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Introduction

I New York City to Albany

A magic space-travel chair awaits you. It moves at 550 miles per hour, about two hundred times faster than you could move your own body over long distances. At thirty thousand feet, the chair flies above the clouds and affords you a bird's-eye view of earth. You traverse 150 miles nearly due north, lifting clean out of the snags of America's largest city. It safely delivers you within an hour to your far-flung destination, the state capital of Albany. Would you like African java, Indian tea, or one of a dozen corn syrup drinks while hurtling through thin air? There are fifty magic chairs on an airplane, in this case a small jet, and at this moment about ten thousand jets are in flight.

There is an alternative magic chair. This one averages sixty miles per hour over the ground, and takes about 2.5 hours to cross New York State. It is amazingly affordable and is continuously, redundantly available whenever you choose to leave the city. There is minimal danger to your body, though more than in the flying chair. Barring traffic, you will probably never need to slacken your superhuman pace during the 150-mile journey. If you do stop, every mass-produced delicacy known to modern society will be offered at multiple competing outlets.

A third chair also moves around sixty miles per hour, but this one rocks on rails and conforms to a time table. One advantage over the second chair is that it is completely self-navigating. This chair is propelled by a different refinement of the same stupendously powerful fuel that pushes chairs one and two: jet fuel, gasoline, and diesel, respectively. Oil. Slow-cooked plankton millions of years old. All three seats are departing right now.

Our near ancestor occupies a fourth chair on a boat. The 1807 river cruise from New York to Albany took about thirty hours, averaging five miles per hour. The *North River* steamboat was the first to navigate that length of the Hudson as

Figure 1.1 The *Clermont*, a replica of the *North River* steamboat, operates on the Hudson in 1909. The original voyage to Albany took place in 1807. Image courtesy of Wikimedia Commons via Library of Congress. Public domain.

a viable commercial ferry. Both of her paddle wheels turned by coal-fired steam, and she had supplemental masts with sails and rigging, a chimera run by fire and wind—a smoke-snorting dragon with pterodactyl wings. On this trip, though, the sails stayed furled. The *North River* burned ancient sunlight, materialized into carbon chains by plants, and then compressed by geologic plates. Coal. She quickly passed sailing sloops tacking windward, taking a straight course north toward her destiny. Her only trace past the first bend in the river was the gray fuzz of carbon fixed from Carboniferous-era air. After three hundred million years, the carbon is free again in the Anthropocene. We are liberated, too, in a way, from slow, disperse fuels formed from sun, wind, tides, wood, grass, and food, to the much denser fossil fuels found in geologic cemeteries. These load-liberating fossil fuels also liberate greenhouse gasses, causing climate change, civilization's leading challenge into the twenty-first century.

Now the nature of the chair changes. We are moving backward through time, and must exchange our lavish fossil-fuel-flown thrones for bare leather saddles. It's the late seventeenth century, and your saddle pack is stuffed with English

silver to trade with Dutch trappers for fur. Keeping your fourth seat requires horsemanship, energy, endurance, and knowledge of the landscape. You may seek recourse to your pistol or fists along the way, depending on the motley company that loiters on the cliffs of the Hudson River. Your horse will require rest and feed, and you will need a new animal altogether if you wish to travel continuously to finish the journey in four days. If all goes well, you will have barely used linens in the bed at the inn, and also vittles and ale to wash down the dust. If not, you may have a leaf tuft beneath a stout oak and a saddle bag picnic. Nighttime brings a prayer that the local wolves and panthers do not visit your camp to kill and devour your chair.

The fifth seat tacks against the wind and tide on the ever-changing Hudson. You rarely sit down, and share a bunk bed in shifts. Your calloused hands follow shouted orders in concert with a dozen other laboring sailors as you stalk the fitful engine of the wind: elemental or primary energy. If you are Henry Hudson sailing in 1609, you hope that you will find China upstream, but once you traverse 150 miles in ten days (an average of 0.63 lateral miles per hour), you elect to return to Holland. Over the next few hundred years, your turn-around spot will become Albany, and sailing ships bearing goods from the interior will crowd the waters. China never materializes upstream, but the wind is free and abundant and sometimes blows the right way, allowing for the exchange of the rich natural resources of the interior, like timber and hides, for traded goods from Europe and points oriental.

The sixth is no chair at all, but a footpath. Before the colonial period, Native Americans used their muscles, powered by digested plants and animals, to traverse long distances over the wild terrain of the future Empire State. It would have taken at least a week to walk from the mouth of the Hudson upstream 150 miles, for the few who chose to wander so far from home. Such paths would have been taken for trade. Humans have been striking out on foot for our entire two hundred thousand-year history, and before that we did it on slightly different legs, most likely those of the ancestor species *Homo heidelbergensis*. Whether horse or human, these journeys were fueled by biomass—food like grains, fruits, vegetables, and some meat. Within a year this biomass fuel would be replenished by the sun.

II Fuel history

Of course, we use fuel for many tasks besides transportation. Besides the fact that our bodies are furnaces that require the fuel of regular meals, in modern society

a great proportion of fuel also goes into industrial production, construction and maintenance of infrastructure, heating and cooling, and the exchange of information and entertainment. The contrast among these six forms of transportation shows how radically and rapidly our lives shift due to changes in the fuel sources propelling society. In the last 250 years, the transition of energy sources from biomass and primary energy to fossil fuels—coal, oil, and natural gas—fundamentally affected the human experience of self, time, and place. By unleashing the astonishing power of fossil fuels using the steam engine, coal introduced more changes to life, environment, and society than the world had seen in the previous twelve thousand years of the agricultural era. Europe first used fossil fuels on a large scale in stationary industry in the 1700s, followed by locomotives and steamships in the 1800s. By the early 1900s, petroleum took some of the burden off coal: it again revolutionized movement, now by personal cars, and was useful as a stock material for an explosion of consumer goods: paints, plastics, and chemicals. This shift in bioenergetics propelled us beyond the ancient constraints of a biomass economy into a realm of modern industrial superpower built upon prehistoric carbon. Petroleum is an acme: it is the only fuel dense enough to make itself fly, when powering a prop or jet engine.

