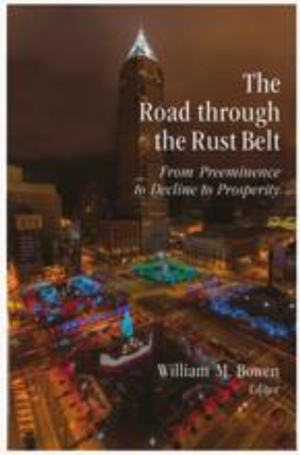
Upjohn Institute Press

How Energy Policy Enabled the Decline of Midwestern Cities, and How It Can Contribute to Their Rehabilitation



Andrew R. Thomas
Cleveland State University

Chapter 7 (pp. 147-190) in:
The Road through the Rust Belt: From Preeminence to Decline to Prosperity
William M. Bowen, ed.
Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2014
DOI: 10.17848/9780880994774.ch7

The Road through the Rust Belt

From Preeminence to Decline to Prosperity

William M. Bowen
Editor

2014

W.E. Upjohn Institute for Employment Research
Kalamazoo, Michigan

Library of Congress Cataloging-in-Publication Data

The road through the Rust Belt : from preeminence to decline to prosperity / William M. Bowen, editor.
pages cm
Includes bibliographical references and index.
ISBN-13: 978-0-88099-475-0 (pbk. : alk. paper)
ISBN-10: 0-88099-475-4 (pbk. : alk. paper)
ISBN-13: 978-0-88099-476-7 (hardcover : alk. paper)
ISBN-10: 0-88099-476-2 (hardcover : alk. paper)
1. Middle West—Economic conditions. 2. Middle West—Economic policy. I. Bowen, William M.
HC107.A14R63 2014
330.977—dc23
2013046745

W.E. Upjohn Institute for Employment Research
300 S. Westnedge Avenue
Kalamazoo, Michigan 49007-4686

Cover design by Alcorn Publication Design.
Index prepared by Diane Worden.
Printed in the United States of America.
Printed on recycled paper.

7
How Energy Policy Enabled the Decline of Midwestern Cities, and How It Can Contribute to Their Rehabilitation

Andrew R. Thomas
Cleveland State University

Globalization can't be seen as the sole factor that led to the decline in cities in the upper Midwest. Another contributing factor is homegrown: domestic energy policy. For instance, subsidies for rural electricity, funded by midwestern cities, made it possible for manufacturing to move to the Sunbelt. Similarly, subsidies for an interstate highway system established a permanent preference for trucking over the Great Lakes shipping ports and railroad centers. However, there are a number of energy policies that, if adopted, could foster rather than impede economic growth in declining Rust Belt cities.

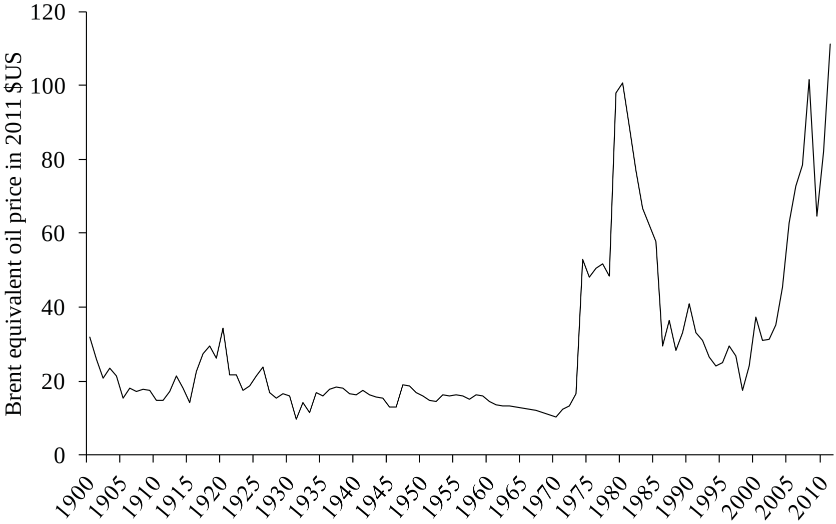
In 1986 Michael Kinsley wrote an essay in *The New Republic* that helped popularize the word *schadenfreude* in America. *Schadenfreude* is a German word meaning "glee at the misery of others," a word Kinsley noted that only the Germans, with their grim humor, could invent. Kinsley speculated that, after more than a decade of watching vast amounts of wealth being transferred from the Northeast to the Texas Gulf Coast, the Northeast would enjoy watching the collapse of the oil and gas industry, and with it, the Texas economy. Indeed, in the late 1980s prices for natural gas dropped from over $4 per thousand cubic feet (mcf) to below $1.50 per mcf, and prices for oil fell from nearly $40 per barrel (bbl) to below $15 per bbl (1980 dollars). As a result, the oil and gas industry began a major contraction in the late 1980s that continued through the 1990s. But the Texas economy, while damaged, did not collapse. Nor did the Rust Belt economies of the Midwest and the Northeast fully recover when oil and gas prices remained low throughout the 1990s.

For those of us who grew up in the Midwest, the 1970s were a difficult time. The cost of fuel at the pump had skyrocketed overnight. Families waited in long lines to buy gasoline. Ford station wagons were abandoned for Volkswagen Beetles. The expense of heating the family home with natural gas was even more painful, as prices rose from around $0.20 per mcf to over $3 per mcf in a decade. With the rapid increase in energy costs came rampant inflation. Life in the Midwest was forever changed, with the perception that Texas cowboys had hijacked our way of life—and in the process pocketed billions of our hard-earned dollars. So it is small wonder that residents of the Midwest and Northeast experienced *schadenfreude* when increased production and decreased consumption inevitably led to an oversupply of oil and natural gas and a price collapse in the 1990s.

To be sure, the advent of the Rust Belt economies of the Midwest had many causes. We have heard much about them: bloated unions, high taxes, globalization, and underperforming education are the most cited. However, there can be little doubt that the energy crisis of the 1970s was a principal catalyst for the decline of the cities in and around the Great Lakes region. It decimated the American automobile industry, as Japanese and European automakers stole market share with their smaller, more energy-efficient models. The effects cascaded throughout the Midwest but were particularly hard felt in the Great Lakes region, where automobile and steel manufacturing formed a large part of the economy.

The American Midwest was suffering from what economist Gail Tverberg subsequently described as the "high-priced fuel syndrome" (Tverberg 2012). In short, consumers are required to pay more for a necessity, and as a result they cut back on discretionary goods and services. If oil and gas prices go up, so do food prices, which are dependent on oil for transportation and natural gas for fertilizers. Commuting costs, electricity prices, and business expenses increase. The result is layoffs, cutbacks, and more pressure on discretionary goods and services. Property values and tax revenues decline, and the follow-on effects are magnified. Figure 7.1 shows how acute the problem with oil prices was for the Midwest in the late 1970s.

Figure 7.1 Historic Oil Prices, 1900–2011 (2011$)



NOTE: "Brent equivalency" is the accepted international benchmark for crude oil pricing.
SOURCE: Tverberg (2012).

