Roadmap 2050 and the Promised Landscapes of Low Carbon

Rania Ghosn
University of Michigan

Fellow-Men! I promise to show the means for creating a paradise within ten years, where everything desirable for human life may be had for every man in superabundance, without labor, without pay; where the whole face of nature is changed into the most beautiful form of which it be capable.[1]

In 1833, Joseph Adolphus Etzler, a young German engineer, published a utopian treatise promising *Paradise Within the Reach of All Men, Without Labor, by Powers of Nature and Machinery*. The inscription on the frontispiece offered an immediate gloss to this social ideal: "Toil and poverty will be no more among men, Nature affords infinite powers and wealth." Etzler's world of abundance was to be made possible by harnessing a nature-machine, all while cast in a leisurely experiencing.

Abundant energy from the sun, wind, tides, and water continues to be heralded as the bearer of growth, energy independence, and an intrinsically more just world. In the book *Hot, Flat, and Crowded: Why We Need a Green Revolution—and How It Can Renew America*, *New York Times* columnist Thomas Friedman declared that we have entered the "energy climate" era. According to Friedman's narrative, the solution to the twin crises of peak oil and climate change relies overwhelmingly on technical advances and market innovations. Along with his win-win scenarios for business and the environment, Friedman states, "Only if we got abundant, cheap, clean reliable electrons could we deal with climate change, petro-dictatorship, biodiversity loss, energy poverty, and energy resource supply and demand. That is the cure."[2]

Along with the popular press and presidential discourses,[3] the spatial planning for new energy regimes happens in the hearth of a discourse on landscape, ecology, and urbanism. Large expanses of land and sea are conceptualized as power plants: wind turbines, biofuel farms, and solar panel fields recast regions within a productive energy urbanism. The drive to address larger contexts and respond to concerns that were previously confined to other disciplines has brought designers to address energy concerns beyond the metrics of conservation technologies at the building scale and within the larger terrain of productive landscapes.

Partially drawing on OMA's *Roadmap 2050*, this paper explores the imaginaries of energy futures. It argues that the contemporary conceptualization of carbon as the "energy problem" evades the basic question of what space and which relations such projected landscapes will materialize. Could alternative energy imaginaries, rather than fixating on alternative technologies, begin to render visible transformations in landscapes and livelihoods that occur as places are incorporated into systems of energy?

ENERGY MYTHS: CARBON ELIXIRS

> Since the industrial revolution, technological breakthroughs have changed the way we live. … At the same time, we have become dependent on fossil fuels for energy. How can we sustain our way of life and stop the further pollution of the atmosphere?
>
> —*Roadmap 2010:4*

In 2010, OMA/AMO proposed *Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe*, sharing a vision for a decarbonized power sector that capitalizes on Europe's geographical diversity to integrate renewable energy sources in a continental power grid. The report defines the mission of *Roadmap 2050* as "to provide a practical, independent and objective analysis of pathways to achieve a low-carbon economy in Europe, in line with the energy security, environmental and economic goals of the European Union."[4] Funded by the European Climate Foundation and based on technical, economic, and policy analyses conducted by four consultancies—Imperial College London, Kema, McKinsey and Company, and Oxford Economics—the report outlines why a zero-carbon power sector is required to meet this commitment and illustrates how Europe can reduce domestic emissions by 80% to 95% by midcentury.

Toward this new architecture, OMA contributed a graphic narrative about the geographic, political, and cultural implications of a zero-carbon power sector. It partook as well in the spatial planning and visualization of the grid through a series of images that represented the promises of such proposed infrastructures on the European landscape. Echoing Etzler's promises, the *Roadmap 2050* renderings perpetuate a machine "power fantasy" to capture natural forces as the basis for a better society in a sublime landscape of idyllic solar, geothermal, and wind farms.

