UTILIZATION OF alternative sources of energy IN CHILE

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Abstract

Current state of rural electrification in the field of renewable „non-conventional“sources in Chile presents high progress. Geological, climate and geographic conditions in Chile makes possibilities to generate energy from the renewable sources. At present the development status of projects in Chile is focused to the rural electrification.

Key words: renewable sources of energy, wind power, solar energy, water power, rural electrification, Chile

INTRODUCTION

The access to the electricity improves substantially the quality of life of the human beings. Nevertheless, in any cases, it is not profitable for the producer or distributor company, to supply with electrical energy to agricultural outlying communities. It is for this that these communities must auto generating his electricity. This Chilean isolated rural community, sometimes, generate electricity using renewable non-conventional sources.

In Chile there are four generation network (from the north to the south): SING or Sistema Interconectado Nortre Grande (Big North Interconnected System), SIC or Sistema Interconectado Central (Central Interconnected System), AYSEN and in the far south MAGALLANES.

Chile presents a continental length of 4.337 km and an average wide of 400 km, situated between the parallel 17°30´ and 56°32´ south latitude. Due to his big length, the country includes several climatic kinds.

Chilean potential in renewable sources energy

Due to geographical position, northern zone in Chile present a perfect potential to solar energy use, with monthly averaged daylight from 10 hours in winter time to 13 hours in summer time and at the same position (23 south latitude and 69° longitude) annual average insolarization incident on a horizontal surface is 5,91 kWh/m^2/day (at Prague is only 2,95 kWh/m^2/day).

In the opposite, the south zone is cloudy and far from the Equator, then solar energy is not viable. But there is an enormous potential in wind and hydro sources.

Climates kinds cause many types of fluvial status. Another factor that affects the Chilean hydrology is the geography since in the eastern zone is Andes and in the west is the Pacific Ocean. The Endorreican region (rivers with ephemeral courses that do not end in the sea) spreads from the limit with Peru up to the river Loa and includes Puna de Atacama. The “arreican” region (no exist superficial flow) extends from the river Loa to the river Copiapó (Atacama Desert) where only there exist gouache or launderings of underground waters. The “exorreican” region (rivers that end in the sea during all the year) include the whole rest of the territory from river Copiapó up to the Patagonia.

Chile also present a big geothermal potential because most of the geothermal activity in the world occurs in an area known as the “Ring of Fire.” which rims the Pacific Ocean and is bounded by Japan, the Philippines, the Aleutian Islands, North America, Central America, and South America (included Chile with its Nasca fault). But this source is not rentable in small scale exploitation.

Actually only mining industry and big scale electric generator are using this source. This kind of plants require a high initial investment, making impossible its application in agricultural outlying communities.

In the central and south zone, Chile present many hectares of forest, cellulose plants, agricultural production and other activities what can produce energy from biomass.

Chile possesses important water resources and the hydroelectric use constitutes are around the 55% of the capacity installed in plants of generation of electrical energy in the Electrical Interconnected Systems. Actually, the hydraulic potentials take advantage only in 19 % in relation to the entire potential. In case of the small scale systems to, the well used potential is in percentage terms very much minor, nevertheless, due to the peculiarity of the Chilean geography, with big falls of water in short distances (the mountain are next to the coast), an enormous potential exists for small hydroelectric uses.

Considering the big extension and geography of Chile, country crossed by some principal and other many smaller rivers, as well as for creeks, the use of his waters in small hydraulic outlying head offices should be a reality, during they could be competitive. Many mountainous places in almost the whole extension of the central and south Chilean zones, especially areas as continental Chile and outlying zones of the XIth and XIIth region, are adapted specially for the installation of multiple small water power station.

Current state in electrical generation with renewable sources in Chile.

With regard to the small hydroelectric uses, in Chile

there are almost 350 micro and mini hydroelectric power station destined principally to the electrification of housings, specially in localities isolated in the south zone, where the hydrological conditions are the suitable ones. Approximately 88% is constructed by national manufacturers, being evident an increase in the manufacture in the decade of the 70. The manufacturers companies appear mostly in the 90s constructing generally medium and small turbines Pelton and Banki.

At present in Chile, design, construction and programming of maintenance and operation of small water power station, is principally manage by the National Program for Rural Electrification (PER) coordinated by the National Energy Commission (CNE). The PER was created by the CNE at the end of 1994, in order to give a solution to the lacks of electricity in the rural environment, diminishing the incentives that generate the migrations towards urban zones, encouraging the productive and guaranteed development a stable flow of public investments.

