Completion Report

From diesel to solar: Reducing emissions through PAYG at health clinics in Kenya

Kenya

Grantee: Differ AS

Local Partner(s): PS Kenya, World Resources Institute, Differ Community Power

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Date

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1. EXECUTIVE SUMMARY

Solar energy has become the cheapest source of energy for most uses in large parts of Africa. Still, few health facilities have installed solar energy and many are still maintaining diesel generators as the back-up source. Differ hence joined forces with Differ Community Power (an EPC provider of solar energy solutions in Africa and Asia), PS Kenya (a service provider for franchise networks of health facilities in Kenya), World Resources Institute (a global research non-profit organization) and NCF to investigate whether new business models could catalyse the swich to solar energy for private sector health care facilities in Kenya.

The project aimed to validate the commercial viability of providing solar energy and energy storage solutions to private sector healthcare facilities in Kenya using a form of Pay-As-You-Go (PAYG) contract. With a PAYG contract structure, the facilities can access solar energy against a limited down-payment, followed by a pre-defined monthly payment over a pre-defined period of time. At the end of the payment schedule, the ownership of the system is transferred to the health care facility - and from when the facility can benefit from free access to solar energy.

The viability assessment was twofold, in terms of i.) testing whether facilities that were unable to invest in a solar energy and storage solution without PAYG could have access through PAYG, and ii.) testing whether the facilities were able to make the payments required to make PAYG a commercially viable business model.

In collaboration with PK Kenya, a selection of 18 potential customers were selected and approached. Through site assessments, technical and financial offers were provided to a total of 15 customers. Each facility was offered three alternative system configurations, a “lowest cost” option, an “financially optimal” option, and an option for a system that would make the facility independent of grid electricity.

The project was successful in demonstrating the potential viability of such a business model, while still identifying key barriers to rapid scaling in Kenya. During the project, three contracts were signed and one installation made by the end of the project period, at Topcare Hospital outside Nairobi. The main challenges to scaling the initiative in Kenya were the general worsening of the financial conditions in the wake of Covid, as well as the escalating depreciation of the Kenyan shilling towards the US dollar. The two facilities that signed the contracts are still ambitious in terms of getting back to a sustainable cashflow that can support the investment into solar energy, and would Kenya be successful in returning to a pre-Covid economic climate, scaling the business model commercially would be feasible.

The project also demonstrated the value to the health facility from gaining access to solar and energy storage installations, both in terms of demonstrating how solar gives independence from diesel gensets, as well as maintaining the service levels during grid downtime without excessive diesel costs. For the project this also demonstrated the viability of achieving the intended emission reductions.

2. ACHIEVEMENT OF RESULTS

2.1 Achievement of outcomes and outputs

Original Milestone deliverable	*Total original project target*	*Achieved Milestone Target*	*Completed (Yes/No/Partially)*	*Results*
Outcome 1.1: Standard product and financial solutions offered	*3 pcs*	*3*	*Yes*	*Three standardized technical solutions (Small, Medium and Large) and commercial offers developed and provided to 15 clinics.*
Output 1.1.1. Legal, commercial and operational documents developed	*3 units*	*3*	*Yes*	*Commercial proposal templates developed and used for presenting offers to the facilities. Two alternative, standardised legal contract templates developed and is being tested. O&M contracts are developed alongside draft installation guidelines.*
Output 1.1.1. Project management tool developed	*1 pcs*	*1*	*Yes*	*A tool has been developed for monitoring the sites, including error detection and to support both O&M and commercial management of the projects.*
Activity 1.1.1. Dialogue with financiers, local banks and guarantors on business setup			*Yes*	*Dialogues are ongoing with several relevant financiers, including local banks, international investors and guarantee providers.* *LOI/partnership agreement signed with one investor.*
Activity 1.1.1.2. Develop various draft contracts and test on stakeholders/ clinics			*Yes*	*"Hire for purchase" identified as the appropriate contract form.* *Two alternative standardised contract templates developed to be offered and tested.* *Most comprehensive contract deemed feasible with two contracts signed.*
Output 1.1.2. Health clinics that have signed the contract on energy service delivery	*5*	*3*	*Partial*	*Three contracts signed. Several other facilities have confirmed interest in the technical and financial offers presented, but did not have the required funding available.*
Activity 1.1.2.1 Detailed site assessments and due diligence			*Yes*	*An extensive data collection exercise has been conducted, including both financial, operational and energy usage data. The data has been used to develop suitable system configurations. Financial data indicates how different system sizes impact costs and financial returns for the facilities.*
Activity 1.1.2.2. Develop and execute communication and marketing strategy			*Yes*	*As this concept is new to the Kenyan market, we have developed several documents to explain the concept. We see it as critical that the facilities properly understand all aspects of the service offering, as well as its limitations, to minimize risk of uncertainty and disagrees after installation.*
Activity 1.1.2.3. Pilot facility discussions and contract signing			*Partial*	*We have been in commercial discussions with 15 facilities and three have signed.*

