AMERICAN HISTORY
OXFORD RESEARCH ENCYCLOPEDIAS

[View source]

Energy in American History

Aaron Sachs

There may be nothing so fundamental to U.S. environmental history as energy. But perhaps not for the reasons you might expect.

In the 21st century, environmental thinkers almost always discuss energy in the specific context of global climate change. That makes good sense, given how dangerous a problem global warming is and how crucial an environmental force the climate has always been—but it's also potentially distracting. The fixation on climate change tends to turn the broad question of energy use into a narrow question of emissions. Indeed, in many conversations about climate change policy, it is simply assumed that the goal is to maintain or even expand the current energy supply—while simultaneously we clean up the system and make sure that we're reducing the amount of carbon that gets into the atmosphere. What really matters is whether the energy is "dirty" or "clean."

A more historical approach to energy should help elucidate not just the significance of shifts in production systems, but the significance of shifting expectations with regard to consumption. Certainly, it matters greatly that Americans switched from fireplaces and water wheels to coal furnaces and petroleum-fueled combustion engines. But the enormous growth in Americans' demand for energy should also be noted—a growth tied not just to changes in technology and resource availability but also, and probably more importantly, to the general explosion of American consumerism and commodification.

Americans' changing relationship to energy was at the very heart of American modernization, the sweeping transformations that occurred around the turn of the 20th century, when massive numbers of people started living in cities, working in factories, and realizing that the pace and scope of their lives would never be the same, for better and worse. That means that any serious conversation about energy policy will have to consider not just the technical questions of supply and production but also the cultural and ethical questions of demand and consumption. History can contribute to that conversation and many others by reminding us that nothing about modernity ought to be taken for granted.

Consider, to begin with, two brief stories from the era of modernization, before we back up and try to take a fuller measure of energy's role in U.S. history.

Two Modern Fables: The Light Bulb and the Oil Spill

On September 4, 1882, at 3 p.m., Thomas Edison was in J. P. Morgan's offices on Wall Street—literally inside the mahogany walls—and when he closed a switch shortly after the clock struck three, hundreds of his incandescent bulbs lit up simultaneously in a five-block radius all around him. It seemed like a miracle to the gathered crowd; it seemed like magic. People started murmuring, "They're on!" The lights stayed on as evening fell, and everyone in lower Manhattan noticed how different they were from the smelly, flickering gas lamps that American urbanites were used to. The next day, the New York Times reported that the "light was soft, mellow, and graceful to the eye. It seemed almost like writing by daylight to have a light without a particle of flicker and with scarcely any heat to make the head ache."1

What the crowd did not see was the six steam generators a few blocks away on Pearl Street, each the size of an elephant (they were nicknamed Jumbos, after the famous elephant who starred in P. T. Barnum's circus). To power the generators, men had to shovel loads of coal into furnaces (and of course no Manhattanites had seen the coal dug out of the mountain). Those furnaces boiled water to form steam, which was channeled in such a way that the resulting pressure rotated turbines, which created electrical energy. But of course no one wanted one of these generators in his or her neighborhood or work space. So to connect these contraptions to the lightbulbs, a crew had dug eighteen miles of tunnels that were lined with brick and laid with copper wire, and then they had connected smaller wires from these main channels into light sockets in the walls of various buildings in the Wall Street district.2

Edison's light bulbs lit up lower Manhattan—but simultaneously made labor invisible; it was hidden in the shadows. Energy had become the perfect commodity. All that people knew about electricity was that you could buy it—and that was all that mattered. Like most commodities, it seemed to have no social or ecological context, but it went even further than most in the direction of abstraction and disconnection. In 1882, most people looking at a sausage on their plate still had some solid idea of where it had come from and what it had taken to produce it. People staring at an Edison bulb imagined that somehow they had harnessed lightning.

