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INDUSTRIAL DEVELOPMENT ORGANIZATION

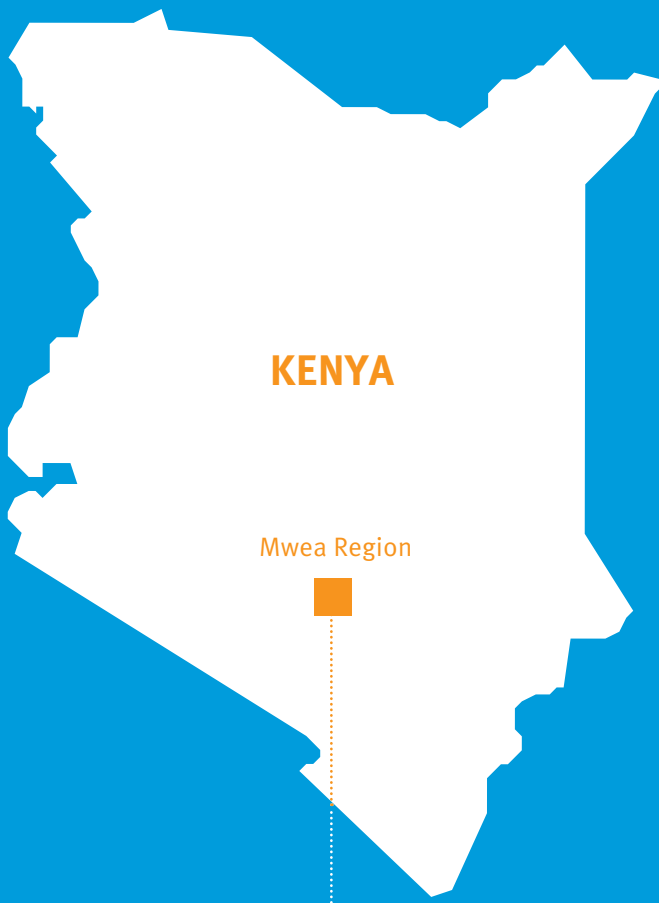
PROMOTING INNOVATIVE GREEN ENERGY SOLUTIONS IN KENYA

ULH-MHP PROJECT IN KENYA

FACILITATING THE DEVELOPMENT OF AN INDUSTRIAL PLATFORM FOR ULTRA-LOW
HEAD MICRO HYDROPOWER SECTOR THROUGH PILOT DEMONSTRATION AND BUILDING
PRODUCTIVE CAPACITY IN KENYA



INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT



KENYA

Mwea Region

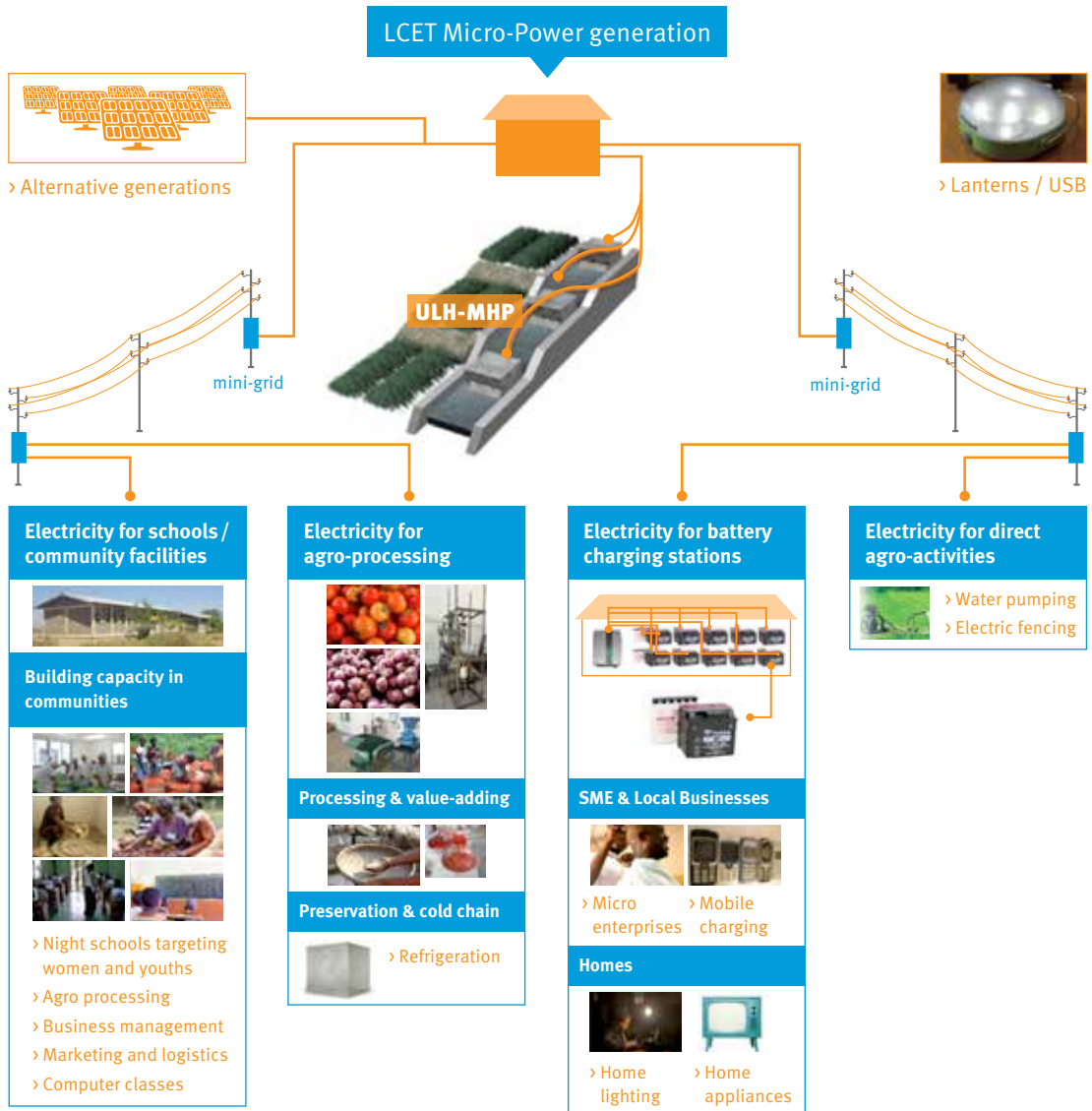


Summary

In 2015, the first ultra-low head micro hydropower (ULH-MHP) system installation in Kenya was completed in the main canal of the Mwea Irrigation Scheme led by the collaborative effort by the Governments of Kenya and Japan, Kirinyaga County and UNIDO. Moreover, UNIDO's work in the respective communities is complemented by the communities' involvement from the very beginning in planning, sensitizing, and installation of the ULH-MHP technology, enhancing the overall impact on the project. This project showcases an innovative green energy technology from Japan, which will be linked to productive uses to support the rural community's sustainable development. Furthermore, the project aims to build a self-sustaining community based mini-grid network based on the ULH-MHP technology as a best practice model for further dissemination.

- ❖ Linking sustainable energy services to productive uses to stimulate economic growth
- ❖ Adopting innovative business model facilitating use of new technologies, services and products and make everyday activities more sustainable
- ❖ Replicating 10kWULH-MHP installations in other areas of Kenya
- ❖ Creating sustainable jobs, which generate income and stimulate entrepreneurial opportunities and development of small businesses
- ❖ Strengthening institutional mechanisms for improved policy formulation to monitor and guide provision of rural energy services
- ❖ Actively promoting a multi-stakeholder and multi-disciplinary approach to strengthen the links to government policy development and industry application
- ❖ Establishing linkages to the Joint Crediting Mechanism (JCM), Japan's Bilateral Offset Credit Mechanism

IMAGE OF PRODUCTIVE USES (LCET COMMUNITY)



Project Background

Low carbon technologies have emerged as a potential solution that can address key global challenges of economic growth and social inclusion, access to clean energy, and climate action. Electricity demand in Kenya is significantly rising mainly due to accelerated productive investment and an increasing population. **Over 85% of the population relies on traditional fuels (e.g. wood, charcoal, dung, agricultural residues) for cooking and heating.** Moreover, many rural areas are not reached by grid-based electrical power, nor is there adequate distribution of gas or other cooking and heating fuels. **Approximately 70% of Kenyan households do not have access to electricity.** With the adoption of the Kenya Vision 2030, Kenya's policy direction is clear in accelerating universal access to clean energy.

Significant potential to generate electricity from ultra-low head micro hydropower was identified in Kenya through a feasibility study conducted by the New Energy and Industrial Technology Development Organization (NEDO), an agency under the auspices of the Ministry of Economy, Trade and Industry of Japan. The framework of this project was developed with strong interests and supports from national stakeholders lead by the Ministry of Industrialization and Enterprise Development, Ministry of Energy and Petroleum, the National Treasury, Ministry of Agriculture, and the National Irrigation Board (NIB). Based on the outcomes of the Consultation Workshop held in Mwea in March 2014 and the National Stakeholder Meeting in Nairobi the following May, the project "Facilitating the development of an industrial platform for ultra-low head micro hydropower sector through pilot demonstration and building productive capacity in Kenya" was developed.

