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Masdar City: A Study of Energy, Infrastructure, and Technological Hope

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ABSTRACT

The United Arab Emirates (UAE) has been a major supplier of fossil fuel for the world economy for decades, which has allowed the country to thrive economically. But global concerns over ecological destruction and climate change is prompting the UAE's leaders to pursue alternative sources of energy. From this ecological fear, Masdar City was born, an ambitious project that hopes to create the world's first "zero-carbon" emission city. The project's goal is to utilize energy in a socially, economically, and environmentally sustainable system without sacrificing modern lifestyles. This case study will utilize theory on energy and infrastructures to analyze the implications of the project's innovations, as well as to explore the rising intersection of neoliberalism and environmentalism to understand how a project like Masdar came to be. In 2016, ten years after its initial construction, the city still had not achieved net zero-carbon emissions, but a mere 50%. The project's ambitions included the creation of a new energy-based currency to account for consumption, and the integration of a massive data vault that stores all consumption of energy. What is found is a complex and highly integrated information system that could lead to the selling of information and the corporate/governmental manipulation of data for control over populations.

1. INTRODUCTION

In 2006, the United Arab Emirates (UAE) began work on Masdar City, an ambitious project that aimed to be the "world's first zero-carbon" emission city, acting as the frontier producer of clean energy solutions for the UAE's environmental problems (Gunel 2011; see Fig. 1). Masdar, meaning "source" in Arabic, is a for-profit, renewable energy company that invests in clean technology projects around the world. Owned by the Mubadala Investment Company of the UAE, Masdar both invests in projects abroad through Masdar Clean Energy and develops environmental solutions at home through Masdar Institute, an MIT-backed Research University. Masdar City is the cornerstone of the company, acting as both a global business hub and an experimental zone for their technology solutions. The goals and plans for this eco-city look like they were taken straight out of a sci-fi film. Run completely on renewable energy technologies, massive information systems, and self-driving cars, this city represents everything the UAE hopes to become. This case study will not concern itself with the larger apparatus of the Masdar umbrella but will turn its full attention to the examination of Masdar City specifically.

The revenue gained from the UAE's fossil fuel industry has made the country a modern marvel over the past three decades. The country's heavy reliance on this oil-based infrastructure powers its widespread use of air-conditioners, its polluting commuter culture of automobiles, and its

overconsumption of water resources. But with concerns over climate change and ecological destruction surrounding global inquiry, this modern way of life is threatened by the prospect of the UAE's oil reserves running dry. From this global fear comes a multitude of projects that are redefining Emirati culture, and reforming their political-economic way of life. UAE leaders such as Sheikh Khalifa bin Zayed Al Nahyanthe, President of the UAE and Ruler of the Emirate of Abu Dhabi, and Sheikh Mohammed bin Rashid Al Maktoum, Prime Minister of the UAE and Ruler of the Emirate of Dubai, have advocated for large scale economic reform to support a robust neoliberal economy that champions human capital, the privatization of many government services, and the integration of a knowledge-based economic infrastructure in addition to its oil-based infrastructure (Government of the Future, n.d.).²

The motive of Masdar City is to secure a foothold in sustainable energy technologies and to support the transition away from a fossil fuel dependency. To clarify, this case study does not claim that the UAE has any plans to decrease its production of oil. The Masdar City project and others like it are acting as supplementary infrastructures as opposed to replacements. Most of the energy needs of the city are met by photovoltaic solar power and concentrated solar power alone, with innovative projects, such as the construction of a solar thermal power plant, underway. Some of the most interesting aspects of Masdar come from its innovations not in energy production, but in decreasing

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² The UAE is not only concerned with infrastructures and resources; there are large scale educational, architectural, artistic, and humanitarian projects functioning throughout the nation to raise its global status as a modern, globally integrated world leader. For a quick look into some of the UAE's projects, visit the UAE's government website at <https://www.government.ae/en/about-the-uae/uae-future>

energy consumption, which is where this case study will focus most of its attention. Masdar's purpose is not just inventing new technologies and infrastructures; it is also about facilitating a cultural shift in its citizens' consumption habits. As will be seen in a discussion on neoliberal and environmental thought, lowering energy consumption to a minimum while maintaining a modern way of life is of the utmost importance to this project.



Figure 1: Artist's Impression of Masdar City. From www.dailymail.co.uk ©Foster + Partners.

This case study will utilize theory on energy, neoliberalism, environmentalism, and infrastructures to understand the ways that Masdar's innovations are changing the ways humans interact with the economy and with the environment they live in. At the core of the Masdar project is the idea of complete sustainability, where social, economic, and environmental factors can continue to produce and consume resources forever. An overarching theme within this study is how Masdar attempts to rethink energy as a social commodity as opposed to a strictly physical force in order to achieve sustainability. In this way, Masdar is the creation of an energy-centered, even obsessed, city. The intersection of neoliberalism with environmentalism will also be discussed to situate the context of this project within the United Arab Emirates, and will lead into a discussion of how ecological hope and technological promise are created by the aesthetics of this eco-city. This new form of energy infrastructure will be examined in its ability to both inspire change and facilitate the creation (aesthetically and politically) of a new identity for the UAE.



Figure 1: SHAMS 1 Concentrated Solar Power Plant. 256,048 Mirrors in an area of 2.5 km². Licensed by CC BY-NC-SA 2.0.

2. ENERGY, INFRASTRUCTURES, AND THE EXPANSION OF NEOLIBERAL IDEOLOGY INTO ENVIRONMENTALISM

Primarily two areas of theory have guided my examination of Masdar City. The first area is based in the study of infrastructures and examines the development of this zero-carbon city where energy production, transfer, and consumption are at the core of the infrastructure. Technopolitics and energopolitics will be used to evaluate the political rationality of the project, as well as to explore the implications of its technological developments. The second area is based on an understanding of environmental optimism within the neoliberal ideology, using Masdar City as a basis for examining how the value placed in the potential of technological systems can be sorely misleading. Neoliberalism, environmentalism, and the persona of the "ecomodernist" will be explored to understand this optimism. Ideas of speculative value will also be briefly discussed to see how this optimism is tangibly generated for this project.

At the center of both areas of theory and the entire project of Masdar City is the idea of utilizing energy in the most sustainable system thinkable. Energy must be understood as a dynamic, culturally utilized physical force where its harnessing, transfer, and consumption work to create value through a socio-technical system.³ Energy is essential to an analysis of Masdar City that explores the implications of its ambitions and the sociocultural potential of its infrastructures.

A. *A Discussion of Energy in Anthropology*

Energy as a topic has not been fully explored in anthropology. Except for Leslie White's introduction of this topic to the field in the 1940s and 1950s, and the recent resurgence of energy as a topic in the past two decades, this universal aspect of human life has been primarily untouched. This could be due to energy's uncertain place in the framework of anthropology and, for that matter, most social sciences. Energy is popularly viewed as a strict member of

³ A socio-technical system is a broader term used by many studying infrastructures in anthropology (see Anand 2011; Von Schnitzler 2013).

physics with a touch of chemistry, but the idea of the singularity of energy's relation to human life has been contested throughout the past century. It is important to note this history of energy in anthropology because with the rising anxiety of ecological disaster, the connection humans have with energy is growing more integral to our lives than ever before. Our trains, cars, and airplanes carry us around the globe, our heaters warm us in the harsh winter, our air-conditioners cool us off from a scorching sun, and our smart phones bind us together through it all. An understanding of energy as social commodity, political tool, and economic currency is essential in the analysis of energy becoming the absolute core of many sustainable infrastructures.

Examining how one chooses to characterize energy can be quite telling. For example, the ancient hunter-gatherer idealized one of the purest forms of energy humanity has ever sourced: fire.⁴ The first externalization of the human expenditure of energy is fire. It is also the first known natural force that humanity conquered and subjected to its rule. With it, humans outsourced their digestion of food and bolstered their defense against predators. To the ancient hunter-gatherers, energy was something to be collected and burnt—and perhaps even deified. How people use, collect, and perceive energy is derived from the social world in which those people are living.