Output 1.1.3. Installations that have been installed and commissioned at targeted clinics	*5-8*	*1*	*Partial*	*Installation completed at one facility. Other contracted facilities have not made required down-payment to make installation.*
Activity 1.1.3.1. Purchasing equipment and sending to Nairobi			*Yes*	*Based on an RFQ suppliers have been identified and selected. Equipment for the sites under contract acquired*
Activity 1.1.3.2. Contracting local partners for installation, operation and maintenance			*Yes*	*We have identified a selection of candidates for installation and O&M. SOW developed and one preferred partner contracted for initial installation. A separate company contracted to conduct commissioning.*
Activity 1.1.3.3. Installation and commissioning			*Partial*	*Installation completed at one facility.*
Output 1.1.4. First payment from all clinics received	*5-8*	*1*	*Partial*	*One facility has commenced payments with mobilization fee amortized over 18 months.*
Activity 1.1.4.1. Establishing payment structure & routines			*Partial*	*We are planning to use the payment module integrated in the solution we have selected for remote monitoring. Plan to set up MPESA account to be able to receive Kenyan Shillings as in contracts.*
Activity 1.1.4.2. Invoicing facilities and follow up			*Partial*	*Customer is paying timely and regularly. Invoicing to be sorted out.*
Outcome 1.2: Solar systems are commissioned at a minimum of 30 health facilities	*30*	*0*	*No*	*The project was not successful in scaling the business beyond the pilot facilities within the end of the project, but processes to develop a portfolio relevant for financing is ongoing and continues beyond the project end.*
Output 1.2.1. Established an operative SPV	*1 unit*	*0*	*No*	*With insufficient number of sites, we have not yet established an SPV.*
Activity 1.2.1. Developing, testing and improving the financial and business models			*Yes*	*During negotiations with the different facilities, we have landed on a modified financial and business model.*
Activity 1.2.1. Developing, testing and improving the software-based project management system, including indicators and reporting			*Yes*	*We have developed and improved the software and process for project management, as well as developed a new and improved methodology and model for developing technical and financial offers more effectively.*
Activity 1.2.1. Establishing appropriate SPV			*No*	*On hold until sufficient volume.*
Output 1.2.2. Explored grant funding opportunities supporting the energy investments	*1 pcs*	*1*	*Yes*	*Discussions on potential grant contributions to attract commercial capital has commenced with a few candidates (e.g. IKEA Foundation, Power Africa and HETA).*
Output 1.2.2. Secured commercial financing of the SPV	*600,000 EUR*	*0*	*No*	*No commercial financing secured, but activities are still undergoing, but may be in a structure without SPV (direct bank lending).*
Activity 1.2.2. Continuous dialogue with potential financiers, local banks and guarantors to secure financing			*Yes*	*A list of potential investors has been developed with the support of Get.Invest. Discussions are ongoing with several potential investors.*

Activity 1.2.2. Develop and test impact assessment framework			*Yes*	*The project has developed an impact assessment framework and collected baseline data on finance and economy. We have collected data from 15 facilities, which will enable us to work with the facilities that will not be part of the pilot as a reference group. Data on the health aspects have been collected from a selection of sites by WRI supported by PSK.*
Activity 1.2.2. Develop framework forcapitalising on SDG performance			*Yes*	*Ongoing discussions with Powertrust regarding D-RECs, a unit developed by Southpole et.al. as a unit of SDG impact from a MWh of renewable energy consumed.*
Activity 1.2.2. Secure grand funding based on expected SDG achievements			*No*	*We have not been successful at this.*
Output 1.2.3. Contracts signed with targeted clinics	*30*	*0*	*No*	*We have conducted outreach activities and uncovered clear interest, but hesitancy to move forward due to elections and general economic downturn.*
Output 1.2.3. Systems shipped and installed on targeted clinics	*30*	*0*	*No*	*No systems ordered for scale-up.*
Activity 1.2.3 Installation and commissioning			*No*	*Not commenced.*
Activity 1.2.3. Pipeline development and site assessment			*Yes*	*We have developed a process for pipeline development and conversion strategy with estimated costs (customer acquisition costs). The process includes the assessment steps on our side (i.e., DD).*
Activity 1.2.3. Purchasing equipment and sending to Nairobi			*No*	*Not commenced.*
Activity 1.2.3. Standardised service offer, negotiations and signing			*Yes*	*We have developed a new process for this for the scale-up.*
Output 1.2.4. Operational control centre established	*1 pcs*	*1*	*Yes*	*We have developed and staffed a central operational control. The centre is monitoring the installation and has taken advantage of this ability during the longest blackout on record in Kenya.*
Output 1.2.4. Standardised routines for operations and repayments	*1 units*	*0*	*Partial*	*We have developed operations routines on the technical side, but not yet on the financial side.*
Activity 1.2.4 Development of automated payment systems and mechanisms			*No*	*We have decided to test the payment module integrated with the monitoring equipment we have selected for the project. Remaining work will be to make it work and to amend to suit our purpose and contract structure.*

