3rd LAMNET Workshop – Brazil 2002

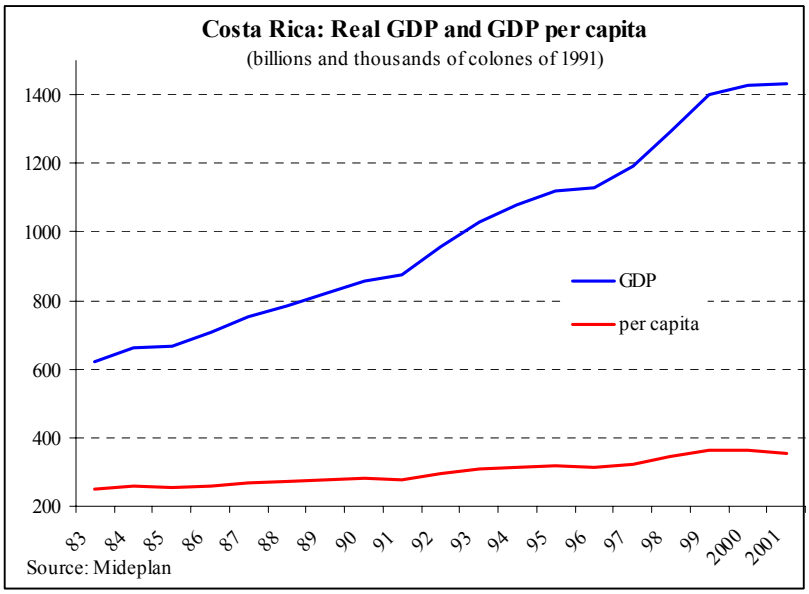
Ethanol Potential in Costa Rica

Mr. Leiner Vargas Alfaro
ECOMAP Unit - International Center of Economic Policy (CINPE-UNA)
P.O. Box Cinpe-Una-Heredia, 555-3000 Heredia
Costa Rica
Email: lvargas@una.ac.cr
Internet: www.una.ac.cr

Section 1: Some economic and social figures: from the crisis to a new economy based in exports and tourism[1]

