Danske Commodities

LIGHT OVER MALI

Annual Social Return on Investment Report
2018

10,000
people given access to light annually

400,000
hours of light annually

2.98
SROI-ratio after the first 12 months

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ABSTRACT

With the CSR project 'Light over Mali', Danske Commodities helps fight socioeconomical challenges like illiteracy and poverty by bringing electricity to off-grid areas in rural Mali. Specifically, Danske Commodities installs solar panels on schools to offer Adult Basic Education (ABE) after the work day ends and the sun sets, and on health clinics to improve the working conditions at night.

In 2018, the project has provided electricity to more than 10,000 Malians, who would otherwise be without energy. Light over Mali has created tangible value by generating more than 400,000 hours of light by providing renewable energy to eight rural villages. In total, Danske Commodities has helped install solar panels on five schools (10 class rooms), five health clinics, established five lampposts in the city centres and distributed 250 solar-driven homework lamps to families living far from the schools.

To generate sustainable value for the Malian society from these installations, priority must be given to education – both for the adult and child population. Education is the first step on the long road to improve their quality of life; to pointing the way towards general improvements in the society; and to changing the entrenched correlation between rates of electrification and illiteracy – which in rural areas of Mali runs up to 70%[1] . With electricity, the full potential of the dark hours can be realised.

Solar power makes it possible to provide ABE to the Malians who works during the day, and therefore, only has the evenings to improve their skills. The educational programme enhances the villagers' business savvy, making it possible to make better deals or start a business on their own. Especially female ABE participants can enhance their range of confident behaviour in the marketplace as their literacy and numeracy skills improve, which help optimise the output of their daily work, mainly within cotton, fishing and agriculture. Also, pupils have the possibility to come in the evenings to study and prepare for exams, as having light makes it possible for the teachers to offer classes and provide academic support in the evening.

Giving the rural population access to energy has an influence on health, awareness and general well-being. Installing solar panels on health clinics help the personnel treat diseases at night while the electricity also enables cooling of medical supplies. As a result, this help enhance the general health and lower the number of sick days among the workforce.

THE OUTCOME

The method used in this paper is the Social Return on Investment (SROI), which is a monetary valuation of social efforts that compares the investments made with the effects created for the stakeholders. The SROI-analysis measures and documents the economic value of the social and environmental outcomes from Light over Mali in a systematic way, converting the social efforts into a SROI-ratio. The ratio consists of input vs. output, which means comparing the investments made in the social effort with the value created for the Malians involved, calculating the monetary effects of providing rural villages with light.

The SROI-ratio based on the evaluation of the first 12 months of the Light over Mali project is calculated to be 2.98, and over a 10-year period the SROI-ratio is 10.73. This monetary estimate means that for every DKK 1 spent on Light over Mali, the project generates DKK 10.73 over a 10-year period. While the analysis has been conducted with a conservative approach, there are some uncertainties in the calculations. Therefore, a sensitivity analysis has been conducted to unveil the uncertainty and depict how the results depend on different durations of the effects.

ADDITIONAL VALUE CREATION

A large share of the value created for the stakeholders cannot be measured monetarily. Additional areas of value have been identified: gender equality, positive spill-over effects from ABE, decrease in infant mortality and increased safety at night.

It should be considered that since ABE is more successful in reaching women than men, it positively impacts the power imbalances between men and women. The basic education does not only affect the participants but shows positive effects on the knowledge and health of the family members of the participants. General modernising and investments in education and development initiatives also help keep young people in the local communities instead of migrating to large cities, strengthening the rural economy.

The solar panels on the health clinics help save women and new-borns from dying during labour and installations of public street light in the villages heightens safety after dark, minimising the risk of theft and help the villagers avoid dangerous animals during night-time. Lastly, jobs are created as part of the project, as two people from each village receive basic education on electricity and maintenance of solar panels.

These effects are also expected to have a long-term impact.

1 Nordic Folkecenter for Renewable Energy (2015). Light over Mali. Denmark. Published by Nordic Folkecenter for Renewable Energy.

PURPOSE

It is a central part of Danske Commodities' approach to corporate social responsibility to measure and evaluate the relationship between the input and outcome of the project to assess the impact and socioeconomic effects of providing electricity to rural Malian villages.

The analysis is based on the investment in the project in 2018, defined as input, and examines the outcome generated for the stakeholders. The purpose of the analysis is to evaluate the value creation of Light over Mali, examining the effects of providing rural villages in Mali with solar power. Furthermore, the purpose is to find and show the social impact that is generated for the local community.

PROJECT PRESENTATION

Light over Mali is a project established by Mali Folkecenter. The vision of the project is to provide village schools and health clinics with solar panels, making the Malian rural population less dependent on natural lighting.

Developing countries often lack modern energy services, as power supply from coal, gas and oil relies on national grid structures. While conventional energy forms are getting scarcer and costlier, mass production and competition are making renewables more accessible. Global solar and wind resources are inexhaustible and can deliver more energy than needed. In some parts of the world (e.g. Mali) solar energy is abundant – in other parts it is hydro or wind energy. Through technological innovation, solar power is a solution for bringing electricity to un-served areas of the world, without building costly power grids that are supplied by conventional power. Renewable energy is by nature decentralised and can be installed in every village and on every building[2].

DANSKE COMMODITIES AND LIGHT OVER MALI

In 2018, Danske Commodities donated DKK 200,000 to Light over Mali to help improve the living conditions in eight different villages, creating tangible value for more than 10,000 Malians.The solar panels were distributed based on the specific needs of each village, in total placing solar panels on five schools (10 class rooms), five health clinics and five public street lights, and distributing 250 homework lamps, which is depicted in the chart.

By installing solar panels with associated storage batteries on schools, it is now possible to educate the adult population when they are not working. Men and women have the opportunity to attend evening classes, learn to read and write and acquire other basic educational skills. Also, children from primary and secondary school can use the classrooms in the evenings to prepare for exams and tests while receiving academic support from teachers.
The installed solar panels at health clinics make the medical facilities operational after dark, increasing the service and quality of care, which means that the hospitals can treat diseases like malaria, help deliver babies, cool medicine etc.

The project also includes that selected children – living far away from the villages – receive solar-driven lamps, so they can do their homework after the sun sets. As part of the project, public street light through solar-driven lampposts was installed in the city centres to help patients find their way to the health clinics as well as to minimise the risk of theft and to help the villagers avoid dangerous animals during night-time.