Leslie White was the first anthropologist to have an explicit focus on energy, and his ideas were heavily reliant on physics. White wanted to explain the development of society evolutionarily based on how much energy it expends. This mindset was matched perfectly with the nuclear energy boom in the 1940s and 50s when energy potentials seemed limitless (see Potter 1940; O'Neill 1940). For White, energy was something to be measured as it pertained to a civilization's development. But with the recession and the "oil shocks" of 1973 and 1979, the older regimes of power were called into question, and the study of energy in anthropology separated from that of White to a study based in ethnographic development studies focusing on justice for indigenous groups (see Robbins 1980, 1984; Nordstrom et al. 1977), and the scientific politics of energy production (Nader 1981, 2004).

The most recent change to the study of energy in anthropology has taken place after a sort of hiatus in the subject (Boyer 2014). Recently, research has been focused on energy as the basis of human activity, and the remodeling of political power by changing the production, transfer, and consumption of energy in populations. In 2005, Harold Wilhite called for anthropologists to become involved in the study of energy because of rising concerns over climate change and how the consumption habits of the developed world strain "economic and environmental limitations of energy resources, as well as the economic and technical capacity to convert resources into usable energy" (Wilhite 2005: 1).⁵ More importantly, he combated the common assumption that energy can only fall under the technical spectrum because it is unrelated to humans. He argued that consumers do not consume energy, but instead they consume what energy makes possible (such as travel, motive power, and light), and through this, value is created in the form of "comfort, convenience... cleanliness," mobility, health, and even time saved through increased efficiency.⁶ To Wilhite, energy is something that creates value when consumed (i.e. the burning or electrification of energy), and energy should be studied to see how our social world is changed by the ways we use it.

Every new development in the study of energy in anthropology arises from a political uncertainty in energy production (see Boyer 2014).⁷ What has prompted the most recent resurgence of energy studies in anthropology is a societal fear of climate change and energy scarcity. From studying wind parks in Oaxaca (Howe 2014), to analyzing the potential of Latin America in developing renewable energy technology (Howe 2015), to the examination of an "energopolitical regime" in Russia between the state and a major oil company (Knox 2014), current research in energy anthropology is centered on power structures of energy in transition. It attempts to understand a world frantically transitioning between regimes of power and sources of energy. While White saw energy as something to be harnessed for societal progress, and Wilhite saw energy as a metric for creating value through consumption, many anthropologists today are seeing energy as a force to both create value and change social behavior.

4 Stephen Pyne's (2012) book, *Fire* explores the history of human interaction with fire. This intriguing look at fire as tool and fire as culture provides new ways of viewing human interaction with energy, as fire was quite likely humanity's first external expenditure of energy. Through what he deems, the "pyric" transitions, humanity learned to target the use of this wild resource of pure energy. We internalized the value that was created by fire through the creation of combustion engines, fueling the industrial revolution. Examining the manipulation of fire is just one example of new anthropological perspectives that can provide insights into energy production and consumption. I thank Dr. Christopher Roos for encouraging me to read this fascinating work.

5 Wilhite notes explicitly that consumption would be the most prevalent area in anthropology, in addition to some of the theoretical aspects of consuming energy that relate to infrastructural theory and which will be discussed in the paper. Wilhite states that energy itself is not valuable or useful to the consumer of energy until it passes through a "socio-technological system" where it is converted into something useful (see also Larkin 2013).

6 This insight can almost argue for the possibility of energy as currency in the case of the United Arab Emirates. This idea is one for future research.

7 Dominic Boyer gives a succinct history of energy in anthropology in his work, "Energopower: An introduction" where he outlines three generations of anthropologists that have studied energy, each with its own era of uncertainty around energy production. Those in the school of White in the 1940s and 50s were influenced by the rise of atomic power and the endless potential of energy seen in it. In 1973, northern imperial control over oil was challenged in the "oil shocks," and anthropologists such as Laura Nader questioned the effectiveness of nuclear power and oil infrastructures and the scientific community enforcing those views. Following a hiatus of research in anthropological theory in energy, the third generation has been focused on mapping out the effects of energy regimes becoming vulnerable and conducting case studies on how "energopolitics" can discipline and control populations.

But energy is merely a tool to the whims of our idealisms. Its production and consumption both hinge on the ideals of the people using the energy. Environmentalists have an entire pantheon of renewable energies they wish to implement around the world. Free-market liberalism has sprung its own approach to fixing sustainability issues, wholly attached to its idea of entrepreneurial ingenuity. To combat climate change, energy's place in the human imagination will change to be unrecognizable even to today's standards of renewable-tech fascination. But environmentalism will not win on its own—it needs an untouchable ideological ally.

B. *The Marriage of Neoliberalism and Environmentalism*

Climate change, and the ecological destruction that could ensue from it, is one of the main concerns for contemporary environmentalism. Some work in anthropology has touched on the ways our energy choices are affecting our environment and causing potential dangers to human health.⁸ Along with the concern for human health in the face of environmental disaster is the prospect of the world's oil supplies dwindling. With fears of economic growth in its current state being unsustainable, resources are becoming increasingly finite, leading many to view the limits of populations and resources as a Malthusian disaster (Jonsson 2015; Pimentel 2010).

This may seem grim, but, in fact, hope is flourishing. Much of the UAE's own concern for environmental sustainability is inspired by a global movement toward environmentalism. The United Nations has taken a leading role in setting agendas for global environmentalism starting with the creation of the United Nations Environment Programme in 1972 in Stockholm, Sweden, where a commitment to protect the environment and emphasize human health was made (United Nations 1972), and then renewed in 1992 with Agenda 21 in Rio de Janeiro, Brazil (United Nations 1992). The Johannesburg conference on sustainable development marked an even stronger commitment to an equitable world economy where poverty and human rights violations would be eliminated (United Nations 2002). A global initiative is most certainly in action to combat inequalities and environment-damaging practices. Environmentalists are unified for the cause but divided on the solution.

If the pillars of science and capital work together, new resources, materials, and technologies will be created and will become the new norm over depleted resources. Or,

at least, this is what the minds behind Masdar City hope will happen. According to Clapp and Dauvergne's (2015) book, *Paths to a Green World*, there are four categories of environmentalists: market liberals, institutionalists, bioenvironmentalists, and social greens.⁹ Market liberals and institutionalists emphasize market growth on a large scale, viewing a free-market as the solution to current issues in development. Bioenvironmentalists and social greens see the current world economy as unsustainable. Bioenvironmentalists follow the Malthusian line of thought in which population limits are the ultimate determinant of progress, while social greens see the global system as ridden with inequalities, and the entire movement of globalization as being a force for capitalistic dominance over the world. For the purposes of this paper, only market liberals and institutionalists will be discussed. Institutionalists see regulations as necessary for sustaining the market, and they advocate for a strong central institution to account for the functioning of the market. This is the closest fit for the environmentalism of the United Nations, as "institutionalists emphasize the need for stronger global institutions and norms as well as sufficient state and local capacity to constrain and direct the global political economy" (Clapp and Dauvergne 2015: 7). Market liberals on the other hand are strongly focused on a classic laissez-faire economic system where markets are unregulated so that growth can occur as it is warranted by the market.

This is where neoliberal thought enters the light of environmentalism. This market liberal view of a market unhinged by government involvement is most likely to draw in proponents of neoliberal thought.¹⁰ According to neoliberal thought, governments and institutions are to keep intervention in the market at a minimum as to not inflict bias into the market or to disrupt the accurate pricing of commodities, as it is thought that no institution can have enough information to "second-guess market signals" (Harvey 2005: 2).