The result of the "high-priced fuel syndrome" in the late 1970s was an exodus out of the Midwest and the Northeast, especially of young people. A comparison of a timeline of inflation-adjusted oil prices with demographic change in the Northeast, Midwest, and the South demonstrates this: after decades of double-digit population growth, growth in the Northeast and the Midwest plummeted after the oil shock of the 1970s. In the South, on the other hand, population growth continued unabated, as shown in Table 7.1.

Yet when oil and gas prices crashed in the 1990s, the Northeast and the Midwest failed to regain their pre-energy-crisis population growth levels—clearly there were other forces at work. Some of these were energy related and are discussed later in this chapter. Others were not, although arguably the initial oil shock set in motion some of the pathologies that prevented a reversal of the trend. As of 2012, however, as shown in Figure 7.1, oil prices were again at near historic highs (trading at around $100 per bbl in 2011 dollars). The midwestern and northeastern economies are once more under the threat of the "high price fuel

Table 7.1 A Comparison of Oil Prices with Population Change in the Northeast, Midwest, and South, 1930–2010

	Price of oil per barrel (2011$)	% change in population		
		Northeast	Midwest	South
1930	19.00	16	14	14
1940	18.00	5	5	10
1950	17.00	10	11	13
1960	18.00	13	16	16
1970	17.00	10	10	14
1980	45.00	0	4	20
1990	38.00	3	2	14
2000	28.00	5	8	17
2010	90.00	4	4	14

NOTE: Oil prices are per barrel and based upon Brent Crude equivalencies.
SOURCE: Tverberg (2012); U.S. Census Bureau (2010).

syndrome," as they export more and more wealth to import expensive oil.

However, the advent of shale development promises some future relief. In 2010 oil imports accounted for over half of the American trade deficit (*Economist* 2010). For the Midwest, which reached "peak oil" (the inflection point at which oil consumption becomes permanently greater than concurrent reserve addition) long before the nation did, this deficit is even higher. While oil prices have not yet dropped, American oil imports have—principally as a result of the Bakken Shale in North Dakota. In Ohio, there is likewise potential for oil production from the Utica Shale. More importantly, domestic natural gas production has increased dramatically because of shale drilling, and natural gas prices are at historic lows. Indeed, for the first time ever, natural gas prices are completely decoupled from oil prices, creating a migration of truck fleets from gasoline-powered to natural-gas-powered engines. For the reasons discussed later, shale development provides considerable hope for an economic recovery in the American Midwest.

The volatility in oil and gas prices has hardly been the only energy problem facing midwestern cities since the 1970s—it has just been the most visible. This chapter will explore energy policies that have contributed to the decline of these cities and will consider strategies that might reverse some of the pathologies that have become so commonplace in the Midwest.

Some policies have had an adverse impact on cities in general; other policies have had a deleterious effect specifically on the Midwest. Presumably all of these were unintended consequences: the policies were intended to produce desirable outcomes, but eventually had results that society did not necessarily want. Those energy policies that have affected cities in general will be considered first, and then those that have negatively affected cities specifically in the Midwest.

POLICIES THAT HAVE TENDED TO HARM CITIES IN GENERAL

Low-Cost Gasoline

There can be little doubt that the American migration to the suburbs has been enabled by cheap gasoline. There is also little question that federal and state policies have played a part in keeping gasoline inexpensive. The debate, rather, is about how much government support there really is. In other words, what is the actual cost of a gallon of gasoline at the pump, if you include all the externalities? Regardless of how one calculates this, it is clear that cheap gasoline has been a significant incentive for the exodus from the inner cities.

The public policy that can be most easily identified that has led to inexpensive gasoline in the United States is the relatively low excise tax on gasoline at the pump. Many people would agree that excise taxes on gasoline are necessary to generate funds for building and maintaining roads, and that those who drive the most ought to bear the highest burden of those costs. Many would probably also concur that we are currently undertaxed on gasoline at the pump; in 2010, for the first time since President Eisenhower signed the Federal-Aid Highway Act into law in 1956, the U.S. Highway Trust Fund was broke. Congress had to infuse $8 billion in general revenue funds into the Trust to keep it solvent. In 2011 Congress was forced to place another $19.5 billion into a fund that is supposed to be self-sustaining through gasoline taxes (Segedy, n.d.).

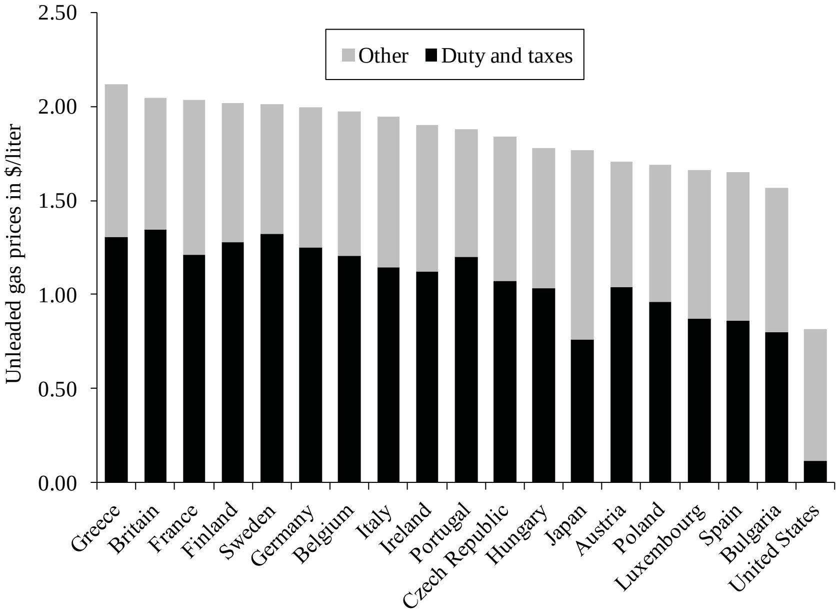
The issue that is most often debated now is not whether we should raise gasoline taxes, but rather when and by how much they should be increased. These taxes vary from state to state, but they average around $0.49 per gallon (American Petroleum Institute 2013).[1] In Europe, where migration from the central city has not devastated urban areas as severely as it has in the United States, gasoline taxes are as much as 10 times greater, and prices at the pump are typically double what they are in America (*New York Times* 2011). Figure 7.2 provides a comparison of gasoline prices internationally.

It is no coincidence that Europeans tend to live closer to their jobs than do Americans, or that Europe, as a result, tends not to suffer from as much residential abandonment of the inner city as does the United States. In short, the policy of making the cost of commuting by private vehicle inexpensive has also made it easier for Americans to flee urban problems rather than to solve them.

