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TERNA Wind Energy Programme

Energy-policy Framework Conditions for Electricity Markets and Renewable Energies

23 Country Analyses
Chapter Costa Rica

Eschborn, September 2007

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New Edition of the TERNA Country Survey

Since the first edition of the TERNA country survey appeared in 1999, there has been a distinct heightening of public and political awareness of the consequences of climate change and of energy provision as a key factor in sustainable development. In Germany and other industrialised countries, a political tailwind, effective promotion mechanisms and rising energy prices have created the conditions for a dynamic market in which renewable forms of energy are exhibiting high growth rates within the energy mix. In 2006, global new investment in renewables amounted to US$ 70.9 billion – an increase of 43 % over 2005.

Strong economic development in many emerging countries has triggered rapidly rising demand for energy and competition on the international oil market. Against the background of the rising cost of fossil fuels, supply risks and damage to the environment, the significance of renewable energy as a means of generating electricity is growing – also in developing and emerging countries: according to analyses conducted by the Renewable Energy Policy Network for the 21st Century (REN21), 39 countries have set expansion targets for renewable energy sources and introduced promotion mechanisms, nine of which are developing or emerging countries. Of total new investment in renewable energy around the world, US$ 15 billion was invested in developing and emerging countries. Nevertheless, the majority of countries still have a long road ahead of them before they overcome existing barriers to the successful introduction of renewable forms of energy.

The German and European market acts as the driving force for the wind energy industry and provides an indispensable background of experience. However, growth in the industry is also increasingly apparent in developing and emerging countries. It is the successes in countries such as India, China and Brazil which encourage commitment beyond the borders of industrialised nations. In those three countries there is a growing proportion of local content in the systems and equipment they produce – and not only for supply to their own domestic markets.

A number of other countries though, too, are erecting their first wind farms, thereby establishing the basis for gaining experience to be utilised in future markets.

To help interested players gain access to the new markets, this survey provides detailed descriptions of the framework conditions for electricity markets and renewable energy in 23 developing and emerging countries.

Latin America	Africa/Middle East	Asia
Argentina	Egypt	Bangladesh
Brazil	Ethiopia	China
Caribbean States	Jordan	India
Chile	Morocco	Indonesia
Colombia	Namibia	Pakistan
Costa Rica	South Africa	Philippines
Dominican Republic	Tunisia	Viet Nam
Mexico		
Nicaragua		

This latest country survey and the previous editions are available on our homepage: www.gtz.de/wind. For the first time, the publication is also available on CD-ROM. For information on how to obtain this, again, go to the homepage.

Our grateful thanks go to a large number of GTZ staff members and other experts in the field for their help in putting this information together.

Eschborn, September 2007

Legal Information

1. The data used in this study is based on both publicly accessible sources of information (publications, specialist articles, internet sites, conference papers etc.) and non-public papers (for example internal expert reports from promoting institutions), as well as personal interviews with experts (for example officials at energy ministries in the investigated countries and project staff at promoting institutions). Although all information has been checked as far as possible, errors cannot be ruled out. Neither the GTZ nor the authors can therefore provide any guarantee of the accuracy of the data included in this study; no liability can be accepted for any loss or damage resulting from use of the data included in the study.

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The TERNA Wind Energy Programme

There is great potential for generating electricity from renewable energy sources in many developing and emerging countries. Obstacles to the exploitation of such sources include a lack of knowledge of framework conditions in the energy industry and insufficient transparency with regard to the prior experience and interests of national actors.

The purpose of the TERNA (Technical Expertise for Renewable Energy Application) wind energy programme, implemented by GTZ on behalf of the Federal German Ministry for Economic Cooperation and Development (BMZ), is to assist partners in developing and emerging countries in planning and developing wind power projects. Since 1988 the TERNA programme has pursued the twin goals of laying the foundations for sound investment decisions while at the same time enabling partners to assess wind energy potentials, plan wind energy projects and improve energy-policy frameworks for renewable forms of energy.

The TERNA wind energy programme's partners are institutions in developing and emerging countries that are interested in commercial exploitation of wind power. These include, for example, ministries or government institutions which have the mandate to develop BOT/BOO projects, state-owned or private energy supply companies (utilities) and private enterprises (independent power producers).

TERNA offers its partners expertise and experience. In order to initiate wind power projects, favourable sites must be identified and their wind energy potential ascertained. To do this, wind measurements are normally taken over a period of at least twelve months and wind reports are drawn up. If promising wind speeds are found, the next step is to conduct project studies investigating the technical design and economic feasibility. TERNA also provides advice to partners on matters of finance, thus closing the gap between potential investors and offers of funding from national and international donors.

If required, CDM baseline studies can be prepared and advice can be offered to potential operators on setting up an efficient operator structure. In order to ensure as much transfer of know-how as possible, efforts are made to ensure cooperation between international and local experts, for example when preparing the studies.