Activity 1.2.4. Establishing call centre for remote monitoring and support			*Yes*	*The remote monitoring is up and running and the staff is prepared to receive and manage messages and calls as soon as new systems are in operation.*
Activity 1.2.4. Revising and improving the O&M procedures including software			*Yes*	*Scoping and procedures for installation and commissioning tested and amended based on experience from initial installation.*
Reduced GHG emissions 1.2 Indicator	*60 %*	*77%*	*Yes*	*With baseline emissions of 11.2 tCO2e/yr and reductions of 8.25 tCO2e/yr at Topcare*
Reduced diesel consumption at the targeted clinics 1.2 Indicator	*80 %*	*100%*	*Yes*	*Diesel consumption reduced to zero to date at Topcare.*
Relative diesel consumption at the targeted clinics 1.2 Indicator	*60 %*	*0%*	*Yes*	*Diesel consumption reduced to zero to date at Topcare.*
Relative increase in hours of business operation 1.2 Indicator	*10 %*	*TBD*	*TBD*	*Topcare is grid connected and has not extended hours of business operation.*
Repayment to debt providers according to loan contract 1.2 Indicator	*30 units*	*1*	*Partial*	*Repayments from customer has been regular*
Return on investment according to investor agreement 1.2 Indicator	*15 %*	*N/A*	*TBD*	*System has been sold with instalments at commercial level, but with amortized mobilization fee. Repayments from customer has been regular.*
Clinics with improved impact 1.2.5 Indicator	*75 %*	*100%*	*Yes*	*Improved impact from continuous power supply.*
Impact assessment tool developed and tested 1.2.5 Indicator	*1 unit*	*0*	*No*	*Not yet conducted. WRI has collected baseline data and is planning to conduct an impact assessment after a year of operations.*
Impact assessment at health facilities 1.2.5 Activity	*1 unit*	*0*	*No*	*Not yet conducted. WRI has collected baseline data and is planning to conduct an impact assessment after a year of operations.*
Change in time without access to electricity 1.2.6 Indicator	*20 %*	*100%*	*Yes*	*The facility has had continuous power since commissioning and has not experienced blackouts or needed to use the diesel generator.*
Issues solved by troubleshooting over the phone 1.2.6 Indicator	*70 %*	*100%*	*Yes*	*Managed to keep power for the longest grid blackout on record for Kenya, using phone communications and remote monitoring.*

Payments on time 1.2.6 Indicator	*60 %*	*95%*	*Yes*	*All payments have been made with less than 14 days delay, most of them on time*
Repayment rate 1.2.6 Indicator	*85 %*	*100%*	*Yes*	*So far, no payment defaults*
Assisting the clinics in developing and improving their business models to enhance bankability of energy investment 1.2.6 Activity			*Yes*	*PSK has implemented a program so support financial management at the facilities, in particular the smallest. This has been useful in the decision-making relating to our offers. Even if it has led to some facilities turning down the offer due to uncertainty regarding the future cashflow and ability to pay, understanding this ahead of making an installation is to the benefit of both us as a supplier and the facilities as our customers.*
Ensure payments and actions in case of non-payment from the facilities 1.2.6 Activity			*Yes*	*We have not had any cases of non-payment.*
Mid-term audit 1.2.6 Activity			*No*	*Mid-term audit was waived in agreement with NCF.*
Operation at one control centre for all facilities 1.2.6 Activity			*Yes*	*The installation is monitored as part of the Differ Community Power portfolio at the operations center.*
Panel cleaning and preventive maintenance at the facilities 1.2.6 Activity			*Yes*	*The regular cleaning of the panels is the responsibility of the facility owner. The project has provided cleaning training, cleaning process recommendations and appropriate cleaning equipment to local staff. We are also working on implementing machine learning features to automatically alert relevant staff if dust significantly reduces the electricity generation from the system.*
Developed success story marketing material 1.2.7 Indicator	*1 units*	*1*	*Yes*	*Published story: https://www.wri.org/insights/decentralized-renewable-energy-hospitals-africa*
Scale-up plan developed 1.2.7 Indicator	*1 units*	*1*	*Yes*	*The scale-up plan is in process with G4A/Greenmax, HETA/USAID and Kenya bank branch offices.*
Continued impact monitoring and communication 1.2.7 Activity			*Yes*	*We are continuously recording the performance of the system installed.*
Continued operation and maintenance follow up 1.2.7 Activity			*Yes*	*Issues have since completion of the installation been managed remotely through the monitoring system or over the phone.*

Continued testing and improving of the project management system 1.2.7 Activity			*Yes*	*Several improvement initiatives identified and in process in the wake of the long outage that Topcare experienced,, aiming to automize and build in key learning points from the case.*
Revising business model for scaling up 1.2.7 Activity			*Yes*	*We have made changes to every step of the customer acquisition, installation and operational phases of the project development and management.*

2.2 Deviations from the planned outputs and activities

We are still in process with PS Kenya to put together a portfolio of facilities that can be financed and scale the business model. Economic conditions in Kenya have made it challenging to close a bankable and scalable financing model.

