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ORIGINAL ARTICLE

Harnessing 'Wasted' Waters: Conservation, Hydropower and the Origins of Chile's National Electrification Plan

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Abstract

This article examines the origins of national electrification in Chile, situating its technocratic promoters within a broad trend – unfolding across Latin America – toward the 'rational' management and conservation of natural resources by the state. It surveys the early history of Chilean electrification (1890s–1940s) to show how conservationist thinking flowed through discussions and debates among engineers about the proper uses of the country's waters. These ideas eventually shaped the 1943 national electrification plan, which focused on hydropower. The article sheds new light on the history of Chile's technocracy, the relationship between perceptions of the environment and development planning, and the political and economic debates over national electrification. It also shows how the conservationist dilemma of using versus preserving natural resources operated within a utilitarian and highly technical framework for thinking about nature's bounty. The article thus contributes to recent historical scholarship on conservation and environmental technocrats in Latin America.

Keywords: electricity; technocrats; conservation; power systems; CORFO; water; Chile

Introduction

In 1939, Chile embarked on a decades-long experiment with state-led industrialisation. The recently elected Popular Front government, an alliance of the reformist Radical Party and the Socialist and Communist parties, created the Corporación de Fomento de la Producción (Production Development Corporation, CORFO), an early variant of the state development corporations that appeared throughout Latin America in the mid-twentieth century.[1] The ostensible motivation was a

[1]José Carlos Orihuela, 'One Blueprint, Three Translations: Development Corporations in Chile, Colombia, and Peru', in Augustin E. Ferraro and Miguel Angel Centeno (eds.), *State and Nation Making in Latin America and Spain: The Rise and Fall of the Developmental State* (Cambridge: Cambridge University Press, 2019), pp. 107–33.

massive earthquake that had devastated southern Chile in January, providing enough political leverage to push an expansive reconstruction bill through conservative opposition in Congress. Although tied to the earthquake recovery bill, CORFO was given a broader mandate to transform the export-oriented economy and raise living standards. One of its first tasks was to shore up the electricity supply by intervening in the power industry, which had been slow to recover from the Great Depression. CORFO soon began devising a plan, finalised in 1943, to exploit Chile's rivers for power and build a national electric grid.

Many of the ideas behind CORFO and the electrification plan had emerged in the preceding decades. Furthermore, some key figures were involved in such projects, working in or at the margins of government. The authoritarian regime of Carlos Ibáñez del Campo (1927–31) increased spending on public works and professionalised the state bureaucracy, staffing it with engineers and technocrats. In the tumultuous Great Depression years, which saw the Ibáñez regime collapse in 1931, a group of engineers began a public debate over the merits of nationalising the power industry and lobbied the government to intervene. At the end of the 1930s, the Popular Front incorporated key ideas emerging from those debates as it expanded the state's role in the economy, marking the beginning of what is known as '*el estado empresario* [the entrepreneurial state]'.[2] The new administration brought in engineers involved in the electricity debates and several key figures from the Ibáñez years to staff CORFO and the Empresa Nacional de Electricidad S.A. (National Electricity Company, ENDESA), created in 1944 to implement the electrification plan.

Scholars have characterised this political transformation and acceleration of state capitalism as the emergence of a purportedly apolitical style of public administration that sought 'rational' solutions for Chile's social and economic problems, in contrast to the oligarchical patronage and endless politicking of the Parliamentary Era (1891–1925).[3] Early works by Marcelo Cavarozzi and Adolfo Ibáñez Santa María highlighted the importance of technocratic actors in developing and sustaining this new mode of governance.[4] Although not a monolithic group, the technocrats were united by their faith in industrialisation as the path to progress and attempted to insulate themselves from political interference. Building on that earlier work, Patricio Silva has argued that Chilean technocracy was constituted around the reformist, meritocratic middle class, whose political ascendancy was marked by frustrations with elite indifference toward growing social unrest and fears of working-class radicalisation.[5] More recently, Chilean historians have

[2]Gabriel Salazar and Julio Pinto, *Historia contemporánea de Chile*, vol. 3: *La economía: Mercados, empresarios y trabajadores* (Santiago: LOM Ediciones, 2002), pp. 76–84.

[3]However, new evidence suggests that a de facto, merit-based civil service had existed since the 1880s, complicating this interpretation somewhat. See Diego Barría Traverso, 'Carreras administrativas en Chile, 1884–1920 ¿Patronazgo o carreras burocráticas?', *Historia*, 51: 2 (2018), pp. 317–38.

[4]Marcelo Cavarozzi, 'The Government and the Industrial Bourgeoisie in Chile: 1938–1964', unpubl. PhD diss., University of California, Berkeley, 1975; Adolfo Ibáñez Santa María, 'Los ingenieros, el estado y la política en Chile: Del Ministerio de Fomento a la Corporación de Fomento, 1927–1939', *Historia*, 18: 1 (1983), pp. 45–102.

[5]Patricio Silva, *In the Name of Reason: Technocrats and Politics in Chile* (University Park, PA: Pennsylvania State University Press, 2008). On middle-class reformism, see also Patrick Barr-Melej, *Reforming Chile: Cultural Politics, Nationalism, and the Rise of the Middle Class* (Chapel Hill, NC: University of North Carolina Press, 2001).

re-examined the electrification debates of the 1930s to explore how technology, ideology and politics intersected to establish a new role for the state in the power sector and redefine electricity as a tool for development.[6] Economic historian César Yáñez, in turn, has characterised the electrification plan as part of a longer history of state intervention in areas of the economy that favoured the creation of natural monopolies, such as the railroad.[7]

This article offers an innovative analysis of Chilean national electrification that situates its technocratic promoters and the debates leading to the 1943 plan within a trend, unfolding across Latin America, toward state-led management and conservation of natural resources. Electrification, from this perspective, was a form of water management.[8] Recent scholarship on Latin American technocrats, particularly in the burgeoning field of environmental history, has explored their role as mediators not only between different social groups, but also between society and the environment. Those searching for a middle politics of reform also believed that social and economic modernisation depended on the rational management of nature's bounty.[9] In Santiago, for example, municipal reformers at the turn of the century saw rivers as clean sources of energy that would modernise the city's public transport system, improve hygiene and stimulate industry, although they ultimately favoured private capital over the state to harness that potential.[10] Later, in the 1930s–40s, state bureaucrats introduced scientific forestry policies in

[6]Mauricio Folchi, Gustavo Blanco-Wells and Stefan Meier, 'Definiciones tecno-políticas en la configuración de la matriz energética chilena durante el siglo XX', *Historia*, 52: 2 (2019), pp. 373–408; José Soto Vejar and Carlos Sanhueza Cerda, 'El problema eléctrico chileno: Un estudio de caso de controversia sociotécnica (1935–1939)', *Athenea Digital*, 20: 3 (2020), available at https://doi.org/10.5565/rev/athenea.2543, last access 23 Jan. 2023. See also Rafael Sagredo Baeza, 'Electricidad para el desarrollo', in Sergio Villalobos (ed.), *Historia de la ingeniería en Chile* (Santiago: Hachette, 1990), pp. 339–58.

[7]César Yáñez, 'La intervención del estado en el sector eléctrico chileno: Los inicios de la empresa pública monopólica', in Manuel Llorca-Jaña and Diego Barría Traverso (eds.), *Empresas y empresarios en la historia de Chile: 1930–2015* (Santiago: Editorial Universitaria, 2017), pp. 109–32.

[8]For a recent study that relates water conservation to mining in Chile, see Thomas Miller Klubock, 'The Early History of Water Wars in Chile: Rivers, Ecological Disaster and Multinational Mining Companies', *Environment and History*, 27: 3 (2021), pp. 421–46.

[9]Key works include Mark Carey, *In the Shadow of Melting Glaciers: Climate Change and Andean Society* (New York: Oxford University Press, 2010); Mikael Wolfe, *Watering the Revolution: An Environmental and Technological History of Agrarian Reform in Mexico* (Durham, NC: Duke University Press, 2017); Eve E. Buckley, *Technocrats and the Politics of Drought and Development in Twentieth-Century Brazil* (Chapel Hill, NC: University of North Carolina Press, 2017). For recent work on experts and the environment, see Andra B. Chastain and Timothy Lorek (eds.), *Itineraries of Expertise: Science, Technology, and the Environment in Latin America's Long Cold War* (Pittsburgh, PA: University of Pittsburgh Press, 2020).

[10]Elisabet Prudant, 'Del caballo a la electricidad: Imaginario ambiental y tecnológico en la transformación del sistema tranviario chileno a fines del siglo XIX', *Historia Crítica*, 74 (Oct. 2019), pp. 41–64. Prudant is one of several scholars in Chile developing new approaches to studying early electrification, traditionally the domain of economic and business historians. See Marion Steiner, '"El fantasma de la fuerza motriz del agua": Emil Rathenau y sus redes eléctricas en Chile y España', *Labor e Engenho*, 11: 4 (2017), pp. 446–76; Damir Galaz-Mandakovic, 'Turbinas y electricidad para la mina, lámparas a parafina para la población: Crónica de una asimetría del capitalismo minero en Tocopilla (1914–1942)', *Estudios Atacameños*, 54 (July 2017), pp. 179–200; Yohad Zacarías, 'La construcción de una ciudad cableada y la extensión del tranvía eléctrico: Electrificación, desarrollo técnico y nuevas configuraciones del espacio urbano. Santiago de Chile, 1890–1920', in Simón Castillo and Marcelo Mardones (eds.), *La ciudad en movimiento* (Santiago: Ediciones Universidad Alberto Hurtado, 2021), pp. 127–70. For an innovative approach

an attempt to curtail ecologically destructive land-use practices and avert social upheaval in Chile's southern frontier region.[11]

Throughout Latin America, technocrats oversaw similar conservation programmes to protect and control natural resources. The regional scholarship on conservation, which tends to focus on parks and reserves, has highlighted a recurring tension between protecting and using nature.[12] As Emily Wakild notes, modernisation ultimately required using more, not less, resources.[13] This overarching development imperative clashed with other, less utilitarian reasons for protecting nature, such as aesthetic, cultural or spiritual values. In pursuing ambitious development programmes that incorporated conservation, Latin American states tried to reconcile these competing imperatives, a dilemma which persists to this day in debates around sustainable development.