Replete with promises of a better future, *Roadmap 2050* presents itself as a radical break with the fossil fuel past. The euphoric tone, however, is uncanny. It is noteworthy for its historical consistency with a nearly unbroken attitude of wonderment, extending from the advent of steam power through the spread of fossil fuels. As early as 1934, Lewis Mumford "warned that modernity's supporters would seek to derail present-tense evaluations of the era's social and ecological performance with forecasts for a bountiful future in which the perennial social conflicts over resources would end."[5] Furthermore, such "sustainable alternatives" perpetuate a series of "energy myths," most importantly that "any newly discovered source of energy is assumed to be without faults, infinitely abundant, and to have the potential to affect utopian changes in society. These myths persist until a new source of energy is deployed to the point that its drawbacks become apparent and the failure to establish a utopian society must be reluctantly admitted." The next new source of energy is not treated any differently. "Instead, the recently discarded energy myths are resurrected and bestowed upon the newcomer."[6]

In the postwar period, (sub)urbanization was largely conditioned by a prodigious expansion in energy sources, of which oil made the largest single contribution. Urban and territorial forms reflected the absorption of oil into the landscape from the interstate highway system to the democratization of single-family homes. Although the extensive deployment of the oil system was mostly a postwar condition, the politics of the transition were in place in the prewar period, familiarizing the public with the manifestation of fossil future technologies in the urban landscape. In 1939, 25 million visitors to the New York World's Fair were impressed by the promises of the "World of Tomorrow." Designed by architect Norman Bel Geddes and sponsored by the General Motors Corporation, *Futurama* showcased images of the United States 20 years into the future. Consisting of 500,000 individually designed houses and 50,000 cars, the *Futurama* model was an introduction of the idea of a network of superhighways, a precursor of the 1956 Interstate Highway System. The visualization of the new energy regime served thus to publicize the promises of the energy transition to a large public.

Oil has since shed its emancipatory promises. The 1970s marked the end of cheap, abundant, and guilt-free petroleum. The world came to consider the finitude of resources, risks of supply, and environmental costs of fossil fuels. Widely circulated books such as Rachel Carson's *Silent Spring* (1962), Paul R. Ehrlich's *The Population Bomb* (1968), and the Club of Rome's *The Limits to Growth* (1972) argued that humanity's lack of concern for the environment produced a dangerous imbalance in the ecosystem. Contemporary events further reinforced the economic and environmental costs of oil. In the United States, the Santa Barbara oil spill of 1969 made visible the repercussions of offshore drilling; long queues at the pump materialized the threats of foreign oil dependency following the 1973 Arab oil embargo.

The energy question was soon after equated with a carbon problem. In reports on fossil fuel depletion, surging global demands for energy, and climate change, "carbon" became a keyword of energy policy and culture. Beyond official recommendations, energy futures project visions across a broad spectrum of the imaginary. On one end, apocalyptic scenarios imagine the deterioration of the earth; on the other, social reformist scenarios project nothing short of a global revolution to alter society's relation with energy.[7] In the middle ground of scientific and policy reports, technology continues to be the modus operandi: the promise is that a shift in the infrastructure of energy production will insure a smooth transition into an even better future. In such scenarios, low-carbon techno-landscapes are the salvation cosmology of all concerns, insuring in one stroke the sustainability of energy supply, economic markets, and the planet.

PRODUCTION WITHOUT REPRESENTATION

SNIPPET ONE

> Today Europe retains a large dependency on other nations for natural gas. A primary incentive for European integration is that it enhances our own energy security and reduces our dependency on others, and especially on politically unstable regions.
>
> —*Roadmap 2010:72*

SNIPPET TWO

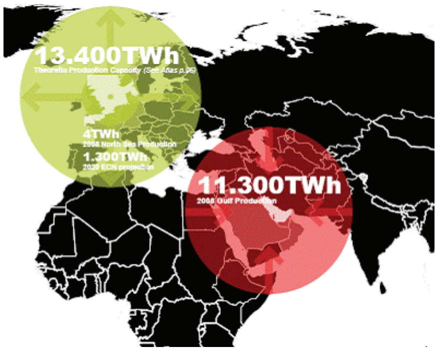
> Europe is more than just a lot of countries and landscapes. Europe also has an enormously diverse climate. This makes it the perfect territory to capitalize on renewable energy sources in a situation of mutual benefit. For example: In summer, the windy north can profit from the sunny south, and in the winter the sunny south can profit from the windy north. The complementarities are not just limited to wind.[8]
>
> —*Reinier de Graaf*

