

TECHNOLOGY TRANSFER IN COSTA RICA

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Introduction

Costa Rica has been working on climate change since the 80's. The National Meteorological Institute has participated in the meetings coordinated by the Intergovernmental Panel on Climate Change, the Conference on Climate, and the Conference of the Parties of the Framework Convention on Climate Change.

In 1994, the Framework Convention on Climate Change was ratified and in accordance with its compromise, the first inventory on greenhouse emissions by sources and sinks was carried out for 1990. This inventory was up-dated to 1996 and additional studies on mitigation and vulnerability in regions susceptible to climate change have been carried out.

These studies have evidenced the country needs concerning the development of technologies that seek progress without harming the environment.

Nonetheless, Costa Rica, like all developing countries, is in a difficult position in regard to technology transfer because the implementation of environmentally sound technologies faces important barriers.

During the last decade, the government has given special attention to sustainable development, but citizens and the private sector need to raise their awareness of the problem in order to achieve this goal.

In spite of these conditions, the government is currently promoting the use of clean technologies. In like manner, the Regulations to Control Gas Emissions and Particles from Automotive Vehicles were promulgated. These regulations aim at controlling pollutant and greenhouse gases, establishing limits to the following emissions: nitrogen oxides, non-CH₄ hydrocarbons, carbon monoxide and smog. Furthermore, they establish that all vehicles should undergo the technical inspection.

The law to promote the rational and alternative use of energy sources was enacted. This law allows private institutions to participate in the generation of electricity with alternative energy sources like solid and organic wastes processing or hydraulic, geothermal and wind power. Moreover, the National Committee for Energy Conservation was created. This institution is part of the Ministry of Environment and Energy (MINA E) and aims to prepare and implement a National Energy Conservation Program.

In 1994, the law and regulation on the rational use of energy was enacted. It establishes that enterprises with high electricity consumption have to implement programs for the rational use of energy, control equipment and installations to pursue energy saving. This law also requires that the Ministry of Environment and Energy settle energy rates per economic activity for each company. These actions are focused on improving the technological level in the energy sector; however, other sectors have contributed to this objective as well.

Technology needs and technology needs assessments

Studies carried out on mitigation and vulnerability for each sector have identified several technological needs. As a matter of fact, some sectors demand immediate attention because of their increase and participation in gas emissions.

Transportation contributes with 60% of the total gas emissions and has shown a continuous increase in its emissions during the 90's; indeed, the number of vehicles raised 50% in the last decade, thus augmenting the consumption of hydrocarbons. It should be important to mention that the problem worsens because vehicles are in average 10 years old.

Energy constitutes one of the most important sectors. Even though electricity is generated with 92% of renewable energy, demand has been increasing at a 5% annual rate during the last decade. Therefore, it is necessary to have new environmental technologies that favor conservation and energy generation. Most electricity comes from hydropower, but the country could use complementary power generation from wind, solar, and biomass energy.

Residential, commercial and industrial sectors are heavily reliant on electricity; therefore, it is a priority to foster actions that guarantee an adequate use of electricity. According to the National Energy Balance of 1997 (ICE, 1998), 45% of the generated electricity was employed by the residential sector, 24% by the commercial sector and 29% by the industrial sector.

The residential sector needs energy for end-use applications like cooking, lighting, and cooling while the industrial sector destines 94% of the electricity in motive power generation (ICE, 1998).

In order to reduce emissions, it is important to design appropriate policies to control energy consumption, foster saving and rational use, diminish the increasing demand and re-distribute loads during maximum demand peaks. This would be translated in an efficient use of the existing infrastructure, and it would not be necessary to invest on new projects.

The industry not only consumes 29% of the energy generated, but also consumes 16% of the total imported hydrocarbons. Measurements and energy

audits are needed in several national industries, especially in small and medium industries because thermopower and electricity are not used efficiently.

Energy conservation in regard to demand and efficiency require the introduction of new environmentally sound technologies.

There are other sectors that also need access to and transfer of technologies. Agriculture highly contributes to incrementing methane emissions, thus needs new equipment and techniques to produce “green” products. Livestock, rice cultivation and other agricultural practices could increase yields if new technologies became accessible to farmers.

On the other hand, waste management, particularly wastewater and solid waste management need to adopt technologies to diminish or mitigate gas emissions to the atmosphere.

Capacity building needs

Trained technical personnel, improved infrastructure and laboratories for environmentally sound technology analysis are critical to guarantee development and a high quality of life without affecting gas emissions to the atmosphere.

Building capacity should not only focus on hard technology transfer, but also on the so-called “soft technologies” because it is important to find, gather and frequently analyze information from several sources.

Currently, information networks dedicated to energy issues are available, but it is necessary to have more specific networks for environmentally sound technologies.

Training is fundamental since it guarantees success during the implementation of new technologies.

Presently, a project oriented to building institutional capacity is being carried out. This project has generated a technical team of experts from different fields.

Barriers to technology transfer

Technology transfer encounters multiple obstacles for both soft and hard technologies. Research and development limit the implementation of new technology since they have to be tested before being applied. Institutional capacity is usually constrained by the lack of personnel to carry out and analyze the country demands.