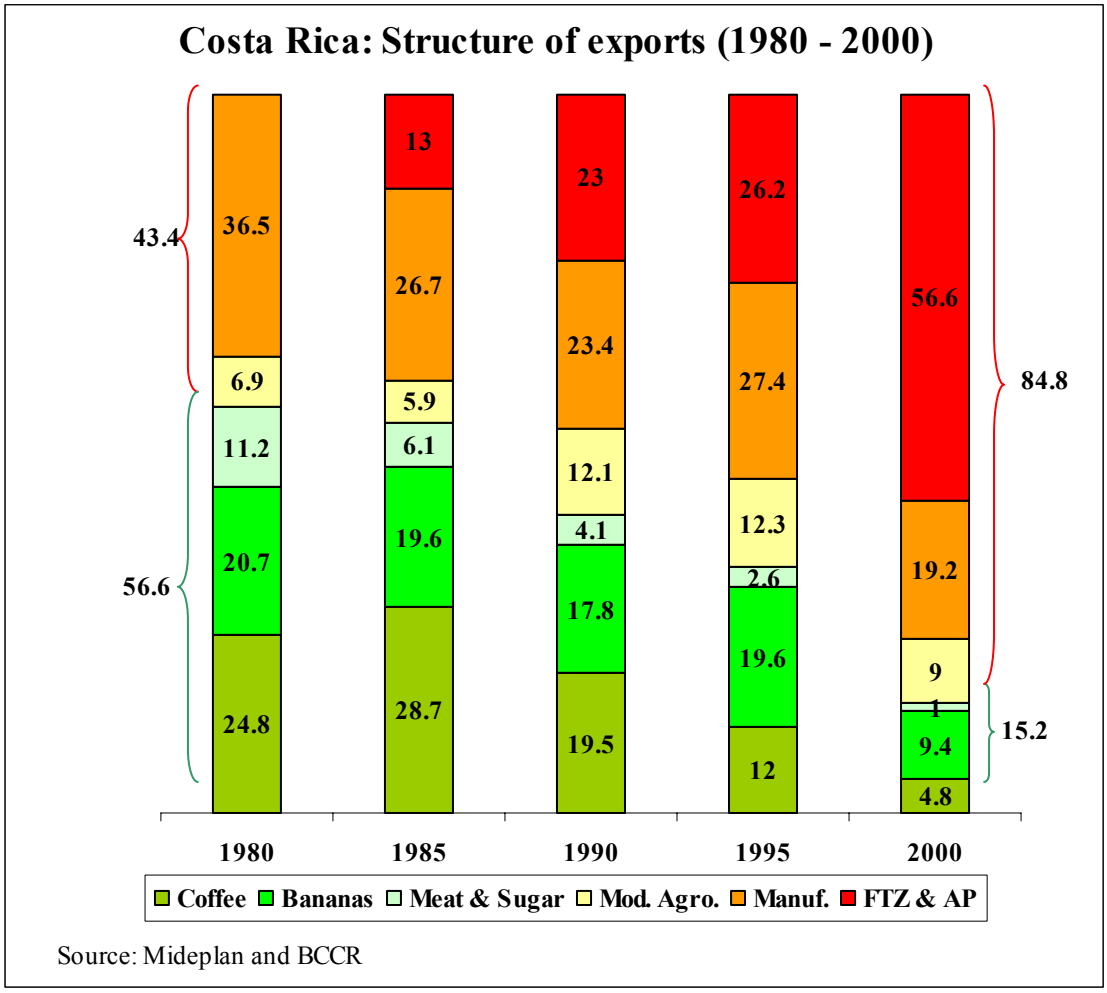
Since the beginning of the seventies, the Costa Rican economy has been strongly affected by external shocks by the international oil market. An small economy, basically driven in the external sector by basic tropical commodities like coffee and bananas, was and will always be affected by global energy crises. During the eighties and the nineties, the economy has been diversifying into more industry based free zone facilities, tourism and non-traditional agricultural products. All these diversification of the economy has implied important changes in energy uses and demands.

In spite of the severity of the crisis at the beginning of the eighties, stabilization was particularly successful, as it took only two years to control most of the basic macroeconomic and social disequilibria. A combination of factors made possible such a rapid recovery, ranging from a very able management of stabilization policies by the government – both in economic and political terms – to a significant amount of foreign aid, that came to support Costa Rica's efforts at a time Central America was going through a critical period. Most impressive, however, was the fact that Costa Rica's stabilization process in the post-crisis years, as well as the process of structural adjustment that followed, while generally in line with the strictures of fiscal and external responsibility imposed by both crisis and adjustment, did not follow the typically recessive and regressive recipes then en vogue.



[1] This section is based in the report Costa Rica within the 'New Economy: The Role of Education, Training and Innovation Systems, de Garnier, Leonardo 2002.

But it was not just that the economy was growing again, that employment, incomes, investment and consumption were growing again, but that this was happening through a complex, not always consistent and, sometimes, even contradictory process of structural adjustment, through which Costa Rica's economic and social structure, as well as its institutional setting, were gradually being transformed. This transformation was particularly evident in the structure of Costa Rica's exports, which had been historically concentrated in a few traditional agricultural products. As the next graph shows, coffee, bananas, meat and sugar represented, as late as 1980, almost 57% of Costa Rica's exports, while 36% were manufacturing exports, mostly to the Central American Common Market and which, being highly dependent on heavy tariff protection, could hardly survive international competition. In just two decades, this changed radically: by 2000, Costa Rica's traditional exports would only account for 15% of its exports.