THE PROJECT CONSISTS OF THREE COMPONENTS



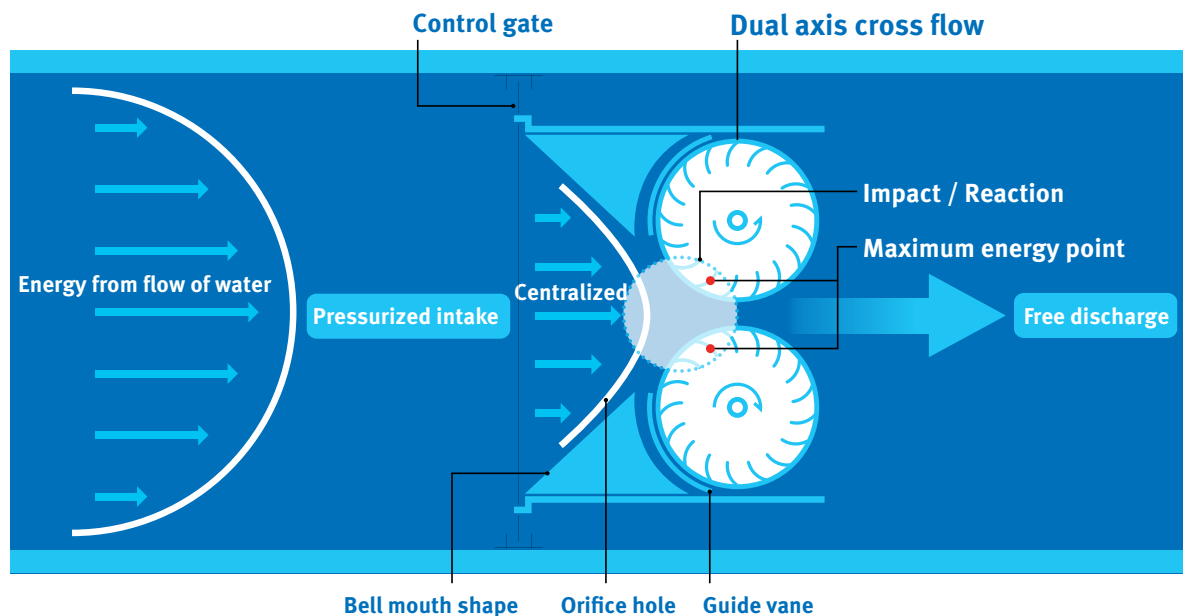
STAKEHOLDERS LIST

- Ministry of Industrialization and Enterprise Development (**MOEID**) – UNIDO Line Ministry and Project Steering Committee Chair
 - Ministry of Energy and Petroleum (**MOEP**)
 - Ministry of Environment and Natural Resources (**MENR**)
 - The National Treasury
 - Ministry of Water and Irrigation (**MOWI**)
 - Ministry of Agriculture Livestock and Fisheries (**MOA**)
 - The National Irrigation Board (**NIB**)
 - Kirinyaga County
 - Irrigation Water Users Association (**IWUA**)
 - Kenya Industrial and Research and Development Institute (**KIRDI**)
 - Jomo Kenyatta University of Science and Technology (**JKUAT**)
 - Kirinyaga University College (**KyUC**)
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The ULH-MHP Technology

This innovative ULH-MHP technology can be plugged into a man-made waterway to generate power (e.g. irrigation scheme canals) with minimal civil works involved, easing effectiveness to the environmental and social surroundings eliminating major costs of installation. Key pros such as compact structure ease of installation and maintenance, and relatively hi operation hours make the technology ideal for decentralized power generation.

The dual vertical axis cross-flow turbine generator produces electricity with head of less than three meters. The system is comprises mainly of simple fabrication with generic replaceable parts that can be easily machined and assembled on site. In addition, on-site maintenance and trouble-shooting can easily be carried out and makes maintenance quite simple for any trained operator.



Installation Sites on MIS

Two installation sites in the Mwea Irrigation Scheme (MIS) with sufficient head drops ($>0.53.0m$) were selected to each install 10kW ULH-MHP systems, to generate 20kW combined. The drops are located on the main canal at the border Kiuria village, one of the Mwea village communities.

MIS was selected based on technical criteria (e.g. less than three meters of head, channel width over two meters, controllable water flow, concrete or stone lining) suitable for deployed technology and canal structure indicative for replication. Furthermore, close proximity to the Kenyan capital city of Nairobi (120km) for demonstration and above all strong community interests with NIB facilitation were the key factors for selection.



