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Electricity and the role of the state: New Zealand and Uruguay before state-led development (1870-1930)

Reto Bertoni *
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Abstract

The configuration of a "modern" production structure requires there to be sufficient energy supply at competitive costs to justify exploiting the corresponding natural resources. New Zealand's better economic performance, since the last third of the 19th century in coal production and better natural conditions to generate electric energy at low cost –thus offering energy at low prices– explain, at least partially, the differences with respect to Uruguay. New Zealand's advantage in energy endowments facilitated the development of a dairy sector, certain energy-intensive manufactures and a more efficient use of railways that reinforced the differences between the two economies. However, endowments are not the complete story and the institutional arrangements are another relevant factor of differentiation. Our argument is based on the concept of endogeneity of natural resources and we use it to prove the hugely different roles of states in the creation and management of the electricity systems. These differences were not related to the extent of state intervention but to the achievements of such action. This action aimed at improving the welfare conditions in the case of Uruguay without paying enough attention to those aspects related to the production conditions; instead, in New Zealand, the productive development was the focus of the public intervention. The result was the creation of differential production conditions that explain the long-run divergent economic performance in terms of sector diversification and international competitiveness in favour of New Zealand.

Keywords: settler economies, endogeneity of natural resources, role of state, electric system.

JEL Classification Number: N50, N70, Q41.

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Electricidad y el rol del Estado: Nueva Zelanda y Uruguay antes del desarrollo liderado por el Estado

Reto Bertoni
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Resumen

La configuración de una estructura productiva "moderna" requiere de suficiente oferta de energía, a costos competitivos, para justificar la explotación de los recursos naturales que correspondan. El mejor desempeño económico de Nueva Zelanda, desde el último tercio del siglo XIX, en la producción de carbón y las mejores condiciones para la generación de energía eléctrica a bajo costo –y, por lo tanto, con la posibilidad de ofrecer energía al consumo final y productivo a precios reducidos– explican, al menos parcialmente, las diferencias con respecto a Uruguay. La ventaja de Nueva Zelanda en la dotación de recursos energéticos facilitó el desarrollo de la industria láctea, ciertas manufacturas energético-intensivas y un uso más eficiente del ferrocarril, factores que reforzaron las diferencias entre ambas economías. Sin embargo, las dotaciones de recursos no son toda la historia y los arreglos institucionales constituyen otro factor de diferenciación relevante. El argumento conceptual que se propone está basado en la endogeneidad de los recursos naturales y, con él, se explican las sustanciales diferencias en los roles desempeñados por los Estados en la creación y la administración de los respectivos sistemas eléctricos. Estas diferencias no estuvieron relacionadas con la intervención estatal per se –que estuvo presente en ambos casos– sino con los alcances y los propósitos de cada tipo de acción estatal. Mientras que la acción pública en Uruguay procuró, sobre todo, mejorar las condiciones de bienestar de los habitantes, en Nueva Zelanda, la política pública se focalizó en alentar el desarrollo productivo. El resultado fue la creación de diferentes condiciones de producción que explican el desempeño económico de largo plazo divergente en términos de diversificación sectorial y competitividad internacional en favor de Nueva Zelanda.

Palabras clave: economías de reciente asentamiento, endogeneidad de los recursos naturales, rol del Estado, sistema eléctrico.

Clasificación JEL: N50, N70, Q41.

1. Introducción

The configuration of a "modern" production structure requires there to be sufficient energy supply, at competitive costs, to justify exploiting the available natural resources. New Zealand has had better economic performance since the last third of the 19th century (Álvarez & Bértola, 2013; Willebald, 2013). Its context includes coal production and superior natural conditions to generate electric energy at low cost –thus offering energy at low prices. This explains, at least partially, the differences with respect to Uruguay (Bertoni & Willebald, 2015).

New Zealand's advantage in energy endowments facilitated the development of a dairy sector, certain energy-intensive manufactures and a more efficient use of railways that reinforced the differences between both economies. However, endowments are not the complete story and the institutional arrangements are another relevant factor of differentiation. Our argument is based on the concept of endogeneity of natural resources and we use it to prove the hugely different roles of states in the creation and management of electricity systems.

These differences were not related to the extent of state intervention –given that both states attempted to and in fact did intervene in the electricity markets– but rather the outcomes of this action. This action aimed at improving the welfare conditions in the case of Uruguay without paying enough attention to those aspects related to the production conditions; instead, in New Zealand, the productive development was the focus of the public intervention. The result was the creation of different production conditions that explain the long-run divergent economic performance in terms of sector diversification, international competitiveness and social conditions in favour of New Zealand.