Source: Mideplan and BCCR

This radical change in the structure of exports did not come as the result of a reduction in the volume or total value of traditional exports, but rather through the emergence of new exporting activities that have grown at a very rapid pace during the last two decades and, especially after the mid nineties. The problem with traditional exports remains – as in the past – one of relative prices: in fact, the amount of coffee Costa Rica exported between 1980 and 2000, doubled; but, as coffee prices almost halved in the same period, the total value of coffee exports remained basically the same in 2000 as in 1980, so that their relative importance went from 25% to a mere 5% of total exports. With bananas the situation was better: while the volume of exports also doubled during these two decades, banana prices remained relatively stable, so that total value of banana exports increased from US$207 million in 1980 to $549 million by 2000. Still, their participation was halved during that period: from 20.7% to 9.4%. The rest of Costa Rica's traditional exports – meat and sugar – went from 11% to 1% of total exports.

There were other significant changes: diversification of agricultural exports (like flowers and ornamental plants, fruits, and more exotic products like heart of palm, macadamia, asparagus, and so on); contraction of traditional manufacturing activities – whose weight in total exports went from over 36% to less than 20% - and, especially, the emergence and consolidation of new industrial activities, that came to represent about 57% of Costa Rica's total exports, that is, the same proportion that, twenty years earlier, depended on traditional agricultural exports.

But changes were not limited to Costa Rica's exporting activities. There were also significant changes in the services sector: in commerce, where traditional *pulperias* and local stores were confronted by the appearance of huge supermarkets and shopping malls; in professional services (medical, consulting, engineering, educational and so on); and, especially, in banking and financial services. Last but not least, tourism became one of Costa Rica's most important sources of income and indirect employment. These changes were clearly reflected in the changing structure of Costa Rica's labor market. People working in agricultural related activities, for one, went from 35% to 20% of the economically active population during the last quarter of the 20th century, which is rather significant for a country that, by the 1950s, was basically a rural nation, with 60% of its workers dedicated to agricultural activities.

Costa Rica: employment by sector (structure)				
	1950	1976	1990	2000
Agriculture and related activities	59	35	26	20
Industrial and manufacturing activities	8	15	18	15
Construction	4	6	6	7
Basic Services	4	6	5	7
Commerce, restaurants, hotels	8	16	16	20
Financial institutions			3	5
Personal and social services	16	22	25	26
Source: MIDEPLAN (Ofiplan for 1950)	100	100	100	100

Significant as they are, however, these structural transformations have occurred in parallel with the ongoing operation of many of Costa Rica's more traditional activities. Today, Costa Rica is a much more complex society, but also one with much stronger contrasts and contradictions. Some parts of its economic and social structure, as well as some of its institutions – public and private – have changed dramatically in the last couple of decades, while others remain practically untouched.

Energy sector in Costa Rica

The transportation sector was the most important user of fuel based energy, followed by industry, residential and others. Mayor fuels used in transport are diesel and gasoline. The demand for transportation increased not only for goods (train system failed and it was close down beginning of the nineties) but also, passengers using private cars. The amount of new cars grows rapidly, just as the process of urbanization of the country.

As a result of the democratization processes in Central America and the increasing role of trade in the economy, demand for international transportation is also growing, leading to a collapse of the infrastructure build from the fifties until the eighties. The new demands for transport and air quality is increasingly putting pressure on the mayor oil refinery state company (RECOPE).

Also, the demand for environmental quality is growing. New governments are doing efforts to set rules and regulations for the petrol industry as well as the electricity sector. Even though mayor state owned sectors where privatized at the beginning of the nineties, electricity and oil oriented industry is still public oriented sector. Some space for small investors in areas like exploration and co-generation was allowed at the beginning of the nineties, but mayor reforms were block-out by civil society groups (See Vargas, 2001).