Original Milestone deliverable	*Completed (Yes/No/ Partially)*	*Results*
Outcome 1.2: Solar systems are commissioned at a minimum of 30 health facilities	*No*	*We were unsuccessful in closing a sufficient number of contracts.*
Output 1.2.1. Established an operative SPV	*No*	*With insufficient number of sites, we have not yet established an SPV.*
Activity 1.2.1. Establishing appropriate SPV	*No*	*With insufficient number of sites, we have not yet established an SPV.*
Output 1.2.2. Explored grant funding opportunities supporting the energy investments	*Yes*	*Discussions on potential grant contributions to attract commercial capital has commenced with a few candidates.*
Output 1.2.2. Secured commercial financing of the SPV	*No*	*No commercial financing secured, but activities are still undergoing, but may be in a structure without SPV (direct bank lending).*
Output 1.2.3. Contracts signed with targeted clinics	*No*	*We have conducted outreach activities and uncovered clear interest, but hesitancy to move forward due to elections and general economic downturn.*
Output 1.2.3. Systems shipped and installed on targeted clinics	*No*	*No systems ordered for scale-up.*
Activity 1.2.3 Installation and commissioning	*No*	*Not commenced.*
Activity 1.2.3. Purchasing equipment and sending to Nairobi	*No*	*Not commenced.*
Activity 1.2.4 Development of automated payment systems and mechanisms	*No*	*We have decided to test the payment module integrated with the monitoring equipment we have selected for the project. Remaining work will be to make it work and to amend to suit our purpose and contract structure.*

2.3 Achievement of NCF indicators

NCF core indicator	Results (quantitative)			Clarifications/Means of verification
Number of beneficiaries reached	women			Patient tally for Topcare is 80 outpatients and 10 inpatients per day; access to health services with reliable power. Gender-breakdown currently unknown. Commissioned 17.05.2023 and in operation for 136 days before project's formal end date on 30.09.2023.
	men			
	total		12,240	
Number of people with increased resilience to climate change	women			Not applicable for project.
	men			
	total			
Number of people with improved livelihoods	women			Not applicable for project.
	men			
	total			
New decent jobs created	full-time	women		Own full-time and external part-time. Within sales, site assessment, installation, operation and maintenance.
		men	2	
		total	2	
	part-time	women		
		men	12	
		total	12	
	seaso-nal	women		
		men		
		total		

3. CLIMATE CHANGE

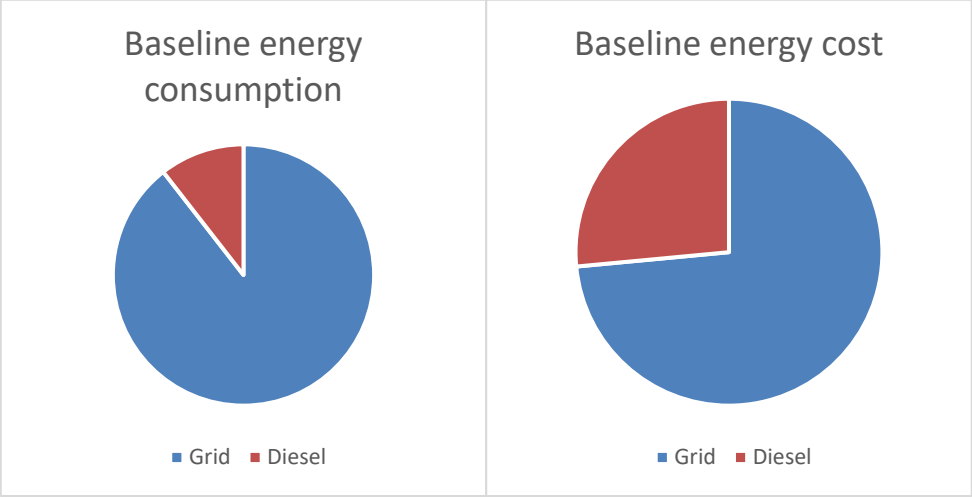
The baseline for each facility will be established based on the CDM methodology. Small scale diesel generators has an emission factor at 1.3 kg CO2/kWh (CDM methodology AMS-I.F) and the average operating margin emission factor for Kenya at 0.66 kg CO2/kWh (UNFCCC).

The baseline emissions for each health clinic will further be based on their ex-ante emissions from grid and diesel, based on the share of energy consumption from each energy source.

Mitigation from the project will be estimated for each facility by assessing the share of genset and grid electricity respectively being replaced by the solar energy solution.

For Topcare, the PV and battery have the capacity to remove all use of diesel generator representing about 5 kWh/day on average – 1.825 MWh/year. In total, the solar energy solutions supplies just above 30 kWh per day on average (~70% of the total energy consumption of 45 kWh/day), equalling 11,3 MWh/year – of which about 16% replaces diesel and about 84% replacing grid electricity. In sum, the mitigation impact is:

Baseline	*MWh/year*	*Baseline emissions (tCO2e/MWh)*	*Mitigation/year (tCO2e/year)*
Diesel	*1.825*	*1.4*	*2.56*
Grid	*9,475*	*0.603*	*7,71*
Total	***11.3***		***8.27***



Total potential energy supply from the installed PV is 17.3 MWh/year.

