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Costa Rica 100% Renewable: Keys and Lessons from a Successful Electric Power Policy

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On March 25, 2015, Costa Rica announced that during 75 consecutive days it had produced 100 per cent of its electricity from renewable sources. Although it was not the first time the country had achieved this goal, that news traveled around the world as a symbol of the ecological transformation of the electrical grid.

In order to achieve climate goals, countries must re-evaluate their market schemes through clear regulations that do not respond to market variables only, but also to strategic goals aimed to consolidate a model of transformational, sustainable and inclusive development.

The history of Costa Rica demonstrates that for more than a century progressive politicians and social movements have been instrumental in the definition and protection of energy as a public good. A State policy had established clear objectives and standards favoring the sustainability and social justice of the electric power system.

FRIEDRICH EBERT STIFTUNG

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On March 25, 2015, a key year for international climate negotiations, Costa Rica announced that for 75 consecutive days it had produced 100 per cent of its electricity from renewable sources. Although it was not the first time that the country had achieved this goal, the news spread around the world as a symbol of the ecological transformation of the electrical grid. But, how did Costa Rica achieve this success?

In actual fact, Costa Rica had never transformed its electrical grid like many countries of the world must do. Since its inception, it has been largely renewable and geared toward sustainability and social justice. In order to understand the development of a successful, inclusive, and sustainable electric power policy, the history of electric power development in Costa Rica will be briefly explored in order to position the reader in the context of this Central American country. In addition, factors contributing to this success, the primary lessons learned from it, and the future challenges will be analyzed.

A Brief History of Electric Power Development in Costa Rica[1]

Electric power arrived in Costa Rica on August 9, 1884 with the inauguration of the first incandescent street lighting system in the capital city. Only two years before, Manuel Víctor Dengo had been authorized to develop this industry in Costa Rica for which he had partnered with Luis Batres García to establish the Electric Power Company of Costa Rica. Despite having only an available capital of around 50,000 Costa Rica colones (CRC), for five years the State subsidized the development of the electric power infrastructure with 200 CRCs a month. In 1989, the company became the Electric Light Company of Costa Rica with Batres García, Minor Cooper Keith and Fabián Esquivel Flores as partners. Eleven years later it turned into the Costa Rica Electric Light & Traction Company, with its headquarters in London. The process of large companies acquiring smaller ones would be repeated in the electric power market for many years, until a private quasi-monopoly was established.

In spite of the incipient development of the electrical grid, since 1910, the Costa Rican government saw energy as a public good. That year, under the administration of President Ricardo Jiménez, a bill for the nationalization of the hydraulic power system was sent to Congress and approved. As noted in the project's explanatory preamble, if hydraulic power "is a natural wealth of superior value to other riches of our soil, it is the State's duty to try to preserve it for general interest uses, free of speculative hoarding, taking measures analogous to those issued in Switzerland, which declare them inalienable property of the State for public use, and place their limited concession and use under the control and surveillance of the State and its bodies." This marked the public orientation of the Costa Rican electric power system as an inalienable feature from its inception to date.

Although in 1919, after a military coup, this law was no longer enforced, the core idea was taken up again in 1928 with the Electric Power Nationalization Act and the creation of the National Electricity Service (SNE by its Spanish acronym). The adoption of these two legal instruments was driven primarily by the National Civic League, a nationalist movement created in 1923 that, among other things, advocated for hydroelectric energy to remain in the hand of the State,[2] in line with its philosophy against the absorption of strategic State assets by foreign capitalists. Moreover, the SNE developed guidelines to prevent the monopolistic interests of private companies from continuing to operate freely in the country.

In the 1940s, the Association for the Defense of Electric Consumers was created. Rodríguez (2004) notes that the main objective of this initiative was to "exchange ideas that [would permit] the effective development of the country's great natural wealth, especially the use of hydraulic resources."[3] Both Rodríguez and Fernández considered that the movement's key contribution was that it had raised awareness about the country's future electrical development. The nationalization of electricity, considered by Fernández as the historical yearning

1 The information in this section is mainly drawn from: Fernández Robles and Joaquín Alberto, *100 Años de actividad eléctrica en Costa Rica 1884-1984. 2ed ed.* (San José: Instituto Costarricense de Electricidad/ICE, 2000).

2 *Costa Rica en el Siglo XX - Tomo II*, ed. Eugenio Rodríguez (San José: Editorial Universidad Estatal a Distancia, 2004).