The paper is ordered as follows. First, we present our conceptual framework based on the notion of the endogeneity of natural resources (Section 2). After that, in Section 3, we propose our hypotheses and an empirical strategy based on three analytical stages: (i) examination of arguments and concepts offered by the literature to understand the evolution of the electricity system in each country; (ii) review of laws, acts and norms that represented the tenor of the public policy on the matter; and (iii) considering the electrical grid of each country as evidence of the different governmental actions. We then resent a brief description of the creation and management of the electrical system (Section 4), we review the legal norms related to the implementation of the electricity system (Section 5) and show evidence of the extension and coverage of the electrical network in both countries (Section 6). In Section 7, we conclude.

2. Endogeneity of natural resources

Abundance of natural resources is not a question of endowments but of the productive application of resources and, in this sense, abundance is an endogenous process. We emphasize that an abundance of natural resources is not a fixed situation but a process that reacts

to changes in the structure of commodity prices and factor endowments, technical progress and suitable institutional arrangements. Therefore, this abundance is not a given but is part of the evolution of the economic system. This idea is not new and it goes back a long way.

"Resources are highly dynamic concepts; they are not, they become, they evolve out of the triune interaction of nature, man, and culture..." (quoted in Ding & Field, 2004, p.2, from Zimmerman, 1933, p. 4). Natural resources *"should not be seen as merely a fortunate natural endowment, but rather as a form of collective learning, a return on large-scale investments in exploration, transportation, geological knowledge, and the technologies of mineral extraction refining, and utilization"* (Wright & Czelusta, 2007, p. 186).

In economics, it is usual to consider natural resources as initial endowments which remain unchanging in time. However, endogeneity of natural capital is an obvious result of an historical analysis. History teaches us that "curses" and "blessings" are constructions –they are the result of the socioeconomic system– and the exploitation of natural resources means to address opportunities and challenges with profound consequences in the historical process of the societies (Willebald et al., 2015).

Some successful experiences of economic development (such as Australia, Canada, Sweden) highlight the fact that institutions promoting the interaction between enablement and receiving sectors are fundamental to science-based and innovation-driven growth in resource-based economies. Therefore, it is crucial for institutional structures to evolve in ways that support knowledge capabilities and efficient uses of the energy in the growth of natural resource-based industries.

In particular, in the field of the energy economics, the exploitation and value of energy resources, transport and marketing, as well as satisfying the energy needs of production and households, are closely related to virtuous linkages between natural resources, technology and institutional arrangements. In the case of electric power, an additional factor can be considered. Electricity provided by a public utility generates a natural monopoly in transmission. As a result, state intervention has constituted a key feature both as a producing agent and as a regulatory entity both of which are interesting for understanding the long-run performance of societies and economies.

3. Hypotheses and empirical strategy

In the concept of endogeneity, the role of the state is a central matter and the modalities of action of the government regarding natural resources have fundamental differences between Uruguay and New Zealand. This idea is not new. Previously, other scholars (e.g. Álvarez et al., 2011) have applied concepts similar to one of the main components of the abundance of natural resources of settler economies, namely land as the main natural wealth of these economies.

Indeed, though similar under many respects, Uruguay and New Zealand appear to have had substantial differences with respect to institutions governing both access to land and distribution of agricultural product. In New Zealand, the Crown adopted a policy that strongly facilitated access to land for white colonizers and European descendants. This in turn allowed an increasing number of landowners, which expanded along with immigration and population growth. Instead, in Uruguay land was heavily concentrated in the hands of a small group of landowners that benefited from massive transfers of public lands (Álvarez et al., 2011). Moreover, Uruguayan landowners obtained a larger share of agricultural production (in terms of land rents) than their New Zealander counterparts (Willebald, 2015). We present a similar concern but instead of focusing on land we base our analysis on energy natural resources.

Our hypothesis is that the different outcomes resulting from the state action in energy natural resources and strategy for electricity supply explains, at least partially, an electrical system having been extended and networked at an earlier date and with better articulation with the production structure. To test these hypotheses, we propose to proceed through three analytical stages. Initially, we examine the arguments and concepts that the literature offers to understand the long-run evolution in the creation and management of the electricity systems in each country. Second, we illustrate the differences with a review of laws, acts and norms that represent the tenor of the public policy in terms of creation of development conditions. Finally, one outcome of this process is the electrical reticulation of each country which is shown as the extension and coverage of the systems in terms of public and residential lighting and motive-power propose for farming, manufacturing, commerce and other productive activities.

