

ENGINEERS WITHOUT BORDERS DENMARK



Development projects in Sierra Leone supporting the UN Sustainable Development Goals

Inspiration for technical students



Med støtte fra Udenrigsministeriets Oplysningspulje

Introduction

Engineers Without Borders Denmark (EWB-DK) is a technical humanitarian NGO established in 2001. Through the donation of time, skills and experience, our volunteers develop international partnerships, create sustainable solutions and improve living conditions in some of the poorest communities in the world. By June 2018, EWBDK counts more than 1,300 members, of which more than 250 are actively engaged in projects.

Our project activities are guided by the UN Sustainable Development Goals (SDG's), and besides technical interventions, fostering of local partnerships and transfer of knowledge constitutes our core mission.

We have been engaged in a variety of development projects in Sierra Leone since 2009 within our four strategic focus areas: WASH (Water, Sanitation and Hygiene), Environment (Sustainable Energy, Waste Management, Environmental Planning), Food Security and Disaster Relief and Preparedness.

This educational material about our activities and achievements in Sierra Leone is developed to demonstrate how technical solutions and the successful transfer of knowledge play an all important role in improving life for people in developing countries such as Sierra Leone, thereby contributing to the SDG's. With this we want to inspire students at technical universities and marine engineering schools to consider to take part in international humanitarian projects during and after graduation, e.g. through our internship programme.

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1. Country profile on the Republic of Sierra Leone

Sierra Leone is one of the poorest countries in the world and about 60 % of the population is living below the poverty line. The country has the worst literacy rates and one of the highest youth unemployment rates in Africa. On top of it much of the country’s drinking water is polluted and HIV/AIDS, malaria, and yellow fever is widespread. Diseases and malnutrition in turn contribute to infant, child, and maternal mortality rates among the highest in the world.

Sierra Leone is a country in West Africa bordered by Guinea to the northeast, Liberia to the southeast and the Atlantic Ocean to the southwest. The Portuguese explorer Pedro de Cintra named the country "Serra Leoa" (Lion Mountains) for the impressive mountains he saw while sailing the West African coast in 1462. The country has a total area of 71,740 km² and a total population of 7,092,113 (based on the 2015 national census).



Sierra Leone is a constitutional republic with a directly elected president and 132 directly elected members of a unicameral legislature known as Parliament. The latest general elections were held on March 7th 2018 when president Maada Bio was elected.

The country is divided into four provinces (Eastern, Northern, North Western and Southern) plus the Western Area, which comprises the capital Freetown and the surrounding area. These are further divided into 16 districts, which in turn are comprised of 190 chiefdoms. Today the chiefdoms are third-level units of administration but until 2004, where the World Bank sponsored the creation of elected local councils, the chiefdoms were the sole local government in Sierra Leone. The chiefdoms still have the power to raise taxes, control the judicial system, and allocate land, the most important resource in rural areas in which 80 % of the population lives.

A nation built on freed slaves

In 1772 slavery was declared illegal in Great Britain and in 1787 the "Province of Freedom" (which later became Freetown) was founded as a British colony and a naval base to patrol against illegal slave ships. By 1792, freed slaves from Nova Scotia in Canada crossed the Atlantic Ocean and joined the original settlers, the Maroons. Another group of slaves from Jamaica travelled to Freetown in 1800.

In 1808, Sierra Leone officially became a crown colony with the land possessions of Sierra Leone Company transferred to the crown. In 1833, British Parliament passed the Emancipation Act and slavery was finally abolished. By 1855, over 50,000 freed slaves had settled in Freetown. Today, the repatriated settlers of Freetown live in a multi-ethnic country.



National identity has been influenced by several factors. Besides the common experiences shared under colonialism or since independence, one of the most important has been the development of the regional lingua franca Krio, a language that unites all the different ethnic groups, especially in trade and interaction with each other. While English is Sierra Leone's sole official language, Krio is far more widespread.

Independence, civil war and the Ebola outbreak

Sierra Leone gained independence from the British in 1961. After this the country has experienced many social, economic and political challenges. From 1991 to 2002, Sierra Leone was devastated by civil war after a rebel group, the Revolutionary United Front, intervened in an attempt to overthrow the country's Government. The conflict was characterized by acts of extreme brutality and resulted in over 50,000 deaths, internal displacement of over 2 million people, and another half million forced to seek refuge in neighbouring countries.

A UN Peacekeeping and subsequent British military intervention resulted in the war being declared over on January 18th 2002. The country has made tremendous progress since the conflict ended to establish good governance and consolidate peace and security, and is often cited as a success story in peace building. The UN Refugee Agency (UNHCR) has helped almost 180,000 Sierra Leoneans to return home, while more than 90,000 others have repatriated on their own initiative.

Until 2014, the government relied on external assistance to support its budget, but Sierra Leone has gradually become more independent. The Ebola outbreak during 2014 and 2015, combined with falling global commodities prices, caused a significant contraction of economic activity in all areas. While the World Health Organization declared an end to the Ebola outbreak in Sierra Leone in November 2015, low commodity prices in 2015-2016 contributed to the country's biggest fiscal shortfall since 2001. However, in 2017, increased iron ore exports finally lead to a resumption of the economic growth.

Extreme poverty and foreign aid

Despite the economic growth, Sierra Leone remains among the world's poorest countries, ranking 179th out of 188 countries in the Human Development Index in 2016. Life expectancy is just above fifty years of age, health and nutrition outcomes are among the worst in the world, and infant mortality rates are among the world's highest. About 60 % of the population are living on less than the equivalent of US\$ 1.25 a day.

Continued economic growth will depend on commodities prices and increased efforts to diversify the sources of growth. Agriculture is still the mainstay of the economy (46 % of Gross Domestic Product) and inflation is high due to internal factors and external disturbances, including rising food and fuel prices. Non-mining activities is constrained by inadequate infrastructure, such as power and roads, even though power sector projects may provide some additional electricity capacity in the near term. Pervasive corruption and undeveloped human capital will continue to deter foreign investors.

