SPECIAL COLLECTION:
Energopower and Biopower in Transition

Ergos: A New Energy Currency

Gökçe Günel, *Columbia University*

ABSTRACT
In 2006, Abu Dhabi launched an ambitious project to construct the world's first "zero-carbon" city: Masdar City. Soon after, Masdar Institute, a renewable energy and clean technology research center founded in collaboration with Massachusetts Institute of Technology, opened its doors to an international group of faculty and students. Located at the heart of the Masdar City construction site, the Institute was responsible for experimenting with new energy infrastructures. In this article, I contend with the novel instance of Masdar City trying to invent "ergos," a new currency based on energy unit expenditure. Bringing together literature on science and technology studies and economic anthropology, I explore the paradoxes that emerge during the project and map out the stakes of this currency proposal for the actors involved. Consequently, I show how "ergos" provides us with a unique instance of "energopolitics" wherein the disciplinary and biopolitical qualities of power merge together to control both individuals and populations, resulting in a "disciplinary biopolitics" for the eco-city. I suggest that a commitment to fixing the everyday failures of the emergent technological infrastructures (as well as a reverence for an abstract higher good) eventually emerges as the endpoint of the ergos project. In this way, I provide a refreshing look on planned cities, energy infrastructures, and currency debates. [Keywords: Energy, climate change, the Arabian Gulf, technological imaginaries, urban design, eco-city, value, alternative currencies]

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Introduction

In 2006, the government of Abu Dhabi launched an ambitious plan to produce what it imagined to be "the world's first zero-carbon city": Masdar City. Articles on Masdar City began appearing in the international press soon after the official launching of the project. "Abu Dhabi, the capital of the United Arab Emirates, the fourth largest OPEC oil producer with about ten percent of the known reserves, is seeking to become a center for the development and implementation of clean-energy technology," a *New York Times* article announced (Fattah 2007). The zero-carbon district would cost $22 billion USD, and eventually house 50,000 people and 1,500 renewable energy and clean technology businesses. The producers of Masdar City claimed that they would implement a personal rapid transport (PRT) network throughout the city, thus completely prohibiting car entry. Moreover, they announced an effort to start a renewable energy focused research institution at the center of the city with support from Massachusetts Institute of Technology (MIT). The Masdar Institute of Science and Technology would serve to transform Abu Dhabi in the same way that MIT transformed the Boston area into a start-up haven. Together with other satellite campuses, such as New York University in Abu Dhabi (NYU-AD) or the Sorbonne, Masdar Institute would have a significant role in initiating a knowledge-based economy in Abu Dhabi. While some commentators mocked the project for being located in a country where the carbon footprint per capita is the highest in the world, others appreciated the fact that an oil-rich Emirate was investing in renewable energy resources, thereby acknowledging that the energy portfolio of the future would not only consist of fossil fuels. During the groundbreaking ceremony, Sultan Al Jaber, the CEO of Masdar, declared, "[w]e are creating a city where residents and commuters will live the highest quality of life with the lowest environmental footprint. Masdar City will become the world's hub for future energy. By taking sustainable development and living to a new level, it will lead the world in understanding how all future cities should be built."[1]

In addition to implementing the UAE's economic vision, Masdar Institute attempted to engineer an economic vision of its own, specifically by planning a new currency based on energy consumption. Masdar Institute faculty members,[2] with whom I worked as a research assistant during my fieldwork in Abu Dhabi between September 2010 and June 2011, imagined that, in the future, inhabitants of Masdar City could be issued a balance of energy credits called "ergos," as a means of defining and regulating their

pre-allocated energy budget. Through individual monitoring and regulation, ergos aimed at decreasing energy consumption among the residents of Masdar City. And yet the researchers that I worked with occasionally mentioned that the ergos project had a "Big Brother side" to it, and worried that it could lead to a "technocratic dictatorship."

At a time of uncertainty and anxiety regarding the future of energy resources, the ergos experiment would serve to create awareness about consumption behavior among Masdar City residents. Through its dedication to a sophisticated technological infrastructure, the experiment would not only monitor the population within Masdar City as a whole, but also track individual energy use. By replacing dirhams with kilowatts, the Masdar Institute researchers would also redefine the meaning of a currency, and frame it as an information-tracking device with possibly global reach. In this way, the ergos experiment would pose a potential challenge to national currencies, and seemingly tie consumers of energy together in the face of fears regarding future ecological destruction. Eventually, ergos could serve as a universal currency, thereby disciplining and regulating individuals and populations beyond the boundaries of Masdar City.

