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Perceptions: Environmental Knowledge and Knowledge Societies

Marc Landry

Water as "White Coal"

The Exposition Universelle is remembered for introducing the world to the Eiffel Tower, but the fair was also the site of another important debut: In the shadow of the immense iron structure that was to become the symbol of both a city and an era, French engineer Aristide Bergès launched the career of a concept that swept Europe and the world. Bergès's innovation took the shape of an exhibit informing visitors about a new, and potentially useful, energy source. His display consisted of a turbine, two meters in diameter, placed above a plaster relief map depicting a section of the French Alps. On a plaque attached to the turbine, Bergès included a long inscription that began with the words "exploitation of white coal (*houille blanche*)." He used the metaphor white coal to describe the power of Alpine water, and argued that it represented "riches just as precious as the coal of the depths"[1] in an accompanying pamphlet. Bergès did not live to witness it, but his prediction about the value of this energy source proved more correct than he could have ever imagined. Over the course of the early twentieth century, Europeans harnessed Alpine water power to generate more electricity than any other energy source save coal. In the wake of the Second World War, the United Nations estimated that over half of Western Europe's electricity—one-quarter of the continent's—was produced by Alpine water power. The term Bergès coined also proved wildly successful. Though he had used it to describe the power potential of glacial runoff, white coal quickly became one of the most popular metaphors to describe hydroelectricity across the globe.

In the long history of water use and management, white coal belongs in one of the more recent chapters. What follows are some considerations on the emergence of the vision of water as white coal, and what it reveals about the history of both water and energy use.

1 Marcel Mirande, *Le comte de Cavour et la Houille Blanche* (Grenoble: Allier Père & Fils, 1927), 5–6.

Though the term white coal eventually came to mean hydroelectricity, Bergès had something different in mind. For him, the color white referred specifically to the eternal ice of Alpine glaciers, whose runoff he had managed to harness for industrial purposes. He had first done this at his own paper mill in the Isère Valley in the late 1860s. There, he had diverted a portion of the torrents descending from the Freydane glacier and the tiny Lac Blanc into metal pipes that led to a set of turbines in his factory. The enormous water pressure created by the 200 meter difference in elevation between the point of capture and the paper mill—the head, in engineering terms—provided the motive power to drive Bergès's machines. The system was successful enough that by the end of the 1870s, Bergès was actively persuading other industrialists in the region to follow his lead. By the time of the Exposition Universelle, Bergès's installations were capable of harnessing falls as great as 2000 meters. With the advent of long-distance power transmission in the 1890s, generating electricity became the preferred means of converting water power into useful energy. Nevertheless, the moniker white coal stuck.

Bergès's ability to see white coal in glacial torrents speaks to a shift in the very definition of water power that was underway in the industrialized world around 1850. Harnessing water power was nothing new; in the Alps, water power had long played an important role. Indeed, during the Medieval and early modern periods, the Alps were a hot spot for the proliferation of waterwheels. Small-scale industries—textiles, paper-making, glass-making—flourished in pockets throughout the mountain range. But these facilities did not exploit the power of the enormous falls touted in Bergès's exhibit. Alpine watermills, like all watermills worldwide, harnessed the power of relatively small falls that waterwheels could handle. Furthermore, mills were bound to those sites where abrupt descents in the streambed permitted an economical concentration of fall. Only the advent of modern turbine technology in the mid-nineteenth century permitted the exploitation of higher heads, making all running water in the Alps a potential source of energy. All that was required was a demand for energy and a means to direct that water onto a turbine. Bergès was one of several entrepreneurs at the time who experimented with systems to utilize high-pressure water power to support industrial endeavors in Alpine valleys. Thanks to electricity, and the development of long-distance power transmission in the 1890s, the energy of falling water no longer even needed to be utilized at the site of production. It also meant a new means of transforming water power into both light and heat. The unshackling of hydroelectric

exploitation from its earlier spatial limits was further reflected in the more general language we use to describe it nowadays. Up until the early-twentieth century, a "waterpower" was a noun denoting those geographic points where mills were, or could be, constructed. Nowadays, usually if one uses the term water power, instead of the more common hydroelectricity, it is to describe the general energy potential of water.

The provenance of the term white coal suggests that at the time the fossil fuel had especially positive connotations in certain circles. When explaining why he chose these words to describe Alpine waterpower, Bergès revealed that he had sought to "excite the imagination and signal with vitality"[2] that glacier water could be exploited for motive power. Clearly, Bergès believed that his coal-based metaphor would ignite European energy fantasies. The combination of coal and steam engines had indeed opened up unprecedented economic opportunities. Tapping into stores of solar energy that had accumulated over the span of geologic time burst the traditional constraints on economic activity. By the late nineteenth century, observers agreed that coal was the key source of economic growth and prosperity in that era. As a region, the Alps possessed precious little coal supplies, and many concerned with the economic development of the mountain chain worried about the consequences of this geologic reality. For such people, capitalizing on an energy source would have seemed a very appealing business proposition.

