



## NDIZA TURBINES

**Turbine Type: Twin Jet Pelton**

**Number of Turbines: 1**

**Power: 3.4MW**

**Net Head: 260 m**

**Flow: 1500 l/s**

**Runner Dia: 1075 mm**

**Speed: 600 rpm**

## RUO TURBINES

**Turbine Type: Twin Jet Pelton**

**Number of Turbines: 2**

**Power: 3.2MW Each**

**Net Head: 250 m**

**Flow: 1500 l/s Each**

**Runner Dia: 1075 mm**

**Speed: 600 rpm**

## Run of river Project at the foot of Mount Mulanje

Commissioning of the Ruo-Ndiza hydro power station in Mulanje, Southern Malawi was completed by Gilkes engineers in early 2020. The run-of-river project, on the river Ruo at the foot of Mount Mulanje, was carried out on behalf of Mulanje Hydro Ltd (MHL) in two phases over two years. The contract, which was awarded in mid-2018, involved the installation of three horizontal Pelton turbines in the same powerhouse.

The run-of-river project utilises the flow from two rivers – the Ruo and the Ndiza – to drive dedicated turbines in the same common powerhouse and delivers the power through a common interconnector to ESCOM, the Malawian utility.

The first phase of the project was installed and commissioned in 2018 with a 3.4MW Pelton turbine using the flow from the river Ndiza, with 2 further 3.2 MW Pelton Turbines being installed and commissioned in early 2020, harnessing the flow of the river Ruo. The schemes are located on the Lujeri tea estate where Gilkes have a long history of hydropower, installing turbines here as far back as 1934.

## Design & Civil Works

The civil works and grid connection were carried out by MHL, with the support of Gilkes Hydro. The scheme was supplied in two distinct phases with the Ndiza turbine commissioned first in 2018, and both Ruo machines commissioned in 2020. This allowed the Ndiza scheme to generate power and income, whilst civil work could be completed on the larger and more complicated Ruo scheme. Ruo was an existing scheme that was refurbished back in 2008. MHL saw the potential to move the powerhouse and gain more head which increased the scheme size from 700kW to 6.4MW. The new penstock follows the route of the existing penstock to the intake at the foot of Mt Mulanje.

## CASE STUDY

### Ruo-Ndiza, Mt Mulanje, Malawi

The Ruo Ndiza plant is designed to generate an average annual output of 22.3 GWh for supply to the national utility, ESCOM. The system has been designed and installed to allow Black Start and run islanded. This provides support to the ESCOM grid and ensures that the tea estates in the Mulanje District can maintain production with a reliable and stable power supply. When running at full power, the system accounts for ~3% of Malawi's total grid power.

#### Technical Challenges

It was identified that the electrical network was of such poor quality that the voltage fluctuations would cause significant issues with the generating capability of the proposed increase in capacity. Gilkes assisted with the grid impact study which further highlighted areas of concern including areas of weakness on the local network caused by reduced conductor sizing, poor maintenance of poles and insulators. MHL conceded that intervention was required and assisted with the network upgrade of the local area while Gilkes made design changes to the generators' capability, allowing the new station to assist with the voltage regulation and stability. The station is linked to the National Control Center (NCC), which allows the local electricity network operator (ESCOM) to have full visibility of the station and its impact on national supply, the first of its kind for an IPP in Malawi.

#### Early Turbines at Lujeri

The greenfield project replaces two existing schemes totalling around 700 kW on the Lujeri Tea Estates. Four of the five turbines at the two powerhouses, situated on the estate, were equipped with turbines previously supplied by Gilkes that had operated well beyond their design lifetimes. The first turbine was installed in the Ruo powerhouse in 1934 to supply power to the tea factory and for domestic use with a further two installed in 1946 and 1957. An additional unit was installed in the Lujeri plant in 1957.

#### Operational Status

Commissioning of the Ruo-Ndiza hydro power station in Mulanje, Southern Malawi was completed by Gilkes engineers in early 2020.

The station is running very well, matching expectations of estimated generation within its first full year of operation. The station is operating as designed and although there is no storage capacity on either scheme, together, they provide a constant source of income for MHL when the grid is available and a reliable stable source of power for all ESCOM consumers including the tea estates in the area, whose seasonal electricity demand neatly matches the seasonal nature of the run of river units. Local villagers in the project area have benefited by improved access to electricity with MHL extending the 33kV grid to local centres.

#### FURTHER SCOPE OF SUPPLY (AS PART OF THE COMPLETE WATER TO WIRE PACKAGE)

- Generator (6.6kV, 3600kVA)
- Main inlet valve (DN500, PN42)
- Control Panel (PLC with 300Ah full system autonomy)
- Transformer (6.6kV / 33kV, 4000kVA complete with all protection CT's)
- Hydraulic control module (AC & DC pumps for black-start capability)
- Switchgear 6.6kV (Schneider Genie Evo, complete with generator and transformer protection relays)
- Installation
- Commissioning





## CASE STUDY

### Ruo-Ndiza, Mt Mulanje, Malawi



Ndiza turbine & generator



Ndiza Runner



Lujeri Tea Estate



Ndiza Turbine & Generator



Penstock route & waterfall