4. A brief description of the creation and management of the electrical systems

4.1. New Zealand

The history of electric power in New Zealand reflects the natural endowments of the country and the political environment (Martin, 1998). It also reflects the fact that development of its electricity supply occurred in step with the development of its initial administrative and

economic infrastructure as a country of recent settlement (Culy et al., 1996). The fact that hydro was the cheapest source of power (Bertoni & Willebald, 2015) made direct government involvement almost inevitable. Although there were pioneering private schemes to provide hydro power for gold mines, large-scale hydro development tended to come under government control.[1] Damming major river systems caused very significant effects on the environment (flora, fauna, changes in the rainfall pattern), land ownership rights, village settlements, conditions for river navigation, and deep changes in economic activities. In addition, because many hydro development opportunities happen at distant sites, substantial investment in transmission infrastructure was necessary. In a context in which the economic and administrative structure of the country was newly evolving, the role of the state was fundamental because of the difficulties for private investors to negotiate with affected parties, defining secure property rights, and taking on potential liabilities (Culy, et al., 1996).

In 1903, 1910 and 1918, three engineers from the Public Works Department reported on the hydro-electric potential of New Zealand. These reports formed the basis for the government's involvement in electricity, in particular, the planning and construction of hydro-electric stations at: Lake Coleridge, Mangahao, Waikaremoana and Arapuni (Aspden & Astwood, 2011). As a result of this strategy, in the third decade of the 20th century, the consumption of electricity grew by 22% per annum and total generation in 1931 was more than 40 times greater than in 1911. This dynamic allowed for the majority of urban dwellers and farmers to connect to the network (https://nzhistory.govt.nz/culture/the-1920s/overview).

New Zealand is a relatively small country, which made central control possible. The government played a dominant role in the economy in general and, in particular, in the management of natural resources (Álvarez, 2014). This intervention was so important that historians have identified this process with modalities of "socialism" or "paternalism" (Milburn, 1960). In fact, the needs to develop the country and the pragmatism to solve constraining factors had become a "non- ideological" socialism where the participation of people was elicited. As was noted, "while politicians restricted their planning to the solutions immediate problems, by 1890 political thought and action had become dependent largely on two beliefs: that the state existed to aid its people; and that the people should participate in government by selection of their representatives" (Milburn, 1960, p. 62).

In New Zealand, democracy can be seen as a movement that used the instrument of expanded state action and intervention to bring about a more humane, democratic and egalitarian society. *"New Zealand shared the same fragment culture as Australia, even its Liberal reforms would reflect the same underlying egalitarian, communally-focused, working-class radical values*

[1] The first hydroelectric power station built by central government management was located on the Kaituna River (Okere Falls) to supply electricity at Rotorua, a touristic place, to power sewage pumps and lighting (http://www.ipenz.org.nz/heritage/itemdetail.cfm?itemid=2537, accessed 08/30/2017).

and presuppositions as Australia's 'mateship' society." (Paulson, 1988).

This socio-political context made natural resources one of the main issues in public policy, and politicians, theorists and common citizens identified these concerns early on. In this sense, a particular feature of the New Zealand experience was the concerted drive by the government, with support of the general public, toward development.

This tendency toward state power production was reinforced, in our field of interest, by the *"belief that an integrated network, along with extensive reticulation, would be an engine of economic growth and social development the benefits of which would be only partially captured by the power companies"* (Culy, et al., 1996, p. 315).

Accordingly, by the end of the 19th century, the government passed a series of acts that (i) granted power to the state to create lines of communication (telegraph, telephone); (ii) established the Crown agency control of streams, lakes and rivers; (iii) hampered private enterprise from constructing and maintaining electric lines for lighting purposes in public places; (iv) prevented local authorities from granting anyone the right to generate or use electricity as a motive power without special permissions.

In the first decades of the 20th century, the government became actively involved in the electric supply and constructed its own hydroelectric stations, alongside legislative actions that formalised the financial role of the government and established conditions for funding hydroelectricity. The Electric Power Board Acts of 1918 and 1925 constituted two of the main norms passed during the period in that they systematized and organized the regulations referring to the sector and represented the official vision about the management of energy natural resources. But, principally, because they allowed a virtuous articulation between state action, natural resources and civil society.

The petition for any area to be constituted as an electric-power district was presented to the Governor General. Every such petition had to be signed by not less than one-fourth of the ratepayers within each proposed constituent power district and specify how to elect the members of the Board (whether the members of the Board were to be elected by the electors of the several constituent districts or by the ratepayers of the electric-power district). This process is indicative of the importance of civil society in the creation and management of electric systems.