With active participation and enthusiastic local support, it is possible to transition to a sustainable energy solution in rural areas of Mali. Therefore, as part of the project, Mali Folkecenter educates local villagers in installation and maintenance of the solar panels. In each village, two people – always a man and a woman – receive fundamental education on the ins and outs of the solar panel systems. Training people from each village is a prerequisite for keeping the solar panels up

MALIAN VILLAGES AFFECTED IN 2018

CITY / INHABITANTS	Solar panels on school classrooms (adult literacy)	Solar panels on health centres (health)	Solar-driven homework lamps	Public street light	Training of local technicians (installation / maintenance)
Biron Inhabitants 1,464			50	1	2
Safe'Korin Inhabitants: 843	2		50	1	2
Nianzana Inhabitants: 1,004	2	1			2
Kangolè Inhabitants: 1,262		1			2
Dezebela inhabitants: 927		1			
Gladié: inhabitants: 2,548	2	1	50	1	2
Kadjila: Inhabitants: 1,101	2		50	1	2
Kolle inhabitants: 1,059	2	1	50	1	2
TOTAL	**10**	**5**	**250**	**5**	**14**

Source: Mali-Folkecenter Nyetaa

MALI IN BRIEF

Population	18,429,893
Language	French (official), Bambara 46.3%, Peul/Foulfoulbe 9.4%, Dogon 7.2% etc. (Mali has 13 languages)
Capital	Bamako
Religion	Muslim 94.8%, Christian 2.4%, Animist 2%, none 0.5%, unspecified 0.3%
Population growth rate (annually)	3%
Median age	16.5 years
Total fertility rate:	5.9 children born per woman (6th highest rate in the world)
Infant mortality rate	67.6 deaths / 1000 live births (7th highest rate in the world)
Maternal mortality rate	587 deaths / 100,000 live births (16th highest in the world)
Life expectancy (total population)	60.8 years
Literacy (total population)	33.1% can read and write
GDP per capita	$2,200 (DKK 14,473)
Net national income per capita[3]	$1,500 (DKK 9,965)
Population below poverty line	36.1%
Electrification – total population	26%
Electrification – rural areas	9%

Source: Central Intelligence Agency (CIA). The World Fact Book. Mali.

and running.
In short, the aim of Light over Mali is to enhance the villagers' opportunities to help themselves. Educating the local technicians is a fundamental part of this vision. Also, the training provides the two people from each village with a new set of skills that can be used to better their lives and pass on the skillset to others. In combination, these project components will support each other to modernise rural villages in Mali.

MALI FOLKECENTER AND NORDIC FOLKECENTER
Light over Mali is part of a larger project called Light over Africa, which is established by Mali Folkecenter in collaboration with Nordisk Folkecenter.

Mali Folkecenter is a local NGO that counsels the Malian government on renewable energy and energy consumption in Mali. Also, the NGO acts as a partner to the United Nations concerning global renewable energy policies. Mali Folkecenter was established in 1999 by PhD Ibrahim Togola, who serves as chairman of the board today. Togala established the NGO after being a trainee at Nordisk Folkecenter, which is located in Thy, Denmark. Today, Mali Folkecenter has 30 employees and four offices across Mali.

Nordisk Folkecenter is an independent Danish NGO and renewable energy research facility, which provides industrial innovation, information, training and implementation of renewable energy technologies and energy savings throughout the world.

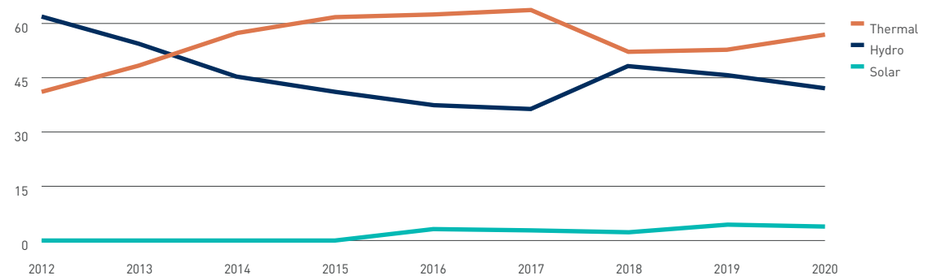
THE CHALLENGES IN MALI
Mali's total population is expected to double by 2035 and its capital Bamako is one of the fastest-growing cities in Africa. A young age structure, a declining mortality rate and a sustained high total fertility rate of six children per woman ensure a continued rapid population growth for the foreseeable future. Despite decreases, Mali's infant, child and maternal mortality rates remain among the highest in sub-Saharan Africa. The high total fertility rate is a result of the ongoing preference for large families, early childbearing, the lack of female education and empowerment, poverty and low contraceptive use[4].

The evening classes, made possible by installing solar panels on schools, help enlighten the adult population in Mali through courses in contraception. ABE enhance the knowledge and raise awareness about contraceptive use, which is an important step towards improving sexual and reproductive health, preventing unwanted pregnancies and decreasing the birth rate.

ENERGY POTENTIAL IN MALI
Landlocked Mali is one of the largest countries in Africa. It is also heavily reliant on fossil fuel imports, exposing the country to price volatility and unreliable supply. As a result, around 91% of the country's mostly rural population lacks access to electricity. And though the current primary energy supply largely consists of non-renewable energy sources, the country's potential for renewable energy is large.

