Daniel Pérez-Zapico

# Coal anxieties and the search for a "moral" energy resource in early twentieth-century Catholic Spain

## Introduction

In 1923, Salvador Grech Abellán, an assistant professor of electrical engineering at the *Instituto Católico de Artes e Industrias* (Catholic Institute for Arts and Industry – henceforth ICAI), delivered the following statement during a field trip by fourth-year electrical engineering students to the Bolarque dam. Inaugurated in 1910 with the objective of supplying Madrid, this infrastructure marked the transition to large-scale hydroelectric power production aimed at providing urban centers with high-voltage electric transmissions:

> Upon observing the tranquil waters as they meander into the canal, one cannot help but admire Man's hand, who stops the water, directs it where he pleases, and use machines built by him to transform its energy into electricity; this electricity in turn illuminates our dwellings and streets, and it powers our trams and subways … Indeed, Man stands as the pinnacle of Creation.[1]

This chapter will explore several of the topics found in the kind of Catholic "technological sublime" articulated by Abellan: the theological significance of specific natural assets, the role of religious imaginations in aestheticizing particular energy resources and technologies, and the intersection of these elements with extractivist narratives used to promote industrial and capitalist development during a period of national crisis.

In my previous work, I have examined the controversies surrounding the electrification of Spain during the Restoration era (1874–1931), particularly following the loss of Spain's last overseas colonies in 1898 – a process that shocked public opinion as it underscored the nation's declining status as a second-rank European power. These debates saw the coexistence of diverse modernizing agendas, which connected varying conceptions of development with different notions of nationhood. This chapter delves further into these issues by examining the intersection

1 Salvador Grech Abellán, "Excursiones científicas," *I.C.A.I.: revista ilustrada del Instituto Católico de Artes e Industrias*, year VII, no.28, July 1923, 116; all translations of quotations from Spanish are by the author unless otherwise noted.


https://doi.org/10.1515/9783111611358-003

of energy and Catholicism in early twentieth-century Spain. It does so by exploring the ideas and values embedded in the exploitation and use of natural energy resources – particularly coal and electricity.[2] While the harnessing of nature and the mobilization of its energy assets were central to all developmental schemes of the period, Spanish Catholicism adopted a more cautious stance toward industrial modernization. In this context, not all natural resources carried the same ethical connotations. Catholic thinkers often viewed coal-fueled industrial modernization as undermining domestic values, rural life, and the balance between cities and the countryside to the detriment of the latter. Accordingly, this chapter explores how hydroelectricity was expected to shape particular techno-environmental trajectories and configurations, reflecting Catholics' visions of how the long-desired national development should be achieved.

The opening section of this chapter introduces a set of ideas concerning the technology–environment–development nexus in late nineteenth-century Spain, which foreshadow the debates that followed. As such, this section highlights the diversity of voices and cultural frameworks used to interpret and represent nature and its resources within a Spanish Catholicism that was far from ideologically homogeneous. Accordingly, it will juxtapose two opposing perspectives. On the one side are anti-industrial, traditionalist visions informed by theological traditions which sought to preserve a pristine nature wisely ordained by the Creator, and unspoiled by a potentially destructive industrialization. Conversely, on the other side, these views coexisted with religious discourses in which extractivist narratives and capitalist developmental needs converged. This section situates these positions within a geopolitical context of developmental ideas that positioned Spain as backward. Since industrial modernization was generating a new global economic geography polarized between dynamic and stagnant regions – including fading empires such as Spain – access to and control of specific natural resources – particularly coal reserves – played a pivotal role in facilitating development within an emerging worldwide energy economy with a broad mineral base. Consequently, the second section of the chapter introduces and examines the concept of "coal anxieties" to describe a transnational phenomenon during the formation of global coal capitalism, marked by concerns in certain countries about the potential of their domestic coals to support national development. This section will follow the endeavors of a group of Catholic engineers affiliated with the ICAI in their pursuit of alternatives to coal. During the period

2 This chapter elaborates on certain ideas previously mentioned in Daniel Pérez-Zapico, "A Way Out of Darkness: Thinking About the Future of Spain Through the Promises of Electricity and Energy Abundance, 1898–1931," *Journal of Energy History* 8, no.1 (2022): 12–17.

under consideration, the prospect of coal shortages was a persistent source of concern; however, this section also addresses the social and moral challenges posed by specific industrial configurations dependent on coal. This topic will be further developed in the final section, which focuses on hydroelectricity as a "moral" natural resource. In grappling with the need to overcome the limitations of domestic coal, Catholic thinkers also explored the social and political possibilities enabled by the subdivision and decentralized distribution of energy – made feasible by the material properties of hydropower and emerging electrical infrastructures.

A growing body of literature has explored the connections between religion and the environment.[3] Energy historians have also examined the cultural forces shaping both past (and present) energy transitions.[4] This chapter contributes to that conversation by analyzing the moral economy underpinning specific models of industrial development reliant on hydraulic power. In doing so, it engages with the moral dimensions embedded in different energy regimes and the possibilities of transitioning between them.[5] It also highlights the role of religious and political imaginaries in shaping discourses on development, visions for natural resource exploitation, and the adoption of specific technologies. In this context, the prevalence of Catholicism as a cultural and ideological force in nineteenth and early twentieth-century Spain reveals the intriguing ambivalence surrounding notions of development and progress, as well as toward nature itself as a source of future possibilities. As will be shown, innovation was not necessarily aligned with progressive visions – it could also be mobilized in the service of conservative agendas.[6]

**3** See, for example, Bronislaw Szerszynski, *Nature Technology and the Sacred* (Hoboken: Wiley, 2008); Celia Deane-Drummond, Sigurd Bergmann, and Markus Vogt, eds., *Religion in the Anthropocene* (Cambridge: The Lutterworth Press, 2017); Evan Berry, *Devoted to Nature: The Religious Roots of American Environmentalism* (Oakland: University of California Press, 2015).

**4** See, Stephanie LeMenager, *Living Oil: Petroleum Culture in the American Century* (New York: Oxford University Press, 2014); more generally, Imre Szeman and Dominic Boyer, eds., *Energy Humanities: An Anthology* (Baltimore: Johns Hopkins University Press, 2017).

**5** See, Leo Coleman, *A Moral Technology: Electrification as Political Ritual in New Delhi* (Ithaca: Cornell University Press, 2017); Rebecca K. Wright, *Moral Energy in America* (Baltimore: John Hopkins UP, 2025).