4. DEVELOPMENT IMPACTS AND CROSS-CUTTING ISSUES

The project has important impacts on SDG3, SDG7 and SDG13.

SDG3: The installation of solar energy and energy storage solutions has proven important in terms of the reliability of the energy access for the facilities, and hence the provision of full-range health services at any given time. The solution switches seamlessly and the facility can provide continuous service also through grid

downtime. Without the solar energy solution, the facility would either suspend services during grid downtime, or start the diesel generation if life critical. However, the diesel generator was also not fully reliable.

SDG7: The Topcare installation is providing more than 30 kWh/day, representing about 70% of the facility's overall energy consumption. In practice the solution replaces all use of the diesel generator, and the rest of the power offsets electricity from the grid.

SDG13: The Topcare installation is mitigating emissions of 8,3 tCO2e/year, from a baseline emission from the facility of 11,3 tCO2e/year, i.e. more than a 70% reduction.

Relevant impacts on cross-cutting issues are:

- The project is addressing a sector currently underserved in terms of access to sustainable and reliable energy from PV solar.

- Implementation of "The DCP WAY" for installation and O&M: DCP has developed a framework aimed at ensuring good quality and ethics in all stages of the project. We are improving the code of conduct among our local partners, through providing training and following up on HSE issues and environmental issues when they work on our installations. This is also a key part of our assessment of any potential local partner, stimulating the companies to emphasize more strongly on these aspects in order to be competitive on out contracts.

- The project is hugely benefitting women and children. Predominantly, the users of the health facilities are women and children. Reliable energy supply has several benefits to both patient and parent – health wise, time wise and cost wise. First, the grid-connected health facilities are able to maintain services also during grid outages, and e.g. surgical services are risky to perform if energy supply is unreliable. For off-grid facilities, solar energy will allow them to offer a range of additional services – powered by electricity. Also, some medical equipment is destroyed by electricity interruptions and predictable energy supply reduces the risk of this. Second, solar energy will over time reduce the cost of electricity for the health facilities, allowing them to offer services at lower cost. Finally, Continuous service, thanks to the battery solution means that the facility can treat more patients per day and there is less waiting and fewer return trips for patients and parents.

5. ASSESSMENT OF THE RESULTS AND IMPACTS OF THE PROJECT

5.1 Relevance

The promoted business model is clearly in demand among private sector health facilities. A general down-turn in the economy, combined with elections made many facilities hesitant to take on a long-term payment obligation. With the right set-up in terms of financing and currency risk mitigation, the business model has the potential to respond to a strong demand among the facilities for a way to hedge against both downtime in the electricity grid and the rapidly increasing tariffs from grid electricity.

PS Kenya continues to promote solar energy as a service in their networks. We have also seen interest from municipalities regarding the possibility for providing solar energy on a PAYG model also to public sector facilities.

5.2 Effectiveness

The outcomes of the project were at a substantially lower scale than originally planned. Substantial changes in the general economic situation in Kenya required additional financial solution in order to scale, mainly on currency. Although the work to structure a more suitable financing solutions to the new economic conditions were initiated, but not completed within the project period. We were able to install solar energy at only one health facility during the project period where the original target was 5-8 pilot clinics. However, this facility served to provide useful input to out further work, and valuable insights in terms of the overall potential of reducing emissions from diesel generators through offering solar energy on a PAYG scheme.

5.3 Efficiency

The process of arriving at an investment decision from the health facilities was substantially longer than anticipated. Most facilities approached were and are interested in installation of solar energy. However, this is one of several potential investments and needs to be assessed regularly in comparison with other potential investments by the individual facility. Hence, installing solar and energy storage solutions is still on the agenda for several of the facilities approached, but the investment decision depends both on the size and criticality of other investments, and also on the financial standing and outlook for the facility. As a consequence, we were not able to deliver this project according to the planned timeline, as the facilities will not always be ready to invest in soler energy when we approach them, but rather that we need to be ready to deliver when they are ready. We were, however, successful in conveying a new business model that would make investing in solar more affordable.

Judging from the number of installations during the project period, the results were not achieved with high efficiency, but we hope that a low-intensity follow up of the facilities involved in the pilot project and reaching out to new facilities via PSK will

change this over time, securing new contracts with limited efforts, and with processes and paperwork in place.

In terms of cost, we have spent close to the full budget – partly due to an extension of the project duration – while we have underspent on other cost – mainly due to the lower progress than budgeted. As a consequence of limited progress, we have underspent on both hardware and e.g. legal support. Due to covid, travel has also been less than anticipated.

5.4 Impact

Despite having made only one installation, the Topcare installation has demonstrated many of the desired impacts of the project. First, it has demonstrated the impact in terms of emission reductions, these are estimated to be about 75%, including full replacement of the diesel generator use. Additionally, it has demonstrated the impact on energy reliability in the fact that the facility on a daily basis is no longer impacted negatively from grid downtime, and when the longest outage in history occurred, the facility managed to maintain operations throughout with based on the solar and battery solutions installed. Finally, it has demonstrated the commercial viability in terms of the regular payments received.