What I wish to argue in this article is that the "energopolitics" of the ergos experiment is a normative attempt at discipline (exerting power over man-as-body) and biopolitics (exerting power over man-as-species) simultaneously. In *Society Must Be Defended*, Michel Foucault (2003:245) demonstrates the fundamental differences between discipline and biopolitics, suggesting that discipline deals with individuals and their bodies, whereas biopolitics deals with population as a political problem. Accordingly, he states:

> The mechanisms introduced by biopolitics include forecasts, statistical estimates, and overall measures. And their purpose is not to modify any given phenomenon as such, or to modify a given individual insofar as he is an individual, but, essentially, to intervene at the level at which these general phenomena are determined, to intervene at the level of their generality. (2003:246)

In responding to this special collection's exploration of the interrelationship of biopower and "energopower," I would like to show how the "energopolitical" experiment to form a new currency regime based on energy was quickly drawn into the biopolitical project of regulating populations

into new habits of energy use, while simultaneously utilizing disciplinary measures to govern individual behavior. Accordingly, I seek to show how the use of energy currency as a disciplinary and biopolitical instrument transformed the character and objectives of "biopower" along the way, resulting in a "disciplinary biopolitics" where both individuals and populations emerged as units of governance. While acknowledging its capacities as a tool for creating awareness on energy use, I understand the ergos project as an attempt to remold political power first within, and eventually outside of, Masdar City.

And yet, during the years I participated in the project, the ergos experiment proved to be increasingly costly—not only in terms of the technologies that are required for the system to operate, but also in terms of a systemic commitment on the part of the human actors. What exactly does such incapacity tell us about "disciplinary biopolitics"? Learning from such Orwellian experiments, would it be safe to assume that "disciplinary biopolitics" is in some ways impossible to realize?

Presenting

Alexander, an assistant professor at Masdar Institute, presented his recent research paper to an audience of faculty members, postdoctoral researchers, and students in a spacious classroom on the new Institute campus, only a few weeks after the Fall 2010 semester began.

"The way we understand the economy," he said, "is based on a decoupling; a decoupling of the economy and the physical world." Pointing out how "money is a belief about a belief generated by debt in a fractional reserve system," he argued that it was time to make monetary exchange more tangible. Accordingly, his research paper aimed at bringing "the economy and the physical world" together through a new currency based on energy consumption. "In order to link the economy to the physical world, why not have an energy ticket for every service that is provided? Use energy as a currency? Could this be a universal currency?" he inquired, rhetorically.

Then he revealed the system that he and his colleagues at Masdar Institute had been imagining. Inhabitants of Abu Dhabi's Masdar City could routinely be issued a balance of energy credits called "ergos," etymologically signifying "work" or "action," which would define their pre-allocated energy budget over the validity period of the credits.[3] A single credit would represent the right to consume a physical quantity of electricity (e.g., one

kWh) and have a defined expiration period (e.g., one month). If the ergos account of any user ran down to zero, electricity would be consumed by buying ergos at spot market price. If a consumer used exactly the same amount of electricity that had been allocated, he or she would not be subjected to the credit spot price, which was expected to be substantially higher than the subscribed price. Accounts would be filled with energy credits at the beginning of each validity period, and diminished or increased commensurate with the user's practices. "Everyone has to be part of it," Alexander underlined, "otherwise it does not work."

In some ways, Alexander's project meant to restore the gap that Philip Mirowski (1989) laid out in his book *More Heat than Light*. According to Mirowski, founders of neoclassical economics had borrowed the concept of energy from 19th century physics, thus eventually formulating the concept of utility. In doing so, these economists had actually overlooked the multiple discrepancies between energy and utility. One such discrepancy Mirowski delineates is how energy conservation cannot be translated into an economic concept when studied within the boundaries of utility theory. As such, Mirowski constructs a lens that enables him to expose the flaws of neoclassical thinking from its very beginnings. But what happens when utility is taken out of the equation and is directly replaced with energy? Could this be perceived as an intervention in neoclassical economics, or perhaps serve to link the "economy" and the "physical world" as Alexander aspired?

In this imaginary, ergos would give Masdar City a particular independence, especially because the energy consumed within the city limits would also be produced by the renewable energy power stations connected to the city. The amount of kilowatt-hours of energy produced on site would have to correspond to the amount of ergos reserves that would be available to Masdar City residents. In this way, Masdar City residents would only consume the energy that they would have the capacity to produce. Setting the eco-city apart from other renewable energy generation and consumption projects that make use of large networks, such as DESERTEC,[4] Masdar City's ergos would contribute to situating the city as a showcase for decentralized energy systems.

One of the postdoctoral researchers at Masdar Institute denied ergos such potential, and suggested that it was mostly constituted as a tool for creating awareness on energy efficiency issues. In this way, she said, people will have a better sense of how much energy they are consuming. "At

the end of the day, ergos is just a derivative of any available energy unit. So we must still think about how useful or necessary it is to create yet another artificial measure," she concluded. She thought that ergos would primarily serve as a discursive instrument.

In the question and answer session of his presentation, Alexander clarified that ergos would still function within market dynamics; there would be price volatility, and therefore value to be gained. Of course, initially, ergos would operate together with the UAE dirham, especially because the inhabitants of Masdar would be paid in dirhams. Since Masdar City was still not a completely self-sustaining eco-city, and since the people who live in Masdar would be required to purchase goods outside the ergos zone, they could not just abolish dirhams yet. It would be best if ergos could become a universal currency, Alexander explained. This is what they aimed at, eventually.

