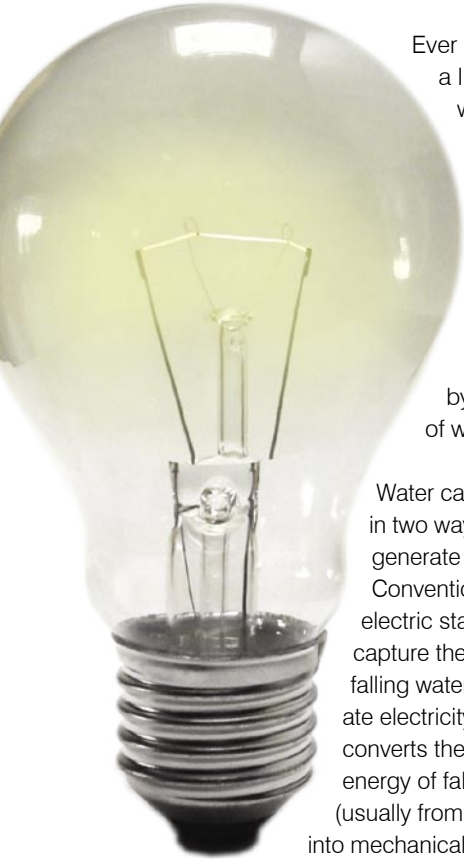


The Power of Water



Ever switch on a light and wonder where the electricity came from? It might have just been generated by the power of water.

Water can be used in two ways to generate electricity. Conventional hydroelectric stations capture the energy of falling water to generate electricity. A turbine converts the kinetic energy of falling water (usually from a dam) into mechanical energy.

Then a generator converts the mechanical energy from the turbine into electrical energy. The electricity generated is fed on to the transmission lines that link up with the national electricity grid. Once the water has run through the turbines it is discharged back into the river below the power station to continue its course.

On the other hand, pumped storage schemes reuse water to generate power. The schemes use off-peak energy to pump water into an elevated dam from a lower dam from which it can be released to generate electricity when required. When the energy is needed, the water is released from the top dam to flow through the power station to the bottom dam.

The amount of electricity a hydro-power plant produces depends mainly on how far the water falls (i.e. the further the water falls, the more

power it has, this is usually dependent on the size of the dam); and the amount of water falling (more water falling through the turbine will produce more power, the amount of water available depends on the amount of water flowing in the river).

While hydropower stations are considered more environment-friendly than coal-fired stations, there is some debate whether they should really be actively pursued. This is because most hydropower stations involve the construction of a dam, which can be disruptive to the surrounding environment and to communities who might be displaced.

Because of its limited water resources and erratic rainfall, South Africa does not have much potential for large hydropower stations. Whereas, worldwide, about 20% of all electricity is generated by hydropower, in South Africa it varies between 2% and 4%. The country's largest power producer, Eskom, operates six hydropower schemes at present.

There are two hydropower stations on the Orange River. The Gariep

THE BASIC COMPONENTS OF A CONVENTIONAL HYDROPOWER UNIT

Dam: Most hydropower plants rely on a dam that holds back water, creating a large reservoir.

Intake: Gates on the dam open and gravity pulls the water through the penstock, a pipeline that leads to the turbine. Water builds up pressure as it flows through this pipe.

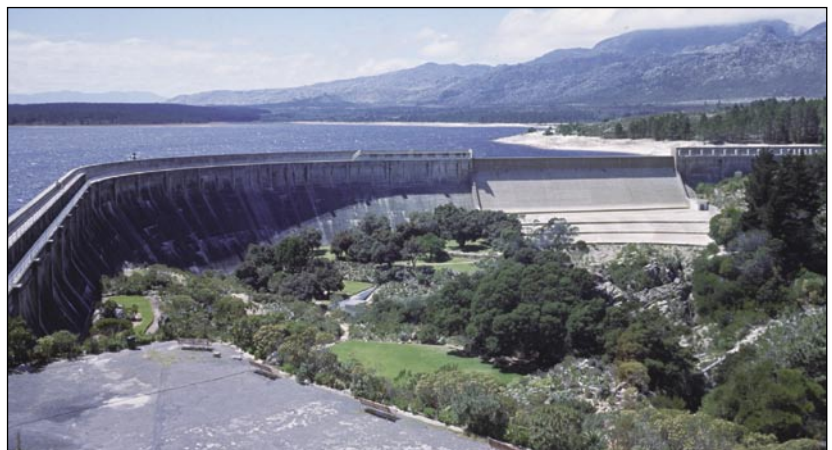
Turbine: The water strikes and turns the large blades of a turbine, which is attached to a generator above it by way of a shaft.