Most of the technocrats in this study, however, were trained and employed as electrical or railroad engineers. These were not the foresters and park officials typically associated with the origins of conservation in Chile and elsewhere.[14] Yet conservation as a movement and as a concept can take various forms depending on the historical moment, regional context and specific resource under consideration. As Julie Cohn has observed in the United States, early power-system developers shared many ideals with certain schools of conservation and often ended up pursuing conservationist goals, even though their ultimate motives differed.[15] In Chile, national electrification aligned with a utilitarian strain of conservation thinking that sought to maximise rather than mitigate the use of natural resources, with an eye toward sustaining long-term development goals – akin to what Mikael Wolfe has elsewhere called 'incidental conservationism'.[16] Chilean engineers sought to protect the nation's waterpower resources from private and foreign interests by, somewhat paradoxically, increasing their exploitation over the long term. Such a paradox was, as Cohn has noted, embedded in the principles of power-system management,

elsewhere in Latin America, see Diana J. Montaño, *Electrifying Mexico: Technology and the Transformation of a Modern City* (Austin, TX: University of Texas Press, 2021).

[11]Thomas Miller Klubock, *La Frontera: Forests and Ecological Conflict in Chile's Frontier Territory* (Durham, NC: Duke University Press, 2014). For a pioneering environmental history of forestry in Chile, see Pablo Camus, *Ambiente, bosques y gestión forestal en Chile, 1541–2005* (Santiago: Centro de Investigaciones Diego Barros Arana, 2006).

[12]Emily Wakild, *Revolutionary Parks: Conservation, Social Justice, and Mexico's National Parks, 1910–1940* (Tucson, AZ: University of Arizona Press, 2011); Christopher R. Boyer, *Political Landscapes: Forests, Conservation, and Community in Mexico* (Durham, NC: Duke University Press, 2015); Frederico Freitas, *Nationalizing Nature: Iguazu Falls and National Parks at the Brazil–Argentina Border* (Cambridge: Cambridge University Press, 2021).

[13]Wakild, *Revolutionary Parks*, p. 24.

[14]Camus, *Ambiente, bosques y gestión*; Emily Wakild, 'Protecting Patagonia: Science, Conservation and the Pre-History of the Nature State on a South American Frontier, 1903–1934', in Wilko Graf von Hardenberg, Matthew Kelly, Claudia Leal and Emily Wakild (eds.), *The Nature State: Rethinking the History of Conservation* (Abingdon: Routledge, 2017), pp. 37–54.

[15]Julie Cohn, 'Data, Power, and Conservation: The Early Turn to Information Technologies to Manage Energy Resources', *Information & Culture*, 52: 3 (2017), pp. 334–61; 'Utilities as Conservationists? The Paradox of Electrification during the Progressive Era in North America', in Hartmut Berghoff and Adam Rome (eds.), *Green Capitalism? Business and the Environment in the Twentieth Century* (Philadelphia, PA: University of Pennsylvania Press, 2017), pp. 94–111.

[16]Wolfe, *Watering the Revolution*, pp. 12–14.

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which requires a large consumer base to maximise production, and in the properties of electricity, which is wasted if not consumed immediately.[17]

This article examines the history of Chilean electrification from the 1890s to the 1940s to show how conservationist ideas and dilemmas flowed through the discussions and debates leading up to the national plan of 1943. It draws on a range of published primary documents, government reports, and archival sources to trace how different engineers over this period discussed electrification and water in the context of resource management. On the one hand, national electrification extended technocratic ideas about the rational management of society to hydrological systems to usher in a long-anticipated modernity, one that would flow from Chilean rivers. Proponents of a national grid advocated for long-term, comprehensive planning to conserve water, or more precisely, to maximise hydroelectric production, which would then stimulate industrial and residential energy use. On the other hand, these nationalist engineers and their precursors were influenced by their understandings and perceptions of Chile's fluvial geography.[18] An early idea for an 'electrical nerve' linking hydroelectric plants and consumers across the country became, by the 1940s, the seven 'electrical regions' of the plan, which sought to exploit differences in local hydrological regimes to maximise power generation.

The lens of conservation also provides additional context for political economic debates, emphasised in previous studies of the electrification plan, about public–private power, industrialisation and the developmental potential of electricity. With a large-scale grid interconnecting different river basins, engineers could invoke the national interest to further justify their technical proposals.[19] Contrasting the benefits of a large grid with the limitations of smaller existing networks also bolstered nationalist critiques of private utility investors as short-sighted and, more broadly, of the export-oriented economy as wasting Chile's natural resources. Electrification became a nation-building project that aimed to merge diverse geographies, climates and socio-technical networks into a cohesive and productive territorial unit, much like the Popular Front sought to rally an uneasy alliance of moderate middle-class and radical working-class parties behind a single political project.[20]

Finally, this examination of Chilean electrification shows how the dilemma between using and preserving nature could exist even within a narrowly utilitarian framework for conservation thinking. While they mostly ignored or brushed aside non-utilitarian concerns, Chilean engineers did argue, somewhat contradictorily, that local waterpower resources were uniquely abundant but also limited. In other words, Chile's natural abundance was both exceptional and under threat, thus requiring careful stewardship and coordinated exploitation. Protecting the

[17]Cohn, 'Utilities as Conservationists?', pp. 95–9.

[18]Sagredo Baeza, 'Electricidad', p. 339.

[19]See Gabrielle Hecht, *The Radiance of France: Nuclear Power and National Identity after World War II* (Cambridge, MA: MIT Press, 1998), especially chap. 1; Sara B. Pritchard, *Confluence: The Nature of Technology and the Remaking of the Rhône* (Cambridge, MA: Harvard University Press, 2011).

[20]On the parallels between the Popular Front alliance and Chilean landscapes, see Bárbara Silva, 'La espacialidad y el paisaje en las representaciones nacionales durante el Frente Popular chileno. 1938–1941', *Revista de Historia Social y de las Mentalidades*, 22: 1 (2018), pp. 129–53.

energy flowing through rivers was, to paraphrase a famous Chilean conservationist, a matter of national survival.[21]

The article begins by exploring the views of early Chilean advocates of electrification at the turn of the twentieth century. It then examines nascent efforts to measure and manipulate rivers, which led some engineers to develop distinctive ideas about water conservation. The remainder of the article explores how, in the aftermath of the Great Depression, these two lines of thinking converged around the issue of national electrification. First, it examines the context for and debates around the 'electricity problem' in the mid-1930s. It then considers how the conservationist dimensions of those debates influenced the state engineers who drafted the electrification plan after the Popular Front took power.

Early Electrification

The first hydroelectric station in Chile, the 430-kilowatt Chivilingo plant, was put in service in 1897 at the Lota coal mine on the southern coast, near Concepción. While Chivilingo was small compared to later developments, the energy potential at sites higher up in the mountains did not go unnoticed. The mine's head engineer mused that an 'inexhaustible power' stored in the Andes might one day illuminate cities and electrify factories: 'Undoubtedly, hydraulic power and electricity will have a great future in this country, the day that its inhabitants and government give it the attention it deserves and cease occupying themselves solely with politics and personal ambitions, the sort of affairs which serve only to pervert and corrupt.'[22]

These remarks reflected growing frustrations among advocates of electrification in *fin-de-siècle* Chile, a group that included engineers, urban reformers and municipal politicians. Not long after the first urban networks powered up in the United States and Europe, agents of foreign equipment manufacturers appeared in Chile, installing a prototype generator and lighting system in downtown Santiago by 1883. Despite the early introduction, electrical networks were slow to expand outside of the capital city, a pattern which repeated itself throughout Latin America.[23] Even in Santiago, electrification proceeded gradually. The first public service network in the capital, tied to an electric streetcar concern, did not start operating until 1900. Another municipal network appeared a few years later in the nearby port city of Valparaíso. Outside of these two cities in central Chile, urban electrification remained limited until after the First World War. Large investments in the mining sector were also slow to materialise, Chivilingo notwithstanding. When copper-mine operators introduced the first industrial-scale generation stations and high-voltage networks in the 1910s, these remained confined to mining towns far away from urban centres.[24]

[21]Rafael Elizalde Mac-Clure, *La sobrevivencia de Chile: La conservación de sus recursos naturales renovables* (Santiago: Ministerio de Agricultura, 1958).

[22]Guillermo E. Raby, 'Empresa de trasmisión de fuerza de Chivilingo', *Anales del Instituto de Ingenieros de Chile* (hereafter *AIICh*), 82 (1897), p. 251. Also quoted in Sagredo Baeza, 'Electricidad', which inspired some of my framing in this section.

[23]Xavier Tafunell, 'La revolución eléctrica en América Latina: Una reconstrucción cuantitativa del proceso de electrificación hasta 1930', *Revista de Historia Económica*, 29: 3 (2011), pp. 327–59.

[24]César Yáñez, 'El arranque del sector eléctrico chileno: Un enfoque desde las empresas de generación, 1897–1931', in Manuel Llorca-Jaña and Diego Barría Traverso (eds.), *Empresas y empresarios en la historia*

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To its earliest advocates, electrification represented modernity and prosperity, and they worried that Chile was falling behind. In 1896, two engineers lamented that Santiago's electrical infrastructure was developing at a slower pace compared to other cities. Whereas New York and Milan had made notable technical advances since the 1880s, in Santiago there were only 'memories of industrial failure'.[25] They blamed this disheartening situation on the public's unfamiliarity with the technology and the intransigence of entrenched business interests, which another advocate described as 'economic scepticism'.[26] Municipal gas utilities and horsecar trolley companies in Valparaíso and Santiago, for instance, resisted the installation of electric lamps and streetcars, which threatened their lighting and transport monopolies.[27]

Arguments for electrification emphasised its economic, hygienic and social benefits, especially in cities. Early studies sought to prove that electric lighting was commercially competitive with gas lamps and, moreover, less polluting. One proponent, the engineer Arturo Salazar, had managed the Valparaíso gas utility before moving to Santiago in 1896. He then accused his former industry and other sceptics of offering 'impressionistic' critiques drawn from a selective sampling of failed electrical enterprises.[28] Another engineer, Enrique Vergara Montt, published a long technical and economic study of electric streetcars in the *Anales del Instituto de Ingenieros de Chile (Annals of the Chilean Institute of Engineers)*. For urban reformers, replacing horsecar trolleys with electrified trams would clean up city streets, end an abusive practice toward the horses, and emulate the modern infrastructure of the European capitals that so enchanted local elites. Not all *santiaguinos* enthused over the new technology. Safety was a recurring concern for pedestrians and, as some social critics pointed out, for working-class passengers forced to ride in second-class seating, which was exposed to the trolley cables.[29]

To proponents of electrification, unused waterpower was natural abundance going to waste and, with it, an industrial future. Salazar and Vergara Montt both argued that rivers were untapped reserves of energy and industrial wealth, differing materially and economically from the commodity exports that had fuelled the

de Chile: 1810–1930 (Santiago: Editorial Universitaria, 2017), pp. 175–93. This pattern of urban and mining enclave development follows global trends in early electrification. William J. Hausman, Peter Hertner and Mira Wilkins, *Global Electrification: Multinational Enterprise and International Finance in the History of Light and Power, 1878–2007* (Cambridge: Cambridge University Press, 2008), chap. 3.