**6** See, also, Sorcha O'Brien, "Electricity, Modernity and Tradition During Irish Rural Electrification 1940–70," *Journal of Energy History* 8, no.1 (2022): 1–18.

# Religious imaginations and the technology-environment nexus in late-nineteenth-century Spain: between anti-industrialism and extractive capitalism

In 1884, *La Ilustración Católica* (The Catholic Enlightenment), a widely read Catholic weekly, documented the installation of the first electric lights on the streets of Madrid. The author of the article articulated his skepticism regarding the novel lighting system, citing concerns over its potential impact on public health, as electricity was considered too harsh for the eyes. This criticism, particularly prevalent among those with interests in the gas industry, reflected a broader disapproval of modern technologies, which echoed the views of some Spanish Catholics. According to this analysis, industrial technologies – and, by extension, industrial modernity – had a questionable moral standing:

> To be honest, the [electric] light is shiny but too bright. During the day, we enjoy the bright sunlight, and at night, we enjoy the vivid light of electric bulbs. This means that our eyes are always under persistent strain. God gave us eyes with eyelids to show that we should protect them and rest. Anything that disrupts the natural order of things, meticulously crafted by the Almighty, seems to cause disasters for humankind, … It is not possible for either day to be night, or for night to be day, or for the Earth to be an Eden without humankind suffering the consequences of such a sudden change.[7]

At the start of the Restoration era (1874–1931), certain sectors of the ultra-Catholic traditionalist faction expressed reactionary views regarding the changes wrought by industrial modernization in prominent, widespread publications. These views evidenced vehement opposition within a militant anti-modern framework that was shared across European Catholicism. In Spain, however, this perspective was influenced by the traumatic legacy of the previous regime, the so-called "Six Democratic/Revolutionary Years" (1868–1874) (*Sexenio Democrático/Revolucionario*), which, for the first time in Spain, sanctioned the separation of church and state and the freedom of worship. With the restoration of Alfonso XII in 1874, the Church regained its strength and once again became one of the state's central institutions, as Catholicism was reestablished as the official religion. However, internal divisions emerged between liberal Catholics, more willing to accept political

7 "Revista," *La Ilustración Católica. Seminario religioso científico-artístico-literario*, no.26, September 15 1884, 302.

modernity, and fundamentalist and traditionalist movements that wanted an even more confessional and Catholic society. Moreover, social changes, new political movements, and the advance of secular ideologies became a constant source of tension.

At any rate, fundamentalist Catholic critiques of the modern industrial world often responded to the Promethean challenge of technology, which was seen as threatening a pristine environment and a natural order deemed perfect by divine creation. By adhering to the fundamental principles of patristics – a field of theological study dedicated to examining the teachings of the Church Fathers from the early centuries – certain Catholics concluded that any modification to the natural order was inherently sinful. While craftsmanship was viewed favorably – after all, Jesus himself had been a carpenter – modern industrial technologies represented a qualitative leap forward. Consequently, the transformative impact of modern technologies and industry appeared to be associated with a novel form of materialism that was denaturalizing Creation. This, in turn, resulted in the erosion of the cultural and, hence, political authority of the Church.[8]

However, despite the anti-industrial connotations of such narratives, the defeat of 1898 emphasized the pressing need for industrial modernization, with several developmental schemes framed in the public debate in terms of national "regeneration."[9] In an international context in which economic performance was associated with industrial prowess, numerous voices within national Catholicism espoused the view that industrial development was imperative. Consequently, positions favoring industry as a catalyst for economic prosperity and national pride coexisted with those opposed to the excessive ascendancy of techno-scientific initiatives. For instance, around the 1898 crisis, the main journal associated with the emerging Catholic social doctrine movement was aware of the underdeveloped state of Spanish industry when compared with that of other European nations:

> We will speak out if we have to, because we cannot be satisfied with our country's remaining behind in the contemporary industrial movement. We also cannot be content with our nation, so glorious in many respects, being behind other countries. We want that our nation

**8** Numerous examples demonstrated how these tropes concerning a pervasive, artificial modern technology circulated: "The Sun must be jealous of the advancements in physics, for, at this rate, it will be completely overshadowed. Its absolute sovereignty risks being overruled by the proliferation of multiple electric suns that will provide us with light, heat and movement in accordance with our desires." "Revista," *La Ilustración Católica. Seminario religioso científico-artístico-literario*, December 21 1881, no.23, 177.

**9** "Regenerationism" was an intellectual and political movement, primarily active in the late nineteenth and early twentieth centuries, that sought to diagnose and address Spain's perceived decline.

> occupies the first place in religious matters and in matters of honor, but also in the order of material wealth.[10]

How were the fundamental differences between those Catholic sectors that viewed industry as a threat to a natural environment wisely ordained by God, and those that promoted industrial entrepreneurship reconciled? The neo-Thomistic revival of the late nineteenth century arguably provided the intellectual basis for revalorizing industrial labor and integrating machinery into broader developmental paradigms. According to Aquinas' system, God had chosen humanity as his preferred creation. As such, humankind was entrusted with the responsibility of contributing to God's creative endeavors, thereby transforming nature into a kind of second creation. This narrative proved instrumental in countering the anti-industrial intransigence of virulent anti-modern reactionaries since, contrary to the patristic tradition, humans were legitimized to dominate and enhance the natural order, even if that dominion should prioritize spirit over matter.[11]

It is evident that a number of "regenerationist" intellectuals concurred with the notion that Spain possessed a wealth of natural resources which were perceived as practically inexhaustible, but in a state of neglect and underdevelopment.[12] Therefore, a legitimate research question may explore the role of Catholicism as a cultural and ideological driver behind broader attitudes and visions of nature, including the promotion of specific extractivist narratives. It is evident that certain religious imaginaries that aligned with the Christian conception of nature as a second creation proved instrumental to the needs of Spanish capitalism, as they were responsible for promoting the harnessing of those natural resources through a rhetoric of abundance and limitlessness. In 1884, for instance, an article in *La Ilustración Católica* (The Catholic Enlightenment) discussed the application of Faure's electric accumulator to Parisian trams, envisioning a brave new world

**10** "La crisis obrera," *Boletín del Consejo Nacional de las Corporaciones Católico-Obreras de España*, February 1897, no.2, 3.