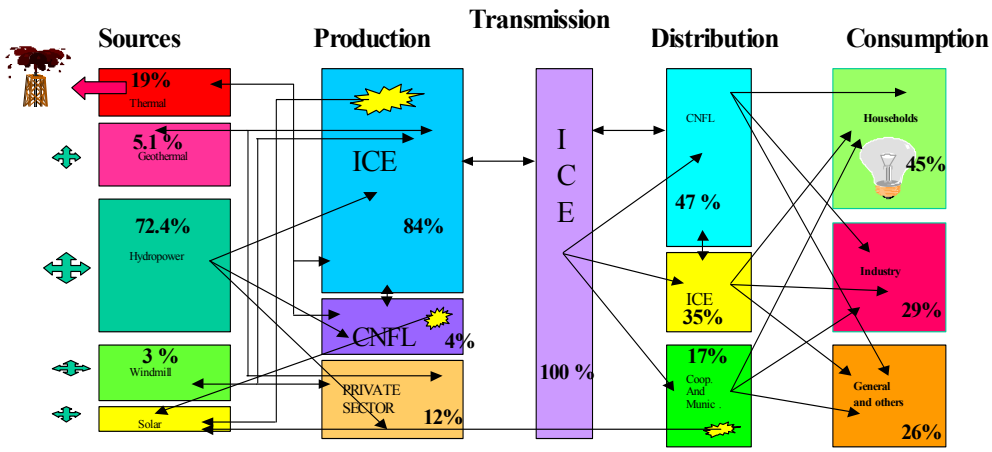
Contrary to what has been seen in other developing countries in Latin America, the Costa Rican public electricity sector has shown quite good results in all the main indicators traditionally used to measure performance. In 1949, when the National Institute for Electricity was founded, the installed capacity was 36,637 kW. At that time there were many problems related to the maintenance of the networks and the inefficiency of private local monopolies. Only major cities were electrified and some technical problems such as blackouts and quality of the power were common. In order to solve these problems, the development of infrastructure for the network and additional capacity became the priority of the new company (ICE) during its first decade.

This process of increasing the capacity was developed by means of different mechanisms, especially the use of external funding for the support and implementation of interconnection of the country with the new hydropower supply-oriented system. Since then, hydropower has been the most important source of electricity (ICE, 1996).

For example, in 1999, 19.1% of all the energy consumed in Costa Rica came from the electricity sector. Of this energy, 82% is produced by hydroelectric sources.[2] Another aspect is that the electric interconnection levels for 1999, covered approximately 96% of the population. This implies a strong share of equity and access to energy for the multiple needs of production and consumption throughout the country. This has been a result of a *clear public policy to electrify Costa Rica*, which had a coverage of under 41% in the early 1950s (DSE, 1996). Generally speaking, in spite of the existence of a heterogeneous production structure, the main source or primary input for electricity production in Costa Rica is water. In 1999, the total generation was 6198 GW. Of that, 82% of the generation came from water resources, 13% was geothermal, 3% thermal, and 2% came from windmill generators.

Although Costa Rica is smaller in size and population than some of the other countries, the size of the electricity sector is larger and the amount of water and geothermal resources is higher than the rest. Also, the country is the first in including non-conventional energy sources, such as wind in the electricity system. A general chain of electricity production for Costa Rica is presented in the Figure below to illustrate the degree of development of the sector and characteristics at this moment. The sources of electricity have been concentrated in hydropower and thermal projects; more recently geothermal and windmill projects have been included.

Figure 2.5. Costa Rican Electricity Chain in 1999



Source: Original, with data on the sector in 1998.

[2] The above reflects a relevant characteristic of the Costa Rican electricity sector: It produces electricity with more environmentally efficient energy than other countries in the region.

New private actors in the field of production have concentrated on small hydropower, wind and geothermal projects, while the National Electricity Company (ICE) has continued with the most important part of the production. According to the new regulatory framework, the new capacity in private sector projects could achieve no more than 30% of the total capacity (Law #7505).