[25]Arturo E. Salazar and Karlos Newman, *Kosto komparatibo en Chile del gas i de la elektrizidad komo sistemas de distribuzion de enerjía* [*sic*] (Santiago: Imprenta Moderna, 1896), p. 31.

[26]Enrique Vergara Montt, 'Valor mecánico i económico de la electricidad en los usos i necesidades de la industria', *AIICh*, 57 (1895), pp. 191–285.

[27]Ricardo Nazer Ahumada and Gerardo Martínez Rodríguez, *GASCO 1856–1996: Historia de la Compañía de Consumidores de Gas de Santiago S.A.* (Santiago: Ediciones Universidad Católica de Chile, 1996), pp. 156–73; Samuel J. Martland, 'Constructing Valparaíso: Infrastructure and the Politics of Progress in Chile's Port, 1842–1918', unpubl. PhD diss., University of Illinois at Urbana-Champaign, 2003, chap. 3.

[28]Salazar and Newman, *Kosto komparatibo*, pp. 69–70.

[29]Prudant, 'Del caballo a la electricidad', p. 60; Zacarías, 'La construcción de una ciudad cableada'. According to one contemporary account, hygiene advocates also worried that turbines would taint the capital's drinking water. Arturo E. Salazar, *Kálkulos sobre las kañerías de agua* [*sic*] (Santiago: Hume y Cía., 1898), pp. 99–100.

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national economy since independence. Salazar claimed that rivers contained more riches than the most productive mining enterprises. The problem was a lack of imagination: Chileans did 'not favour such abstract industrial endeavours, where the initial product extracted is not a gold nugget or something else equally tangible'.[30] Similarly, Vergara Montt claimed that his compatriots misunderstood waterpower because they knew only agricultural wealth. Chile's resources, he argued, lay not only in its soils, but also in the inexhaustible 'natural forces' which could be harnessed to produce new goods and resources.[31] To neglect these forces was to allow wealth to slip from the nation's grasp. 'Here is a country where gold is thrown into the sea', he told his engineer colleagues in 1893.[32]

Salazar would go on to articulate an influential concept of national electrification that would later earn him recognition as the 'forefather' of the national grid.[33] An inventor with wide-ranging interests, Salazar likely had his first hands-on experience with electric-power technology while working at the Valparaíso gas company. Sometime around 1893, he convinced the company to install a small prototype generator powered by manufactured coal gas.[34] A few years later, he relocated to Santiago for a professorship at the University of Chile, where he taught generations of electrical engineers, including several authors of the plan. Early studies produced in conjunction with Salazar's teaching programme hinted at an understanding of electrification that went beyond the urban scope of early systems. One influential publication examined the technical and economic dimensions of transporting electricity over long distances, a major hurdle for developers of large hydroelectric plants, which were usually sited in hinterland regions.[35] In a treatise on hydraulic engineering, Salazar observed that a sizeable demand base – ideally industrial – was necessary to convert waterpower potential into real wealth. As an example, he pointed to the Aconcagua River, whose main tributaries rise in the mountains north of Santiago. A power plant sited in the upper basin, where copious, unexploited energy flowed down every year, could transform the fertile valley below into an important industrial centre. Numerous sites like the Aconcagua, Salazar noted, were scattered along the steep slopes of the Andes.[36]

[30]Salazar and Newman, *Kosto komparatibo*, p. 56. On the problem of materiality, see Yohad Zacarías, 'El fluido eléctrico y la búsqueda de materialidad: Tecnología y visiones de la energía en la publicidad de los primeros alumbrados eléctricos. Santiago de Chile. 1900–1920', *Diseña*, 18 (2021), available at https://doi.org/10.7764/disena.18.Article.3, last access 23 Jan. 2023.

[31]Vergara Montt, 'Valor mecánico', pp. 193–4, 283–4.

[32]He was paraphrasing an unidentified foreign visitor to Chile. See the 30 Sept. 1893 minutes in 'Actas de las sesiones del Instituto', *AIICh*, 33 (1893), pp. 588–607. See, similarly, Prudant, 'Del caballo a la electricidad', p. 58.

[33]E.g., Reinaldo Harnecker, 'Elogio de los señores Diego A. Torres y Arturo E. Salazar', in 'Incorporación como miembro académico del profesor ingeniero don Reinaldo Harnecker von Kreschmann, decano de la facultad', supplement (*apartado*) to *Anales de la Facultad de Ciencias Físicas y Matemáticas*, 8–9 (1952), pp. 4–7.

[34]Luis L. Zegers, 'La compañía de gas de Valparaíso i su instalación de alumbrado eléctrico', *Boletín de la Sociedad Nacional de Minería*, Nov. 1893.

[35]Arturo E. Salazar, *Trasmision eléktrika de potenzia a largas distanzias* [*sic*] (Santiago: Hume y Cía., 1899).

[36]Salazar, *Kálkulos*, pp. 3–5, 97–9.

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Eventually, Salazar would argue that interconnecting these sites was a matter of national importance, a panacea for underutilised hydroelectric potential. Linking different hydroelectric systems would grow and diversify the customer base and reduce the price of electricity since a stable load allowed plants to operate at higher utilisation rates, 'a difficult thing to achieve locally without incorporating extensive regions of a country'.[37] Salazar wrote this in 1917, while the state railroad company was considering proposals to electrify the Santiago–Valparaíso line. While coal mining interests opposed the plan when it was first floated a decade earlier, others seized on railroad electrification as a means to tap into Chile's 'squandered' hydroelectric resources and consume less coal, which was becoming expensive and difficult to import.[38]

In 1916, Salazar had attended the Pan-American Scientific Conference in Washington DC, where he heard presentations on water conservation and electricity transmission.[39] Later that year, he and several other engineers asked the Ministerio de Industria i Obras Públicas (Ministry of Industry and Public Works) to fund a national electrification study. They eventually produced a report recommending the creation of a 'longitudinal artery', a north–south transmission line – paralleling the central railroad – fed by hydro plants in the mountains and coastal thermoelectric stations (which burn fossil fuels). The proposal elicited some talk of forming a national power company with a mix of public and private capital but was ultimately discarded.[40] The notion of an electrical 'artery' or 'nerve', however, endured as the local paradigm for national electrification, kept alive by Salazar and his pupils at the university.[41]

Measuring Rivers

In one of his early treatises, Salazar lamented the lack of reliable quantitative data on Chile's waterpower potential, faulting both the private sector and the government for neglecting the important task of measurement.[42] Indeed, detailed, site-specific hydrometric data, necessary to develop power projects, were scarce before the mid-twentieth century. During the post-independence period in the 1800s, river research mainly consisted of surveys and cartographic expeditions, all part of a larger nation-building project to demarcate borders and inventory natural resources. The importance of rivers was primarily as logistical corridors connecting agricultural hinterlands

[37]Arturo E. Salazar, 'Notables resultados de la tracción eléctrica en los grandes ferrocarriles', *El Mercurio*, 11–12 Jan. 1917. Quote is from the 12 Jan. edition.

[38]Ruperto Echeverria S., 'Datos para la electrificación de los ferrocarriles', *AIICh*, 7 (1912), pp. 321–2. On the coal problem, see Guillermo Guajardo Soto, *Tecnología, Estado y ferrocarriles en Chile, 1850–1950* (Mexico City: Universidad Nacional Autónoma de México, 2007), pp. 81–2.

[39]Arturo E. Salazar, 'Segundo Congreso Científico Pan-Americano', *Anales de la Universidad de Chile*, 74 (1916), pp. 389–459.

[40]'Arteria longitudinal distribuidora de energía eléctrica', *Revista Económica*, 4 Nov. 1918, pp. 269–70; Chile, Cámara de Senadores, Sesión 7ª extraordinaria, 30 Oct. 1917, pp. 120–4. Citations from the congressional record may be located online using the session date: www.bcn.cl/historiapolitica/corporaciones/index.html, last access 24 Jan. 2023.

[41]Harnecker, 'Elogio'; Humberto Jorquera G., 'Don Arturo E. Salazar V., profesor e ingeniero', *Anales de la Facultad de Ciencias Físicas y Matemáticas*, 13 (1956), pp. 3–7.

[42]Salazar, *Kálkulos*, pp. 3–4.

