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Siting and design

Palmiet, South Africa

Overview

Palmiet was commissioned in 1988 by the national electricity utility Eskom and South Africa's Department of Water Affairs and Forestry. The partnership enabled the optimization of the use of water for:

- a pumped storage operation to provide system stability for the South African electricity network, as well as
- the provision of extra water supply for the greater Cape Town municipal area.

The Palmiet Pumped Storage Scheme was constructed in one of the spurs of the Hottentots Holland Mountains through which the Palmiet River flows. It transfers water via reversible pump turbines from the lower Kogelberg reservoir on the Palmiet River to the Rockview reservoir on the watershed between the Palmiet and Steenbras rivers and thence by conduit to the Steenbras upper reservoir. This enables Palmiet to not only function as a hydroelectric pumped storage power station, but also as a water transfer scheme.

Scheme Specifications

Dam Name

Scheme operator
Eskom Holdings Ltd.

Size of scheme (MW)
400 MW

Country
South Africa

Catchment area
Palmiet River catchment - 535 km²

River
Between Palmiet & Steenbras Rivers

Effective reservoir capacity
Rockview Dam (upper reservoir) - 20,800 ML

Kogelberg Dam (lower reservoir) - 19,300 ML

Construction years

1983 - 1988

Reservoir size

Rockview Dam - 73.4 Hectares

Kogelberg Dam - 155.4 Hectares

External recognition

1987 Most Outstanding Civil Engineering Achievement awarded by the South African Institute of Civil Engineers.

1988 Integrated environmental planning and management award from the Environmental Planning Professions Inter-disciplinary Committee (EPPIC)

1997 Conserva Award for outstanding achievement in effective conservation and sustainable utilisation of the environment to ensure a better quality of living for all South Africans by the South African Minister of Environmental Affairs and Tourism.

2000, 2002, 2003

NOSCAR award (NOSA's most prestigious annual achievement award) – for excelling in the field of occupational health, safety and environmental risk management.

Recognition was given by NOSA to 100 companies who demonstrated world class performance in occupational risk management and related systems certifications of which Eskom Peaking Generation - Palmiet Power Station was one.

Details on sustainability aspect

Fynbos is indigenous to South Africa. It refers to the distinctive community of plants found within the Mediterranean type climate of the South Western Cape. Many of the plants have small fine stems and leaves hence the name fynbos. Fynbos is characterised by three plant families: [Ericaceae](#) (heaths), [Proteaceae](#) (proteas) and [Restionaceae](#) (reeds).

The Kogelberg is regarded as the centre of fynbos endemism, where roughly a fifth of all fynbos species are known to occur. There are approximately 1,500 species of plants, 70 mammal species, 43 reptile species, 22 frog species and a vast number of birds and insects in this reserve. Of the plants, about 150 do not grow anywhere else in the world.

The uniqueness and biodiversity of the Kogelberg was recognised in 1998 when UNESCO registered the area as a biosphere reserve. Eskom was one of the signatories to the application for biosphere status submitted to UNESCO. However, construction of the Palmiet Pumped Storage Scheme took place between 1983 and 1988, well before the area received this recognition.

In the early stages of planning for the scheme, a multi-disciplinary team was formed – the Palmiet Committee. It was comprised of representatives from many state bodies, educational institutions and societies, all with specialist knowledge, with the aim of

determining the environmental effect of the scheme on the Palmiet River. An Environmental Impact Control Plan, considered a forerunner of its time, was developed and implemented. Both during and after construction of the Palmiet Pumped Storage Scheme, particular attention was paid to protection and management of the Cape Floral Kingdom, which includes the unique fynbos flora.

During the construction phase of the operation four factors were given high priority:

Fynbos rehabilitation

- Top soil containing indigenous plant material was removed from construction areas and stored. It was subsequently replaced and indigenous plants re-established when construction work had been completed
- Fire management plans were put in place and strictly enforced
- Careful inspection of materials was carried out to prevent introduction of alien vegetation
- Gardening of the entire site was restricted to the cultivation of indigenous species

Argentine Ant

- Argentine ant infestation was a risk to the fynbos as it is highly attracted to food waste and, unlike the native ant, after eating the fleshy seeds of fynbos it does not bury them leaving them exposed to harm.
- High standards of hygiene were set and adhered to
- Specially constructed eating sectors were built for workers and all food remains were carefully removed on a daily basis.