Of course, Americans today would choose to pay just about any price for gasoline if it means not having to live next to urban blight. But the difference in living conditions that has engendered the migration to the suburbs has been created gradually. When the migration first began, it was not a matter of escaping urban blight: it was about choosing to live in a marginally better environment. We might, for instance, expect a working-class family to stay in an inner-ring suburb, rather than to move further away from employers, if faced with the incremental increase in cost. With gasoline taxes at levels similar to those in the United Kingdom, moving 15 miles farther from the job might mean an extra $4,000 per year in commuting costs, rather than an extra $2,000 per year. For a working-class family, that would be a powerful incentive to stay put.

However, low gasoline taxes are only a part of the energy policies associated with inexpensive gasoline. A more difficult consideration is the so-called oil and gas subsidy, the tax incentives that President Obama called for an end to in his 2011 State of the Union address. Any government subsidy for oil inevitably makes it easier for commuters to move away from the downtown areas toward ever-longer commutes. Critics of U.S. energy policy have for years called for the termination of what they argue are massive subsidies to the oil and gas industry through federal tax policies. Unfortunately, energy policy is largely set in the United States through advocacy, and as a result it is hard even for

Figure 7.2 Global Gasoline Price Comparison, January 2011



NOTE: “Other” refers to those costs associated with acquiring, delivering, storing and retailing gasoline at the pump.
SOURCE: Washington (2011).

experts, let alone the general public, to understand exactly what subsidies actually exist for oil and gas. Indeed, established energy interests frequently express outrage over subsidies granted to “clean energy,” even as fossil fuel technologies enjoy over 10 times as much government support as do these newer approaches (Plummer 2010).

The American Petroleum Institute (API), not surprisingly, argues that there are no such subsidies. The ability to amortize investments, accelerate depletion allowances, and offset “intangible drilling costs” from tax obligations are, according to the API, standard accounting practices in the mining industry (American Petroleum Institute, n.d.). API points out that these accounting strategies are necessary to encourage the sort of massive investments required for such a high-risk business, and there is no reason to treat the oil and gas industry differently from other mining industries.

In the end, we can reasonably differ about what subsidies may or may not exist in the Internal Revenue code, how big those subsidies might be, and which of them are really necessary. But it probably does not matter, because we do know that one massive subsidy exists for imported oil that dwarfs all others: the United States spends billions of dollars every year policing the world's oceans, and it has done so for a long time. The total U.S. yearly military expenditure to patrol the world's petroleum supply has been estimated to range anywhere from $47.6 to $113.1 billion in 2003 U.S. dollars (International Center for Technology Assessment 2005).

It is this policy that makes the shipping of inexpensive oil from the Middle East possible. If this cost were passed along to the purchasers of gasoline at the pump, there is little doubt that the price of gasoline would be several times what it is today. Such an undertaking would also be a boon to domestic oil production, which would be competing with the actual cost of delivering foreign oil to the United States rather than the subsidized cost. However, we are unlikely to see this "external" cost realized at the pump. The notion that much of our defense budget is in fact a massive subsidy to Saudi Aramco is not easy to understand or accept. Nevertheless, the price of gasoline at the pump is artificially low as a result of this subsidy, and this reduction has enabled mass migration to the suburbs.

Inexpensive gasoline and the resultant increase in automobile commuting have created another troubling consequence for urban centers that has led to outmigration: a rise in pollution. Suspended particulate matter, in the form of soot, dust, smoke, and other pollutants, has been distributed into the air by traffic exhaust fumes. In the United States, measures have been taken to reduce the air pollution generated by automobiles, including the banning of lead-based gasoline. Indeed, compared to other major urban areas of the world, American inner cities today have good air quality, or at least not greatly worse than that of suburban areas. Unfortunately, many of these measures were taken after the exodus from the central city had already begun.

Public Policies Encouraging Rural Electrification

We often hear that the solution to our energy problems is another of America's great collaborative undertakings in ingenuity and initiative, usually discussed in terms of either the Manhattan or Apollo projects. It has been posed, for instance, that if we undertook a major Apollo-type effort to develop a hydrogen filling-station infrastructure, we could shift to a new transportation economy. This would be based on ultraefficient fuel cells, which rely on cleaner, locally produced natural gas as the feedstock, and which produce clean water as a byproduct.

In fact, however, in the last century the United States has undertaken two “Manhattan-type” energy policy initiatives that have had a significant impact on midwestern cities. The first was the development of the interstate highway system, now fundamental to the fabric of American society. This program subsidized a nationwide preference for automobiles and trucks over railroads and waterways and will be discussed later as among those energy policies that have been particularly problematic for the Great Lakes cities. The second great American energy policy undertaking was the program to bring electricity to rural areas. It is this latter policy that has, over time, done the most to encourage migration out of the cities (and, as will be discussed later, out of cities in the Midwest, specifically).

In the early 1930s rural electrification was stalled, leaving what was then a majority of Americans, literally, in the dark. The reason why rural markets had failed was manifest: the infrastructure to connect widely dispersed houses to the grid had proven too costly. The Great Depression further delayed investment in rural electrification. The growing gap between living standards in rural and urban areas, a lag in productivity growth in the agricultural sector, and the untapped potential rural demand for manufactured items such as household appliances and telephones led President Roosevelt to create the Rural Electrification Administration (REA) in 1935. The REA (now the Rural Utilities Service) has since been touted as one of the most profoundly successful public policy initiatives in U.S. history. Some $410 million dollars were set aside by Congress in 1936 for a 10-year program subsidizing loans to construct the rural electrical supply infrastructure. Federally funded public works programs such as the Tennessee Valley Authority and the Hoover Dam were set in motion, designed not only to create jobs, but also to generate and deliver cheap electricity. Rural electrical cooperatives were granted preference in purchasing the cheapest power available, such as that generated by the Tennessee Valley Authority.

The result was that, just two years after the creation of the REA, electricity was being delivered to 1.5 million farms in 45 states. By the mid-1950s, almost all U.S. farms had electricity service. The cultural, educational, and commercial disparity between rural and urban America shrank considerably as electrification spurred growth in demand for electrical appliances, plumbing, and information media such as radio and television (Malone 2001).

But as with all social engineering, an unintended consequence inevitably followed: subsidized power in the suburbs meant people could abandon the city. The initial movement outward from city centers began with the rapid expansion of the streetcar system, itself a product of rural electrification. The first suburbs that developed in the 1920s and 1930s were laid out along streetcar lines. With the electrification of rural America, streetcar lines extended further, creating the next ring of suburbs, and a migration outward has continued to this day (El Nasser 2011; Shumsky 1996).

