Innovative design of the Neusberg Hydro Electric Power Project – South Africa’s first run-of-river mini-hydro under the REIPP program
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Project Background

- Site identified in 2009 by Mulilo Renewable Energy.
- Environmental and technical studies proved the project to be viable.
- The project company, Kakamas Hydro Electric Power (Pty) Ltd (KHEP), is a consortium comprising Hydro SA, Hydro Tasmania, Old Mutual and the Kakamas Community Trust.
- KHEP was awarded preferred bidder status in Round 2 of the REIPPP program.
Benefits of the Project

- The project will generate 71.9 GWh of base load energy per year with a capacity factor of 82%, enough to provide power to around 5,000 households.
- The KHEP Economic Development Plan achieves the following objectives:
  - A total of 171 jobs will be created, of which 156 will be South African.
  - The project’s local content is 78%.
  - It is envisaged that the Kakamas Community Trust will invest R62 million into the local community across its twenty year contract.
Drivers of the Design

- Design was developed to:
  - Maximise energy output
  - Minimise capital & operational costs
  - Meet the requirements of the Environmental Authorisation

- Environmental Authorisation included two specific conditions that resulted in significant design changes:
  - 33. The irrigation scheme, flow gauging requirements and standards of the Department of Water Affairs must be met before any water can be utilised by the proposed activity.
  - 34. All final designs and final layout plans for the proposed hydropower plant must be forwarded to the Department of Water Affairs for approval, before any construction activities can commence.
Drivers of the Design (cont.)

- In addition to the requirements of the Environmental Authorisation, the Department of Water Affairs required a number of concerns to be addressed:
  - Security of supply of water to the Kakamas Irrigation Scheme.
  - Maintenance of the aquatic environment downstream of Neusberg Weir.
  - Maintain the flow measurement functionality of the Neusberg Weir as a gauging site.
  - Minimal effects from construction activities in the vicinity of DWA/Water Users Association structures.
Scheme Layout

Background Image Source: "Neusberg", 28°46'2.83"S and 20°44'0.19"E, Google Earth, 9th November 2010, 12th July 2012.
Design Details

- The 10 MW Neusberg Hydro Electric Power Project consists of:
  - An offtake weir and 130m of inlet canal
  - An inlet structure fitted with a radial gate
  - 1400 m of open canal waterway
  - A reinforced concrete forebay structure
  - A partially buried powerhouse
  - 300 m long tailrace canal
  - A 21km long 33 kV transmission line to the Eskom distribution network.
Design Details – Offtake Weir & Inlet
Design Details – Offtake Weir and Inlet

- 100m long offtake weir provides passive protection against drawdown of weir pool water levels.
- Water conveyed around the north embankment of Neusberg Weir to inlet structure via inlet canal.
- Inlet structure fitted with single radial gate, which will close in case of high or low water levels.
- Stoplog slot will be built into structure
Design Details – Canal and Forebay
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- 1400m long x 8m wide canal conveys water from the inlet to the forebay.
- Alignment runs parallel to existing irrigation canal.
- 300,000 m³ of material to be excavated and stockpiled
- Acoustic Doppler flow measuring device installed in canal to meet DWA flow measurement requirements.
- Sharp bend at entrance to forebay requires CFD modelling to confirm flow characteristics.
Design Details – Intake and Conduits
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- Intake structure contains six fixed wheel gates, six trashracks, and stoplogs.
- Gates will close automatically in case of emergency.
- Conduits convey water from forebay to powerhouse under existing irrigation canal.
- Critical construction activity as supply of water to irrigators must be contained.
- Irrigation canals will be diverted through the forebay to allow construction of conduits and intake to occur.
- Timing of diversion and reinstatement must match scheduled outages of the irrigation canals.
Design Details – Powerhouse
Design Details – Turbine Chamber

- Three 4.01MW horizontal axis Kaplan turbines will be installed in the turbine chamber.
- Turbines and generating equipment are to be supplied and installed by HPP of France.
- To reduce costs, the turbine chamber has no above ground superstructure.
- Access for large equipment to the machine floor is through a service hatch in the roof, which is at ground level.
Design Details – Tailrace

- 440m long tailrace canal conveys water from the turbine chamber to the Orange River.
- To satisfy DWA requirements, a crump weir in the tailrace measures discharge through the project and also acts as fish barrier.
Coordination and Interface Agreement used to deliver single point of responsibility despite split structure.
The Neusberg Hydro Electric Project will be operated remotely from Hydro Tasmania’s Control Centre in Australia.

On-ground operations and maintenance to be provided by Wright Dixon.
Questions