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to national and international markets via coastal ports, although the railroad largely superseded fluvial transport by the late 1800s.[43] Some geographical descriptions from this period even characterised Chilean rivers as diminutive compared to the sprawling fluvial systems of other American republics.[44]

Precise measurements and long-term studies are basic prerequisites for comprehensive river development, as Chilean engineers frequently observed. Eventually, the 1943 electrification plan would sponsor topographic and hydrometric surveys in all major river basins. The aim was to create a national waterpower inventory, which one engineer characterised as the foundation for electrification and industrial planning.[45] Before those systematic studies, the limited corpus of useful hydrometric data existed largely thanks to private initiatives.[46] The state waters surveys of the 1940s did have at least one precursor, however. In 1909, at the urging of the Sociedad Nacional de Minería (National Mining Society), the Public Works Ministry created a waterpower research division.[47] Tasked with quantifying Chile's hydroelectric potential, the division developed a five-year work programme that organised the territory into four regions for the purpose of data collection. It then installed stream gauges in the upper Aconcagua Basin and began surveying the Maipo River. The division's mandate also included evaluating dam and transmission projects and identifying hydro sites to reserve for state use. In 1912, it produced a report on practical conservation measures 'to obtain the maximum amount of waterpower in order to ensure the maximum benefit for the community, the state and the national government'.[48]

Despite its ambitious mandate, the waterpower research division was underfunded and understaffed from the outset. In 1913, the division merged with another department in the ministry and narrowed its remit to data collection, eventually shifting its focus to irrigation projects.[49] The brief emphasis on waterpower,

[43]Rafael Sagredo Baeza, 'De la hidrografía imperial a la hidrografía nacional: Reconocimientos del Pacífico sur. Siglos XVIII y XIX', *Anuario de Estudios Americanos*, 70: 2 (2013), pp. 509–56; Valeria Maino Prado, *La navegación del Maule: Una vía de conexión con el exterior. 1794–1898* (Talca: Editorial Universidad de Talca, 1996). On an important figure in nineteenth-century hydrography, see Zenobio Saldivia Maldonado, *Francisco Vidal Gormaz: Fundador del SHOA y padre de la hidrografía nacional* (Santiago: Corporación Patrimonio Marítimo de Chile, 2021).

[44]Vicente Pérez Rosales, *Ensayo sobre Chile* (Santiago: Cámara Chilena de la Construcción, Pontificia Universidad Católica de Chile, Biblioteca Nacional de Chile, 2010 [1859]), p. 53; Pedro Lucio Cuadra, *Apuntes sobre la jeografía física i política de Chile. Primera parte: Jeografía física* (Santiago: Imprenta Nacional, 1868), p. 43.

[45]Comisión Técnica de Energía (hereafter CTE), Acta No. 60, 17 Oct. 1941, Archivo Nacional de la Administración, Santiago (hereafter ARNAD), Fondo CORFO, vol. 5053.

[46]For brief overviews of Chilean hydrology, see Andrés Benítez Girón, 'Evolución de la hidrología en el mundo y en Chile', *Anales de la Universidad de Chile*, 8 (1985), pp. 591–609; Hans Niemeyer Fernández and Pilar Cereceda Troncoso, *Geografía de Chile*, vol. 8: *Hidrografía* (Santiago: Instituto Geográfico Militar, 1984), pp. 13–15.

[47]A letter to the ministry is reprinted in 'Las fuerzas hidráulicas de Chile', *Boletín de la Sociedad Nacional de Minería*, July 1909. See also Ministerio de Industria i Obras Públicas (hereafter MIOP), Decreto No. 1358, *Diario Oficial*, 21 Aug. 1909, p. 4171. The following account of the division's activities draws from the MIOP *memorias* for 1910–15.

[48]I have been unable to locate the full report, which is referenced in MIOP, *Memoria correspondiente al año 1912* (Santiago: Imprenta 'Santiago', 1914), p. 497.

[49]See the MIOP *memorias* for 1913–14.

however, indicated the changing role of rivers in national development imaginaries. The division's first director proclaimed that 'aquatic currents' would provide Chile with tremendous industrial advantages and ease the economic impacts of the local nitrate industry's decline.[50] A few years later, legislators cited the untapped energy of rivers in speeches on Chile's economic and industrial future in light of the global economic fallout of the First World War.[51] Even those who still considered local rivers to be relatively 'mediocre' described water as 'the goddess of production'.[52]

In those early decades of the twentieth century, a few hydraulic engineers also began to articulate notions of water management that were, in some ways, distinct from mainstream conservation thinking. The dominant discourse at the time emphasised the role of forests in regulating the water cycle, a view that in Chile had originated in the 1830s and was promoted by foresters in the early 1900s. This line of thinking favoured policies that protected native forests and encouraged tree planting. As Thomas Klubock has observed, early water conservation was thus understood not in terms of regulating use, but rather managing deforestation.[53] Engineers who studied and intervened in other parts of the watersheds, however, had to think carefully about use and other forms of water management. Their approach did not constitute an entirely separate school of Chilean water conservation, but it does point to some distinctive ideas about waste and long-term planning that would surface later in the electrification plan.[54]

Articles on river engineering and hydrology in the *Anales del Instituto de Ingenieros* provide glimpses of this thinking. Discussions often centred on agricultural uses of water, especially while Congress debated irrigation legislation in the 1910s. One engineer wrote that the challenge was not so much increasing supply as it was mitigating waste by water users – '*menos agua, más cerebro* [less water, more brainpower]', as he put it.[55] Others warned against short-sighted engineering interventions that were poorly attuned to the natural environment. In 1908, an engineer named Eduardo Reyes Cox wrote that it was important to study, to interrogate, the flow regime to reveal its natural cycles.[56] Recent dredging projects to improve navigation on the lower Valdivia had failed, he explained, because they

[50]Oscar Schmidt E., 'Nuevas tendencias con relación al aprovechamiento de las fuerzas hidráulicas en países modernos', *Boletín de la Sociedad Nacional de Minería*, April–May 1910.

[51]Chile, Cámara de Diputados, Sesión 13ª extraordinaria, 7 Nov. 1917, pp. 337–8; Sesión 21ª extraordinaria, 14 Nov. 1918, pp. 449–52. One of these politicians was Pablo Ramírez of the Radical Party. He was later instrumental in recruiting engineers to work for the Ibáñez regime. See Silva, *In the Name of Reason*, chap. 2.

[52]Santiago Marín Vicuña, 'La navegación fluvial', *AIICh*, 10 (1917), pp. 433–53.

[53]Klubock, 'The Early History', pp. 434–6. See also Klubock, *La Frontera*; Camus, *Ambiente, bosques y gestión*.

[54]I am not suggesting an either/or scenario – most of the authors cited here likely accepted the notion that forests influenced the water cycle – but rather that the importance ascribed to forests varied in degree. For an early example, see Benjamín Vicuña Mackenna, *Ensayo histórico sobre el clima de Chile* (Valparaíso: Imprenta del Mercurio, 1877), pp. 351–6, who argued that while forests had a localised effect on watersheds, rainfall was also influenced by longer-term, larger-scale meteorological factors.

[55]Carlos Hoerning D., 'El fomento de la irrigación en Chile', *AIICh*, 3 (1913), p. 123; see also 'El problema de la irrigación', *AIICh*, 8 (1909), pp. 364–71.

[56]Eduardo Reyes Cox, 'El problema del mejoramiento de los ríos ante los últimos congresos de navegación', *AIICh*, 8 (1908), pp. 338–9.

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did not consider the river's variable flow and sedimentation dynamics. He also observed that hydraulic interventions designed in isolation risked interfering with other projects in the same basin, undermining the larger goal of 'improving' rivers.[57] Reyes Cox, who would later contribute to the electrification plan, worked on various river navigation and port projects early on in his career as a state engineer, which began in 1902. After becoming director of the government's irrigation department in 1935, he would extend his vision of comprehensive basin development to the entire territory, advocating for a national irrigation plan. In a 1936 article, for instance, he argued that state-funded irrigation projects had been tailored too narrowly to regional concerns, with little consideration for national or long-term development imperatives.[58]

In different ways, these articles blended the notion of abundant water resources, also articulated by early proponents of electrification, with incipient demands for state intervention. After all, such abundance had to be protected. As one engineer wrote, 'I hope that the public will come to understand that our waters are our national wealth and that the state is obligated to ensure, with every means at its disposal, their fullest utilisation.'[59] A more elaborate version of this idea appeared in a 1915 article on stream gauging by Gustavo Lira,[60] then a young engineer in the public works department. Lira would have a long and influential academic career at the University of Chile, authoring an important early textbook on hydrology. His career in government was equally impressive. In addition to holding several ministerial posts, he was instrumental in the creation of Chile's first electricity services regulator in the 1920s, serving as its director on two occasions.[61]

In the article, Lira argued for a more nuanced understanding of water wealth. Part of this wealth, he explained, derived from an 'external nature' that fulfilled societal needs in its unmodified state. As an example, Lira pointed to the topography of central and southern Chile, where the Andean peaks to the east and fertile valleys to the west offered numerous opportunities for power and irrigation development. Exploiting external nature, however, required human intervention to harness water for specific projects and uses. Accessing this 'other half' of Chile's natural wealth introduced the risk of error and waste. Such risks could be mitigated only through systematic measurement, the careful study of hydrological systems, and a legal framework that both protected the integrity of rivers and encouraged their development.[62]

Monopolised Waters

Throughout the 1920s, private power utilities underwent a period of expansion and consolidation, with several large holding companies emerging in central and

[57]*Ibid*.; see also Eduardo Reyes Cox, 'Mejoramiento de los ríos', *AIICh*, 3 (1914), pp. 134–5.

[58]Eduardo Reyes Cox, 'El regadío en el país', *AIICh*, 9 (1936), pp. 361–71. For biographical details, see Domingo Santa María, 'Necrología, Don Eduardo Reyes Cox', *AIICh*, 3–4 (1949), pp. 61–2.

[59]Hoerning D., 'El fomento', p. 127.

[60]Gustavo Lira, 'Aforo de ríos', *AIICh*, 1 (1915), pp. 32–54.

[61]For Lira's influence on hydrology, see Benítez Girón, 'Evolución de la hidrología', pp. 598–9; Niemeyer Fernández and Cereceda Troncoso, *Hidrografía*, p. 14. On his government service, see 'Medalla de Oro otorgó el Instituto a Don Gustavo Lira Manso', *Revista Chilena de Ingeniería*, March–April 1959.

[62]Lira, 'Aforo de ríos', pp. 32–3.