In promoting the use of ergos as a currency uniting initially Masdar City, and then hopefully the rest of the universe, Alexander dreamed of a semiotic shift, wherein national signs of value would slowly be replaced by a universal sign of value that had practical use. In this sense, Alexander's project would reverse the nationalization of money, and make people united, in harmony, to a seemingly universal future (see Peebles 2008). The imagined globality of climate change and energy scarcity justified the shift from the national level to a desired universal level, where energy units would be distributed to individuals via their proposed cap and trade system, and tracked down through expansive smart grid infrastructures.

In this case, the acknowledgment of climate change and energy scarcity, and the associated plans to inhabit a zero-carbon city, produced novel epistemic and political effects. These effects not only pushed the producers of Masdar City to call for a global currency that debunks former national currencies, but also necessitated the formation of an infrastructure that disciplines and regulates individuals and populations. As such, Masdar City's ergos experiment seemingly challenged biopolitics and sought to create a system wherein a "disciplinary biopolitics" would flourish. The "energopolitics" of Masdar City was, in this case, a shift from the current understandings of biopolitics where population is the foremost unit of governance.

At the end of his presentation, Alexander expressed how he is aware of the potential social implications of their proposed project. In order to track energy consumption through ergos, every individual would be assigned a code, and would have to use that code in order to access electricity in public

spaces, such as when taking the elevator or charging a laptop at the library. Through ergos, every individual's consumption patterns would be traced at every point in time, as long as he or she remained within the boundaries of Masdar City. After pointing out that commitment to energy constraints could lead to a form of "technocratic dictatorship," Alexander asked if we could "maintain freedom of action, promote equality, and meet resource constraints," while utilizing technology towards increased energy efficiency.

A postdoctoral researcher that I later spoke with also argued that ergos has a "Big Brother side" to it, suggesting that a utilities company could study a consumer's appliance/electricity consumption ratio, develop a better sense of the consumer's habits, and sell this information to vendor companies. This information would easily reflect and include private data about an individual consumer's everyday life, as well as the patterns of consumption among the larger group. In the end, it would comprise a highly detailed surveillance mechanism, charting how, when, and how long any appliance in a household is utilized. Ergos would thus track down individuals and the population with the intention of discipline and regulation. The researchers working on the experiment of building an energy currency explicated how their proposal could be socially and politically problematic, but eventually put their hesitations aside.

Energopolitics as Disciplinary Biopolitics

When suggesting that they feared a potential "technocratic dictatorship," the researchers at Masdar Institute implied that the ergos experiment generated a significant side effect, wherein energy became utilized as a new means of what I call "disciplinary biopolitics."[5] As such, "energopolitics" in the case of the ergos experiment emerged as an assembly of the disciplinary qualities of power, as well as its biopolitical underpinnings.

In *Society Must Be Defended*, Foucault (2003:239-264) explicates that the emergence of biopolitics is about "the second seizure of power," where power is no longer about disciplining man-as-body, but rather becomes directed at man-as-species, represented through statistical measures and forecasts. Foucault writes:

> Biopolitics deals with the population, the population as a political problem, as a problem that is at once scientific and political, as a biological problem and as power's problem…The phenomena

> addressed as biopolitics are, essentially, aleatory events that occur within a population that exists over a period of time. (2003:246)

Here, the individual ceases to be the unit of governance.

And yet, this explanation regarding the differences between discipline and biopolitics seemingly departs from an earlier depiction that Foucault provides in regards to power. In their "Biopower Today," Paul Rabinow and Nikolas Rose suggest:

> One pole of biopower focuses on an anatamo-politics of the human body, seeking to maximize its forces and integrate it into efficient systems. The second pole is one of regulatory controls, a biopolitics of the population, focusing on the species body, the body imbued with the mechanisms of life: birth, morbidity, mortality, longevity. He claims that this bipolar technology, which begins to be set up in the seventeenth century, seeks "to invest life through and through" (Foucault 1978:139) And, by the nineteenth century, he argues, these two poles were conjoined within a series of "great technologies of power" of which sexuality was only one. In so establishing themselves, new kinds of political struggle could emerge, in which "life as a political object" was turned back against the controls exercised over it, in the name of claims to a "right" to life, to one's body, to health, to the satisfaction of one's needs. (2006:196)

In this understanding, biopower is inherently disciplinary, and governs individual bodies as well as populations through a multiplicity of controls. But in his *Society Must Be Defended* lectures, Foucault proposes a different, "nondisciplinary" dynamics of power. While disciplinary power targets individual bodies, biopolitical power permeates the wide-ranging processes of life and death for a whole population. And so, what happens when biopolitics—that is, the production and management of the population as a political problem—is combined with the disciplining of "man-as-body"?