The second story takes place less than twenty years later, on January 10, 1901, in Beaumont, Texas, where there was an explosion on a hill known locally as Spindletop. A primitive drilling operation had been going on here for almost a year—just one derrick, with one drill, powered by a boiler fed by firewood. Over the course of several months, the drill had gone down hundreds of feet, then 1,000 feet, then 1,300 feet—and suddenly there was a bubbling up of mud, and then a blast of gas, with huge chunks of bedrock flying everywhere, and then finally a stream of oil that shot up 150 feet into the air. The flow was 18,000 barrels every twenty-four hours. But the problem was that the flow was so intense it couldn't be capped. On January 14, the Dallas Morning News ran a headline: "Want it stopped: reward offered to anyone who will control the flow!" Every vehicle in Beaumont had been requisitioned to help carry buckets of oil to holding tanks, but still about 60,000 barrels had

been simply wasted, and people started to worry that the oil-soaked ground might catch fire. Finally, some engineers managed to put on an iron T-joint and a pressure valve to cap the gusher. And then Beaumont became a boomtown, and by January of the following year, Texas oil was burning not only in New York and Philadelphia but also in Europe, Cuba, and Mexico. It was another miracle, and the men responsible for drilling and capturing this new resource were seen as contributors to the common good. Drilling thus came to be governed by an old legal principle called "The Rule of Capture," according to which the driller was allowed to take as much oil as he could get without needing to pay any local or national taxes.3

Soon it became clear that both Texas and California were full of oil, and the industry took off over the next couple of decades in those states. When World War I came around, it became patriotic to produce oil, because this was the first war in which petroleum-powered vehicles like tanks played a prominent role. Congress established a key precedent by offering a sweet subsidy: a 27 percent tax deduction for any investment made by a U.S. oil company in projects meant to open up new oil supplies to development. Then, immediately after the war, industry leaders came together to form the American Petroleum Institute, which has been defending this kind of subsidy ever since, with a great deal of success. Meanwhile, the supply available within a few years of Spindletop absolutely dwarfed what had been coming through pipelines in Pennsylvania. (The first U.S. oil strike was in Pennsylvania in 1859, and Rockefeller's Standard Oil company was founded in 1870; by 1882 it controlled 90 percent of the nation's refining capacity.)4

Beaumont oil created companies like Gulf, Texaco, and Exxon, all of which provided a new kind of product: the older Pennsylvania strikes had yielded oil that was really good for lubricating machines and burning in lamps, but the Texas oil turned out to be really good for burning as fuel in engines. It was perfect for cars, in particular, and it helped spur the explosion of the auto industry, which, in turn, had a huge impact on the development of American consumerism. But meanwhile, Spindletop had immediately revealed some of the dangers inherent in buying into an oil-based economy. In 1901, the Spindletop field produced 3.5 million barrels; peak production came the next year, with 17.5 million barrels; in 1903 production fell to 8.6 million; and by 1907 the resource had been depleted and there was nothing left. The oil market, in other words, has always been volatile. In 1901, each barrel was selling for $1. In 1902, the price per barrel was down to 3 cents. But two years later, as the supply shrank, and as more people started converting their coal-fired engines to oil-fired engines, which spurred more demand, the price shot back up again.5 Oil was amazing, exhilarating, magical; it was also deeply unsettling. Like modernity itself.

Wood and Water

Energy is the capacity to do work. That sounds humble and ordinary, but a society's energy system actually goes pretty far in setting expectations and assumptions of what is possible and normal. How much of the world do you expect to see? How far away from your family do you expect to live? What do you think your society ought to provide for you? What

kind of work can you imagine getting done? That all depends on how much energy you have at your disposal.

A family in colonial America with several healthy children and one hired hand and a team of oxen—in other words a middle-class or upper-middle-class family—had about three horsepower, and needed to convert that into its equivalent in food and fuel. A good investment of that energy might have been to cut down a tree, with the goal of getting more energy via firewood. Today, a typical middle-class suburban family has about 100 times as much power available, almost all of which comes from fossil fuels.6 So, on the one hand, we can now envision accomplishing much more: it's normal to expect to travel great distances and to eat food that has traveled great distances. But on the other hand it's also the case that now we actually work much less (on average; of course some hard labor still has to be performed). The basic work done to keep us alive is mostly done by fossil fuels rather than bodies, which is a great advantage in some ways, because it frees us up to do more interesting things, like get an education. It can also be seen as a disadvantage, though, because by buying into a system where we do much less bodily work, we also bought into much higher rates of depression, and heart disease, and obesity, and general alienation. Here we are with far more energy at our disposal, and yet how often do we say that we're feeling "low energy"? That's not something people said in colonial times.

