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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

POLICY BRIEF

Development of natural resources

Optimal use of thermal springs

A completed Water Research Commission (WRC) project studied the protection, use, development, conservation, management and control of South Africa's thermal water resources.

Background

The National Water Act (Act 36 of 1998) requires that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons.

Water resources are usually assumed to be surface water bodies and groundwater resources to be used for domestic, industrial and agricultural purposes. Thermal (hot) springs are rarely recognised as being a resource. However, such springs have been used for religious, medicinal and other purposes for hundreds (if not thousands) of years.

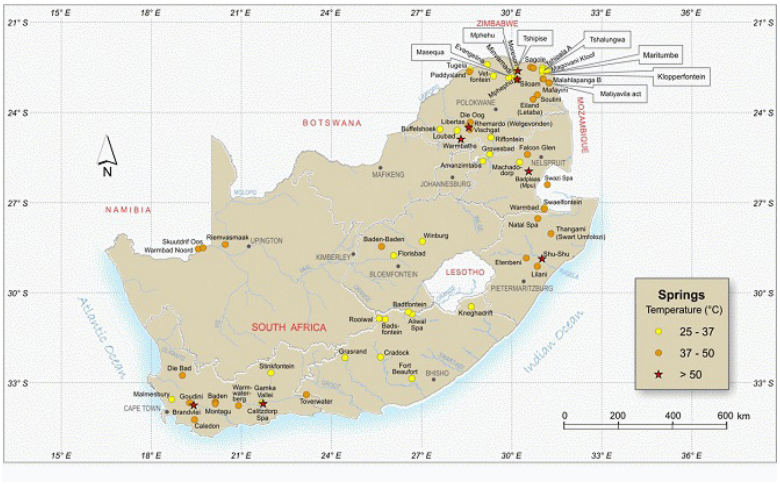
During the last few decades, their potential as versatile natural resources has become apparent. In addition to being popular tourist and health resorts they are used internationally for the generation of electricity (geothermal power), agriculture, aquaculture, bottled water production, and the extraction of rare elements, among others.

However, in South Africa only about half of the documented 74+ thermal springs have been developed, mostly as leisure and recreational resorts, while the rest remain undeveloped. Thus, in comparison with global trends, South African geothermal resources appear to be under-utilised.

The aim of this WRC study was to determine the optimal uses for each of the thermal springs in South Africa in terms of their chemical, physical and biological characteristics. Such uses included their potential for geothermal energy production, bottling, agriculture and aquaculture as well as for niche markets such as the cosmetics industry, mineral extraction, the health and wellness industry and for the specialised tourism market.

Thermal springs in South Africa

The most thermal springs are located in Limpopo Province, followed by the Western Cape, KwaZulu Natal, the Eastern Cape, Mpumalanga, the Free State and the Northern Cape.



Location of the thermal springs in South Africa.

The suitability assessment revealed that **each thermal springs can be used for a number of different purposes** while, conversely, one or more of the thermal springs can be used for each of the potential uses investigated.

The most viable uses include greenhouse heating and crop drying. The former would enable crop production throughout the year. This would result in sustained supply to markets and ensure premium prices during off-seasons.

The use of heated greenhouses could stimulate the production of exotic produce that could boost small-scale export to neighbouring African countries. Geothermal energy sources could also be used for agro-processing of locally produced produce. This would not only bring about sustained food security and enhance the resilience of people and the economy to climate change, but could boost the local and regional economy by, for example, the creation of home-based cottage industries for niche products such as local cheeses, beverages, vegetables and herbs.

Similar benefits could also accrue from aquaculture. The production of fish from inland rural areas would provide a rich source of protein to people and impact directly on the health status of communities. Fish wastes make an excellent organic fertiliser for local use and for sale elsewhere, while all agricultural and agro-processing waste could be used for the generation of fuel in the form of biogas.

Spirulina/algae production, using geothermal energy resources alone, could be developed into small enterprises supplying the local pharmaceutical industry. Spirulina is also a rich source of nutrition for humans and animals. All algal waste can be fashioned into building materials with high insulation properties – contributing to energy efficiency.

