

Final report on the project "Improving pediatric medical care for the "Hôpital Évangelique UEEB Bembéréké" hospital in Benin with a photovoltaic system"

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The Republic of Benin is a country in West Africa. It borders Togo to the west, Burkina Faso and Niger to the north, Nigeria to the east and the Gulf of Guinea to the south. The capital of the Republic of Benin is called Porto-Novo, which means 'new port'. The economically most important city in Benin, with one of the largest ports in West Africa, is Cotonou
Benin is ranked 159th out of 194 countries in terms of gross national income per capita (Atlas method) at USD 1,370 per year (source: Federal Statistical Office)4
In just 42 years, Benin's population has grown from 3.3 million people in 1979 to 12.5 million in 2021. Given today's high fertility rate of 4.7 children per woman, the population will continue to grow. A large proportion of Benin's population, 41.7%, is under 15 years old. Only 3.3% of the population is 65 or older. While a young population potentially represents a large labor force in the future, it places a heavy burden on the working-age population (15 to 64 years old) to provide the basic needs and services of children and youth, such as education and health must provide. (Source: Basic table for Benin from the Federal Statistical Office)
In the global South, and in Benin in particular, poverty, a lack of education and poor infrastructure prevent the population from receiving comprehensive medical care4
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According to World Health Statistics 2021, Benin has 0.6 doctors per 10,000 inhabitants. This puts Benin in 183rd place out of 194 countries in the country ranking. In comparison, Germany ranks 25th with 43 doctors per 10,000 inhabitants4
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The unstable electricity grid in Benin leads to power cuts several times a day. These can lead to life-threatening situations during a critical phase of an operation or treatment. Although the hospital has an outdated emergency power generator (diesel generator), this does not provide an uninterrupted power supply. At the same time, power failures shorten the service life of

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	Almost 42% of the population in Benin is under the age of 15, which means that the hospital treat 180,000 children up to the age of 15, or 540,000 children up to the age of 15 as a reference hospital. These children are the target group that the association Kinderchirurgie in Afrika e.V. addresses with the activities described above	
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1. Project initiator and owner of the project

The project "Improving pediatric medical care for the "Hôpital Évangelique UEEB Bembéréké" hospital in Benin through a photovoltaic system" was initiated at the beginning of 2022 by the association **Kinderchirurgie in Afrika e.V.** (https://kinderchirurgie-in-afrika.de/). The association was responsible for collecting the funds required to finance the project (fundraising), project management and the organization of all tasks between all project participants.

The association **Kinderchirurgie in Afrika e.V.** (https://kinderchirurgie-in-afrika.de/) is a non-profit association based in Stuttgart with the aim of improving pediatric surgical care in Africa. The association was founded in 2018.

- The aim of the association is to support pediatric medical care by supporting local projects in which children are examined, operated on and treated. At the same time, local staff and doctors are trained in these areas and enabled to carry out some or all of the treatment themselves. The association also supports other measures such as courses and internships for local staff and improving equipment.
- A team of pediatric surgeons, anesthesiologists and nurses flies to Bembéréké/Benin regularly (on average twice a year) for approx. 2 weeks to carry out the above-mentioned activities.
- Patients in Benin typically have no health insurance and therefore have to pay for medical treatment themselves. Due to a lack of financial resources, this often means that families either visit a hospital extremely late or, in the worst case, never take their children for necessary treatment. The association therefore finances the medical treatment and operations of children on a pro rata basis and also provides the financial means for follow-up treatment where necessary. Thanks to this financial support, children whose families do not have the means to have their children treated medically can also benefit from medical treatment.
- The association finances its activities through membership fees, donations and the helpers' own financial commitment. All those involved in the association work on a voluntary basis. The association's administrative and advertising costs (currently 1.5%) are covered entirely by membership fees. Donations go 100% to the projects.
- The association's budget currently amounts to around €35,000 per year (not including the photovoltaic project).
- For the "Photovoltaic system for the hospital in Bembéréké" project, the association Kinderchirurgie in Afrika e.V. had around €44,400 of its own funds from donations from private individuals and a further €196,981 from federal funds, donations from companies and aid organizations. With these funds, the financing of the project, which we have divided into two expansion stages (expansion stage 1 - 3* operating rooms, expansion stage 2 pediatrics and neonatology) is secured.