In successful cases, TERNA initiates investment-ready wind farm projects by this method. TERNA itself is not involved in financing. In addition to the activities that are tied to specific locations, TERNA advises its partners on how to establish suitable framework conditions for the promotion of renewable energy sources.

Up until 2007, TERNA has been active in over ten countries around the world.

Further information on GTZ's TERNA wind energy programme, the application procedure etc. is available at www.gtz.de/wind or directly from:

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4 Costa Rica

4.1 Electricity Market

Installed capacities

This country of 4.5 million inhabitants has no domestic fossil energy resources. The installed electrical generating capacity of the National Electricity System (SEN) at the end of 2005 totalled 1,931 MW, with 67 % provided by hydropower, 21 % by thermal power generating facilities[1], 9 % by geothermal plants and 3 % by wind power. The state-run electrical utility Instituto Costarricense de Electricidad (ICE) controls some 80 % of this installed capacity. Private power generators own a share amounting to about 13 % of total capacity, while the remaining 7 % is run by cooperatives for rural electrification.[2] The highest demand for electric power reached to date was 1,390 MW, in December 2005.

Year	Hydropower		Geothermal		Wind power		Thermal power		Total
	MW	%	MW	%	MW	%	MW	%	MW
2001	1,224	72.0	143	8.4	46	2.7	288	16.9	1,701
2002	1,262	71.8	143	8.1	66	3.8	288	16.4	1,758
2003	1,295	67.6	161	8.4	66	3.4	395	20.6	1,916
2004	1,304	67.5	164	8.5	66	3.4	398	20.6	1,931
2005	1,304	67.5	164	8.5	66	3.4	398	20.6	1,931

Tab. 1: Installed electricity generating capacity; Costa Rica; 2001–2005; MW and %[3]

Electricity generation

In 2005, Costa Rica was able to meet 96 % of its nationwide demand for electricity by utilising renewable energy sources. Thermal power plants, which make up 21 % of the electrical generating capacity in the country, are reserved primarily for use in times of low precipitation, contributing a share that amounted to slightly more than 3 % of the total electric power generated in 2005.

Year	Hydropower		Geothermal		Wind power		Thermal power		Total
	GWh	%	GWh	%	GWh	%	GWh	%	GWh
2001	5,651	81.7	986	14.3	179	2.6	99	1.4	6,916
2002	5,963	80.0	1,117	15.0	254	3.4	122	1.6	7,456
2003	6,021	79.6	1,144	15.3	230	3.0	157	2.1	7,554
2004	6,518	80.8	1,206	15.0	255	3.2	83	1.0	8,062
2005	6,568	80.0	1,149	14.0	202	2.5	295	3.6	8,215

Tab. 2: Electricity production according to energy source; Costa Rica; 2001-2005; GWh and %[4]

Electricity transmission

The electricity transmission grid in Costa Rica is based on a 230 kV high voltage line system totalling just under 1,000 km in length and 138 kV medium voltage lines measuring some 700 km in total. Energy losses incurred in electricity transmission lie at about 4 %.

There is little cross-border power transmission capacity with neighbouring countries, amounting to a mere 80 MW. Marginal improvement to this situation is expected from cooperation between the Central American states. Within the framework of the SIEPAC project fostered by Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama, a Central American electricity market is to be created by 2008 by expanding and linking existing transport networks. The accord formalising this effort was signed by six of the region's countries as far back as 1999. The project is being financed for the most part by the Interamerican Development Bank (BID).[5] The envisaged SIEPAC grid is to comprise a central 1,830 km-long 230 kV main line. This should enable the region's interstate grid transmission capacity to grow from 4 % of demand to 10 %.

1 These thermal power generating units mainly use diesel fuel.
2 The distribution grids of the cooperatives for rural electrification are linked to the SEN.
3 Source: ARESEP.
4 Source: ARESEP 2006.
5 Among other things, BID is granting loans worth US$ 240 million for erection of these transmission lines. The total cost of the grid is estimated to amount to US$ 320 million.

Degree of electrification

While in 1970 a mere 47 % of the population had access to electricity, this degree of electrification had increased to 98 % by 2005. Depending on the region, the percentage of the population with access to electricity varies between 80 % in the Puntarenas province in the country's south to almost 100 % in the province of the capital city, San José.

Electricity consumption

Demand for electric power in Costa Rica has grown in recent years by annual rates ranging from 4 to 6 %. Electricity consumption in the years just past has been divided up between the various user groups as follows:

Year	Households		Commerce/Other		Industry		Lighting		Total
	GWh	%	GWh	%	GWh	%	GWh	%	GWh
2002	2,720	42.8	1,613	25.3	1,862	29.2	165	2.6	6,361
2003	2,855	42.5	1,775	26.4	1,913	28.4	173	2.6	6,715
2004	2,951	43.5	1,922	27.4	1,950	27.8	186	2.7	7,010
2005	3,056	41.5	2,068	28.0	2,046	27.8	192	2.6	7,363

Tab. 3: Electricity consumption according to user groups; Costa Rica; 2002-2005; GWh and %[6]

Electricity prices

Electricity tariffs are generally based on the short-term marginal costs of the country's existing power generating facilities. In comparison with other Central American states, electricity prices remain stable and relatively low in Costa Rica owing to the country's lack of dependence on importing primary energy sources.