Market liberals as presented in *Paths to a Green World* are the perfect agents of neoliberalism in environmental politics. Deregulation and the empowerment of private corporations in a free market is at the heart of this economic pathway to sustainability. If there is pollution in a developing country due to low environmental and economic standards set by the country, a market liberal would conclude that as economic prosperity (higher per capita incomes) enters a nation, environmental standards will be applied within companies (Clapp and Dauvergne 2015: 157-164). As seen on the UAE's government website, the country is a strong proponent of the market liberal viewpoint in its

8 Janice Harper's piece titled, "Breathless in Houston: A Political Ecology of Health Approach to Understanding Environmental Health Concerns," is focused on air quality in certain neighborhoods in Houston, TX. She showed that death rates due to asthma have risen, and the prevalence of asthma is growing in areas surrounded by industrial developments. Asthma tends to affect poor and impoverished groups. Overall, Harper blames this phenomenon on the untethered growth of industry, and she calls for public education and lobbying for regulation.

9 I thank Dr. Nicolas Sternsdorff Cisterna for recommending this book to me in the early stages of my research.

10 See Harvey (2005) and Wood (2002) for in-depth discussions and histories of economic thought in liberalism, classical economics, and neoliberalism. Neoliberalism is an economic philosophy that champions deregulation and a free-market. David Harvey states that, "Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade" (2).

attempt to be attractive for businesses entering its market.¹¹ Masdar City itself is supposedly a haven for free, unhindered business opportunities with little to no regulations (Youtube 2017a). It should be noted that the UAE is neoliberal with a twist, as most of its corporations are heavily influenced and run by the government. The UAE is like the connection David Harvey (2005) makes with Deng Xiaoping instituting neoliberal traits in the authoritarian Chinese economy in the late 1970s, in that the UAE is an authoritarian regime that directs the flow of capital to free markets where it can flourish. In this way, the UAE is neoliberal through its state-driven capital. Sheikh Mohammed bin Rashid Al Maktoum, the Prime Minister of the UAE and ruler of the emirate of Dubai, controls and runs a wide variety of holding companies in the country.

Along with its business-friendly atmosphere, the UAE also exhibits the qualities of a neoliberal economy in its unwavering commitment to technology and human ingenuity as the solution to environmental issues and economic growth. In this way, they could even be referred to as “ecomodernists” as Isenhour (2016) discussed in his ethnography of Swedish and Chinese efforts to mitigate climate change without sacrificing quality of life and economic growth. Alternative energies were at the heart of the agenda for these movements, and they attempted to provide a solution that was solely based on hope for scientific ingenuity. As will be discussed in the case study, the rhetoric of the UAE government shows that they value technological progress above all else.

Gunel (2017) presents an interesting view on many of the initiatives seen in the UAE, stating that climate change is seen as a business opportunity, where the private sector is forced to innovate to survive and is tasked with networking the system of the future. The UAE has most definitely taken up this task with flying colors, but this opportunity for the country to rebrand itself and slowly deconstruct its oil-based infrastructure is revealing the extent to which the neoliberal ideology of corporate freedom and unhinged markets are affecting environmental efforts. The UAE is using the notion of climate change as an opportunity to get ahead in the clean technology industry. In this case, climate change is not a bad thing, but a chance for businesses to innovate new technologies and to get an early start in the clean technology industry.

The UAE is appearing more like a market liberal, “ecomodernist” country with their trust in technological innovation and human ingenuity. An astounding aspect of Masdar is its focus on energy infrastructures as the cornerstone of the city’s purpose. What would an infrastructure that focuses entirely on the production and consumption of energy look like? How is this attempt to change our approach to fueling a city physically manifested in Masdar? Infrastructural theory, as it explores the inner, often hidden, workings of systems, will be used to understand the rationality behind what guides the conception of those workings.

C. *Technopolitics and Energopolitics: Achieving Social Longevity*

Energy is more than just a topic in particle physics, than the calories humans consume, or than the kilowatts humans expend. Energy is pure value. With rising global concerns over climate change, nations and entire unions of nations are rethinking energy production and consumption. The UAE, being the market liberal, ecomodernist state it is, created a city based around the value of energy that works with, instead of around, the environment. Here enters infrastructural theory, the field that explores how our built structures and systems change social customs and behaviors, and sometimes create them from scratch. It should be noted that since Masdar is not yet functioning near its planned potential, it must be examined as vision, and infrastructural theory will aid in fleshing out some of Masdar’s more elusive elements.

The study of infrastructures is of recent interest in anthropology.¹² From studying the electrification of the developing world (Wilhite 2015), to the urbanization of Kinshasa in the Democratic Republic of the Congo (Boeck 2011), much of the work in infrastructures is concerned with themes of globalization, modernity, neoliberalism, citizenship, and biopolitics (Anand 2011; Khan 2006; Larkin 2013; Von Schnitzler 2013; see also Besky 2016 and Ferguson 2005).

Brian Larkin (2013) wrote an encompassing review of literature on infrastructures where he touched on the idea of a technopolitics present in many projects, which focuses on how infrastructures organize populations and territories and can reveal the “political rationalities that underlie technological projects” (Larkin 2013; 328).¹³ Also, as mentioned in the section on energy, an interesting way of studying energy in a socio-cultural context is through the power exhibited by energy regimes; energopower. The idea of energopower was extensively explored in a special issue of *Anthropological Quarterly* in 2014 (Ed. Grinker), where the concept was defined and introduced by Dominic Boyer.

“I would describe energopower as an alternative genealogy of modern power, as an analytic method that looks in the walls to find the wiring and ducts and insulation, that listens to the streets to hear the murmur of pipes and sewage, that regards discourse on energy security today as not simply about the management of population (e.g., “biosecurity”) but also about the concern that our precious and invisible conduits of fuel and force stay brimming and humming. Above all, energopower is a genealogy of modern power that

11 “Bashr” is an eService that allows anyone to quickly setup and begin operating a credited business within the UAE in an almost immediate fashion. Learn more at <https://www.government.ae/en/information-and-services/business/bashr>

12 The curated collection in the journal *Cultural Anthropology* titled “Infrastructure,” edited by Jessica Lockrem and Adonia Lugo offers an introduction to the breadth of knowledge that the study of infrastructure holds.

13 I thank Dr. Maryann Cairns for encouraging me to read this work and to explore theory on infrastructures.

rethinks political power through the twin analytics of electricity and fuel” (2014: 325).

Boyer described the idea of energopower as a modern adaption to those concepts of the Foucauldian “biopolitical” to understand energy as a “companion and collaborator of modern power over life and population from the beginning” (Boyer 2011: 5; see Foucault 1991; 2003). Inherent in both energopolitics and technopolitics is the theoretical foundations of biopower, created by Michel Foucault in the second half of the twentieth century. Simply put, biopower is control any type of government holds over massive populations without ever using physical force. (Physical force can be involved, but my examination into Masdar City does not utilize any such traits of biopower.) It is the voice in the heads of the people that prompts them to abide by the laws and customs of a system. It can function in the form of fear: to not speed because an officer could be right around the corner, to not smoke marijuana because it might show up in a random drug test in the office, or to not use the fire-escape door because it might sound an alarm. But biopower does not just function out of fear; it can function through a necessity created by social systems the government itself established. An example of this can be found in Von Schnitzler’s (2008) work in South Africa on water metering, which saw the local government issue water meters to help eliminate waste in townships. In this new system, citizens would be responsible for their own calculations on water quality and consumption. The citizens consumption of water decreased, in part because they could now see and be aware of their consumption habits, and because of the agency that the citizen gained in the end, both economically and politically. The government championed scientific citizenship to great success. This piece showed how introducing an infrastructure could successfully change the approach to water management, and thus the lifestyle, of the citizens. The water meters acted as a disciplinary infrastructure, and in this way, the concept of biopower will be employed to study Masdar’s attempt to change its citizens’ behavior.