**11** The Neo-Thomistic revival, which emerged in the late nineteenth century, was a philosophical and theological movement aimed at revitalizing the ideas of Thomas Aquinas. Gaining momentum after Pope Leo XIII's 1879 encyclical *Aeterni Patris*, the movement sought to apply Thomistic principles to contemporary debates and challenges. It aimed not only to counter the influence of Enlightenment thought and the decline of traditional Thomism, but also to reconcile modern scientific discoveries with the foundational teachings of the Church. A comprehensive view of the interactions between Catholicism and science in Don O'Leary, *Roman Catholicism and Modern Science: A History* (New York: Continuum, 2006).

**12** On the pivotal role that nature and natural resources played within "Regenerationism" see, for example Santos Casado de Otaola, *Naturaleza patria. Ciencia y sentimiento de la naturaleza en la España del regeneracionismo* (Madrid: Marcial Pons, 2010).

of inexhaustible energy resources made possible by "God's providence." This narrative, however, was entirely blind to the potential ecological consequences of "mankind's insatiable thirst":

> Mankind, characterized by insatiable pleasures and needs, tends to consume and devour everything, disregarding what will happen in the future and thereby destroying the might vitality and lifeblood of the world ... but then, luckily, Providence intervenes to rectify these ravages and provides new resources for human activity.
>
> That the global supply of olive trees is insufficient to meet human demand, and petroleum comes to help with its great deposits, which are abundant in the Earth's crust; that oil production declines or its consumption increases significantly, and gas comes to help with its light; coal becomes expensive and its luminosity proves inadequate to meet the demands of contemporary industry, and so electric light jumps in to open new horizons, which seem limitless to the desires and ambitions of mankind. God's kind and watchful Providence, what would men do without your loving care?[13]

At the turn of the twentieth century the dominant moral imperatives arising from the necessary extraction and mobilization of the country's natural resources for industrial and capitalist modernization may have further reinforced this narrative. In this sense, these discourses were convenient as the Church was eager to demonstrate its industrial capacity and initiative, especially in the face of those secularists who considered that Catholicism was at odds with any serious development project. A key question, however, remained about the role of the nation's energy resources in this broader context: what raw materials could be then mobilized for national development?

## Questioning coal

Economic historians have generally regarded the presence of energy resources as a pivotal factor in the historical process of industrialization and economic modernization.[14] Recent scholarship in industrial and energy history, however, increasingly challenges the "coal-centric" narratives that have long dominated canonical interpretations of the nineteenth-century "industrial revolution."[15]

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**13** Nulema, "Revista," *La Ilustración Católica. Seminario religioso científico-artístico-literario*, no.5, February 15 1884, 50.

**14** See Edward A. Wrigley, *Energy and the English Industrial Revolution* (Cambridge: Cambridge University Press, 2010).

**15** The presence of natural resources – particularly coal – was a necessary but not exclusive precondition for the initial industrial take-off, as evidenced by Robert C. Allen, *The British Industrial Revolution in Global Perspective* (Cambridge: Cambridge University Press, 2009). More-

Jean-Baptiste Fressoz, for example, argues against the modernist ideologies implicit in defining epochal changes in human history, relying on the dominance of a single energy source. Fressoz proposes an alternative to the teleological language of the "energy transitions" metaphor, suggesting instead a consideration of the multiple and dynamic "energy additions" throughout history based on the incorporation of concurrent fuels and energy technologies.[16] Notwithstanding this, and even if the shift from a traditional, pre-industrial energy regime to another one reliant on fossil fuels did not happen overnight, at the beginning of the twentieth century, coal became the cornerstone of an emerging global fossil economy and a cultural force that defined the power and capacity of nations.[17] Indeed, between 1850 and 1914, coal extraction increased 16-fold worldwide, with the United Kingdom producing 65 % of coal globally at the beginning of the period, falling to 25 % by 1914. This was second only to the United States' 43 %, and followed by Germany with a further 25 %.[18] The extraction and consumption of coal thus established a geopolitics of development. As such, the world appeared to be divided between a minority of countries that had access to fossil fuels and had developed robust infrastructures for their use, and a majority of nations that depended on traditional

over, in the mid-nineteenth century coal provided only a limited amount of the global energy consumption; see, Jürgen Osterhammel, "Energy and Industry: Who Unbound Prometheus, When, and Where?" in *The Transformation of the World: A Global History of the Nineteenth Century*, by J. Osterhammel (Princeton/Oxford: Princeton University Press, 2014), 637–672. Other energy sources, in particular water, were essential as a primary source of energy in the initial processes of industrialization, whether in the United Kingdom, the United States, Canada or, in the case of Spain, Catalonia; see Louis C. Hunter, *A History of Industrial Power in the United States, 1780–1930, vol. 1: Waterpower in the Century of the Steam Engine* (Charlottesville: University Press of Virginia, 1980); Ruth W. Sandwell, ed., *Powering Up Canada: A History of Power, Fuel, and Energy from 1600* (Montreal: McGill-Queen's University Press, 2016); Jordi Maluquer de Motes, "La despatrimonialización del agua: movilización de un recurso natural fundamental," *Revista de historia económica* 1, no.2 (1983): 79–96. An interesting case is Japan, where limited domestic coal resources had to be "crafted" as to suit foreign technological imports. See, Aleksandra Kobiljski. "Energy Workarounds: Designing Coals for the Japanese Steel Industry, 18951911," *Technology and Culture* 63, no.2 (2022): 326–348.

**16** See Jean-Baptiste Fressoz, *More and More and More: An All-Consuming History of Energy* (London: Penguin Books, 2024); another suggestive notion is that of "reorganized energy regimes." See, David E. Nye, "A Model for Heterogeneous Energy Transitions," in *Electrical Conquest. New Approaches to the History of Electrification*, ed. W. Bernard Carlson and Erik M. Conway (Cham: Springer, 2023), 21–50.

**17** See Cara N. Daggett, *The Birth of Energy: Fossil Fuels, Thermodynamics, and the Politics of Work* (Durham: Duke University Press, 2019).