Wildlife Protection

- Rigid controls for the protection of wildlife were enforced in line with Nature Conservation Ordinance applicable to South Africa
- Feeding of animals was forbidden

Environmental Training

- Programs to raise environmental awareness of workers were conducted on site in all the main language groups
- This was reinforced by implementing recognition schemes for achievements in environmental awareness

The success of the impact control measures has been taken into the ongoing operational phase of the power station. The current Environmental Impact Management Procedure focuses on

- Estate Management
- Waste and Recycling
- Water and Sewage
- Air pollution/Ozone depletion

- Training

There are instream flow requirements for the Palmiet River in place. These must be satisfied first before there is any water transfer to the Steenbras Dam for Cape Town drinking water use.

Other Aspects

Distribution and sharing of benefits

South African electricity generation is dominated by coal-fired power stations. Palmiet provides valuable back up generation in the event of the loss of thermal plant. Thus, the power station is viewed by the Network Operator as the key to system stability.

The Palmiet Power Station not only provides hydroelectric peaking power for the national grid, its reversible pump turbines are components of an inter-catchment water transfer that provides drinking water for Cape Town consumers.

Multiple Use Benefits

The Palmiet River catchment has a much greater run-off than that of the adjoining catchment around Cape Town. Construction of the pumped storage scheme allowed Eskom and the Department of Water Affairs and Forestry (DWAF) to exploit this to not only provide hydro-peaking power but also much needed additional drinking water supply for Cape Town. Water is gravity fed from the Rockview reservoir to the Steenbras upper reservoir (part of Cape Town's drinking water supply infrastructure). There is currently a specific allocation of 25 million m³ per year to DWAF.

Siting and Design

- Siting and design considerations included situating the surge tank behind a rocky ridge to minimise the visual impact.
- The headrace tower contains a vertical duct with a spillway on top which makes it possible to close the emergency gate during any phase of surging in the waterways.
- Sand and rockfill for construction of the Rockview Dam were taken from the reservoir basin.
- The plant has been designed so that it may be started and synchronised even under conditions of network blackout.
- Low level tubular busbars have been used in the high voltage yard instead of high voltage connecting cables in order to minimise visual impacts.
- Three years before contracts were awarded investigation of site geology and geotechnical aspects was carried out to provide contractors with accurate data to assess contractual risk.

Community engagement and acceptance

The Minister of the Department of Water Affairs and Forestry in 1996 formed the Palmiet Catchment Management Committee. As a result of public consultation and participation meetings, representation was drawn from Eskom, local government, recreational organisations, farming organisations, industry/business, environmental

bodies, governmental departments, tourism bureau, ratepayers associations, civic and farm workers associations.

The committee serves as a forum and lobby group for local issues ranging from water matters to land use and includes stakeholders from the source to the estuary of the Palmiet River.

The vision of the committee is:

“To manage the Palmiet River Catchment Area so that optimal use is made of the total resources (land, water and air) to sustain the ecological, social and economic requirements and to maintain the unique conservation status and scenic beauty of the area”

The committee ensures that ongoing catchment management is implemented and adhered to so that the Palmiet Pumped Storage Scheme remains compatible with its surrounding environment. It is recognised that the Catchment Management Plan for the Palmiet River may serve as a blueprint for other catchments.

Safety

Palmiet has been consistently rated a five-star performer by National Occupational Safety Association (NOSA) - an international auditing body. Palmiet has been awarded the NOSCAR award three times – eligible to companies scoring 95% or more for effort measured during a NOSA Certification Authority (NCA) Grading Audit and having recorded a Disabling Incident Frequency Rating of 0.8 or less.

Further Information

http://www.hydropower.org/3_1a.htm

Blue Planet prize – IHA website

<http://www.eskom.co.za/about/CompanyInformation/Facts&Figures/GFS%200037%20Palmiet%20Blue%20Planet%20Prize%20Rev%201.doc>

<http://www.ieee.org/organizations/pes/public/2004/may/pesindustrynews.html>

http://www.eskom.co.za/about/providingelectricity/powerstations/palmietpumpedstorage_content.html

[http://projects.shands.co.za/Hydro/Downloadfiles/BRBS/Public/Breede%20-%20Overberg%20CMA%20Proposal%20\(2nd%20draft\).PDF](http://projects.shands.co.za/Hydro/Downloadfiles/BRBS/Public/Breede%20-%20Overberg%20CMA%20Proposal%20(2nd%20draft).PDF)