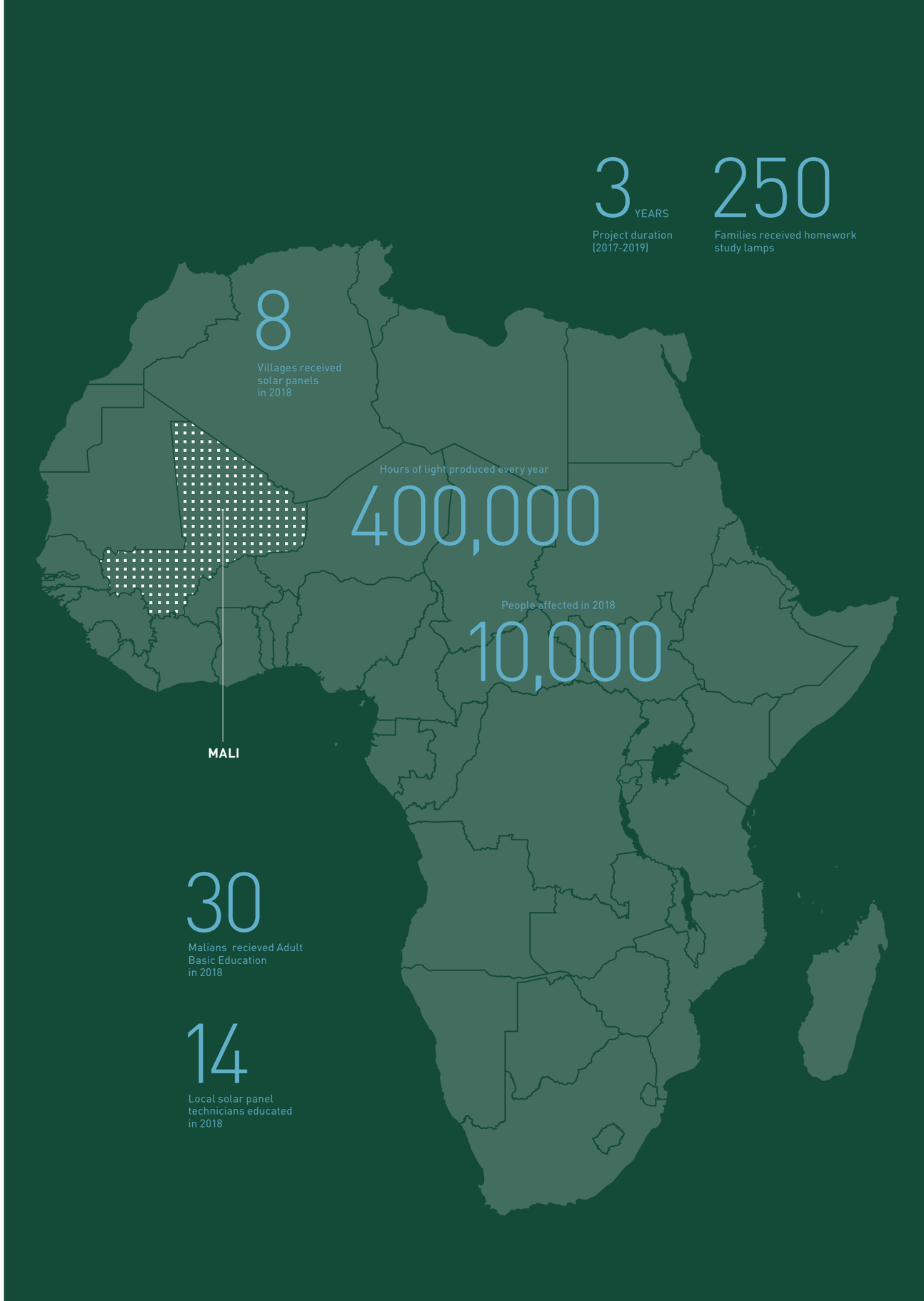
Solar irradiation is well distributed over the territory and is at 5-7 kWh/m2/day relatively high, and there is plenty of space to make use of this irradiation[5]. In Mali, there are 2819 hours of sunlight per year, compared with 1600 hours of sunlight per year in Denmark[6]. Sunrise and sunset in Mali does not differ much throughout the year. On average, the sun sets around 18:30[7], leaving little time for evening activities dependent on light. The yearly output of a solar panel will be approximately 60% higher in Mali than in Denmark, since the yearly output in Mali is 1622 kWh per kWp compared with 1017 kWh per kWp in Denmark[8].

2 Nordic Folkecenter for Renewable Energy (2015). Light over Mali. Denmark. Published by Nordic Folkecenter for Renewable Energy..
3 Empower Mali. About Mali.
4 Central Intelligence Agency (CIA). The World Fact Book. Mali.
5 Energypedia. Mali energy situation.
6 Climatemps. Bamako, Mali & Copenhagen, Denmark.
7 Timeanddate. Bamako, Mali – sunrise, sunset and daylengt.
8 Global Solar Atlas- Photovoltaic electricity output, Mali.



ENERGY SORUCES DISTRIBUTION IN MALI (%)

Data: Quartz, Compiled by african Development Bank



METHOD

Social Return on Investment (SROI) is a systematic way of incorporating social, environmental, economic and other values into decision-making processes.

The SROI-framework was developed in 2009 by former Office of the Third Sector (OTS) in the Cabinet Office of the UK Government[9]. By measuring the economic value of social and environmental outcomes, it creates a perspective on whether a development project, social business or a CSR-project is beneficial and profitable. Like a traditional cost-benefit analysis, SROI includes a ratio; in this case a Social Return on Investment ratio. In a traditional cost-benefit analysis, the ratios would be used to compare different projects; however, the SROI-ratio is seen merely as an element in communicating general progress of certain developments.

The method is a process of understanding the social impact being created in an organisation as well as how to measure that impact. In this sense, the SROI becomes a framework for measuring and accounting for a much broader concept of value. The method uses stakeholder evaluations to value softer outcomes, such as personal development, enhancement of skills, experiences and well-being of stakeholders affected by the social project – outcomes which are normally difficult to measure with numbers.

CARRYING OUT A SROI ANALYSIS INVOLVES SIX STEPS:

1) **Establishing purpose and scope** of the analysis and identification of key stakeholders. It is important to have a clear purpose and boundaries of what the SROI analysis will cover, who will be involved in the process and how.

2) **Statement of results.** Through engaging with stakeholders, an evaluation of the monetary value of input is developed, which shows the relationship between inputs, outputs and outcomes.

3) **Evidencing outcomes and giving them a value.** This stage involves finding data to show which outcomes have happened and valuing them.

4) **Establishing impact.** Having collected evidence on outcomes and monetising them, the aspects of change that would have happened anyway or are a result of other factors are eliminated from the analysis.

5) **Calculating the SROI.** This stage involves adding up all the benefits, subtracting any negatives and comparing the result to the investment. This is also where the sensitivity of the results can be tested.

6) **Reporting, using and embedding.** This last step involves sharing findings with stakeholders and responding to them, embedding good outcomes processes and verification of the report.

THERE ARE TWO WAYS OF APPROACHING THE SROI:

1) An evaluation which is conducted retrospectively and based on actual outcomes that have already taken place.

2) A forecast which predicts how much social value will be created if the activities meet their intended outcomes.

This SROI report consist of both an assessment of the actual achievements, value and impact of the Light over Mali project during 2018 as well as a final SROI-ratio, which is calculated based on the predicted effects 10 years after the project started. The purpose of employing both an evaluation and a forecast is that the SROI will give a much broader perception of the value created as change and development of skills evolve over time.

9 Social Value UK (2012). A guide to Social Return on Investment.

> SROI is a framework for measuring and accounting for a much broader concept of value

STAKEHOLDERS

The following section presents an overview of the stakeholders affected by the installation of solar panels in the eight Malian villages, who will therefore affect the SROI-ratio.

The stakeholders are defined in groups and their involvement in the analysis is described. How the groups are involved or affected is explained in the second column and an account of whether the groups are included in the analysis or not is noted in the last column.