**18** Osterhammel, "Energy and Industry," 655.

energy resources and were compelled to import coal from other regions, including the United Kingdom, the Ruhr area, and other far corners of the world.[19]

In the case of Spain, its early industrialization – very localized and uneven, yet with noteworthy developments since the early nineteenth century or even the late eighteenth century – was heavily reliant on the abundance or scarcity of natural resources at the local level (water or coal, but also iron ore), the degree of institutional and social maturity of the respective regions (including the level of technical training), as well as the presence of foreign capital and expertise. The dynamic interplay between these factors resulted in diverse patterns that gave rise to intense processes of regional industrial modernization in areas of Andalusia, but above all in Catalonia, the Basque Country, and Asturias throughout the nineteenth century. However, Spain was among the group of countries where the problems derived from the location and poor conditions of coal extraction negatively affected the national economy, although a good transport infrastructure could have alleviated these initial deficiencies. It is evident that other factors mattered, such as the political instability that characterized the entire nineteenth century, the fiscal hardships faced by the state, and the competing interests of the agrarian elites who wielded near-hegemonic power and were reluctant to prioritize industrial entrepreneurship in the development of the country.[20]

As already mentioned, at the turn of the twentieth century, Spanish coals – and by extension the country's natural resources – became subject to public scrutiny within the context of "regenerationist" debates. Opinions on this matter varied widely. Some were overly optimistic, assuming that abundant domestic coal reserves could be readily extracted if only national infrastructure were improved. In contrast, more pragmatic assessments recognized the challenges posed by Spain's coal resources. In the face of mounting imports from foreign nations (particularly the United Kingdom) to compensate domestic shortages, prominent experts and business leaders advocated for the protection of national coal resources via tariffs and taxation. Other recommendations included intensifying coal extraction through more efficient methods – including the installation of large thermoelectric power plants near coal pits that were expected to utilize low-quality coal – and enhancing transport infrastructure. As a matter of fact, coal shortages worsened during the early years of the twentieth century. For example, the 1912 mining strikes in the United Kingdom had deleterious effects on Spanish industries as international coal prices rose. Paradoxically, coal extraction

**19** Osterhammel, "Energy and Industry."

**20** An overview in Gabriel Tortella-Casares, *The Development of Modern Spain: An Economic History of the Nineteenth and Twentieth centuries* (Cambridge and London: Harvard University Press, 2000).

in Spain increased during the Great War, although production primarily served the needs of the European combatants. This surge was driven by entrepreneurs who promoted small-scale mining ventures to capitalize on foreign demand. However, after the war boom, these small coal pits proved economically unviable and highly inefficient due to their limited size. In the northern regions, the presence of low-quality coals that accumulated without viable usage, exacerbated the so-called "coal question." Additionally, Spain's mining sector lacked the necessary technological upgrades and mechanization. In any case, the Great War aggravated domestic shortages, and the resulting rise in energy prices and inflation worsened the social situation – families lacked coal for cooking and heating – and pushed the already weakened Restoration political system to the brink of collapse. The efforts of the Minister of Development, Viscount of Eza, during the Dato government (June-November 1917) were unsuccessful in ameliorating the economic and industrial crisis. This culminated in the nation's first general strike in August 1917, orchestrated by railroad workers. It was preceded in July by the so-called Assembly of Parliamentarians, which sought a radical democratization of the oligarchic Restoration regime.[21]

I have previously examined the expectations associated with the potential transition to hydroelectricity in Spain, as discussed by some Spanish engineers at the beginning of the twentieth century from a techno-nationalist perspective.[22] Here I will focus on a group of Catholic engineers affiliated with the *Instituto Católico de Artes e Industrias* (ICAI), an institution established in Madrid in 1908 with an initial focus on providing night-time education for workers. This institution subsequently evolved to train mechanical assemblers and other qualified intermediate personnel for industry, in addition to electrical engineers.[23] The institution embodied the Jesuit commitment to technical education by providing an alternative educational system to the state. This system included other scientific institutions such as the Chemical Institute of Sarriá (1905) and the Ebro Observa-

**21** An overview of Spain's mining sector in Miguel Ángel Pérez de Perceval, Miguel A. López-Morell, and Alejandro Sánchez Rodríguez, eds., *Minería y desarrollo económico en España* (Madrid: Instituto Geológico Minero de España, 2006); Isabel Bartolomé Rodríguez and Carles Sudrià, "Un recorrido poco exitoso: de la Primera a la Segunda Revolución Industrial, 1814–1939: la era del carbón," in *Atlas de la industrialización de España1750–2000*, ed. Jordi Nadal Oller (Barcelona: Crítica, 2003), 61–100.

**22** See Daniel Pérez-Zapico, "Electrical Futures for a Regenerated Spain: Electricity, Engineering and National Reconstruction after the 1898 'Disaster,'" *History and Technology* 39, no.1 (2023): 91–125.

**23** The ICAI awarded a diploma that was never officially recognized by the state, due to opposition from industrial engineers, leading to ongoing friction between ICAI's electrical engineers and the broader engineering community.

tory (1908). Notably, however, the industrial sector that they prioritized matched the ICAI's focus on the energy sector, particularly electricity, as a pivotal driver for national revitalization. Besides its role in supplying a significant number of specialized, highly skilled workers and engineers who received hands-on, practical training oriented towards the private sector, the ICAI was an agenda-setting institution. Accordingly, it played an active role in the technical discussions of the period. Notable figures – including military officers, politicians, the King and Queen, as well as students and engineers from other prestigious technical schools in Madrid, such as the School of Civil Engineering and the Central School of Industrial Engineers – frequently attended ICAI's halls for regularly held outreach talks. In these sessions, ICAI's experts discussed both the technical requirements for Spain's electrification and the moral foundations of the endeavor, in particular, the social challenges arising from coal extraction.

Indeed, José Agustín Pérez del Pulgar (1875–1939), a Jesuit priest, scientist, and founding member of ICAI, played a central role in shaping the debates around national electrification, especially in response to the issues associated with coal dependency. Pérez del Pulgar proposed the establishment of a large national high-voltage electricity network, under the protection of the state, that would cover the entire national territory, and traverse the main centers of energy production and consumption.[24] The grid's primary function was to facilitate the connection of power stations within the coal basins – mainly in the north of the peninsula – with the abundant waterfalls, which were to be systematically exploited through the construction of a series of large dams to produce hydroelectricity. Most importantly, Pulgar viewed the energy issue as a matter of political economy. In essence, energy was regarded as a crucial element in ensuring stability and social justice during a period of significant unrest. In this way, Pulgar defined energy as "the most powerful tool for lifting people out of economic ruin and sustain them so that they do not descend into the abyss of social revolt into which the high cost of living and the decrease in production threaten to plunge them."[25] Indeed, Pulgar could not help but refer to the "social question," i. e. the rise of "the masses who lived by their manual labor" and who sought to improve their living conditions, demanded better wages, and, as Pulgar noted "consumed greater amounts of energy." As a result, meeting the "needs and aspirations of the weakest" –

**24** Pulgar's first articles on the grid were published in 1915 in the Jesuit scientific magazine *Ibérica.* In 1917, his proposal for electrification was referred to the Permanent Electricity Commission, which issued a report in 1919 confirming the viability of the grid; however, the project was never realized.