Under both norms, local authorities were established to purchase a bulk supply of power from the state. The power board jurisdictions were defined so as to make urban communities subsidise the cost of reticulating to the local countryside. Because the system was not mandatory, several urban supply authorities refused to surrender their generating and distribution systems, allowing these municipalities to retain control of their electricity departments and of any profits. These two types of electricity supply authorities –the power

boards and the municipal electricity departments– maintained their main characteristics until the 1980s when the profound changes experienced in the system extended to distribution and retailing stages.[2]

Electricity demand grew in the 1920s, slowed in the Depression, and then picked up before World War II. All of New Zealand's cities and many towns were connected to the grid and reticulated by 1930. Urban industrial and commercial users were attracted to the comparative cheapness, efficiency and cleanliness of electricity. From the 1920s suppliers intensivelly encouraged the domestic use of electricity. Showrooms displayed the latest appliances, cooking classes were held, and the cleanliness and convenience of electricity was highlighted. In the 1920s and 1930s, closely-settled and well-to-do farming areas, particularly those next to cities or large towns, were connected, but reticulation of remote hilly areas and the back country did not take place until after World War II (Cook, 2010).

4.2. Uruguay

The origin of electrification in Uruguay is associated with the installation of electric lighting as a public service in urban areas.[3] From the late 19th century the state granted concessions to private firms to install this service, first in Montevideo –the main city of the country and the administrative and political centre– and later in major towns (Salto, Paysandú, Colonia, Canelones). In general, relatively small companies installed power plants to provide electricity for public lighting of the city and for domestic use. This power stations used coal (and oil afterwards) as primary energy.

Uruguay had an extensive hydrographic system and it was protagonist of a pioneer experience of using water power for mining proposes in the 1880s,[4] but technological and financial restrictions delayed large-scale hydroelectric generation up to the mid-20th century (Bertoni & Willebald, 2015).

Initially, the granting of concessions by the government to private entrepreneurs for the generation and sale of electricity was the institutional arrangement that allowed the diffusion of electricity (Bertoni, 2011). In the first decade of the 20th century, 13 cities with electrical services offered by privately owned companies existed outside the capital (Montevideo).

[2] In particular, in the 1990s, local electric power boards and municipal electricity departments became commercial companies in charge of distribution and retailing.

[3] It is true that, previously, some firms used generators to carry out their economic activity, but they did not supply to other producers or consumers.

[4] In 1882, the French company "Minas de Oro del Uruguay" inaugurated a hydroelectric dam in the Cuñapirú stream (in the north of the country, 400 kilometres from Montevideo), which provided light and power facilities that were built for the exploitation of gold mines.

From 1909 onwards, and with the exception of Montevideo, little installed power and the near absence of electricity grids around the cities made it very difficult to use electricity in production activities, particularly in manufacturing and agriculture (such as dairy production and shearing).

Between 1906 and 1912 the Uruguayan state became prominent in the configuration of the electrical system. In 1906, the Act of "Transformation of the Electric Power Plant Montevideo" put the public service of electricity in the capital of the country in the hands of the state and, in 1912, the Act of "Creation of the General Administration of Electric Power Plants of the State" established a state monopoly in generation, transmission and distribution of electricity across the country *"excluding any other company or person"*.[5]

From 1912 onwards, the Electric Power Plants of the State (UEE for the acronym in Spanish) absorbed or acquired thermal plants that had arisen in the context of public service concessions and created new power plants in cities and towns that still lacked electricity. The dominant scheme was so-called distributed generation,[6] creating or absorbing 35 thermoelectric plants between 1912 and 1932. This strategy allowed a major coverage of public electric service in urban areas but did not create electric grids. It wasn't until the 1930s that the first high voltage electrical networks were built to supply to smaller villages and towns with the capacity to connect farms and other rural establishments in the vicinity of the grid.

This brief description of facts reflects, in the energy sector, the policies promoted by the "Batllismo", a political group created around the leading figure of José Batlle y Ordóñez, head of the Colorado Party that dominated the Uruguayan political scene in the early decades of the 20th century.

The "Batllismo" promoted a set of transformations to build a "social republic" that faced the opposition of the conservative sectors of Uruguayan society (Caetano, 1991, 1992). The strong statist imprint of the policies implemented during the period induced the characterization of a government identified with a socialist ideology. But from 1915 the reforms were stopped and a "conservative republic" arose from those social and political groups threatened by the social policies (Caetano, 1991, 1992). However, although the most radical plans were left aside –especially those about land taxation– a great sensitivity was maintained to bring well-being to the people. The "social republic" survived the decline of radicalism (Azar et al., 2009).