We may not realize the fantastically larger amounts of fuel we use in developed nations compared to our predecessors in preindustrial societies, both the agricultural societies of the last twelve thousand years and the hunter-gatherer societies that subsisted for hundreds of millennia before that. Energy consumption correlates with cultural evolution. For 95 percent of our existence as a species, we have lived as hunter-gatherers, mainly on the calories needed to keep our bodies fueled, plus a bit of biomass for fires. Agriculture tripled that rate by introducing the labor of domestic animals needing fodder, the calories provided by their milk and meat, and the grain harvests enabled by their labor. By the early modern period, agriculture was accentuated by widespread metallurgy and glassmaking that required furnaces fueled by charcoal, a processed form of biomass. Once we figured out how to intensify industrial fires with coke derived from coal, rather than charcoal, the stage was set for mass industrialization and, with it, mass consumerism. This was the single largest leap in energy consumption in history, made visible in the coal-gray skies hulking above nineteenth-century cities.

By 1900, people in industrial culture were using more than twenty-two times the number of daily calories as ancestral humans. Between 1850 and 1970, Americans witnessed a 150-fold increase in energy consumption despite

improvements in efficiencies (Johnson 5). Consuming ever-greater amounts of energy was an invisible buoy of the American dream, in which each generation could observe gains in energy use beyond their parents' time. These gains in energy use are commonly coded as "successories": higher incomes that propagated larger houses, yards, cars, wardrobes, appliances, vacations, and toys.

We live in an era in which fuel is ubiquitous in our lives, but our experience of it is largely immaterial. Fuel is not invisible: the landscape of the average early twenty-first-century city in a developed country is filled with highways and gas stations, power lines and charging stations. However, this abundant energy network spares the energy consumer most of the physical, mental, and social effort that was once required to secure enough energy to survive. The average consumer's body no longer performs the work of harvesting, preparing, and releasing energy contained in fuel, as the preindustrial forest dweller felled, split, cured, and burned the wood that permitted his community to endure winter and cook food that would be inedible in raw form. Today, and for several generations now, the idea of energy has been growing increasingly abstract. Abundance and scarcity are not entwined with a physically observable extent of forest cover. They have become tabulations of oil and coal reserves, solar and wind installations, presented as numbers in newspapers, or, more likely, shine on websites in which the relationship between the actual energy supply and the physical experience of using that energy—the coal burning to illuminate the laptop—are fully abstracted from one another. Similarly, the energy network spares us the work of thinking about, let alone performing, the fuel tasks necessary to cook food. The steam emanating from a bowl of microwaved oatmeal is energy stored from the photosynthesis of Carboniferous-era trees, cured by deep time, compression, and heat into a rock of coal. This energy is liberated by a minerals corporation from a mine in the next state or around the world, pulverized to powder, and burned in a diabolically hot fire that heats water to steam and turns turbines in a nearby power plant. Finally, the grid transmits that energy as electricity into our home, our microwave, and our oatmeal.

We look to the sky and see blue or white, not the gray smog that oppressed early industrial cities in which coal smoke blew from every chimney. As our skies display much less of the visible malaise of industrial-level energy consumption than our recent forbears endured, our fingernails bear no grime from the hard work of energy extraction. (More than ever, machines do the work that laborers once performed to harvest fuel like coal, and clean fingernails across the world tap at keyboards.) Locales that do suffer from oppressive, palpable pollution

tend to be centers of industrial production, like the Chinese city of Baoding, or centers of individual oil consumption, like the highways in the bowl of greater Los Angeles. These exceptions that are in parallel between energy and experience only make the general paradox more striking: we consume more energy per capita than any humans ever have before, and we invest minimum cognitive, physical, and temporal effort, and experience less discomfort than any of the fuel-burning *Homo sapiens* gathered around open fires for the last two hundred thousand years. And yet (here's the rub), the collective result of our energy binge is the colossal problem of climate change that has only come to the full social and political consciousness in the last generation. With fuel, we have a lighter physical burden and a heavier moral burden than any of our ancestors.

In using this general *we*, I am of course eliding the differences between socioeconomic levels that make exposure to the negative aspects of energy use a varied experience. Poor people in the Houston area are more likely to suffer from the air and water pollutions inherent to petroleum refineries than their wealthy counterparts, who can afford to buy real estate less tainted by the local industry (those very people who benefit most from the industry's profits). This story of socio-environmental geography is nothing new. Queen Elizabeth removed to Windsor Castle to avoid the coal smoke endemic to early modern London, which defaced building facades and choked out trees long before the modern industrial era (Hiltner 316); Frederick Engels observed laborers' hovels in the industrial labyrinths of mid-nineteenth century Manchester; Charles Dickens created Coketown as a study of urban laborers' oppression juxtaposed to the pastoral suburbs of the wealthy; Upton Sinclair updated these visions for the petroleum industry of early twentieth-century southern California, which displaced subsistence homesteaders and pulled the culture into the thrall of oil speculation and get-rich-quick schemes; today, environmental justice focused especially on racial and income disparities is a major subfield in the social sciences and humanities, public policy, and environmental regulation.

Still, for most people in developed nations, energy is secured by an online electricity payment and a few swings into the gas station and the grocery store. In return, we enjoy a practically limitless supply. Of course, the individual American experience of infinite, cheap, high-quality energy (at this writing, the average gas price in several US states is less than \$2.50/gallon) is an illusion supported by a global network of corporate colonialism, industry-driven regulation standards, and federal subsidies. We live in a strange era in which fossil fuels signify both abundance and the threat of scarcity, enjoyment and fear, exuberance and melancholy: this is our fuel ontology.

III Defining *Fuel*

At this point, a definition and justification of terms is in order. To the casual reader, in the preceding paragraphs I have used the words “energy” and “fuel” interchangeably. But they actually preserve an important distinction. *Energy* denotes both a literal, material entity known as fuel, but it may also be used to obfuscate between fuel and metaphorical concepts such as the “energy” of intellect, ingenuity, collaboration. Allen MacDuffie’s study of energetics and thermodynamics in Victorian England wisely dismantles the rhetoric of a Shell Corporation advertisement that slyly substitutes “human energy” for diminishing and increasingly problematic supplies of fuel (1). As MacDuffie observes, this rhetorical sleight of hand cons the viewer into believing that the abstract, disembodied energy that emanates from human cognition and cooperation is equivalent to, and even greater than, the “limits brute matter would impose” (1). Succinctly, there is no energy crisis. We have a *fuel* crisis (2).