3 *Ibid.* p. 96.

of Costa Ricans, was completed in April 1949 with the creation of the Costa Rican Electricity Institute (ICE by its acronym in Spanish). The constitutional decree defined ICE as responsible for the "sound development of the nation's productive sources of physical energy, particularly hydraulic resources." The idea came from the General Plan for the Electrification of Costa Rica presented to the National Bank a year earlier by a group of Costa Rican engineers.

The central government, particularly the National Bank, supported ICE financially at the time of its creation. Funding was reinforced in 1961 to enable the institution to issue bonds in order to meet its financial needs, as well as to formalize loans from international financial institutions such as the Central American Bank for Economic Integration (CABEI), the Inter-American Development Bank (IDB), among others. By the 1960s, with support from the United States Agency for International Development, rural electrification cooperatives began to emerge.

A Civic Attitude Vis-à-Vis Market Liberalization

Costa Rica did not escape the trend toward the electric power market liberalization in the 1980s, although initiatives to this end were unsuccessful at the time. In March 2000, a package of bills was adopted in the first legislative debate to reform ICE and promote the liberalization of the electric power and telecommunication markets. This rekindled the civic attitude forged since 1910 when the concept of energy as a public good was institutionalized in Costa Rica, subsequently consolidated in the nationalization of hydraulic power, and the creation of ICE along with other public enterprises and rural electrification cooperatives.

After several days of public protest against these liberalization measures, with the participation of labor unions, environmentalist, political, student, and community groups, among others, public discontent reached full expression in the protest of March 23 in one of the largest demonstrations in recent national history. Just 12 days later, a special joint committee was formed that would bring an end to this period in Costa Rican politics by making the adoption of the liberalization legislative package unfeasible. More recently, however, after great social polarization, the Free Trade Agreement with the United States was approved by referendum, which authorized the opening of the telecommunications market. In 2010, during the Arias Sánchez administration, the General Electricity Act was presented, aimed at opening the electric power market. However, after years of discussion and the presentation of several alternative projects, these initiatives did not prosper.

Costa Rica's goal to achieve renewable energy through a development model oriented toward social justice, resulting from the century-old vision of energy as a public good, remained dormant in its history of electrical development. The participation of hydroelectric and geothermal energy sources has responded to their availability and in particular to the mandate ICE was granted in 1949, although their development has represented a technical and financial challenge. With regard to Costa Rica's socio-strategic calling, the political leaders of the first half of the twentieth century and social movements have been of key importance to the defense of a sui generis electric power model.

The Key to Electric Power Development in Costa Rica

The principles of systemic thinking provide a useful tool to analyze the success factors of the Costa Rican electric power system in including renewable energies. Donella H. Meadows[4] points out that any system consists of three basic parts: elements, interconnections, and purposes. Systems therefore aim at an interaction among all the elements through certain rules in order to fulfill a specific purpose. In the case of Costa Rica, these three basic elements have been harmonized with each other by means of a State policy that has allowed the electric power system to achieve international recognition for its successes in social justice, sustainability, and reliability.

4 Donella H. Meadows, *Thinking in Systems*, Diana Wright (ed.) (New York: Earthscan, 2009).

Stakeholders, Legal Frameworks and Goals

Like in any electric power system in the world, there have been innumerable stakeholders involved in the Costa Rican electric power system: investors, politicians, social movements, and regulation agencies, among others. Two key stakeholders, however, have contributed to the success of what may be called a State policy: the politicians of the first half of the twentieth century and the social movements to date. Since 1910, the synergy between these two stakeholders has been of key importance for electric development to be conceptualized and defended in Costa Rica under the principle of energy as a public or common good. Politicians in the first half of the twentieth century, as well as social movements and organizations have acted as a historical memory and guarantor, even though the former for a variety of reasons abandoned the State perspective that the electric power sector had enjoyed for over a century.

Moreover, there are interconnections within the system that could be considered the "rules of the game." The legal framework of the electric power sector in Costa Rica has also been instrumental in consolidating a renewable model based on social justice, despite the diffused legal framework currently in force. The law that created ICE is perhaps the most dominant factor, because despite its simplicity compared to other legal instruments, it set the foundations for national electrical development, establishing the institution as an autonomous body independent from the Executive Branch and responsible for the development of the country's electric power based on renewable sources.