The energy policy of "Batllismo" should be analysed and interpreted in this context. The priority was the social welfare. From this perspective, the electrical system would be developed with the

[5] Act No. 3121, September 27th, 1906; Act No 4273, October 21st, 1912.

[6] Distributed generation is an approach that employs small-scale technologies to produce electricity close to the end users of power.

primary objective of meeting the needs of citizens (mainly lighting); in other words, the main destination of electricity was final consumption. Distributed generation with locating plants in cities and/or towns was functional to that goal and thermal generation was an adequate technological option in this scheme (in contrast with the huge and costly investments that would mean the creation of a system based on hydroelectricity).

Certainly, the state's budget constraints and, in relation to them, the difficulties for financing the electrification plans, slowed the process and delayed infrastructural works, principally the construction of hydroelectric power stations and the reticulation throughout the country.

In Montevideo, it was possible to relate the social function of electrical energy supply to the requirements of an incipient industrial sector and, thereby, a virtuous circle was established. But in the countryside, where the locations of the productive activity were "out of the cities", this kind of synergy is not observed, at least until the 1930s, when the surrounding rural areas were integrated into the high voltage networks.

We can see during this same time period that New Zealand had an extraordinary expansion of electrification. This asymmetric behaviour in the two countries resulted in different paths. While around 1913 they had similar electricity consumption per capita, in 1930 we observe that consumption in New Zealand was six times greater than in Uruguay (Table 1).

Table 1. Electricity consumption per capita

in kWh

	1900	1913	1920	1930
New Zealand	--	14	80	417
Uruguay	2	17	33	70

Source: Bertoni (2002, p. 41), Table Nº IV.3

5. A review of legal norms

A legal norm is a mandatory rule of social behaviour established by the state and aims at developing certain social relations in the interests of the ruling class or the institutional arrangements resulting from a certain correlation of forces between social classes. The legal

norm indicates the conditions of its own execution, the subjects of the regulation, the mutual rights of the parties, and the corresponding sanctions. The body of legal norms in a given society constitutes its law. Legal norms have been the preferred instrument used for creating, controlling and managing the electrical system.

In New Zealand, in 1891, the New Zealand Electrical Syndicate (Limited) was authorised for the production of electricity and electrical energy, and for supplying the same for lighting purposes and as a motive power. Power was to be given to enable the mentioned company to carry out the objectives for which it had been established in and over the area corresponding to the city of Auckland, and also the Parishes of Titirangi, Waitemata and Takapuna as they are included within a five-mile radius of the centre of the Auckland City Market.

All the acts corresponding to the 19th century identified in this research[7] show the same feature. They indicate two aims –lighting and motive power– and a broad coverage in the territory covering suburbs and rural zones. We can see the "tenor of the public policy" in these aspects of the norm that govern the creation and management of the electrical system in New Zealand.

A survey of the regulations applied to the public provision of electricity in Uruguay up to 1912 shows that, with the exception of Montevideo, the goal was only the lighting of the streets, public buildings and homes. This is the tenor of the acts that granted concessions to the cities of Salto, Paysandú, Minas, Mercedes, San José, Durazno and Florida (National Register of Acts and Decrees, www.impo.gub.uy). In the case of Salto, even in 1906, when the concession was extending, the act it gave the option to consumers of paying a conventional light bulb or pay price for their consumption at counters indicating devices. Clearly the homes' lighting in the cities was the focus of public service that the norms referred to.

In the second decade of the 20th century, the state intervention was intensified in both countries. But the modality of this intervention was different. State monopoly in generation, transmission and distribution was enacted in Uruguay in 1912. It established that a public company –*Usinas Eléctricas del Estado*– was the only entity authorized execute the electrification of the country.

The text of the act says (own translation):

> "The General Administration of the Power Plants is created as dependent of the Executive Power... (Art. 1). The provision to third parties of electric energy for lighting, power, traction and other applications in the entire territory of the Republic shall be entrusted to the State Power Plants, excluding any other company or person." (Art. 6) (http://www.impo.com.uy/diariooficial/1912/10/29/2)

[7] The Christchurch Electric Lighting Act, 1891; The Wellington Electric Lighting Act, 1891; The Gore Electric Lighting Act, 1893; The Hawera Gasworks and Electric Lighting Act, 1897; The Stratford Electric Lighting Act, 1898; The Olnnemuri County Electric Power and Lighting Act, 1899; The Queenstown Electric Lighting Act, 1900; The Hawera County Electric Lighting Act, 1902; The Wanganui Suburbs Lighting Act, 1903; The Waipori Falls Electrical Power Act, 1904.