Therefore, the government is still heavily dependent on foreign aid, with about 50 % of public investment programmes financed by external resources.

Growing population and unemployment

Sierra Leone has a rapidly growing population. The total fertility rate (TFR) is almost 5 children per woman. This is sustained by the continued desire for large families, the low level of contraceptive use, and the early start of childbearing. The population growth is somewhat tempered by the high maternal, infant and child mortality rates as a result of factors such as, poor nutrition, lack sanitation and potable water, limited access to quality health care services, and the prevalence of female genital mutilation.

About 60% of the population in Sierra Leone is under age 25 and they struggle with high unemployment rates, which was one of the major causes of the civil war. The youth unemployment rate of about 60 % is closely connected to high levels of illiteracy and unskilled labour, a lack of private sector jobs, and low pay.

Gender inequality

On UN Development Programme's (UNDP) Gender Inequality Index, Sierra Leone is ranking 179th out of 188 countries in 2016, reflecting significant gender-based inequalities in reproductive health, empowerment and economic activity. Only 13.2 % of seats in parliament are held by women and no more than 9.5 % of adult women have reached a secondary or higher level of education compared to 20 % of their male counterparts. For every 100,000 live births, 970 women die from pregnancy related causes.

Environmental problems, climate change and natural disaster

Sierra Leone's recovery and development is hampered by huge environmental problems and vulnerability to climate change and natural disasters.

The vast majority of people in Sierra Leone rely on natural resources for their main sources of livelihoods. Water, soil and forest resources are threatened by population growth, the dependence on biomass based energy (80 % of the total), unsustainable mining activities, pollution of rivers, and rising demands from agribusiness, resulting in massive deforestation (3,000 hectares a year) and increased risk of soil erosion and landslides.

In rural areas of Sierra Leone the water supply often comes from polluted streams. This entails a high risk of diseases like cholera and typhus and polluted water is one of the main reasons for the low life expectancy. According to WHO more than 40 % of the population has no access to potable water and about 60% do not have adequate sanitation. The UN global assessment of sanitation and drinking water figures indicate even lower levels: 51 % of the population only has access to unimproved sources of drinking water and 24 % practice open defecation. The Ebola outbreak has caused a greater focus on water supply, sanitation and hygiene in the country.

The country has a tropical climate with a diverse environment ranging from savannah to rainforest. In the rainy season from May to December, rainfall along the coast can reach 495 cm a year, making it one of the wettest places in coastal, Western Africa. From December to February, dry, sand-laden harmattan winds blow from Sahara resulting in sandstorms. Due to climate change, extreme rainfall and drought occur more frequently resulting in low yields of critical crops and increased risk of floods and mudslides as the devastating mudslide that hit Freetown in August 2018. The disaster was aggravated by massive deforestation and the lack of drainage and sewer systems.

Lack of technical and vocational skills

According to Sierra Leone's Ministry of Education, Science and Technology, the number of graduates and post-graduates from the technical and vocational institutes, colleges, polytechnics and universities does not meet the growing demand for mid-level technical and professional personnel such as machinists, technicians, electricians, crane operators, irrigation engineers etc. with the skills, knowledge and attitude needed to transform Sierra Leone's economy.

Foreign companies investing in Sierra Leone are importing foreign labour for positions that could be filled by trained Sierra Leoneans had they been available. There is a need for a complete overhaul of skills training which includes the introduction of more demand-driven programs and new equitably distributed provision of sustainable TVET institutions (Technical and Vocational Education and Training).

Facts and figures

Roadways (2002)

- Total: 11,300 km
- Paved: 904 km
- Unpaved: 10,396 km

Electricity

- Population without electricity: 5,800,000 (2013)
- Electrification: 5 % of total population (2013)
- Electricity from fossil fuels: 33.3 % of total installed capacity (2015)
- Electricity from hydroelectric plants: 66.7 % of total installed capacity (2015)

Cell phones

Total: 6,279,270 (2016)

Natural resources

Diamonds, titanium ore, bauxite, iron ore, gold and chromite.

Industries

Diamond mining; iron ore, rutile and bauxite mining; small-scale manufacturing (beverages, textiles, footwear).

Agriculture products

Rice, coffee, cocoa, palm kernels, palm oil, peanuts, cashews, poultry, cattle, sheep, pigs and fish.

Land use (2011)

- Agricultural land: 56.2 %
- Forest: 37.5 %
- Other 6.3 %

Ethnic groups

Sierra Leone has 16 different ethnic groups, each with a different language. The largest ethnic group is the Temne (35 %), followed by the Mende (31 %). The Temne are dominant in the Northern Sierra Leone and areas around the capital, while the Mende live mostly in the South-Eastern Sierra Leone and the Kono District.

Religion

About 71 % of the population are Muslims, while Christians make up 27 % of the population. The remainder practice indigenous beliefs.

Literacy (2015)

Definition: Age 15 and over can read and write English, Mende, Temne, or Arabic:

- Total population: 48.1 %
- Male: 58.7 %
- Female: 37.7 %

The numbers vary in different parts of the country.

Sources

- [UNDP](#)
- [CIA World Factbook](#)
- [The CommonwealthThe Commonwealth](#)
- [Ministry of Education, Science and Technology: Education Sector Plan, 2014-2018, “Learning to Succeed”](#)

2. The Sustainable Development Goals in action

The Sustainable Development Goals (SDGs), also known as the Global Goals, are a universal call to action set by the United Nations to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. EWB-DK’s projects in Sierra Leone are contributing to the SDGs in various ways.

In September 2015 Heads of State and Government agreed to set the world on a path towards sustainable development through the adoption of the 2030 Agenda for Sustainable Development. This agenda includes 17 Sustainable Development Goals (SDGs), which address the most pressing global challenges of our time, calling upon collaborative partnerships across and between countries to balance the three dimensions of sustainable development — economic growth, environmental sustainability, and social inclusion. The goals are interconnected and often the key to success on one goal will involve tackling issues associated with another.