All Americans in the colonial period were accustomed to using their body to accomplish certain crucial tasks, like carrying buckets of water and waste, but they also relied heavily on animals like the aforementioned oxen and especially horses—as well as cows, goats, and sheep. Agricultural systems, meanwhile, were of great help in converting the sun's energy into plants that could serve as fuel for both people and their livestock. Bodies eventually break down, and animals erode the soil, but generally "mixed farming" regimes, in relatively temperate climes, were sustainable over very long periods of time. It is true that most Americans had abandoned subsistence-level agriculture by the late 18th century in favor of market-oriented production and the quest for energy surpluses, which led to shifts in scale that were more compatible with industrial development. But energy use throughout the colonial era has to be considered moderate or even lean.

Two additional ways of harnessing energy were to chop and burn wood and to use wood to build dams and water wheels. For a time, most wood went toward the heating of private homes, but wood was also burned to make charcoal, the fuel that drove the burgeoning 18th-century ironmaking industry. The first mills were built in the early 17th century, at the start of the colonial period, and they were generally flour mills or saw mills—communal places where settlers could bring grain and have it ground into flour or bring wood to be sawn into planks. This was a highly efficient process compared to what it would have taken for individual bodies to grind the grain or saw the logs. In the 17th century a four-horsepower mill could grind flour between two sixteen-hundred-pound grindstones at 120 revolutions per minute; to achieve the same level of power without the water's help would have taken forty men simultaneously turning a crank.7

By the start of the 19th century, when water-powered mills started to proliferate and started to be used not just for grain and wood but for making paper or textiles or dyes or nails or screws, they could harness between ten and sixty horsepower.8 On many levels this was an excellent technology: after all, it was potentially renewable, and it produced no carbon emissions. But there are always costs when energy is generated. Watermills often destroyed fish populations, because with dams every few miles or every few yards in some places, the fish couldn't move up rivers to spawn. The dams also caused seasonal flooding of meadows, destroying local hay supplies and taking some very fertile soil out of production. And the new manufacturing mills produced pollutants—acids, dyes, even large volumes of sawdust—that were often released directly into rivers.

The most famous symbols of the new industrial age were the textile mills at Lowell, Massachusetts, which employed thousands of young women from the New England countryside starting in the 1820s. Here it became clear that Jefferson's agrarian desire to eschew the example of England, where polluted cities like Manchester and Liverpool had already been sacrificed to the nation's industrial ambition, was losing out to the argument that the United States should try to use manufacturing to become more independent. At the Lowell mills, the combination of wood, water, and powerful cultural trends resulted in great labor-saving efficiencies and great economic productivity. On the other hand, as managers took control over the pace of work, class divisions were intensified, and the national economy became more deeply invested in the labor of slaves in the South, since the cotton they picked and cleaned could now be processed in Massachusetts instead of getting sent overseas. Population growth and urbanization took off, and America's power dynamics grew increasingly complex.

Steam and Coal

Wood and water power were dominant until the middle of the 19th century, when the steam engine started to gain ground. At first, steam engines were fed by firewood, but during the course of the century coal started taking over as the main fuel source (it was dominant by the 1880s). And the steam engine, regardless of what fuel it used, gradually started transforming Americans' whole set of assumptions about what was possible. This was the era of the so-called "annihilation of space and time": people suddenly started moving faster than the speed of nature, faster than their legs could carry them, faster than river currents, faster than wind—and, again, this was both exciting and disorienting, magical and unsettling. Steamboats came first, and then trains took over in the eastern United States in the 1840s and 1850s, and early travelers talked about how dizzy they got traveling at such high speeds (like thirty miles per hour!), how they felt they were being dehumanized, how they became a piece of baggage, how it had become impossible to stay calm and converse with one's fellow passengers. With the emergence of the railroad companies, bolstered by federal grants and

subsidies, the world of American business began to shift from the small-firm model, characterized by artisanal work, to a kind of capitalism geared toward major corporations.

Steam power allowed factories to expand and produce far more goods than before, and it also made the penny press possible, so the culture got flooded with ephemeral publications, especially newspapers and magazines. One could argue that steam power helped to democratize American culture. Generally speaking the flow of people, goods, and ideas expanded greatly during the mid-19th century, and steam drove industrialization and urbanization. Steam power meant you could have a city virtually anywhere, without needing to worry about rivers, and steam power made it so that it was easier to connect production with consumption: markets were more reliable, so much more seemed possible.