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southern Chile. In 1928, the US company American & Foreign Power acquired the largest utility company, the Santiago-based Chilectra, as part of an overseas expansion facilitated by the steady flow of capital from New York City's banking sector into modernisation projects across Latin America.[63] At the onset of the Great Depression, Chilectra and other local utilities froze new investments and fought bitterly with Chilean regulators to increase rates. In 1935, the government uncovered a financial scandal at the company and threatened to arrest its local directors, fuelling calls for nationalisation. By then, rate hikes and labour conflicts had transformed Chilectra into a symbol of US imperialism. Despite broad public support for aggressive action against the company, the government eventually adopted a more conciliatory position, dropping the charges after securing various concessions from Chilectra. The final settlement agreement negotiated by Finance Minister Gustavo Ross was poorly received by reformist and left-wing politicians, who used it against Ross during his failed presidential campaign in 1938.[64]

The financial scandal was only the latest flare-up in the fraught relationship between Chilean authorities and the Santiago utility company. Since its foundation as a German-backed lighting and transport concern, Chilectra had clashed with politicians over its electricity rates and transit fares, service quality, and investment decisions.[65] Although rate and fare hikes drew the strongest political backlash, Chilectra's control of development rights on the major river basins around the capital created another source of tension. In the 1890s, when Chilectra's German backers appeared to renege on a promise to build a plant on the lower Maipo River, municipal authorities in Santiago threatened to cancel the concession before it had even started operating.[66]

After the First World War, Chilectra bought out competitors and combined systems in the provinces of Santiago, Valparaíso and Aconcagua into a proto-regional grid. Through these mergers, it also acquired the rights to develop the upper Maipo Basin, where it completed the Maitenes (1923) and Queltehues (1928) hydroelectric plants to power the electrification of the Santiago–Valparaíso and Transandine railways. As it amassed water and development rights around Santiago, Chilectra again came under scrutiny. In 1920, the public works minister informed his staff that he was concerned about waterpower resources falling into the hands of 'large trusts'

[63]William J. Hausman and John L. Neufeld, 'The Rise and Fall of the American & Foreign Power Company: A Lesson from the Past?', *Electricity Journal*, 10: 1 (1997), pp. 46–53; Carlos Marichal, *Historia mínima de la deuda externa de Latinoamérica, 1820–2010* (Mexico City: Colegio de México, 2014), pp. 171–5.

[64]Silvia Castillo Ibáñez, *Historia de Chilectra, 1898–1994* (Santiago: Chilectra, Dirección de Planificación, 1996), pp. 84–9, 96–7; Richard J. Walter, *Politics and Urban Growth in Santiago, 1891–1941* (Stanford, CA: Stanford University Press, 2005), pp. 195–8; Thomas F. O'Brien, *The Revolutionary Mission: American Enterprise in Latin America, 1900–1945* (Cambridge and New York: Cambridge University Press, 1996), pp. 198–201.

[65]Castillo Ibáñez, *Historia de Chilectra*, *passim*; Elisabet Prudant, 'El affaire de la Chilian Electric Tramway & Light Co. y la respuesta nacionalista a las operaciones del capital trasnacional en el servicio de transporte público de Santiago, 1914–1920', in Castillo and Mardones (eds.), *La ciudad en movimiento*, pp. 61–88. Although Chilectra did not become the formal corporate name until the 1970s, I use it here for simplicity's sake.

[66]Castillo Ibáñez, *Historia de Chilectra*, pp. 21–3; Steiner, 'El fantasma', pp. 458–60.

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and inquired about the legality of reserving water rights for the state.[67] That same year, Chilectra's executives were pressing for legislative reforms to clarify, among other things, right-of-way rules. They also asked the government to prevent the company's unused water rights from expiring.[68] Congress eventually passed an electricity services law in 1925 and then revised and expanded it in 1931.[69]

As the first comprehensive effort to regulate the power industry, the law was, in the eyes of nationalist critics, a missed opportunity to rein in foreign operators and increase national participation.[70] Their harshest criticism, however, was reserved for a new power-supply contract that the government had signed with Chilectra just before the 1931 revisions. Negotiations had been long and contentious, with an early version of the contract scrapped after public outcry over certain provisions.[71] The final contract was better received but not without controversy. Chilectra's existing and future plants were granted operating concessions of 90 years, the maximum term under the new law. The contract also included 90-year water rights for eight undeveloped sites in the Aconcagua and Maipo basins. While Chilectra forfeited those rights if it failed to develop them within a certain timeframe, it could sidestep the deadline by building thermoelectric plants that used domestic fuels.[72] A lawyer who worked at the public services regulator later argued that the 90-year terms were excessively generous, even for a country like Chile, whose unstable currency made it difficult to lure investors for capital-intensive projects. He criticised legislators for failing to reduce the legal maximum and claimed that the electricity law was written to justify, retroactivity, the cushy terms of Chilectra's contract.[73]

While the Chilectra controversy was not about conservation specifically, it does provide important context for the subsequent statist response that would accuse private utilities of (among other things) squandering Chile's waterpower resources. From Salazar onwards, moreover, local engineers and promoters had eyed the very basins where the company now controlled the most promising development rights. From a nationalist perspective, foreign interests were appropriating resources and 'extracting' from the national patrimony 'a source of energy whose economic importance increases each day'.[74] Radical Party politician Pedro Aguirre Cerda, who would later defeat Ross as the Popular Front's presidential candidate in

[67]The minister singled out rights granted on the Loa and Maipo rivers – in the latter case, to a US–Chilean concern that would soon be absorbed by Chilectra. O. Dávila I. to Director de Obras Públicas, 26 March 1920, ARNAD, Fondo Ministerio de Obras Públicas, vol. 3073.

[68]José Miguel Seguel C., *La industria eléctrica ante la legislación chilena* (Santiago: Imprenta y Litografía Leblanc, 1941), pp. 10–11; Castillo Ibáñez, *Historia de Chilectra*, p. 58. It is unclear if Chilectra's request was related to the minister's concerns about large trusts, or vice versa, but it does indicate that water rights were on the agenda for both parties.

[69]Decreto – Lei 252, 18 Feb. 1925, available at https://bcn.cl/2lqli, last access 26 Jan. 2023, followed by Decreto con Fuerza de Ley 244, 15 May 1931, available at https://bcn.cl/34isw, last access 26 Jan. 2023.

[70]Seguel C., *La industria eléctrica*.

[71]Walter, *Politics and Urban Growth*, pp. 139–42.

[72]See Art. 11, 13 and 14 of Decreto con Fuerza de Ley 29, 11 March 1931, available at http://bcn.cl/2iwy5, last access 26 Jan. 2023.

[73]Seguel C., *La industria eléctrica*, pp. 185–8. Cesár Yáñez argues that the law can be seen as an attempt to regulate Chilectra specifically. The government was the company's largest client for electricity by the 1930s. Yáñez, 'La intervención', pp. 122–3.

[74]Seguel C., *La industria eléctrica*, p. 136.

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1938, accused the government of giving away Chile's waterpower resources 'without regard for the national interest'.[75]

A Policy for Chile

What were the nation's best interests when it came to electrification? A detailed answer came just a few years after Chilectra signed the new contract. In 1936, a group of engineers affiliated with the Instituto de Ingenieros released a study known as the '*Política eléctrica chilena* [Chilean Electricity Policy]'. This influential policy document would eventually serve as the blueprint for the national electrification plan, which quoted from it approvingly.[76] In addition, the lead author of the *Política eléctrica* was Reinaldo Harnecker, a professor of electrical engineering at the University of Chile who would later play a central role in drafting the national plan.

As a former student of Salazar's, Harnecker owed many intellectual debts to his mentor, as will become clear below. But it is also important to situate his views on electrification within a longer tradition of Chilean thinking on interventionism and the state as a protector of national economic interests.[77] Like many Chilean nationalists, Harnecker admired President José Manuel Balmaceda (1886–91), whose support for national control over the nitrate and rail industries in the nineteenth century made him into an enduring icon for nationalist and anti-imperialist intellectuals and politicians.[78] Since the 1880s, nitrates and, later, copper revenues had funded the expanding state apparatus, but also cemented its dependence on foreign capital and subjected the economy to vicious boom-and-bust cycles. As Chile approached its centennial in 1910, a sense of pessimism about the nation's prospects had begun to spread across the political spectrum.[79] Brownouts in the capital on the week of the centennial celebrations likely did little to alter the mood.[80] The economic repercussions of the First World War, while Harnecker was in university, and subsequent turmoil of the Depression years only reinforced perceptions that the old model of laissez-faire, export-led growth had run its course.

In 1934, Harnecker met with colleagues in the office of his private consulting business to discuss the 'electricity problem', which eventually led to the publication

[75]Pedro Aguirre Cerda, *El problema industrial* (Santiago: Prensas de la Universidad de Chile, 1933), p. 126.

[76]CORFO, *Plan de electrificación del país de la Corporación de Fomento de la Producción, Chile* (Santiago: CORFO, 1942), pp. 15–16. All copies of the plan consulted were dated 1942, although it appears that formal approval by CORFO's directors did not occur until early 1943.

[77]On this tradition, see Rafael Sagredo Baeza, 'Balmaceda y los orígenes del intervencionismo estatal', in Luis Ortega Martínez (ed.), *La Guerra Civil de 1891: 100 años hoy* (Santiago: Universidad de Santiago, 1991), pp. 37–48.

[78]On Balmaceda's influence on Harnecker, see Fernando Duque, 'The Chilean National Electric Enterprise (ENDESA): A Treatise on the Behavior of a Public Corporation in a Transitional Society', unpubl. PhD diss., University of California, Los Angeles, 1978, pp. 116–24, 404. See also Raúl Sáez S., 'Don Reinaldo y la ENDESA', *Revista Chilena de Ingeniería*, 401 (Oct. 1988), pp. 5–32.

[79]Barr-Melej, *Reforming Chile*, chap. 2.

[80]'La iluminación de la ciudad', *El Mercurio*, 17 Sept. 1910; 'La iluminación de la ciudad', *El Mercurio*, 18 Sept. 1910; 'Día a día: Las iluminaciones', *El Mercurio*, 19 Sept. 1910.