Transmission activities have been considered a national monopoly and have continued in the hands of the ICE as a public enterprise. The distribution process included local and regional monopolies and a different pricing system, all of which are comprised of co-operatives or regional municipalities. There is a great deal of controversy about introducing competition and quality control in these companies (Orozco, 1996).

Finally, the consumption of electricity is highly concentrated in residential and industrial activities. Due to the fact that cooking in urban areas depends mainly on electricity, the urban sector is a large consumer of electricity. Costa Rican electricity rates, traditionally subsidised in residential consumption (Singh and Acuña, 1996), have caused an important increase in demand. This has led to the installation of thermal power plants based on imported fuel, and has affected the environmental and economic efficiency parameters that the Costa Rican electricity sector has sustained when compared with other countries in the region (Jiménez, 1997).

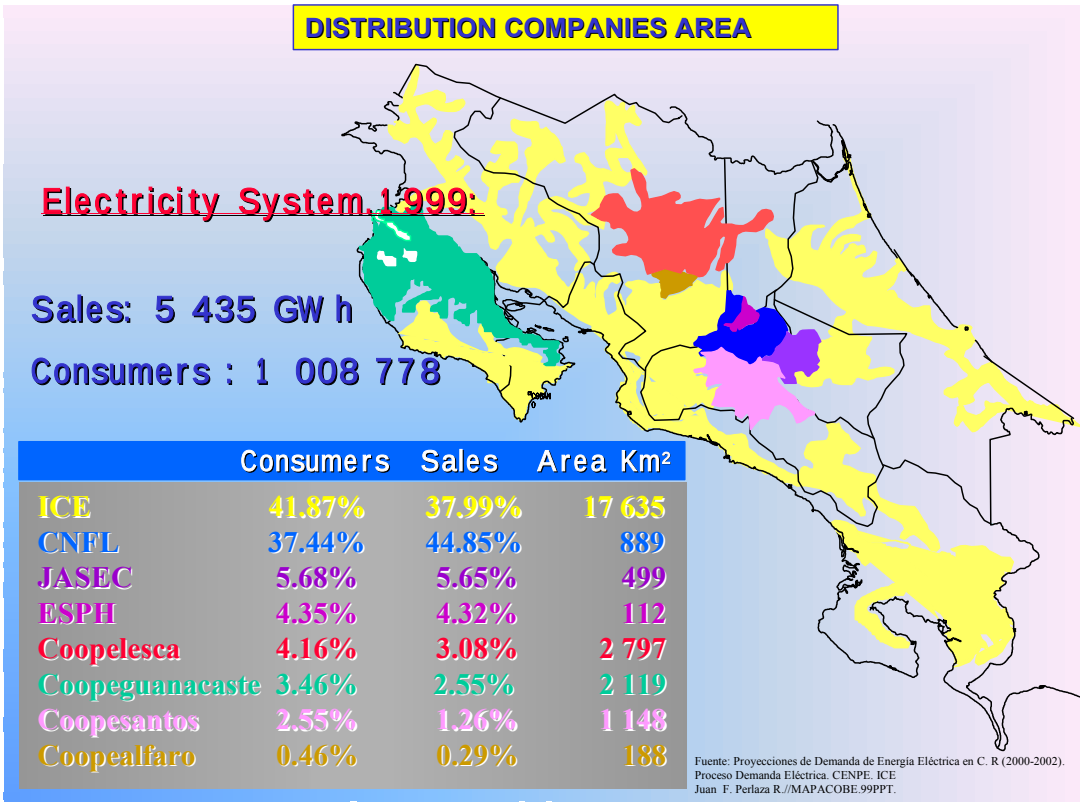


Figure: Costa Rican Distribution Companies

Another important aspect to consider in the case of Costa Rica is the source of innovative activities in the sector. Of course, during the planning period this sector has been oriented mainly by the use of the natural resource base and the importation of the relevant technologies in order to develop the existing capacity.