In 2005, the average electricity price per household was 5.1 €-ct/kWh (33.13¢), while the average rate paid by the commercial sector came to 9.8 €-ct/kWh (43.89¢) and that by industry to 5.3 €-ct/kWh (34.33¢). A further differentiation is made in the tariff system between rates at normal and peak load periods and in relation to consumption quantity. According to this system, households must pay 4.4 €-ct/kWh (28.60¢) for the first 200 kWh during normal load periods, whereas at peak load times the rate is 5.3 €-ct/kWh (34.50¢). Each additional unit of electricity consumed during peak load periods is charged at 9.0 €-ct/kWh (58.00¢), compared with only 7.4 €-ct/kWh (48.10¢) at times of normal loading.[7] Tariffs in rural areas supplied with power by the cooperatives tend to be lower than in the region around the capital city San José. Consequentially, cross-subsidation exists between urban electricity consumers and those in rural parts of the country. In addition, customers who consume more pay on average higher rates than those who consume less.

ICE has submitted a request to the regulatory authority to raise electricity prices in the year 2007. The average price increase of 16.5 % over the 2006 rates is significantly higher than the 9.4 % rate of inflation. Moreover, a rise in rates introduced in early 2005 already raised the price of electric power by an average of 17 %.

Expansion planning

Envisaged additions to the nation's electrical generating capacity are spelled out in national plans for expansion of electricity production that are prepared by ICE about every two years. Such efforts are formulated in coordination and agreement with the National Development Plan and National Energy Plan.[8] ICE bases its calculations for planned capacity expansion on a continuing annual increase in demand ranging between 5.3 and 6 %.

The current plan for expanding electricity production[9] of January 2006 has a planning horizon stretching to 2025 and is intended to ensure a power supply independent of neighbouring countries, i.e. one which is not dependent on possible electricity imports. The initial planning period covering the years from 2006 to 2010 calls for installation of new generating capacity totalling some 500 MW, of which 360 MW is to be provided by hydropower projects, 50 MW by an additional wind farm and 116 MW by Garabito thermal power plant.

6 Sources: ARESEP 2006.
7 A detailed listing of all electricity tariffs can be found on the website of the regulatory authority ARESEP (www.aresep.go.cr).
8 Plan de Desarrollo Nacional and Plan Nacional de Energía 2002-2016, issued by the Ministry of Environment and Energy.
9 See ICE (2006).

Originally Garabito power station was supposed to be completed as early as 2007. However, construction has been postponed indefinitely due to difficulties incurred in financing this gas turbine power plant project.

According to planning up to 2016, thermally generated electric power is to assume a greater role in the coming years. Plans envisage construction of three additional thermal power plants between 2010 and 2015. If all of these projects are indeed implemented, computational analyses by ICE foresee the share of total power generation provided by thermal power plants increasing from just less than 4 % today to almost 20 %.

Owing to the steeply rising demand for electricity, fears of shortages in electricity supply and a possible need for electricity rationing have already arisen in recent years. Uncertainty as to when Garabito power station is to be completed has aggravated matters even further. Consideration has been given to alleviating this tense situation by leasing mobile power generating units. However, for the time being any power shortages are to be circumvented by electricity imports from the expanding and intermeshing Central American electricity market.

While the go-ahead to implement projects planned for the timeframe 2006 to 2010 has already been given, an assortment of projects has been proposed for the period from 2010 to 2025 for which final selection for implementation remains to be decided. Plans call for installation of 1,400 MW of additional hydropower capacity, 70 MW of new geothermal power generating capacity and a further 180 MW within the scope of wind power projects.

A broad glance at the planning period spanning 2006 to 2020 reveals that 53 % of the overall planned capacity of some 3,000 MW is to be based on hydropower, 38 % on new thermal power plants, approximately 6 % on wind energy and slightly more than 2 % on a new geothermal facility.

In addition to the power plant projects of the state-run electrical utility ICE, the plan also includes projects currently under construction thanks to financing by private investors. As expansion of the country's power generation infrastructure cannot be financed by the state alone, it is anticipated that private investment in the form of BOT (Build-Operate-Transfer) contracts will increase in future.

4.2 Market Actors

Government actors

The electricity market is dominated by the vertically integrated state-owned electrical utility ICE, which was founded in 1949.[10] This company is active in the fields of power generation, transmission, distribution and marketing. Owing to the fact that the National Centre for Energy Controlling (CENCE) forms an integral part of this enterprise, ICE also assumes the role of system operator.