TABLE 1 DESCRIPTION OF STAKEHOLDERS

GROUP	Effect	Included in analysis
Danske Commodities	Danske Commodities funds the entire project. No funding, no project.	Yes. Danske Commodities is included on the input side of the SROI.
Nordisk Folkecenter	Nordisk Folkecenter provide administrative services and continuous follow-up.	Yes indirectly. The salaries are included in the input.
ABE participants	The adult villagers receive education in terms of basic literacy, math and health and contraceptive information. This education will enhance the villagers' opportunity of starting a business, avoid getting cheated at the marketplace and decrease the child birth rate.	Yes. The effects of ABE are included on the output side of the SROI. By using data from the affected stakeholders, existing scientific reports and data from the World Bank, a monetary effect of ABE can be estimated.
Teachers of ABE	Education after dark would not be possible without solar panels or teachers and classrooms.	Yes. To establish a broader picture of the value created through ABE, we have included the teachers' perception of the effects of the project.
Personnel at health clinics	The solar panels at the health clinics help the personnel treat diseases, cool medicine and save women and children from dying during labour, because the medical facilities are fully operational after dark.	Yes. The effect of light after dark at the health clinic is included on the output side of the SROI. Enhancing productivity by reducing sickness among the workforce could not happen without medical personnel and medicine.
Children of ABE-participants	The children of the parents that attend evening school are believed to get enhanced support from home to continue schooling, spend time on homework etc.	No. It is difficult to estimate these spill-over effects in monetary value, but the World Bank has documented that ABE affect children in a positive manner.
Children in general	The village children will be able to get more school support, because teachers and classrooms are available after dark.	No. The enhanced educational possibilities for children in general are difficult to estimate in monetary value and we do not know how many children will benefit from this.
Children receiving homework lamps	Children that live far from the villages will receive a solar lamp, so they can do homework and prepare for tests after dark.	Yes. Light enables homework and preparing for exams, which is included in the analysis.
Village workforce	The village workforce will benefit from the solar panels, as the health clinics are able to treat more patients and provide a better care after dark. This will reduce illness among the workforce, thereby enhancing productivity and income.	Yes. As the number of sick days are minimised, the more the village population can work, which will affect their income level.

DATA

An SROI analysis is conducted through three data entry points: input, output and outcome.

Data for the output and outcome is based on individual interviews, as different stakeholder perspectives are a very important aspect of the complete analyses as well as the validity of the information. The data of this analysis is collected by carrying out interviews with several stakeholder groups, consisting of:

1) The recipients of ABE
2) The teachers of ABE
3) The children receiving homework lamps
4) The personnel at the health clinics

Data from the stakeholders are composed by parallel data gathering, of which qualitative and quantitative data are collected at the same time. The interviews are conducted by combining open-ended qualitative questions and close-ended quantitative questions. Using a combination of qualitative and quantitative data help improve the evaluation by ensuring that the limitations of one type of data are balanced by the strengths of another.

Quantitative data from a World Bank report from 2001[10] is used to estimate the effects of ABE. Furthermore, the World Bank report is supported by an evaluation conducted by the Norwegian Agency for Development Cooperation[11] and a systemic academic review, Returns to Investment in Education by educational scholars George Psacharopoulos and Harry Patrinos[12].

The analysis combines the different data types through triangulation, which is a useful technique that facilitates the validation of data through cross-verification from more sources.

Additionally, a part of the data is derived from HACT, which in 2014 launched the Social Value Bank – the largest set of methodologically consistent social value metrics produced, including 636 wellbeing valuations. HACT has developed the Social Value Bank in partnership with Simetrica, a research consultancy led by Daniel Fujiwara, who is an economist specialising in social impact measurement[13]. The outcome in term of well-being effects is based on research from HACT's Social Value Bank. In the calculation section, there is accounted for the project activities' impact on the stakeholder's well-being. Moreover, the World Bank measures global poverty using an international poverty line set at $1.90 a day. But converted to local currencies at market exchange rates, $1.90 can buy very different amounts of goods and services, depending on where in the world they are spent. Thus, to ensure that the well-being effects of Light over Mali can be compared across economies in the world, purchasing power parity (PPP) adjustments are made throughout the calculations. PPPs are calculated by collecting and analysing data on the prices of the same goods and services across many economies, and measure what the price of an item is in one country relative to another[14].

In the section below, a short extraction of the statements from the different stakeholder groups is presented, giving a more nuanced picture of the underlying data as well as the experienced value.

Teachers of ABE:

- "The lack of electricity affected the lives of the beneficiaries because adults and students had difficulty doing exercises and evening classes, such as: taking lessons at night. With classroom lighting, we started doing evening classes and people come to learn. The skills acquired include raising the standard of living, understanding and awakening of consciousness on many aspects of the life of the citizens in the village" – teacher from Safe'Korin.
- "At nightfall, electricity in the class rooms and homework lamps has positively affected the children of the village a lot, as many pupils have improved their grades, resulting in an average increase from 58% to 77%" – teacher from Safe'Korin.

Children with homework lamps:

- "The solar lantern allows me to learn at night and this has brought a big change in my school life" – male, 8 years old.
- "It has created an improvement in our social life and especially at school, because we could not work at night (learn and do exercises), which is no longer the case" – female, 15 years old.
- "My life has changed, because I can do my home-work without difficulty and I get a good average now" – male, 11 years old.
- "Besides lighting up my room during the night, I often also use the little solar lamp to go to the shop or to my parents at night" – male, 17 years old.

ABE participants:

- "After receiving education after dark, I have improved my reading and writing, acquired skills for negotiating new businesses and increased my level of motivation. Additionally, I have found a new job, utilising my skills on the adoption of sesame farming" – female, 65 years old.
- "I have learned to read and write, and I raise awareness and encourage the education of my children" – male, 51 years old.
- "The evening classes has taught me how to read, write and master food hygiene standards. I have improved my knowledge about hygiene and conservation of food products. I have also become a member of the village health committee, actively participating in village clean-up initiatives. I have also become a member of a cooperative of shea butter producers. In general, I now have a strong involvement in the mobilisation of village women around local initiatives" – female, 51 years old.
- "My level of empowerment has strengthened, as well as my know-how and trading abilities. My job has also changed as I have started up a small business" – female, 25 years old.

Personnel at health clinic:

- "Solar power has brought a high level of satisfaction to the village of Gladié and the surrounding villages – the light generates a higher satisfaction, ease and facilitation of care, plus a better quality of care. Before it was very difficult and dangerous to give birth at night without lights. We can now welcome people at any time because of the light. It reduces risks and health problems, especially for pregnant women, who can come for consultations and childbirth. It also reassures the population" – male nurse from Gladié.