In parallel, the Global Environmental Facility (GEF) is co financing the project "Removal of Barriers to the Use of Renewable Energies Sources for Rural Electrification in Chile". In September, 2001 was signed the agreement CHI/00/G32 between the Program of the United Nations for the Development (UNDP), the CNE and the Chilean Department of Foreign Affairs. The purpose of the project is remove the barriers that prevent the use of technologies based on Renewable Energies on the rural electrification in Chile, across the development of a set of activities that will allow with it to reduce the gas emission of greenhouse effect produced by the energy supplying in the rural world.

The Table 1 show current state of projects in the GEF program. It is a quite wide portfolio that affects a whole of 9.873 housings of very outlying rural sectors and with lack of basic services. Photovoltaic system are the most important with 6.358 housing, then small hydro with 1.403 housing, hybrid (hydro-diesel) 1.047, hybrid (PV-diesel) 475 and finally wind project in the south zone with 68 housing. Non biomass or geothermal projects are included in this program.

Table 2 show the Chilean electrical generation installed capacity in MW in the year 2005 and make a parallel between conventional and renewable sources in the four Electrical Systems in Chile measured by the National Energy Commission. Geothermal and solar generation are not mentioned in this table.

CONCLUSION

Actually, the enormous potential of renewable sources is not correctly exploited in Chile. The most important causes of this problem are: Low budget form governmental organizations and NGOs to implement new projects, users are not aware of the ecological advantage using renewable sources to generate electricity and potential users are not informed about the different system to generate electricity by renewable sources.

Then, is recommended that the government modificate the rural electrification program, using in big scale solar energy in the northern zone and wind power in the south.

Hydropower is correctly exploited and the energy from biomass is starting to be implemented.

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Tab. 1: Projects related with the use of renewable energies sources for rural electrification in Chile

Region	District	Project name	Type	Housing	Project situation
I	Arica	Híbrido Valle Chaca	Hybrid (PV-Diesel)	25	Pre-feasibility
I	Camarones	FV Camarones	PV system	50	Pre-feasibility
I	Camarones	MCH Esquiña e Illapata	Small Hydro	42	Pre-feasibility
I	Camiña	Híbrido Nama	Hybrid (PV-Diesel)	28	Pre-feasibility
I	Iquique	Híbrido Caleta San Marcos	Hybrid (PV-Diesel)	70	Pre-feasibility
I	Huara	Híbrido Achacahua	Hybrid (PV-Diesel)	19	Execution phase
II	Calama	Híbrido Cupo	Hybrid (PV-Diesel)	11	Pre-feasibility
II	Ollagüe	Híbrido Ollagüe	Hybrid (PV-Diesel)	80	Pre-feasibility
II	Ollagüe	FV Ollagüe	PV system	18	Project
II	San Pedro	Híbrido Camar	Hybrid (PV-Diesel)	10	Project
II	Loa	FV el Loa	PV system	60	Project
II	Tocopilla	FV Tocopilla	PV system	11	Project
II	San Pedro	Micro centrales de Socaire, Talabre y Río Grande	Small Hydro	121	Done
III	Huasco	Híbrido Carrizal Bajo	Hybrid (PV-Diesel)	100	Pre-feasibility
III	Chañaral	Híbrido Pan de Azúcar	Hybrid (PV-Diesel)	20	Pre-feasibility
III	Regional	FV Regional	PV system	441	Project
IV	La Serena	Híbrido Almirante Latorre	Hybrid (PV-Diesel)	70	Pre-feasibility
IV	La Higuera	Híbrido Los Morros	Hybrid (PV-Diesel)	42	Pre-feasibility
IV	Regional	FV Escuelas y Postas [(1)]	PV system	55	Project
IV	Regional	FV viviendas y establecimientos rurales [(2)]	PV system	3064	Execution phase
IV	Regional	Mejoramiento sist. FV instalados [(3)]	PV system	1500	Pre-feasibility
V	Petorca	no information	no infromation	38	Project
VII	Colbún	FV El Melado	PV system	21	Done
VII	Regional	FV Regional	PV system	365	Project
VII	Empedrado	FV Proboste	PV system	21	Project
VIII	Arauco	FV Arauco	PV system	424	Project
VIII	Bio Bio	FV Bio Bio	PV system	164	Project
VIII	Ñuble	FV Ñuble	PV system	164	Project
VIII	Coronel	Isla Santa María	no infromation	490	Pre-feasibility
X	Cochamó	Valle El Frío	Small Hydro	5	Pre-feasibility
X	Cochamó	Paso El León	Small Hydro	16	Pre-feasibility
X	Cochamó	El Manso	Small Hydro	12	Pre-feasibility
X	Cochamó	Sotomo Alto	Small Hydro	10	Pre-feasibility
X	Cochamó	San Luis	Small Hydro	50	Pre-feasibility
X	Cochamó	Segundo Corral	Small Hydro	15	Pre-feasibility