**25** José A. Pérez del Pulgar, "Producción y distribución nacional de energía eléctrica," *La Energía Eléctrica*, no.1, January 10 1921, 2.

which Pulgar defined in terms of energy provision – was framed as falling within "the norms of what is legitimate and just." Achieving this goal, in Pulgar's view, required a fundamentally interventionist state.[26] During the critical moment of autumn 1917, as the priest intensified the dissemination of his writings, he strategically advocated for energy policy that emphasized the necessity of a state-led approach to organizing and systematizing national energy resources.[27]

Pulgar undertook numerous international trips to study the energy sectors and electrification efforts of various European countries, often at the request of companies or influential figures in the international electricity industry. In 1923, Pulgar visited Berlin at the invitation of the Siemens company to examine the Siemensstadt installations, before moving on to Stockholm at the invitation of the Allmänna Swenska company. He documented his observations of coal shortages in Germany during the Franco-Belgian occupation of the Ruhr with the assistance of Walter Reichel, director of Siemens-Dynamowerk, and professor at the Technical University of Berlin.[28] Pulgar shared his observations regarding "the enormous logistical endeavors underway in Germany to compensate for the reduction of coal reserves from the Ruhr and other coalfields." Pulgar's account underscored the significance of charcoal as a viable alternative energy source. While he noted the poor quality of this coal – "so waterlogged that it requires drying before use in large cookers resembling very wide chimneys that emit substantial steam clouds" – he underscored its utilization in areas facing shortages. The scarcity of coal also led to the electrification of the Silesian railway network, with the power station constructed at Mittelsteine serving as a key asset. This station utilized lower-quality coals that were deemed "to be of an even lower quality than the coal commonly referred to in Spain as absolutely useless."[29]

It is evident that Pulgar focused on subjects pertinent to solving the "coal question" in Spain. This focus appeared to align with efforts observed in Germany, where the objective was not only to implement technologies for the utilization of lower-quality coals in proximity to pitheads, but also to identify alternative sour-

**26** Pulgar, "Producción."

**27** "The organization of these elements [energy and other natural assets] should be regulated in normal times, in such a way that, in necessary cases, it would be possible to make them independent of the will of private individuals, employers or workers, but much more independent of direct or indirect foreign intervention." José A. Pérez del Pulgar, "La nacionalización de la energía eléctrica," *La Energía Eléctrica*, November 25 1917, no.22, 257.

**28** His observations paint a picture of a devastated Freiburg, characterized by its "gloomy and poor" population, and a nation dispossessed "of all its coal mines, light and railways have had to be restricted to the indispensable." José A. Pérez del Pulgar, "Desde Berlín," *I.C.A.I.: revista ilustrada del Instituto Católico de Artes e Industrias*, October 1923, no.29, 8–10.

**29** Pulgar, "Desde Berlín."

ces of power. In this way, Pulgar wanted to stimulate Spanish ingenuity and inventiveness.[30] However, the reference to the electrification of the Silesian railway was particularly telling for other reasons. Pulgar identified two primary issues concerning the transportation of coal in Spain. Firstly, the country lacked the necessary railway infrastructure to effectively transport this fuel due to an outdated infrastructure in urgent need of renovation. This led to his advocacy for the electrification of Spain's railroads. Secondly, and more importantly, coal transport resulted in the concentration of such an important resource in the hands of a highly unionized branch of workers, as evidenced by the events of 1917. In this vein, an outreach talk held in April 1921 by ICAI professors, titled "The railway problem in Spain," addressed the issue primarily as a "social problem," due to the numerous "social conflicts" derived from the organization of transport infrastructure, which was keeping the country "in constant state of alarm." ICAI's professor Pedro M. de Artiñano advanced the argument that electric traction was the most economical system, given "our hydraulic resources … immensely superior to what our railways would need."[31] For Pulgar, Artiñano, and their colleagues at ICAI, the case for shifting to hydroelectricity and implementing a national grid was closely tied to concerns over the social organization of coal extraction and distribution. This viewpoint was reiterated by Pulgar, who insisted that labor costs in the coal sector would persistently rise as the workers became more skilled, hence demanding higher wages. And, while Pulgar stressed the need to rationalize coal consumption, the broader trend pointed toward a growing shift to hydroelectric power:

> In addition to the substantial increase in coal prices, we must not lose sight of the fact that the aforementioned calculations do not account for the labor involved in loading and unloading coal, nor the myriad of eventualities associated with transport, particularly those of a social nature. It is important to note that labor requirements are considerably less pronounced in the context of electric supply compared to those associated with coal and steam.[32]

**30** "To put it simply, if we could emulate the Germans, we could get all the railways of our Northern line up and running by utilizing the waste from the now almost totally ruined poorest coal basins of Spain, such as those in Palencia, for which our mines are insufficient to meet our needs, having to import more than half of the coal they consume from England." Pulgar, "Desde Berlín."

**31** Manuel Hernández, "El problema ferroviario en España. Conferencias de carácter industrial y financiero, organizadas por el ICAI," *I.C.A.I.: revista ilustrada del Instituto Católico de Artes e Industrias*, April 1921, 69.

**32** José A. Pérez del Pulgar, "Producción y distribución nacional de energía eléctrica," *La Energía Eléctrica*, no.4, February 25 1921, 39.

The social and political concerns surrounding coal extraction and transport extended beyond the circle of ICAI's engineers. Nevertheless, I argue that Pulgar's particular framing of these issues as matters of social order reflects the influence of the Church's social doctrine on his understanding of technology's role in society. In fact, several of these professionals contributed to widely circulated Catholic periodicals, aiming to engage both clergy and lay audiences. Within these forums, technical discussions on the feasibility of transitioning from coal to hydroelectric power in early twentieth-century Spain became deeply intertwined with the broader social concerns of Spanish Catholicism, as demonstrated in the following section.