Of course, as usual, there were significant costs. First came massive deforestation for wood to feed the boilers that ran the steam engines. American deforestation rates peaked in the 1870s, raising serious concerns about soil erosion and flooding;9 afterward, as land clearing for settlement shifted to the plains and as more coal seams were opened up in the East, the more obvious environmental problems tended to be associated with the scars and pollution of mining, especially in Appalachia. First, Americans burned boatloads of the somewhat cleaner anthracite coal of eastern Pennsylvania, and then they switched to the much softer and dirtier bituminous coal of western Pennsylvania and beyond. The bituminous variety was more plentiful and easier to get at, and so it started to dominate American energy regimes in the last three decades of the 19th century. But while anthracite (the oldest, shiniest, most pure kind of coal, with the highest carbon content) could burn without giving off any smoke, the younger bituminous coal caused such terrible air pollution—which in turn had such a significant impact on people's health—that it spurred the first modest calls to regulate smokestack emissions. Americans were poised to strike a strange bargain: in the era of coal and steam, the thrill of eliminating certain kinds of human labor and of generally living a faster and easier life made it seem acceptable for them to admit at least certain amounts of black smoke into their everyday spaces. Moreover, it was becoming clear that some new forms of labor would be undertaken in circumstances that were both miserable and risky: workers routinely suffered and died in coal mines and various kinds of factories, and the concentrated energy in steam engines had a tendency to cause catastrophic explosions. Even before oil and electricity, in other words, the world of American work had changed quite drastically.

Meanwhile, the new availability of coal, especially the cleaner anthracite, also had a major impact on lighting and heating systems for American homes and communities. People living in and near Pennsylvania started warming themselves and cooking with coal as early as the 1820s and 1830s, using mostly open grates but gradually switching to furnaces and stoves. Some eastern cities also built coal-fired gasworks in this same period, with the result that by the time Moby-Dick was published (1851), the use of whale oil for illumination was becoming far less common. Every transition to a new source of energy is complicated, driven by countless human decisions, but in American history financial markets have often played an important role. In the 1820s and 1830s, much of eastern Pennsylvania was infected by a

"speculative fever," with prospectors meeting at night to trade "real and fictional coal lands."10

By the post–Civil War period, with bituminous coal deposits getting discovered across the nation (in more than twenty states), a new cultural commitment had arisen to all-out growth and expansion.11 Industrialism had won the war, after all, and now the goal was to spread westward and sell manufactured goods all along the line of the new transcontinental railroad (completed in 1869). In particular, the swift evolution of the steel industry in Pittsburgh—unsurprisingly, near the greatest concentration of soft coal—permitted American dreams of power and majesty to soar ever higher, as skyscrapers began to sprout up in new and old cities alike. Even the nation's metaphors and figures of speech had begun to change to reflect the new energy regime. America no longer needed to hold its horses, for it had gotten up a full head of steam. The only real concern was the danger of blowing a gasket or two along the way.

Commodification and Modernization: The Era of Electricity and Oil

With the arrival of electricity and petroleum, American society approached full-on modernity. Energy was now perfectly commodified, and individual Americans found themselves roped into an elaborate system that they had no control over and could not possibly understand. It was even becoming more difficult for people to know when they were using energy, because flipping a switch takes so little work. The U.S. energy system had been developing along these lines throughout the 19th century—the majority of people had gotten further and further removed from physical labor in general, from the acts of chopping wood and grinding grain into flour. But the scale of Americans' alienation changed drastically at the end of the 19th century, just as the scale of cities changed, and the scale of industrial production changed. The United States was becoming a society of mass consumption in which the average person had less and less of an idea of what production looked like or what it depended on. Of course, that alienation and ignorance and even helplessness were considered acceptable to many people because oil and electricity came with so many obvious benefits: not just the possibility of cutting back on difficult labor but also the prospect of enjoying things like movies, radio broadcasts, tourism, escalators, amusement parks, and light shows.