The energopolitical, disciplinary infrastructure that Gunel (2014a) studied in Masdar City through the creation of the “ergos” currency is based on the networked behavior of citizens and the allotment of energy usage per household. Ergos replaces dirhams with kilowatts and would essentially monitor and limit an individual’s consumption of energy based on a preset energy budget. Masdar wished to build the world’s first zero-carbon emission city without sacrificing economic growth, and technical solutions alone could not accomplish that. A change of behavior in consumption patterns would also be required. Ergos is about both forcing a change in consumption within citizens and making each citizen aware and responsible of personal energy

consumption.¹⁴ This successfully happened in South Africa with water consumption; why not in Masdar with energy consumption?

Even a redefined energy, a changed citizenry, and a free-market entrepreneurial mindset are not enough to make a zero-carbon emission city happen. One ingredient is missing still: optimism and the creation of value in the minds of the beholders. This project would not be possible if the people behind it were not pragmatists first and idealists second. Projects like Masdar City require technical experts and ruthlessly practical thinkers. But without trust in the potential of the project, no amount of practicality can save Masdar City. This trust is secured through an optimism about the promise of technology to solve our problems. The ecomodernist persona of the UAE sought to bring life to their neoliberal fantasy through the optimism that is communicated through the aesthetics of the architecture, and the creation of “hype” from the city’s ambitious goals.

D. Optimism and the Generation of Value: Creating Economic Incentive

There is a promise made by technology in our minds, which assures us that science, capital, and government power will not fail us. To create value and amass capital, the creators of Masdar City must play on the technological fantasies of investors and government officials.

As the UAE’s future depends on environmental stability, much faith is put in the capabilities of their technological projects. Dubai’s Clean Energy Strategy includes building the world’s largest solar tower, making them a world leader in solar power development.¹⁵ Many anthropological field studies have been conducted in the UAE that examine both technological developments and modernizing agents in the country. They explore the ambitious projects of green businesses in Abu Dhabi (Günel 2011; 2014a; 2014b; 2016; 2017), the development of US universities in Abu Dhabi (Looser 2012), and the swift rise of neoliberalism in Dubai’s cultural processes and young labor force (Kanna 2010). To fund projects like these, this faith in modernity and technological solutions must be withheld. How? Advertising is a surefire way of creating exposure, but it can often fall short of convincing investors and government officials. The UAE needed more than exposure—it needed symbolic significance. And Masdar City’s significance exuded from its aesthetics and architecture.

Larkin (2013) proposes that examining the aesthetics of infrastructure can offer insight into how the politics can be constituted through symbolic, semiotic, and aesthetic means. He also posits that “...it forcibly reminds us that the deeply affectual relation people have to infrastructures—the senses of awe and fascination they

14 Anand (2011) witnessed the production of “hydraulic citizenship, a form of belonging to the city enabled by social and material claims made to the city’s water infrastructure,” where he looked at the unequal dispersal of water in the slums in Mombasa (545). He studied both an infrastructure of pipes and engineers that was the water system and a communicative infrastructure where communities in need of water would engage *dadas*, patrons who provide infrastructural connection in exchange for electoral support.

15 See link to UAE Government Website for more information on the future technological plans for the country. <https://www.government.ae/en/about-the-uae/uae-future>

stimulate—is an important part of their political effect” (334). Larkin later clarifies a fascinating way to view infrastructures based on embodied experience as opposed to a representational being. Larkin states,

“Aesthetics in this sense is not a representation but an embodied experience governed by the ways infrastructures produce the ambient conditions of everyday life: our sense of temperature, speed, florescence, and the ideas we have associated with these conditions. Infrastructures create a sensing of modernity (Mrázek 2002), a process by which the body, as much as the mind, apprehends what it is to be modern, mutable, and progressive.” (336-337).

In Masdar, the ambience of its infrastructure communicates a sense of progress and embodies the aspirations of the UAE. As stated earlier, neoliberal optimism is the hope felt by many market liberals and ecomodernists that human ingenuity, and thus economic growth, will save the planet from ecological destruction. This neoliberal optimism is made manifest by the look and feel of Masdar City’s modern infrastructure. This aesthetic of modern success creates value and thus generates capital for the city. Thus, Masdar, being an idealized city, primarily persists on an infrastructure of speculative value.

Infrastructures are not all sewers and pipes; they can act as dynamic social networks or cultural institutions.¹⁶ The speculation of value is one of those forces. Tsing (2000) examined the 1994 instance in which a Canadian gold-mining company—Bre-X—announced that gold was in Kalimantan. Heavy investment poured into this venture, while an intense battle over ownership ensued. This sharp increase in value continued until 1997 when it was discovered that Busang mine was barren. How was value so vigorously created with the potential of a substance and the speculation of a presence? The gold that gained so much value never even existed, and Tsing argues that this was possible through the functioning of an “economy of appearances” (118). This economy is based on the creation of spectacles that catch the eyes of investors. As Tsing states, “no one would ever have invested in Bre-X if it had not created a performance, a dramatic exposition of the possibilities of gold.” Drama, suspense, and anticipation guide the market in these situations, and often, this economy of appearances is active in the creation and funding of massive technological projects.

Masdar brings pride to the nation that created it and emboldens it to strive for more. But the dark side of the

economy of appearances is all too encompassing, with fantasy outselling truth. Much of the project seems to be more about the appearance of the project through its promotion, its physical representation, and its ambience than the project constituting what would be considered a “city.” It is through this promise of modern achievement that Masdar stays afloat. But this is to be expected. Masdar is an investment company first and a techno-city second.

This case study will call on many areas of knowledge to understand the implications of Masdar’s innovations. The anthropological theory included in this analysis spans an understanding of energy as social commodity, infrastructural theory, and political economics. With this theoretical basis, the innovations of Masdar City will be analyzed.

3. MASDAR: A PROJECT OF MANY MINDS

This massive project came to life in 2006 with the collaboration of a multitude of companies and institutions. The Masdar initiative is wholly owned by Mubadala Investment Company, a UAE international investment company focused on sustainable energy and resource infrastructures. The project was originally funded by a US\$22 billion investment from Mubadala leading to the creation of Masdar Venture Capital, Masdar City, and Masdar Clean Energy, and other smaller sects of the firm such as Masdar Carbon and Masdar Power. This case study is focused on Masdar City specifically.¹⁷ The Masdar project is also lined with international partnerships, as the English firm Foster + Partners was hired to design the city, and the Massachusetts Institute of Technology was brought in to facilitate the creation of Masdar Institute, the on-site research university. This “zero-carbon emission city” could be the technological savior that market liberals and ecomodernists have always dreamt of. But it has not been easy, and much of the international value that has been attributed to the city has been due to a hype generated by Masdar’s own self-promotion.

This case study will first look at why Masdar exists in first place, and what Masdar is expected to do. It will explore the innovations that have come the out of the project and their implications, examining the proposal of the energy currency “ergos” as a disciplinary and communicative infrastructure. Then, the architecture and the ambience of the infrastructure will also be examined to see how the intense integration of infrastructure into architecture creates a sense of promise and ecological hope within the city, thus promoting the project’s neoliberal optimism about technological solutions. Before delving into the specifics of

16 Besky’s (2016) work in the Indian tea market dealt with a “communicative infrastructure” through the outcry auctioning process as a social infrastructure. Her work studies how the Tea Board of India began a renewed effort to convert the auctioning process from the old, outcry auctioning process to a digital one. Much of the tea’s value had to do with the embodied experience of each tea, and the relationships of brokers. With this face-to-face interaction between brokers gone, the infrastructure of the old system collapsed. Besky connects our understanding of the embodied experience of the tea with the value we place in it through this communicative infrastructure. It is from a similar line of thought that value is generated for a project like Masdar City. I thank Dr. Sternsdorff for recommending this reading.