2. Facts about Benin

- The Republic of Benin is a country in West Africa. It borders Togo to the west, Burkina Faso and Niger to the north, Nigeria to the east and the Gulf of Guinea to the south. The capital of the Republic of Benin is called Porto-Novo, which means 'new port'. The economically most important city in Benin, with one of the largest ports in West Africa, is Cotonou.
 - In 1990, Benin adopted a new liberal constitution and free and democratic parliamentary elections followed a year later. The country was given the name Republic of Benin. Today, more than 12 million people live in Benin. There are over 58 ethnic groups with just as many different languages. The official language is French.
 - The Federal Republic of Germany has maintained diplomatic relations with Benin since 1960. The focus is on development cooperation.
- Benin is ranked 159th out of 194 countries in terms of gross national income per capita (Atlas method) at USD 1,370 per year (source: Federal Statistical Office)
- In just 42 years, Benin's population has grown from 3.3 million people in 1979 to 12.5 million in 2021. Given today's high fertility rate of 4.7 children per woman, the population will continue to grow. A large proportion of Benin's population, 41.7%, is under 15 years old. Only 3.3% of the population is 65 or older. While a young population potentially represents a large labor force in the future, it places a heavy burden on the working-age population (15 to 64 years) to provide the basic needs and services of children and youth, such as education and health. (Source: Benin basic table from the Federal Statistical Office)
- In the global South, and in Benin in particular, poverty, a lack of education and poor infrastructure prevent the population from receiving comprehensive medical care.
 - According to the WHO, Benin has 0.5 hospital beds per 1,000 inhabitants. In Germany, there are 8 hospital beds per 1,000 inhabitants
 - According to World Health Statistics 2021, Benin has 0.6 doctors per 10,000 inhabitants. This puts Benin in 183rd place out of 194 countries in the country ranking. In comparison, Germany ranks 25th with 43 doctors per 10,000 inhabitants.
 - According to the UN, the infant mortality rate in Benin in 2021 is 83 children per 1,000 births. In comparison, the infant mortality rate in Germany in the same year is 3.6 children per 1,000 births
- Photovoltaics plays a decisive role in the future development of energy in Benin. With solar radiation of ≤6.1 kWh/m2/day, the sun shines for 8 hours a day (Source: Mensah JHR, do Santos IFS, Filho GLT. A critical analysis of the energy situation in the Republic of Benin and its development over the last decade. Renew Energy, 2023, 202:634-650).

3. Problem description and Procedure

- Hospitals in Benin in no way meet German or European standards. In addition to staffing deficits, they lack technical equipment in particular.
- The unstable electricity grid in Benin leads to power cuts several times a day. These can lead to lifethreatening situations during a critical phase of an operation or treatment. Although the hospital has an outdated emergency power generator (diesel generator), this does not provide an uninterrupted power supply. At the same time, power failures significantly shorten the service life of technical equipment due to the associated severe power fluctuations. The shortened service life of technical devices caused in this way results in new acquisition or repair costs, which in turn are reflected in increased treatment costs. This is one of the reasons why, from a financial point of view, a stay in hospital becomes unaffordable for many residents of Benin.
- The team of doctors repeatedly experienced an average of six power cuts a day during their missions in Benin. At the beginning of 2022, during one of their missions in Benin, the doctors had the idea of supplying the areas responsible for the medical care of the children (3* operating theaters, paediatrics and neonatology) with solar power using a photovoltaic system with electricity storage.
- In the first expansion stage of the photovoltaic system, the three existing operating theatres will be supplied with solar power. In the second expansion stage, the pediatrics and neonatology departments will be supplied with solar power. The financing for both expansion stages was secured through private donations, federal funds and financial support from companies and aid organizations.
- Our technical team installed SmartMeters in the hospital in mid-2022, which provided us with the data we needed to plan expansion stages 1 and 2.
- The photovoltaic system was planned and dimensioned by our technical team. The material required for the implementation of expansion stage 1 was tendered and procured by Begeca gGMBH and the transport to Benin was organized. The material required for the implementation of expansion stage 2 was procured via Helion Energy AG in Switzerland. The transport was organized by the association.
- Based on the electricity consumption measured via the SmartMeter, the photovoltaic system was dimensioned with an output of 195 kWp and a storage capacity of 182 kWh
- The structural measures required for the inverters and electricity storage units were planned accordingly and implemented on the hospital grounds as part of the project.

4. Target groups

- The Protestant hospital "Hôpital Évangelique UEEB Bembéréké" in Bembéréké/Benin is a private denominational hospital of the Union of Protestant Churches of Benin (UEEB). As a regional hospital, the hospital primarily serves a population of approx. 400,000 people; as a reference hospital, the catchment area covers approx. 1.2 million people.
- Almost 42% of the population in Benin is under the age of 15, which means that the hospital treats 180,000 children up to the age of 15, or 540,000 children up to the age of 15 as a reference hospital. These children are the target group addressed by the association Kinderchirurgie in Afrika e.V. with the activities described above.
 - In 2018-2021, the hospital in Benin treated an average of 9,200 children per year in pediatrics and 930 children per year in neonatology.
- In addition to pediatrics and neonatology, we also supply the operating theatres with solar power and adults are also operated on in the operating theatres, so all patients who are operated on in the hospital benefit from the solar system.