In 1850, gross energy consumption in the United States was about 2,000 trillion BTUs. By 1930, it was ten times that amount; it had grown twice as fast as the population.12 The United States had the largest economy in the world, and it was the most powerful nation in the world, and anything seemed possible—so it was during this period that incredibly ambitious projects like the Hoover dam were undertaken (which goes to show that old energy regimes don't simply disappear; sometimes they just grow in scale). It's also in this period

that Americans clearly developed the habit of high energy consumption, in part to fuel a preference for cars (Europe and Asia, significantly, stuck with trains). Car culture was in turn connected to sprawling suburban development (for the most part, Europe and Asia have more densely packed populations and housing stock that is easier to heat; row houses are more efficient than isolated single family homes).The new oil boom, then, went largely toward transportation, and the new access to electricity fed all kinds of consumerism (think vacuum cleaners, dishwashers, televisions), culminating in the classic picture of sprawling 1950s suburbs, awash in perceived abundance and the convenience of interstate highways and fast food chains.

Ever since then, one could argue that Americans have behaved like addicts. The United States uses 40 percent more energy than Germany in per capita terms, twice as much as Sweden (and keep in mind, it's cold in Sweden), and three times as much as Japan or Italy. Those are all places with a high quality of life.13 Are Americans particularly wasteful? Lazy? Why are Americans so unwilling to consider the possibility of using less energy? Certainly, cheap, abundant energy is seductive, especially since it dramatically improved the lives of so many people; no one can argue with the benefits of replacing bodies with oil-powered engines when it comes to the most brutal kinds of labor, much of which, throughout history, has been done by the most vulnerable classes (sometimes enslaved racial minorities, sometimes women) in any given society.

More broadly, the assumption has always been that higher energy use meant more economic activity, which meant more jobs and more prosperity. Occasionally things have happened that could have left Americans chastened—like the Great Depression, or, most relevant for energy, the oil crisis of 1973–1974, when OPEC (the Organization of Petroleum Exporting Countries) launched an embargo and thus restricted the amount of oil flowing to the United States. OPEC's move was spurred largely by the Arab-Israeli conflict and by the United States' support of Israel. The upshot in the United States was that the price of gasoline doubled and there were long lines at gas stations, leaving American society with a new sense of limitation, and leaving the American economy mired in what came to be known as the era of stagflation (stagnation plus inflation). By the late 1970s President Jimmy Carter was starting to talk about energy conservation, but his stance was unpopular with the American people. When Ronald Reagan was voted into office in 1980, he proclaimed that it was once again "morning in America," and by the 1990s the United States had a culture of gas-guzzling SUVs instead of the culture of tiny fuel-efficient vehicles that would have been possible if research and development priorities had been different. Americans don't like limits; they don't like frontiers to be closed; they think expansively. Although this is a broad generalization, it correlates with what has always been a sloppy, ineffective energy policy.

Ultimately, the power of the American system, created and maintained through cooperation between corporations and the state, makes people reluctant to think about using less energy. It's difficult to live "off the grid," and most of us no longer know how to harness

our own bodily power. When hurricanes or ice storms strike and power lines go down, many energy consumers are left utterly helpless. All they can think about is getting the power back.

And yet the grid is a very recent creation. American energy gluttony developed in just one century, the century of oil. In 1910 not even 15 percent of American households had electricity.14 Societies tend to make drastic changes in their energy systems every few decades. Think back on the history we've been tracing: the U.S. moved from wood and water to steam and coal to electricity and oil. And of course older systems have never completely disappeared; many of them are still viable. Pricing, technology, consumer preferences, environmental impacts, and many other factors can spur shifts in energy regimes. Even a minimal environmental awareness should push us toward more serious energy shifts in the 21st century. We need to burn fewer fossil fuels, and we need more renewable forms of energy; solar power and wind power should be exploding on the market by now—it should have happened 20 years ago. But we also need to remember that it's not just the form of energy that matters—it's how much energy, it's how we think about energy. Again, there are always going to be costs to energy production. Some communities have already rejected wind farms on aesthetic grounds. Solar panel production creates toxic pollution. Energy is never free. History suggests a need to think about energy regimes not just in terms of human comfort and our survival, but in terms of ethics.

Cultures of Production and Consumption

Ethically, it is difficult to justify what can only be described as a decadent energy culture in the United States. Consider how we might examine the problem from the perspective of the environmental justice movement, which tends to marshal dumped-on communities to confront dumping communities. The majority of our electricity in this country comes from coal-fired power plants, so every time we switch on a light we are contributing to processes like mountain-top removal. What if you had to dig your own coal in order to produce electricity? Think about areas that are rich in resources in this country and consider their economic well-being. Have they profited from our all-out pursuit of fossil fuels? Well, the most resource-rich region in our country, the place with the highest concentration of fossil fuels, is also one of the most impoverished: Appalachia.