17 Masdar Clean Energy acts as a global investor in renewable energy technologies.

Masdar, it would be beneficial to answer the question of why: Why does Masdar really exist?



Figure 3: Masdar Institute of Science and Technology.
©Foster+Partners

A. *The Goal of Masdar*

Masdar has a highly specific end goal, formed by a daunting question: how can we make a city where citizens expend the least amount of energy while maintaining a high quality of life, while the infrastructure produces the most amount of energy possible without at all affecting the environment in and around the city? The most important part of this question is “high quality of life.” As Sultan Al Jaber, CEO of the National Oil Company, Chairman of Masdar, and Chairman of Abu Dhabi ports (From Gunel 2014a) says,

“We 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” (360).

They are setting a goal that many modern countries are hoping to achieve, to change the source of our energy without affecting our current quality of life. Can people’s quality of life still be rich with a reduced consumption of energy? Sustainability would not be as difficult a task if citizens were willing to give up their modern lifestyle. This is an especially important question to ask in the UAE as their lifestyle is made luxurious by heavy “air-conditioning, chilled swimming pools and even an indoor ski slope in the emirate of Dubai” (“Abu Dhabi Explores Energy Alternatives,” 2007). The UAE is criticized for being one of the world’s leading emitters of carbon dioxide and other greenhouse gases, a title which it undoubtedly holds because of citizens’ enjoyment of modern lifestyles almost entirely supported by fossil fuels (Gunel 2011).

But under this publicized goal lies another more nationalistic and economically incentivized goal. This city has business incentives that “make ‘zero carbon–zero waste’ a kind of catch-phrase or a fashion statement that would enhance the value of the real estate” that the eco-city would offer (Premalatha, Tauseef, and Abbasi 2012: 660). Is Masdar our ecological savior or just another slogan? This is

an important question to ask, especially considering the neoliberal (although authoritarian as discussed before) nature of the UAE. The project has yielded and will yield great results. But it also has a precarious nature in that its survival relies on the faith that the state holds for the city.

B. *The Battle between Sun and Sand: Maintaining the Environmental*

Masdar, in its most true and simple form, is the “source” (its actual meaning in Arabic) of the UAE’s future as a modern power. All the problems faced during construction and the innovations devised to solve them are manifestations of this identity. Masdar is the source of, and the pathway into a knowledge- and information-based economy, leaving behind the crude oil and labor/resource-based economy of its past. Masdar is also deeply rooted in the rebranding of the UAE as a nation of engineers and businesspeople and its rebirth as a frontier modern nation with human intellectual prowess at its helm.

In Gökçe Günel’s (2016) work, “Inhabiting the Spaceship: The Connected Isolation of Masdar City,” she paints a metaphor of Masdar as a spaceship, secluded from the wild, uninhabitable outside world by the walls of modernity. In this metaphor, the spaceship is “demonstrating the inevitable boundaries of human activities, vilifying the space beyond human habitability, and producing the outside as a vacuum that should not be inhabited” (364). Masdar is an entity that is separated from the desert by a veil of modern development and shows how human technologies can conquer nature (Gunel 2011; 2016). But this conquest was far from easy and was beset by technical difficulties on the first day of construction.

Building this city in the middle of the desert was not the optimal situation, but it was all that was afforded to the initiative as the land along the coast of Abu Dhabi was already lined with development (“Masdar: Exploring Our Future” 2012). But the desert location is only one of many problems Masdar’s planners had to work around. Significantly, the UAE’s overconsumption of water and overuse of air-conditioners will come into play in Masdar’s construction, as water will have to be used sparingly, and air conditioners will be strictly prohibited because they guzzle too much energy. Throughout the construction process two elements have proven to be both promising allies and unforgiving enemies: the sun and the sand. Both have enabled innovations but also threatened the success of the project. Sand is the unpredictable substance that is everywhere; there is no escape from the sand. The sun on the other hand is extremely predictable and is the source of the city’s energy. The issues that were at the center of most of the decisions made during this construction process were heat, wind, water, and sand.

The city was built on flat sands which make for a terrible foundation because the sands could shift and dangerously destabilize the buildings. Large concrete pillars had to be sunk into the sand to act as the foundation to the city, with the concrete itself being made with mixed recycled metal waste so that it would be less susceptible to erosion by

salt water deposits within the sand.¹⁸ But sand did not cease as a problem after this initial issue; the uncontrollable nature of sand would eventually find itself covering solar panels and decreasing their efficiency of energy capture (Gunel 2016; “Masdar: Exploring Our Future” 2012). In an interview with Afshin Afshari, head of the Masdar Energy Department, this issue was discussed as a large hindrance on energy harnessing. With the strain on water use, it would be unsustainable to clean the panels with water even once a week, so there is much labor put into cleaning the panels with brushes, with the common job being titled by many, “man with a brush” (Gunel 2016: 370).

But sand is not all bad. In fact, just as sand impeded the good relationship with the sun by covering solar panels, it also protects the city from the sun’s heat. Austin Relton, an architect working in Masdar, used RVC—Reinforced Vitrified Concrete—as the façade for the dormitories (“Masdar: Exploring Our Future” 2012; see Fig. 3). RVC effectively insulates against heat and does not require cleaning, thus reducing the use of water, and effectively solving both the issues of no air-conditioners and rare use of water. With temperatures reaching 130 degrees Fahrenheit on days during the summer, materials like this are essential.¹⁹



Figure 4: Facade of the Masdar Institute Dormitories. By Masdar Official. Licensed by CC BY-NC-SA.

The heat is not just an enemy to the cause though. It is also a pathway into the frontier of innovation for Masdar. Dr. Matteo Chiesa, a professor of Mechanical Engineering at MIT, worked with his students to build one of the largest solar thermal plants in the world, with solar thermal plants being a recent addition to the solar power family alongside the older photovoltaic panels (see Fig. 4). Only around ten exist in the world. Thermal power panels are different from photovoltaic panels in that thermal panels

use the pure heat of the sun to harness energy while photovoltaic panels convert the sun’s light (photons) directly into energy. This is giving the UAE a leg up in clean technology on a global scale, as this technology enables the storage of electricity without large, expensive batteries.



Figure 5 Masdar Solar Thermal Plant. Photo from Gineersnow.com

These innovations, from the small to the big, contribute to our understanding of Masdar on a monumental scale. Masdar exists with the purpose of facilitating a transition between economies born out of a fear of ecological destruction and an ecomodernist mindset to solving the problem. And now, the persona of Masdar has developed into the actual “source” of the UAE’s modern future. Innovations in technology are useful, but to achieve the goal of Masdar described above, more needs to be done than just solving technical issues in infrastructures. A sociocultural change in consumption must take place. Masdar attempted to facilitate this change in consumption habits by developing a highly intelligent data collection system that monitors energy consumption.

C. Why Monitoring Matters to the System: Maintaining the Social

As seen from other works on sustainability, water conservation, and allotment specifically (Von Schnitzler 2008; Anand 2011), citizens must be willing to learn about how to more efficiently use and conserve their resources and then take it upon themselves to monitor that consumption for sustainability to be realized. It is not enough for a perfect infrastructural and architectural system to be designed in line with the standards of sustainability, the people living in that built environment must be wary of expending too much energy and consuming too many resources.²⁰ In Masdar, this information collection and storage is done in the basement

¹⁸ As concrete is a large emitter of carbon dioxide, Masdar city has always attempted to make concrete a smarter and more sustainable construction resource. It announced a competition for the most sustainable concrete in 2010 (see Elchalakani, Aly, and Abu-Aisheh 2013).

¹⁹ Literature concerning the difficulty of labor for the construction workers would be an interesting exploration. For countries like the UAE who are committed to religious obligations/celebrations such as Ramadan, how do workers get by? It is already hard enough to work in temperatures of 130 degrees but doing that while fasting is another story.

