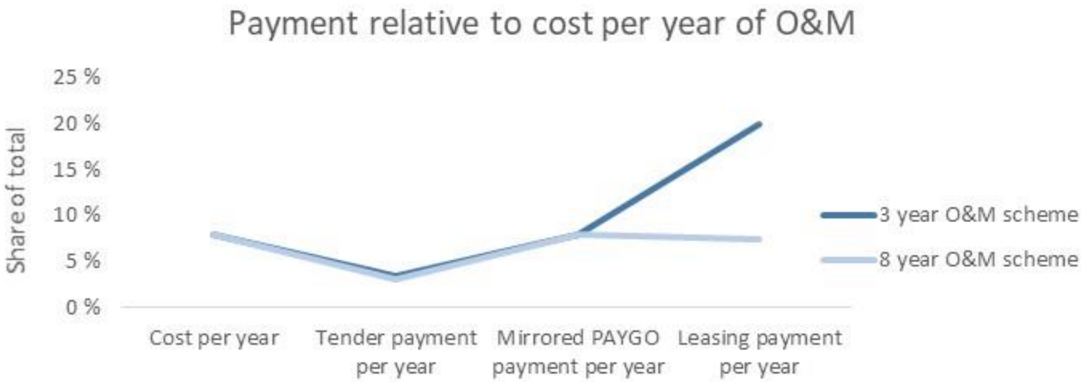
The bottom graph illustrates how the payment per year of operation compares with the annual cost of O&M (as a % of total contract value)

- 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

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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: payment obligation under the PPP covering CAPEX and OPEX costs
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

MoME
NEI/NamPower/REEDs

Financial role: could provide subsidies within rural electrification plan, Feed-in-Tariff
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