The Planning Centre (CENPE) – likewise part of ICE – is responsible within the scope of electricity production expansion plans for ensuring power supply by erecting new facilities providing adequate electrical generating capacity. Furthermore, ICE likewise has a monopoly on the nation's power transmission grids. Regional distribution companies and customers connected to the high voltage grid can use the services of ICE for a flat rate of 0.68 euro cents/kWh (4.40¢). The regulating authority ARESEP sets grid rates.

The power provider Compañía Nacional de Fuerza y Luz (CNFL) was founded in 1941. In 1968, ICE purchased some 98 % of the company's shares when the enterprise was nationalised. Private shareholders own the remaining stocks. CNFL is active in the fields of electricity production[11] and distribution. With almost half a million customers throughout the country, it is the largest power distribution company in Costa Rica, serving a 41% share of this market in 2005. This power provider supplies the most densely populated region in the capital city's metropolitan area.

10 See Law 449 from the year 1949.

11 Some 11% of the electricity sold is generated by nine hydropower plants. The remaining 89% is sourced from ICE.

Private actors

Four cooperatives (Coopelesca, Coope Alfaro Ruiz, Coope Guanacaste and Coope Santos) operate in rural regions of Costa Rica, all of them organised on a not-for-profit basis. The primary objective of these cooperatives is to achieve rural electrification[12] in accordance with Law No. 8345 enacted in the year 2003. Two local power provider enterprises, JASEC in the province of Cartago and ESPH in the city of Heredia, assume similar special positions in the nation's electricity market.[13] The primary task of these local power provider companies is to supply the public with electricity. JASEC was founded in 1964 and is active in electricity production[14] and distribution. ESPH, in existence since 1976, specialises in providing water and electrical power, supplying some 65,000 customers in six of the country's cantons.

In addition, there are 27 private generators active in Costa Rica who sell electricity to ICE. Prices paid to such private generators range between 4.65 and 6.92 euro cents per kWh, depending on the specific facility.[15]

Other Actors

Governmental responsibility and authority for energy policy lies with the Ministry for Environment and Energy (MINAE). MINAE leads the Energy Commission (Consejo Subsectoral de Energía), which is composed of the most important institutions and state-run enterprises in the energy sector. These include the Ministry of Science and Technology, the Ministry of Planning and Economic Policy, the regulatory authority ARESEP, the national oil company RECOPE and the national electrical utility ICE. The association ACOPE represents the interests of the private power generation companies.

The regulatory authority ARESEP

The independent regulatory authority ARESEP was created in 1996[16] and is responsible most importantly for determining transit fees and electricity prices. ARESEP specifies these tariffs giving due consideration to economic, social and ecological aspects. In doing so, the regulator is authorised to levy duties for financing grid expansion and supporting low-income groups among the nation's population. An additional important task of ARESEP is to provide supervisory monitoring of the electricity sector at all levels. This also includes technical and safety inspections. The government nominates the regulatory authority's five-member managing board, and these appointments are subject to approval by the Legislative Assembly.

4.3 Legal Framework

Energy and electricity market policy

Despite liberalisation efforts launched in the early 1990s, the electricity market still remains predominantly in the hands of the state. Legislation targeting more extensive liberalisation of the electricity market was rejected by the Legislative Assembly in 1998.

Private power generation

Upon enacting its Law No. 7200 in 1990, Costa Rica became the first Central American state to introduce requirements by law regulating private generation of electric power. The objective of this legislation was to reduce dependence on imports in the energy sector and to promote the use of hydropower and other renewable energy sources. This law allowed private actors to generate electricity based on renewable energy, while the share of the country's installed electrical generating capacity owned by private actors was not to exceed 15%. Moreover, the output of such renewable energy facilities was not to exceed 20 MW, and contract terms of 15 years were agreed.

12 See section on Rural Electrification.
13 See Law 7789 and 7799 enacted in 1998.
14 JASEC has a 19 MW hydroelectric power plant at its disposal.
15 A detailed listing of the remuneration received by all private power generators can be found on the regulatory authority's website (www.aresep.go.cr).
16 See Law 7593 from the year 1996.

These regulations governing private power generators were subsequently reformed and expanded in 1995 by Law No. 7508. According to this, a minimum of 35 % of the corporate capital of private power generators and cooperatives must be held by citizens of Costa Rica. ICE now purchases electricity from private-sector plants with electrical generating outputs of up to 50 MW. The permitted percentage of total installed capacity that may be owned by private power producers was raised to 30 %.

Concessions for electricity production are awarded by the regulatory authority within the framework of tendering processes. The terms of purchase contracts were extended from 15 to 20 years. These regulations apply equally to cooperatives as well as local provider enterprises.[17]

Procedures for licensing of private power generating facilities were reformed by the regulatory authority in January 2004.[18] In addition to precise description of the project, the main conditions for such approval include a public hearing, submittal of a power purchase agreement with ICE and a certificate issued by the Ministry of Environment and Energy verifying compliance with environmental compatibility review requirements.