5. Project goals and project partners

- The safety of medical care for children in the "Hôpital Évangelique UEEB Bembéréké" hospital in Benin will be significantly improved by the photovoltaic system.
 - Life-threatening situations caused by a power failure during critical treatment of children (e.g. during an operation) are eliminated by the photovoltaic system.
 - Critical medical treatments can be carried out independently of the unstable local power grid
- The independence from the public power grid achieved with the photovoltaic system reduces electricity costs. Further cost savings result from the longer service life of the electro-medical devices.
 - Depending on the expansion stage, electricity costs are reduced by up to €30,000 per year.
 - The service life of electromedical devices is increased by up to a factor of 5.
 - Due to the longer service life of the electromedical devices, we expect further savings of around €50,000/year.
 - These cost savings are largely used to reduce treatment costs, which in Benin have to be borne by the patients themselves, and thus relieve the financial burden on patients and their families or make treatment possible in the first place
- The photovoltaic project supports Benin's sustainability goals.
 - Benin is aiming to electrify 50 percent of its rural areas from renewable energies by 2025 (source: <u>The Infrastructure Consortium for Africa (ICA)</u>).
- Through the photovoltaic project at the "Hôpital Évangelique UEEB Bembéréké" hospital in Benin, we are creating and securing local jobs. Our local partner "<u>Centre de Formation Liweitari</u>" (CFL) was founded in 2009 by the Swiss Heinrich Roth in Benin to offer professional vocational training for local young people. The CFL offers young people from all over Benin the opportunity to receive training in various fields (bricklaying, polymechanics, electrics, car mechanics, organic farming). The CFL promotes long-term, positive development in the local economy and society by offering young people from all social backgrounds, regardless of tribe, religion or gender, high-quality, comprehensive vocational training in theory and practice. The skilled workers trained in this way quickly bring their knowledge to the job market and play a leading role in the country's development through their active and responsible actions. The CFL actively supported us during the planning phase and carried out the installation together with our PV expert Uwe Buchwitz. The CFL will also be responsible for maintenance for the first two years.
- The company <u>Begeca gGmbH</u> supported us in project phase one with its technical expertise and excellent purchasing conditions, in addition to financial support from the Catholic Central Agency for Development (KZE).
- The company <u>Helion Energy AG</u> supported our project with 400 PV modules, which were made available to us at prices significantly below the market rate.

6. Current status / acceptance

- The photovoltaic system was installed in the hospital as planned in March/April 2024 and officially handed over to the hospital on April 26, 2024.
- After more than two years of intensive planning and preparation, the chairman of the hospital's supervisory board, the president of the UEEB (Association of Protestant Churches in Benin), thanked all those involved at a small inauguration ceremony for the handover of the photovoltaic system to the hospital.
- The photovoltaic system now ensures an uninterruptible power supply for three operating theaters, the paediatric clinic and the neonatal ward. This means that the times of an average of 5 power cuts per day are now a thing of the past, at least in these areas.
- The hospital's technical staff were familiarized and instructed with the system during installation. Our project partner CFL was commissioned by us as part of this project to take over and ensure maintenance for the first two years.
- This completes the project "Improving pediatric medical care for the "Hôpital Évangelique UEEB Bembéréké" hospital in Benin with a photovoltaic system" in expansion stages 1 and 2 for the association "Kinderchirurgie in Afrika e.V.". The system works as planned and supplies electricity for the 3 operating theaters (expansion stage 1) and the pediatrics and neonatology departments (expansion stage 2).

7. Acknowledgments

In total, the system cost just over €240,000 including all costs and maintenance for the first two years. On behalf of the association "Kinderchirurgie in Afrika e.V." and the hospital "Hôpital Évangelique UEEB Bembéréké" in Benin, we would like to thank everyone who believed in the success of our project and made it possible through their financial support and sponsorship. Our thanks also go to

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- **Dr. Hartwig Sauter,** who was responsible for coordination and communication between the hospital and our project manager,
- **Uwe Buchwitz**, who actively supported us on a voluntary basis with the planning and installation of the system,
- our association member **Urban Niesser**, who also took over the project management and the procurement of financial resources on a voluntary basis, and to the
- "Centre de Formation Liweitari" for the good cooperation and support on site during the preparation and installation of the system.

We had a board printed with all the companies and organizations and put it up at the hospital.