SNIPPET THREE

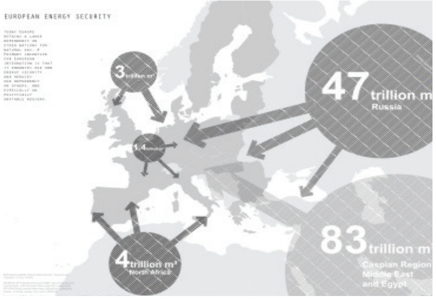
> Bas: North Africa is probably one of the biggest opportunities for the real solution.
>
> Abrahams: North African solar does raise a lot of issues also about dependence and geopolitics.
>
> Ruys: If you would include North Africa we could be attacked with the rational that some people might not want to include North Africa.
>
> De Graaf: North Africa does allow you to be more ambitious as a whole, in the sense that if you do not want to rely on breakthroughs in technology, the incorporation of North Africa is needed for a 100% renewable scenario.
>
> —*Roadmap 2010:176*

AMO began to explore the energy security question in *Zeekracht* (2009), commissioned by the not-for-profit Dutch cooperative Natuur en Milieu. In relation to climate and security concerns, AMO proposed a master plan for the development of wind power in the North Sea, whereby a "super ring" of offshore wind farms could generate 13,400 TWh energy, a production figure graphically highlighted as comparable to the insecure but necessary oil fields in the Middle East.

Roadmap 2050 frames similar geopolitical developments that have heightened Europe's sense of energy vulnerability with respect to the stability of its energy supplies from the Persian Gulf or Russia.[9] EU Energy Commissioner Andris Piebalgs summed up the European reaction: "It is clear that Europe needs a clearer and more collective and cohesive policy on security and energy supply."[10] To reduce the geopolitical dependence on "instable regions," and particularly the Gulf region, Russia, and North Africa, *Roadmap* proposes a network of integrated energy sources *within* Europe.



01

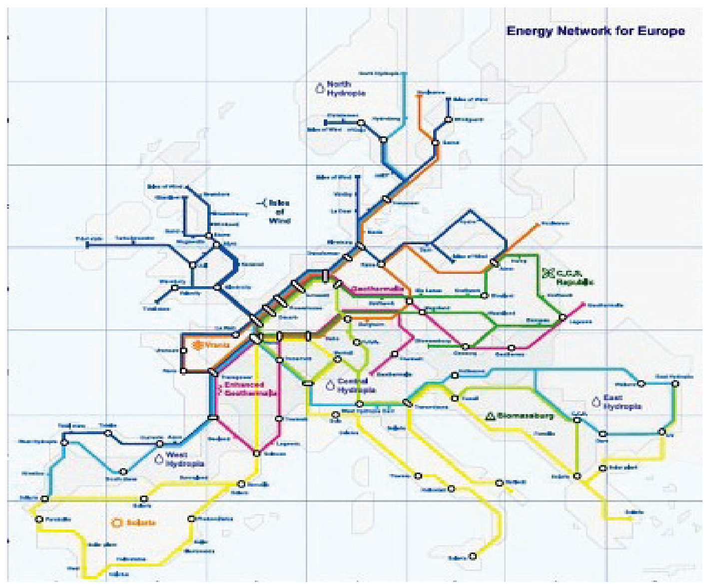


02

Figure 1: OMA, *Zeekracht*, 2008.

Figure 2: European Energy Security. OMA, *Roadmap 2050*, 2010.

03



04

Figure 3: Europe Energy Network. OMA, *Roadmap 2050*, 2010.

Figure 4: Eneropa. OMA, *Roadmap 2050*, 2010.

Drawing on the power of the network, OMA' s proposal capitalizes on Europe's geographical diversity to unify the territory it serves and reinforce its economic position. The proposed continental grid requires the construction of a new Manhattan-like Project on the foundations of the modern grid. Echoing Buckminster Fuller's 1969 proposal to create a "global energy electric grid," the network represents Europe's best hope, according to the renewable energy proponents, for speedy, large action.

The vision of an integrated European network reconfigures the geography of the continent away from political boundaries and into energy regions. Eneropa redefines European regions by their energy source: Ireland and the western half of Britain are the "tidal states," while the eastern half forms part of the "isles of wind." Former Yugoslavia is reunited as "Biomassburg." Most of Spain, Italy, Greece, and some of North Africa become "Solaria."