## "White coal" and its moral underpinnings

In 1917 and 1918, two articles appeared in the ultraconservative Catholic newspaper *La Hormiga de Oro* (The Golden Ant) barely six months apart and with the same title, "Hulla negra y hulla blanca" (Black Coal and White Coal). Both pieces addressed the energy assets available in Spain and reiterated some of the same concerns surrounding national coals. The author of the first piece was Antonio Fernández de Navarrete, IX Marquis of Legarda (1859–1936), an aristocrat and civil engineer who occupied a prominent position in the management of public works and was associated with the electricity sector in La Rioja and Aragon; the second author was Leocadio Lorenzo, a member of the Claretian order. Navarrete defined coal as a relevant, albeit "discredited" energy source. In order to confront the ongoing challenges posed by the coal crisis, Navarrete proposed a strategy that centered on the protection and increase of coal extraction, although he acknowledged the inherent limitations of that approach, including its slowness. Lorenzo, on the other hand, remained skeptical about the potential for enhancing transport infrastructures and extraction techniques, despite efforts underway by national engineers. While Navarrete contemplated other fuels, including gas and petrol, both agreed that hydropower was the optimal choice.[33] As in Pulgar's writings, Lorenzo was aware of the superior qualities of "white" coal over mineral fuels, which had to be taken from the earth and necessitated substantial manpower for its transportation and distribution: "[Hydroelectricity] does not travel stored in slow, ponderous carriages; rather, it moves rapidly, akin to lightning, riding

**33** Marqués de Legarda, "Hulla negra y hulla blanca," *La Hormiga de Oro*, no.31, August 4 1917, 170–171.

lightly and smoothly on thin copper wire, as if on Zephyr's wings."[34] According to the priest, calculations by Spain's experts placed available hydraulic energy at five million horsepower. This could be used to save the eight million tons of hard coal needed by the national economy, according to his calculations. Therefore, hydroelectricity was described as an apparently "inexhaustible mine":

> Given the favorable circumstances of Spain regarding its hydraulic endowment, we can hold great hopes for the industrial revitalization of Spain, provided that the abundant resources with which God has endowed us are not mismanaged … Does the reader understand what it means for Spain to have an energy reserve of five million horsepower annually, which are exempt from taxation, thereby eliminating the financial burden of coal, and providing a safeguard against fluctuations in fuel and motor machine costs?[35]

Given his confessional background, Lorenzo further highlighted the theological valences of electricity produced through water, which contributed to the aestheticization of hydropower: "White coal, the hydraulic energy signified by that white foam that bubbles at the base of waterfalls and emanates from the inside of the turbines with a dull rumble… this is our treasure, our great national wealth."[36] As mentioned in the first section, the neo-Thomistic revival of the late nineteenth century favored the promotion of metaphysical conceptions of the cosmos, matter, and nature. The Catholic Church invested significant efforts in promoting a particular interpretation of natural history through science popularization campaigns, which suggested that the natural world was imbued with divine forces as opposed to strictly naturalistic and materialistic conceptions of nature. In this regard, steam, electricity and other natural forces were posited as creations which had been "bred" by God and intended to showcase His might.[37] The physical properties of electricity in its natural state played a pivotal role in this regard, as they facilitated the preservation of a significant degree of mystery within nature, thus facilitating the endorsement of a dualistic perspective, both on a cosmic and on a human scale. The existence of electricity thus demonstrated the presence of a divine or spiritual dimension in the natural world, as humans were entrusted with the responsibility of harnessing and subduing this force as part of the divine

**34** Leocadio Lorenzo, "Científica. Hulla Negra y Hulla Blanca," *La Hormiga de Oro*, no.7, February 16 1918, 38–39.

**35** Lorenzo, "Científica."

**36** Lorenzo, "Científica."

**37** An example from 1906: "Who gives power to steam and its expansion to gas, / and makes the fleeting electric fluid sparkle?" J. de Mena, "Dios… ¿dónde está?," *La Hormiga de Oro*, no.44, November 3 1906, 708.

plan.[38] Furthermore, a crucial component of the celebration of hydroelectricity pertained to the moral implications of this new energy regime. In his 1917 article, the Marquis of Legarda highlighted the moral advantages of electricity over coal, noting "its divisibility and ease of household distribution," which "has achieved the ideal (so much praised by sociologists and moralists) of domestic industry."[39]

Indeed, the material properties of electricity, particularly the subdivision of energy, enabled Spanish Catholics to address two key issues in the country's political economy. Firstly, the promotion of hydroelectricity would stimulate national development. Secondly, and most importantly, this energy resource would contain the social ills linked to industrialization, as observed in more developed industrial countries. Catholic intellectuals, particularly those associated with the clergy, identified an inextricable bond between the economic and industrial challenges faced by the nation and its imperative "religious and social regeneration," particularly after the events of 1898. These ideas were emphasized during the First Social Catholic Week held in Madrid in 1907, an event designed to promote the principles of Catholic social doctrine in the country.[40] While industrialization was indeed recognized as an imperative, Julián de Diego y García Alcolea (1859–1927), Bishop of Astorga and future Archbishop of Santiago de Compostela, highlighted the profound transformations in the socio-economic order brought by the modern industrial world. He associated these changes with the emergence of large-scale industrial settlements, which he viewed as a key factor in the decline of small workshops. In his view, this shift was a primary cause for widespread social unrest.[41] In light of the challenges posed by large-scale industrialization, the Church's social program advocated for the restoration of Christian civil society,

**38** A series of articles aimed at disseminating electrical technologies published in 1916 in *La Hormiga de Oro* included the following statement: "the myriad applications of this force that fills the Universe are so vast and important, I believe we must focus our understanding on comprehend this phenomenon so that we can fully control and draw from it all the good that the Creator, the only infinite and truly wise, wants us to make of this force, for it is common sense that God has not made anything useless." "De Polo a Polo. La electricidad en la Edad antigua. Origen de la ciencia eléctrica," *La Hormiga de Oro*, no.1, January 1 1916, 4–5.

**39** Marqués de Legarda, "Hulla negra y hulla blanca," 170–171.

**40** *Crónica del curso breve de cuestiones sociales celebrado en Madrid durante el mes de mayo de 1906* (Madrid: [s.n.], 1907).