In this sense, the public budget conditioned the development of the electrical system and specially the effective monopoly across all provinces of the country.

Meanwhile, after 1918 the Electric Power Board Act allowed virtuous complementarities between the public sector and civil society to develop the electrification in New Zealand. As the original document says, it was about,

> "An Act to provide for the construction or purchase of works for the generation, transmission and supply of electric power... [on] any area...[starting from] a petition shall be signed by not less than one-fourth of the ratepayers within each proposed constituent district... [at Governor-General]... For every electric-power district there shall be an Electric-power Board constituted... [and] every Electric-power Board shall consist of one or more representatives of each of the constituent districts within the electric-power district." (http://www.nzlii.org/nz/legis/hist_act/eba19189gv1918n5285/)

The result was an accelerated process of building of generation plants and transmission and distribution lines to supply electricity in cities and their respective hinterlands.

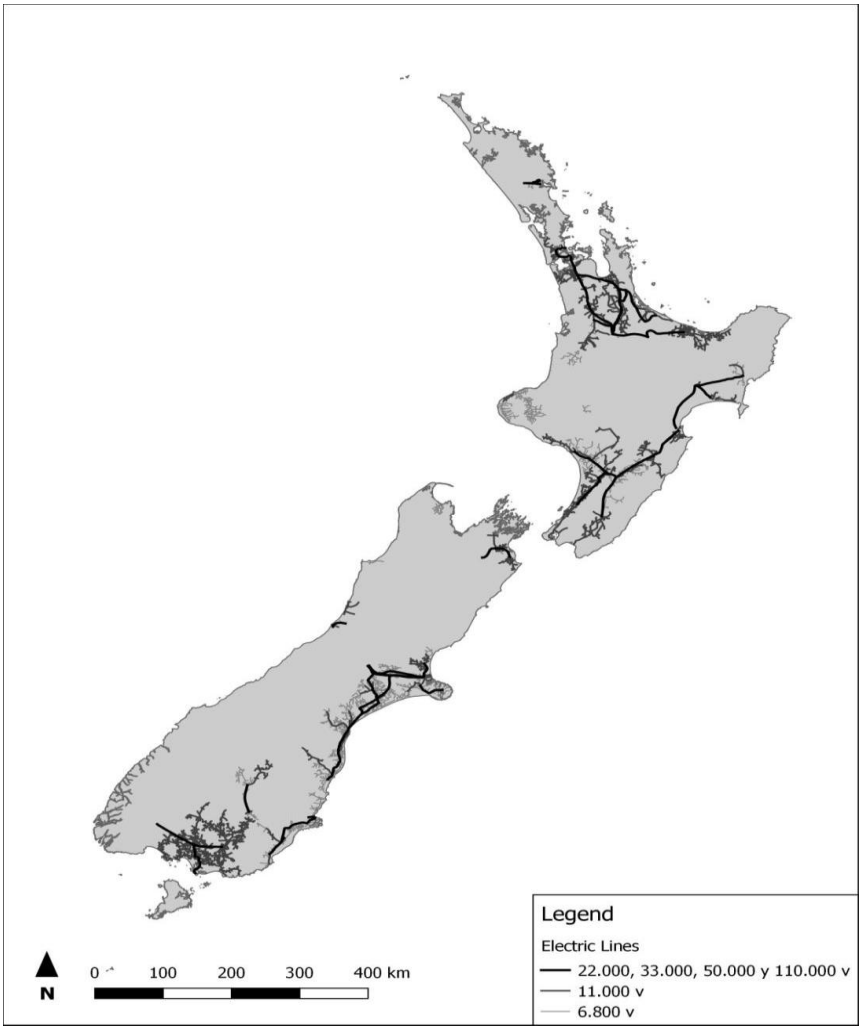
6. Electrical network

Hydro-electricity generation began on a small scale in New Zealand in the late 19th century. It was immediately identified, it was identified as a clean, reliable and instant form of energy and with extensive production and consumption applications. It could provide heat and light for homes, and electricity was particularly useful on dairy farms, where it could be used to run milking machines, light milking sheds, and heat water for cleaning and sterilising. Small power companies in Taranaki built their own hydroelectric plants in the late 19th and early 20th centuries, offering energy to local towns and farms. In the first decade of the 20th century small electricity-generating stations were mainly found in dairying regions like Taranaki, Waikato and Southland (Swarbrick, 2016).