The scale of the project activity is not yet sufficiently substantial to drive higher-level effects, however with successful scaling of the business model going forward, higher-level social impacts in terms of people's proximity and access to improved health services and improved well-being can be expected. WRI will continue to monitor this beyond the project as DCP scales operations in Kenya.

We have been approached by a municipality interested in exploring the option of installing solar and energy storage solutions on public hospitals and health posts, using a PAYG model rather than the conventional payment upon installation. They are working on identifying how this could be conducted in practice from their side.

5.5 Sustainability

The project has been clear in terms of its focus on commercial viability and sustainability. The hard line has to date limited the scaling of the activities, but at the same time safeguards that a scaling will only happen if the activities are both commercially viable and sustainable. The key principle of introducing the PAYG business model was to test if and how both could be achieved.

In terms of sustainable results, the installation at Topcare is a sustainable output from the project. In addition, the partnerships established between DCP, PSK and WRI continues beyond the end of the project – with a continued effort to enter the market with a hire-to-purchase business model. Finally, the establishment of a DCP Africa legal entity in Nairobi is a testimony of sustainability under this project.

5.6 Coherence

We are not aware of other players active in the same market segment with the same business model. There is an active market for service with payment upon installation, but has some challenges in terms of sustainability. Also, stand-alone solar on PAYG is well established both for the off-grid household markets (Solar Home Systems), and for larger Commercial and Industrial projects (pure PV). However, the mid-size segment remains unaddressed. That this market segment remains underserved is not driven by policy barriers. Low prices in the "cash market", driven by lower quality installations and shorter lifetime components remains a challenge in the sales process for quality services where the benefit may lie some time into the future.

6. INNOVATION

The business model is designed to deliver long-term value to both direct and indirect beneficiaries, yielding multiple positive impacts. The business model also improves affordability, meaning that it caters for a higher number of installations than what would be possible with conventional business models.

The direct beneficiaries are facility owners that over time will reduce their cost and uncertainty regarding their electricity supply. They are also enabled to provide a wider range of services without interruption from grid outages.

The indirect beneficiaries are generally the peri-urban and rural population which will benefit in terms of proximity of, availability and spectrum of medical services.

The project has demonstrated that solar and battery in practice replaces the diesel generator, leading to reduced emissions. The higher the diesel/petrol consumption without the project, the more attractive the project, as the cost of energy from the generators is by far the most expensive. The use of generators is driven by the downtime in the grid. Strengthening the grid to reduce or eliminate grid downtime is a very costly and long-term work. Hence, stand-alone solar and energy storage solutions is the most cost and time effective way of eliminating the generator usage, but the model needs to be commercially viable and sustainable in order to be permanent solution.

As part of the innovative business model, the project has developed the many bits and pieces that are required to ensure a sustainable and scalable business model. These includes a suitable contract framework, proper remote monitoring including the possibility of remote management of the systems, as well as efficient operation and maintenance routines.

7. POTENTIAL FOR SCALING UP AND FOLLOW-UP INVESTMENTS

The business development in Kenya is still ongoing, including collaboration between DCP and PSK. In terms of financing, there are several avenues being explored, where private sector finance will play the main role, but the current economic environment and FX uncertainty means that part financing or risk mitigating measures are likely to be required to scale the activities with private sector financing. E.g. there is an ongoing process with G4A/Greenmax, HETA/USAID and Kenya bank branch offices to structure a financing solution for portfolio of facilities under development by PSK and DCP.

In a predictable, growing economy with stable FX rates, the initiative is not likely to need grant financing once activities reach a certain scale.

8. RISKS

Among the risks identified in the application, the main risks that materialized during the project were:

I. The time and cost required to convert a lead to a contract. On the back of the process implemented in the project, a different approach to the sales process was developed and is being followed.

II. KPLC, the energy utility in Kenya, did signal cuts in energy tariffs, making some customers uncertain about the attractiveness of the solar investment.

III. The election towards the end of the project created a general standstill in terms of investment decisions. This lasted for 4-6 months and included the period before and after the election itself.

Among the unexpected challenges that materialized were due to the arise of Covid:

I. Not possible to travel to Kenya

II. Decreasing revenues for the facilities

III. Increasing prices on hardware and shipping

IV. Longer delivery lead times

V. Devaluation of the Ksh relative to the USD

After Covid we also experienced Covid-related impacts:

I. General economic downturn and higher interest rates

II. Reduced availability of both private sector and soft financing

9. MONITORING AND EVALUATION

The project has worked with an Advisory Group comprising key players in the stainable development field, including IKEA Foundation, Power Africa, SEForAll and CHAI, in addition to senior resources from WRI and PSK. The Advisory Group has provided regular and valuable feedback and input to the project.

The project continues to monitor the performance of the installation at Topcare. Feedback from Topcare on the performance of the system is generally positive, and they are making regular hire payments. Managing through the longest grid outage in history in the area, with online support from DCP, was a major achievement and has been documented e.g. here: https://www.wri.org/insights/decentralized-renewable-energy-hospitals-africa

WRI has conducted a baseline study as part of the project, planning to make an assessment after 12-18 months to analyse outputs and impacts.