By monitoring energy flows, and regulating them in the form of monetary transactions, the researchers at Masdar Institute attempted to rationalize the energy problems posed by the population within Masdar City. Through statistical measures, forecasts, and education, the energy consumption patterns of this collectivity would be subject to surveillance and control. The researchers at Masdar Institute were inventing a rational technique

of intervention in order to monitor flows that had not been subject to surveillance before and assisting in the construction of a new architecture that would allow and facilitate such surveillance systems—an enhanced Panopticon, to say the least (see also Peebles 2008).

This enhanced Panopticon did not disregard man-as-body. Just the opposite—at Masdar City's ergos experiment, individual bodies would be made public and visible through their energy consumption. Regulated through a costly currency regime, energy consumption would emerge as a technique that could be applied to both the body and the population, with disciplinary and regulatory effects. Foucault writes that there is one element that circulates between the body and the population, with such disciplinary and regulatory effects. He suggests, "The norm is something that can be applied to both a body one wishes to discipline and a population one wishes to regularize…The normalizing society is a society in which the norm of discipline and the norm of regulation intersect along an orthogonal articulation" (2003:253). In the case of the ergos experiment, energy management manifested itself as one such norm, through which both the small-scale individual risks and infinitely large-scale collective uncertainties that characterize the anthropocene would be governed (see also Ewald 1993).

The "energopolitics" of the ergos experiment thus became a normative attempt at discipline and biopolitics, at the same time. The researchers at Masdar could only associate their attempt at "disciplinary biopolitics" with *Nineteen Eighty-Four*, one forceful instance when the regulation of individuals and populations were meddled together.

A Visible Currency

But why does "energy" emerge as a factor for controlling individuals and populations today—as a means of "disciplinary biopolitics"? And what does it mean that "energy" becomes manipulated through another system of cultural concern—that is, monetary exchange? What is so particular about it? Finally, what do these emergent material infrastructures of energy and money tell us about energy and money per se?

Let me start answering these questions with a reference to the literature on economic anthropology. "Concerned with the way in which money is symbolically represented in a range of different societies and, more especially, with the moral evaluation of monetary and commercial exchanges as against exchanges of other kinds," Jonathan Parry and Maurice Bloch

(1989:1) emphasized in their edited volume *Money and the Morality of Exchange* how worldviews of a particular era give "rise to particular ways of representing money" (1989:19). Alternative or complementary currencies, as examined by Bill Maurer (2005) for instance, may thereby be perceived as symptomatic of the social conditions of a particular period or collectivity. Taking Bloch and Parry's suggestion into account, what exactly were the motivations behind the formation of energy as a currency—and thereby a means of governance?

The ergos experiment embodied the commitment to a technoscientific infrastructure that would govern energy consumption at a time of uncertainty regarding future energy resources and regarding the future of economic systems. Perhaps, it was hoped that an energy currency would resolve both problems at once with a single systemic transformation.[6] With this question in mind, in July 2012, I attended an international conference entitled "Energy Currency: Energy as the Fundamental Measure of Price, Cost and Value," held in Split, Croatia.[7] The meetings started on July 10, which—as the opening speaker announced—was Nikola Tesla's 156th birthday, with the intention of rectifying the historical injustice that Tesla suffered as an energy physicist.[8] Promoters of energy currencies, including Alexander from Masdar Institute, had gathered to discuss the past, present, and future of their proposed systems.

What I encountered at the conference was a group of scholars and practitioners searching for ways out of the Eurozone crisis. Climate change—or energy scarcity, for that matter—was not the central topic of interest. The participants framed the debate as a conversation on market failure instead. In this context, "our ecological footprint" constituted one of the problems of the existing monetary system, comparable to unemployment or income inequality. "Joining Adam Smith and Nikola Tesla together, we can achieve a world that's better for human beings," one participant exclaimed. All in all, participants agreed upon how the current monetary and financial system is unsustainable, specifically because it relies on an unsustainable means of exchange—that is, the currency system. They did not have all that much to say on climate change.

The intellectual backdrop for this conference, which brought together the foremost actors involved in the production of energy currency systems, comprised of "readings" and "misreadings"[9] of a recent history of energy currencies. While the participants never cited older advocates of energy currency systems, such as Howard Scott of the Technocracy Movement,

they heavily relied on two important books: Richard Douthwaite's (1999) *The Ecology of Money* and Bernard Lietaer's (2001) *The Future of Money*. "Is energy the money of the future," the participants wondered, and referenced Richard Douthwaite's (1999) call for a multiplicity of currencies, each one for its own purpose. They also buttressed how the deteriorating physical value of materials should be reflected in the currency system, and referred to a system called "scrip," implemented during the Great Depression in the US. Lietaer (2001) had written about this system, suggesting that at some point in history complementary currencies were used all around the world. "Otherwise, we will experience the collapse of cultures and countries," the participants said, once again referring to Lietaer's writings on future scenarios. Human evolution is the evolution of power, one person remarked, reminiscent of early anthropological work on energy systems.