The 17 global goals are:



The 17 goals are accompanied by 169 targets for all countries to adopt in accordance with their own priorities and the environmental challenges of the world at large. In this section you can learn more about selected goals and get an overview of how EWB-DK’s projects in Sierra Leone work towards these goals.

GOAL 1: NO POVERTY

Globally, more than 800 million people are living on less than US\$1.25 a day. Rapid economic growth in countries like China and India has lifted millions out of poverty, but progress has been limited in sub-Saharan Africa. According to UNDP more than 60 % of the population in Sierra Leone is living below the poverty line.

The SDGs are bold commitments to end poverty in all forms and dimensions by 2030. This involves targeting the most vulnerable people, increasing access to basic resources and services, and supporting communities affected by conflict and climate-related disasters.



EWB-DK’s projects in Sierra Leone in several ways support the overall goal of eradicating poverty. By securing basic needs like access to adequate food, clean drinking water and sanitation, EWB-DK especially contribute to target 1.5: By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

GOAL 2: ZERO HUNGER

Hunger and malnutrition remains a barrier to development in many countries. 795 million people are estimated to be chronically malnourished as of 2014. One person in every four goes to bed hungry in Africa.

The SDGs aim to end all forms of hunger and malnutrition by 2030, making sure all people have access to sufficient and nutritious food all year round. This involves promoting sustainable agricultural practices such as supporting small-scale farmers and allowing equal access to land, technology and markets.



EWB-DK’s food security projects in Sierra Leone contribute to target 2.1: By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.

Approximately 450,000 Sierra Leoneans are disabled. Many of these are civil victims of the civil war and amputations of arms and legs have made them unable to work in the fields. They live in extreme poverty, are landless and have no way of supporting themselves or their families. EWB-DK has implemented food security activities in three amputee townships. The activities include raising poultry and goats, constructing growing walls, establishing backyard gardening and planting fruit trees, allowing the community households to sell eggs and grow crops and thereby generate an income.

GOAL 3: GOOD HEALTH AND WELL-BEING

More than 6 million children die before their fifth birthday. Each day 16,000 children die from preventable diseases such as measles and tuberculosis and hundreds of women die during pregnancy and childbirth. To a large extent these deaths may be avoided through prevention, treatment, education, immunization campaigns, and sexual and reproductive healthcare.

Sierra Leone has an infant mortality rate of 94 in 1,000 live births, which is among highest in the world. The health and nutrition outcomes are also among the worst in the world, and the life expectancy is just above fifty years. Due to the lack of access to electricity in rural Sierra Leone health clinics in isolated communities do not have light after sunset or a refrigerator for medicines and vaccines.

In rural areas of Sierra Leone the water supply often comes from polluted streams. This entails a high risk of diseases like cholera and typhus and polluted water is one of the main reasons for the low life expectancy.



Public health can be improved significantly if rural clinics are provided with electricity and therefore EWB-DK’s energy projects in Sierra Leone contribute to target 3.1: By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births.

EWB-DK is establishing solar power systems at four health clinics, serving 10,100 people. This will provide power for lighting, basic medical equipment and refrigeration for medicine and vaccines. Three of the clinics have more than 500 childbirths yearly and with electricity in the clinics, childbirth will become much safer.



EWB-DK’s WASH projects in Sierra Leone contribute to target 3.3: By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.

Disease control is an essential issue in IUG's WASH projects. The projects ensure access to clean water combined with hygiene education, and the establishment of health committees that propagates information on the importance of good hygiene to the local communities.

By establishing wells, latrines, solar panels and the maintenance of these as well as providing hygiene education, IUG's projects have a strong impact on public health and the general standard of living in the small communities.

GOAL 6: CLEAN WATER AND SANITATION

Water scarcity affects more than 40 % of people around the world and dwindling supplies of safe drinking water is a major problem on all the continents.

EWB-DK consider access to water, sanitation and hygiene (WASH) as the foundation for all development and during the last ten years, Africa has become the main operation area of EWB-DK WASH interventions, with Sierra Leone as the primary target country. In Sierra Leone, more than 40 % of the population does not have access to potable water and about 60 % do not have adequate sanitation.



Several of EWB-DK’s projects in Sierra Leone aim to provide safe and reliable water supply for rural domestic use, provided from hand-dug or drilled wells powered by solar energy. From 2013-2018 EWB-DK have established water supply in more than 24 villages in Kenema Province providing access to clean drinking water to more than 10,000 people. Thereby EWB-DK contributes to targets 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.



In addition to water infrastructure, the WASH activities include establishing sanitation facilities and irrigation, as well as community training in hygiene and sanitation. So the projects also contribute to target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.



All WASH projects provide local organizational capacity building and community empowerment. The community training include maintenance of the water supply systems and all villages have established a local water organization that collects money from the users and ensures that the installations are maintained. Thereby the projects also contribute to target 6.b: Support and strengthen the participation of local communities in improving water and sanitation management.

GOAL 7: AFFORDABLE AND CLEAN ENERGY

On a global level one in seven people has no access to electricity, and as the demand is ever increasing a substantial increase in the production of renewable energy is needed across the world.

In Sierra Leone the building of and access to the electrical grid is focused around the capital Freetown, while the rural areas have low priority. Providing electricity to vulnerable and exposed communities through adapted sustainable technology is a powerful step towards eradicating poverty and ensuring sustainable and prosperous local communities.



Several of EWB-DK’s projects in Sierra Leone aim to provide electricity to remote areas and vulnerable groups and thereby contribute to target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services.

Public health can be improved significantly if rural clinics are provided with electricity. EWB-DK is establishing solar power systems at four health clinics, serving more than 10,000 people. This will provide power for lighting, basic medical equipment and a refrigerator for medicine and vaccines.

While the overall access to electricity in Sierra Leone is below 6 % of the population, 83 % has access to a mobile phone. EWB-DK has established solar powered mobile charging stations in 5 villages with a total of 2,100 inhabitants. At the stations, mobile phones can be recharged offering small businesses and small-scale farmers means of communication for selling their produce and to obtain information about prices. Also, funds can be raised at the village level offering opportunities for more widespread community development.