The absorption of much of the costs of rural electrification by those who lived in urban areas made possible the exodus to the suburbs. It became feasible for much of America to move "to the country"—and to leave behind them the developing urban pathologies. Amazingly, although the problem of rural electrification has been resolved for some 50 years, subsidies for rural electrification continue. Today our federal government subsidizes rural electricity with billions of dollars of taxpayer money through an assortment of guaranteed loans, grants, and preferred treatment; the most controversial of these strategies is support for new coal-burning plants—while the rest of the country is trying to cut back carbon emissions (Slivinski 2009).[2]

An Artificially High Cost of Electricity in Urban Areas

The energy cost increases in the 1970s and 1980s were not restricted to oil and gas: electricity prices also rose significantly. For decades U.S. electricity generation, transmission, and distribution were all regulated, with utilities enjoying "cost plus" rate recovery for nearly all of their expenditures, regardless of their folly. The cost-plus strategy invited not only technology stagnation, but also bloated utility budgets, since there was no incentive to constrain costs. Inevitably, rates soared under this paradigm; average U.S. electricity rates rose 60 percent between 1969 and 1984, adjusted for inflation (Vaitheeswaran 2004). The biggest culprit for this problem lay with massive cost overruns associated with the building of large centralized nuclear generation plants (D'Ambrosio and O'Brien 2009).

Skyrocketing electricity prices were a major blow to urban areas throughout America because those economies, especially in the Midwest, relied heavily upon a healthy manufacturing base. Manufacturing, which even today consumes 30 percent of the nation's electricity (Ohio Manufacturers' Association 2010), was severely damaged by this, eventually leading to energy-intensive manufacturers championing electricity policy reform through deregulation. Ultimately this resulted in what one energy writer calls the "Quiet Revolution": governments around the world began liberalizing their energy markets for both natural gas and electricity (Vaitheeswaran 2004).

This regulatory reform, unfortunately, has not been uniformly enacted throughout the United States, and even when it has, it has been too late for many struggling urban areas that depended upon manufacturing jobs for their economic health. Even worse, many cities that reside in deregulated electricity markets are captive to transmission and peak capacity constraints, leading to excessive capacity (grid standby power) and other charges by utilities, passed through on wholesale power costs via regional transmission organizations. These capacity charges threaten the value proposition provided by deregulation.

Energy reform legislation

The reform was motivated in part by the energy shocks of the 1970s and the resulting legislation: the Natural Gas Policy Act (1978) and the Public Utilities Regulatory Policy Act (1978). Both laws were passed to deal with the energy crisis that had gripped the nation and catalyzed the onset of the Rust Belt in the Great Lakes region. The Natural Gas Policy Act froze "old" gas sold on the interstate market at unsustainable prices but rewarded companies that drilled for new natural gas production with market prices, thereby eventually alleviating the natural gas crisis. The Public Utilities Regulatory Policy Act, however, was less successful in resolving electricity problems. Its goal was to resolve electricity shortfalls by encouraging conservation and mandating that utilities purchase power from independent wholesale power producers. Nevertheless, the existing regulatory framework caused electricity prices to continue to rise even as new generation was brought on line.

Under the Public Utilities Regulatory Policy Act the individual states were to encourage new generation from small (below 80 megawatts [MW]) facilities that used something other than fossil fuels, or used waste heat. Utilities were required to purchase power from these producers at "avoided cost," the cost the utility would have had to pay if it had built new, centralized electricity generation of a like amount. But avoided costs were not based on market prices; there was no wholesale market for electricity at the time. Instead, prices were based on "but for" forecasts, that is, the generation cost expected to be incurred had no such new generation been developed, and regulators soon found that electricity prices had no relation to market realities. Independent power producers had no incentive to innovate or to provide electricity at a lower cost (Lesser and Giacchino 2007).

By the 1990s a wholesale electricity market was beginning to develop (partly in response to the Energy Policy Act of 1992). Further, because of a sluggish economy, demand for electricity was stagnant, and surplus capacity developed. Yet power costs remained high because of the massive cost overruns and the cost-plus regulatory recovery schemes. Residential and commercial end users, with limited voice for advocacy at the time, could do little about this. Energy-intensive industrial users, on the other hand, had the wherewithal to influence energy policy in the United States and began to lobby for the right to bypass utilities and to take their loads to an open wholesale generation market. As a result, in 1994 deregulation was introduced to America through sweeping regulatory reform in California (Lesser and Giacchino 2007).[3] Deregulation thereafter spread throughout the nation and continues to develop to this day.

The impact of deregulation on electricity production and distribution

It has taken nearly 20 years for wholesale markets to develop for electricity, and the jury is still out on how well deregulation will work. Ohio, which first deregulated in 2001, suffered through a deep recession before wholesale electricity prices finally began to drop. Even then, states like Ohio that have restructured their energy markets continue to have electricity prices higher than those that did not (American Public Power Association 2012).

One reason why deregulation has failed in some urban areas is that the regional transmission organization (RTO) remains captured by constrained transmission. As a result, utilities are forced to maintain large and expensive amounts of standby (backup) power for peak periods of use. This results in an RTO capacity charge passed through with the wholesale price that can be on the same order of magnitude as the actual cost of electricity. Nowhere is this problem more evident than in the urban areas of northern Ohio, where a 2012 capacity auction held by the RTO resulted in an increase in capacity charges by 2015 that will approach or exceed in magnitude the wholesale price of power actually delivered. In theory, these high capacity charges should encourage utilities to build more local capacity. In fact they do not: utilities do not build new generation in an unregulated environment in response to short-term price signals, since there is no guarantee of a return on their investment. If anything, high capacity charges have the opposite effect—they encourage utilities to underinvest, thereby distorting the generation technology mix toward more expensive peaking units (Meunier 2010). The result is that utilities will pass through capacity charges—the cost of expensive standby generation—onto wholesale power costs that can be nearly as much as the cost of the power actually consumed.

But for Ohio and other midwestern states, the damage was already done before deregulation. Electricity-intensive manufacturing—e.g., steel, aluminum, glass, and chemical industries—has traditionally made up a large part of the urban workforce in Ohio. These industries struggled to remain competitive in the face of high electricity prices, and the loss of jobs severely damaged urban areas throughout the Midwest.

Yet even while generation has been deregulated, the transmission and distribution side continues to be devoid of competition. Electricity, natural gas, and telephone grids fall into what are traditionally considered to be "natural monopolies," instances where we cannot build and maintain multiple grids. The best we can do is to provide alternatives to the grid. Indeed, this was exactly what happened in the telephone industry: wireless networks provided the competition that drove down the cost of wired phone systems.

For electricity, however, utilities have no desire to see their principal asset—the grid—devalued. Not surprisingly, utilities have lobbied hard to protect this resource. For instance, one way of introducing competition for the grid is for end users to generate their own electricity on site. Utilities have perceived on-site generation, the most common form of distributed generation (DG), as a threat to the grid and have not welcomed it. Utilities have been very successful in advancing regulatory barriers to DG that continue intact to this day.

Generation alternatives

Nevertheless, the next "quiet revolution" will be the introduction of competition to the regulated side of electricity. The first place this is likely to happen will be in the shift from centralized to distributed electricity generation. It has long been thought that energy-intensive industries like steel, glass, and chemical manufacturing could be "ground zero" for rethinking how energy is generated and used in the United States. These industries consume large amounts of fossil fuels and electricity to melt scrap iron, iron ore, and sand, and to produce chemicals. Recycling the waste heat from these industries could itself generate some 5 percent of America's electricity needs. Likewise, in Gothenburg, Sweden, two refineries use waste heat to provide nearly half the 450,000 residents of that town with district heating. None of the 150 refineries in America recycles waste heat for use in residential heating (Vaitheeswaran 2004).