Here, energy became comparable to gold, as a reference value in "the real world." Kilowatts, the participants of the conference argued, is the best model that we can think of today. Energy would become scarce, but still remain a master commodity. "Gold," one proponent of energy currencies suggested, "the poor dig it up and the rich bury it under the ground. It does not have any use." But energy, an emergent measure of price, cost, and value was not like that. It could serve as a means of exchange, while maintaining a use value in the real world.[10] "It should not store value, it should not have interest," others agreed. "Money should be an information system, tracking real world wealth—planetary resources, and all the energy of the earth."

By suggesting that money should be an information system, tracking real world wealth, the participants seemingly recalled what Keith Hart (2000) calls "the memory bank," where money is a source of collective social memory, and thus will take "as many forms as the plurality of associations we enter." In the form of an energy currency, money would contain detailed information not only about the amount of energy available to a particular population, but also depict energy transactions between different individuals. This information would create awareness about the energy that is available to this planet and about the ways in which it is used. It would shift money's definitive characteristics—money would stop carrying a value of its own, and instead become a marker.

In addition to advocating the use of money as an information tracking device, the participants urged for a shift in the visibility/invisibility of money.

Could money be made visible again, and serve as a device of measurement? In *The Economy of Literature,* Marc Shell writes:

> It is not easy for us, who have used coinage for some twenty-five hundred years, to imagine the impression it made on the minds of those who first used it in their city-states. The introduction of money to Greece has few useful analogies...Tales of Gyges associate him with founding a tyranny in Lydia and with a power of being able to transform visibles into invisibles and invisibles into visibles. This power…is associated with new economic and political forms that shattered the previous world and its culture. (1993:13)

Likewise, David Graeber (1996:5) suggests, "whenever one examines the processes by which the value of objects is established (and this is true whether one is dealing with objects of exchange, or wealth more generally), issues of visibility and invisibility always seem to crop up." He concludes that, "[m]oney tends to be represented as an invisible potency because of its capacity to turn into any other thing. Money is the potential for future specificity even if it is a potential that can only be realized through a future act of exchange" (1996:20). And yet by making money traceable again (by pegging it to a system of energy production and consumption), the promoters of energy currencies suggested, they could put the monetary system on display, or in other words, make it visible.

In the case of ergos, which remains the focus of this article, such visibility would induce a new kind of tyranny, or perhaps what I call "disciplinary biopolitics," wherein the open tracking of real world wealth would facilitate the emergence of new rationalities for the operators of the system. How would such new visibles transform relations of governance? Why did we need this openness now, and why through energy?

Energy Theories of Value

Neither Alexander and his team nor the other participants at the Energy Currency conference were the first ones to come up with an energy based currency system, which would tie a particular collectivity together, like any other currency that connects citizens of a country within porous boundaries.[11]

Writing in the 1930s, with the purpose of recommending solutions for the economic depression in the US, Howard Scott, the founder of the Technocracy Movement, argued, for instance:

> To say it in one way, the cause of our troubles lies in the fact that during these years, instead of thinking of our well-being and of the operation of our country in terms of energy, we have thought of it in terms of something purchasable with dollars. If we are to understand the problem at all we have got to grapple with this question of energy; upon it everything else rests. (1933:130)

Furthering his argument, Scott stated:

> It is the fact that all forms of energy, of whatever sort, may be measured in units of ergs, joules or calories that is of the utmost importance. The solution of the social problems of our time depends upon the recognition of this fact. A dollar may be worth—in buying power—so much today and more or less tomorrow, but a unit of work or heat is the same in 1900, 1929, 1933 or the year 2000. (1933:131-132)

The Technocracy Movement thereby suggested that energy, given its stability throughout years, should replace the dollar and be put into use as a currency. According to this proposal, the net energy budget of the US would be calculated and divided among the residents of the highly centralized "North American Continental Technate," providing an energy certificate of "joules" or "ergs" to the residents of the continent. These non-transferable credits would expire after a period of two years. As William Akin posits, Howard Scott believed that "his system would assure the goals that the technocracts desired: to restore purchasing power, assure maximum distribution of all goods produced, balance production and distribution, and abolish debts and profits" (1977:84). As such, the economic crisis would be managed by what they referred to as apolitical engineering solutions.[12]

As Akin states, "In the minds of the technocratic planners, the rationality of science and the harmony of the machine, not utopian virtues, would dictate organizational forms" (1977:84). However, the rationality of science and the harmony of the machine could only be achieved through specific social and psychological transformations. First of all, the human would have to accept that s/he is a machine, through precise conditioning

methods. In order to ensure that humanity would assume the character of machines, the technocrats would eliminate religion, fine arts, and humanities along with all other possible kinds of intellectual activity. For them, these nonproductive acts would have no function within the upcoming era of technical rationality, organized around an energy theory of value.