The status of Solaria is particularly paradoxical in the project. The proposed 100% Renewable Pathway requires additional capacity, which is achieved through the introduction of solar technologies from North Africa. Thus, Solaria embodies tensions within the discourses of "energy security" and "energy independence": it expands the scale of the energy network while maintaining that of the political body of Europe. The geographic paradox of North Africa: it is simultaneously necessary for the productive network all while not within political representation.

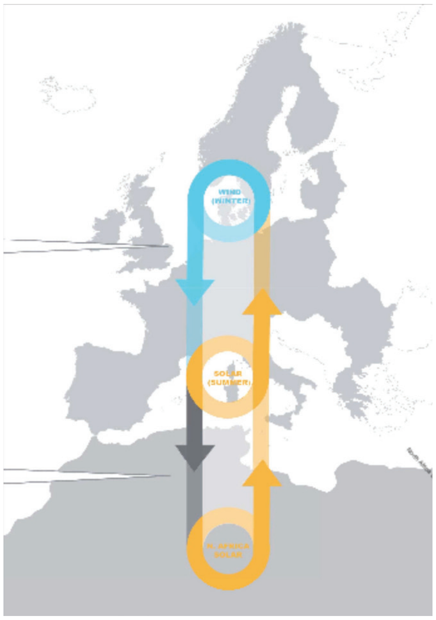
The discussion in the epitaph highlights such mixed advantages and drawbacks with respect to the extension of the European energy grid to North Africa. On one hand, the solar potential of North Africa reduces oil dependence by 4 trillion of M3. On the other, and with respect to Europe's energy security, investments in North African energy represent a possible threat to the continuity of energy supply in Europe. The *Roadmap 2050* diagrams illustrate how the geography is selectively represented: within the exchange cycle between North and South and outside political reconstruction of Eneropa.

The positioning of Solaria within production and without representation echoes a genealogy of European visions and projects for North Africa. Around 1920, Herman Sorgel, a German architect, along with Peter Behrens and Erich Mendelsohn, designed a reclamation megaproject called "Atlantropa," which encompassed the Mediterranean Sea basin and the Sahara (07). The proposal for a 35-kilometer-long hydroelectric dam across the Strait of Gibraltar represented the Mediterranean south as a huge power plant that could ensure energy and economic security for an enlarged Europe. The project remained on paper. However, later in the century, pipelines underneath the Mediterranean linked the oil and gas fields of Africa to European markets. The energy geographies of the Sahara continue to embody a productive potential to the large neighboring powers. Such reconfigured geopolitical spaces, to expand a political referent of the system, had been framed within discussions of the Union for the Mediterranean.[11]

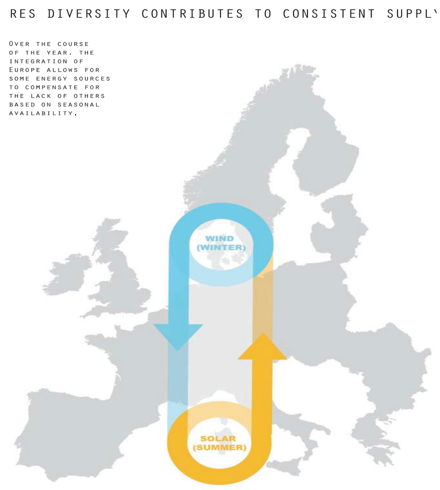
The rendering "Parisian Energy from Sahara Sun" further illustrates Europe's historical relationship to its North African productive hinterlands (08). On one side of the Mediterranean, France is embodied in the Parisian Eiffel Tower; on the other side, a caravan of camels travels across a field of solar panels. The Sahara is significant only as far as it hosts the square-meter demands of energy technologies. The rendering simultaneously decomposes the energy system into insular solar panels, all while emptying out the geography of production into a far-and-away tabula rasa recognizable only to its camel inhabitants. Such externalization of space continues to sustain the myth of eco-friendly growth because it slides costs to the periphery, to the desert, or out of sight.