Another example is the Opportunity Training Centre (OTC) for polio survivors in Kenema where young people with physical disabilities are trained in order to provide them with vocational skills. EWB-DK supports the technical capacities for training and has as a first priority established cheap and stable solar energy.

GOAL 13: CLIMATE ACTION

While greenhouse gas emissions rise, people all over the world are impacted by climate change. The poorest are the most vulnerable and there’s an urgent need to help these countries and regions adapt to climate change. Goal 13 aims to mobilize \$100 billion annually by 2020 to address the needs of developing countries and help mitigate climate-related disasters.



EWB-DK’s disaster relief and preparedness projects in Sierra Leone contribute to target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

After days of heavy rainfall in August 2017, devastating floods and mudslides occurred in and around the capital Freetown. Thousands of lives were lost and many poor families lost everything. Many of the local water systems were destroyed or contaminated and latrines were flooded, causing a high risk of cholera and typhus in the affected communities.

EWB-DK along with partner EWB-SL has joined the local cluster on the WASH disaster management and has secured new water points in the affected areas. The solution is based on flood-proof new community toilets, deep drillings for water and rehabilitation of natural catchments.

GOAL 17: PARTNERSHIP FOR THE GOALS

The SDGs can only be realized with a strong commitment to global partnership and cooperation.



In addition to technical interventions, the building of capacity as well as the fostering of local partnerships and transfer of knowledge are at the core of EWB-DK’s mission.

Since 2009 EWB-DK has been collaborating with their sister organization Engineers Without Borders Sierra Leone (EWB-SL), donors, knowledge institutions and local partners, communities and authorities on a wide variety of projects.

EWB-DK’s projects in Sierra Leone thereby contribute to target 17.17: Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.

3. Water supply driven by solar energy

Intelligent solutions with solar powered pumps, data transmission systems and local engagement are part of a 'second generation' approach to ensure clean water for people in rural Sierra Leone.

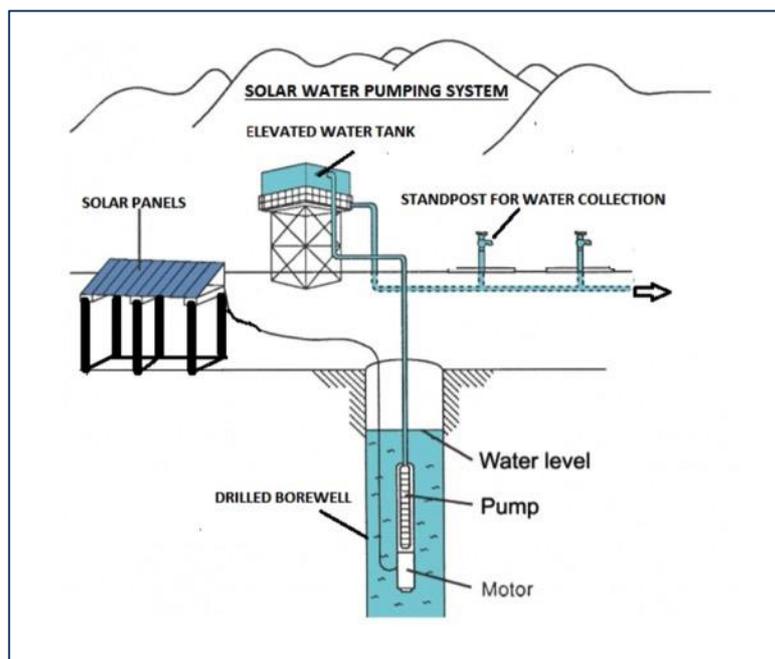
In rural areas of Sierra Leone the water is often supplied from streams or wells located far from the village and women often have to carry buckets and tanks of water over long distances. Also, the wells may run dry if the yearly drought period persists for a long time.

Since 2013 EWB-DK and partner EWB-SL have provided 21 villages in Kenema District in Sierra Leone with hand dug wells (10-15 meters deep) and traditional hand pumps. These villages now have two wells and the demand for clean water is satisfied. However in rural communities with a higher population density a different approach is needed in order to ensure reliable water supplies. To meet these needs, EWB-DK has introduced an enhanced water system. In 2017, Gandorhun, a village of 2,000 inhabitants in the Kenema District, was the first to receive this 'second generation' water system and in 2018 a similar system was implemented in the village of Nomo Faama with 1,500 inhabitants.

The technical solution

The water system is based on a typically 50-90 meters deep drilled borehole and a solar powered Grundfos SQFlex pump that delivers the water into elevated reservoirs. From here, pressurized water is transported via a drainage pipeline to stand posts in various parts of the village. To ensure success the projects conducted hydrogeological surveys before determining the location of the bore well.

As water is extracted from a deeper groundwater source this system may deliver a minimum of 20 litres per person per day all year, without the risk of running dry or contamination.





The trenches for the water pipes were excavated by workers from the community.



The water tower is designed to contain 20 m³ of water. The construction is a concrete scaffolding.



The water pipes transport the drinking water to five stand posts.

A critical factor for the success of the 'second generation' water system is maintenance and repair. Together with the University of Southern Denmark, EWB-DK has developed a data transmission solution that allows local service providers to monitor the function of the water pumps and to service the pumps on a "call in" basis. The water pumps will in frequent intervals transmit data regarding

water flow, temperature, power supply state of charge, and operational status to a central application.

The on-going monitoring of the pumps allows technical service personnel to assess the status of the pumps from a central location without the need to travel to each site to assess if the pumps are malfunctioning. This saves time and money and also increases the long-term functioning of the water pump installations as system maintenance will not be dependent on EWB-DK to provide service.



The solar powered satellite and Arduino device, WASH MONITOR 1, is installed and in operation in Gandorhun.

Local ownership and capacity building

In order to ensure local ownership of the water supply system, the community and authorities (Kenema District Council and Ministry of Water Resources) were deeply involved in the project from the very beginning. The location of the bore well, water tower and stand posts was decided together with the community and the authorities. The community invested a small sum in the implementation, supplied sand and gravel for the construction and provided manpower for the excavation of the trenches.

