REPORT NO. INT 141

PROGRESS REPORT

ENERGY ALTERNATIVES FOR THE SUPPLY OF WATER IN NAMAQUALAND

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TITLE: Energy alternatives for the supply of water in Namaqualand

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1. INTRODUCTION

The objective of this project is to investigate appropriate water supply alternatives for underdeveloped rural areas with reference to a specific case study of an equivalent diesel and photovoltaic water pumping installation at Rietpoort in Namaqualand.

Appropriate energy supply devices for delivering water remains a crucial area of concern in underdeveloped rural areas. Diesel pumping has been the conventional option for large communal water supply systems from ground water, but has a number of disadvantages in terms of maintenance requirements and fuel delivery in remote areas. Photovoltaic water pumping is becoming an attractive option with the costs of photovoltaics falling. Water pumping is also an ideal application for photovoltaics as expensive battery storage is avoided.

Equivalently sized diesel and photovoltaic systems have been installed at Rietpoort in Namaqualand. It was planned that technical monitoring would be done manually, rather than with expensive automatic data loggers. A parallel project is looking at detailed system dynamics at another site. The emphasis in this project is on a comparative study.

A diesel and electrically powered water pumping system at Karkams also provides an opportunity for a useful comparative study.

The main research question is what the comparative technical and economic advantages of photovoltaic water pumping are compared to diesel and electrical pumping. This question is evaluated within the broader framework of appropriate water supply planning strategies.

2. DETAILED PLANNING

After undertaking a literature survey and visiting areas in Namaqualand the scope of the project has been extended to:

(i) To examine the relationship between water, health and development; and to investigate water consumption patterns that satisfy basic needs in rural areas and communities in order to obtain guidelines for adequate water supply in terms of quality, quantity and accessibility.

(ii) To review the available technical options of water supply in rural areas based on the experience of schemes internationally and locally, taking due account of their socio-cultural and economic implications.

(iii) To investigate the water supply systems currently used in the Project Areas (Karkams and Rietpoot), identifying the planning, implementation and maintenance techniques - including the degree of local community involvement in these places.

(iv) To monitor and evaluate the systems in the Project Areas to obtain - with the aid of cross-referencing to the available technologies in (ii) above and their implicit recommendations - both quantitatively and qualitatively the planning, implementation, operation, maintenance and monitoring techniques that should be used in the conceptualisation and development of any rural water supply system. The case systems would evaluate:

(a) Karkams - the technical, financial, O+M considerations of a small diesel and electric borehole pumping.

(b) Rietpoort - the technical, social and economic drawbacks and benefits associate with diesel and photovoltaic water pumping.

(v) Finally (optional), based on the planning mechanics derived above and in conjunction with the situation in the Project Areas, to propose an alternative framework for an equitably-based rural water supply in Namaqualand.

3. PROGRESS AND RESULTS

A brief summary of some of the initial findings is given with reference to the numbering used above.

(i) A chapter has been written outlining the context of the problem (viz. water, health and development; consumption patterns; water requirements).

Criteria for adequate water supply:

(1) Quantity - >20l/cap/day
(2) Accessibility - >200m from dwelling
(3) Quality - TDS > 4 000mg/l;
E.Coli< 10 per 100ml

Socio-economic and physical Profiles of Study Area (Namaqualand) and selected Project Areas outline:

(a) Populations:

Namaqualand	-	63 000
Karkams	-	1 084
Rietpoort	-	1 637

(b) Mean annual rainfall:

Rietpoort	-	109mm
Karkams	-	251mm

(c) Mean household monthly income:

Rietpoort	-	R150

(d) Average household size:

Rietpoort	-	5,3 persons

(ii) A chapter has been written covering water supply alternatives:

(a) Sources - springs, rainwater catchment, ground water.
(b) Pumping Technologies - reciprocating/rotary positive displacement, traditional, centrifugal, hydrams.
(c) Energy for Water pumping - human, animal, wind, solar, diesel.

Examples of local and foreign water supply schemes are given.

(iii) Water Supply Technologies in Namaqualand, and in particular the Project Areas are discussed under he following headings:

- Technical, social and economic implications
- Planning and implementation
- Operation and maintenance

Some observations include:

(a) Operation/Maintenance - water supply is centrally administered by regional office of Dept of Local Government, Housing and Agriculture, House of Representatives; a salaried caretaker operates the pumps; and maintenance is contracted to private firms.

(b) Planning/Implementation - planned by consultants for Dept.; no local community participation; constructed by contractors.

(c) Water Tariffs
- Rietpoort: 0,5c/l
- Karkams: up to 2kl free; thereafter R1/kl
- Other rural settlements: R5 per year

(d) Technical
- Rietpoort: diesel-mono pump; PV-3 phase submersible unit
- Karkams: diesel-mono; electric-3 phase submersible

(e) Construction costs for Rietpoort and Karkams have been obtained

(iv) The Case Studies are monitored and evaluated under the following headings:

- Water consumption
- Water pumped
- Pumping efficiencies
- Reliability and maintenance

The data reveal the following:

(a) Daily per capita consumption:

Rietpoort - 12,61 (below WHO standard)
Karkams - > 201
Nourivier - 20-301

(b) Monthly household expenditure on water:

Rietpoort - R10 (7% of gross income)
Nourivier - R0,42
Karkams - between 0 and + R10

(c) Water pumped:

Rietpoort - PV: 41,8 m3/day (winter)
42,6 m3/day (summer)
Diesel: +40 m3/day

Karkams - Electric: 690 m3/month (6 months ave.)
Diesel: 298 m3/month (6 months ave.)

(d) Reliability:

Rietpoort - PV has been running faultlessly since June 1989; diesel only commissioned in December 1989 due to construction fault.

Karkams - Diesel commissioned February 1989 and removed from service in June 1989 due to weak compression.

- Electric pump only commissioned June 1988 to rectify electrical current surge fault in equipment; both pumps stopped repeatedly due to leakage in pipeline.

(e) Monthly O+M Costs:

Rietpoort - PV: R680 (operator wages)
- Diesel: R1 062 (wages, fuel, maintenance)

Karkams - Electric: R971 (wages, electricity, maintenance)
- Diesel: R929 (wages, fuel, maintenance)

(f) Unit costs (based on O+M costs)

Rietpoort - PV: 0.08 c/l
Diesel: 0,13 c/l

Karkams - Electric: 0,14 c/l
Diesel: 0,31 c/l

The relatively high costs for the Karkams systems are largely due to their being of-line frequently because of leaks in the pipeline and at valve points.

Further work is being done to determine life-cycle costs of the systems. A unit cost per capita is also being calculated to compare sectoral allocation of funds, eg with health services.

4. EXPECTED COMPLETION DATE

The project engineer, Mr Ilyas Omar, has undertaken to complete this study by mid year.

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