4.4 Policy for Promoting Renewable Energy Resources

In Costa Rica, no separately defined tariffs are granted for electricity generated from renewable energy sources, such as within the scope of specific instruments of promotion.[19] Nevertheless, utilisation and promotion of renewable energy constitute an important guiding principle of national energy policy. The current National Energy Plan confirms that use and promotion of renewable energy in the electricity sector makes a major contribution to environmental protection. Consequently, the long-term goal set for the electricity market calls for an increase in the share of electricity generated from renewable energy sources (excluding hydropower) to 15 %.

In addition, several of the country's major laws stipulate promotion of renewable energy sources. Harnessing of hydropower was defined to be a primary task of the state-owned electricity enterprise ICE, anchored in the company's articles of organisation in 1949. Law No. 5961 enacted in 1976 gave ICE a monopoly on research into and use of geothermal energy sources. The country's 1995 Environmental Law states that the state is obligated to investigate the availability of alternative energy sources and to promote their use in order to achieve sustainable economic growth.[20]

The use of hydropower alone is restricted by the regulations of Decree No. 30480 adopted in 2002, which spells out that technologies enabling utilisation of other renewable energy sources are to be given priority over hydropower provided any related negative environmental impacts thereof can be limited. Directive 22 on the Promotion of Renewable Energy, issued in 2003,[21] clearly stipulates that renewable energy sources, with the exception of hydropower, are to be used in the electricity sector provided such use is preferable from an environmental policy standpoint and at the same time economically feasible.

In the Declaration of San Salvador issued in February 2006, the Central American energy and environmental ministers proclaimed their countries' political will to further increase the share of renewable energy sources in the energy portfolio. Furthermore, private actors are to play an important role in future, and potential economic incentives evaluated.

Clean Development Mechanism

Costa Rica ratified the Kyoto Protocol in August 2002. Responsibility for Clean Development Mechanism (CDM) affairs lies with the Oficina Costarricense de Implementación Conjunta (OCIC), which is attached to the Ministry of Environment and Energy. OCIC provides technical support and advises private and public enterprises in the preparation of CDM projects. OCIC had already been set up in 1995 within the scope of the Activities Implemented Jointly programme, the pilot project programme of the Kyoto Protocol.

17 The legal framework for cooperatives was regulated by Law No. 8345 of March 25, 2003.
18 See ARESEP, 2004.
19 All that has been made available is tax incentives for some wind power installations.
20 See Ley Orgánica del Ambiente 7554 of 1995, Article 58.
21 See D22-26389 of 25 March 2003.

At the time of signing of the Kyoto Protocol, an organisation comprising private actors – the Asociación Costarricense de Implementación Conjunta (ASOCIC) – was formed for the purpose of improving financing of CDM projects. Membership of ASOCIC is open to the largest national enterprises in the private and public sectors and the Chamber of Forestry. OCIC reports to ASOCIC in administrative matters. Thus, formation of the Designated National Authority (DNA) in Costa Rica constitutes a case in which certain competencies and authorities were outsourced to enable access to the know-how of private institutions.

Two Costa Rican CDM projects had been registered with UNFCCC (United Nations Framework Convention on Climate Change) by the end of January 2007. The Rio Azul facility for harnessing and using landfill gas was registered in October 2005. This 3.7 MW plant in the capital city San José is under the ownership of the SARET group, which was awarded the contract to implement the project following a call for tenders from CNFL.

In March 2006 the Cote hydroelectric project, with a power output of some 7 MW, was also registered. The plant is located in the northern province of Guanacaste and is being financed by the state-owned company CNFL.[22] The electricity generated is to be fed into the national power grid.

In August 2006 the Spanish electric power utility Union Fenosa achieved registration of La Joya hydroelectric power station with Spain's DNA. This hydroproject, with a generating capacity of 50 MW, has not yet been registered with UNFCCC.

4.5 Status of Renewable Energy Sources

For the time period 2006 to 2025, the current plan for expansion of electricity production calls for greater exploitation of renewable energy sources, primarily of hydropower, followed by geothermal energy and wind power. To a lesser degree it is also planned to utilise biomass as well, in particular biomass (bagasse). Solar energy, on the other hand, is to play only a marginal role due to the cost factors involved.

Hydropower

The technically exploitable hydropower potential of Costa Rica is estimated to amount to 5,800 MW. Feasible exploitability is restricted, however, as some 800 MW of the identified potential lies in national parks where the use of hydropower is prohibited by law. Sites for a further 1,800 MW of potential electrical output are located in areas home to indigenous populations. ICE views implementation of such projects in these regions to be problematic.

Installed hydropower generating capacity at the end of 2005 totalled 1,304 MW. Some 75 % of this installed capacity is provided by large hydroelectric power stations (> 50 MW), 20 % by midsize hydropower projects with outputs ranging from 10 to 50 MW, and the remaining 5 % by small hydropower projects producing less than 10 MW.

