

**JAPAN INTERNATIONAL COOPERATION AGENCY
VICE MINISTRY OF ENERGY AND HYDROCARBONS
THE REPUBLIC OF BOLIVIA**

**THE STUDY ON RURAL ELECTRIFICATION
IMPLEMENTATION PLAN BY
RENEWABLE ENERGY
IN
THE REPUBLIC OF BOLIVIA**

MAIN REPORT

SEPTEMBER 2001

**KRI INTERNATIONAL CORP.
NIPPON KOEI CO., LTD.**

Exchange Equivalents

(May 2001)

US\$1 = ¥120.5

US\$1 = Bs 6.53

Bs 1 = ¥18.5

PREFACE

In response to the request from the Government of the Republic of Bolivia, the Government of Japan decided to conduct the Study on Rural Electrification Implementation Plan by Renewable Energy in the Republic of Bolivia, and the study was implemented by the Japan International Cooperation Agency (JICA).

JICA sent a study team, headed by Mr. Toshikazu Tai of the KRI International Corp., to the Republic of Bolivia six times from August 1999 to September 2001.

The team held discussions with the officials concerned of the Government of the Republic of Bolivia, and conducted related field surveys. After returning to Japan, the team conducted further studies and compiled the final results in this report.

I hope this report will contribute to promotion of rural electrification and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Bolivia for their close cooperation throughout the study.

September 2001



Takao Kawakami

President

Japan International Cooperation Agency

September 2001

Mr. Takao Kawakami
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Kawakami

Letter of Transmittal

We are pleased to submit to you the Final Report on “The Study on Rural Electrification Implementation Plan by Renewable Energy in the Republic of Bolivia”. Under the contract with your esteemed organization, the subject study was carried out during the 27-month period from July 1999.

In conducting the study, the study team has prepared the rural electrification plan in line with the government’s energy policies and transferred the technology of renewable energy development, with due consideration of the current situation of energy supply/demand and socio-economy.

This report compiles the rural electrification implementation plan in the Republic of Bolivia. Also reflected are the comments of the officials of energy related institutions through the discussions with the Coordinating Group, seminars and counterpart team meetings held in Bolivia from time to time in the study period.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and Ministry of Economy, Trade and Industry. We also wish to express our deepest gratitude to the Vice Ministry of Energy and Hydrocarbons (VMEH), the JICA Bolivia office and the Embassy of Japan in Bolivia for the close cooperation and assistance extended to us during the period.

Very truly yours,

Toshikazu Tai
Team Leader
The Study on Rural Electrification Implementation
Plan by Renewable Energy in the Republic of Bolivia

Location Map, Oruro



South America



REFERENCE

- Capital of Department
- Capital of Province
- Capital of Sección
- Cantón
- Major City/Town
- International Border
- Department Border
- Province Border



Bolivia

Scale: 1: 1,209,000



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Member of Coordinating Group, Working Group and JICA Study Team

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APPENDIX I AND II:

- I PV Pilot Project and Monitoring
- II Pre Feasibility Study on Micro-Hydro Power Projects

APPENDIX III AND IV:

- III Pre-Feasibility Study on Wind Power Projects
- IV Report on Technology Transfer

Abbreviations and Acronyms

(1) Domestic Organization

CINER	Centro de Información en Energías Renovables
CNDC	National Committee of Electricity Supply
COSUDE	Agencia Suiza para el Desarrollo y la Cooperación
CRE	Cooperativa Rural de Electrificación, Santa Cruz
DUF	Directorio Unico de Fondos
ECOTEC	Ecotecnologías Energéticas y Productivas
EDU	Energy Development Unit, VMEH
EDESER	Empresa de Servicios
EFP	Facilitator Team of PRONER Program
ELECTROPAZ	Electricidad de La Paz S.A.
ELFA	Empresa de Luz y Fuerza Aroma
ELFEC	Empresa de Luz y Fuerza de Cochabamba
ELFEO	Empresa de Luz y Fuerza Electrica de Oruro, S.A.
ENDE	National Electric Company
ENERGÉTICA	Energía para el Desarrollo
ESAND	Energía Solar Andina S.R.L.
FNDR	National Fund of Regional Development
FPS	National Fund of Productive and Social Investment
IGM	Instituto Geográfico Militar
IHH	Instituto de Hidraulica e Hidrologia, UMSA
INE	National Statistics Institute
MDE	Ministry of Economic Development
MDSP	Ministry of Sustainable Development and Planning
NOGUB	Programa de Apoyo a Organizaciones no gubernamentales
PRONER	National Program of Rural Electrification
SE	Superintendencia de Electricidad
SENAMHI	Servicio Nacional de Meteorologia e Hidrologia
SERGEOMIN	Servicio Nacional de Geologia y Minería
SERNAP	Servicio Nacional de Areas Protegidas, MDSP
SIN	National Interconnected System
STI	Interconnected Trunk System
TDE	Transportadora de Electricidad
UMSA	Universidad Mayor de San Andres

VIPFE	Vice Ministry of Public Investment and External Financing
VMARNDF	Vice Ministry of Environmental Natural Resources and Forestry Development
VMEH	Vice Ministry of Energy and Hydrocarbons

(2) International or Foreign Organization

AECI	Spanish International Cooperation Agency
ESMAP	Energy Sector Management Program, World Bank
GEF	Global Environmental Facility, World Bank
GTZ	German Technical Cooperation
IDB	Inter-American Development Bank
JICA	Japan International Cooperation Agency
KfW	German Financial Cooperation
NRECA	National Rural Electric Cooperative Association
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNDCP	United Nations Drug Control Program
USAID	The US Agency for International Development, USA
WB	World Bank

(3) Others

GDP	Gross Domestic Product
NGO	Non Governmental Organization
O&M,O/M	Operation and Maintenance
VAT	Value Added Tax

(4) Technical Term

AC	Alternative Current
CO ₂	Carbon Dioxide
DC	Direct Current
FC	Fuel Cell
Grid	Transmission Line
H	Head (m)
Hyd	Hydraulic Generator
LDC	Load Dispatching Center
MHP	Micro Hydro Power

PV	Photovoltaic
Q	River Flow Discharge
WG	Wind Generator

(5) Unit

mm	millimeter
m	meter
km	kilometer
El.m	Elevation in meter
l/s	liter per second
m/s	meter per second
m ³ /s	cubic meter per second
mm ²	square millimeter
km ²	square kilometer
mg	milligram
ton, t	metric ton
V	Volt
W	Watt
kW	kilowatt
MW	Megawatt
Wp	Watt peak
kWp	kilowatt peak
GWh	Gigawatt hour
kWh	Kilowatt hour
MVA	Megavolt ampere
KVA	Kilovolt ampere
Ah	ampere hour
Hz	Hertz
RPM	Revolution (revs) per minute
%	percentage

(6) Currency

Bs	Boliviano, Bolivian Currency
US\$	US Dollar
M.US\$	Million US Dollar
US '	US cent