Generators: As the turbine blades turn, so do a series of magnets inside the generator. Giant magnets rotate past copper coils, producing alternating current (AC) by moving electrons.

Transformer: The transformer inside the powerhouse takes the AC and converts it to higher-voltage current.

Outflow: Used water is carried through pipelines, called tailraces, and re-enters the river downstream.

Source: www.howstuffworks.com



The Steenbras Dam forms part of the Palmiet Pumped Storage Scheme, in the Western Cape.

(formerly known as Hendrik Verwoerd) hydropower station started feeding into Eskom's transmission system in 1971. Vanderkloof, a similar hydropower station, was commissioned in 1977.

Eskom also operates four smaller hydropower stations, namely Colley Wobbles (Mbashe River), First Falls and Second Falls (Umtata River), and Ncora (Ncora River). The Eastern Cape (particularly the area of the former Transkei) and parts of KwaZulu-Natal have been identified as having the most potential for the future development of hydropower in South Africa.

In addition, there are two pumped storage schemes at present. The Drakensberg Pumped Storage Scheme not only supplies the country with 1 000 MW of electricity during peak periods, it also assists in supplementing the Vaal Dam with water transferred from the Tugela River in KwaZulu-Natal. Completed in 1988, the 400 MW Palmiet Pumped Storage Scheme is situated about 50 km from Cape Town. This scheme is also used to pump water from the Palmiet River catchment into the Steenbras Dam to supplement Cape Town's water supply. At present, Eskom is also developing a third pumped storage scheme at Braamhoek, in the Klein Drakensberg (for more details, see the article elsewhere in this issue).



The Gariep Dam is also used for hydropower.

There are also a number of independently-operated hydropower stations in South Africa, for example, the 2,5 MW Friedenheim mini-hydropower plant situated on the Crocodile River, near Nelspruit, Mpumalanga. This plant has been operational since 1998 to provide power for the Friedenheim Irrigation Board while excess power is sold to Mbombela Municipality.

The Bethlehem Hydropower Project is currently under construction. The project comprises two generation facilities: a 2,2 MW run-of-river site located on the As River, midway between Bethlehem and Clarens; and a 1,7 MW facility at the existing concrete wall of the Saulspoort Dam, in Bethlehem. The first electricity is expected to be delivered later this year.

HYDROELECTRIC FIRSTS IN SOUTH AFRICA

- The first hydropower plant on the Orange River was constructed near Kakamas, in the Northern Cape.
- The Sabie River Gorge power station was the first hydropower station to be erected by Eskom. It started commercial operations in 1927, and was built mainly to support mines in the area. The plant closed in 1964.
- The hydroelectric power station at the Vanderkloof Dam was the first power station in South Africa situated entirely underground.
- The Friedenheim Hydro Power plant is recognised as the first independent power producer in South Africa.

TABLE 1 Eskom's hydropower & pumped storage schemes		
Hydroelectric Stations	Area	Total Capacity
Colley Wobbles	Mbashe River	42 MW
First Falls	Umtata River	6 MW
Gariep	Orange River	360 MW
Ncora	Ncora River	2 MW
Second Falls	Umtata	11 MW
Vanderkloof	Orange River	240 MW
Pumped Storage		
Drakensberg	Bergville, KZN	1 000 MW
Palmiet	Grabouw, Western Cape	400 MW

Source: Eskom

HYDRO-ELECTRIC WEBSITES

- http://www.dme.gov.za/energy/renew_hydro.stm
- <http://assets.panda.org/downloads/africahydropowerreport2006.pdf>
- www.eskom.co.za
- <http://mp2mas26.eskom.co.za/heritage/main.htm>
- <http://people.howstuffworks.com/hydropower-plant.htm>