Several effects have been created for the parents and the children in the rural Malian villages. Homework lamps make it possible for children living far from the schools to do their homework, increase their grades, go to the shop or visit family and friends after nightfall. Solar panels at the health clinics combined with ABE strengthen the overall health and help women and children during labour. Public street light in the villages heighten safety after dark.

Moreover, light at schools has shown to be especially important for women. Some places in Mali, 90% of women have never attended school, as they are required to take part in activities around their home and neighbourhood[15]. ABE strengthens the women's business understanding as their literacy and numeracy skills improve, which help optimise the output of their daily work, mainly within cotton, fishing and agriculture.

RESEARCH AND DATA LIMITATIONS

It is not without difficulty for social projects and organisations to collect valid data to measure the value created. Thus, some uncertainties might be attached to the data used in this analysis. These uncertainties will be commented on in the sensitivity analysis and in appendix 2.

Measuring improvements in the quality of life, feelings and well-being of individuals is very difficult to value with precision. The SROI analysis attempts to measure this by asking the stakeholders how they themselves value the change, i.e. how important it is to them and how it has changed their life. Some will argue that qualities such as self-confidence have an intrinsic value that is simply not reducible to a monetary value[16]. Furthermore, the collected data contain uncertainty factors like social desirability bias, which occurs when respondents answer questions in a manner that will be viewed favourably by others, because of the norm or simply by a natural wish to demonstrate success. This is a common source of bias in questionnaires[17]. Another limitation of the SROI, as with other types of evaluations, is that it is difficult to compare results between organisations and other projects, as analyses are based on diverse indicators. Furthermore, it is time-consuming to conduct due to an extensive data collection and there might simply be a shortage of data. There are also challenges linked to determining an appropriate discount rate as well as considering potential risk factors when projecting values into the future forecasting of the impacts after five or 10 years[18].

10 Lauglo, Jon. (2001). Engaging with adults: the case for increased support to adult basic education in Sub-Saharan Africa. Africa region human development working paper series; Africa regional educational publications. Washington, DC. World Bank.
11 Burnet, Nicholas (2015). Education for development. Estimating the costs and benefits of education from a health perspective.
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13 HACT (2018). UK Social Value Bank Calculator. Version 4.0.
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16 The Guardian. Can SROI help the voluntary sector measure value.
17 Nederhof, J. Anton (1985). Methods of coping with social desirable bias. A Review. In European Journal of Social Psychology.
18 Social Value UK (2012). A guide to Social Return on Investment. Stage 5. Calculating the SROI.

My life has changed, because I can do my homework without difficulty and I get a good average now

Male, 11 years old

My level of empowerment has strengthened. My job has also changed as I have started up a small business

Female, 25 years old

CALCULATIONS

SOCIAL RETURN ON INVESTMENT

In this section, a detailed description of the input, output and outcome is presented. For consistency, all values are shown in DKK.

INPUT

Input is defined as the total amount of project expenses. In this case, the input is Danske Commodities' donation of DKK 200,000.

OUTPUT

Energy production

The output consists of energy production – the amount of light generated by the solar panels. Each solar panel generates the following amount of energy:

- Solar panels for one school: light up two class rooms for four hours per day
- Solar panels for one health clinic: light up the clinic for nine hours per day
- Solar panels for one lamppost: light up the public square for eight hours per day
- Solar-driven homework lamp: generate light for eight hours per day on a low light setting and four hours on a high light setting

For the villages in total, the installed solar panels on schools, health clinics and public street light can generate 105 extra hours of light per day. Adding 250 solar-driven homework lamps, that run on the high light setting to the equation, the solar panels can generate a total of 1105 hours of light per day. In a year, the panels produce more than +400,000 hours of extra light combined for the eight villages.

Experienced impact

The output also consists of the qualitative and quantitative statements of the activities and people comprised in the Light over Mali project, as several stakeholder groups have experienced a number of different effects.

Furthermore, when calculating the monetary effects of providing rural villages with light, it is essential to calculate the effects of ABE and health clinics on an income level. The effects of education and access to health treatments after dark make up the majority of the SROI-ratio, as light is the prerequisite for the two.

Outcome

The outcome is defined as the substantial effect Light over Mali has on the stakeholders. In this section, a monetary value is assigned to the output – in term of an evaluation of the first 12 months of the project, followed by a forecast of the project after a 10-year period.

The outcomes of the evaluation should be read together with the impact map and in appendix 1.

A number of deductions have been carried out throughout the calculations above, because some stakeholder groups only experience a part of the well-being effects and with different levels of intensity. Moreover, to present the most realistic estimate possible when calculating the effects and to isolate the impact of Light over Mali, the aspects of deadweight, displacement, attribution and drop off are taken into account in the calculations.

Deadweight is the change that would have happened anyway without the donation. In this project, the deadweight is estimated to be 20%. Displacement looks at whether the social change displaced something else or has unintended consequences. This is expected to be

TABLE 2 OUTCOMES OF THE EVALUATION FIRST 12 MONTHS

OUTCOME TYPE	Description of outcome	Value
Income increase based on ABE	30 people have received ABE and improved their literacy and numeracy skills. The average annual net income for an adult in Mali is DKK 9,965. Psacharopoulos & Patrinos (2002) approximate that one year of education enhances the average income by 10%. As evening classes do not comprise a full year of education, we estimate that the ABE recipients will be able to raise their average annual net income by 0.9%. The calculation is a breakdown of the 10% increase in annual income. That is, how much increase in income does one hour of additional education create. This was calculated to be 0.0085% by dividing the 10% with the average total hours of education per year in Europe. To estimate the ABE participants' increase in income, it was assumed that on average an ABE would have two hours of education per week, resulting in 104 hours per year. Finally, the hours per year were multiplied with the increase in income per additional hour of education.	DKK 1,057
Income increase based on reduction in sick days	According to OECD, health affects productivity; poor health correlates negatively with productivity and thereby income level[19]. Due to poor hygiene and exposure to diseases like malaria, it is believed that the average Malian will miss 14 days of work due to sickness each year[20]. In comparison, the average Dane has 8.3 days off work due to sickness a year. By providing medical services at night, it is assumed that the amount of absence can be reduced by approximately one day for the village workforce. Based on the data collection, 20 more patients were treated on average per month resulting in 240 per year. Additionally, the participants in ABE were taught the importance of hygiene and basic food handling, which is assumed to affect both the ABE participants and their families' reduction of sick days. This adds 210 extras to the calculation as the participants of the ABE on average have eight working family members. The average Malian earns DKK 27 per day. By providing light to health clinics and knowledge about hygiene and basic food handling, 450 sick days are avoided.	DKK 4,860
The well-being effects of adult education to ABE recipients	The 30 people receiving ABE gain different personal well-being effects. The following effects from the Social Value Bank have been included in this calculation: general job training, being able to obtain advise locally, high confidence and being a member of a social group.	DKK 93,285
The well-being effects of light at health clinics and public street light to villagers	The villagers gain a number of different personal well-being effects based on light at health clinics and public street lights. The following effects from the Social Value Bank have been included in this calculation: good overall health as it has become possible to treat more patients and cool medicine at night and minimised the risk of being a victim of a crime as a result of the public street lights and increased safety.	DKK 350,941
The well-being effects of children receiving homework lamps	250 school children have received a solar-driven homework lamp, which among other things have improved their school and social life as well as their grade average. In relation to the Social Value Bank, the effect of improved confidence has been included in the calculation.	DKK 145,328
TOTAL OUTCOME	All stakeholders	**DKK 565,471**