Utilities initially disfavored DG because they found value in economies of scale: large-scale coal plants in particular were more efficient and capable of producing less-expensive power than smaller plants. However, large-scale coal plants were not amenable to being located in crowded urban areas, rendering the waste heat produced from such plants difficult to use. Waste heat has a limited value unless buildings and homes are spaced closely together and are located near the source of the heat.

Once utilities became heavily invested in the grid, they had little interest in local generation. What's more, deregulation of the generation market cemented the utilities' distaste for DG. Utilities today nearly always favor investment in the grid, with its guaranteed return, to risky generation ventures. Indeed, the bigger the grid became, the more money utilities made. So when large-scale power users began to push for opportunities to self-generate, utilities pushed back with an assortment of obstacles, ranging from exit and standby fees to heavy-handed interconnection standards. DG was simply not cost effective except for very large industrial users.

The effects on cities were twofold. First, because cogeneration (also called "combined heat and power," or CHP) was not cost effective, few cities developed heating networks to use waste heat. And second, as large industrial users departed from the grid through the deregulation of power generation, captured urban residential and commercial users were left behind to pay a larger share of the cost overruns associated with nuclear and other expensive power. Rural residents, on the other hand, were able to avoid this capture through their cooperatives.

Successful lobbying by the clean energy industry and others, including smaller industrial users and new aggregated power purchasing cooperatives, has led to some regulatory reform. Most notably, net metering (where meters run backward when excess power from DG is placed into the grid) rules have enabled a recent increase in small-scale renewable DG. However CHP, the most cost-effective form of DG, continues to be ineligible for net metering in most jurisdictions, and standby fees continue to render most CHP projects uneconomical. Moreover, the changes that have been made have been mostly too little too late: the longtime preference for centralized power has made it difficult for cities now to develop waste heat networks similar to those that exist in Europe. A hostile regulatory environment and a lack of a heat transportation infrastructure have colluded to play a role in the decline of urban economies.

ENERGY POLICIES THAT HAVE TENDED TO SPECIFICALLY HARM MIDWESTERN CITIES

Cheap Air Conditioning

For all the angst over public policies that have led to the exodus from the Midwest to the South and Southwest, none would matter but for the advent of inexpensive air conditioning. Around the same time that the energy crisis gripped the Midwest, air conditioning had begun to be widely available, cheap, and commonplace throughout the United States. Until this transformation, the climates of the American South and Southwest were miserable to live in year-round.

It is difficult to overstate how cheap air-conditioning has changed U.S. society. It catalyzed the population boom in the South and Southwest (Cooper 1998), and it reformed the American political landscape (Pfiffner 2009).[4] We have become so dependent on air conditioning that some have likened it to a drug. Anyone who has stepped into an air-conditioned store on a hot summer day can attest to the sense of instant gratification climate control can provide. Fifty years ago a third of the U.S. population resided in the South and Southwest; now it is over half. The relocation of manufacturing, businesses, and jobs to the American South is a direct result of air conditioning and of the energy policies that made it cheap (Evans 2005).

The policy that has most enabled this transformation has been the Rural Electrification Act (REA), which provided the largely rural south with the favorable electricity rates that allowed it to grow (Diamond and Moezzi, n.d.). Without the REA, it would have taken generations longer for air conditioning to become affordable in the South, if ever. But it is hardly the only energy policy that enabled cheap air conditioning: the failure to account for external environmental costs associated with the emission of refrigerants has also served to artificially suppress the cost of air conditioning. In the 1980s, wealthier countries, such as the United States, moved away from using chlorofluorocarbons (CFCs) for air conditioning to save the atmosphere's ozone layer, but the replacement refrigerants are still highly potent greenhouse gases. North America, with 6 percent of the world's people, accounts for 40 percent of the world refrigerant market (Cox 2007). The South and the Southwest represent the vast majority of this usage—and our policies ignoring the actual cost of air conditioning have made it easier for businesses and manufacturing to move there.

In the Midwest, summers can be uncomfortably hot for short periods, but brief spans of heat are not debilitating to labor. Long periods of cold, on the other hand, can be inexpensively managed with proper clothing and heating systems. Manufacturing has historically thrived in cold climates and could not have been successfully implemented in a climate where intense heat dominated for half the year. Cities like Houston, Dallas, Atlanta, and New Orleans in the past were home to sleepy societies where work often shut down during the long summer. There was no interest by captains of industry to relocate manufacturing to the U.S. South or Southwest—or to Mexico or other subtropical countries, for that matter—due to the toll taken on both the workforce and machinery.

Cheap air conditioning changed all of that. With the emergence of mechanical cooling, working conditions in factories improved and entire manufacturing industries rose up in the South, facilitating the explosive economic development and population growth in the Sunbelt region. Air conditioning did more than make the workplace bearable; it also enabled the South to manufacture products sensitive to heat and humidity, such as textiles, color printing, pharmaceuticals, and food processing. In addition, the office environment improved, with air conditioning becoming an important factor in workplace efficiency (Steinmetz 2010). One study tested federal employees and found a 24 percent increase in output by typists when transferred from an environment without air conditioning to one with it (Cooper 1998).

Before air conditioning, the extreme heat in the South was not only uncomfortable and counterproductive, it was also a major health concern, as it facilitated the spread of disease. With the introduction of air conditioning, infant mortality was reduced and malaria eliminated (Arsenault 1984). The South became a more pleasant and attractive place to live as air conditioning and technological advances brought about improvements in public health.

Air conditioning was originally implemented in industrial and commercial settings but eventually proliferated in residential homes and automobiles, as the technology became not only cheaper, but also smaller and less dangerous with the development of nontoxic coolants. Several types of air conditioners were available on the market starting in the 1930s, but as they were both expensive and cumbersome, they remained a novelty for home use for the next 20 years. In 1951, an inexpensive, efficient window air conditioning unit was finally introduced and became popular. By 1965, central air conditioning had entered the market and could be found in 10 percent of homes in the United States (Carrier, n.d.). With technology steadily improving, most new homes were being built with central air conditioning, and window air conditioners were increasingly financially accessible (Great Achievements 2013). By 1975, air conditioning existed in 50 percent of American homes. By the 1980s, when depopulation of the Rust Belt in favor of the Sunbelt had begun in earnest, 90 percent of new homes in the South had adopted central air conditioning (Pipe Doctor Plumbing, Heating, and Air Conditioning, n.d.).

Paralleling this development was air conditioning in cars. Air conditioning in automobiles was first available as a factory-installed accessory in 1940 with the Packard line, but with the onset of World War II, growth in this sector was stunted along with the rest of the air-conditioning market. Even in the 1950s, the air-conditioned car was considered an extraordinary luxury and the ultimate status symbol, to the degree that some people in Texas drove around with their windows rolled up in the 100-degree heat just to give the impression that their car had air conditioning installed. By 1973, however, more than 80 percent of new cars in the South were being outfitted with air conditioning (Fergusson 2006).