**BEFORE AND AFTER INSTALLATION
OF THE ULH-MHP AT THE MWEA IRRIGATION
SCHEME CANAL**

Strong Local Community Commitment from Kiuria Village

The main beneficiary community under this project is from Kiuria village which is located at the Mwea section of the irrigation scheme along the main canal of Thiba which is part of the Mwea-west sub County of Kirinyaga County. The village is about 10km from Wangúru town which is a major commercial center at the Mwea Irrigation Scheme area. It neighbors Kangichiri village to the northwest and Nguka village to the southeast. Moreover, the village is adjacent to six drops along the main canal, two of which have been selected for the pilot installation project. Approximately 4,700 inhabitants can be counted at Kiuria village.

The main economic activity of the beneficiary community is rice farming. The community engages in rice farming related activities such as rice drying, rice milling and hay processing. Being a labor intensive kind of farming, rice engages a majority of the workforce in the area. A minority is involved in other businesses such as retail shops, mini-restaurant, barbershop and civil service jobs such as teaching. Other crop farming such as maize, kales and arrow roots is mainly for subsistence with the surplus taken to market. Dairy farming and poultry farming are also at a subsistence level. A few farmers practice domestic fishing within the scheme with mud-fish being the prominent fish found as well as some tilapia.

EXPECTED OUTCOMES FOR THE COMMUNITY OF THE KIURIA VILLAGE

- Enhanced income through productive use such as agro-processing and small service businesses (i.e. hair salons)
- Longer hours through lighting provided in the households at night provides children with a chance to study. Furthermore, uneducated adults can be encouraged to organize adult education classes in the evenings after farming.
- Fuel savings and reduced workload on women through electricity generated by the ULH-MHP (i.e. kerosene usage reduces as well as the workload on women and children to collect firewood)
- Improved night time security through street lights
- Empowered local community members through additional competences and skills in operating and maintaining the ULH-MHP plant
- Improved health through access to energy generated by ULH-MHP (i.e. decreased indoor air pollution, cold storage of medicine)
- Increased access to information and knowledge through telecommunication

Emphasis on Building Local Capacity for More Effective Development

Multi-faceted capacity building trainings and sensitizing workshops have been conducted in parallel to the installation in efforts to raise awareness, elevate technical skills and know-how, and develop business opportunities in Kenya for the ULH-MHP sector.



LOCAL COMMUNITY AWARENESS TRAININGS IN MWEA



INTERNATIONAL CAPACITY BUILDING TRAININGS IN JAPAN

- Opinion Leaders Awareness Workshops: opinion leaders from various communities were familiarized with the ULH-MHP technology and its impact on the community.
- Mwea Community Awareness Forums: community members were introduced to key aspects and benefits of the ULH-MHP technology system and its link to productive uses.
- LCETs Awareness Training in Japan: targeted Kenyan policy makers to deepen their understanding on key global trends, innovative technologies, policies and inter-disciplinary solutions in the field of energy and sustainable development.
- Training for Trainers in Japan: 2-week training familiarized Kenyan energy experts and future leading trainers on ULH-MHP in Kenya with the installation, operation, and maintenance of the ULH-MHP technology system in Japan.

To establish institutional knowledge, especially in the ULH-MHP technology, one of three expert group meetings had been held to initiate institutional capacity building framework.

Going forward, operations and maintenance training in collaboration with local academic institutions is planned to empower local community members to build local capability while developing additional competences and skills in operating and maintaining the ULH-MHP plant.

THE LCET PROGRAMME AT A GLANCE

- GOAL** To transfer innovative low carbon technologies for achieving inclusive and sustainable industrial development globally.
 - THEMATIC AREA** Low carbon technologies, rural development, Off-grid productive activities
 - DONOR** Government of Japan (Ministry of Economy, Trade and Industry, METI)
 - PARTNERS** in Kenya – Ministry of Industrialization and Enterprise Development (MOIED), Ministry of Energy and Petroleum (MOEP), National Irrigation Board (NIB), The National Treasury, and the Ministry of Agriculture, Livestock & Fisheries
 - DURATION** Three years (started in 2013)
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CONTACT

United Nations Industrial Development Organization (UNIDO)

Ms. Hiromi Sugiura

Energy Branch, Climate Policy and Networks Unit

E-mail: h.sugiura@unido.org



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Vienna International Centre · P.O. Box 300 · 1400 Vienna · Austria
Tel.: (+43-1) 26026-0 · E-mail: info@unido.org
www.unido.org