From 1918 onwards, the government gave priority to extending electricity lines to farms with a clear objective of helping to develop agriculture. Power boards were set up, and had to ensure that the grids reached the hinterlands of cities and villages. By 1936, 80% of farms had access to electricity powering a wide range of farming equipment (shearing machines, pumps and milking machines) (https://www.teara.govt.nz/en/rural-services/page-4).

In Figure 1, we present a map with both islands that represents the electricity network in New Zealand (classified by voltage) and it can be seen how it extends into farming areas. Canterbury, Otago and Southland, like Waikato, the Bay of Plenty, Taranaki, Rangitīkei and Wairarapa, were electrified relatively early in the 20th century. The first farms had been electrified in the early 1890s while remote areas of the country (Northland, the East Cape and the West Coast) were not yet connected in 1930.

Figure 1. New Zealand. Electrical network, 1930



Source: Mckinnon (1997): based on New Zealand parliamentary papers (1930).

In Uruguay, the scheme based on distributing electricity generated from direct current (DC) stations with low capacity per plant acted against the development of the electrical system. It implied low prospects for designing networks transmitting at high voltage to cover nearby rural areas or another cities or towns. A phenomenon of path dependency took place in the Uruguayan electrification process. Decisions in institutional and technological spheres prevented the construction of transmission or distribution networks of a certain density even in small areas. In times as advanced as September 1934 a publication of the public electricity company lamented the low penetration of electricity in *"farming areas of outstanding production"* (Energy Review, No. 2, pp. 25). This journal stated that the recent opening of the high voltage lines ("Central" and "Centenario") opened the possibility of promoting the application of electrical energy in rural activities (especially dairy farms) and proposed to develop an educational campaign among rural producers "*in order to properly teach [...] with practical experience [...] showing how electricity is used in rural work*" (Energy Review No. 3, pp. 15).

While New Zealand by 1930 had hundreds of kilometres of transmission lines that resulted in a relatively dense grid in some regions (Figure 1), in Uruguay, at the same time, there were only a few tens of kilometres of high voltage lines. These networks allowed only modest supply to some localities in the vicinity of Rosario, Maldonado and Montevideo (in the South, on the River Plate). In the rest of the territory, small power stations offered the public electricity service in 25 locations (Figure 2).

Figure 2. Uruguay. Electrical network, 1930

Source: UEE "Annual Reports" and Journal of the UTE, No. 2, July 1936

The construction of two high-voltage lines in the early 1930s was the first major change in the scale of the Uruguayan grid. As a result of these infrastructures, regions located up to 100 kilometres from Montevideo were interconnected, including provincial capitals such as San Jose, Florida and Canelones. Electricity was generated in a new thermal power plant inaugurated in Montevideo in 1932.

It should be noted that the area covered by this network was an area on which an incipient dairy farming industry was located. The arrival of electricity meant the possibility of major development in dairy in the 1940s. However, it was not until the 1950s that the Uruguayan electricity sector was configured as a mixed national utility grid (hydro and thermo) with an actual capacity to offer electricity to the various economic activities in the territory. In Table 2

we present a summary of our evidence for around 1930 in both countries.

We consider the three main high-tension transmission lines of Uruguay –around the 90% of the generation– and New Zealand –around 60%–, the length of the lines and the corresponding coverage area. In the case of Uruguay, the city where the power station was located was not considered. In New Zealand only lines over 11,000 volts were considered and those over 6,300 volts in Uruguay. These decisions may be debatable but they are justified because the important issue, from the perspective of this work, is to show long distance transmission lines (which require high-voltage connections).

The evidence is overwhelming to show the magnitude of the difference in the reticulation in both countries.

Although our data records only 60% of the high voltage lines in New Zealand, the extension is more than 27 times that of Uruguay and 126 times the area covered.

We propose an indicator of the density of the network in the form of the ratio between the coverage area and the length of the lines. This is an index that represents how many square kilometres are served by each kilometre of line. The ratio for New Zealand (24) is almost 5 times that of the Uruguayan ratio (5). This is accompanied by huge differences in terms of consumers served and energy consumed. Whereas the average user in Uruguay consumed 202 kWh, in New Zealand this ratio reached 2,828 kWh; i.e. the consumption per user in New Zealand was 14 times higher than in Uruguay.