Another barrier is the lack of information in some areas. For instance, the private sector, particularly the small and medium enterprises lack the necessary tools to

access systems and databases. Some entities have information, but it is either insufficient or they lack financial resources to spread it.

As for the technological aspect, the country lacks technical standards regarding gas emissions. Even though there are laws that affect this issue, people work with the regulations of other countries. Accordingly, the compromises are not always met.

Infrastructure is also a problem. For instance, the country has hydroelectric plants, but they will not be able to supply for the increasing demand if infrastructure is not improved.

The elevated costs of new equipment makes them inaccessible to poor and inflated economies like ours; therefore, foreign support comes as the ultimate way to acquire such equipment. Environmentally sound technologies are novel and consequently, they are expensive. Solar panels are still unaffordable to us despite their cost reduction.

Public awareness is still low and further training in technological aspects is critical. Consumers are not conscious of the benefits and of the need to be efficient, nor are they aware of the consequences of a potential climate change.

Possible actions and initiatives to remove barriers

An immediate necessary action would be to support the government in raising public awareness through education and training.

Furthermore, it is important to attend national, regional and international workshops, conferences and courses on technology transfer and on environmentally sound technologies and initiatives.

Access to information networks is critical to widening knowledge in technical teams, academic institutions, private organizations and NGO's. To achieve this, it is necessary that sources provide and facilitate information through the mass media (Internet, press, etc).

The private sector should be encouraged to develop and use clean technologies to diminish greenhouse gas emissions. Indeed, a number of laws were enacted on the rational use of energy. They designed incentives such as tax exoneration for environmentally safe equipment like solar water heaters, storage tanks for solar heating, photovoltaic panels and their controlling systems, wind or hydroelectric generators and their controlling systems, economic hot water showers, fluorescent lamps, efficient halogen headlamps, thermal insulators, solar refrigerators and kitchens, small hydroelectric generators and others. The forestry law also controls and creates incentives like the payment for environmental services.

The private sector and research institutions should join in order to increase knowledge and enable the application and access to new technologies, and therefore, eliminate the obstacles that impede the adequate implementation of new clean technologies.

Another important aspect is the role of higher education as regards to training qualified engineers on technology transfer and its adaptation to the existing circumstances.

Financial support from developed countries is key to acquiring new technologies because local organizations or institutions cannot afford them.

Opportunities for investment and private sector participation

Despite the moderate awareness that the private sector has on the need of implementing environmentally sound technologies, the truth is that few have indeed initiated changes in their processes towards novel and clean options. Small enterprises have problems in regard to energy consumption; they do not have adequate insulators and their equipment is old, thus they are not very efficient. Even if they have adequate equipment, they have problems operating it correctly.

The private sector could contribute to the implementation of environmentally sound technologies, but it should first promote awareness in small and medium enterprises, which require support from international organizations like the World Bank. If this is accomplished, objective 4.5 of the FCCC will be achieved.

The Cement Industry in Costa Rica, which significantly contributes to gas emissions, is currently participating in the development and execution of new technologies to avoid emissions and improve production.

Other companies are working to improve their production processes without harming the environment; they are working on the design of new options for wastewater management, raw material recycling, and others.

Ongoing and planned technology transfer activities

A pilot project on electric transportation comes as a major initiative to apply technology in reducing gas emissions. The objective of this project is to establish ten electric buses downtown and other five in the surrounding cities, fifty electric motorcycles and fifty electric automobiles. These vehicles will provide information and constitute *running* laboratories. The project connects the transportation industry with the initiatives towards electric transportation through their active participation and the implementation of incentives and adequate

regulations that enable the substitution of fuel vehicles for electric vehicles. This project will also help determine how feasible and costly its execution will be.

Furthermore, an assessment on the possibility of changing to LPG is being carried out. For this purpose, infrastructure is being adapted and people are working to raise public awareness on the advantages and disadvantages of this type of technology.

Fuel improvement is a continuous project of the Costa Rican Oil Refinery, which has been introducing new and less pollutant fuels. In 1989, unleaded gasoline started to be sold and in 1996 high octane gasoline was implemented since its oxygenation level allows the reduction of pollutants emitted by vehicles; it is less volatile, dropping hydrocarbon emissions and increasing efficiency because it consumes less fuel. The Oil Refinery is also trying to install a diesel treatment plant, reducing sulfur content and consequently, the emission of sulfur oxides from vehicles.

Projects are also designed to raise public awareness on efficiency and fuel yields. However, since funds are scarce, not all end-users get the information.

People are presently working to improve rural electrification with photovoltaic panels. These panels supply for basic electricity needs (lighting, radio and TV) to a small number of families.

The residential sector has developed a pilot project to promote the use of fluorescent lamps to determine if this technology actually reduces the consumption of energy. Reports have so far indicated positive results; this confirms the need to implement this technology nationwide.

The project included 375.000 fluorescent lamps of 20 W; they were distributed to the different companies that supply electricity in the country. These companies subsidized the fluorescent lamps in order to make them affordable for the population.