As a State monopoly, production activities have been concentrated in the ICE. Therefore, innovative dynamics operated within this company, which also was in charge of the telecommunication activities. Because the main source of electricity was water, engineering

research and development activities were concentrated on the different technical aspects of the development of these projects. More recently, as the sector has been opened up to private production, many different types of expertise and relationships have been developed in order to generate the new supply capacity.

At least three different sources of institutional and technological changes, which did not exist previously, have been developing in the 1990s. Environmentalist groups and consumer organisations have been promoting and influencing the parliamentary process toward additional renewable energy sources. In some cases, they are also direct actors in the process of implementing pilot projects and illustrative experiences in order to create confidence in new technologies. Private producers also have been promoting new energy sources such as windmills and small hydro projects with a set of new networks, which are integrated within groups of national and international expertise. Knowledge and technology transfer has been promoted at this new organisational level along with different links with the natural resource base such as forestry and land management activities. The government's new environmental policy is another source of innovative pressure and some results have been shown in recent years through the national agency in charge of the Global Agreement on Climate Change. So far, four new windmills and two small hydro projects have been included in the activities recently, and new ones are on the list for the coming years. A new innovative organisational structure has been created to support this agreement; in addition, new expertise and technological development are also being promoted (Eco-markets, 1999).

Another interesting example is the procurement policy, which includes ICE's obligation to buy electricity from the renewable energy capacity developed within the framework of the new laws. It has also shown that it is capable of creating a new cluster of renewable energy sources, with different effects on the technological and institutional framework. Indeed, scale problems, connectivity and transmission pricing are still a problem in the relationships between the new actors (private owners) and the State company. Some new projects have been developed with ICE's supervision and there are many plans for increasing the supply with small hydro and windmill alternatives. The *Build, Operate and Transfer* (BOT) mechanism was recently used in a 50-MW geothermal project (ICE, 2000).

A unit to study and promote direct solar application in heat and electricity demand has also been created in recent years with the support of governmental and non-governmental resources. So far, new pilot projects have been implemented and some of them with enormous success.[3] A new cluster of small enterprises is involved in producing components and some prototypes for direct solar heating, and direct solar applications, but many technical problems still exist at the level of technological development. All of these projects have resulted in a slow but interesting change in the composition of supply resources and also actors within the sector. It mainly shows a change in composition of the supply as well as new space for private producers within the small hydro, windmill, biomass and solar businesses.

The rest of the sector has continued to be dominated by old public, municipal, or co-operative companies. Some of those enterprises also have been motivated to work with the new renewable options; for example, Conelectrica R.L. is a consortium of rural electrification co-operatives that has invested in a 16-MW hydro project in San Lorenzo. ESPH has been also developing some new projects in renewable resources. Co-generation in sugar cane industry was allowed during the nineties under specific rules and regulations also.

[3] There are four different initiatives so far: the Coopeguanacaste project in Guanacaste, the Peninsula de OSA project (ICE-ASIADE), the Caballo Island project and the CNFL promotion project. Some interesting results and applications for rural electrification and tourism activities have been promoted, but the political confidence and institutional capacity to manage and publish these experiences are still lacking.

Sugar-cane industry in Costa Rica:

The sugar industry developed as an export-oriented commodity. A mayor shock of the industry was associated with the Cuban Embargo at the beginning of the sixties. The impact of local regulated prices and profits control in mayor transformation processes were also part of local organizations structure until the nineties.

Today, an important percent of the producers are small and medium side farms. During the last period 2000 - 2001, the production was distributed in 53.65 % white sugar and 46.35 on crudo sugar of the total of 7.161.665 bultos (equivalent to 50 kg each). The secondary part is controlled by 16 mayor sugar-mills and the process of exportation and international commercialization is dominated by few actors. Local organization of the industry have been publicly established since the fifties. The public sector's main agency is LAICA, where private and public interest confront.

The amount of exports in 2001 were 3.328.137 bultos. The production of energy was concentrated in two mills that are interconnected to the national grill while biomass use is concentrated on classical heat facilities and internal electricity needs.