This book is about brute matter. I titled it *Fuel* because I mean to indicate the physical substance used in specific eras of history to provide energy. Wherever possible, I wish to disentangle the material denotation of fuel from its metaphorical lives as energy, which are often deployed without much awareness of materiality. (The *Oxford English Dictionary* records both material and abstract uses of the word “energy” first dating to the early 1600s; material “fuel” dates much earlier to 1398.) Laurie Shannon has identified a problem with the elision of fuel materiality: “Western culture has transitioned to forms of energy whose origins are opaque to ordinary perception, whose material workings are comprehended only by specialists, and whose business operations are shielded and securitized. One result seems clear. Literally visceral knowledge of where energy comes from, or what energy is, has been substantially extinguished” (312). Unlike some enlightening studies on the metaphorical lives of energy in specific cultures, such as MacDuffie’s focus on the idea of thermodynamics in early industrial England, this book is focused on the *material cultures of fuel* within the three distinct bodies of biomass, fossil, and new renewable energy.

Writers have for centuries taken account of how our human condition directly relates to fuel sources. Usually in literature, though, the relationship is obscured and implicit. It is the aim of this book to make it overt and explicit. There is no better source material to study the history of fuel than literature. The technology and sociology of fuel is already well-represented by scholars like Vaclav Smil, but literature provides source texts that are at once historical,

rhetorical, and emotional, thus opening ecocritique to new perspectives on how energy histories inform the nature of our existence—as humans, and as twenty-first century consumers in the Anthropocene. This book uses mostly Anglophone literature—with a few excursions into translated works from Europe—to explore the fuels of three basic categories. *Primary energy* is derived from sunlight, wind, flowing water, and atoms. *Biomass energy* is based upon plant growth and photosynthesis, and is renewable. We eat biomass, feed it to animals, and sometimes burn it, though in much smaller total proportions than in the previous millennia. *Fossil-fuel energy* comes from epochs-old biomass cooked and compressed into energy-dense matter. Every day, global industry burns fossil fuels that were millions of years in the making. Fossil-fuel sources are depleting, and they are famously dirty, especially coal.

Like predators in an ecological community, fossil fuels are the scarcest fuel because they rely on so much raw biomass and deep time to develop. They are highest on the fuel chain: secondary consumers of primary solar energy. Plants are first consumers of that energy, annually fixing solar energy into carbohydrates using photosynthesis, energetic plant mass that we, in turn, burn or eat. Each unit of fossil fuel requires a large platform of biomass, which is in turn built upon floods of primary energy from the sun striking our planet.

It seems natural that a literary study of fuel would follow the historical arc that has directed human history. Lewis Mumford's influential periodization of energy discerns three major eras that softly echo this book's divisions. He begins with the eotechnic period, c. 1000–1750, where wind and water were the prime movers and wood was the favored building material; next is the paleotechnic phase, c. 1750–1890, which used coal as the fuel, steam engines as the prime movers, and iron replaced wood for infrastructure; last is the neotechnic period (after 1890), when petroleum entered the scene, joining coal-fired electricity as the prime mover of advanced industrial culture (Nye 251).

At first there was water and wind, then humans yoked populations of plants and animals, and at last came the technology to exploit the fuels cached deep inside the earth, which was an event so significant that it caused its own series of distinct eras. However, the story is more complicated than this neat historical arc. Biomass has always been on the fuel scene. Writing is only a few thousand years old, coming with the advent of agriculture, but prehistorical cave paintings by hunter-gatherers depict prey animals: biomass-made-meat. Pastoral literatures of the Greek classical age that depict shepherds dancing on the grass and Bacchus crushing grapes also reveal the importance of biomass for animal fodder to premoderns. Primary energy, derived directly from sun

and wind, actually came comparatively late on the fuel scene. It would be a long time after the advent of agriculture (at about 12,000 BC) before the technologies of sailing ships, water wheels, and wind mills would become the fuel sources of civilization (about 5000 BC, 300 BC, and AD 100, respectively).

As MacDuffie and other scholars such as Frederick Buell and Imre Szeman have noted, energy history is filled with epochal shifts in which a new source (coal, petroleum, nuclear) is initially hailed as a savior from a limited and problematic older source (wood, coal, and petroleum, respectively). The new source is figured in popular discourse as functionally infinite and, therefore, millennial: it promises to liberate humans from the physical yokes of material limits and hard work with virtually no side effects. Before long, usually within a few decades, problems with the new source become manifest; these problems may be technical, supply-based, and/or environmental in nature. Frederick Buell has called this a cycle of “exuberance and catastrophe,” and convincingly studied petroleum culture under this rubric, noting astutely that the bipolar emotions often exist simultaneously, as they do in our present culture. In the stage of catastrophe, futurist rhetoric moves on to another source, real or imagined (remember George W. Bush touting hydrogen fuel cell cars?), and the public discourse indulges in another round of idealization worthy of science fiction. Indeed, science fiction, a genre that uses imagination to generate new ideas later to be tried out technically, is often the nascent rhetoric of exuberance. Crucially, Imre Szeman notes that the “fiction of surplus” enables the tailing, even more dubious notion that easy access to abundant sources of fuel plays “a secondary role in history by comparison with human intellect and the adventure of progress” (324). Literary fictions are collusive in both obscuring fuel as physical matter, and enabling the pure fantasy of the energy cornucopia (324).