KINDERCHIRURGIE	Diese Photovoltaikanlage wurde im April 2024 installiert und dem Krankenhaus vom Verein Kinderchirurgie in Afrika e.V. gespendet.		Ce système photovoltaique a été installé en avril 2024 et offert à l'hôpital par l'association Kinderchirurgie in Afrika e.V.
in Afrika e.V.	Die Anlage hat eine Leistung von 195kWp und eine Speicherkapazität von 182kWh	KINDERCHIRURGIE in Afrika e.V.	Le système a une puissance de 195kWp et une capacité de stockage de 182kWh.
	Das Projekt wurde finanziell von privaten Spendern von folgenden Organisationen und Firmen gefördert:	v	Le projet a été soutenu financièrement par des donateurs privés et par les organisations et entreprises suivantes:
BEGECA	Die Firma Begeca Beratung – Beschaffung – Logistik gemeinnützige GmbH unterstützt unser Projekt mit ihrer fachlichen Kompetenz und ihren eszellenten Einkautsbedingungen sowie mit Mitteln der Katholischen Zentralstelle für Entwicklung e. (V. (ZE)		La société BEGECA gOmbH soutient notre projet grâce à son expertise professionnelle et à d'excellentes conditions d'achat ainsi qu'à des fonds provenant de la Katholische Zentralstelle für Entwicklung e. V. (KZE).
HERZ FÜR KINDER	Elitvincaung er. v. (v.c.) BILD hilft e.V. "Ein Herz für Kinder" ist eine international aktive Hilfsorganisation, gegründet 1978 von Axel Springer.	EIN HERZ FÜR KINDER	BILD hilft e.V. "Ein Herz für Kinder" est une organisation d'aide internationale fondée par Axel Springer en 1978.
	Kindermissionswerk 'Die Sternsinger' e.V. Die Aktion Dreikönigsaingen ist die bekannteste Aktion des Kindermissionswerka. Die beim Sternsingen und anderen Aktionen eingeworbenen Spenden flußen in unsere umfangreiche Projektarbeit.		Kindermissionswerk 'Die Sternsinger' e.V. La campagne de Dreikönigssingen est La campagne la plus connue de Kindermissionswerk. Les dons récottés grâce aux chants de Noël et à d'autres campagnes sont utilisés pour notre vaste travail de projet.
Ilutinger Jeitung	Nürtinger Zeitung mit der Aktion "Licht der Hoffnung". Seit 32 Jahren richten Nürtinger und Wendlinger Zeitung die Aktion "Licht der Hoffnung" zugunsten von sozialen Projekten aus.	1100000 Jeitung	Nürtinger Zeitung avec la campagne "Licht der Hoffnung". Depuis 32 ans, Nürtinger et Wendlinger Zeitung organisent la campagne "Licht der Hoffnung" au profit de projets sociaux.
Deviations for a good cause ProCent	Marcedes-Benz Group AG mit der Initiative Mercedes-Benz Group <u>PtoCent</u> , Seit dem Start im Dezember 2011 hat cile "Initiative Mercedes-Benz Group <u>PtoCent</u> ", für der 1800 gemeinnützige Projekte Fördermittel von mehr als 12 Millionen Euro freigegeben.	Constitutes for a good tasks ProCent Water Annual States (A states)	Mercedes-Benz Group AG avec l'Initiative ProCent du groupe Mercedes-Benz. Depuis son lancement en dicembre 2011, l'Initiative ProCent du groupe Marcedes-Benz' a dibloqué plus de 12 millions d'euros pour financer plus de 1 800 projets caritatis.
C Cents for help	Aktion, von Bosch "Cents-for- <u>Help"</u> Die Aktion "Cents-(gs-Help" lat eine gemeinsame Initiative von Mitarbeiten der Robert Bosch GmbH und dem gleichnamigen Unternehmen, bei der bundesweit die Nitarbeiter freiwilligigieden Monat die Cent-Beträge ihrer Gehaltsabrechnung spenden.	Cents for help	Campagne "Cents-for-Help" de Bosch. La campagne "Cents-for-Help" est une initiative conjointe des associés de Robert Bosch GmbH et de l'entreprise du même nom, dans le cadre da laqueil les associés de toute l'Altemagne font volontairement don des centimes figurant sur leur fiche de pale chaque mois.
Le Helion	Die Firma Helion Energy AG unterstützt unser Projekt mit 400 PV-Modußle, die uns deutlich unter den marktüblichen Preisen zur Verfügung gestellt wurden.	Le Helion	La société Helion Energy AG soutient notre projet avec 400 modules photovoltaiques, qu'elle nous a proposés à des prix fortement subventionnés.
Wir bedanken uns im Nam	en des Vereins und des Krankenhauses bei allen Unterstützern, die dieses Projekt ermöglicht haben Der Vorstand vom Verein Kinderchirurgie in Afrika e.V.	and the state of the state of the state of the state of the	L'hôpital, nous tenons à remercier tous les donateurs qui ont rendu ce projet possible. Il d'administration de l'association Kinderchirurgie in Afrika e.V.