Philip Mirowski (1988:812) calls movements like Scott's (which seek to show how energy is identical to economic value) "neo-energetics," and differentiates them from others who have been interested in energy as a metaphor for constructing economic principles. According to Mirowski (1988), the founding ideas of neo-energetics date back to the 1860s. While these principles have never been fully developed, they have remained present within certain scientific communities. Mirowski argues that a lack of rigor along with multidisciplinary interest in the subject have been the main factors contributing to the popularity of energy theories of value.[13]

But what do the energy theories of value have to say about the concept of value? In modern theories of neo-energetics, energy is analyzed as a common denominator for all commodities, just like labor would be for Marxist economics. Berndt, a somewhat promoter of modern day neo-energetics, explains:

> First, much like Marx's labor theory of value in which all commodities represent congealed labor, in the accounting sense commodities can be measured by the direct energy input into their production plus the indirect energy input embodied in capital, material and other inputs. The second sense in which energy tends to be viewed as embodied or sequestered in materials is as thermodynamic potential. From the basic principles of physics and chemistry, it is known that materials have thermodynamic potential which changes as the materials pass through various states in productive processes, encountering heat energy and/or work. (1983:342)

In a similar vein, Robert Costanza, a prominent neo-energeticist, suggests: "Can anyone seriously suggest that labor creates sunlight! The reverse is obviously more accurate" (as quoted in Daly and Umaña 1981:167). In calculating how energy would correspond to value, neo-energeticisits also utilize various formalisms and look for ways of sorting out "embodied or sequestered energy" within commodities. In doing so, the movement argues that it is bringing together biology, physics, and economics into a single

science. Yet Mirowski (1988) states that these theories merely underline the simile between human labor and energy and do not amount to a serious synthesis of the three disciplines. At the same time, these understandings of value dismiss the various ways in which value becomes generated through the sociality of exchange, as explored through a rich literature in anthropology of value.[14]

The Hidden Brain

When I asked Alexander how he compares these older energy currency systems to the experiment that he is working on, he explained that they are conceptually similar. "But it was not possible to implement them at the time," he continued, "especially because of an absence of information technologies." Now they had access to novel technical infrastructure, and could rely on the building management system (BMS), what Rowan Moore, an architecture critic at *The Observer*, referred to as the "hidden brain" of the Masdar Institute building.[15] The BMS was laden with expectations to act as a regulatory device for the imagined energy currency system of Masdar City, facilitating the institution of a "disciplinary biopolitics" within its buildings.

Building Management Systems are common technological infrastructures that have been implemented in large buildings since the late 1960s, mostly to control the building's indoor environment. Due to the decreasing price of hardware required for their manufacturing, these systems became further popularized during the 1970s. In addition to managing the building's environment by keeping track of heating, lighting, ventilation, air conditioning systems, or window opening and shading, such systems administer security, fire protection, lift operation, and surveillance mechanisms. Experts on building automation also stress that the historical development of BMS is interlaced with improvements in technologies of computation, wherein the incorporation of computers, on top of various optimization techniques, provides opportunities to further complicate the machineries of control within large buildings today.[16] At Masdar City, the BMS would have an additional function, tracking and regulating energy use of individual residents as well as the overall population, and providing information in the form of an energy currency, thus acting as a new type of regulatory device. Given how the building machinery sought to remain outside the conscious awareness of its residents, while having a decisive effect on how they live, perhaps the analogy of the "hidden brain" is not so misplaced.

The implementation of the desired BMS machinery would breathe life into the Masdar Institute building, augmenting its capacities of discipline and regulation. It would not only contribute to the centralization of decision-making power and facilitate the dominance of an optimization logic within the building environment, but also prohibit individual occupants from interfering with the system as much as they would like to. Thus once the BMS was fully functional, the raw values that the database comprised would be values produced by the "building" and not by its occupants. Unless the occupants matched the profile determined by the BMS control panel, they would have to come to terms with the discomforts of the building environment (see also Murphy 2006). The building would have a say in managing individual energy consumption, as well as in controlling the total energy use of the population.

Relying on this infrastructure, Alexander and his colleagues not only introduced a new layer of governance, monitoring energy flows of individuals and of the populace, but also intended to produce what they called a more "real world" indicator of "visible" economic value. They would later assess whether their experiment was actually the institution of what Alexander called "a technocratic dictatorship."

(Re-)Defining Masdar City

The production of ergos as a unit of energy currency, and the building of its affiliated technical infrastructures, eventually gave rise to questions about the future eco-city that ergos users would inhabit. What kind of a prototype was Masdar City? The marketing department had come up with a promotional statement at the very beginning of the project, suggesting that Masdar City would be the first "zero-carbon city" of the world. But what did "zero-carbon" mean?