10. LESSONS LEARNT

Key lessons learnt in terms of potential for improvement were:

- **Site assessment:** Collecting data remotely from the health facilities is time consuming and data has limited reliability. We have completely revised the approach in terms of how we bring leads through the sales process.

- **Currency risk** always need to be mitigated. Even if the exchange rate between Ksh and USD had been quite stable for five years leading up to the start of the project, Covid created instability and led to a devaluation of 75% over a period of less than four years.

- **Investment decision process:** Even if an investment in solar energy is attractive from the perspective of the facility, it represents one of the investments under consideration. Moving from interest to signing a contract may be long, as the investment needs to fit into an overall investment plan and fit within the cashflow plan. Despite the fact most facilities considered a solar energy installation as an attractive investment opportunity, several were in the middle of other investments like expansions of the building or investing in medical equipment. In retrospect, we would have planned better for this and probably reached out to a wider range of potential sites in the early stages of the project. However, given the approach to site assessments as mentioned above we did not see this as viable in terms of the resources required.

11. OUTREACH

WRI and DCP together wrote a blog on the Topcare installation.

DCP has been present at several conferences in Kenya, together with PSK and Topcare staff to present the project and promote the solution.

DCP has presented the project at the Medexpo East Africa conference in Nairobi.

WRI presented the project at the SE4All conference in 2023.

DCP has developed a marketing brochure (available in print only) which us used in outreach campaigns in Kenya.

12. FINANCIAL SUMMARY

Table 1. Project financing per partner

Expenditures	NCF	Differ	DCP	PSK	WRI	Total (EUR)
Differ	123.611,67	57.673,80				181.285.47
DCP	176.105,98		36.922,74			213.028.72
PSK	31.810,18			15.047,89		46.858.07
WRI	38.681,94				13.259,32	51.941.26
Total	370.209,76	57.673,80	36.922,74	15.047,89	13.259,32	493.113,51

13. CONCLUSIONS AND RECOMMENDATIONS

A key takeaway from the project is that the PAYG business model targeting private sector health facilities is seen as an attractive offer by the facilities. Also, an important finding is that energy reliability is an important factor for the facilities in addition to energy cost. However, our experience shows that competition among other investment opportunities is strong. Moreover, with the appropriate sales process, the project verified that the business model is also commercially viable and scalable. The potential customers do not have exiting options for accessing solar power.

However, the financing structure needs to allow for a reasonable interest rate and currency risk needs to be mitigated in the business case in order for it to be bankable. Hence, to see this business model scale in different markets, it is recommended that measures are put in place so that currency risk can be hedged at a low cost, or that local currency financing is made available at rates more in line with USD and EUR financing rates.

Annex 1 Project completion fact sheet

Project Name:			
Project no.	NCF-C9-1237		
Country:	Kenya	**Financing:**	
		EUR	**%**
Nordic Partner:	Differ AS	57.673,80	12%
Local Partner:	PS Kenya	15.047,88	3%
Other Partner:	World Resources Institute	13.259,31	3%
	Differ Community Power AS	36.922,74	7%
	NCF grant disbursed	370.209,77	75%
	Total	**493.113,50**	**100%**
Classification:	Mitigation		
Project cycle:	Project start date: 01/02/2021 Original closing date: 31/03/2023 Actual closing date: 30/09/2023		
Short project description:	Reducing emissions through offering solar energy and energy storage to health clinics in Kenya on Pay As You Go contracts. The project tested the commercial viability of a new business model with improved affordability and sustainability compared with the conventional business model of payment upon commissioning.		

Project performance:	**Expected Outcomes and Outputs**	**Achieved**	**End-of-project status**
	Standardizing processes and documentation	Yes	Process is redesigned and standardized to fit the market
	Development and signing contracts	Yes	Standard contract developed and four signed contracts.
	Installation of solar and energy storage solutions on site	Partial	One site installed and operational.
	Continued operations and monthly payments from	Yes	The installation has very high uptime and customer is making PAYG payments
	Scaling the business model	No	Project participants still developing a pipeline
	Establish an SPV financing structure	Partial	Relevant financing structures are under development, potentially structured without an SPV.

Climate change outcomes and impacts:	The solar and energy storage solution installed has completely replaced the diesel generator. The Topcare installation is mitigating emissions of 8,3 tCO2e/year, from a baseline emission from the facility of 11,3 tCO2e/year, i.e. more than a 70% reduction.
Development outcomes and impacts:	The solar and energy storage solution has demonstrated the improved reliability of power supply to the facility, with improved health services for the catchment area. Avoiding the use of the diesel generator is also a cost saving output from the project for the facility, with improved financial position of the facility as an outcome.

NCF core indicators	NCF core indicator	Results (quantitative)			Clarifications/Means of verification
	Number of beneficiaries reached	women			Patient tally for Topcare is 80 outpatients and 10 inpatien to health services with reliable power. Gender-breakdow unknown. Commissioned 17.05.2023 and in operation fo project's formal end date on 30.09.2023.
		men			
		total		12,240	
	Number of people with increased resilience to climate change	women			Not applicable for project
		men			
		total			
	Number of people with improved livelihoods	women			Not applicable for project.
		men			
		total			
	New decent jobs created	full-time	women		Own full-time and external part-time. Within sales, site assessment, installation, operation and maintenance.
			men	2	
			total	2	
		part-time	women		
			men	12	
			total	12	
		seaso-nal	women		
			men		
			total		

Annex 2 Results Framework

Project's Logframe is available on page 4.