19 OECD Observer (2004). Health and the economy: A vital relationship.

20 Danmarks Statistik (2018). Fravær 2017.

very low. Attribution acknowledges that some of the created value can be attributed to others – which is the aspect that generates the most substantial deductions in this report from 50-85%. It is recognised that enhancing productivity by reducing sickness among the workforce will not happen without medical personnel or medicine. Education after dark will not be possible without solar panels; nevertheless, education will be impossible without teachers and classrooms. These elements are also deducted in the evaluation-value. The drop-off effect is presented in the calculations of the forecast below.

OUTCOMES OF THE FORECAST

The 10-year forecast predicts a total value net present output of DKK 17,412,673. The forecast takes departure in a new donation of DKK 200,000 every year, which is allocated to new villages with new participants. The value of the new investments is the same as the evaluation value of the first year. All investments continuously generate output but with a year-on-year drop-off effect of 10%. The forecast is discounted based on a Discounted Cash Flow (DCF) analysis, entailing that the time value of money is considered. In the model, a 4% return on capital has been used.

CALCULATING THE SROI-RATIO

The SROI-ratio is calculated by dividing the value of the net output with the value of the net input.

$$\frac{\text{Output}}{\text{Input}} = \textit{SROI Ratio}$$

The SROI-ratio depicts how much value is generated in output for every DKK 1 spent on input. The ratio falls in two parts.

The evaluation depicts the immediate value that has been created after 12 months of the Light over Mali project and a forecast estimating the value after 10 years.

EVALUATION

The total input spent on the project is DKK 200,000 and the output is calculated to be DKK 595,471. The SROI-ratio is therefore 2.98 as shown below. This means that for each DKK 1 spent on Light over Mali, DKK 2.98 is generated for 2018.

$$\frac{\text{Output}}{\text{Input}} = \frac{595{,}471}{200{,}000} = \textbf{\textit{2.98}} = \textbf{\textit{SROI-ratio}}$$

FORECAST

If we look at the 10-year forecast, the net spending of Light over Mali sums to DKK 1,622,000 and the total net output sums to 17,412,673 DKK.

$$\frac{\text{Output}}{\text{Input}} = \frac{17{,}412{,}673}{1{,}622{,}000} = \textbf{\textit{10.73}} = \textbf{\textit{SROI-ratio}}$$

TABLE 3 FUTURE CASH FLOWS (DKK)

	1	2	3	4	5	6	7	8	9	10
Group 1	595,471	535,924	482,332	434,098	390,689	351,620	316,458	284,812	256,331	230,698
Group 2		595,471	535,924	482,332	434,098	390,689	351,620	316,458	284,812	256,331
Group 3			595,471	535,924	482,332	434,098	390,689	351,620	316,458	284,812
Group 4				595,471	535,924	482,332	434,098	390,689	351,620	316,458
Group 5					595,471	535,924	482,332	434,098	390,689	351,620
Group 6						595,471	535,924	482,332	434,098	390,689
Group 7							595,471	535,924	482,332	434,098
Group 8								595,471	535,924	482,332
Group 9									595,471	535,924
Group 10										595,471
TOTAL	**595,471**	**1,131,395**	**1,613,726**	**2,047,825**	**2,438,513**	**2,790,133**	**3,106,591**	**3,391,403**	**3,647,733**	**3,878,431**

TABLE 4 DISCOUNTED CASH FLOW ANALYSIS (4%)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Investments	-200,000	-200,000	-200,000	-200,000	-200,000	-200,000	-200,000	-200,000	-200,000	-200,000
Total Output	595,471	1,131,395	1,613,726	2,047,825	2,438,513	2,790,133	3,106,591	3,391,403	3,647,733	3,878,431
Net Cash Flow	395,471	931,395	1,413,726	1,847,825	2,238,513	2,590,133	2,906,591	3,191,403	3,447,733	3,678,431
Present value of Net Cash Flow	380,261	861,127	1,256,798	1,579,528	1,839,895	2,047,020	2,208,770	2,331,927	2,422,332	2,485,016

SENSITIVITY ANALYSIS

The forecast is based on assumptions and with assumptions come uncertainties. The aim of this sensitivity paragraph is to present an analysis that examines how unfavourable changes in the assumptions change the SROI-ratio. Hereby, the reader can form a more informed opinion about the conclusion.

EDUCATION

The analysis assumes an average income increase of 0.9% per ABE participants. According to the sensitivity analysis, it is evident that if the income increase is either higher or lower, it does not affect the overall SROI significantly.

SENSITIVITY ANALYSIS UNCERTAINTY IN INCOME INCREASE (%)

	INPUT	0,0%	2,5%	5,0%	7,5%	10,0%	12,5%	15,0%	17,5%	20,0%
Mali income increase (%)	104	0,0%	0,2%	0,4%	0,7%	**0,9%**	1,1%	1,3%	1,6%	1,8%
Income increase per person based on ABE (DKK)	9965	0	22	44	66	**89**	111	133	155	177
Total value generated (DKK)		0	2,214	4,429	6,643	**8,858**	11,072	13,287	15,501	17,716
ΔSROI first year (ratio)	595,471	2.93	2.94	2.96	2.97	**2.98**	2.99	3.00	3.01	3.02

HEALTH CLINICS

If the reduction in sick days is different from the 1 day estimated, it can be seen from the sensitivity analysis below that the change in sick days likewise does not significantly influence the SROI-ratio. With zero reduction in sick days, the SROI-ratio is still above 2.