Today we live in a very different world, where the hot climate is considered a reason to live permanently in the South rather than a reason to avoid it. This is more than a little bit due to the advent of inexpensive air conditioning. Most Americans prefer suffering through a short walk in intense heat from their air-conditioned house to their air-conditioned car to digging out of a snow drift and scraping ice off their car windows. Corporations are eager to blame their decisions to relocate manufacturing to the Sunbelt on unfavorable tax rates, unions, and other dollars and cents considerations. But one wonders how much executive distaste for midwestern winters controls decisions about relocations for manufacturing. So long as air conditioning is cheap and readily available, no amount of tax incentives or union concessions can compete with a lifestyle preference for mild winters.

Promotion of Trucking over Railroads and Waterways

The U.S. government undertook a major social initiative in the 1950s and 1960s designed to make interstate transportation by automobile easier and less expensive. This energy policy would have interesting and momentous consequences for the American Midwest. The program was promulgated during the Eisenhower Administration as the American Federal-Aid Highway Act. The initiative consisted of the development of a national trust for the purchase, through eminent domain, of large amounts of private land, and the subsequent building of an interstate highway system unlike anything ever seen. In short, the United States embarked upon a strategy to build a highway and bridge infrastructure that would transform the American landscape forever, making travel across the country easier, faster, and less expensive.

Change the landscape it did—and a great deal more: it forever altered American culture. Trucking benefited relative to railroads and waterways, helping it to become the transportation mode of choice for shipping a wide range of goods and materials throughout America. This contributed to the decline of the traditional midwestern transportation economy—railroads and waterways—and with it, to the decline of the Great Lakes port communities.

Developing a network of major interstate highways was certainly a laudable public policy: driving time and costs were reduced significantly, and travel efficiencies inured to the benefit of all, as the expenses of transporting goods dropped. Moreover, the indirect subsidy to the automobile industry was a short-term boost to the Great Lakes cities that manufactured trucks, automobiles, and parts. However, the long-term effect on these cities manifested itself later in another, less desirable manner: Great Lakes shipping ports and railroad terminals became largely obsolete. The advent of subsidized high-speed interstate highways, combined with subsidized cheap gasoline and diesel fuel, inevitably led trucking to become the preferred method of transportation of goods and materials across America. From Duluth to Buffalo, Great Lake cities watched their once-busy harbors turn into ghost ports. Railroad terminals across the Midwest also shut down, and with them disappeared the livelihoods of many Midwestern families who had worked on those trains for generations.

Although the majority of the people in America at that time were located in the Midwest or the Northeast, the new superhighways crisscrossed the country in equally spaced patterns without regard to population. The goal of the new interstate system was, after all, to make travel among the states easier—and this included crossing the underpopulated regions of the South and Southwest. The consequence, however, was to indirectly support migration to the rural South and Southwest. The new interstate highway system not only helped render obsolete the traditional transportation economy of the Midwest, it also subsidized the inevitable movement of workers to the South and Southwest by making it cheaper to transport goods and materials to and from those regions.

Failure to Embrace Change in Energy Policy

A third category of energy policy that generally has had a troubling result for midwestern cities stems from a behavioral disorder common to all leaders who set public policy: the failure to identify and understand social change, and to respond to that change in a timely way. The general reason for this shortcoming is that vested interests, especially in the trillion-dollar-a-year energy business, usually resist change mightily. Steps that may be good for society in general may not be good for a particular sector of the economy, and that segment may be particularly persuasive in helping government leaders to set public policy. In a society where policy is made by competing advocacy groups, alignment with the status quo has a significant advantage.

The best example of how this culture can be shortsighted relates to the political resistance to the adoption of Corporate Average Fuel Economy (CAFE) standards. These guidelines were originally established as a means of improving automobile efficiency in response to the 1973–1974 Arab oil embargo, which caused crude oil prices to triple and exposed the United States to vulnerabilities in relying on imported petroleum. In the period leading up to this first oil shock, new-car fleet fuel economy had dipped from 14.8 miles per gallon (mpg) in 1967 to 12.9 mpg in 1974. With the Energy Policy Conservation Act of 1975, CAFE standards required the passenger-car program to achieve new-car fleet fuel economy standards of 27.5 mpg by 1985.

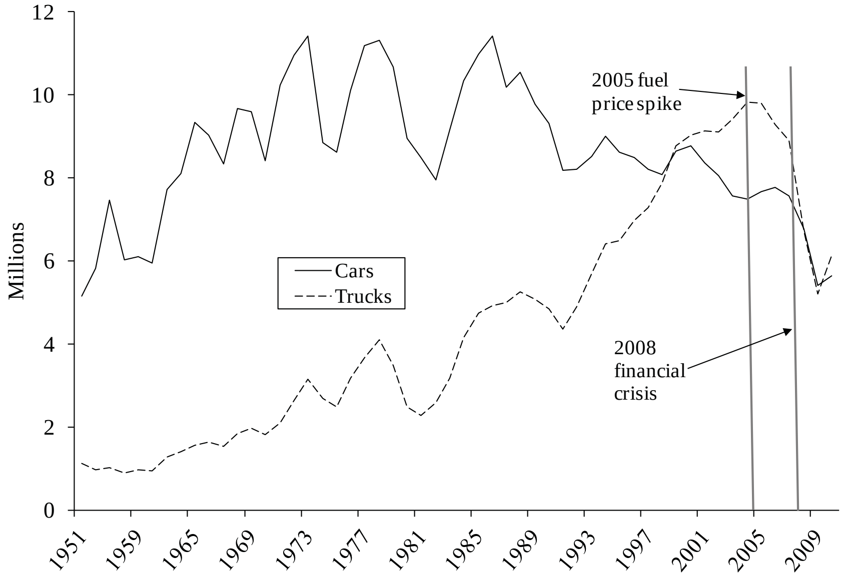
Control over the passenger-car program remained in the hands of the Secretary of Transportation, and standards could be adjusted within a range of 26 to 27.5 mpg without requiring Energy Policy Conservation Act amendments and the subsequent approval of Congress. Under the same act, the National Highway Traffic Safety Administration (NHTSA) was given authority over the structure and alterations of the light-truck program (Yacobucchi and Bamberger 2007). CAFE standards set by the NHTSA were only held to the "maximum feasible fuel economy standards," broadly defined by Congress as having technological feasibility, economic practicability, and consideration for the effect of other standards on fuel economy and the need of the nation to conserve energy (Moulton, n.d.).

The predictable reaction from the automobile and petroleum industries was to resist any change as long as possible. This strategy worked. Since achieving the first target of improving fuel economy to 27.5 mpg in 1985, no improvement in standards has been made, and none is anticipated until 2017. Further, those energy efficiency standards that were adopted were easily circumvented. A sport utility vehicle (SUV) loophole was exploited that encouraged American families to buy trucks (including SUVS) instead of cars. Light trucks with a gross vehicle weight rating of 8,500 pounds are exempt from CAFE standards. For light trucks under this weight, fuel economy standards only increased by 2 mpg, from 20.2 to 22.2, during the 15 years between 1992 and 2007 (NHTSA 2013). Buoyed by the SUV market, truck sales in America exploded, eventually overtaking car sales by the late 1990s.