These enormous differences between systems presumably caused important differences in financial terms.

Around 1930, the capital outlay amounted to £13,765,542 in New Zealand, a substantial share of which financed by public debt (60%).[8] In contrast, Uruguay had capital stock, at that same time, of £2,614,422 in electrification of which only 35% financed by public debt.[9]

Although during the First World War and in the immediate post-war period the availability of financing sources was very restricted, during the 1920s the context could have been different and probably New Zealand was presented with more favourable conditions due its specific relation with the British capital market.

Table 2. Reticulation indicators of New Zealand and Uruguay, *circa* 1930

[8] The New Zealand Official Year-Book, 1930. (https://www3.stats.govt.nz/New_Zealand_Official_Yearbooks/1930/NZOYB_1930.html).

[9] Electric Power Plants of the State "1929 Annual Report". We used the exchange rate from Maubrigades (2003) to show the Uruguayan data in pounds.

Power Station	Transmission lines	Length (km)	Coverage area (km²)	Consum-ers (no.)	Consump-tion (kWh 000s)
URUGUAY					
Montevideo	Montevideo; La Paz; Las Piedras.	30	210	1,673	400
Rosario	Rosario; Juan L. Lacaze; La Paz (Colonia Piamontesa); Col. Valdense; Nueva Helvecia.	42	200	777	149
Maldonado	Maldonado; San Carlos; Punta del Este.	19	50	1,125	173
	Total	**91**	**460**	**3,575**	**722**
NEW ZEALAND					
Coleridge	Ashburton Power Board; Banks Peninsula Power Board; Christchurch City; Halswell County Council; Heatheote County Council; Kaiapoi Borough; Lyttelton Harbour Board; Lyttelton Borough; Malvern Power Board; North Canterbury Power Board; Rangiora Borough; Riccarton Borough; South Canterbury Power Board; Sumner Borough; Tai Tapu Dairy Co.; Timaru Borough; Waitaki Power Board; Waimairi County Council.	806	12,502	52,326	112,601
Mangaho-Waikaremoana	Central Hawke's Bay; Dannevirke; Hawke's Bay; Horowhenua; Hutt Valley; Manawatu-Oroua; Poverty Bay; Tararua; Wairarapa; Wairoa; Wanganui-Rangitikei.	673	31,370	72,741	159,013
Arapuni-Horahora	Cambridge Power Board; Central Power Board; Te Awamutu Power Board; Thames Valley Power Board; Waitorno Power Board;	933	13,970	32,171	173,003

	Franklin Power Board; Waitemata Power Board; Bay of Plenty Power Board; Hamilton Borough Council.				
	Total	**2,413**	**57,842**	**157,238**	**444,617**

Sources: for Uruguay: Electric Power Plants of the State. *Annual Reports*. Several years. For New Zealand: New Zealand parliamentary papers, 1930, AJHR 1930.

7. Conclusions

Valorization of natural resources results from a complex interaction between endowment, available technology and institutional arrangements that reflect power relations. From this perspective, the state appears as a key agent.

New Zealand –in the last decades of the 19th century– and Uruguay –in the early 20th century– showed the influence of political parties with a strong belief in the role that the state must adopt to achieve results in economic development and social welfare. In this sense, when we analyse energy policies in both countries in the early 20th century, the differences are not the extent of state intervention but the kind of intervention.

In New Zealand, the government promoted state control of natural resources viewing them as the basis of the economic and social development. This strategy included considerations about strategic management of natural wealth, improvement in the productive capabilities of private agents and amendment of social conditions. As a result, the government of New Zealand (and the case of Australia is similar) set up administrative and institutional arrangements that were closer to the notion of a developmental state (Willebald, 2011).

In Uruguay, the construction of a "social republic" did not have, in the energy sector, a clear expression of developmentalism. Unquestionably, the electricity policy improved the public welfare of consumers in Montevideo and in the largest cities of the country, but the extension and the coverage of the electrical grid was smaller. It was not until the 1930s-1940s when the expansion was significant and linkages with production activities gained major relevance (coinciding with the industrialization process). In a previous article (Bertoni & Willebald, 2015) we dealt with the role of abundance of energy natural resources in the capability of countries in offering electrical energy to consumers and producers. In the present article, we consider the role of the state in this process and, in particular, in the construction of an extensive electrical network. As further research, we propose study of energy demand to understand the economic possibilities opened up by the electricity expansion. In particular, we will focus on the role of firms in attaining large-scale production in different activities with special focus on the dairy

and cooperative production organizations.

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