In his presentation, Alexander reiterated that there were three ways in which an eco-city's carbon emissions could be defined. First, there were "strictly zero-carbon" cities, which did not emit any carbon to begin with. Second, were "net zero-carbon" cities, where carbon emissions could be eliminated or balanced. Third, a city could be "carbon neutral." In this case, the residents of the city would be required to purchase third-party carbon offsets to balance their carbon emissions. "Of course, we've dropped even these…" he said in frustration, pointing to how Masdar City's claims to be a zero-carbon city had slowly faded away. Many in the audience shared

this, at times public, discontent regarding what they conceived to be the foundering ideals of Masdar City, and grinned at each other.

And yet Alexander insisted that ergos would be critical in establishing Masdar as a zero-carbon city. Most importantly, ergos would trigger energy awareness and end-user behavioral changes towards satisfying energy demand within the city's established limits. In producing a zero-carbon city, researchers could not only rely on device-based efficiency. The transformation had to be systemic. It had to have social impact. It had to cause a discursive shift. Ergos, Alexander affirmed, would be able to satisfy these requirements.

In suggesting that ergos would satisfy these requirements, Alexander also showed how ergos would be key in the transformation of political power within Masdar City. The imagined energy currency would bring in tools that would allow the researchers to discipline and regulate individuals and the population within the eco-city, thereby enabling the city to remain "zero-carbon." In other words, the "disciplinary biopolitics" of ergos were perceived to be essential in preparing for future ecological destruction, energy scarcity, and possible economic failure. Through monitoring individuals as well as populations, Abu Dhabi could safeguard its energy future, along with its economic well-being.

Later, Alexander went on to classify different types of carbon emissions. "Internal emissions" were emissions produced within the boundaries of a city, by the city residents. "External emissions," on the other hand, were emissions produced through the goods that come into the city. "Out of scope emissions" comprised items such as private employees' commutes—they were caused by the residents of the city, but not within the city limits. After this brief overview, Alexander once again asked: "Can Masdar City be zero-carbon?" He responded to his own question with a determined "yes," and suggested that it would only come at some cost. "We must keep in mind that our world is running out of fossil fuels—besides there is climate change," he conclusively stated. The anxiety regarding the ecological destruction and energy scarcity resurfaced, thereby serving to justify the decisions taken within the eco-city.

When mapping the future of Masdar City, such formal definitions served as directives and incentives to proceed with the project. The paradoxes of the city were not directly confronted, thereby further facilitating the tendency to remain inattentive to the potential bigger picture problems. What role would ergos play in creating the zero-carbon city that was once

envisioned? The researchers and the professionals working on the study remained keen on underlining how ergos was key to creating awareness regarding energy consumption, uniting the populace towards a shared future of automated energy conservation. However, the steps required for creating ergos triggered side effects that could be avoided for the time being, but that in the end would transform social, political, and economic relations within communities drastically, resulting in the possible emergence of a "disciplinary biopolitics" that demanded the discipline and regulation of individuals as well as the population.

Yet how exactly did Alexander and his colleagues make decisions to further commit to technological infrastructures in promoting energy efficiency, when they feared a possible technocratic dictatorship? The small rather mundane steps towards the constitution of the project enabled Alexander and his team to leave these bigger ideas aside, while simultaneously making them more and more ingrained in the discourses and practices required for reaching the final goal. At the same time, the researchers remained convinced that the project would serve an abstract higher good, eventually helping humanity in dealing with energy problems. Having fully grasped the potential risks they unleashed, the researchers seemed confident that technology could be used as an educational mechanism, whereby inhabitants of Masdar City would learn more about their consumption behavior. They hoped and believed that an energy currency could allow people to make informed yet free choices. Simultaneously, they thought of their project as a somewhat revolutionary proposal, which would change the understanding of money and energy completely. In addition to the everyday discussions and practices associated with the realization of the project, this belief allowed the researchers to disregard the fears associated with a somewhat dystopian future.

As of April 2012, the ergos experiment had still not started, due to repeated everyday problems mostly associated with the technical infrastructure. "The showers and the air conditioning, even those problems still haven't been resolved," one of my interlocutors told me. "They cannot seem to find what is wrong with the building, or resolve it." Postponed due to the many interlinked inconveniences, ergos thus became an ungraspable yet consistently anticipated object for researchers and professionals at Masdar City. ■

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Endnotes:

[1]See https://www.masdar.ac.ae/component/k2/item/5623-ground-breaking-marks-start-of-masdar-city-10-02-2008 (last accessed March 2, 2014). For an ethnographic exploration of the founding of Masdar City, see Günel (2012).

[2]Currently, Masdar Institute has about 70 faculty members and 200 students who are working towards M.Sc. and Ph.D. degrees. It attracts faculty and students from around the world, for programs focusing mainly on renewable energy and clean technology research.

[3]According to the *Oxford English Dictionary*, "ergos" when in combined form, refers to "the Greek ἔργον work, used to form technical terms usually with the sense 'energy,' as ergometer n., ergophobia n."