Beneficiation could also occur on-site or raw products could be supplied to other outlets. Thermal spring waters could also be used for small-scale irrigation projects.

It is important to note that the very properties of spring water that prohibits its use for some purposes may make it suitable for another. This implies that water that might be unfit for drinking purposes due to high mineral content could be suitable for water mining.

Recent technological advances have made it possible to extract only specific minerals from brines. Although the concentrations of minerals in South African spring waters are local in comparison to the very hot geothermal resources in countries with volcanic springs, small-scale mineral extraction may be feasible, especially for the extraction of boron, titanium and strontium. These minerals have industrial use. Water mining has the added advantage of being environmentally friendly.

Only the hottest springs, namely Brandvlei and Tshipise, could be suitable for power generation at present, but the rate of development of this technology could soon increase the viability of geothermal energy production in South Africa.

In the majority of cases it is the thermal energy that is useful rather than the water itself. Consequently, the water can be cascaded through a multitude of different tiers of uses – with benefits accruing to each – without depleting or contaminating the resource itself.

Many thermal springs are located on existing tourism routes, but have not been exploited optimally for this purpose. Thermal springs have a rich heritage of legends, beliefs and customs. Moreover, salt from thermal springs is one of the most ancient industries in the country, and formed the basis for extensive trade throughout Africa.

This knowledge should not be lost, and should be incorporated into future tourism development plans. The role of an African Health and Wellness tourism centre at thermal springs is self-evident.

Thermal springs and the National Development Plan (NDP)

This project and its possible outcomes address the goals of the NDP which aims to eliminate poverty and reduce

Salt making at Baleni thermal springs, in Limpopo.

inequality by 2030. Since most of the thermal spring resources are located in rural areas, any development should contribute to the economy and create jobs.

Another one of the goals of the NDP is to provide access to the electricity to citizens. Geothermal energy resources are not mentioned in this plan. However, geothermal energy production is used extensively internationally and modern technology has eliminated the need for high temperature resources.

It has been found to have the least environmental impact, since no combustion is required. It eliminates the production of greenhouse gases and does not impact on existing water sources.

Since only the heat energy is used for energy production, the water quality is not affected. All water can be returned to the aquifers via re-injection wells. Such developments would necessarily quality for the proposed incentives for the use of greener technologies.

Conclusion

It must be emphasised that development of thermal spring resources would result in **small-scale rural development** where the sustainable development of the resource could impact significantly on the health and wellbeing of communities; contribute to the production of food and fuel throughout the year; provide a clean source of water that could be used fulfil basic needs; be a source of renewable energy; and stimulate the establishment of new enterprises and expanding existing ones.

Furthermore, jobs can be created in rural areas from expansion of tourism projects, small-scale water mining, niche product developments, agricultural and aquaculture ventures as well as from the establishment of educational centres.

Care should be taken, however, to preserve the quality of the resource and to maintain the integrity of wetlands. The importance of the preservation of springs wit cultural or customary significance should not be overlooked.

Most importantly, it must be borne in mind that geothermal springs development can only become a reality if both industry and Government are prepared to commit to such small-scale development projects.

Recommendations

More research is required on the microbial and algal diversity of the springs as well as their gaseous composition. Indigenous knowledge pertaining to the springs should be documented. Such knowledge will ensure sustainable use of thermal springs and could offer further opportunities for development.

An economic feasibility study should be conducted to identify those springs/uses that could be of the greatest immediate and long-term benefit. It is suggested that priority should be afforded to the erection of a pilot water-mining plant at one of the thermal springs and to pursue the educational potential of the resources. These results should be made available to entrepreneurs in the form of a report.

A combined effort of researchers, industry and government is required to ensure that South African thermal spring resources are used optimally for the benefit and advancement of all its people.

Further reading:
To obtain the report, *Optimal utilisation of thermal springs in South Africa (***Report No.TT 577/13***)* contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.