Power saving was estimated in 15287 kW. The electrical energy saved was calculated in 32 844 657 kWh. The corresponding avoided CO₂ emissions reached 8752 tons.

Two public institutions have developed a project to improve lighting in public buildings because of their high consumption rates. Some of the changes adopted with this project are: switching from type T12 conventional fluorescent lamps to type T8 fluorescent lamps, changing electromagnetic ballasts for electronic ballasts, installing aluminum reflectors or any other with low reflectance coefficients since they need half the tubes per lamp, switching from incandescent lamps to compact fluorescent lamps, installing high-voltage protectors, installing lighting control systems and when needed, changing external lighting, sensors, security lights and others.

The energy conservation program recognizes that success depends on the information rendered to the clients regarding the options to use energy efficiently.

In this sense, marketing and energy generating companies in Costa Rica have focused on the development of a strategy to improve the spread of information.

Electricity supplying companies are designing campaigns to promote the rational use of energy. For this purpose, they are issuing pamphlets and bulletins with different options to save energy. These publications are currently being distributed in the Metropolitan area. There is also a stand to display efficient technology; these exhibitions are presented to the public in areas dedicated to customer service or during fairs. There is also an initiative to organize community activities to provide information and training on the efficient uses of energy.

The area dedicated to promoting energy efficiency is carrying out educational programs like “Energetic”, which comes as part of the Comprehensive Program of Energy Saving, developed in coordination with the Ministry of Education. This program trains teachers on issues related to energy conservation. Furthermore, household-oriented fairs are organized to provide information to the residential sector on the alternatives to save energy at home. Up to now, 45 fairs have been organized throughout the country.

The Costa Rican Electricity Institute is executing a program in the short-term to inform the population on the rational use of energy. With this program, the increasing demand for electricity will be controlled. To achieve this goal, initiatives like the organization of fairs, the “Energetic” Program, and the “Electro-credit” Program that facilitates the acquisition of efficient electric equipment for small dealers and industries will be strengthened.

As regards to research, a laboratory for energy efficiency is being equipped and personnel are being trained. This laboratory is intended to inform the technical team and the general public on new technologies because changes have occurred rapidly and efficient equipment is being constantly designed.

This laboratory will offer measurements, research and information like energy parameters to the clients in each consumption sector. It will also provide technical support to the law on the rational use of energy and other national and regional programs oriented to energy efficiency.

There is an initiative to create a Permanent Learning Center for the Conservation of Energy which will help the end-user on issues related to the conservation of energy, the use of new and renewable energy sources and the different options to save energy. An adequate and attractive methodology will also help raise public awareness.

Most programs have been tested at a small scale and to have them applied to the entire population, it will be necessary to have foreign or external financial support.

Elements of successful transfer of technology activities

To guarantee the success in the activities related to technology transfer, a legal and institutional background was designed. It enables the implementation of strategies to insert clean technologies in this area through learning centers, laboratories and qualified personnel.

A project on climate change has generated a number of technicians among diverse institutions on the issues related to the reduction of emissions from production processes.

On the other hand, a key factor is the governmental position concerning sustainable development, where policies and actions are oriented towards the improvement of production processes.

Nonetheless, financial and technological support from developed countries is a must in guaranteeing success in the transfer of technology.

Local, regional and global efforts to coordinate training workshops, conferences and courses are fundamental to have success in these activities.

Possible elements of a framework for meaningful and effective actions to enhance the implementation of Article 4.5 of the Convention

The compromise established in article 4.5 of the Convention must be achieved if sustainable progress in developing countries is to be expected.

To accomplish this objective, the mechanisms agreed on the Kyoto Protocol, particularly on the Clean Development Mechanism, are critical because Annex 1 countries are to support the development and enhancement of endogenous capacities and technologies of developing country Parties.

Accordingly, the ratification of the Protocol is necessary in order to initiate activities on the transfer of technology.

The relationship among Parties is critical to facilitate, promote and finance environmentally sound technologies.

Conclusions

It must be taken into consideration that social development without damaging the environment is an overriding priority for developing countries.

One of the most important aspects in the transfer of technology is increasing public awareness on environmentally sound technologies. This is a difficult task because the information must reach all people, and many lack access to the mass media. In this regard, research and learning centers should be created to spread information.

Access to information is essential. Besides written materials, there are currently new options on the Internet and networks to display novel technologies. The media widens the action potential in the area.

Technical training is important to guarantee the successful application of technological advances.

Costa Rica not only has the geographical conditions, but also the human resources to promote clean technologies. Until now, projects have been tested at a small scale to determine their feasibility and application to the entire nation. However, success will depend on the extended execution of these programs, and to do that, financial support from developed countries is critical, given the fact that the implementation of these technologies is expensive.

Summarizing, the development of a country can be achieved if there is willingness to promote, facilitate and finance the transfer of technology and know-how, achieved through the implementation of small demonstrative projects. This will help accomplish the commitments established in article 4.5 of the Framework Convention on Climate Change.