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of the *Política eléctrica*.[81] The document was more polemic than dry policy paper, intended to stimulate debate among a technocratic elite. It had little to say on the practicalities of creating a hydro-based national grid. In fact, a tentative 12-year construction programme in the final chapters prioritised coal power and postponed major hydro projects, due to the continued lack of adequate hydrometric data.[82] The authors spilled much more ink on diagnosing the ills of the power industry. They claimed that the industry's spending freeze risked precipitating an electricity shortage that would 'asphyxiate' the economy and stifle industrialisation. Equating control over electricity with economic sovereignty, they called for the state to intervene and build a national grid to supply cheap and abundant electricity, a 'service of extreme public necessity'. This injection of low-cost energy would awaken a 'hunger for electricity' that the private sector was either unable or unwilling to exploit.[83]

Following the conventions at the time, Harnecker and his co-authors presented the *Política eléctrica* to their colleagues at the Instituto de Ingenieros in 1935, prompting a spirited debate that continued in the pages of the institute's journal. The study elicited a strong response from the private utilities, who bore the brunt of its criticism.[84] Their representatives at the institute agreed that Chile needed more electricity and conceded that some government support was necessary. But they opposed direct intervention, rejected the charges of negligence, dismissed the risk of shortages, and questioned whether a 'poor and rough' country like Chile contained as much pent-up demand as the study claimed.[85] Underlying their objections was a liberal economic ideology sceptical of an activist state and a profit-oriented understanding of electricity as a luxury, rather than a basic need.[86]

The *Política eléctrica* also included an underlying call for conservation through electrification, which it characterised as 'the strongest stimulus for the rational

[81]Sáez S., 'Don Reinaldo', p. 13. The study was released in several parts through the *AIICh* during 1935–6 and then as a standalone publication later in 1936, recently reprinted as Reinaldo Harnecker *et al.*, *Política eléctrica chilena* (Santiago: Cámara Chilena de la Construcción, Pontificia Universidad Católica de Chile, Biblioteca Nacional de Chile, 2012).

[82]One of the study's own authors later criticised this prioritisation of coal, a finite domestic energy source. See Soto Vejar and Sanhueza Cerda, 'El problema eléctrico'. Contemporary views on the use of local coal reserves for power generation ranged from rosy (e.g., Aguirre Cerda, *El problema industrial*, p. 116) to pessimistic (e.g., Francisco Encina, *Nuestra inferioridad económica* (Santiago: Editorial Universitaria, 1981 [1911]), pp. 50–1).

[83]Harnecker *et al.*, *Política eléctrica*, pp. 5–6, 12, 16–18, 101–5, 107–8.

[84]The notable absence of mining companies, who controlled most existing generation capacity in Chile, is perhaps explained by the fact that their enclave systems operated apart from major urban consumer markets. They also supported some of the most advanced industrial processes in Chile at the time. In the copper sector, large generation stations powered industrial-grade refinery complexes, which polluted rivers and elicited conservationist critiques from agriculturalists downstream. Klubock, 'The Early History'. See also Ángela Vergara, '"Cuando el río suena, piedras trae": Relaves de cobre en la Bahía de Chañaral, 1938–1990', *Cuadernos de Historia*, 35 (Dec. 2011), pp. 135–51.

[85]E.g., Arturo Aldunate Ph., 'Política eléctrica chilena', *AIICh*, 2 (1937), pp. 43–62.

[86]Sagredo Baeza, 'Electricidad', pp. 341–2. Other historians who have studied the *Política eléctrica* include Ibáñez Santa María, 'Los ingenieros'; Yáñez, 'La intervención'; Soto Vejar and Sanhueza Cerda, 'El problema eléctrico'.

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exploitation of [a country's] natural resources'.[87] Along similar lines, national electrification was 'the most efficient solution for providing, at the lowest cost and with minimal waste of natural resources, the energy which a region or an entire country needs for development'.[88] As the latter quote suggests, efficiency in this context was understood in terms of managing economic and natural resources. Economic efficiencies could be gained through centralised planning to avoid redundant spending on isolated plants and through economies of scale with larger facilities, made feasible by the expanded consumer base of a national grid. In terms of resource management, long-term planning could avoid the construction of small hydro plants that blocked more ambitious projects within the same river basin. Larger turbines and generators were also better at capturing the kinetic energy of falling water. Thermoelectric plants were similarly more fuel-efficient at scale, but the study's technical rationales usually favoured waterpower over finite fossil fuels. At the national scale, for instance, grid operators could synchronise demand forecasts, seasonal rainfall patterns, variable flow regimes, and reservoirs to maximise hydro production and reduce fuel consumption.[89]

Alongside the more technical reasons for conservation, the engineers evinced a nationalist concern about the future of Chile and its natural resources. Harnecker and his colleagues concluded that the country offered an exceptional setting for a national grid: 'Given its geographic configuration and the variety, abundance and distribution of hydro and thermoelectric power resources, Chile, in our view, finds itself in a privileged position to embark on a national electrification plan, under far better conditions compared to other countries that have already adopted this sort of policy.'[90] Invoking Salazar's electrical nerve in all but name, they noted that a north–south transmission line following the central railroad could unify these resources. Elsewhere, they portrayed the marriage of technology and natural resources as a cure for pessimism: 'We are accustomed to saying or hearing that we live in a poor country. This is true only insofar as capital is concerned. We live in a country that is poor in money but rich with possibilities for wealth creation. Daring initiatives based on the latest technical advancements will allow us to escape from today's narrow-minded arguments.'[91]

During the merger and expansion period of the 1920s, the private utility operators had followed many of the same system-building and engineering principles that informed the conservationist arguments in the *Política eléctrica*, albeit for primarily economic and financial reasons.[92] However, their owners were reluctant to

[87]Harnecker *et al.*, *Política eléctrica*, p. 102. Interestingly, when the study's authors submitted a summary to an international conference, they foregrounded conservation in the title. This emphasis did not extend to the accompanying text. Reinaldo Harnecker *et al.*, 'Proyectos nacionales y regionales y su relación con la conservación de los recursos naturales', in Oscar Charles Merrill (ed.), *Transactions, Third World Power Conference: The National Power Economy*, vol. 6 (Washington DC: US Government Printing Office, 1938), pp. 325–30.

[88]Harnecker *et al.*, *Política eléctrica*, p. 103.

[89]*Ibid.*, pp. 53–61.

[90]*Ibid.*, p. 103–4.

[91]*Ibid.*, p. 67.

[92]For a sample of these views, see Ricardo Simpson, 'Organization of Private Electric and Gas Utilities', in Oscar Charles Merrill (ed.), *Transactions, Third World Power Conference: The National Power Economy*, vol. 5 (Washington DC: US Government Printing Office, 1938), pp. 57–68.

commit the substantial capital required for a national grid. In the debates sponsored by the Instituto de Ingenieros, utility representatives questioned the wisdom and feasibility of a national system, as well as the very premise of a 'national' electricity problem. A Chilectra engineer, for example, suggested that the population and wealth disparities between Santiago and the rest of the country, along with climatological and geographical differences, limited the possibilities for growth outside of the capital.[93] In a published response, Harnecker retorted that it was indeed a matter of national concern that domestic energy sources were not being exploited to their full potential. A national grid was not only feasible, he said, but would also stop utilities from wasting resources on small plants with low utilisation rates – the only projects possible on their isolated systems.[94]

The National Plan

The path from the *Política eléctrica* to the 1943 plan was a circuitous one, indicating that resistance to some of its proposals extended beyond the utility industry. After it was published in 1936, the study was mostly ignored by the incumbent government. Following the Popular Front's victory in 1938, the incoming finance minister convened a commission of experts to study the electricity problem. Participants included Harnecker and another author of the *Política eléctrica*, the irrigation engineer Reyes Cox, and the head of the private power utility association. The commission released its final report in March 1939. CORFO, the state development agency established that same year, followed up with a short-term 'action plan' in August.[95] Both documents drew heavily from the 1936 study while tempering some of its more radical proposals – for example, by allowing public and private investments in new generation stations.[96] After CORFO was created, Harnecker took charge of the technical office in the Energy and Fuels Department, whose staff threw themselves into drafting a longer-term plan.

As they worked on the plan under Harnecker's supervision, CORFO engineers had various opportunities to put their ideas about water conservation into practice. The technical staff had to attend to more immediate concerns, including the continued threat of electricity shortages in Santiago and looming coal supply problems at the conflictive southern mines. To cover short-term electricity demand, the engineers quickly drew up plans for a series of small hydroelectric projects. As early as November 1939, the office was exploring development options.[97] It eventually settled on three sites on the Cachapoal, Laja and Pilmaiquén rivers, all later incorporated into the electrification plan. Internal deliberations over the projects

[93]Aldunate Ph., 'Política eléctrica'. See also Guillermo Cox Lira, 'Comentarios a los estudios de política eléctrica chilena', *AIICh*, 1 (1937), pp. 3–10; Agustín Huneus [*sic*], 'Política eléctrica chilena', *AIICh*, 3 (1936), pp. 139–41.

[94]Reinaldo Harnecker, 'Política eléctrica chilena', *AIICh*, 8 (1937), pp. 329–41.

[95]Raúl Simón, José Luis Claro, Manuel Ossa, Reinaldo Harnecker, Julio Santa María, Eduardo Reyes Cox, Agustín Huneeus, and Ricardo Simpson, 'El problema de la energía en Chile y plan de electrificación nacional', *AIICh*, 4 (1939), pp. 207–59; CORFO, *Fomento de la producción de energía eléctrica* (Santiago: CORFO, 1939).

[96]Yáñez, 'La intervención', pp. 126–7.

[97]CTE, Acta No. 2, 6 Nov. 1939, ARNAD, Fondo CORFO, vol. 5053.

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reflected a predominantly utilitarian understanding of rivers, which the engineers valued primarily as sources of energy and, to a lesser extent, of irrigated waters. Little thought was given to other uses that did not serve the larger goal of industrialisation.[98]

CORFO also negotiated with the private utilities controlling development rights on the Cachapoal and Pilmaiquén. This entailed convincing the companies to relinquish their water rights and then sign a contract committing them to buying electricity from the state's hydroelectric plants once these came online. As leverage, the electricity regulator rejected one company's provisional construction plans for the Cachapoal River, citing technical deficiencies.[99] In an internal memorandum, Domingo Santa María, the regulator's director and another co-author on the *Política eléctrica*, explained that 'power stations which do not exploit the entire technical gradient or streamflow volume of a river section will ultimately result in the deficient exploitation of its energy'.[100] Behind this technical language, the implication was that short-sighted projects undermined the river's potential and, by extension, the nation's interests.