Annex 3 Pictures

Contract meeting between Topcare and Differ

Credit: DCP

NCF meeting the management at Topcare

Credit: DCP

The generator at Topcare

Credit: DCP

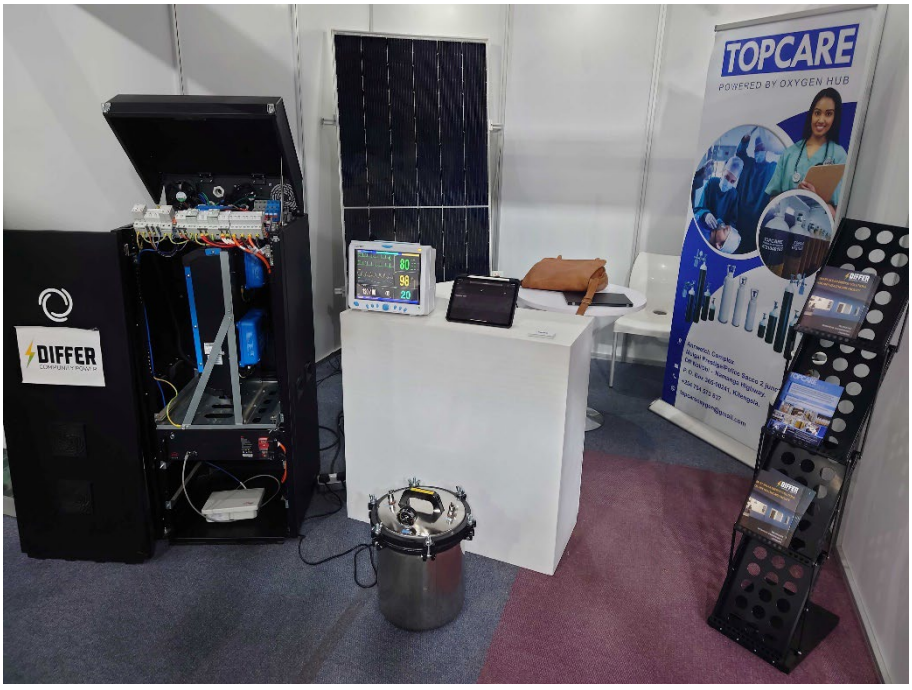
The surgery theatre at Topcare

Credit: DCP

PV installation at Topcare

Credit: DCP

Joint expo with PSK and Topcare at Medexpo East Africa



Credit: DCP

Annex 4 Other supplementary deliverables/documentation/links

None

Annex 5 Impact story

Distributed Solar Keeps Hospital Operational During Kenya's Longest Power Blackout

Kenya experienced its longest nationwide power blackout on August 25,2023, lasting more than 24 hours. While the cause of the system disturbance remains a mystery, the impacts were clear — and severe.

Hundreds of people were stranded in darkness at Jomo Kenyatta International Airport, while many more faced flight delays and cancellations. Suppliers of milk, fish, meat and other perishable products had to throw out their stock due to lack of refrigeration. Restaurants, barbershops, cafes and other small businesses lost revenue from closures.

Some of the most concerning power losses occurred at hospitals and medical centers, where stable electricity is essential for powering ventilators and other life-saving devices. While some facilities were able to run backup diesel generators, these systems require expensive fuel and emit pollutants. But there was one hospital that remained operational without needing to switch on a generator.

Top Care Nursing Home, a hospital on the outskirts of Nairobi, uses power generated from an on-site solar PV and storage system installed by Differ and Differ Community Power (DCP), which helped it remain operational during the entire power blackout. People in the nearby community even came to the facility to charge their phones.

The team from DCP remotely monitored the system at Top Care Nursing Home throughout Kenya's recent power blackout, providing staff at the facility with real-time support to prioritize the power loads and optimize the use to continue operating. This helped the nursing home remain operational for the entire outage.

The Top Care facility had entered into a financing contract with Differ earlier the same year and had the solar energy and energy storage solution installed only four months earlier. The contract was a hire-to-purchase agreement, allowing Top Care to invest in solar energy without having access to the full investment cost. Against a small downpayment (10% of the total investment cost), DCP procured, installed and operates the system over a period of five years, by which time the end user (in this case, the nursing home) will have fully paid for the system and can benefit from energy at basically zero cost. In addition to helping reduce the up-front cost of the investment, this business model provides a closer business relationship between the developer and end-user, thus removing technology risks associated with potential system failures. Due to recent experiences with a solar energy solution that failed after only a short period of time and was never repaired, the offer from Differ on financing, and the operational responsibility of DCP were the factors leading to the investment decision that turned out to be of high value that day in August – an possibly more times in the years to come.