²⁰ Water consumption and conservation in the UAE and Masdar City would be a fascinating topic for further research. As discussed in the documentary, “Masdar: Exploring Our Future” by Saint Thomas Productions in 2012, the average water consumed per head per day is 121 gallons, compared to the UK’s consumption of 23 gallons. Masdar has the goal of achieving a consumption rate of 39 gallons per head per day. Water consumption is also monitored alongside electricity use.

of the Institute where the “hidden brain” is (Gunel 2011; 2014b). An interview with the Masdar Technical Director, Martin Potter, who is nicknamed “the green policeman,” shows the power that this system has. Potter says,

“We can actually measure down to 1kWh, and we can differentiate between each and every residential apartment on campus... If I put all the information together on a graph, I could go and knock on somebody’s door... and say ‘you are the biggest hour consumer on campus.’ And you can’t deny the figures because we know the figures coming out of the system are accurate. Facts are facts.” (“Masdar: Exploring Our Future” 2012: 33:15).

The project requires an actor that is focused on monitoring consumption on an individual level to assure that the population is not consuming more energy than the campus can produce. Along with this individual level of monitoring comes a practice reminiscent of a dystopian novel: the wind tower light. Near the center of the city sits a wind tower that helps cool the city streets by funneling air from 150 feet above down to the bottom of the tower. Every night, there is a light on the wind tower that lights up in either blue or red. When it is blue, everyone can carry on as usual because consumption levels are manageable, but if the light turns to red, then that signifies that there is over-consumption within the campus, and all showers are immediately shut down and unnecessary lights are turned off. Imagining life where you look out your insulated, spaceship-like window to see a red hue emanating from a daunting central tower is, at the least, an eerie sight and, at the most, borderline dystopian (see Fig. 5).

One image that comes to mind when considering the wind tower is that of the “panopticon,” which was originally posited by Jeremy Bentham, and which has been further explored by Michel Foucault (Foucault 1984: 206-213; Sarup 1993: 66-69).²¹ Masdar’s citizens may not be monitored by direct line of vision like in the panopticon, but its data collection system monitors the activity of its citizens extensively. The wind tower is a biopolitical symbol of power that encourages its citizens to internalize a system of self-governance over their energy consumption (see Foucault 1991). Just like in the case of the panopticon, citizens do not know when they are being monitored at any given moment, and this fear of being caught over-consuming or being wasteful essentially encourages the citizens to be responsible. What connects these two structures is their display of power as a biopolitical disciplinary force.



Figure 2 Wind Tower Glowing at Night. From www.dailymail.co.uk ©2011 Bloomberg

But this fear is partially due to the inconvenience of the power shutting down, not to the actuality of a dictatorship over energy consumption. Potter continues with, “some of them [the students] do resent being watched, but we don’t impose problems on them, we just let them do what they do and we reeducate them, and it’s up to them if they want to accept.” This comes back to the central insights offered by work in the field on the importance of citizenship in sustainability. The people must be willing to change their habits too—it is not just up to the infrastructures and the energy harnessing technologies to change.

Cities, governments, and institutions need to discipline their citizens in some way to become more conservative with their energy use. In Gökçe Günel’s (2014a) work, “Ergos; A New Energy Currency,” she examines the proposal of an energy-based currency that converts dirhams to kilowatts and explores how the individual becomes a unit of governance in this system. Simply put, an ergo is a pre-allocated budgeting unit of energy consumption that is given to every individual.²² This is a biopolitical movement at its heart. The institute is changing citizens’ behavior in the long run by making their consumption more relevant to them. This idea of relevance to the citizen is vital; as a proponent of the ergos system at Masdar Institute argued, ergos would make currencies more “tangible,” referring to the transition of currencies from an arbitrary definition of value in the economic world to a direct expenditure of energy. This tangibility of currency makes

21 Bentham’s panopticon is a circular prison where guards are stationed at the inner core and the inmates are in the surrounding areas. The prison was designed in such a way that the guards would have a direct line of sight towards the inmates, but the inmates could not see the guards. Thus, the inmates would never know when they were being watched, and the prison’s structure would serve as a tool for modeling the inmates’ behavior based off this fear.

22 Considering the integration of this technology into the city’s database and mainframe, and the assumed digital nature of this currency, an interesting realm of research would be in how ergos could play into the economies of cryptocurrencies.

energy transactions mean more to the citizen. It would also redefine the meaning of a currency; instead of a currency signifying lines of debt and value, it would be an “information-tracking system” (Gunel, 2014a: 362).

Using the ideas of technopolitics and energopolitics, an initial insight is gained. How much monitoring, and at what intensity, would citizens be subjected to (Gunel 2011a: 361)? Regardless of the existence of ergos in this city, if the entire city is created and crafted into technological perfection, who controls the mainframe and databases? The algorithms required? The maintenance of the renewable energy technology integrated across the city in every building? Who gets the most direct access (and the best prices for) this energy? These questions cannot all be answered within the length of this study, but they are important questions to ask and act on as an inspiration for future research on the topic.

A general concern regarding this system is that this currency could give the central agency too much oversight into peoples’ activities, creating a “big brother” type scenario. If citizens did go over their consumption limit, it is unclear what action would be taken to discipline over-spenders. This dictatorship does not exist today in Masdar, but the technology that would allow that governmental character to form does exist in the “hidden brain,” as it is referenced earlier.

Although this is an intriguing development, ergos is just one innovation of the many that have been cut. As Gunel (2014a) states, “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.” This raises an interesting question; can we find a willingness in the population to submit themselves to this disciplinary biopolitics? In most areas of life, the population already does submit themselves to biopower; the citizen (for the most part) wears a seatbelt and requires others in the car to wear one as well. Despite the rule’s inconveniences, for their own safety and the safety of others, citizens obey it because it becomes habit. Even if the driver does not care about his/her safety or the safety of the other people in their car, they usually wear a seatbelt because of the price associated with being caught without one on. What is different about the citizen obeying the rules of micro-energy consumption? Despite the inconveniences of the rule, there is social cause behind the rule (the perseverance of society), there is fear behind the rule (a possible fine or the power shutting off), and there is a pattern of habits that could be established from it. Perhaps the issue lies in the monitoring itself. As discussed before, energy consumption encompasses every activity of a modern way of life; therefore, the mere monitoring of a citizen’s time in the shower or how cold they like their room at night reveals much about a citizen’s habits and behavior. Would a citizenship be willing to put up with this type monitoring? As of now in Masdar, it seems the answer is yes, but as the system becomes smarter, and more measures are taken to decrease consumption, the pendulum could easily swing the other way.

The political rationality of having a massive database of citizen’s consumption habits is simple. If the people believe their actions are being monitored, they will begin monitoring their actions more strictly to not get fined

or have their power turned off. But this is more than a disciplinary infrastructure; the database and ergos would be a communicative infrastructure as well. There is a column in the middle of the institute’s courtyard that displays all the energy consumed by the institute, and so anyone can view the data. The database in this instance looks less like some force of evil to monitor people’s activities and more like a community initiative that aims to inform the populous of where they can do better. People could begin working together as communities to increase their energy efficiency. Small innovations like this one offer a use of the data that is non-personalized (meaning that no single individual will be called out), and actually takes some of the power and responsibility out of the government’s hands and puts it into the hands of the people.

As Potter discussed before, it is up to the citizens to change their behavior—the system is just there to inform. But there is room for reasonable skepticism about the nature of such energopolitical systems. As discussed before, energy expenditure patterns give some of the most honest inclinations of a consumer’s habits and behaviors. How does a consumer spend his/her time? What activities are really being done by a specific person in a specific place in a specific time? For the first time, these questions can be easily answered without the use of a government spy, a hidden camera, or a microphone. The energy regime recording this information could go further than just informing citizens of their poor consumption habits; they could sell massive batches of data to advertisers and companies like Google, Amazon, and your favorite local grocery store. A consumption monitoring system like this is a gold mine for corporations.