Although Chilectra did not hold rights to Cachapoal or Pilmaiquén, the company loomed over these decisions. In the same memorandum, Santa María referenced Chilectra's unused rights to the Maipo River while arguing that granting concessions without a clear construction deadline prevented the state and other parties from developing projects in the national interest. The meeting minutes of CORFO's technical energy committee, which included Santa María and Reyes Cox, also show that between late 1939 and early 1940 its members considered a blanket decree reserving water rights for the state, although it is unclear if this was ever enacted.[101] Separately, the government approached Chilectra in 1942 about revising its contract and returning its unused water rights. A company representative responded that holding the rights over the long term guaranteed its ability to meet future power demand, a reactive attitude toward development that recalled the recent debates over the electricity problem.[102]

[98]For a rare exception, see Comisión Permanente de Energía y Combustibles (hereafter CPEC), Acta No. 3, 20 Jan. 1942, ARNAD, Fondo CORFO, vol. 5076, where officials discussed tourism on the Pilmaiquén River. See also Rodrigo Booth, 'Sublime natural, sublime tecnológico: Debates en torno a la valoración de la naturaleza en el río Pilmaiquén, Chile (1920–1945)', *ARQ*, 103 (Dec. 2019), pp. 138–49.

[99]The Cachapoal concession is discussed in CPEC, Acta No. 34, 18 Nov. 1941, ARNAD, Fondo CORFO, vol. 5052, and subsequent meetings that year. See also Ricardo Nazer Ahumada, Juan Ricardo Couyoumdjian and Pablo Camus Gayan, *CGE: Cien años de energía en Chile, 1905–2005* (Santiago: Ediciones Universidad Católica de Chile, 2005), pp. 173–7. While CORFO also discussed annulling the Pilmaiquén rights, it appears that negotiations went more smoothly. CTE, Acta No. 10, 12 Dec. 1939, ARNAD, Fondo CORFO, vol. 5053.

[100]Domingo Santa María S., 'Memorándum – Dirección General de Servicios Eléctricos', 2 April 1942, ARNAD, Fondo Ministerio del Interior, vol. 11421.

[101]No mention of the decree appears in the CTE minutes after 21 Feb. 1940, although one session is missing from around this date in ARNAD, Fondo CORFO, vol. 5053.

[102]Eugenio Salazar to Raul Morales Beltramí, 'Situación eléctrica', 23 May 1942, ARNAD, Fondo Ministerio del Interior, vol. 11421. The larger context here was a proposal to nationalise Chilectra following a transit strike in 1941. The government eventually took over the Santiago streetcar network but left the electricity business alone. Castillo Ibáñez, *Historia de Chilectra*, pp. 96–7; Walter, *Politics and Urban Growth*, pp. 244–8. The creation of the national power company was one outcome of this proposal, a

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Harmonious Regions

When it was finalised in 1943, the national electrification plan synthesised many of the conservationist ideas that had circulated among engineers in the preceding decades. These influences are clearest in the plan's adaptation of a development approach that utilised the river basin as its organising principle. Originating in the nineteenth century, the basin as an economic planning tool reached its zenith in the early twentieth century through ambitious regional development schemes such as the Tennessee Valley Authority (TVA), which harnessed US rivers for multiple uses during the Great Depression.[103] US officials promoted the TVA overseas as a model for development, and it clearly had some influence in Chile. The 1943 plan incorporated rural electrification and mechanical irrigation programmes, in addition to its primary emphasis on power generation, system-building and industrialisation.[104]

However, Chile's slender territory and unevenly distributed water resources placed some limits on the applicability of the single-basin development paradigm. Local rivers run short courses and drain relatively small catchment areas, rising in the Andes and descending rapidly toward the coast. This geography favours upper-basin development, where 'high-head' plants on the steep mountain flanks produce substantial quantities of energy from relatively small volumes of water but have limited storage capacity. Most large plants prior to 1940 had followed this design, a trend that would continue until the Rapel arch dam was built in the 1960s.[105] Streamflow regimes also vary significantly by latitude and altitude. In the drier northern half of Chile, rivers surge in the spring and summer, fed by runoff from melting snowpack. In the winter, snowfall replenishes the frozen mountain reserves, while rain causes rivers to rise downstream at lower altitudes. This seasonal dynamic gradually inverts itself as winter rains become more prominent toward the south. Annual discharge also becomes larger and less variable. South of the Bío-Bío River, flow regimes are mostly pluvial and consistent throughout the year, albeit with slight winter peaks.[106]

These geographical and climatological particularities required Chilean engineers to think beyond the basin paradigm, even at the height of its influence.[107] The

story beyond the scope of this article. ENDESA, *ENDESA: 50 años de futuro* (Santiago: Editorial Lord Cochrane, 1993), pp. 37–9.

[103]François Molle, 'River-Basin Planning and Management: The Social Life of a Concept', *Geoforum*, 40: 3 (2009), pp. 484–94.

[104]Chilean engineers trained at the TVA and other US agencies during 1939–44 and corresponded with colleagues at CORFO. Duque, 'The Chilean National Electric Enterprise', p. 424. Recent scholarship has explored the post-war circulation of the TVA model in Latin America. E.g., Amy C. Offner, *Sorting Out the Mixed Economy: The Rise and Fall of Welfare and Developmental States in the Americas* (Princeton, NJ: Princeton University Press, 2019); Fernando Purcell, 'Dams and Hydroelectricity: Circulation of Knowledge and Technological Imaginaries in South America, 1945–1970', in Chastain and Lorek (eds.), *Itineraries of Expertise*, pp. 217–36.

[105]Sagredo Baeza, 'Electricidad', pp. 353–5.

[106]Cristián Maturana B., 'Características fundamentales de los recursos hidráulicos de Chile', in *Los recursos de agua en Chile y su utilización en la generación de energía eléctrica* (Santiago: Asociación de Ingenieros de ENDESA, 1974), pp. 9–80.

[107]They also worked within a strong centralist tradition that inhibited most attempts to delegate political and economic power outside of Santiago. See Andrés Estefane, 'Estado y ordenamiento territorial en Chile,

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Política eléctrica tentatively organised 'central Chile' (defined as Atacama to Puerto Montt) into three regions based on qualitative descriptions of local hydrological regimes.[108] The 1943 electrification plan adopted a more elaborate riparian territorialisation, which organised the entire national territory into seven electrical regions based on annual rainfall, seasonal flow regimes, and the location of demand centres. Instead of individual basins, each region grouped together hydrologically similar rivers. Across regions 3, 4 and 5, which covered the most densely populated parts of central Chile (see Figure 1), daily and seasonal hydrological fluctuations were thought to be complementary. For example, hydroelectric plants in Region 3 could ramp up production when their rivers surged with the summer snowmelt, while southern plants picked up the slack during the rainy winters. The southern lakes region was also thought to have potential sites for reservoirs, which could synchronise with northern plants that lacked storage capacity. Load-balancing at the national scale, it was hoped, would minimise waste at individual plants and redistribute water as 'harmonious pulses' of electricity across the national territory.[109]

This regionalised approach envisioned national electrification as unfolding in three stages over 18 years, quite unlike the vague 12-year timeline provided in the *Política eléctrica*. System-building in each region was to proceed separately at first, gradually working toward a national grid. At first, the systems would remain isolated. In regions 3–5, however, they would take the shape of 'longitudinal vertebra' with nodes along a north–south axis, in anticipation of future interconnections. Small, provisional inter-ties between the regional systems would then balance out local deficits and surpluses, forming the skeleton of a national grid. Finally, high-voltage power lines would unify the regions and their power plants under centralised control.[110]

The core concepts for this approach – to wit, the seven regions, hydrological complementarity, and gradual system-building – can be traced to a presentation that Harnecker gave at an international engineering conference in Santiago, just one week before the January 1939 earthquake that led to CORFO's creation.[111] The tenor of the conference, which drew engineers from across South America, was one of hemispheric solidarity and technocratic nationalism. At the opening session, the Chilean development minister spoke of a 'second independence' from economic colonialism, a process in which *técnicos* (engineers) had a vital role to play.[112] Harnecker's presentation was also intended as a break with the past. He

1810–2016', in Francisca Rengifo (ed.), *Historia política de Chile, 1810–2010*, vol. 2*: Estado y sociedad* (Santiago: Fondo de Cultura Económica, 2018), pp. 87–138.

[108]Harnecker *et al.*, *Política eléctrica*, pp. 103–4.

[109]CORFO, *Plan de electrificación*, pp. 57– 62, 66. On hydrological complementarity, see also ENDESA, *Plan de electrificación del país: Segunda publicación* (Santiago: Empresa Nacional de Electricidad S.A., 1956), pp. 97–8.

[110]CORFO, *Plan de electrificación*, pp. 63–5. The centralised system that emerged by the 1970s encompassed parts of Region 2 and all of regions 3–5. A final northern interconnection was completed in 2017. Systems in Aysén and Magallanes (regions 6 and 7) remain isolated.

[111]Reprinted as Reinaldo Harnecker, 'Desarrollo armónico de un plan de electrificación del país, ejecutado y explotado en la generación, transmisión y distribución primaria de la energía eléctrica, por el estado con fines de fomento', *AIICh*, 6 (1939), pp. 318–31.

[112]'Acta de la sesión de apertura', in *Primer Congreso Sudamericano de Ingeniería*, vol. 1 (Santiago: Imprenta Universitaria, 1939), pp. 58–60.