The legislation authorizing autonomous or parallel electric power generation, Act No. 7200 and its subsequent reform, also established clear rules for the participation of the private sector. The regulations did not depart from national goals. They ensure that new electric power projects have a share of domestic capital and they make use of unconventional sources of energy. The regulations stipulate that these projects should discard the use of oil, coal or water so that they do not represent more than 15 per cent of the overall potential of the electric power plants, that they must present an environmental impact study and have environmental control and recovery programs.

These rules have contributed to a more orderly interaction between the system's stakeholders. ICE was first of all established as the institution responsible for the electric power system and for privileging the renewable sources available in Costa Rica. As Donella Meadows also noted, any changes in these sources can deeply alter the system. The social and ecological transformation of other electrical grids necessarily involves the definition of new rules that allow the stakeholders to interact in a different way. The International Energy Agency (IEA)[5] itself has recognized that regulations are the main instrument that can orient even competitive markets toward a transition that ensures low-carbon electric power at low cost, in tune with international climate commitments under the Paris Agreement signed in 2015.

In the case of the Costa Rican electrical grid, it is evident that having had a clear agenda for the electric power system since 1949 has been the main factor in its success. It is obvious and even well known, that this is key to any public policy. It is perhaps for this reason that processes of social and ecological transformation of the productive sectors are taken for granted or considered lacking in importance. In Costa Rica, this has never been the case. The transformation of the electric power market structure acclaimed in 1949 was clear in establishing three guiding principles of the State's long-term policy: the country's electrification, the use of renewable sources available in Costa Rica, and leadership by public companies without excluding private sector participation.

However, it would make no sense to develop State policies with clear goals and objectives unless the rules of the game generate stakeholder interactions that aim and contribute towards the achievement of the established goals. This idea is perhaps of the utmost importance to this publication that is intended to explore the lessons that have been learned regarding the transformation of productive

5 IEA/OECD, *Re-Powering Markets: Market Design and Regulation during the Transition to Low-Carbon Power Systems* (Paris: IEA Publications, 2016).

grids. So long as the goals of electric power systems around the world focus solely on providing lower rates on behalf of competitiveness, the models based on absolute competition would prevail. Fossil energy sources would be privileged due to their cost, without environmental considerations regarding infrastructure development. That makes projects more expensive and without a social mandate. The underlying belief that access to electrical services depends only on low rates, does not consider the population that, due to their location or income, would be excluded from the electric power system.

Achieving one-hundred-percent of electricity generation within Costa Rica, along with other successes in access and quality, was no accident. It is the result of more than a century of history involving stakeholders, rules and goals. Along this path, political stakeholders have been clear in understanding energy as a common public good, but social movements in particular have been in charge of safeguarding this perspective. Since the 1940s, the rules of the system have encouraged the use of renewable sources. The private sector, even though it has been reluctant due to the prevailing market model, has also struggled for space. Although it considers its participation is limited, the private sector has adhered to the established rules of operation and is also convinced of the purpose of electrification with renewable energies established in the historic long-term State policy.

Towards a Transformation of Productive Grids

The purpose of this article is to contribute to the construction of social and political discourse for the transformation of productive girds, particularly in the electric power sector. It is not intended to be a "recipe" of the Costa Rican electric power model that can be applied to other countries. Each circumstance is unique and this particular case has been evolving over 100 years within a particular sociocultural context, which is perhaps quite different from the rest of Latin America. This article is a reflection aimed at social and political stakeholders who seek to transform their productive grids in response to the challenges posed by climate change, using the experience of Costa Rica as a benchmark for defining success factors. Some of the following lessons learned from this process may contribute towards the creation of this discourse.

Replicable Lessons

The design of the electric power market must respond to a strategic State perspective beyond the consumer price. The successful inclusion of renewable sources into the Costa Rican electrical grid is a response to the prevailing market model, whether through the centralized public monopoly scheme or the rules of the game that allowed their inclusion given the system's goals and the long-term policy targeting the use of the renewable sources of energy available in Costa Rica. In the case of competitive markets, decisions regarding the types of sources to be used are determined by factors such as supply, demand and price. This situation privileges fossil fuel sources in view of their price, partly because many of them are State subsidized. In 2016, the IEA acknowledged "competitive electricity markets are being challenged by the need to decarbonize electricity production." Researchers at the Oxford Institute for Energy Studies[6] presented the same thesis a few months before, noting that reforms to the electricity sector worldwide were experiencing a period of introspection after more than two decades of market-oriented liberalization and restructuring. This introspection is partly due to the appearance of sustainability and climate goals, as well as the effectiveness of the theoretical assumptions that pointed to these schemes as appropriate to improve the markets' technical and economic efficiency as well as to promote social welfare.