SENSITIVITY ANALYSIS UNCERTAINTY IN INCOME INCREASE (DAYS)

	INPUT	0	0,25	0,5	0,75	1	1,25	1,5	1,75	2
Income increase per person (DKK)	27	0	6.75	13.5	20.25	**27**	33.75	40.5	47.25	54
All participants	450	450	450	450	450	**450**	450	450	450	450
Income increase based on reduction in sick days (DKK)		0	3,038	6,075	9,113	**12,150**	15,188	18,225	21,263	24,300
ΔSROI first year (ratio)	595,471	2.92	2.93	2.95	2.96	**2.98**	2.99	3.01	3.02	3.04

In the future, it will be possible to minimise the uncertainties as we can follow the progress of the villagers more closely. That might result in expanding the duration of the analysis or raising the average income levels, which will most likely lead to a higher SROI.

WELL-BEING

The amount of people impacted and the percentage of stakeholders who experience the well-being effects has a significant effect on the SROI-ratio.

SENSITIVITY ANALYSIS JOB TRAINING

% EXPERIENCING FULL EFFECT	0%	5%	10%	15%	20%	25%	30%	35%	40%
SROI	2.92	2.93	2.95	2.96	**2.98**	2.99	3.01	3.02	3.04

SENSITIVITY ANALYSIS BEING ABLE TO OBTAIN ADVISE LOCALLY

% EXPERIENCING THE FULL EFFECT	0%	5%	10%	15%	20%	25%	30%	35%	40%
SROI	2.89	2.91	2.93	2.95	**2.98**	3.00	3.02	3.05	3.07

SENSITIVITY ANALYSIS HIGH CONFIDENCE

% OF STAKEHOLDERS EXPERIENCING FULL EFFECT	0%	3%	5%	8%	10%	13%	15%	18%	20%
SROI	2.73	2.79	2.85	2.92	**2.98**	3.04	3.10	3.16	3.22

SENSITIVITY ANALYSIS MEMBER OF A SOCIAL GROUP

% EXPERIENCING FULL EFFECT	0%	5%	10%	15%	20%	25%	30%	35%	40%
SROI	2.91	2.93	2.94	2.96	**2.98**	2.99	3.01	3.03	3.05

SENSITIVITY ANALYSIS GOOD OVERALL HEALTH

% EXPERIENCING FULL EFFECT	0%	4%	8%	11%	15%	19%	23%	26%	30%
SROI	2.03	2.27	2.50	2.74	**2.98**	3.21	3.45	3.69	3.92

SENSITIVITY ANALYSIS NOT WORRIED ABOUT CRIME

% EXPERIENCING FULL EFFECT	0,00%	0,1%	0,3%	0,4%	0,5%	5,00%	10,00%	15,00%	20,00%
SROI	2.17	2.37	2.57	2.78	**2.98**	10.26	18.34	26.43	34.52

SENSITIVITY ANALYSIS IMPROVEMENTS IN CONFIDENCE

% EXPERIENCING FULL EFFECT	0%	3%	5%	8%	10%	13%	15%	18%	20%
SROI	2.25	2.43	2.61	2.80	**2.98**	3.16	3.34	3.52	3.70

The sensitivity analysis shows that a good SROI-ratio is sustained even in worst case scenarios. If the ratio is to diminish radically several of the above scenarios should deteriorate at the same time, which is unlikely to happen.

OTHER VALUE CREATION

Throughout the analytical process, it has become clear that Light over Mali creates more value than measured in the analysis – value that is difficult or nearly impossible to measure. The following section will present other value created by the project and is based on the 2002 report from the World Bank, scientific research papers and dialogue with Mali Folkecenter and Nordisk Folkecenter.

01

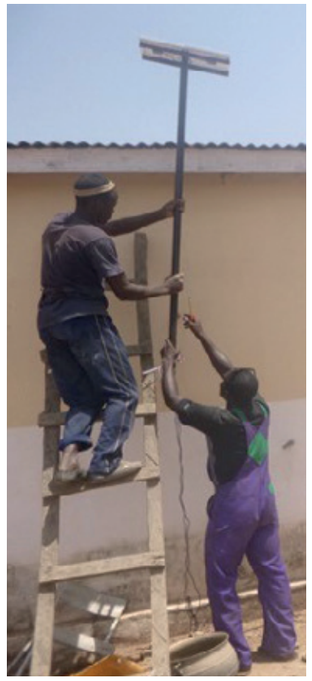
Adult Basic Education increases efficacy for individual or collective action. ABE contributes to basic education not only for the participants but also for their children. ABE has consistently been shown to have a synergy effect on children's primary schooling. This could lead to higher education and improved income for these children.

02

Modernising the poor and rural areas help provide the pull needed to keep young people in the local communities instead of migrating to large cities, strengthening the rural economy.

03

Several studies show positive effects of ABE on the health of family members, as the participants have been taught about hygiene, vaccination and general cleanliness.



04

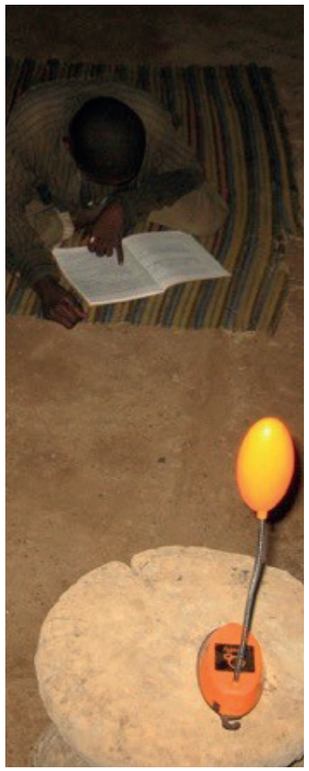
ABE widens the range of confident behaviour in the market place for the villagers when they can read, write and calculate. They will be able to buy and sell with less fear of being cheated and it is easier to compete with others and trade in a wider market.

05

Since ABE is more successful in reaching women than men, it is also a means of redressing the power imbalances between men and women.

06

ABE also teaches the adult population about contraception and fertility, which minimise the number of children being born. Families can improve their prospects for escaping the poverty trap with fewer children to care for and raise. Professor Steven Sidning at Columbia University stresses in his research that moderating fertility enhances economic prospects[21].



07

The health clinics help save women and especially children from dying during birth.

08

The public street light will heighten security after dark, minimising the risk of theft and help the villagers avoid dangerous animals during the night.

09

It will also be possible for the villagers to recharge their cellular phones at the schools, which will ease the communicative infrastructure.

10

As part of the project, two people from each village will receive basic education on electricity and maintenance of solar panels. These skills may be put to use elsewhere.