On the contrary, a running thesis in this book is that a culture’s material fuel source opens a landscape of possibility for the kinds of ideas, ambitions, and progress in which that culture can engage. This is the nature-culture of energy: resource supply and consumption. Scholars in the energy humanities call this a new form of ontology, and have committed the most focus to oil ontology (see Hitchcock, who cites the 2009 MLA special panel on oil ontology, and Patricia Yaeger’s 2011 *PMLA* column on energy literature [126.2]). Without proceeding fully to an abject fuel determinism that would claim that culture is utterly determined by fuel sourcing, not human choices, it is essential to consider how the supply of fuel available has an inexorable influence on culture. A broad arc of infrastructure, social relations, values, and environmental impacts characterizes different fuel cultures through time. Without coal,

there is no steam engine, no mass production, no culture of compulsive mass consumerism, and much less climate change. Without oil, not only would our living landscapes look entirely different (probably organized around steam-driven railways and muscle power), but our cultural values, ambitions, fetishes, and fantasies would shift as well, flashing on the fuels that drive the culture. To the medieval charcoal burner, a Toyota Prius would have the same use value as a Hummer: the nominal value of shelter. Postapocalyptic and peak oil narratives often engage in a proleptic view of a world drained of oil that must take stock of its obsolete apparatuses: cars and their infrastructure in particular. These husks of obsolescence are the inspirational materials of “thing theory.” Without oil, there are no cars or highways, but there is also no internet age and no twenty-first-century culture of viral self-absorption. Oil ontology gives each individual consumer the illusion of being superhuman. Oil as an emancipation from the severe limits of a biomass world is a form of apotheosis: it transforms our physical ontology from bio-muscular to techno-mechanical, a transformation that brings superhuman capabilities. Your car can exert forces a hundred times stronger than a traditional pair of carriage horses, and a thousand times stronger than your spindly legs. We are masters of oil’s raw power, but we have signed a contract that works in reverse, too: because of our reliance, oil masters us. Our use of fossil fuels has completely transformed the world we inhabit, and dependence creates a love/hate dynamic familiar to late industrial culture: love the car, hate the traffic; love the cheese doodles, hate the obesity; love Instagram, hate work emails.

David Nye’s *Consuming Power* is a classic inquiry into how shifts in fuel sources catalyze paradigmatic changes in the societies that adopt them. Nye’s cultural history of energy rejects the determinism that would claim that the evolution of fuel and technology is an unyielding force moving through history, with impacted societies helplessly enthralled by its power. Instead, Nye explores the normativity of energy in particular historical moments and how “each energy system *has been used to shape* distinctive domestic patterns, work routines, urban structures, and agricultural methods, imparting particular rhythms and contours to the everyday round” [italics mine] (8). An intriguing aspect of Nye’s negotiation between a society’s selection of fuel and its design of the technologies that exploit it is his assertion that there is a historical progression from freedom toward inflexibility. Later stages become rigid because societies build expensive infrastructure to support a particular fuel choice. Large-scale systems begin fairly flexibly, with a range of choices in ownership, control, and technical aspects, but rapidly grow resistant to dissidence. Nye cites seemingly

small choices like the arbitrary selection of rail gauge for standard tracks, and large ones like the dismantling of American public rail transportation in the middle of the twentieth century in favor of the automobile, as examples of huge infrastructure investments that are nearly irreversible: “A generation later it is difficult to undo such a decision” (3). Happenstance looks like destiny from the perspective of the future. Evolutionary theorists like Stephen Jay Gould underscore how biological evolution can seem teleological—driving toward some predetermined goal, or *telos*—but in fact evolution is radically contingent upon environment and natural disaster. Analogically, fuel paradigms that seem destined toward improvement—more energy per capita—are the result of numerous choices based on circumstance. Many of these choices are arbitrary or selfish, intended to benefit the private stakeholder rather than society at large. In this book, a nondeterministic historiography recaptures the contingency inherent in all pathways forward.

Societies make choices about which avenues of energy and technology to pursue. American car culture was no inevitable juggernaut predestined to vanquish the railway; it resulted from a series of material conditions such as the availability of cheap oil and assembly line manufacturing, as well as a series of choices such as GM’s choice to purchase and dismantle existing streetcar systems in dozens of cities, including Los Angeles, Baltimore, and St. Louis, in the 1940s. Choices that benefit the profit margins of individual corporations at the expense of the greater good riddle the history of fuel culture, with an illustrative case in point emerging in 2015 with Volkswagen’s fraudulent “defeat devices” giving its “clean diesel” cars false environmental sheen. With these histories in mind, we regain perspective on the kinds of choices that will, in the twenty-first century, guide our adaptation to the material conditions of our growing reliance on diffuse primary energy: solar, wind, water, and nuclear. This nexus between determinism and choice will drive social and environmental changes through the twenty-first century. Today we have more options in energy resources than humans have ever known, but not all options are equal. Most often, our choices continue to favor retrenchment in fossil fuels and continual profits to huge corporations (seven of the top ten largest corporations are in the oil and gas business) that keep the ideology of endless economic expansion in fine clothes. Our freedom to choose alternative energy sources cinches down with every choice in favor of industrial fossil-fueled business as usual.

Because literature, as a human practice, is inherently anthropocentric, it might seem to be a weak or misleading source material for an ecocentric study of energy through history. However, the rich and under-explored vein of fuel

materiality helps the sensitive reader get closer to an understanding of how energy ontology—the nature of surviving, working, and consuming—changes according to particular eras of history and under specific fuel regimes. By looking at preindustrial and “innocent” industrial literature from our position in the Anthropocene, we can reread its action and emotion with a circumspect view of the implications and effects of living with particular kinds of fuel.

Using ontology in ecocriticism may raise the concern that high-theory metaphysical ontology, which explores the basic nature of existence and reality, replaces applied humanist work in the ethics, politics, and cultural relativities of eco-literary thought. These grounded approaches that focus on particular oppressed peoples and landscapes has characterized the last decade, at least, of ecocritical scholarship. However, far from eliding the nexus among culture, nature, and economy that guides the vastly diverse global experiences of a lived environment, this foray into energy ontology is aimed at more specifically capturing how the material and cultural contexts of particular historically embedded energy sources have intrinsic effects based on class, race, geography, gender, and justice. Energy ontology is less about the abstract musings of the empowered sitting atop a pile of fossil-fueled privileges and more about conducting revelatory contextual scholarship that places the Anthropocene consumer in an enlightened history of evolving energy regimes. An essential aspect of that history hinges on the lives of laborers, producers, and bystanders, who often bear the brunt of environmental injustices based on socioeconomic disparity.