But go a step beyond the justice angle. Yes, we have treated certain communities as disposable, expendable, and we have averted our eyes from them, and that is inexcusable. But we also need to ask ourselves the question: is this what we really wanted? Does this energy economy actually serve the majority of Americans? In Texas, the concentration of oil has created significant wealth—but its distribution is far from equitable, and, for all the cultural riches a city like Houston might offer, its problems with air pollution and sprawl and snarled traffic have prevented it from gaining a reputation as a truly desirable place of residence. Do we really want to be this dependent on our cars? Do we want to be this dependent on an unstable supply of oil and an unstable supply of electricity? Do we want to

feel this helpless? Do we want to continue going to war to try to secure our energy supply? And where are we supposed to put all these unnecessary plastic objects?

At its most basic level, commodification means disconnection, not only from natural resources but from ourselves. We don't know our bodies anymore because we no longer measure them by the amount of work we are able to accomplish: the energy we expend no longer feeds us or warms us directly—it just earns us money, an abstract reward if ever there was one. Then we spend and consume in order to make ourselves feel better, to compensate for our alienation—but that's an evasion in the same way that taking a wilderness vacation is an evasion. It doesn't get to the root of the problem. This is not meant to be a romanticization of physical labor. It is just meant to say that the commodification of energy is a historical process, and though historical processes can sometimes pick up a certain technological momentum that locks us into certain patterns for a time, they are always, in the end, driven by cultural debates, by human choices, by human consciousness.

One role history can play in debates about energy regimes is to remind us that human societies have successfully produced and consumed energy in many different modes. Cheap, highly concentrated power has been with us for only a short time, and human societies found ways of thriving even before fossil fuels were dominant, back in the era of night-time darkness and wood and constant walking. In fact, working one's body is a well-established way of bolstering one's mood and resilience, so older, more positive visions of work could become crucial in any effort to remake our energy culture. Recent neuroscience research suggests that some forms of modern depression are closely linked to the fewer opportunities we have to use our bodies to accomplish necessary tasks.15 Americans have been trained to believe that flicking a switch on their thermostat is preferable to chopping wood for their stove, but might it be possible for people to retrain themselves?

What if those with sufficient energy tried to replace a certain amount of fossil fuel consumption with human power, tried to do their work on a more human scale? What if people biked to the office, used a push mower, joined a community garden? Sometimes it might feel like a sacrifice, and sometimes it might actually be fun. Who isn't interested in avoiding traffic jams? Who would object to seeing more constellations in the night sky?

Americans could embrace smaller, more local economies (with much shorter and simpler supply chains), and could try to rebuild a sense of community, in which neighbors help each other. In Bill McKibben's words, Americans could generally try to live more "lightly, carefully, gracefully."16 It's not a matter of advocating social withdrawal or insisting on a joyless efficiency, but perhaps simply of following the example set by the Benedictine monks, as the cultural critic Lewis Mumford once proposed: "Rewarding work they kept for themselves: manuscript copying, illumination, carving. Unrewarding work they turned over to the machine: grinding, pounding, sawing. In that original discrimination they showed their intellectual superiority to many of our own contemporaries, who seek to transfer both forms of work to the machine, even if the resultant life prove to be mindless and meaningless."17

Thinking historically about energy helps us recognize that society has not in fact become more and more perfect through the ages, helps us acknowledge that there will always be work and someone will always have to do it. Isn't it time to admit that our deep love of oil, in particular, and of oil's culture of mobility and consumerist fun, has left us with long-term expectations that fly in the face of the world's hard realities? Many of us are grateful for the pleasures provided by petroleum, but we probably haven't grappled with the actual costs of those pleasures.

A failure to question our level of energy consumption, combined with the assumption that our main goal ought to be simply reducing carbon emissions, has led some energy historians and policy analysts to endorse nuclear power in recent years as our last best hope.18 But a broader framing of energy culture—including the many risks of atomic energy production, from meltdowns to terrorism to the persistence of radioactive waste for hundreds of thousands of years—could help us re-focus on the question of how we might cut back and ease off and re-learn ways of harnessing renewable sources of energy. Solar, wind, water, and geothermal power can all be channeled through many existing infrastructures, and though these sources do not provide as much concentrated energy as fossil fuels, people could rely on them indefinitely. Promising new technologies, like hydrogen-powered fuel cells, which create no pollution, will certainly contribute to our energy future. And if we can drum up enough political will, there are a number of obvious conservation measures, taxation schemes, legislative interventions, and market adjustments that could help spur drastic shifts in the way society gets its work done.