CONCLUSION

Less than 9% of the rural population in Mali has access to electricity. This analysis has shown that Light over Mali creates tangible value for more than 10,000 people in rural Malian villages. The value is created by generating +400,000 hours of light annually by placing solar panels on schools, health clinics lampposts, and giving school children homework lamps.

The new sources of light give the villages new opportunities after dark. First, the schools can provide basic education to the adult population and the children can use the classrooms in the evenings to prepare for exams and tests. Second, the health clinics can treat more patients and help deliver babies safely at night. Third, the public street light will increase safety. Fourth and last, the homework lamps will help children study after dark.

Concretely, the SROI-ratio, based on an evaluation of the first 12 months of the project, is calculated to be 2.98. Over a 10-year period, the SROI-ratio is 10.73. This means that for each DKK 1 spent, DKK 10.73 is generated over 10 years. The values are made of educational programmes and access to medical assistance; increasing the health, productivity, income and general well-being among the villagers.

Through the analytical process, it has been made clear that Light over Mali creates much additional value which is not accounted for in the analysis. This covers educational spill-over effects for the children, lowering the rate of births, reducing infant mortality, redressing the power imbalances between men and women and much more. In a future analysis, it will most likely be possible to include some of these factors.

In conclusion, Light over Mali generates thousands of hours of light, which enable schools and health clinics to function after the sun sets. As the analysis shows, the project has affected the villagers in a very positive manner. This gives hope for a better future – with light and education being the first steps.

SOLAR PANELS

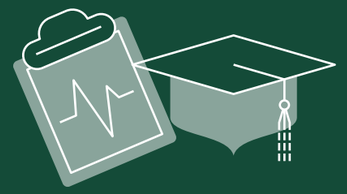
installed on schools, health clinics and lamp posts

LIGHT WHEN IT'S DARK

extended days

HEALTH

Improved treatment conditions
Decreased sickness
Reduced infant mortality
Lowered childbirths



EDUCATION

Improved living standard
Increased income-levels
Empowered entrepreneurship
Redressed power imbalances

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Photo credit: Mali-Folkecenter Nyetaa

APPENDIX 1: IMPACT MAP

	STEP 1	STEP 2			STEP 3	
STAKEHOLDERS	CHANGE	INPUT	OUTPUT	OUTCOME	INDICATOR	SOURCE
ABE recipients and their families	Improved knowledge about health as well as improved working conditions at the health clinics		Solar panels on five schools and solar panels on five health clinics	Increased income based on reduction in sick days	Reduction in sickness	OECD (2004) Danmarks Statistik
ABE recipients	Improved literacy skills	Donation DKK 200,000	Solar panels on five schools	Increased income based on ABE	Income increase	Psacharopoulos & Patrinos (2002)
				Increased entrepreneurship and likelihood of getting a job	General job training	HACT (2014) Individual interviews with the stakeholders
				Improved support system in general and enhancement of the recipients' opportunity of starting up a business	Being able to obtain advice locally	HACT (2014) Individual interviews with the stakeholders
				Increased belief in the ability to succeed	High confidence	HACT (2014) Individual interviews with the stakeholders
				Increased sense of belonging, which positively affects mental health	Member of a social group	HACT (2014) Individual interviews with the stakeholders
Health clinic patients	Reduction in sickness		Solar panels on five health clinics	Ability to treat more patients, cool medicine and provide better care	Good overall health	HACT (2014) Individual interviews with the stakeholders
Villagers in general	Increased safety		Five lampposts in city centres	Minimised risk of being a victim of a crime or an animal attack at night	Not worried about crime at night	HACT (2014) Individual interviews with the stakeholders
School children	Enables homework and preparing for exams		250 solar-driven homework lamps	Improved school and social life	Improvements in confidence	HACT (2014) Individual interviews with the stakeholders

					STEP 4				STEP 5
QUANTITY	STAKEHOLDERS EXPERIENCING EFFECT	TYPE OF INDICATOR	VALUE PER UNIT GBP	YEARLY GROSS VALUE (DKK) PPP ADJUSTED	DEAD WEIGHT	DISPLACE-MENT	ATTRI-BUTION	DROP OFF	NET VALUE
30	25%	Avg. reduction in sick days		12.150 kr.	20%		50%		4.860 kr.
30	25%	Avg. income level		2.642 kr.	20%		50%		1.057 kr.
30	20%	Social Value from Social Value Bank	€ 1,567	29.438 kr.	20%		50%		11.775 kr.
30	20%	Social Value from Social Value Bank	€ 2,457	46.158 kr.	20%		50%		18.463 kr.
30	10%	Social Value from Social Value Bank	€ 13,080	122.862 kr.	20%		50%		49.145 kr.
30	20%	Social Value from Social Value Bank	€ 1,850	34.755 kr.	20%		50%		13.902 kr.
100	15%	Social Value from Social Value Bank	€ 20,141	945.937 kr.	20%		75%		189.187 kr.
7015	0,5%	Social Value from Social Value Bank	€ 12,274	1.347.950 kr.	20%		85%		161.754 kr.
250	10%	Social Value from Social Value Bank	€ 9,283	726.638 kr.	20%		75%		145.328 kr.

APPENDIX 2: ASSUMPTIONS AND MEASUREMENT UNCERTAINTIES

The analysis is based on several assumptions and factors that affect the conclusion. In addition to this, uncertainties are attached to both measurements and data collection. This table describes these assumptions and explains how they can affect the results of the analysis.

POSITIVE EFFECTS	NEGATIVE EFFECTS
Number of participants The annual number of participants receiving ABE is 30. If the number is higher next year this would affect the SROI positively.	**Number of participants** If the number of participants receiving ABE is lower, it will affect the SROI-ratio negatively.
Average income effect We estimate that one year of adult education enhances the average annual net income by 0.9%. Some of the villagers may earn more than that, if they start a new or improve their business.	**Average income effect** We estimate that the income increase is 0.9% the first year. If this number decreases a year, it will affect the SROI-ratio negatively.
Long term effects We estimate that each villager receiving education will have an increased salary for ten years. This number could be significantly higher, thereby affecting the SROI-ratio positively.	**Long term effects** We estimate that each villager receiving education will have an increased salary for ten years. This number could be lower, thereby affecting the SROI-ratio negatively.
Sickness We estimate that each member of the workforce will reduce the average amount of absence days by one day, because of improved knowledge about health and treatment conditions after dark. This number could possibly be higher, which would affect the SROI in a positive way.	**Education** We estimate effects of ABE, but we do not know how great an impact the teaching has. Poor educational quality could affect the SROI-ratio negatively.
Other value creation If other value creation could be measured, this would affect the SROI-ratio positively.	

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