State-owned hydropower plants

The hydroelectric generating facilities of the state electrical utility ICE possess an electrical generating capacity of some 1,000 MW, mainly comprising large power plants. ICE has eleven hydroelectric plants that went into operation between 1958 and 2002 and deliver a capacity of between 24 and 180 MW. In addition, ICE owns five small hydropower plants[23] which, added together, can provide an electrical output of 5.3 MW. The state enterprise CNFL owns three hydroelectric plants with a combined capacity of 73 MW.[24]

22 76% of the total project costs of some US$ 8.8 million are being financed by a loan from the American Bank for Economic Integration.
23 The plants in question are Cacao, Echandi, Avance, Lotes and Pto. Escondido.
24 These plants are Daniel Gutiérrez (18 MW), Cote (7 MW) and Brasil (5 MW).

ICE is committed to expanding the use of hydropower in future as well. Its 80 MW Caroblanco hydroproject is scheduled to go on line in 2007, followed by the 128 MW Pírris scheme in 2009/2010. In addition, planning is currently underway for Veraguas Hydroelectric Power Station which, intended to ultimately provide a generating capacity of 631 MW, will become the nation's largest single power generating facility by far. Preliminary feasibility and environmental impact assessments conducted in 2005 have yielded positive outcomes. The preparatory phase is to be completed by the end of 2008. Total project costs are estimated at just under US$ 1 billion.

Privately owned hydropower plants

Two local power provider enterprises, JASEC and ESPH, own several small hydropower projects that together provide a generating capacity of 22.5 MW. With completion of its Los Negros Hydroelectric Power Station, ESPH has expanded this installed capacity by 17 MW.

Another company, Edificadora Beta, has built power plants for three of the country's cooperatives: an 8 MW plant for Coopelesca was commissioned in 1999, and two other generating facilities for 14 MW and 5 MW respectively went on line in 2003. A 17.5 MW plant is currently being constructed for the Coopeguanacaste cooperative, and 2007 should also see building begin on a 15-MW power plant for the Coopesanto cooperative. Further projects by this company are at the planning stage. The Coneléctricas R.L. cooperative is planning to build the Pocosol hydroelectric power station, expanding the power generating base by a further 26 MW. Work on this US$ 47 million project is scheduled to commence in the first half of 2007 and be completed by the end of 2008. The construction of additional hydropower plants is intended to increase the installed capacity of the four cooperatives to a total of 132 MW by 2010, thereby enabling hydropower to meet 80 % of demand in the respective supply regions.

Other private actors held power purchase agreements with ICE in 2005 totalling 127 MW in hydropower output. The share of private generators in the market grew even further with completion of the La Joya (50 MW) and El General (39 MW) projects in 2006, both plants having been built under BOT contracts.

Wind energy

Wind energy potential in Costa Rica is estimated by the government at between 500 and 600 MW. However, ICE is working on the assumption that existing legal restrictions limit the actually exploitable wind power potential to 274 MW, as the harnessing of wind energy (like hydropower) is prohibited in national parks, where many of the suitable sites are located. Wind energy is seen as an appropriate complementary source to hydropower in Costa Rica, as the summer is marked by strong winds that can be exploited to alleviate the consequences of dry periods on hydropower production. ICE began evaluating the national wind power potential as long ago as the early 1980s. A relatively imprecise study of wind conditions was completed that classifies wind speeds in four ranges.[25]

At the end of 2006, Costa Rica possessed installed wind power generating capacity of some 70 MW. With the exception of ICE's 20 MW wind farm in Tejona, the facilities are in private ownership. All four farms in operation are located in the vicinity of the Lake Arenal, a dammed reservoir in the north of the country.

Costa Rica's smallest wind farm, Aeroenergia, was inaugurated by the company of the same name in 1998 and has a generating capacity of 6.4 MW. Project costs came to US$ 9.5 million. Even before that, in 1995, the Inter-American Development Bank made an US$ 18.7 million loan available for a further project, enabling realisation of the world's first private wind power project without state financial support. This 20-MW wind farm comprising 55 units is owned by Planta Eólica S.A.

25 The study was prepared in 1983 by the Swiss firm Electrowatt Engineering Services.

Movasa wind farm, with a total generating capacity of 24 MW, went on line in 1999. This installation, consisting of 32 turbines each rated at 750 kW,[26] is the property of ERGA, a subsidiary of the Italian utility company ENEL. The purchase contract with ICE, however, is for supply of 20 MW. Any failure to feed the power grid with the agreed purchase quantities triggers the threat of penalties, while at the same time any overproduction is not remunerated.

2002 saw the nation's newest wind farm put into operation. The state-owned Tejona wind farm is operated directly by ICE. This facility comprises 30 wind turbines from the Danish manufacturer Vestas, each rated at 660 kW. The average wind speed at the site is 11.7 m/sec. ICE itself paid the lion's share (US $ 18.8 million) of the US $ 26 million price tag for the wind farm, while support was received within the scope of a pilot CMD project from the Dutch power provider Essent (US $ 3.9 million) as well as from the GEF (US $ 3.3 million). According to information provided by the regulator in January 2007, existing wind power installations are paid on average 6.8 euro cents per kWh (8.75 US cents/kWh).