**41** "Industrial freedom was a powerful stimulus for individual initiative, which, driven by competition, led to the development of large-scale industry with its powerful machinery, manufacturing concentrations and extensive trade; but these triumphs were not without consequence. Each triumph of big industry invariably entailed the demise of numerous small industrialists, who were compelled to either become unskilled workers or to migrate." *Crónica del curso breve*, 22–23.

conceptualized as a unified body of families operating on the basis of home-based economics.[42]

In the year preceding the inaugural celebration of the First Social Catholic Week in Madrid, Álvaro López Núñez (1865–1936), an esteemed member of the Royal Academy of Moral and Political Sciences and a vocal proponent of Catholic social doctrine, engaged in a discussion on the significance of energy resources and technologies in the development of "domestic industries." His article, published in the Catholic newspaper *La lectura dominical* (The Sunday Reading), signaled how "a reaction in favor of [home-based work]" was happening elsewhere, and that this shift was influenced by "the decentralization of motive power, whether gas, oil or electricity." López was cognizant of the numerous problems associated with domestic work, including long working hours and the lack of sanitation conditions in some home-based workshops. However, this industrial organization model would free workers "from the tyrannical rule of the manager or foreman" as the "head of the workshop is also the head of the family." Consequently, domestic work was suggested to "reconstitute families, now separated and demoralized by large-scale industrial work."[43] The *Revista católica de las cuestiones sociales* (The Catholic Journal of Social Issues) had also published several articles since the beginning of the new century on the possibilities of reversing the concentration of machines and workers in large factories, thanks to electricity. This journal was the longest-running publication of a confessional and doctrinal nature dedicated to the Catholic workers' movement, serving as a forum for the most conservative and fundamentalist writers. Its primary goal was the dissemination of the Church's social doctrine guided by Leo XIII's encyclicals *Arcanum Divinae sapientiae* (1880) and *Rerum Novarum* (1891). These documents defined the family as the central pillar of society and aimed to combat its erosion and the ensuing loss of traditional values. In 1904, the Catholic propagandist Jimenez Tejeda published the article "The modern workshop and the evolution of economy" indicating: "We just have to keep up with the current pace of scientific progress with the hope that, just as the discovery of steam lead to industrial production in big factories, electricity delivered to the households will catalyze the decentralization of industry and the return of the family workshop."[44] A further salient concern was ensuring that woman remained within the domestic

**42** T. van Osselaer and P. Pasture, eds., *Christian Homes. Religion, Family and Domesticity in the 19th and 20th centuries* (Leuven: Leuven University Press, 2014).

**43** F. León, "Movimiento social. La industria doméstica," *La lectura dominical*, no.629, January 20 1906, 42.

**44** T. Jimenez Tejeda, "El taller moderno y la evolución económica," *Revista católica de las cuestiones sociales*, no.113, May 1904, 304–305.

sphere, a goal facilitated by a decentralized power supply. The introduction of electricity was therefore proposed to facilitate a way "for women to work at home, thereby reducing their presence in factories and thus mitigating the promiscuity within workplaces." Conversely, the "improvement of communication infrastructures, which are becoming easier and cheaper," was poised to facilitate the mobility of workers, enabling them to commute to factories on a daily basis. This enhancement promised the relocation of individuals to the countryside.[45]

Indeed, the promotion of the home-based economy through hydroelectricity was to be also instrumental in the development of the Spanish countryside, another vector of the Catholics' developmental agenda in a nation where the bulk of its economy was based on agriculture.[46] As the lawyer Jesús R. Coloma noted in his 1916 article titled "Life in the countryside," published in the *Revista católica de las cuestiones sociales:* "The fields produce more than just wheat but a complete civilization as well … It is therefore imperative that the worker loves the land that cultivates, the soil to which his life belongs and where human labor becomes intertwined with eternal creative activity."[47] Agriculture and the countryside were central to the dissemination of Gospel values, serving as a form of national spiritual reserve against the corruption of the "modern world."[48] However, Coloma, in alignment with other "regenerationist" intellectuals, was aware of the countryside's state of neglect. As such, he argued for the need to reform and transform agriculture through technology. Consequently, public authorities must intervene to provide essential services to rural communities, including infrastructures such as railroad lines, highways, postal services, telegraphs and telephones, lighting, and public hygiene. More crucially, he signaled the necessary industrial transformation of agricultural products through the application of "scientific-industrial progress" via locomotives, internal combustion engines and, above all, hydroelectricity supply.

In the face of the state's limited initiative, Catholics endeavored to promote the technification of agriculture through the unionization of consumers and producers in rural cooperatives. It is accurate to state that initiatives in Spain were comparatively less prominent than in other countries, particularly France and

**45** Tejeda, "El taller moderno."

**46** Around 1905, 70% of the population lived in the countryside.

**47** Jesús R. Coloma, "La vida en el campo," *Revista católica de las cuestiones sociales*, no.253, January 1916, 15.

**48** National-ruralism emerged as a conservative ideology in Spanish Catholicism in early twentieth-century. See, Teresa María Ortega López and Francisco Cobo Romero, "'Guardianas de la raza'. El discurso 'nacional-agrarista' y la movilización política conservadora de la mujer rural española (1880–1939)," *Historia y Política*, no.37 (2017): 57–90.

Belgium. In these countries, the Catholic cooperative movement had put forward several national commissions for the improvement of rural life, with the support of local and national administrations. In Spain, the National Catholic-Agrarian Confederation (established in 1917) comprised 57 federations and 2.5 million members as of 1929, according to its internal records. A total of approximately 4,000 trade unions had established some 1,700 rural savings banks with the capacity to invest 300 million pesetas in loans. However, these loans had only financed eleven flour mills, twenty oil mills, fifteen cooperative wineries and seven power stations throughout the country.[49]

In reality, electricity cooperativism in Spain during the first three decades of the twentieth century exhibited a marked weakness and did not originate from a deliberate strategy to promote rural electrification from the state, as was the case in other countries.[50] Despite the notable expansion of Spanish electrification thanks to the transition from coal to hydroelectric production from the 1910s onwards, the distribution of energy remained predominantly in the hands of large enterprises that assumed the role of holding companies. The absence of effective regulatory oversight over distribution networks during the early decades of the twentieth century resulted in the reliance on private sector initiatives. These endeavors focused on major urban and industrial consumption areas, including Madrid, Catalonia, the Levante and Andalusia regions, as well as select industrial and urban centers in the north, notably in the Basque Country. Rural electrification was not a priority.[51] The development of cooperatives was thus driven by a local response to the lack of interest demonstrated by larger companies, highlighting the fundamentally decentralized nature of electricity production in Spain, and accounts for the great variety of its regional electricity markets. As a result, solutions tailored to meet territorial needs for the supply of rural electricity were regionally implemented. In northern areas such as Navarre, Gipuzkoa, Cantabria, Galicia, and Asturias, the dense network of family relations and the abundance of small rural or agricultural landowners facilitated a diffuse industrialization model using local capital in small and medium-sized companies and workshops. This occurred regardless of the concurrent emergence of large hydroelectricity

**49** Manuel S. Cuesta, "La defensa de la organización agraria católica en la asamblea," *Revista católica de las cuestiones sociales*, no.415, July 1919, 9–11.