In this is the prospect of expanded and expedited control over populations through the monitoring of their daily activities (i.e., their energy consumption). While the ergos currency system and the data amassing information system is benign in its current state in Masdar City, developments of this system to more accurately track peoples’ activities and consumption habits could lead to the selling of information and the corporate manipulation of data for advertisements and marketing purposes. In terms of governance, this disciplinary system could and most likely would be used to force behavioral change. Force being the key word here; instead of Martin Potter knocking on the door of some over-consumer and politely asking that person to lower expenditure, perhaps the perpetrator will be sent a large fine or an official warning. Perhaps after enough violations the over consumer’s energy would be deactivated. What would energy bankruptcy look like? Worse than this, less-forgiving authoritarian governments could use stricter, punishment-based disciplinary biopolitics to monitor energy consumption.

The disciplinary system would be more directly effective in changing behavior, but people would be more agreeable to the institution of a communicative approach. The fears and dislikes of a strictly disciplinary approach are not present in a purely communicative infrastructure, as the data collected would be communicated back to the citizenry in general, and thus be instituted as an informational device that gently guides people to better habits. The console in the middle of the courtyard in Masdar acts as a community initiative to improve energy efficiency. Similar consoles

installed in a person's residence would act as a personal initiative to improve energy efficiency. One could set their own consumption budgets and police themselves, while the console is present to inform and guide. In the United States of America, a disciplinary infrastructure with a centralized agency for data collection, such as the "hidden brain" in Masdar, would not be looked upon positively. In countries where people cherish a sense of privacy, perhaps a better approach to invoking a behavioral change would be instituting a communicative infrastructure.

Expounding further on the possibilities of these innovations, data ownership could become an area of major debate about systems like the ones this paper has discussed. A centralized agency collecting data may be less feared if the ownership of any specific data was reserved to the person that data references. For future research, one could investigate how cryptocurrencies would play into an idea like the ergos currency. Trading credits of potential energy is something that a blockchain could be well-suited for. The decentralizing agent of the blockchain may be an interesting aspect to focus on, as many of the issues associated with ergos and its information-tracking system was the power that it granted a centralized entity.

The above section is all about the ways in which Masdar City has tried to change the behavior of entire populations. The last section will focus on the symbolic gestures, the architecture, and the self-promotion of the project. This economy of appearance will be explored in how it communicates to the world a sense of promise, hope, and neoliberal accomplishment and thus creates capital from the imagination.



Figure 7 Wind Tower and Central Courtyard. Photo from Masdar Official. Licensed by CC BY-NC-SA 2.0

D. *Aesthetics and Ambience as Symbol and Strategy: Maintaining the Economic*

There are many minds and different companies working on this project, but what unites them is a strict adherence to sustainable development and common belief in the ecomodernist ideal of human ingenuity being unstoppable. The product of this city's form has much to do with symbol and plays a key role in the strategy of the UAE to rebrand itself as a world leader in clean technology. The aesthetics and ambience of Masdar's architecture will be

examined to see how the UAE's neoliberal optimism is made manifest by the structures and infrastructures that form Masdar. This production and promotion of identity is an important task for the many companies and stakeholders of this project.

One mind in specific is that of Norman Foster, the founder and leader of Foster + Partners. In an interview with the *Guardian*, Foster explains that symbolism is the key to the architecture of Masdar ("Masdar City, Abu Dhabi: the gulf between wisdom and folly," 2010). Foster wished to draw on "the accumulated wisdom of centuries" of Middle Eastern culture and tradition. The idea of using the past to help solve the problems of the present is echoed in the philosophy of architect Austin Relton, mentioned earlier, in solving issues related to heat and wind circulation. The streets and courtyards must be cooled naturally without the use of air-conditioners or too much water consumption. Even in the summer the city must be pedestrian friendly. This idea of using ancient Arabian techniques on modern problems is exemplified with the construction of the 150 ft. wind tower in the center of the institute. Fueled by the shamal, a north western wind that blows through the desert, the tower stands tall, catching the wind at the top with water misters humidifying the air. Thus, cool, humidified air is dispersed throughout the courtyard (see Fig. 6).

Modeling this city after ancient Middle Eastern cities goes far deeper to the roots of Masdar than a mere wind tower; the entire city is designed to reduce the amount of sunlight hitting the streets by placing the buildings at a close distance to one another. Modeled after cities in Yemen, Masdar's streets are also built to line with the northwestern winds of the shamal. These developments are not purely for practicality—they have a governmental motive as well. In this way, the city is the perfect split between symbol and innovation.²³ As Larkin (2013) is cited earlier in this paper, "infrastructures create a sensing of modernity" (337). The textures and curvatures of some of Masdar's buildings have the practical purpose of producing wind flow throughout the city, but function as a form of governance over the population, communicating a sleek and almost groomed experience of modernity (see Fig. 7). This brings back to mind the metaphor of Masdar as a spaceship, a technological zone of human comfort and security. This city is modernity defying nature at last. The market liberal/ecomodernist/neoliberal would look at this project in awe as proof that humanity's problems can be solved purely by businesses innovating technology.

23 An interesting look at modern architecture is given by Marc Kushner in his book, *The Future of Architecture in 100 Buildings* published in 2015. He highlights the fight within architectural development between symbol, what is familiar to us, and innovation, what will push the boundaries of the human built environment.



Figure 8: Masdar City Street View. By Raphael Iruzun Martins. Licensed by CC BY-SA 4.0

As discussed in the theoretical section, the aesthetics and ambience of infrastructural systems can embolden and inspire its citizens, and as seen here, this is true of Masdar under the philosophy of Norman Foster and Austin Relton. This is the positive side, but the “economy of appearances” that Tsing (2016) identified in the gold mines of Indonesia is still pulling many strings in the survival of this project. From viewing the official Masdar welcome video, “Masdar: Who Are We?” found on the UAE’s website,²⁴ several aspects of the project become apparent. To start, Masdar is a globalized company that produces remarkable work around the planet, a clear example of self-promotion. It is true that they have accomplished many feats, and it is only natural for any company to propagate their achievements. But its promotion is reminiscent of the UAE’s neoliberal approach to business with the narrator stating that Masdar “Provides businesses with a hassle-free environment to operate and thrive in” (2:00), essentially saying that the city has purposefully deregulated their market to give startups more room to grow. Again, this is positive news, but focusing in on Masdar City, it is distracting to the fact that many would see the “city” part of the project as a failure. It is an eerie sight to imagine the empty streets of Masdar as a “ghost town” as Suzanne Goldenberg of the *Guardian* says (Feb. 16, 2016). As the article reports, the city only had 300 residents as of 2016, ten years after the start of the project, and in the same year of its supposed completion where it was estimated that 50,000 residents would live within the city with 40,000 commuters. But today, the 300 residents are all graduate students at the institute. This article continues by citing an interview with Chris Wan, the Design Manager of Masdar City,

“We are not going to try to shoehorn renewable energy into the city just to justify a definition created within a boundary... As of today, it’s not a net zero future, It’s about 50%.”

He went on to explain how the idea of a zero-net carbon future was only possible with the city in isolation. Thinking of it as connected to the surrounding city the objective looks more impossible, and Wan continues to explain that the net-zero goal was arbitrary to begin with and that the city is still doing a lot of good through its investment company, Masdar Clean Energy. Looking at this, in addition

to the fact that the city is still not self-sufficient in water production after planning on being early in the process (“Masdar: Exploring Our Future” 2012), one must ask what is different about Masdar than any other clean technology investment company. In the end, not much, other than its budget of 18 billion dollars (lowered from 22 billion after the 2010 economic crisis).