The previous reflection does not exclude private sector participation, as it is a vital element in any electric power system. The key here is to develop clear and mandatory rules that allow public sector participation in a way that respects the system's goals, and is not only guided by the interests of market participants. These goals include universal access to electric power services, the preference for

6 Sen, Anupama, Nepal, Rabindra & Jamasb, Tooraj. (2016). *Reforming Electricity Reforms? Empirical Evidence from Asian Economies*. Oxford: Oxford Institute for Energy Studies.

domestic sources of renewable energy, the protection of ecosystems where projects are developed, and the assurance of the participation of directly involved communities. Political stakeholders are of key importance for the definition of rules in electric power systems that, as has been emphasized in this document, allow for transformation via the systems' behavior and goals.

Organized civic and social movements are fundamental for the defense and consolidation of electric power as a common public good. This is one of the principles underlying the electric power policy in Costa Rica from the first years of the twentieth century. Citizen initiatives such as the National Civic League (1928), the Association for the Defense of the Electricity Consumer (1945), the engineers of the Electrification Plan proposal (1948), and citizen movements against the "ICE Combo" in 2000, have preserved the strategic perspective regarding energy of both the State and society. In the first half of the twentieth century, civic movements even proposed major bills, for instance, the second hydroelectric power nationalization act led by Alfredo González Flores and Max Koberg Bolandi within the framework of the Civic League, or the General Electrification Plan. Today social movements, both in Costa Rica and other countries, should generate clear and feasible proposals in accordance with their objectives of reducing the carbon footprint and curbing social inequalities.

Wage policy in the electric power sector promotes innovation and development. In Costa Rica, ICE and other public companies follow the policy of offering competitive working conditions and wages in order to ensure the availability of highly qualified technical staff, workers, and scientists for the development of multiple and complex tasks in the electric power sector. The main detractors of the current public system have resorted to the wage policy as a mechanism to distort the prevailing scheme. It is true that there are abusive practices that potentially encourage inequality among workers in the public sector. This must soon be resolved. However, public enterprises that wish, as in the case of Costa Rica, to be recognized internationally for their technical and scientific achievements in addressing the challenges set forth by the deep transformation that the global economy demands for the sake of de-carbonization, should resort to the best specialists in the area. The wage policy is thus a decisive factor.

International development financing is of key importance to balance out the costs of renewable energies. As the International Energy Agency points out, low-carbon technologies continue to be capital intensive so their total cost is significantly dependent on cost of capital. Costa Rica knew how to use international development financing for its electrical development. Preferential rate loans allowed the country to offset the high costs of large-scale geothermal or hydroelectric projects. In this respect, international climate financing has played a leading role in the inclusion of renewable energies worldwide. However, the price competitiveness of non-conventional renewable energy is also subject to the phasing out of subsidies for fossil fuels or the introduction of carbon pricing mechanisms.

State policy is indispensable for the social and ecological transformation of an electric grid. This is perhaps the main lesson learned and the most replicable experience of the case under study. State policy involves defining rules and long-term objectives and is the main tool for the transformation of any system. Given that State policies and regulatory instruments define the rules for stakeholder interaction, as well as the system's purpose, politics takes a leading role in this task, especially in parliamentary contexts. Political movements must thus prepare to define these long-term proposals and take on the commitment to make them a reality.

To summarize, the social and/or political movements that wish to set out to transform the way in which electric power is produced must focus on the consolidation of a State policy. In must be understood that the market model must be in tune with those goals that are seeking to expand renewable energy participation. If this is absent, the markets will continue to seek lower rates, regardless of the socio-environmental considerations, which tend to push prices up. In this definition, social movement participation demanding energy as a common public good plays a decisive role. For renewable energies to compete with traditional fossils fuels, access to low-cost capital is required, particularly in developing countries.

Future Challenges

Producing 100 per cent of electricity with renewable sources (depending on the seasonal climate), delivering that energy to 99.4 per cent of the population, and being among the world's top 15 performing electricity systems, seems to be the ultimate goal of some developing countries. Although Costa Rica reached those levels as a result of a clear State policy, there are many challenges to continuing walking this path. It implies keeping in mind the goals established 70 years ago, and adapting energy policy to the transformations experienced in modern times, preparing for the challenges of the future.