**50** In fact, the first National Rural Electrification Plan in Spain was not issued until 1973.

**51** At least until the 1960s-1980s, rural electrification played a modest role in agricultural change in Spain and was the consequence, rather than the cause, of the modernization of the sector. An overview in Joseán Garrués-Irurzun and Iñaki Iriarte-Goni, "Rural Electrification in Spain: Territorial Expansion and Effects on the Agricultural Sector (c. 1900–c. 2000)," *Rural History* 34, no.2 (2023): 201–219.

companies. In 1915, for example, the Asturian priest Graciano Martínez (1869–1925) articulated his hopes for the mechanization of the "workshops and factories of these regions (Asturias, Vizcaya, Catalonia)" thanks to the abundant availability of hydroelectricity – defined in this context as "green coal" – to transform old mills into small power stations, with the objective of mechanizing rural communities:

> Nature endowed [these regions] with those rivers and torrents for a reason, which here and there give rise to magnificent waterfalls producing thousands and thousands of HP. … I do not lose hope of seeing these northern regions, which are renowned for their enterprising and progressive spirit, bestowed with waterfalls abundant in electric power, so that even local kitchens would be powered only by electricity.[52]

Consequently, despite the limited success of the early Catholic cooperative movement, it contributed to the diversification of capital mobilized in early electrification processes in Spain, including off-grid developments. However, while Graciano celebrated this new energy and industrial landscape tied to a peasantry of small landowners, the ideological implications of decentralized, community-based energy provision were even more significant. Firstly, it offered an economic alternative to the dominant model of industrial and urban modernization, aiming to reorganize the nation's productive forces while balancing urban and rural development. Furthermore, the implementation of rural electrification was presented as a strategic response to the accelerating rural exodus, which reached its zenith around the 1920s, coinciding with a decline in emigration to America. Rural electrification was also intended to alleviate workers' urban unemployment by enhancing rural life and productivity. Secondly, this cooperative movement, spearheaded by agrarian Catholic unions, signaled a return to a "corporate regime" within an organic conceptualization of society, a tenet that characterized Catholic social doctrine. Consequently, Catholic unions and credit cooperatives were not to depend on town councils or the state but on the "Christian guilds of farmers," overseen by diocesan councils and protected by the National Council of Catholic Workers' Corporations.[53] In this regard, the development of Catholic cooperatives was concomitant with the strengthening of provincial and municipal rural autonomy. These initiatives sought to modernize the traditional craft and guild institutions of the Middle Ages by adopting corporate ownership. This challenged both economic liberalism – represented by large monopolistic companies –

**52** Graciano Martínez, "Por entre la psicología nacional," *España y América*, no.13, July 1 1915, 7–8.

**53** *Boletín del Consejo Nacional de las Corporaciones Católico-Obreras de España*, July 1898, 50.

but also *caciques*, or local chiefs, upon whom the Restoration's fraudulent political system relied. Most relevantly, Catholic agrarian unions sought to curtail the rise of class tensions and socialist unions in the Spanish countryside. Indeed, despite its idealization, the countryside was undergoing significant transformations, marked by rising social tensions stemming from the emergence of capitalist production relations. In this regard, Catholic agrarian unions – and indeed the countryside as a whole – became a kind of lightning rod against the spread of socialism. Consequently, cooperatives symbolized "the same for production, … as for the maintenance of peace in rural villages" and "the barrier that contains the onslaught of the Revolution, which will be kept at bay as long as the countryside contains it."[54]

## Conclusions

As evidenced in the pages of this chapter, a diverse group of propagandists and authors associated with Spanish Catholicism – ranging from laypeople to clerks and engineers – participated in the development debates that followed the events of 1898. It is important to note that Spanish Catholics were not the only political or social actors who discussed what notion of progress was necessary for Spain after the loss of its overseas empire. However, the specific case of Spanish Catholics offers a unique perspective on the moral dimensions embedded within various concurrent schemes of industrial modernization, while also highlighting the techno-environmental configurations that may arise from these exchanges. Accordingly, the present chapter provides a framework for analyzing how specific nature-related conceptions, influenced by religious imaginaries and theological traditions, can be combined with capitalist and extractivist imperatives in a context of national crisis. This process unfolded within an international context characterized by imperialist and nationalist competition, within the broader framework of an emerging global fossil fuel economy reliant on coal. In these circumstances, when attempting to delineate the relationship between technology, development, and the environment, some Catholics acknowledged that God had been especially generous to the Spanish nation, thus aligning with the most overtly confident "regenerationist" thinkers. However, not all natural resources carried the same moral weight. The ethical considerations surrounding certain natural assets – or the absence thereof – were determined, at least in part, by their physical characteristics

**54** Manuel S. Cuesta, "La defensa de la organización agraria católica en la asamblea," *Revista católica de las cuestiones sociales*, July 1929, no.415, 9–11.

or their availability. The predominant factor in this determination, however, was their social organization and the potential political economy that might result from it. In this context, "white coal" was regarded as both a moral energy and technological resource – as well as a national and superabundant asset – as opposed to coal. As such, hydropower emerged as a proposed solution to address widespread social issues and as a means to embed Catholic principles into industrial modernization. Religious thinkers promoted a vision of nature that retained metaphysical elements as opposed to purely modern materialistic views in an approach that sought to balance industrial and agricultural efforts, thereby protecting domestic life and promoting rural progress. This chapter aims to show how religious agendas may have shaped developmental trajectories, ideas about the mobilization and use of energies, and the role of technologies – from large scale infrastructures to off-grid developments.[55]

55 For an analysis of the ideological dimensions of the nineteenth-century transition from water to coal and steam, see Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (London: Verso, 2016); also, Daniel Macfarlane and Andrew Watson, "Hydro Democracy: Water Power and Political Power in Ontario," *Scientia Canadensis* 40, no.1 (2018): 1–18. This chapter challenges the idea that decentralized, community-based hydroelectricity is inherently "progressive"; see Jim Cooper, "Electric Co-operatives: From New Deal to Bad Deal?," *Harvard Journal on Legislation* 45 (2008): 335–75.