Appointment and training of a community water management committee has established a clear distribution of responsibilities regarding the use, management and maintenance of the water supply system. This includes agreement on a payment scheme based on user fees that generates funds for maintenance of the system and the appointment of paid pump caretakers from the community.

In addition to water infrastructure, the projects established sanitation facilities in the form latrines using the Community Led Total Sanitation (CLTS) methodology, and provided community training in hygiene and sanitation practices. The community contributed with signs for the latrines, hand washing points, plate racks, clothes lines and compost fences.

Finally, the technical and management support to the Kenema District Council's (KDC) WASH Task-force is in coherence with district and national development strategies on WASH and has consolidated KDC towards being an inclusive and democratic led coordinating entity regarding rural and urban water supply.

Contribution to sustainable development

Access to clean water and basic sanitation makes the foundation of sustainable development and effective management and distribution of water resources are essential for economic development, poverty reduction, and gender equality.

The projects stimulate sustainable development in various ways:

- **Fighting water-borne diseases and improving health** by ensuring access to clean water combined with local hygiene education and the establishment of local health committees.
- **Community organization and capacity building** by entrusting the local community with the responsibility of managing, operating and maintaining the water supply systems and payment scheme. This also creates the basis for further and other local development initiatives.
- **Adaption to sustainable technology** by collaborating with district authorities to incorporate new technology in their WASH strategy and ensure sustained provision and maintenance of rural water systems.
- **Development of technical expertise locally** by involving community members and local providers in every aspect of development and operations. This includes local water utility service provider businesses.
- **Consolidation of civic engagement in local policymaking.** By ensuring that KDC in its management and operations engages the public and invites for democratic decision making on local WASH policy a democratic culture is promoted.

The projects thereby contribute to SDG 3, 6 and 17:

<p>TARGET 6-1</p>  <p>SAFE AND AFFORDABLE DRINKING WATER</p>	<p>TARGET 6-2</p>  <p>END OPEN DEFECTION AND PROVIDE ACCESS TO SANITATION AND HYGIENE</p>	<p>TARGET 6-B</p>  <p>SUPPORT LOCAL ENGAGEMENT IN WATER AND SANITATION MANAGEMENT</p>	<p>TARGET 3-3</p>  <p>FIGHT COMMUNICABLE DISEASES</p>	<p>TARGET 17-17</p>  <p>ENCOURAGE EFFECTIVE PARTNERSHIPS</p>
<p>By 2030, achieve universal and equitable access to safe and affordable drinking water for all.</p>	<p>By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.</p>	<p>Support and strengthen the participation of local communities in improving water and sanitation management.</p>	<p>By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.</p>	<p>Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.</p>

Read more

- Project proposal: WASH Program Sierra Leone: Water supply systems by means of submersible pumps driven by solar energy (project 089).
- Project Document: Sierra Leone Community Water – Nomo Faama (project 098).
- Project Document: Sierra Leone Community Water – Gandorhun (project 089).
- Project Document: Democratic and Participatory Sector Governing Institutions – Civil Society Engagement in Water Sector Management, Kenema District, Sierra Leone (project 100)

4. Solar energy for rural health clinics

To utilise the high potential for use of solar energy in Sierra Leone and improve public health, solar power systems are implemented and tested in rural health clinics without access to the electricity grid.

Overall access to the electricity grid in Sierra Leone is below 6 % and in rural areas where the majority of the population resides, access to electricity is virtually non-existent. Government initiatives to expand the electricity grid is limited to the capital Freetown, and rural electrification effort is focused on district headquarter towns – not the outlying areas. This means that local health clinics in isolated communities do not have light after sunset nor refrigeration for medicines and vaccines.



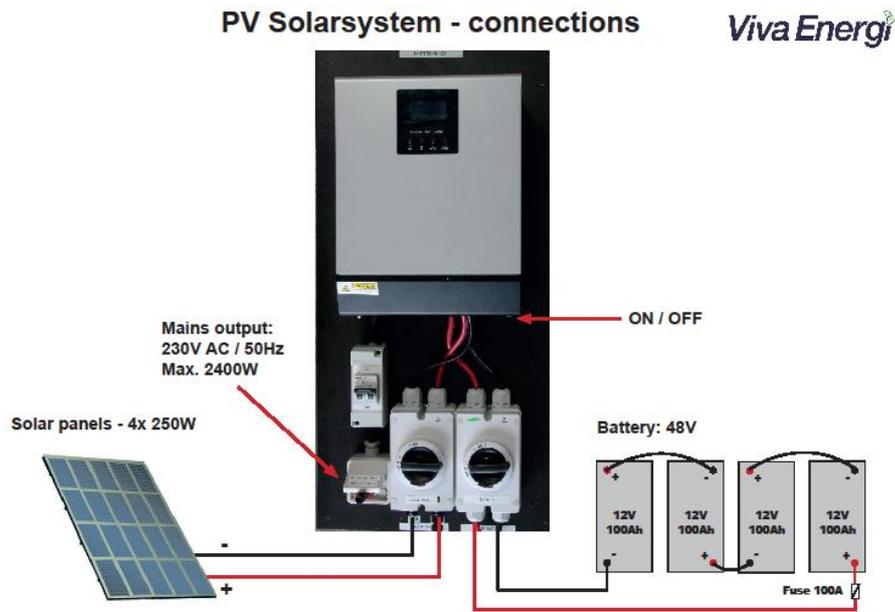
In 2018, EWB-DK established solar power systems at four health clinics, serving 10,100 people in the in Kenema District. Solar energy now provides the clinics with power for light, refrigeration and basic medical equipment. This has improved hygiene and basic health care for the local population and also made audio-visual health education possible. Three of the clinics have more than 500 childbirths a year and electricity in the clinics has made giving birth much safer. Also with improved local facilities the need to travel when in need of medical assistance is greatly reduced.