IV Energy ontology

In using the word ontology, I do not mean to invoke the metaphysical definition of the study of the kinds of entities that exist in the universe, which held sway in ancient Greek philosophy. Instead, my meaning partakes of the more recent tradition, beginning with Husserl and Heidegger, of calling on fundamental ontology to define the social nature of human existence: its qualities and quantities, its community, its physicality, its environment, and its ethics. Within his early ontology, Heidegger explores *Dasein*, the mode of being of an intrinsically social human who functions with a nascent sense of the structures of being-with (*Mitsein*) that make particular ways of living possible. In John Haugeland's words, *Dasein* is “a way of life shared by the members of some community” (423). Our shared way of life today is starkly different from the

shared way of life in the eighteenth century, mostly due to the primary cause of fuel sourcing. Secondary and tertiary effects reflect back on the primary one: higher population levels (there are ten people on the planet today for every one in 1750) are supported by industrial agriculture, mechanical construction, and modern medicine; occupations have shifted from biomass to fossil-fuel based work, from farmer and hostler to truck driver and computer engineer; entertainment that used to be self-generated, such as community dances and folk music is now most often the product of industries that entertain passive consumers. When we binge on Netflix, we are consuming the fossil fuels poured into every stage of the process: development, writing, production, distribution, marketing, and of course, the petroleum-wrought device (computer or television) and its power. With renewable energies like solar and wind coming online, in time we will see the fossil-fueled load redistributed to these renewables, but the paradigm of a fossil-fueled ontology remains largely unchallenged. Fossil fuels cultivate a paradox of voracious passivity.

Since energy ontology is intimately linked to fuel source, energy scholars in the humanities regularly use the concept of ontology to generate insights related to the industrial human condition. For example, Stephanie LeMenager describes artistic reactions to the BP oil spill of 2010 by suggesting that these protests “locate the human, as an ontological category, within industrial-era infrastructures that may be not only in the throes of failure but also predetermined to destroy basic conditions of (human) living, such as water systems” (105–6). Fuel does not lie in the background or in abstraction; fuel sourcing actually designates the polarities of local and global, slow and fast, boring and exciting, sustainable and thanatopic. The more energy dense the fuel source (read: petroleum), the closer energy ontology lies to the second of these parallel terms: global, fast, exciting, and driving toward death.

It is also curiously paradoxical: perhaps because of its ubiquity, petroleum tends to vanish from cultural consciousness. As Imre Szeman notes, “The fact that literature in the era of oil has little to do with oil doesn’t negate the value of energy periodization. On the contrary, one of the most valuable functions of this schematic in our present moment—or, indeed, perhaps even in the whole history of literature—is to bring to light a foundational gap to which we have hitherto given little thought. This gap is the apparent epistemic inability or unwillingness to name our energy ontologies, one consequence of which is the yawning space between belief and action, knowledge and agency” (324). In this context, energy ontology is related to Bourdieu’s notion of *habitus*, where the habits of individuals and groups become imbedded in society’s structure

so intrinsically that they designate new realities. From the structuralist view, individual works of literature are marked by the larger eco-social structures that support them, and *habitus* shows how the structures imposed by fuel regimes lead to self-defeating human behaviors such as compulsory consumerism and sedentary living.

Literature has long downplayed fuel's material cultures while propping up the social construct of human energy, epiphany, and triumph. However, there is a rich and under-explored vein of fuel materiality that helps the sensitive reader get closer to an understanding of how energy ontology, that is, the nature of surviving, working, and consuming, changes according to particular eras of history and under specific fuel regimes. Energy density drives us toward dissonant emotions, culminating with Stephanie LeMenager's insight that "petromelancholia" involves not only an emotional life of loss, failure, guilt, and fear in our repertoire of a shared oil culture, but also that "decoupling human corporeal memory from the infrastructures that have sustained it may be the primary challenge for ecological narrative in the service of the human species' survival beyond the twenty-first century" (*Living Oil* 104). To survive, we will have to relearn how to work with our bodies to fulfill daily needs. Throughout, I pay close attention to the physical nature of specific fuel environments, especially biomass versus fossil-fuel worlds: labor as muscular and practical rather than cognitive and abstract, consumption as material (warmth and food) rather than virtual (information and entertainment), life as textured by seasonal rituals of survival (sowing and reaping) rather than the blended gray-scape of fossil-fueled constants (shopping at the grocery store).

LeMenager's gently apocalyptic idea is that our bodies will have to adjust to a pre-fossil-fueled ontology, where our muscles exit the atrophied space of the car and airplane and walk back into the evolutionary landscape of physical work and practical ritual. The biomass section of this study dwells within the fuel ontology of the working body and the seasonal textures of existence, casting a critical eye on the idealisms of the pastoral, which are themselves often nostalgic constructs of the early industrial era. Still, a biomass ontology affords a more direct translation between work performed, physical satisfaction, and subsistence in well-known natural environment, a condition that ecocritics figure as the trope of dwelling. No wonder that apocalypse narratives like James Howard Kunstler's *World Made by Hand* often cradle reactionary ethics against fossil-fuel culture, examining what we might gain by going retrograde, back to a biomass world. Racist and sexist notions accompany his vision, and call into question how much of our industrial-era gains in human equality are built on fossil-fuel ontology.

A related psychic condition to melancholia comes with our realization of what it means to live in the Anthropocene, in which human impacts on planetary systems are so profound as to be considered a distinct geological era. Timothy Morton's theory of "hyperobjects" elaborates a postmodern ecology of climate change in which human history and terrestrial geology coincide, with the horrifying, sublime effect of ultimate inscrutability (*Hyperobjects* 12). Timothy Clark's study of the Anthropocene also suggests that within this new ontological order, our ability to interpret natural patterns using literature is highly attenuated, since imponderable phenomena like climate change "resist representation at the kinds of scale on which most thinking, culture, art and politics operate" (x). Anthropocene scholars have established how the eco-cultural condition in which we conduct our lives is marked by the wholesale conversion of nature into materials that energize human economies. This extractionist mindset is responsible not only for widespread habitat destruction and climate change, but also marks a poignant psychological moment in cultural history when denial and self-destruction become normal behavior within economies (Clark xi). Perhaps Dr. Seuss captured it best with his Onceler, who steadily consumes himself out of a profitable business by denying the resource limits decried by the Lorax. He chops down all the Truffula Trees and ends up alone in a wasteland. That a children's story written in the 1970s could be as wrenchingly sad as it is popular is a testament to the extent to which Anthropocene is already embedded in our collective conscience.