When it was preparing a development plan for renewable energy sources in 2004, CNFL identified six sites suitable for harnessing wind energy. It was thought that the wind farms would be relatively small, with capacities ranging between 3 MW and 20 MW. Wind measurements were also conducted at the potential sites and cost estimates prepared. However, no concrete plans for utilisation of these sites had been presented as of the end of 2006.

Costa Rica's plan for expanding electricity production in the years from 2006 to 2025 includes the installation of an additional 50 MW of wind power generating capacity by year's end 2008. Project contracts were supposed to be awarded through public tendering, although the process had not been completed by January 2007. Planning calls for installation of an additional 20 MW of capacity in the years following 2008.

Biomass

The energy potential of biomass to generate electricity is estimated by ICE to be 317 MW_e. Biomass obtained as a by-product of the sugar industry (bagasse) is to be more extensively exploited in future for power generation. Contracts are currently in place for the purchase of surplus electricity generated by the two plants described below, which use bagasse as a fuel.

The Ingenio El Viejo plant is operated by El Viejo S.A., a sugar factory established in 1955 in the Guanacaste region in the country's northwest. This 4 MW cogeneration (combined heat and power) plant has been feeding electricity to the public grid since 1991. The second facility – Taboga power plant – has an installed electrical generating capacity of 20 MW according to the plant operator. Owing to its location near the country's northern border, some of the electricity generated there is sold to Nicaragua. ICE has power purchase agreements with both plants. According to ICE, both plant operators have plans to expand generating capacity.

To date, the use of biogas for electricity production has been tried only in the Rio Azul pilot project; this was also the country's first CDM project to be registered. The plant was installed in 2004 to harness and exploit the energy potential of landfill gas and has a generating capacity of 3.7 MW. With the exception of bagasse, biomass as a whole is categorised by ICE to be a "new renewable energy source" that is to be put to only limited use, due to technical and economic restrictions.

Solar energy

Average daily solar irradiation in Costa Rica reaches a maximum of 5.0 to 6.0 kWh/m^2, but is subject to broad fluctuations. Photovoltaic (PV) systems are used in Costa Rica almost exclusively to provide electrification in regions remote from the established grid. The theoretical potential of solar energy in Costa Rica is estimated to be 10,000 MW. Heredia National University has been active in related research since 1977. In addition, the use of solar power is being promoted by non-governmental organisations such as the Costa Rican solar energy association 'Sol de Vida' and CEPRONA.

26 The units installed are NEG Micon NM44/750 wind turbine generators.

1,445 solar energy units for power generation had been installed in the country as of 2006. Almost all of these are deployed in decentralised systems providing a total generating capacity estimated to be 140 kW. The first solar energy installation to generate power for the public grid entered operation with ICE's San Antonio solar project. The PV modules used, each rated at 2.4 kW, can generate some 3 MWh per year. According to ICE, based on the experience gained to date, similar grid-coupled installations with a total output of 500 kW are to be erected at other sites.

In collaboration with the country's cooperatives, ICE has installed almost 1,300 solar systems in off-grid regions. The Coopeguanacaste cooperative has installed another 170 solar systems in its supply area. One of the largest PV systems was installed on the island of Caballo. The central system, consisting of 107 modules, supplies the island's 200 inhabitants with electricity for lighting, pumping water and producing ice for the refrigeration of fish.

Exploitation of solar energy for heating water is still in its infancy in Costa Rica. Throughout the country, total installed collector surface area comes to only about 3,000 to 4,000 m^2. In its current energy plan the government has set the goal of further investigating the use of solar energy for water heating purposes. In only a few cases solar power is employed for water distillation.[27]

Geothermal power

The potential of geothermal power in Costa Rica is estimated by some sources to be as high as 900 MW. In contrast, ICE assumes a potential of only 235 MW, as its analysis takes account of restrictive factors. Such restrictions include, first and foremost, the fact that a large number of the suitable sites are located in national parks in the north of the country and that operation of such facilities at these locations is prohibited by law. A legislative initiative that would allow operation of geothermal installations in national parks has had no success to date. At the end of 2005, Costa Rica had an installed geothermal generating capacity of 165 MW, meeting some 15 % of total electricity demand.

Studies investigating the use of geothermal power were initiated in Costa Rica some time ago, in 1974, in response to the first oil crisis. Preparatory work for construction of the first geothermal power plant near the Miravalles Volcano was launched in 1987, culminating seven years later when the first unit, Miravalles I, went on line delivering output of 55 MW. That same year a second geothermal plant named Boca de Pozo began operation, generating 5 MW. The latter facility was expanded twice, in 1996 and 1997, each time by 5 MW of extra capacity. However, the two most recently constructed units, owned by the Mexican state utility CNE, were decommissioned in 1998.