[4]DESERTEC promotes the production of electricity through solar and wind power stations constructed in North Africa and the Middle East, and suggests that this energy could satisfy the energy needs of many regions, including Europe. For more information on the project, please see http://www.desertec.org/ (last accessed Dec 22, 2011).

[5]I thank James Faubion for his help with formulating thoughts on biopolitics.

[6]Ergos is not the only energy currency proposal that has been put together in the early 21st century. DeKos, for instance, understood as "a method for securing a more stable value currency via the central bank portfolio using electricity delivery assets," is also an attempt at fixing financial problems and energy problems at once (Gogerty and Zitoli 2011:22). For more information on DeKos, please see Gogerty and Zitoli (2011). Also, in 1999, Richard Douthwaite, a philosopher and economist, came up with "ebcu," meaning environment-backed currency unit, which would enable one to buy goods from other countries in addition to the right to produce carbon dioxide. For more information on ebcu, see Douthwaite (1999). For more information on the conference "Energy Currency: Energy as the Fundamental Measure of Price, Cost and Value," please see http://teslaconference.com/ (last accessed March 2, 2014).

[7]I thank Rice University Cultures of Energy Mellon-Sawyer Seminar for their generous financial support in making this visit possible.

[8]Nikola Tesla (1856-1943) is a physicist best known for his contributions to the design of the modern alternating current (AC) electricity supply system. For a recent biography of Nikola Tesla, see Carlson (in press).

[9]For an analysis of "misreading," please see Miyazaki (2012). See also Ginzburg (1980). I thank Webb Keane for this reference.

[10]There was disagreement among the participants regarding whether an energy currency was a political project, attempting to generate a more ethical economic system. One group explicitly stated, "We understand that if there is a more stable currency, then people may plan more in advance. In this way, energy currency will help economic development, and may contribute to fixing inequalities, but this is not our direct goal." However, others had started working on energy currencies with the specific goal of creating a fairer economic model. This debate ensued throughout the meeting.

[11]Interestingly, Alexander and his team, much like others who work on energy theories of value today, do not trace their ideas back to the Technocracy Movement. In July 2012, when I asked the participants of an international conference on energy currency what they thought about the movement, many confessed that they had not heard about it before. Instead, they cited Lietaer's (2001) *The Future of Money* and Douthwaite's (1999) *The Ecology of Money* as significant influences.

[12]I thank Ronald Kline for encouraging me to read about the Technocracy Movement.

[13]Anthropology has also been one of the disciplines to underline the significance of energy theories of value, while providing an interpretation of its own. Mirowski (1988:816) highlights how Leslie White, writing in *American Anthropologist* in 1943, proposed that all culture be conceptualized as a manifestation of "the amount of energy per capita per year harnessed and put to work." He continues, "This theme was taken up by many other anthropologists, such as [Leslie White's student, Richard Newbold] Adams" (1988:816).

While their frame of analysis remained at the macro level, Leslie White and Richard N. Adams are commonly perceived as the first scholars to make energy a matter of concern in anthropology.

[14]Scholarship in the anthropology of value examines the economy by studying the social transformations that take place within spheres of exchange. In doing so, many scholars, perhaps starting with Marcel Mauss' seminal work on the gift, argue that monetary exchange is shaped and defined by varying beliefs, affects, and cultural practices.

[15]Rowan Moore (2010) wrote, "There is something spooky in the controls [Masdar] employs in the name of the environment—a touch of eco-Orwell or at least eco-Huxley. A hidden brain, for example, knows when you enter your building, so that your flat can be cooled before you arrive, while in public places flat screens broadcast uplifting news on the environmental performance of the complex." While on-site architects suggested that what they called "the intelligent system" would eventually enable such controls to be implemented, specifying that "when you're entering the building the entrance recognizes you and you walk into a room that's 24 degrees Celsius, and when you're out it goes up to 28 again," the system had not yet been put into use when my fieldwork at Masdar City ended at the end of May 2011.

[16]See, for instance, Wang (2010).

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Foreign Language Translations:

Ergos: A New Energy Currency
[**Keywords:** Energy, climate change, the Arabian Gulf, technological imaginaries, urban design, eco-city, value, alternative currencies]

Ergos: Uma Nova Moeda Energética
[**Palavras-chave:** Energia, alterações climáticas, Golfo da Arábia, imaginários tecnológicos, design urbano, eco-cidade, valor, moedas alternativas]

人体工学：一种新的能源货币
关键词： 能源，气候变化，阿拉伯湾，科技想象，城市设计，生态都市，货币

Эргос: Новая энергетическая валюта
[**Ключевые слова:** энергия, энергетика, изменение климата, арабский залив, технологические мнимые, городской дизайн, экогород, средство сбережения, альтернативная валюта]

الارغو: عملة الطاقة الجديدة
كلمات البحث: الطاقة، التغيير المناخي، الخليج العربي،التخيلات التكنولوجية، التصميم الحضري، المدينة البيئية، القيم، العملات البديلة