Steeped in a culture of crisis and indulgence enabled by fossil fuels, in a geological era inscribed using fossil-fuel fonts, it is worth questioning whether there can be any clear readings of fuel literature written by people who lived in pure ignorance of the larger effects of their combustion. Alan MacDuffie, Jesse Oak Taylor, and other nineteenth-century scholars have discovered some early awareness of the global effects of industrial emissions, particularly among prescient cultural critics like John Ruskin in his jeremiad "The Storm-Cloud of the Nineteenth Century," but those portentous moments are the exception (MacDuffie 169). To read authors whose characters are warmed by coal, like Jane Austen, Charles Lamb, Charles Dickens, and Charlotte Bronte, in this latter-day context of cause and effect, we must acknowledge that the readings in this book present a kind of self-conscious Anthropocene rereading of literature. They knew not what they did, perhaps, but we cannot pretend we know not what we do. One key quest of this book is to find the moments in which the consumption of fuel became self-reflexive; that is, when art began to represent what we might call an Anthropocene awareness that human activity had the power to change

geo-global history. The British nineteenth century is the era in which these observations shifted from innocence to awareness.

Even though the skies above London have mostly cleared since their time, dispersing the dour industrial ambience of *Bleak House*, today we cannot help but read onto those early works our own hypertextual version of ontological conditions caused by fossil fuels and the Anthropocene: guilt, melancholy, fear, helplessness, and, despite it all, exhilaration. It has often been noted that environmentalism suffers from its shrill, lamenting voice in which elegy and jeremiad match their decibels. Comedy is rarely heard outside of bitter satires on the modern human condition, and Polyanna narratives are anathema, because they appear to support a cornucopian capitalist agenda (Branch 379). By looking into literature penned before the Anthropocene was a known concept, we may recover some of the levity of innocence and optimism that colored preindustrial literature, and the blushes of infinite possibility unleashed with coal and petroleum.

Slingshotting nightmares, environmental writing works against its own interest in rousing popular sympathy, even with the spectacle of apocalypse; presenting dreams, our work supports the larger investment in imagining how a better, more sustainable future might be crafted out of the best iterations of pastoral, technological, and collective. It falls somewhere between dumb and dangerous to oversell cultural representation as a force of change in human behavior (Clark 21). However, the energy humanities can help elucidate ecological problems for the public, especially by identifying how tropes and narratives inhere in our creation of nature and human culture, even if our work contributes little to the direct application of science and policy that helps avert, assuage, and minimize negative impacts of ecological crises.

The exhilaration of living in the Anthropocene is perhaps the most complex among a clutch of complicated feelings. Our culture is exhilarated by the godlike power at our disposal, what William Catton Jr. described as *Homo colossus* (just imagine, as Upton Sinclair did, a train of three hundred horses galloping in advance of a carriage!), but it is also exhilarated by the pure uncertainty, scientific and literary, of what beast of climate we may have unleashed, and how these changes will play out within our lifetimes and beyond. Where the biomass literature of haystacks, charcoal burners, and wood piles belongs in the pastoral tradition, fossil-fuel literature partakes of the apocalypse. The search for intelligibility may be inherent in the very practice of rereading fuel literature in the Anthropocene. If our contemporary culture is “on a darkling plain, / Swept with confused alarms of struggle and flight,” as Matthew Arnold wrote

in a Victorian plea for sweetness and light, looking back along the path of our predecessors may provide us coordinates for our own situation. The singularity of literature, to use Derek Attridge's phrase, is its intrinsic ability to present a unique and innovative Other that enriches a culture's ethical terrain, but that the culture itself cannot immediately assimilate. The material fuel that colors the experience of literary generations before us is bound to shed light upon our condition and, from the Anthropocene perspective, we may be able to attain more insight on the significance of fuel regimes of the past (Attridge 2).

The material fuel at work within these texts is hardly ever its central focus, which overtly circles more celebrated literary topics like triumph and tragedy, love and indifference, selfishness and altruism. But the material fuel in the background actually performs the fundamental work of drawing the landscape of possibility for the characters acting within its horizons. Tim Clark has identified scale effects in climate change, where "numerous human actions, insignificant in themselves ... come together to form a new, imponderable physical event, altering the basic ecological cycles of the planet (72). Background—the material fuel—becomes foreground as its impacts accumulate. Rereading biomass, fossil, and renewable fuels yields a review of historical literature—a preface and rationale for engaging in the primary research of living this twenty-first-century life with the fullest possible awareness of our own horizons.

Incredibly, our industrial culture has mostly forgotten what it was like to exist in a biomass world: sustainably, locally (even parochially), and slowly—no faster than a horse's gallop. To consider the comparative literatures of energy as they relate to transportation, we will begin with wind, then consider muscle-driven biomass giving way to coal locomotion, and conclude with the highest octane fuel, petroleum. My interest is in how the fuel depicted in literature illuminates historical moments in which the interfaces between self, society, and nature are configured by specific energy regimes. By using literature as a source text, we may arrive at an emotionally and philosophically more robust synthesis of energy history than the social and natural sciences, relying upon objective accounts and statistics, are able to provide.

V The arc of *Fuel*

Because its historical scope is broad, *Fuel* provides an abridged review of fuel literature with a running commentary on current issues of landscape destruction, pollution, biological limits, environmental justice, and climate change, all of

which relate to our position in the Anthropocene. It would be absurd to try to capture every literary puff of smoke within these pages, so I have selected works that best transmit the insights on ontology that we seek in our time of overstimulated befuddlement. The primary intended audience for *Fuel* is college students and curious adults who do not necessarily work in academia. I have intentionally used a little specialized language as possible so as to attain a wide-ranging historical scope that engages general readers.

