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CLIENT II
International Partnerships for Sustainable Innovations

LevelUp – Upgrading local markets through the use of biogenic waste products

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Ghana is facing major challenges within the energy sector. While a few years ago, power cuts were commonplace due to falling water levels at hydropower plants, there is currently a surplus of electricity on account of imported fossil fuels. Together with other international partners, the Rottenburg University of Applied Forest Sciences (Hochschule für Forstwirtschaft Rottenburg, HFR) and its partner university, the University of Energy and Natural Resources in Sunyani (UENR), aim to create a sustainable counter-model: by developing and constructing a regional energy park with a view to providing an independent and stable supply of low-emission bio-energy, while at the same time supporting the local circular economy.

Current problems and proposed solutions

Ghana's electricity supply has changed significantly. While regular power cuts previously proved the main problem, the country is now facing a costly energy surplus accompanied by persistent grid instability. This problem is a consequence of climate change: falling water levels have resulted in a decrease in the productivity of hydropower stations, such as the Akosombo Dam, which alone accounts for approx. 20 percent of the country's generation capacity. In response, the government concluded long-term contracts on the import of fossil fuels, which have driven up energy prices for consumers. At the same time, plans for a sustainable energy supply (such as the Renewable Energy Master Plan – REMP) and the funding of corresponding projects have fallen by the wayside. The country has huge potential with regard to renewable energies, which must be utilised in the medium and long-term in order to achieve a clean, reliable and affordable energy supply.

Against this backdrop, the LevelUp project is looking for sustainable and innovative solutions. An energy park is to make a wide range of products available on the basis of previously unutilised waste products from agriculture and forestry. Alongside the generation of electricity, the project team also focuses on the supply of cooling energy – a significant point in light of the fact that compression-based refrigeration machines account for 60–80 percent of power consumption in public and office buildings. There is also further need for refrigeration within the food production and storage industries, with a view to increasing local value. In addition, the project team has planned for a biogas plant, which will generate gas for cooking; this in turn aims to replace the hazardous practice of cooking over open wood fires, which is particularly prevalent in rural areas. Local farmers and forestry workers will also benefit: the energy park's ash, biochar and digestates will be used to produce biological fertilisers, closing local nutrient cycles and improving soil quality.

The LevelUp project team at the symbolic ground-breaking ceremony for the launch of the project in Sunyani, December 2022.

The LevelUp approach

The factors that make the project's approach unique are the location, the variety of input materials and products, the comprehensive accompanying research and the modular technology system. The latter enables transferability as it allows operators to respond flexibly to different local conditions and requirements. On the campus of the UENR in Sunyani, the project team will combine a solar biomass drying plant, a biomass gasifier with an associated combined heat and power (CHP) unit and an absorption refridgerator, which will obtain its energy from the CHP unit's waste heat. The cooling energy will be used on-campus for cold

chains in the natural sciences departments and the university clinic, while the generated electricity will ensure a stable power supply to the university campus. A second process chain consists of a wet fermentation biogas plant, which is adjoined to a constructed wetland and a composting system which will be operated in parallel. The biogas can either be used as gas for cooking, as an alternative to LPG or wood, or can be fed into the CHP unit. The compost will be combined with ash, biochar and the residual materials from the gasification process to produce an effective mineral-organic bio-fertiliser. This creates a closed system, in the sense of a circular economy, whereby modular components can be re-combined in a location-specific manner.

Long-term prospects

In addition to providing scientific support during the configuration, design and operation of the facilities, the project team will also develop modular training programmes for those operating the plants on-site. The plants will be transferred to a private-public partnership operator model, allowing the continued operation of the plants in future.

The project team has ensured it can reach its objectives by cooperating with project partners with international experience. The system is unique with regard to the composition of its components, and can be implemented at other locations in West Africa and beyond. To this end, the team will hold workshops for interested operators throughout the duration of the project.

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