Unfortunately, this only served to put the U.S. automobile industry at a competitive disadvantage to its European and Japanese counterparts, who continued to build more efficient cars. As oil prices rose sharply in the mid-2000s, truck sales faltered (see Figure 7.3). By 2008, with the economy in free fall, car sales caught up with truck sales for the first time in over a decade, as sales for trucks dropped to half of their 1990 numbers. American car companies, notably the Detroit Three (GM, Ford, and Chrysler), were in no position to weather the storm, as profits had become heavily dependent on SUV and truck sales, and these firms required government support to stay afloat. Resistance to the CAFE standards, in response to a perceived threat to the viability of the American automobile industry, contributed to the near bankruptcy of this entire U.S. industry. Midwestern cities, especially Great Lakes cities, suffered grievously in the process.

The resistance to deregulation of electricity markets and to DG provides other examples where vested interests have conspired to thwart job creation in the Midwest, especially in traditional manufacturing industries such as steel, glass, and chemicals. The overall dependence of centralized generation upon the importation of fossil fuels has intensified the high cost of power for midwestern urban areas, insofar as this region has traditionally been an importer of coal, oil, and gas. DG, on the other hand, tends to rely on local fuels such as waste heat, solar, and wind, and as a result usually returns more money to the local economy.

Figure 7.3 U.S. Car and Truck Sales, 1950–2010



NOTE: "Trucks" includes Sport Utility Vehicles (SUVs).
SOURCE: Ward's Automotive Group (2012).

According to one expert, as much as 50 percent of every dollar spent on conventional centralized generation leaves the community. However, for renewable DG, about $1.40 is returned to the local community for every dollar spent (Sovacool and Watts 2009).

There will always be resistance to change by those who stand to lose from it. But when it comes to energy, policymakers are particularly vulnerable to short-sighted decisions. The stakes for energy generation choice are enormous. We can expect parties to aggressively advocate their own interests in the status quo. Unfortunately for midwestern cities, this intransigence has too frequently been harmful to local economies.

ENERGY POLICES THAT WILL HELP MIDWESTERN CITIES RECOVER

U.S. energy policy in the past 70 years has encouraged migration of jobs and residents out of the Midwest, and this needs to change. Yet we do not want to rebuild midwestern cities at the expense of rural areas, or at the expense of the South or Southwest. Certainly no one would advocate a return to poverty and misery for the South so that the Midwest could once again enjoy a more robust economy. Similarly, with so much of our commercial activity now moved to the suburbs, we cannot abandon those spaces. But we can at least try to redress some of the imbalances in our energy policies that have so decimated the cities in the Great Lakes region. New approaches that do not directly encourage migration out of the cities certainly would help. Some of the most important energy strategies that could be deployed are those that can help deliver clean, inexpensive energy to midwestern communities. Several of those policies are set forth in the following discussion.

Policies That Encourage DG

The shift to clean and high-efficiency energy systems is key to both sustainability and economic growth. This change will transform virtually every aspect of the economy, transportation systems, and construction, as well as the configuration of human settlements in the twenty-first century. Urban areas in particular are highly vulnerable to paradigm shifts in technology. Technological innovation is the "principal mechanism underlying the successive epochs of urban evolution." Throughout the history of American cities, changes in transportation and energy have been the root cause of fundamental transformation (Berry 1991). Forces are working together now that will transform the structure of urban society.[5] Cities throughout the United States need to understand these forces and prepare themselves for the changes that are coming.

One of those fundamental transformations will be the shift away from centralized generation toward a DG model. Developing a regulatory environment that is friendly to DG will help position communities for growth and sustainability. This will not only reduce the costs of energy in the inner city through such mechanisms as CHP, but will also create jobs locally. Moreover, since DG tends to be cleaner than centralized generation, it also tends to make for a more pleasant environment in which to live and work.

Advantages of DG for the Midwest

Midwestern cities are well placed to play a leading role in the development of DG. That is because the many locations where DG is likely to first become economical are those involving generation at industrial sites, and midwestern cities are among the nation's leaders in generation capability from industrial waste heat. According to the Environmental Protection Agency (EPA), Ohio, for instance, produces enough waste heat to "generate the equivalent power of 8 nuclear power plants" (Margonelli 2010). The Oak Ridge National Laboratory projects that waste-heat recovery systems can be available for around $1,500 per kilowatt (kW) installed (Margonelli 2010)—a price that should be attractive for electricity-intensive manufacturing. The potential to avoid future carbon taxes and to create jobs also makes this of considerable interest to midwestern cities.[6]

Three other factors will likely lead to the advancement of DG in the Midwest. The first is the April 2012 adoption of new federal EPA Clean Air Act pollution standards (the so-called Boiler MACT regulations [EPA 2013]) that will cause area-wide capital investment into new, cleaner steam-generation capacity.[7] Many midwestern industries have big, old coal boilers producing large volumes (over 100,000 pounds per hour) of steam. These boilers tend to work continuously, are inefficient, and require as fuel low-sulfur "compliance coal" (Casten 2012).[8] Industrial users that are considering an upgrade of their coal boilers in order to comply with the new rules may find this to be a convenient time to convert to more efficient heat-creating systems, such as CHP. With this approach, electricity made as a byproduct of generating heat can be converted for use on site, thereby dramatically improving systemic efficiency.

The second factor relates to grid congestion, especially in the Great Lakes areas. Northern Ohio, for example, has been grid constrained for a number of years. As a result, and in anticipation of retiring old coal-burning generation facilities, First Energy now plans to undertake a $1 billion transmission upgrade (Funk 2012). Indeed, the regional transmission organization (RTO) that Ohio utilities belong to, PJM, anticipates that there will be changes in the next several years to the generation fleet producing power for Ohio on an “unprecedented scale.” PJM announced in May 2012 that it had purchased in an auction a “record amount of new generation” for 2015–2016. Northern Ohio suffered the highest prices in the PJM capacity market—$357 per MW, more than twice the PJM unconstrained price of $136 per MW (PJM 2012). All of these costs will be passed through to urban residents and businesses in the form of capacity charges on wholesale electricity bills. One expert projects that capacity costs alone in First Energy’s Ohio region will increase by 700 percent by 2014 over today’s charges, reaching $0.0317 per kilowatt-hour (kWh) by 2015 for a user with a 50 percent load factor (Brakey 2012). Such costs could be avoided if DG were strategically adopted in response to the constrained grid.