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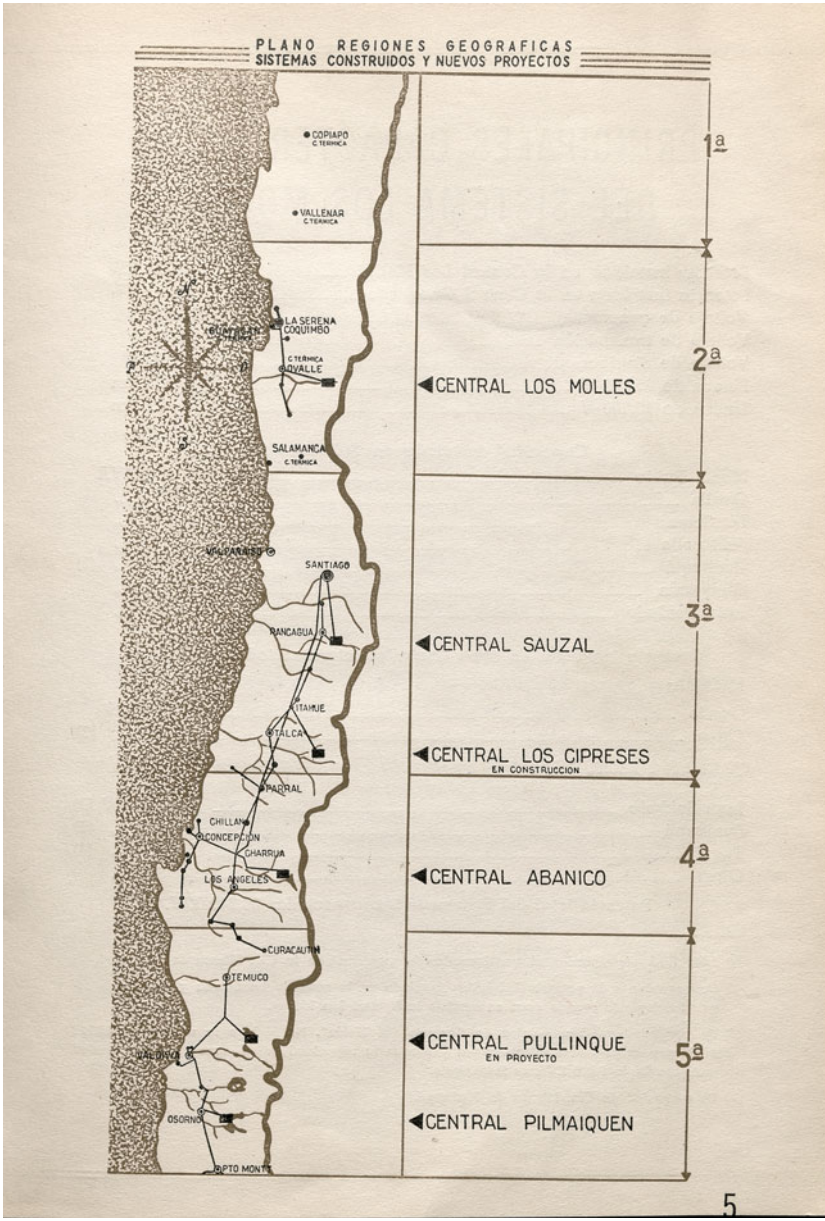

Figure 1. Chile's Electrical Regions and Power Systems, circa 1952

Notes: Regions 1–5 of the electrification plan as of 1952. By this date, ENDESA had completed four hydroelectric plants and their associated transmission infrastructure, with two others under development. Portions of regions 1 and 5 are not visible on this map.

Source: Empresa Nacional de Electricidad S.A., 'Central Los Molles', 1952, p. 5. Image used with permission of ENEL Generación Chile.

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bemoaned the 'erroneous and pernicious' influence of the electrical-nerve paradigm in Chile, blaming others for abusing the concept for a national grid pioneered by his mentor, Salazar. He argued instead for longer-term, more geographically attuned planning to ensure the full utilisation of rivers. After all, he remarked, Chilean waterpower resources were copious, economically attractive, but 'not unlimited' and hence required 'rational, harmonious and unwasteful' interventions.[113]

Conclusion

Harnecker and most of the technical energy staff left CORFO in 1944 to join the recently incorporated national power company, ENDESA. In the decades that followed, ENDESA dammed rivers and built high-voltage systems for long-distance power transmission. It left the major urban distribution systems in the hands of private utilities, which in turn came to depend on the state-owned grid.[114] ENDESA also regularly redrew the boundaries of the plan's electrical regions to reflect changes in its construction programme and the emergence of a centralised national network. Over time, it became apparent that managing the 'harmonious' regions as envisioned in the plan was much messier in practice. The promise of hydrological complementarity proved illusory as ENDESA faced conflicts with downstream water users and an uncooperative climate, including several extended droughts that taxed the system. Into the present, hydropower's share of the electricity matrix has steadily declined. Building new hydroelectric plants, whether large or small, is politically contentious, while other energy sources have caught the attention of planners and developers. A multi-year drought in central Chile is now putting pressure on existing hydropower generators and exacerbating conflicts with other water users. The electricity problem, although much changed, persists.[115]

The present-day politics of dams in Chile suggests a certain historical irony, especially if one views the electrification plan as the outcome of conservationist thinking, as this article has done. A technocratic project seeking to mediate between society and nature ultimately produced a large infrastructure system that is now a source of divisive environmental politics. This is not surprising, given the troubled global history of large dams in the twentieth century.[116] For the historical period examined in this article, treating the electrification plan as a conservationist document reveals how certain ideas about rivers and geography – that is, perceptions of the environment – shaped Chilean approaches to national electrification, which

[113]Harnecker, 'Desarrollo armónico', pp. 318, 322.

[114]ENDESA gradually took over most small urban systems, while the government finally nationalised Chilectra in the 1960s. The power sector was reprivatised during the Pinochet dictatorship (1973–90). Folchi *et al.*, 'Definiciones tecno-políticas', pp. 402–6. On the system's expansion after 1944, see Sagredo Baeza, 'Electricidad', pp. 346–58.

[115]Carl J. Bauer, 'Dams and Markets: Rivers and Electric Power in Chile', *Natural Resources Journal*, 49: 3/4 (2009), pp. 583–651; Jorge Moraga, *Aguas turbias: La central hidroeléctrica Ralco en el Alto Bío-Bío* (Santiago: Observatorio Latinoamericano de Conflictos Ambientales, 2001); Pedro Maldonado, 'La política energética: Una asignatura pendiente a nivel país', *Anales de la Universidad de Chile*, 5 (2014), pp. 23–56.

[116]Patrick McCully, *Silenced Rivers: The Ecology and Politics of Large Dams* (London: Zed, 2001).

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most historians have treated as solely a matter of political economy or technopolitics. Engineers sought to exploit seasonal differences in local climates and an uneven hydro-geography to wring every possible kilowatt-hour from Andean rivers. Thinking at the basin and the national scale followed the conservationist principle of long-term planning and, moreover, suggested a cohesive natural unit for organising an ambitious nation-building project. Such an approach, in the hands of nationalist critics, served to contrast their ideas about national electrification with the supposedly narrow, short-term interests of private utilities and their localised urban systems.

Exploring the conservationist origins of national electrification also highlights the different ways that its advocates mobilised the trope of natural abundance, which has deep roots in Chilean national identity. From the colonial period onward, historical actors have used descriptions of the natural environment to advance different political projects. For example, early colonial accounts of an agreeable local climate sought to attract settlers and resources from the Spanish Crown, while later representations of natural abundance were vehicles for expressing an incipient Creole patriotism as Chile and the rest of Latin America edged toward independence.[117] The engineers in this study were part of this tradition, although their ideas of abundance were tempered by their conservationist preoccupations with waste and efficiency: Chile's riparian bounty was exceptionally suited to national electrification but also at risk of being squandered if not developed comprehensively.

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Explotando las aguas 'desperdiciadas': Conservación, hidroelectricidad y los orígenes del plan nacional de electrificación de Chile

Este artículo examina los orígenes de la electrificación nacional en Chile, situando a sus promotores tecnócratas al interior de una tendencia mayor – a lo largo de Latinoamérica – relacionada con el manejo y conservación 'racional' de los recursos naturales de parte del Estado. Se examina la historia temprana de la electrificación chilena (1890s–1940s) para mostrar cómo el pensamiento conservacionista permeó las discusiones y debates de los ingenieros acerca del uso apropiado de las aguas nacionales. Estas ideas eventualmente conformaron el plan nacional de electrificación de 1943, que se centró en las hidroeléctricas. El artículo da nueva luz sobre la historia de la tecnocracia chilena, la relación entre las percepciones del medio ambiente y la planificación del

[117]Rafael Sagredo Baeza, *Historia mínima de Chile* (Mexico City: Colegio de México, 2014), pp. 54–5, 93–4. On patriotic representations of natural abundance in Latin America generally, see Jorge Cañizares-Esguerra, *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford, CA: Stanford University Press, 2006), especially chap. 6.

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desarrollo, y los debates políticos y económicos sobre la electrificación nacional. También muestra cómo el dilema conservacionista del uso versus la preservación de los recursos naturales operó al interior de un marco utilitario y altamente técnico para pensar acerca de los bienes naturales. El artículo, entonces, contribuye a otros trabajos históricos académicos recientes sobre la conservación y los tecnócratas medioambientales en Latinoamérica.

Palabras clave: electricidad; tecnócratas; conservacionismo; sistemas de energía; CORFO; agua; Chile

Explotando águas 'desperdiçadas': Conservação, energia hidrelétrica e as origens do plano nacional da eletrificação do Chile

Este artigo examina as origens da eletrificação nacional no Chile, situando seus promotores tecnocráticos dentro de uma ampla tendência – que se desenvolve na América Latina – em direção à gestão 'racional' e conservação dos recursos naturais pelo Estado. Ele examina o início da história da eletrificação chilena (décadas de 1890 a 1940) para mostrar como o pensamento conservacionista fluiu por meio de discussões e debates entre engenheiros sobre o uso adequado das águas do país. Essas ideias acabaram moldando o plano nacional de eletrificação de 1943, que se concentrava na energia hidrelétrica. O artigo lança uma nova luz sobre a história da tecnocracia do Chile, a relação entre as percepções do meio ambiente e o planejamento do desenvolvimento, e os debates políticos e econômicos sobre a eletrificação nacional. Também mostra como o dilema conservacionista de usar versus preservar os recursos naturais operava dentro de uma estrutura utilitária e altamente técnica para pensar sobre a generosidade da natureza. O artigo, portanto, contribui para estudos históricos recentes sobre conservação e tecnocratas ambientais na América Latina.

Palavras-chave: eletricidade; tecnocratas; conservação; sistemas de energia; CORFO; água; Chile

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