CONCLUSION

In the history of energy, space is simultaneously essential to the creation of value and one of the venues through which the associated costs of production are shifted out of sight. In the age of fossil fuels, the production of



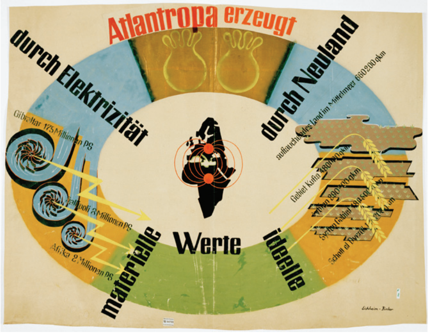
05



06

Figure 5: Diversity contributes to consistent supply. OMA, *Roadmap 2050*, 2010.

Figure 6: Benefits of North African solar. OMA, *Roadmap 2050*, 2010.



07


08

energy in the distant and the underground, coupled with an urban analysis at the city scale, has contributed to keeping the infrastructure of energy out of sight. Indeed, high-energy urbanism rests on the industry's capacity to divest itself of the environmental transformations brought about by the global expansion of the extractive frontier.[12]

The proposed "alternative" perpetuates the abstraction of the systemic nature of the infrastructure of the geography in which it is deployed. While supporters of alternative energies rightly emphasize the environmental costs of fossil fuels, many tend to disregard that all energy systems require space and that such demand will become more pressing as the proposed shift is from a mineral-underground to a surface-based production system. The techno-geographic fix thus eclipses evaluations of the fossil fuel era all while perpetuating the utopian promises of natural resources. "Clean" energy seems to purge dirty matters of geography.

Why does it matter whether energy futures are geographically imagined? For if geography does not exist, or matter, then energy companies cannot be held accountable for the environmental transformations brought about by their operations. The abstraction of space leaves unaddressed the basic question of what social relations such landscapes will materialize. By underscoring the geography of energy, the "geographic" asserts that the conversion of energy is essentially a political-ecological project and hence calls for a critical inquiry into the triad of technology, space, and power. The debate over the (next) mode of energy therefore requires a geographic examination to foresee and possibly avoid the perpetuation of uneven power geographies in the sunbelts, fields, and wind corridors of the world.

To circumvent the limits of the abstraction of space, I propose a framework that emphasizes the systemic and material attributes of technology and space. From this approach, energy is not exclusively the domain of engineers and economists. Furthermore, the space of energy is not an abstract space of capacity and performance that relies on quantitative assumptions and models that differentiate space only by its energy gradients of solar power, wind speed, tidal currents, etc. Wind, solar, or nuclear energies have their distinct qualities and spatial distribution. They set different metrics and processes and require different raw materials. They deploy different geographies and hence project spatial relationships at a regional scale between a productive landscape and its potential markets. To construct such a framework, the literature on science, technology, and society, and, in particular, that on large technological systems, offers a helpful framework.[13] The history of technology, especially since the influential book of Tom Hughes, *Networks of Power*, has sought to socially ground large technical systems; incorporate organizational, economic, political, and material factors into a technological system; and acknowledge in turn their societal implications.[14]

To arrive at a more useful (political) category, it may thus be necessary to conceive of "energy" not as an entity or resource unto itself but as a "social relation enmeshed in dense networks of power and socio-ecological change."[15] At the intersection of the human and the nonhuman, an energy

Figure 7: Herman Sorgel, Atlantropa, 1920.

Figure 8: Solaria. OMA, *Roadmap 2050*, 2010.

resource necessarily "becomes" rather than "is," as it requires a large socio-technical system of exploration, production, distribution, and financial exchange. The production network of a mode of energy can be seen as encompassing the entirety of the circuit of production and to be constituted via a variety of flows (of capital in various forms such as commodities and money, knowledge, and people) between a variety of nodes, sites, and spaces (of production, exchange, and consumption), with varying multiscalar governance arrangements (supranational, national, regional, and urban).[16] Bruno Latour urges for a corresponding new descriptive style that "first prodigiously extends the number of parts necessary for the gathering of the thing and then multiplies the number of assembling principles that gather them together in a functioning whole."[17] Seen through this lens, energy is a technological system in a dialectics of nature and power, whereby value creation involves at once transformations in nature and the formation of social agents across multiple scales.