The book proceeds intuitively, with major sections on biomass, fossil, and new renewable fuels, each partitioned into specific contemporary interests like wood fires and hospitality, coal and rapid locomotion, the split atom and the fallout fate. There is a diversity of genre, from poetry to fiction to essays, despite a generally traditional view of what constitutes “literature” (I have not included readings from the social or natural sciences, for example).

Fuel is a book of literary exploration, so it is slender on statistics and quantitative analysis. Historical economists have produced many worthwhile studies of fuel and energy through time. Particularly notable is the work of Vaclav Smil, specifically his book *Energy in World History*, a primer on the evolution of culture and technology based on shifts in fuel sourcing. For example, Smil’s data and analysis show how the value of working animals on preindustrial farms depended intimately on the amount of biomass that could be spared to feed them. Large numbers of horses and oxen could subsist only in areas with great expanses of arable land, like the United States and parts of Europe; areas poorer in land relied more on human labor (73–80). Smil also usefully considers the roles of charcoal, windmills, and waterwheels in early industry, and how these primary energy and biomass architectures were torn apart to make room for coal in the nineteenth century and petroleum in the twentieth (164–5). I am also indebted to work by cultural historians like Richard Wrangham, E. A. Wrigley, Frederick Buell, and Barbara Freese, among others, and you will see traces of their narratives in the present work. These scholars have been especially astute in their analyses of the Industrial Revolution, with coal’s lead role in affecting myriad changes in environment, self, and society.

In addition to social and ecological histories of fuel, energy scholarship has recently turned to literary sources, which add a complement of fictional history, emotion, imagination, and ontological questioning to the social sciences. The recent work of Bob Johnson and Stephanie LeMenager has opened the world of fossil fuels to literary cultural analysis, with especially powerful insights on the physical and mental traumas of carbon-era living, the general disembodiment of labor ironically juxtaposed to the subaltern bodies toiling to produce coal and

oil, and the narrative trajectories of expansion and declension that guide our cultural perception of energy. Johnson's *Carbon Nation* and LeMenager's *Living Oil* are excellent investigations of fossil-fuel ontology, as is the recent writing of Patricia Yaeger, Ken Hiltner, Michael Ziser, and Imre Szeman.

This book's scope is broader than oil and coal, intending to compare the ontology of the "in" group, fossil fuels, with lives run upon the solar economies of biomass and primary energy. Though the three categories of fuel fall somewhat into a historical arc, they all coexist as well, and their exchanges and overlaps are the nexus of literary insight. This book departs from traditional sociohistorical inquiry to provide some ideas about how poetry and novels—fictional perspectives that encompass, amplify, and elaborate upon reality—are unique vessels for considering fuel. The literary container is potentially experimental, imaginative, speculative, political, ecological, and activist-oriented. Literature is a gumbo of history, philosophy, art, science, and politics, a stew of interdisciplinary knowledge that creates new intellectual tastes to savor. Because literature is so complex, it has the capacity to bring a background issue such as fuel into the foreground. As an inherently reflective medium that supports metanarrative, a counter-reading of literature as a source text for understanding fuel ontology can be particularly timely and rewarding. What I wish to do here is consider recipes using the ingredients of aesthetics, emotion, identity, and, more fundamentally, human ontology, as they relate to fuel. In our historical myopia, we often lose sight of life before the reign of fossil fuels, which began only two centuries ago. What is hidden or taken for granted, I wish to expose. However, because fuel became such a dominant force in culture during the industrial age, the literature of this book is highly concentrated on writing since 1800.

Our language is inflected with metaphors of energy. Older phrases like "three sheets to the wind," "horsing around," "feeling your oats," and "nose to the grindstone"—elements of a preindustrial world—are close to falling into the realm of dead metaphors. They have given way to the industrial metaphors of productivity based on the steam engine, where we "let off steam" so we don't "blow a gasket" (Nye 90). Our metaphors have changed from designating a world of animals, human bodies included, to designating a world of machines that have appropriated the body's work. The language implies that your cranium is now more like a gasket than the head bone of an ape.

It has been surprisingly easy to slough off our evolutionary and physical proximity to other animals and embrace machines as our kinfolk—and even engineer them to have autonomous agency and intelligence. Our concern for machines approaches sentimentality: likening the new locomotive to a "snorting

little animal,” one of the first rail passengers “felt rather inclined to pat” the contraption, as she would her trusty mare. We “baby” our cars, “debug” our computers, and often spend more money and emotion on their maintenance than on creatures that are alive, and suffering. Extending from the life of the metaphor and its power to construct meaning and identity, today we find ourselves literally, materially, made of oil products. This metamorphosis from animal to enhanced petro-animal happens most directly in food, which today usually consumes more fossil-fuel calories than it provides in animal/vegetable ones. It also happens ontologically as we extend our animal selves using energy-intensive prosthetics—things like cars and computers—that help us move and think better, or at least faster. Fossil fuels flummox us into an alluring and dubious “faster is better” ideology.

Sources of fuel, biomass like wood and peat, fossil fuels like coal and petroleum, and renewables like hydropower and geothermal energy, might seem mundane. Is not the interest of literature found in its emotive actions, not its dumb nouns? What literature teaches us about the human condition usually comes from the psyche of complex characters, not from the matter that drives their physical lives. For most humanist scholars, the paramount interest is the interplay between inner psychology and outward action, agency and fate, history and chance. Often literature elides its literal fuels, instead preferring the metaphorical fires of love and anger, the changes augured by the west wind, the depths of coal-black eyes, and the stoutness of oak hearts. Though we generally attend to the tenor, in this book I turn our eye on the vehicle of fuel metaphors. *Fuel* contends that the very nature of place, action, emotion, and fortune is in a large part designated by the material energy powering the scene.

Because of the prevalence of fuel in literature, I have had to select the works that best evoke the human condition within the rubric of a particular fuel, and leave out many others. The literature sampled here is generally Anglophone, with the insight of the fuel source driving the selections rather than any desire to focus on particular nations or genres. There is wide inclusion across class, race, and ethnicity, and readers will recognize well-known canonical works alongside the more obscure but no less illuminating selections. Following a historical arc that is not nearly as neat as the rainbow, we will begin with the oldest of human-used fuels, biomass, by considering the fodder of grass and hay that was critical to agricultural humans, and the pastoral rhythms that energize literature, starting with Virgil’s shepherds and continuing all the way to a postapocalyptic pastoral world envisioned by German writer Marlen Haushofer. It may surprise the modern consciousness to begin a book on fuel

with fodder. The bias that conflates fuel with fossil fuel is one of the weak points in ecocritical engagement: energy is often treated only in its most recent form, which catalyzed the Industrial Revolution. But fodder is the original fuel for the agricultural human, and we have labored to produce it for working animals ever since we had fields to plow and cows to milk.