The technical solution

The solar power system (also called a photovoltaic system or PV system) for the health clinics are dimensioned to 2400W/220V AC for night-time operation on batteries. However, in the daytime the system will provide approx. 3500W/220V AC. With this a clinic may run a small fridge, 10 LED light bulbs, one computer, one water-boiler, an autoclave and chargers for mobile phones.

The systems each have:

- A 4 kW charger and inverter, 230V/4000W sinus
- 6 pcs. 250/255W poly-solar-cell panels
- 6 pcs. 100Ah Gel-batteries



The solar panels have a very long lifetime (20-30 years) and are practically maintenance free except for regular cleaning. Properly maintained, batteries should last 6-8 years before needing replacement. The inverter and charger are expected to last 15 years.

Local ownership and capacity building

Community members have been actively involved in the system development to ensure the long-term viability of the solar power systems. During installation, the local hospital staff and other community members were trained in basic system maintenance for example cleaning of solar panels and electrical connections.

The project was executed in close cooperation with EWB-SL and they will maintain close contact with participant communities to supervise and support them. The District Health Management Team (DHMT) operating under the Ministry of Health and the Kenema District Council are the beneficiary of the project and they will allocate a professional technician to perform maintenance checks on a yearly basis.

Contribution to sustainable development

Access to modern, renewable energy is a prerequisite for combating many of the challenges facing the world such as poverty, food security, climate change, clean water, health and economic growth.

The project contribute to sustainable development in various ways:

- **Improving health services for the rural population** by providing health clinics with power for light, refrigeration and basic medical equipment. The project will ultimately contribute to reduce infant and child mortality in Sierra Leone. With an infant mortality rate of 94 in 1,000 live births, there is a great need to improve the statistics.
- **Providing clean and reliable energy** by establishing solar power systems that are affordable reliable and easily maintained. The reduced need for kerosene, candles, or diesel and unreliable diesel generators will improve the indoor climate and reduce air pollution.
- **Adaption to sustainable technology** by increasing the knowledge of the solar power technology and opportunities. Solar power systems can easily be replicated in other rural communities in the region and may therefore attract public and private interest.
- **Development of technical expertise locally** by involving community members in every aspect of the system development and operations.

The project thereby contribute to SDG 3, 7 and 17:

<p>TARGET 3-1</p>  <p>REDUCE MATERNAL MORTALITY</p>	<p>TARGET 7-1</p>  <p>UNIVERSAL ACCESS TO MODERN ENERGY</p>	<p>TARGET 17-17</p>  <p>ENCOURAGE EFFECTIVE PARTNERSHIPS</p>
<p>By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births</p>	<p>By 2030, ensure universal access to affordable, reliable and modern energy services.</p>	<p>Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.</p>

Read more

- Project Document: Solar energy project in Sierra Leone (Project 087).

5. WASH disaster management and climate adaptation

In August 2017, devastating floods and mudslides in the capital Freetown destroyed and contaminated local water systems. Securing and building up community resilience in the affected areas are an important part of the WASH disaster management.

Sierra Leone's capital Freetown is squeezed into the small space between the mountains and the sea, and the country has the highest annual rainfall in Africa. In August 2017 after three days of intense rainfall, a mountain side collapsed and caused a major landslide. Residents reported a 'tidal wave' of material advancing down the river immediately after the landslide as debris pushed the river water in front of it. More than 1,000 people lost their lives with another 5,900 people (and 1,100 houses) affected – of these 2,600 children.



The flooding damaged the GUMA dam and many local water points/wells and thus disrupted the water supply to the affected communities. The subsequent lack of clean water and sanitation posed a serious threat to health conditions as water borne diseases like cholera and diarrhoea spread rapidly under poor sanitation and hygiene conditions.

EWB-DK along with partner EWB-SL joined the local cluster on the WASH disaster management and has established four new water points serving an estimated 2,500 people and improved sanitation in two affected communities (Pottor and Kaningo in the Regent area of Freetown). Due to the local vulnerability to climate change an important part of the project was to investigate how to best secure and build up community resilience.

The technical solution

The intervention was based on EWB-DK's experience from other WASH projects in Sierra Leone. In the emergency phase the project has focused on:

- Construction of 2 water supply systems, including borehole drilling and installation of pumps, 5-10,000 litre tanks and solar energy PV-systems.
- Establishing a flood-proof latrine and sanitation facility.
- Training of caretaking committees to maintain water supply systems including provision of tool kits for pump and solar technology.
- Empowerment and awareness raising in sanitation and hygiene for mudslide victims at two holding centres, with main focus on children and their mothers.

Enhancing climate resilience is a lengthy process, tapping into much cross-disciplinary knowledge. Next phase will focus on initiatives that can alleviate the floodplains and at the same time generate income. Initiatives may include:

- Excavating sediments from the riverbed to create room for the river and using the sediment for producing construction materials.
- Collection of plastic that is currently polluting the environment and clogging the drains to recycle it into construction materials e.g. bricks, tiles, slaps for latrines, toilet seats and household products e.g. plates, buckets and trays.
- Establishing vegetation covers on hillsides to stabilise slopes and at the same time harvest fruit from the trees.

Local ownership and capacity building

The two communities were engaged in all steps of the intervention to ensure local ownership. A WASH committee was established in each community as responsible entity of the facility and the committees were trained in operation and maintenance. On short-term, a payment scheme is not feasible, but the communities are responsible for establishing a payment scheme to secure local funds for maintenance in the long run.

EWB-SL was custodian of the project with guidance from a WASH and disaster response expert from Denmark. During this EWB-SL has gained substantial knowledge and experience on community resiliency in disaster prone areas. EWB-SL handled local contracting and procurement, as well as coordination in the relevant government/UN and NGO structures.

EWB-SL also arranged regular stakeholder dialogues to discuss project challenges and outcomes. This included focus groups with community representatives in three categories; women, elders and children below 18 to hear their perspective. The results from these engagements were recorded and will serve as a learning point for future interventions.

Contribution to sustainable development

Developing countries are generally the most vulnerable to climate change and there is an urgent need to help them mitigate climate-related disasters and adapt climate change measures.