The inclusion of non-conventional renewable sources, namely wind, solar, biomass or other energies currently under research is the greatest technical and financial challenge Costa Rica will be facing in the decades to come. So long as the State's policy continues to be geared to consolidate an electric power system with renewable energies, from a technical perspective, the challenge is to balance the daily and seasonal variability of these sources, since mismanagement would jeopardize the safety and quality of the electricity supply. Financially, it should be considered that despite the historical tendency for prices to drop, renewable sources continue to be more expensive than traditional sources. In addition, inclusion of renewable energies could demand the development of backup systems that would increase costs or lead to an overload of the electrical system. Again, the new role played by State policy will be crucial to assess not only price and competitiveness, as variables, but also the multiple social and environmental considerations that help reach the ultimate goal of ensuring the population's quality of life and a model of sustainable development resilient to climate change.

As Hermann Scheer,[7] a German parliamentarian, says, the world is experiencing a tension between centralized and decentralized energy. Although the former will continue to occupy the leading role, with the development of renewable sources such as wind, solar and biomass energy, new ways of producing energy are emerging. Scientific progress, the steady decline in the price of technology, the environmental awareness of consumers, and government incentives, among other factors have encouraged an accelerated integration of electric power generation to be distributed in many countries. Although some consider this model as a way of democratizing investments, thus potentiating the clients' energy efficiency, in the medium-term, the decentralizing scheme could represent a threat to the traditional way of producing and distributing electric power. The challenge is to prepare companies with new business models and value packages that maximize acquired knowledge and potentiate the provision of services in areas such as energy efficiency, maintenance, technologies, and financing, among others.

Transport electrification is a unique opportunity for Costa Rica given the renewable composition of its electrical grid so long as it continues generating its electricity from renewable sources, using its resources sustainably, caring for those most socially vulnerable in terms of access, price, and project development. Costa Rica currently has an electrical grid with an environmental footprint per kilowatt-hour like few developed countries in the world. Given that transportation is the main contributor of net CO_2 emissions in the country, this seems the most natural option.

No additional kilowatt will make sense unless citizen involvement is ensured as well as care for the communities directly involved in the development of large-scale electric power generation projects. Costa Rica faces the paradox of having already developed hydroelectric projects of great technical, environmental and social viability. In recent years, social conflict around this kind of project has increased, both around large dams, and run-of-the-river projects, as well as geothermal exploration and exploitation in protected wilderness areas. Although the conflict does not reach levels of criminality like in other countries, there is an intense ideological debate between public and private developers with environmental movements

7 Hermann Scheer (*29.04.1944 †14.10.2010) was a Social Democrat member of the German Bundestag (parliament) who decisively marked his party's environmental and energy policy. In 1999, Scheer was awarded the Alternative Nobel Prize for his unflinching work in favor of renewable energies.

and organized communities. The latter argue that the proliferation of projects in the same watershed, sponsored by an unjustified need to expand electric power generation, goes against ensuring water access to surrounding communities and generates irremediable imbalances in ecosystems. Moreover, communities are increasingly skeptical regarding the local benefits obtained from the development of large-scale projects, so they demand more information and greater participation in the process, and they even suggest that developers share their profits. Again, the answer lies in adjusting the legal frameworks in force, both in terms of access to water and citizen participation in project development, in order to define an area of clear and transparent action between communities and developers.

More research and development is necessary in order to spearhead electrical development. The new energy paradigm of non-conventional renewable energies, decentralized generation, energy storage, transport electrification, and smart networks and cities for optimized energy consumption, oblige Costa Rica to invest in human capital and use the knowledge gained to contribute to the future of energy. Moreover, as a medium-high-income country, Costa Rica must also offer international development cooperation. The knowledge that Costa Rica has developed and will continue to develop can be offered to other countries through triangular or horizontal cooperation schemes.

Having developed a sustainable electric power system, and being on the way to transform the electrical grid, Costa Rica is at a different threshold compared to many other countries. The challenge involves maintaining this infrastructure with renewable sources, expanding toward non-traditional sources, and developing projects with other sources such as water or geothermal energy in a sustainable and inclusive manner. In addition, Costa Rica should incorporate decentralized generation into its market model, and deal technically with variability, without implying higher economic costs for the electric power system. As long as Costa Rica can continue to ensure supply in an inclusive and competitive way, transport electrification and research into this new energy paradigm will be the next great challenges to continue at the forefront internationally.

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