Ethanol Potential

All these scenarios paying respect to potential energy crises are even more complicated under the present global political conditions, where the US politics is committed to go to a war with the Irak and oil scenarios are not very easily forecasted. Considering these circumstances, the Costa Rican Government is very interested in ethanol and bio-fuel options. Mayor interest groups are related to sugar-cane industry and crops option in the south of the country. The Costa Rican new president mandate in the National Plan for Development (2002-2006) includes the substitution of MTBE (methyl tertiary butyl ether) in gasoline by ethanol or similar options for the utilization of bio-fuels.

For the implementation of this mandate, the public authorities have organized a group with different representatives from the Agricultural Ministry, RECOPE, the Ministry of Environment and mayor interest groups. The first exploited option will be the possible substitution of MTBE for ethanol. Terms of reference for a pioneer study are in fact being developed and CINPE is joining the group as a part of the University Academic Consortium. The mayor aim of this study is the quantification of the potential use as well as the investigation of the technical and economic conditions where these substitution process is possible.

The mayor potential for sugar is in north area, closed to Guanacaste province, as well as north-west areas of the Central Valley.

Considering the above said, the mayor potential of ethanol is associated with the substitution of fuel based MTBE use. The main opportunity under the regulatory framework thereby is security of supply and the increasing demand for environmental quality. The table followed is presenting qualitative analysis of the potential and the opportunities, considering regulation, institutional and political framework, economic figures and social interest.

Matrix of opportunities for ethanol in Costa Rica

Institutional and political Positive factor in term of high priority in political terms	*Social interest* Very high in term of diversify the industry and develop new relevant value added. Strong power of environmental groups.
Economical Low productivity and few modernized sector with an important number of small producers	*Regulation* Very regulated economic activity under quotas and internal market structure. Possible for developing new interest groups and alternative pricing policies.

The matrix is showing that political actions are crucial for the introduction of ethanol in the first phase of the development. Once demand is clarified and well established, State subsidies and market regulation should be relaxed and strategically oriented as in many cases of rising technology diffusion processes.

Literature

Garnier, Leonardo (2002) Costa Rica within the new economy: The role of education, training and innovation systems.

Jiménez, Roberto and Leiner Vargas (1998) *Las reformas del sector eléctrico en Centroamérica: los casos de Costa Rica y Panamá.* CINPE working document; Proyecto ECOMAP.

Jiménez, Roberto and Leiner Vargas (1999*) Impuestos a los combustibles fósiles para la generación de electricidad, en el marco del mercado eléctrico de Centroamérica*. Paper presented in the workshop: Reformas al sector energía y el espacio para las fuentes renovables. CINPE-UNA, November.

Ley #7200 (1990) *Ley que autoriza la generacion privada de electricidad.* Asamblea Legislativa, San José, Costa Rica.

Ley General de Electricidad (2000*) Documento de ley aprobado el 2000*. Asamblea Legislativa, San José, Costa Rica.

MIDEPLAN (2002) Plan de Gobierno 2002-2006, Todo por Costa Rica.

RECOPE (1999) Las implicaciones del uso de etanol como carburante. Internal study.

RECOPE (1999) Estudio de sustitución de MTBE por etanol anhidro nacional en la gasolina. Internal study.

RECOPE (2001) Valoración Económica de la utilización del MTBE en las actividades de refinería. Internal report.

Singh, Balbir and Vargas Leiner (1996) *Fuel taxes and urban air pollution in developing countries: the case of Costa Rica.* Working Paper, CINPE-UNA, Heredia, Costa Rica.

Vargas, Leiner (2001). Competitiveness, innovation and democracy. Space for Clean energy under electricity sector reforms in Costa Rica. Ph.D. Thesis, IKE group, Aalborg University, Aalborg, Denmark.

World energy assessment (2000). Chapter 5. Biomass potential.