The project contribute to sustainable development in various ways:

- **Strengthening the community resilience to future floods** by establishing a flood-proof WASH infrastructure and raising awareness on sanitation and hygiene.
- **Enhancing emergency preparedness in the communities** by engaging the community in the intervention and sharing lessons learnt with all stakeholders.
- **Empowering of local communities and individuals** by focusing on initiatives that are useful and meaningful for the communities and engaging women and youth.

The project thereby contribute to SDG 3, 6 and 17:

TARGET 6-1	TARGET 6-2	TARGET 6-B	TARGET 13-1	TARGET 17-17
 <p>SAFE AND AFFORDABLE DRINKING WATER</p>	 <p>END OPEN DEFECTION AND PROVIDE ACCESS TO SANITATION AND HYGIENE</p>	 <p>SUPPORT LOCAL ENGAGEMENT IN WATER AND SANITATION MANAGEMENT</p>	 <p>STRENGTHEN RESILIENCE AND ADAPTIVE CAPACITY TO CLIMATE RELATED DISASTERS</p>	 <p>ENCOURAGE EFFECTIVE PARTNERSHIPS</p>
<p>By 2030, achieve universal and equitable access to safe and affordable drinking water for all.</p>	<p>By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.</p>	<p>Support and strengthen the participation of local communities in improving water and sanitation management.</p>	<p>Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.</p>	<p>Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.</p>

Read more

- https://reliefweb.int/sites/reliefweb.int/files/resources/19371_Sierra_Leone_DaLA_Web-forprinting.pdf
- Project document: THE DANISH EMERGENCY RELIEF FUND HUMANITARIAN INTERVENTION - Organisational capacity assessment.

6. IUG-frivilliges vigtigste erfaringer fra felten

For mange ingeniører er det en drøm på et eller andet tidspunkt i karrieren at få lov til at bruge sin viden på udviklingsprojekter, der hjælper befolkningerne i verdens fattigste lande. Men hvad er det egentlig for en oplevelse, man står overfor? Hvilke udfordringer kan man støde på undervejs? Og hvad kan man gøre for at forberede sig bedst muligt?

Ingeniører Uden Grænser (IUG) har siden 2007 udført en lang række projekter i det vestafrikanske land Sierra Leone, hvor både unge og mere erfarne ingeniører er rejst afsted på frivillig basis for blandt andet at sikre rent vand i landsbysamfund og soldrevet elektricitet til sundhedsklinikker. I denne artikel får du en række gode råd fra IUG's sekretariatschef Dorte Lindegaard Madsen og fem frivillige ingeniører, der alle har arbejdet på projekter i Sierra Leone.

Teknikken er ikke løsningen i sig selv

Befolkningen i Sierra Leone er generelt gode til at tage ny teknologi til sig. For eksempel bruger mange smartphones til at foretage mobile bankoverførsler. Til gengæld mangler de en grundlæggende teknisk forståelse og viden om hvordan man udbygger og vedligeholder relativt simple systemer. Derfor nytter det ikke noget at installere en driftssikker og miljøvenlig pumpe, som for de lokale er meget avanceret. Og derfor kommer man som teknisk udviklingsarbejder til at skulle lede efter teknologier der er så robuste, bæredygtige og enkle som mulig, at de lokale har en chance for selv at varetage systemet efterfølgende.

- I 1980'erne troede vi i udviklingssektoren måske, at vi kunne kopiere de tekniske løsninger fra Europa i formatet én til én. Men vi har måtte indse, at folk i Europa og Afrika ikke har samme tilgang til services, videndeling og materialer. Derfor må vi hver gang tilpasse teknologien. Det kan virkelig være en udfordring at spotte de bedste løsninger, der både holder længst muligt, er nemme at vedligeholde og samtidig møder befolkningens reelle behov, siger Bent Kjellerup, der siden har 1980'erne har arbejdet med teknisk udviklingsarbejde i både Afrika og Asien.

For IUG er målet derfor ikke kun selve byggeriet, men også at lære lokalbefolkningerne og den lokale samarbejdspartner, hvordan de selv vedligeholder og administrerer de implementerede systemer på længere sigt. I alle IUG's projekter er lokalbefolkningen inddraget i både planlægnings- og implementeringsfasen. Afhængig af projektet bliver der eksempelvis udpeget lokale ildsjæle, der hjælper med at indsamle penge til landsbyens andel af projektets komponenter og eventuelle reservedele, og IUG sørger også for at sende materialeindkøb i udbud blandt lokale entreprenører.

- For både os og andre organisationer er det en relativt ny erkendelse, at teknikken ikke er løsningen i sig selv. Det er ikke nok at komme med systemerne, vi skal også tænke på, hvordan vi arbejder med landsbyen, dens organisering, og hvordan de lokale får ejerskab til det. Det er supervigtige komponenter i vores arbejde, siger Dorte Lindegaard Madsen.

Forstå lokalbefolkningens mentalitet

Når selve implementeringen af et projekt går i gang, så er det ikke ualmindeligt, at arbejdet skrider langsommere frem end IUG's frivillige har planlagt ud fra. Peter Kasozi oplevede under sine fem måneders praktik i Sierra Leone i 2017, at landsbyens indbyggere, som var den primære arbejdskraft bag udgravningen af render til landbyens vandledningsnet, ikke overholdt de aftalte tidsfrister. Derfor måtte han i højere grad tage styring over projektet.

Et godt råd er derfor at tage bestik af lokalbefolkningens interne hierarki og dynamik, så man ved, hvem der kan sørge for, at aftaler bliver overholdt. Eksempelvis henvendte Peter Kasozi sig til landsbyens høvding, da lokalbefolkningen udskød deres opgave med at grave render.

- IUG kan ikke ændre folks mentalitet i løbet af nogle måneder, men hævdingen forstår befolkningen meget bedre, end jeg gør, og resultatet blev da også, at gravearbejdet ikke tog de forventede 30 dage, men tre dage, siger Peter Kasozi, som til dagligt læser på Aalborg Universitet.