The Miravalles complex was expanded in 1998 with the addition Miravalles II power plant, likewise generating 55 MW. The 27.5-MW Miravalles III followed in 2000, the first unit to be financed by private investors within the framework of BOT contracts.[28] The most recent unit, Miravalles V, expanded the power plant complex's total generating capacity by 15 MW in 2003.

A further geothermal power plant, dubbed Las Pailas, is at the planning stage. Deep wells for the 35 MW plant have already been successfully sunk. According to the plan for expansion of electricity production, the plant is scheduled to be ready for operation in 2011 and will be financed through a BOT contract. Precise information about financiers was not yet known at the end of 2006. The power plant is then to be expanded in 2013 by an additional 35 MW of generating capacity. No further power plants are envisaged within the scope of the plan to expand electricity production.

27 See Nandwani, 2006, for a detailed listing of selected solar energy installations in Costa Rica.

28 The costs, amounting to some US$ 65 million, are being borne by the private consortium comprising Oxbow Power, Marubeni Corp. and José Altmann. A power purchase agreement covering a term of 15 years was concluded ICE.

4.6 Rural Electrification

In view of the fact that over 98% of the nation's population has access to electric power, rural electrification in Costa Rica is also well advanced, constituting an exceptional case in Central America. This development is due in particular to the cooperatives that have been active since the 1960s. These four not-for-profit organisations were founded for the express purpose of achieving rural electrification. All told, the distribution grid of the cooperatives is over 7,000 km long and supplies some 150,000 customers. The supply area of the four cooperatives stretches across 22% of the nation's territory. However, their few power generating facilities based exclusively on hydropower[29] can meet only 34% of collective demand, such that remaining electricity needs have be met by sourcing from ICE. It is intended that self-generation should be expanded to meet 80% of demand by 2010 by building additional hydropower plants. The interests of the cooperatives are represented by the cooperative Coneléctricas R.L., which was founded in 1989 and acts a parent association for all the cooperatives.

Cooperation between UNDP, ICE and MINAE

Under the National Development Plan, the government has set itself the goal of ensuring that every citizen of Costa Rica has access to electricity by 2010. In order to reach the remaining 20,000 households not yet supplied, a national programme for electrification of off-grid areas, to be based exclusively on the decentralised use of renewable energy sources, was set up within the framework of a cooperative effort between the United Nations Development Programme (UNDP), ICE and (MINAE).

The programme is broken down into two phases. In the first phase, an institutional, financial and normative framework is to be created in the energy sector to prepare for rural electrification with the aid of renewable energy sources. The second phase is then to comprise actual implementation of the projects.

In concrete terms, electrification efforts are to concentrate on electrification of 329 municipalities by means of small hydropower plants or photovoltaic systems. 7,000 families stand to benefit from this project, in which the generating capacity of each unit will be less than 100 kW.

For the project's initial phase, which is to cost some US$ 2 million, the GEF has approved subsidies amounting to US$ 1.15 million. ICE and the Ministry of Environment and Energy are to contribute US$ 660,000 and US$ 240,000, respectively. The project contract was signed in May 2005 by ICE and the Ministry of Environment and Energy. 16 municipalities that to date have had neither any connection to the public grid nor any diesel generators are to be supplied with electricity within the scope of pilot projects.

To achieve systematic electrification of the remaining households in Phase II, in October 2006 the UNDP office in Costa Rica issued a call for tenders for a project in collaboration with the GEF. The bidders submitting proposals are asked to prepare a thorough plan for comprehensive rural electrification. This should show the locations that can be reached by expanding the existing distribution network. Consequently, all remaining sites will have to be electrified using decentralised power generating systems based on renewable energy sources. Furthermore, the most cost-effective options are to be identified and elaborated, and studies conducted for implementation of the initial projects.

Exchange rate (27 January 2007):
1,000 Costa Rican colón (CRC) = 1.546 euro (EUR)

29 Coneléctricas and Coopelesca have hydropower schemes with capacities of 17 MW and 27 MW respectively.

4.7 Information Sources

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www.gtz.de/de/weltweit/lateinamerika-karibik/627.htm

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There is great potential for generating electricity from renewable energy sources in many developing and emerging countries. Obstacles to the exploitation of such sources and to the involvement of foreign investors include a lack of knowledge of framework conditions in the energy industry and insufficient transparency with regard to the prior experience and interests of national actors. This fourth, updated and expanded edition is aimed at overcoming barriers such as these.

The electricity markets and their respective actors are investigated for 23 countries in various regions: Latin America, Africa – Middle East and Asia. The country studies analyse the energy-policy framework conditions and closely examine the status of and promotion policy for electricity generation on the basis of hydropower, wind power, solar power, biomass and geothermal energy. The chapters on each country are rounded off by information about rural electrification.

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