When ads from companies like Walmart or Masdar present videos and illustrations of drones delivering grocery store goods to one’s doorstep and beautiful green cities lit entirely by solar power, one must remember that, while it could actually be happening, it is currently just a modern fantasy that is meant to generate hype and value (see Gunel 2017 for a further look at the economy of appearances in Masdar, as well as in Songdo, South Korea). In the economy of appearances, the quickest and sometimes largest generators of capital value are not computers, potatoes, iphones, and coal, but ideas that play on the imagination of the public. The instance of Bre-X is at its core, like the dotcom bubble, a speculative mishap where value was created out of hope and the appearance of probable success.

With the many issues impeding Masdar’s success, one large-scale issue stands out: its ambition. It attempted to build a city from scratch, which is possible, but costly considering that one could find ways to convert old infrastructures to suite the city’s needs. It could be argued that building the city from scratch was a necessary venture for fulfilling its purpose, and thus worth the manpower and capital. But it also wished to revolutionize how we produce energy, which involved creating a whole new energy-efficient infrastructure. Then the project attempted to create a medium for that infrastructure that would ensure that its goal of lowering consumption was accomplished, ergos. This was followed by an attempt to create an all new self-driven zero-emission, AI-run car transportation system, all while dealing with the climate of a desert. The ambition for this project was too widespread. Much of this giant ambition is also a part of the city that made it popular to begin with. It was part of the generation of hype and the value of speculation to shoot for the stars. But everything must be in moderation. For future projects in the UAE and Masdar, less breadth and more specificity in goals need to be emphasized. A separate company could have been created for each one of the above stated innovations.

When outsiders look in, they see an institution that struggles to meet deadlines and stay afloat, but the institution itself still believes in its mission. Scrolling through the official YouTube page and the website of Masdar City, the company still offers itself as a global leader in clean tech innovation, which, notably, it is. This section is not arguing that Masdar City is a failure; it succeeds every day it invests in new experiments to produce, use, and track energy consumption across the globe and it succeeds with every successful and unsuccessful experiment it conducts in its institute. This article is arguing that the aesthetics of its infrastructure and its self-promotion communicate an idea of Masdar City that is contrary to its reality, where the reality is that it is an investment company—an investment company that does great work, but an investment company nonetheless. Everything that made the city “special” in the

24 <https://masdar.ae/en/masdar/detail/launched-by-the-abu-dhabi-leadership-in-2006-with-the-mission-to-advance-re>

public eye—it being a “zero-carbon” emission city and it being a fully functioning green metropolis with start-ups pouring in from around the globe—fell through the cracks.



Figure 9: Driverless Electric Car. Photo from www.dailymail.co.uk ©2011 Bloomberg

4. CONCLUSION

This case study's use of theory and the ideas that came from its analysis are meant to encourage further research on the Masdar City project and projects like it, as well as display the rich societal insights that can come from implementing these methodologies. The analysis of this city has been multi-faceted because the city itself is multi-faceted, with its existence being intertwined in dynamic understandings of the economy and the environment. What follows is a review of the concepts that guided Masdar's creation to its current form, and then a statement of the primary findings. Then, this section will examine the theoretical approach of this study and its possible uses going forward.

Global temperatures have been on the rise for decades, the sea levels are slowly rising, and weather patterns are becoming more severe. Fear over climate change itself is what spurred the UN to environmental regulatory action, as well as the UAE in investing in projects like Masdar City. An overarching theme across the institutionalist environmental thought as seen in the UN, and the market liberal thought seen in the UAE, is that most agree that change must be made to the way we produce energy, but neither wish to consider implementing the changes in modern human lifestyle that are required for defeating climate change. Creating sustainability without sacrificing lifestyle was the primary objective of this project. The creators of Masdar City broke from this way of thought when they realized that to truly find environmental sustainability, technological power was not enough; human behavior also had to change. The individual's consumption of energy had to be budgeted and accounted for, and thus biopolitical infrastructures were put in place to facilitate this cultural change. By integrating energy consumption with highly specified data collection and analysis, Masdar City redefined a human's relation to their energy. Activity was

converted into currency, and energy was subconsciously converted into value.

These systems were found to be a possible threat to privacy and a pathway to a city governed more by fear of over-consuming than anything else. The “hidden brain” of the city, where massive batches of data were collected on residents' consumption patterns, could pinpoint specific over-consumers. Without proper protections to a resident's privacy, these batches of data could also be sold to corporations for advertising and marketing purposes without the knowledge or compensation of the citizens. The over-governance that could result from a system like this is worrisome and invokes slightly dystopian imagery. But experimenting with a citizen's ownership of their own data could relieve that concern. While the prospects of both communicative and disciplinary infrastructures were explored, it was found that a communicative system that informed rather than fined would likely be given more leeway in installation by a populous. Lastly, the aesthetics of the city was examined to see how the UAE's neoliberal character could be seen in their architectural choices. Looking at this aesthetic, one could see an appearance being constructed that bolstered investor confidence in the city and contributed to peoples' faith in the project. This generated hype and press for the city and encouraged speculation as to its possible success.

Theoretically, this work concerns itself with the social applicability of technological creation. Energy was looked at not as a metric of physics or engineering, but as a force that can create some form of social, cultural, or capital value. Infrastructures were thought of not just in terms of their technical functions, but also in terms of their symbolic power, their political undertones, and their display of ideological character. In the end, the success of a technology has little to do with its functions, and everything to do with the aptitude of people to use it. These sociocultural ways of looking at technology allow for this aptitude to be assessed.

This case study specifically works to apply these methodological ways of thought to Masdar City and is meant to function as an example of the thought process alone. Taking methodologies such as the ones presented in this paper into account could support the research of disciplines outside of anthropology. It could add more adherence to an argument for the social need of a specific innovation, be it technological, infrastructural, architectural, or otherwise. It could spur thought for further ethnographic or ethnological research in studies concerned with the technical aspects of science or engineering. Urban studies and city planning, while already being rigorous in efforts to uncover the human psyche behind a successful city, could benefit from exploring this technological adaption of anthropological theory.

There are massive technological projects around the world where these ways of understanding human ingenuity and technology could thrive. In Masdar specifically, further research could be done on the extent of the effect on people's awareness of their consumption from the community consoles. How were the consoles implemented and do they work to increase awareness and change behavior? What are the long-term cultural effects of biopolitical systems that focus solely on economic and environmental sustainability? For more technically inclined

disciplines looking to research this project, research could be done into data ownership, as discussed earlier in this paper, charting out Masdar's data empire with the prospect of individually owned information on consumption. Does the data collection system lose its negative attributes of corporate manipulation when assurances of data ownership are in place? How can the issue of over-governance be approached in creating a disciplinary system like this? In terms of applications to these methods and social theories to other projects, China's Belt and Road Initiative is a project of global proportions, spanning much of Eurasia and the coasts of Africa. It hopes to establish both trade routes and commuter roads and trains connecting nations in the European Union to the Chinese economic sphere. There are robot cities in Japan, highly contested railways in Britain, and 5G networks being established around the world.²⁵ Utilizing these modes of thought even as supplemental tools for analysis will enrich our understanding of technological projects. Now is a time rife with massive technological endeavors.

Above all else, the relevance of this study stems from the fact that a great volume of projects much like Masdar City will be attempted in this century, as more societies begin realizing that true environmental sustainability will take more than efficient solar panels and better recycling practices. It will take a change in our liberty, or a change in our privacy, or a change in our equality, or some combination of those factors to eradicate the risk of ecological disaster. Studying a place like Masdar City gives us a forward look into what the future of sustainable governance looks like. Masdar allows energy to act as an infrastructure in and of itself. It shows how humanity's relation to infrastructures is integrated into people's everyday lives through our consumption and expenditure of energy on a massive scale. The marriage of energy production and consumption in a singular system is undoubtedly at the helm of humanity's global future.

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²⁵ This article outlines the protests of the construction of the HS2 High Speed rail in England. May 5th, 2020. <https://www.usnews.com/news/world/articles/2020-05-04/protesters-stage-day-of-action-against-britains-planned-high-speed-rail-link>

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