- Som udviklingsarbejder og projektleder må man være klar til at kontrollere processen, nok også mere end man er vant til hjemme i Danmark. Tingene skal gøres i et tempo, som vi, vores søsterorganisation og de lokale entreprenører forventer. Men vi må heller ikke spænde buen for hårdt, for så går det ud over samarbejdet, siger Per Jacobsen, der er projektleder på IUG's WASH projekter og har arbejdet i Sierra Leone og andre afrikanske lande flere gange.

Som frivillig skal man derfor være forberedt på, at opgaven kræver både kræver ingeniørfaglige og personlige kompetencer. Tålmodighed, is i maven og kulturel forståelse er mindst lige så vigtigt som viden og håndværksmæssige kompetencer.

- I Sierra Leone er der ikke de store sæsonudsving, som vi kender i Vesten. Jeg tror, at det ligger dybt i os, at vinteren kommer på et tidspunkt, og at vi for at overleve bliver nødt til at planlægge os ud af det. I et land som Sierra Leone lever man mere fra dag til dag, simpelthen fordi man ikke har behov for langtidsplanlægning. Det er en viden vi skal tage med ind i vores projekter, for det kan tage toppen af de værste frustrationer. Vi skal altså dyrke nogle sider af os selv, som vi ikke traditionelt forbinder med ingeniørfaget, men som i stigende grad bliver bygget ind i uddannelsen, siger Dorte Lindegaard Madsen.

Lær fra de bedste og stil en hulens masse spørgsmål

Hvad kan den grønne og uprøvede ingeniør, der står overfor at skulle ud på sit første projekt i Sierra Leone, gøre for at forberede sig – udover at lave en grundig research på landet, klimaet, historien osv.? Spørger man de erfarne IUG-folk vil den vigtigste forberedelse altid være den mentale. For eksempel skal man indstille sig på, at det at være på feltarbejde i forbindelse med et udviklingsprojekt ikke er en badeferie, og man skal lægge sine turisttanker fra sig, når man beslutter sig for at tage af sted.

I det hele taget er det en god idé at komme under vingen på en af de erfarne ingeniører, som har arbejdet i både Sierra Leone og andre udviklingslande i mange år.

- IUG er privilegeret ved, at vi har nogle frivillige med en enorm erfaring fra udviklingsprojekter og som selv har prøvet begå de typiske begynderfejl. Så selvom de uprøvede ingeniører ofte tager afsted med et stort engagement og et helt uundværligt gåpåmod, så vil jeg klart anbefale at man suger til sig og lærer af erfaringerne. Mentorer og "under vingen" er derfor en model vi i stigende grad benytter, når vi etablerer vores projektgrupper, siger Dorte Lindegaard Madsen.

Og så er evnen til at stille spørgsmål helt uvurderlig.

- Som projektleder vil du sommetider stå over for at skulle træffe hurtige beslutninger i uforudsete situationer, og det kan vise sig at de informationer du har til rådighed ikke svarer til virkeligheden. Vi vidste for eksempel ikke, at en af de sundhedsklinikker, hvor IUG skulle installere solceller havde gamle solcellesystemer, som ikke virkede længere. Kunne vi bruge noget af det eller kunne det bruges andre steder? Og hvad med de gamle batterier? Skulle vi finde en måde at bortskaffe dem på, så de ikke var til fare for folk? Der hober sig en masse spørgsmål op, og det kan være nødvendigt at stille det samme spørgsmål 10 gange på forskellige måder indtil du får et svar, du kan bruge til noget, siger Helga Hubeck-Graudal, som i 2018 var 14 dage i Sierra Leone som projektleder på solcelleprojektet.

Udsæt ikke dig selv for unødigt fare

Som udsendt frivillig bliver man ikke indkvarteret i den landsby, hvor projektet pågår, men på et hotel eller motel i den nærmeste større by. Og selvom det kan være fristende at blive og overnatte i landsbyen for at følge projektet tæt og sikre fremdriften, så vil det typisk være noget IUG fraråder af sikkerhedsmæssige årsager, men også fordi risikoen for at få malaria eller andre sygdomme er større, når man bor helt lokalt. Og at kaste sig op på en motorcykel for at spare transporttid er direkte livsfarligt på grund af de dårlige veje. Men hvis man tænker sig om, passer på hinanden og ikke udsætter sig selv for unødigt fare, så venter der en oplevelse ud over det sædvanlige.

- Min egen erfaring er at det er en kæmpe oplevelse at arbejde i felten i Sierra Leone - på godt og ondt. Det er ikke til at sige hvad der sker den næste dag, og når man skal ud til sites, tager det over to timer af jordveje igennem bushen, som minder om udtørret floder. Her står den på improviseret arbejde under solen med halvdelen af landsbyens børn som publikum. Folket hernede er til gengæld meget nysgerrige og hjælpsomme med en lyst til at se en positiv forandring, så tingene ender altid med at lykkes på en eller anden måde, siger Frederik Kragh, der er studerende på DTU. I 2018 var han tre måneder i praktik i Sierra Leone på WASH-projektet.

Ingeniørernes 10 bedste råd

1. Research værtslandet, så du er bekendt med landets historie, klima og kultur.
2. Vær forberedt på, at din traditionelle tilgang og umiddelbare tekniske løsning skal og vil blive modificeret til lokale forhold.
3. Forvent, at opgaver tager længere tid end normalt, og at der nemt opstår forsinkelser på eksempelvis byggematerialer.
4. Vær klar til at holde projektet i kort snor og følge op på aftaler og tidsfrister.
5. Hold øjne og ører åbne, så du bedre forstår lokale dynamikker og spilleregler.
6. Find den rette balance mellem at styre udviklingsprojektet og lade lokalsamfundet have ejerskab over opgaverne.
7. Sug til dig af viden fra de erfarne ingeniører.
8. Bliv ved med at stille spørgsmål til du får et svar du kan handle på.
9. Overhold sikkerhedsanvisningerne og udsæt ikke dig selv for unødigt fare.
10. Vær forberedt på meget transporttid, hvis du skal ind i landet.