Region	District	Project name	Type	Housing	Project situation
X	Cochamó	Llanada Grande	Small Hydro	54	Project
X	Purranque	Caleta San Pedro	Small Hydro	7	Pre-feasibility
X	Purranque	Manquemapu	Small Hydro	15	Pre-feasibility
X	Chaiten	Caleta Loyola	Small Hydro	16	Pre-feasibility
X	Chaiten	Chumelden	Small Hydro	10	Pre-feasibility
X	Futaleufu	Valle El Espolón	Small Hydro	6	Pre-feasibility
X	Futaleufu	Las Escalas	Small Hydro	12	Pre-feasibility
X	Futaleufu	La Dificultad	Small Hydro	5	Pre-feasibility
X	Futaleufu	Río Chico	Small Hydro	4	Pre-feasibility
X	San Juan de la Costa	Barra del Río Bueno	Small Hydro	13	Pre-feasibility
X	San Juan de la Costa	Caleta Milagro	Small Hydro	3	Pre-feasibility
X	Corral	Cadillal Alto(Dimter)	Small Hydro	9	Pre-feasibility
X	Corral	Cadillal Alto Don Omar	Small Hydro	8	Pre-feasibility
X	Chaiten	Auteni	Small Hydro	25	Pre-feasibility
X	Calbuco	Tabón	Small Hydro	142	Pre-feasibility
X	Queilen	Acuy	Small Hydro	22	Pre-feasibility
X	Calbuco	Chaullin	Small Hydro	26	Pre-feasibility
X	Chaiten	Chuit	Small Hydro	35	Pre-feasibility
X	Chaiten	Chulin	Small Hydro	50	Pre-feasibility
X	Chaiten	Imerquiña	Small Hydro	6	Pre-feasibility
X	Hualaihue	LLanchid	Small Hydro	19	Pre-feasibility
X	Chaiten	Nayahue	Small Hydro	31	Pre-feasibility
X	Calbuco	Quenu	Small Hydro	55	Pre-feasibility
X	Chaiten	Talcan	Small Hydro	48	Pre-feasibility
X	Quemchi	Teuquelin	Small Hydro	11	Pre-feasibility
XI	Natales	MCH Gaviota	Small Hydro	500	Project
XI	Guaitecas	Proyecto Híbrido Melinka y Repollal	Hybrid (hydro-Diesel)	450	Project
XI	Aisen	Proyecto Híbrido Islas Huichas	Hybrid (hydro-Diesel)	107	Pre-feasibility
XI	Cisnes	Proyecto Híbrido Islas Grupo Gala	Hybrid (hydro-Diesel)	490	Pre-feasibility
XII	Pueto Natales	Villa Renovales	Wind	12	Pre-feasibility
XII	Laguna Blanca	Villa Tehuelche	Wind	50	Pre-feasibility
	(1)	***Schools and Rural Health Clinic***	TOTAL	9873	
	(2)	***Rural housing***			
	(3)	***Improvement PV system***			

Source: Data base of project Removal of Barriers to the Use of Renewable Energies Sources for Rural Electrification in Chile

Tab. 2: Electrical Generation Installed Capacity [MW] Year 2005

Electrical Generation Installed Capacity [MW] Year 2005						
	Source	SING	SIC	Aysen	MAG	Total
Conventional	Hydro > 20MW	0	4612,9	0	0	4612,9
	Diesel	3583	3422,1	13,88	64,7	7083,7
	Total	***3583***	***8035***	***13,88***	***64,7***	***11696,6***
Renewable	Hydro < 20MW	12,8	82,4	17,6	0	112,8
	Biomass	0	170,9	0	0	170,9
	Wind Power	0	0	2	0	2,0
	Total	***12,8***	***253,3***	***19,6***	***0***	***285,7***
TOTAL		**3595,8**	**8288,3**	**33,48**	**64,7**	**11982,28**
Renewable Sources %		**0,4**	**3,1**	**58,5**	**0,0**	**2,4**

Source: CNE data base

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