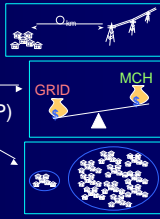
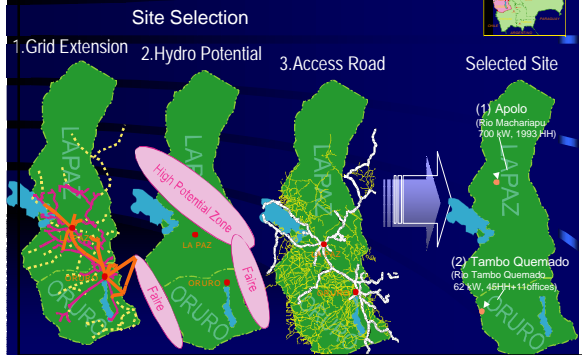


(1) Selection Criteria

- Distance from Existing Grid Line
- Comparative Investment Cost
(cost of Grid Extension/ cost of MHP)
- Beneficiary Household Size of MHP
- Project Maturity (Stage of project study)
- Hydropower Potential
- Good Access to the site



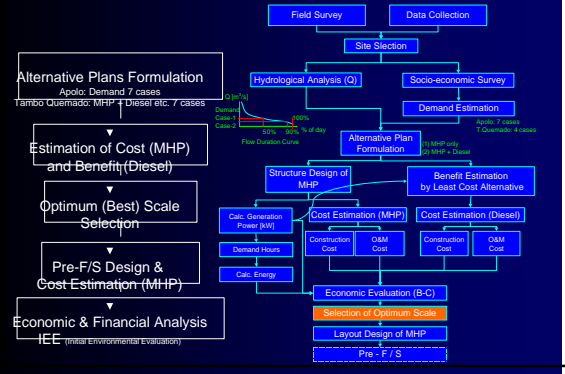
(2) Selected Sites



4.6 Process of Pre-F/S and Results

(Apolo & Tambo Quemado MHP Project)

(1) Work Flow of Pre-F/S



(2) Location (Apolo MHP Project)

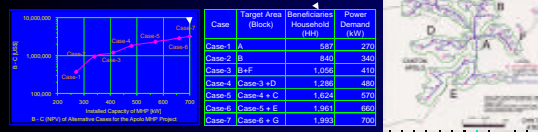
Proposed Site : Machariapu River
 Department : La Paz
 Province : Franz Tamayo
 Municipality : Apolo
 Canton : St. C. del V. Ameno, Apolo, Aten, Pata



Year	Site	Study	Year	Scale (kW)	Cost (USD)	Beneficiaries (HH)	Power Demand (kW)
1987	Turipapu	Pre-F/S	1987	553	1.8	31	2,400
1994	Turipapu	Pre-F/S	1994	310	3.0	12	360
1997	Vilipiza	Pre-F/S	1997	480	1.0	150	1,000
2001	Machariapu	Pre-F/S	2001	700	1.5	150	1,000

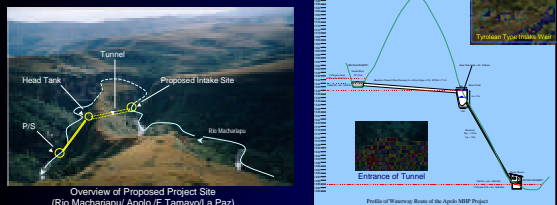
(3) Optimization Study (Apolo MHP Project)

- Abundant Water Resources: High MHP potential in Machariapu River ($Q_{max} = 2.47 \text{ m}^3/\text{s}$ - $P = 950 \text{ kW}$)
- Alternative Plans: different scale of power demand (Target Power Supply Area: Block A - F, 7 Case)
- Case-7 (700 kW) was selected as optimum scale of the Apolo MHP project.



(4) Formulated Schemes (Apolo MHP Project)

- 1) Intake: Bottom intake weir (Tyrolean Type) was selected to reduce the cost and safety for flood.
- 2) Sand Settling Basin: it was not planned to reduce the cost.
- 3) Headrace: Tunnel (L=143m, H=1.6m, W=1.1m, Slope=1/60)
- 4) Head Tank: To have the function of a sand settling basin.
- 5) Penstock: (Q=1.815 m³/s, H=51.7m, D= 1.1m, L=74m)
- 6) Turbine: 2 turbine (350 kW + 350 kW, Francis type turbine)



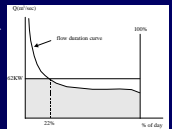
(5) Location (Tambo Quemado MHP Project)

Proposed Site : Tambo Quemado River
 Department : Oruro
 Province : Sajama
 Municipality : Turco
 Canton : Chachacomani
 Town : Tambo Quemado



(6) Optimization Study (Tambo Quemado MHP Project)

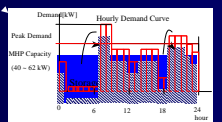
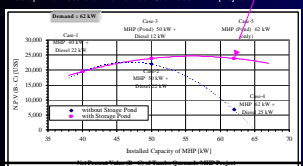
- 1) Limited river discharge in Tambo Quemado River (Q_{10%} = 0.088 m³/s ; P = 62 kW) ← Peak Demand 62 kW (Q_{50%} = 0.053 m³/s ; P = 40 kW)



2) Alternative cases: Power supply methods

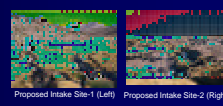
- Case 1: MHP 40kW (Q_{10%}) + Diesel (22kW)
- Case 2: MHP 50kW (Q_{10%}) + Diesel (22kW)
- Case 3: MHP 50kW (Q_{10%}) with storage pond + Diesel (12kW)
- Case 4: MHP 62kW (Q_{25%}) + Diesel (25kW)
- Case 5: MHP 62kW (Q_{25%}) with storage pond (Two cases)

3) Case-5 (62 kW with pond) was selected as optimum scale of the Tambo Quemado MHP project.



(7) Formulated Schemes (Tambo Quemado MHP Project)

- 1) Intake: 2 intake was planned at 2 stream flows
- 2) Sand Settling Basin: it was not planned to reduce the cost.
- 3) Headrace: PVC Pipe (Rib-Roc, L=2,310m, Slope=2%)
- 4) Head Tank: with storage volume (V=225 m³) (W=6m, L=30m, H=1-3.5m, with sand settling basin effect)
- 5) Penstock: PVC pipe (Q=0.0813 m³/s, H= 99.1m, D= 0.36m, L=300m)
- 6) Turbine: 1 turbine (62 kW , Perton type turbine)



(8) Results of Evaluation (Apolo & Tambo Quemado)

	Unit	Apolo	Tambo Quemado
Installed Capacity	kW	700	62
Economic Cost (without Tax)	US\$	3,403,500	205,700
Financial Cost (with Tax)	US\$	4,000,500	239,700
EIRR	%	28.3	11.9
Estimated Power Tariff (for Residential)	US\$/month/HH	1.27	3.50

IEE: no serious impact is anticipated in both projects

One Suggestion for Sustainable Rural Electrification (SRE)