Next, fire-giving wood and charcoal fueled innovations of cooking, indoor heating, and early industry, and the importance of the forest-dwelling charcoal burner comes center stage through its rather obscure literature, from the children's writer A. A. Milne to the creole hollers of Lafcadio Hearn. Finally, we turn to more unusual biomass sources like whale oil and tallow, animal products essential to pre-fossil-fuel illumination, and peat, a "slow renewable" heat source used intensively in regions with bogs, particularly Ireland, that claims its own leitmotif in the poetry of Seamus Heaney. With each of these biomass sources, themes that defined human existence since the agricultural revolution more than ten thousand years ago will be important to our understanding of biomass ontology: hard physical work, attunement to season and weather, synchrony with working animals and other laborers, and the perils of shortfall, particularly failed harvests and deforestation.

Next we will leap into the industrial space-time of high-energy fossil fuels, which have received the most attention in the energy humanities for good reason. Coal shouldered the Industrial Revolution beginning in the eighteenth century, but had been used more sparingly for heat centuries earlier. Its singular power to drive the steam engine revolutionized the means of production and distribution, requiring higher agricultural yields of raw goods such as cotton, as well as luxury items formerly consumed only by the very wealthy: tea, coffee, sugar, and chocolate. All of these products were grown mainly with slave labor in the Americas. In the imperial center, Britain, coal transfigured landscapes, both urban and rural, and created the possibility of suburbs along railway lines, reshaping human settlement patterns and the kinds of work performed by all classes, from rural peasants, who flocked to cities to become factory workers, to the wealthy classes, in which ancient, landed wealth made way for industrial barons quickly enriched by the new consumerism. Coal also supported a society of middle-class workers who could aspire to such aristocratic luxuries as large homes with new goods to fill them, higher education, and leisure travel. The environmental, epidemiological, and emotional impacts of widespread coal use are intricately recorded in nineteenth-century literature, perhaps most indelibly in the works of Charles Dickens, but also in more subtle ways in the writing of the Romantics, the Brontë sisters, and Anna Sewell's bestselling *Black Beauty*.

These texts are the first wave of reckoning with the fossil-fuel ontology that characterizes our industrial experience. They sit at the pivot point in history when fuel use was becoming self-reflexive—the nascent awareness of living in an Anthropocene.

The next fossil fuel, petroleum, is a less striking paradigm shift than biomass to coal, but oil held the power to modify rail-based systems into the private car—that classic symbol of freedom that doubles as its own fuel ontology. Particularly in America in the twentieth century, individual rapid movement redefined time and space on the map and the mind. Jack Kerouac is one among many high-octane American writers who explored the thrill and peril of a high-speed, transient existence characteristic of an age of fossil-fueled fury and ennui. Oil products also served as stock material for whole new categories of consumer goods made from plastics. The age of the internet was made possible, materially and energetically, by oil. The fossil-fuels section also contains short excursions into less pervasive materials such as coal gas and natural gas, the latter of which is enormously important in this era of hydrofracking and transitioning away from coal to generate heat and electricity. Natural gas has left only a faint trace on literature compared to its kindred fuels. In a short interlude that partakes of all categories of fuel, we will consider human fuel—food—in its pastoral and industrial versions, particularly in the poetry and philosophy of homesteader Wendell Berry and Billeh Nickerson, a McDonald's employee.

The last major section of the book turns to primary energy derived from the sun, wind, water, and atom—sources of energy with both ancient and contemporary lives. Ambient energy from natural flows like wind and water held great importance for preindustrial societies, whose mills refined wheat berries into flour and performed other grinding tasks like the preparation of gunpowder. These energy sources varied dramatically according to natural conditions, and early feats of engineering regulated water flows using millraces and containment ponds. Still, drought and flood and, for windmills, calm days, often suspended production. George Eliot's Tulliver family is helpless in the face of the elements—an ontology in common with biomass societies that relied on the harvest, but one quite foreign in our empowered age of fossil fuels, which can be deployed regardless of natural conditions.

The modern era of the giant dam began with the public works projects in the mid-twentieth century United States, and this great elevation of dam-building scale and ambition showed a fossil-fuel era's approach toward regulating natural water flows to control flood, opening rivers to large shipping vessels, and generating electricity. The effects on riparian fisheries and tribal fishing

rights, as well as the landscapes flooded in the wake of the dam (most famously Glen Canyon), continue to be controversial sacrifices in the name of progress. Writers like Edward Abbey are synonymous with dam protest, and his work in particular shows how fiction can inspire real-world activism. Though large dams continue their furious pace of construction in developing regions, the era of dam decommissioning is well underway in most highly industrialized countries. Because so much literature might be included in a study with such a broad scope, many of the readings are short and pithy. However, more in-depth studies of a few remarkable works appear in each section.

It is important to remember that we hold the benefit of hindsight when reading the literatures of previous centuries. Fully aware of the global impacts of the Anthropocene, and particularly the changes of last two industrial centuries, it could appear a form of critical bad faith to foist judgments upon the behaviors of past generations. As much as possible, I have placed perception over judgment, and left the ethical orientations of the writers themselves to stand as a historical record of how literary figures marked their own experience. My interest is in how the fuel depicted in literature illuminates historical moments in which the interfaces between self, society, and nature are configured by specific energy regimes. By using literature as a source text, we may arrive at an emotionally and philosophically more robust synthesis of energy history than the social and natural sciences, relying upon objective accounts and statistics, are able to provide. Rereading these texts with an emphasis on fuel helps us mark today's cultural and ecological coordinates. Tomorrow's literature will continue to record the evolution of fuel cultures while developing characters whose ontology reveals the immediate and downstream effects of consuming energy. The literary imagination pays forward its insights.