American society's current energy problems are dramatic and complex, and no single discipline or field of study can hope to solve them. But history at least springs us from the trap of inevitability: human choices established our existing energy system, and human choices, under certain kinds of social and environmental pressure, will transform it.

Notes:

(1.) New York Times, September 5, 1882.

(2.) For good accounts of Edison and the demonstration in Lower Manhattan, see Louis C. Hunter and Lynwood Bryant, A History of Industrial Power in the United States, 1780–1930, vol. 2, The Transmission of Power (Cambridge, MA: MIT Press, 1991), 185–193, and Amanda Little, Power Trip: From Oil Wells to Solar Cells—Our Ride to the Renewable Future (New York: Harper, 2009), 216–221.

(3.) On Spindletop, see Little, Power Trip, 18–26; Brian Black, Crude Reality: Petroleum in World History (Lanham, Md: Rowman and Littlefield, 2012), 38–42 and 67–73; and Daniel Yergin, The Prize: The Epic Quest for Oil, Money, and Power (New York: Free Press, 2009), 62–79.

(4.) Little, Power Trip, 26–38; Yergin, Prize, 19–39, 151–167, and 190–211; and Paul Sabin, Crude Politics: The California Oil Market, 1900–1940 (Berkeley: University of California Press, 2005).

(5.) Little, Power Trip, 24–25.

(6.) David E. Nye, Consuming Power: A Social History of American Energies (Cambridge, MA: MIT Press, 1998), esp. 11–12. Also see Martin V. Melosi, Coping with Abundance: Energy and Environment in Industrial America (Philadelphia: Temple University Press, 1985), and Sam H. Schurr and Bruce C. Netschert et al., Energy in the American Economy, 1850–1975: An Economic Study of Its History and Prospects (Westport, CT: Greenwood, 1977; orig. 1960).

(7.) Nye, Consuming Power, 21–22, and Louis C. Hunter, A History of Industrial Power in the United States, 1780–1930, Volume One: Waterpower in the Century of the Steam Engine (Charlottesville: University Press of Virginia, 1979), 107.

(8.) Hunter, Waterpower, 112.

(9.) Michael Williams, Deforesting the Earth: From Prehistory to Global Crisis (Chicago: University of Chicago Press, 2003), 302–307.

(10.) Donald L. Miller and Richard E. Sharpless, The Kingdom of Coal: Work, Enterprise and Ethnic Communities in the Mine Fields (Philadelphia: University of Pennsylvania Press, 1985), 46.

(11.) Melosi, Coping with Abundance, 30.

(12.) Ibid., 3–8, and Schurr and Netschert, Energy in the American Economy, 35–36, 145, and 522–524.

(13.) Nye, Consuming Power, 6, and see chapters 6 and 7; also see Little, Power Trip, chapter 3; Melosi, Coping with Abundance, chapter 6; and Christopher Flavin and Nicholas Lenssen, Power Surge: Guide to the Coming Energy Revolution (New York: W. W. Norton, 1994), esp. chapters 10 and 11.

(14.) Ernest Freeberg, The Age of Edison: Electric Light and the Invention of Modern America (New York: Penguin, 2013), 286.

(15.) Kelly G. Lambert, "Rising Rates of Depression in Today's Society: Consideration of the Roles of Effort-Based Rewards and Enhanced Resilience in Day-to-Day Functioning," Neuroscience and Biobehavioral Reviews 30 (2006), 497–510.

(16.) Bill McKibben, Eaarth: Making a Life on a Tough New Planet (New York: St. Martin's Griffin, 2011), 151.

(17.) Lewis Mumford, The Myth of the Machine: Technics and Human Development (New York: Harcourt, Brace, and World, 1967), 269.

(18.) Alfred W. Crosby comes across as an advocate for nuclear energy at the end of his Children of the Sun: A History of Humanity's Unappeasable Appetite for Energy (New York: W. W. Norton, 2006), 126–146.

(19.) Ibid., 1.

(20.) Nye, Consuming Power, 176.

Aaron Sachs
Department of History, Cornell University

[View source]