Interestingly, there is little evidence that the term white coal was intended to invoke images of hydroelectricity's cleanliness. When explaining the advantages of white coal over its carboniferous cousin, boosters rarely included hygienic arguments. When listing the advantages of hydroelectricity over coal, contemporaries seem to have referred to coal's "dirtiness" only in certain situations. The only times it was indicated that hydroelectricity was in any sense "cleaner" than coal was during discussions of using water power to provide electric traction for railways.[3] Proponents of substituting hydroelectricity for steam emphasized that electric trains would be free of the plague of smoke and soot. In the Alpine lands, where the abundance of water power and the dearth of coal made electric traction an especially critical economic problem, supporters of electrification stressed particular travel benefits for the moun-

2 Mirande, *Le comte de Cavour*, 6–7.

3 Historian David Blackbourn also found that the argument frequently came up during discussions of railway electrification. See David Blackbourn, *The Conquest of Nature: Water Landscape and the Making of Modern Germany* (New York: W.W. Norton, 2006), 219.

tain region. They highlighted that smoke from steam-powered trains would no longer be an issue in the mountains' numerous tunnels, nor would it obscure the vistas that drew many passengers to the mountain railways.

Glimpsing coal in water also attached certain expectations to the energy source. Energy experts in the early twentieth century not only compared water power to coal, they gradually demanded it behave more like the fossil fuel. In the Alps, for example, after an initial phase of development when the choicest of hydroelectric sites had been exploited, engineers began to complain about the disadvantages of water power compared to coal. Chief among these was the seasonal variation in the availability of water. In the Alps, waterways run their highest levels during the summer melt period. During the winter time, less power is available because precipitation remains in the mountains in the form of ice and snow. Unfortunately, winter was precisely the time of year when demand for electricity—especially in the form of light—was highest. It is conceivable that Europeans could have adjusted their energy use habits to the seasonal rhythms of water power availability. Instead, they sought to counteract this perceived drawback, by finding ways to store water until it was needed. The mountainous Alps provided unique impoundment opportunities, both in lakes and valleys, and Europeans took great advantage of these. As of 1970, over three hundred new lakes dotted the Alpine landscape. The emergence of these new bodies of water reversed a global historical trend, whereby erosion in conjunction with human efforts had gradually been diminishing the number of Alpine lakes. It has been calculated that these reservoirs can store about 5 percent of the annual drainage in the Alps.[4]

While thinking of water in terms of white coal represented something new, the impulse to make such a comparison was not. A survey of modern energy history reveals that comparing potential energy sources to other valuable commodities—including other energy sources—has been quite widespread. No less an authoritative source than the theme song to the 1960s American sitcom *The Beverly Hillbillies* reminds us that oil was both "black gold" and "Texas tea." Thanks to Rolf Peter Sieferle's more scholarly contribution on the impact of coal in the industrial revolution, we know that some seventeenth-century Europeans conceived of the fossil fuel in terms of the primary biomass fuel of the era. Sieferle's work is entitled *The Subterranean Forest,* a phrase

4 Werner Bätzing, *Die Alpen: Geschichte und Zukunft einer europäischen Kulturlandschaft* (Munich: C.H. Beck, 2003), 196.

he borrowed from the title of a treatise published by the German jurist Johann Philipp Bünting. Employed by the Electorate of Brandenburg's Upper Court Chamber, Bünting described how the transition to coal usage could relieve the widespread wood scarcity he perceived as a sign of the coming Judgment Day.[5]

The popularity of the term white coal waned dramatically in the postwar period. On the one hand, the positive connotations once associated with coal have largely disappeared. Since the nineteenth century, humans have been harvesting the subterranean forests with the same intensity once devoted to the clearing of forests and woods in some countries. At the outset of the twenty-first century, in the wake of smog, acid rain, and now climate change, the reputation of coal as an energy source has suffered in many circles. At the same time, with the advent of other sources such as nuclear power, the importance of hydroelectricity for energy systems has declined relatively.

Nowadays, potential energy sources are rarely described in comparison to past prime movers and fuels. Rather, it seems the most popular metaphors refer to the environmental impact of energy. Thus we read about "clean coal" and "green" solar and wind power. Curiously, while many insist that the future belongs to these green—and so-called renewable—energy resources, hydroelectricity is rarely included in such pronouncements. Some may find it difficult to refer to hydroelectricity as a green energy source in light of the far-reaching environmental changes caused by dams and diversions. But the lack of attention to hydroelectricity also stems from the perception that most of the planet's large scale hydroelectric potential has been exhausted. Historian Alfred W. Crosby sees the future of hydroelectricity in "thousands of unpretentious dams on minor rivers."[6] Nevertheless, with the current wariness of nuclear power in the wake of Fukushima and with no clear energy savior in sight, reasonable energy development might focus on extracting what power can be had from the humble lesser tributaries of the planet. The energy history of the Alps suggests that there is great power to be had in even tiny waterways. One thing is for certain: If hydroelectricity should ever enjoy a resurgence in popularity, it must do so with the help of another metaphor. In an age preoccupied not with industrialization but its supposed effect on the global climate, the era of white coal is officially history.

5 Rolf Peter Sieferle, *The Subterranean Forest: Energy Systems and the Industrial Revolution*, trans. Michael P. Osman (Cambridge: White Horse Press, 2001).

6 Alfred W. Crosby, *Children of the Sun: A History of Humanity's Unappeasable Appetite for Energy* (New York: W.W. Norton, 2006), 133.