An alternative geographical imagination unfolds the spaces of energy and renders visible transformations in landscapes and livelihoods that occur as places are incorporated into systems of energy. The geographic of energy emphasizes the political assumptions underlying such visions, the actors involved, the negotiations that will intersect their operations, and their ecological repercussions. In this respect, it is apt to revisit Ivan Illich's 1973 essay "Energy and Equity," in which he posits that there are social limits to the ever-expanding consumption of energy, renewable or otherwise. Illich states: "The widespread belief that clean and abundant energy is the panacea for social ills is due to a political fallacy, according to which equity and energy consumption can be indefinitely correlated."[18] ◆

ENDNOTES

1. John Adolphus Etzler, *The Paradise Within the Reach of All Men, Without Labor, by Powers of Nature and Machinery: An Address to All Intelligent Men* (Pittsburgh, PA: 1833). See also, Dolores Greenberg, "Energy, Power, and Perceptions of Social Change in the Early Nineteenth Century," in *The American Historical Review* 95.3 (1990): 693-714.
2. Danny Shea, "Tom Friedman Calls for Green Revolution," Huffington Post website. See Thomas Friedman, *Hot, Flat, and Crowded: Why We Need a Green Revolution—and How It Can Renew America* (New York: Farrar, Straus and Giroux, 2008).
3. In his 2008 inaugural address, in support of the development of alternative-energy technologies, President Obama proposed "to harness the sun and the winds and the soil to fuel our cars and run our factories." "Barack Obama's Inaugural Address," *The New York Times*, January 20, 2009: 1.
4. *Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe* (2010): 27.
5. John Byrne, Noah Toly, and Leig Glover, eds. *Transforming Power: Energy, Environment, and Society in Conflict* (New Brunswick: Transaction Publishers, 2006), 3.
6. George Basalla, "Some Persistent Energy Myths," in *Energy and Transport: Historical Perspectives on Policy Issues*, eds. George H. Daniels and Mark H. Rose (Beverly Hills, CA: Sage Publications, 1982), 27.
7. For an overview of such debate, see the Boston University Sawyer Seminar on Energy Transitions website.
8. Reinier de Graaf.
9. The modern idea of "energy security" emerged in the nineteenth century as warfare became mechanized and began to require substantial fuel inputs. On the eve of World War I, First Lord of the Admiralty Winston Churchill made a historic decision. He shifted the power source of the British navy's ships from coal to oil, which meant that the Royal Navy would rely not on coal from Wales but on oil supplies from Persia. Energy security thus became a question of national strategy as the state depended on reserves on foreign territory and on transport in international waters.
10. Gawdat Bahgat, "Europe's energy security: challenges and opportunities," *International Affairs* 82.5 (2006): 961-975.
11. At the EU level, there is also activity in the form of the EU's "Union for the Mediterranean" and its Mediterranean Solar Plan (MSP), as well as the "Desertec" initiative for a solar-based, radical transmission expansion project across the Mediterranean.
12. Rania Ghosn, "Where Are the Missing Spaces," *Perspecta 45: Agency* (Cambridge: MIT Press, 2012): 109-116.
13. Wiebe Bijker, Thomas Hughes, and Trevor Pinch, eds., *The Social Construction of Technological Systems* (Cambridge: MIT Press, 1987). Wiebe Bijker and John Law, *Shaping Technology/Building Society* (Cambridge: MIT Press, 1992). Arne Kaijser and Erik van der Vleuten, eds., *Networking Europe: Transnational Infrastructures and the Shaping of Europe, 1850-2000* (Sagamore Beach, MA: Science History Publications, 2006).
14. Thomas Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: John Hopkins University Press, 1983).
15. Matthew Huber, "Energizing historical materialism: fossil fuels, space and the capitalist mode of production," *Geoforum* 40 (2008): 105-115, 106.
16. Gavin Bridge "Global Production Networks and the Extractive Sector: Governing Resource-Based Development," *Journal of Economic Geography* (2008): 389-419.
17. Bruno Latour, "Can we get our materialism back, please?" *Isis* (2007): 138-142, 140.
18. Ivan Illich, *Energy and Equity* (New York: Harper & Row, 1974). See also Ivan Illich, "The Social Construction of Energy," in *New Geographies #2: Landscapes of Energy*, Rania Ghosn, ed. (Cambridge: Harvard GSD, 2010), 11-19.