The third factor relates to another threat midwestern urban economies face: carbon regulation. Driven in part by EPA requirements to either clean up or shut down old coal plants and in part by a depressed natural gas market, much of coal electricity generation will be replaced by natural gas in the coming years. According to one recent study, even accounting for a marginal increase in life-cycle greenhouse gases generated through hydraulic fracturing, burning natural gas emits less than half the carbon that burning coal does (Hultman et al. 2011). This reduction in carbon emissions will likely become a critical element to the viability of midwestern economies, especially in urban areas that are so dependent on manufacturing, as increasing restrictions are placed on carbon emissions. CHP will in all likelihood become the most compelling solution to the problem of reducing greenhouse gas emissions: it not only uses natural gas (or biomass) as its principal fuel, it is also far more efficient than centralized generation.

CHP systems, however, do not as a rule enjoy the benefits of net metering. Utilities do not have to pay the full value of electricity when taking power back onto the grid. Instead, they pay what they consider to be the value of displaced power, calculated at the cost of generation at some distant centralized point. The actual electrons may be delivered to a manufacturer down the road 100 yards, but the utility is not required to compensate for the strategic location of the power generation.[9]

This policy, along with the general one of guaranteeing a “cost plus” recovery on expenditures on the still-regulated grid, has led to the traditional utility being incentivized to allocate as much of its costs as possible to building and operating the grid, and as little as possible to generateing electricity. Not surprisingly, we see as a result widely disparate estimates for the cost of power production from centralized generation. Utility accounting under this system, which may not include such things as the anticipated cost of decommissioning a power plant, typically sets a low generation cost for nuclear power. Yet the cost for nuclear energy generation, by most measurements, is very high (Vaitheeswaran 2004).[10]

Needed changes in policies

As noted by energy pundit Amory Lovins of the Rocky Mountain Institute, the old model of centralized generation with a ubiquitous grid was based upon the twentieth-century idea that generation was less reliable than the grid. But the twenty-first century reality turns this model on its head: today, generation, especially gas turbine, is more reliable than the grid. Accordingly, one of the fundamental reasons for centralized generation no longer exists. As Lovins (2001) notes, today "the cheapest, most reliable power" is that which is "produced at or near the customers" (p. xiii).

For DG to take hold in the Midwest, several policy changes will be required.

- Net metering and/or improved sales options for excess generation. Currently, in most jurisdictions excess generation cannot be "net metered" (i.e., the meter does not run backward), and must be sold back into the grid at the unbundled "generation rate" (i.e., the generation charge, without the transmission or distribution charge) for power. Under such circumstances, the return for generation is significantly diminished: there is no value attributed to the strategic location of the generation near a market. For smaller systems (below 138 kilovolts [kV]), however, utilities are often required to purchase the power only at the displaced generation price (i.e., the "avoided cost of generation.") In Ohio, the avoided cost has been set as low as $0.012 per kWh (Wissman 2012). Accordingly, smaller systems will likely not even recover the going rate for unbundled wholesale generation. Net-metering rules should be established for CHP, or at least regulations should allow for better sales options for excess power.

- Reduced standby rates. At the outset, it should be noted that the public policy case for the assessment of any standby fee is by no means clear. A strong argument can be made that both utilities and consumers benefit greatly from DG, and it is counterproductive to charge standby fees (Casten 2003). Any measures that reduce the need for repair or construction of distribution and transmission assets inures to the benefit of all users, not just the DG end users (Casten 2003; Miller 2012). Nevertheless, regulatory bodies are inclined to accept the utility arguments for the need for standby fees. The problem, then, is to determine what charges are reasonable under the circumstances—and what charges can be borne by distributed generators without rendering the project unviable. The EPA has determined that, unless the customer can avoid at least 90 percent of its otherwise applicable rate costs, CHP will not be viable (Weston et al. 2009). Unfortunately, this number is one that is not commonly met with existing standby charges in most jurisdictions. In a study by the Midwest Clean Energy Application Center, avoided-cost percentages from utilities in Iowa, for instance, ranged from a low of 74 to a high of 81 percent among Iowa investor-owned utilities (Miller 2012). Policies need to be established either doing away with or making manageable standby charges.
- Microgrid development. One way to capture the full potential of DG is through a distribution system architecture called a "microgrid." Unlike DG, a microgrid consists of more than a single point of generation. Like DG, however, a microgrid should have the ability to isolate itself (islanding) from the utility's distribution system during a grid disturbance. Islanding has the potential to give a higher level of reliability to end users than that provided by the macrogrid system as a whole.[11] The typical microgrid uses DG and cogeneration to provide both electricity and heat to multiple customers joined together on a local network. Microgrids also offer potential advantages in power quality and reliability over macrogrids, which tend to provide homogeneous power quality when customers may have heterogeneous requirements (Neville 2008). There is currently considerable uncertainty over how microgrids will be regulated, but under most jurisdictions, it appears that only utilities can operate

> microgrids. There will need to be clarity in the regulations over how microgrids may be operated and who may operate them before they can be deployed.

However, the policies necessary to enable DG are not just regulatory in nature. Urban universities, for instance, can play a critical leadership role in preparing cities for a transition to DG. To accomplish this, universities should change their approach toward technical education for the energy industry, and federal and state governments need to support this shift. Policies that promote DG will have little value if there is not a workforce that is capable of deploying the new technologies, and, importantly, of understanding the value proposition associated with DG. Without such a workforce, transactional costs threaten to slow the advancement of DG.

For centralized generation, professional services have traditionally comprised a small percentage of the total project cost. Accordingly, utilities have engaged the biggest and most expensive law firms, banks, architectural and engineering firms—and money has been no object. But in the world of DG, projects may cost $300,000 instead of $300 million. Yet many of the same legal, regulatory, financial, and engineering issues arise in small projects as in large projects; transactional costs do not go down in proportion to project size. Today's energy-systems professional needs to be nimble, trained in multiple disciplines, and capable of assessing value inexpensively.

State and federal resources should be brought to bear on urban four-year engineering and engineering technology programs throughout America, but especially in the Midwest, to create comprehensive, cross-disciplinary energy-systems training. Under current university models, applied technology is not a priority, and certainly the social sciences are not. Universities are rewarded with large research grants with generous overhead compensation for energy technology, especially through federally funded programs such as the National Science Foundation. But applied engineering programs and research on social impediments to the adoption of advanced energy do not generally get this same sort of support.

Midwestern urban areas have the most to lose if a transition to DG is not enabled. Ohio, for instance, is highly vulnerable to a carbon tax or a cap and trade system. Roughly 88 percent of Ohio's power generation comes from burning coal. In the meantime, Ohio, which is ranked seventh nationally in population, is ranked sixth in total energy consumption, fourth in industrial energy consumption, and fourth in greenhouse gas emissions (Consortium for Energy, Economics, and the Environment 2008). In short, Ohio's economy is dependent on traditional forms of energy generation that are patently unsustainable. Urban universities in Ohio and other midwestern states must take the lead in helping to rewrite regulatory law and in retraining their workforces for the inevitable paradigm shift from central to distributed power generation. State and federal resources need to enable this transition to be made without a massive disruption of midwestern economies.

Exploitation of Shale Formations

One of the most exciting and promising developments for the urban economies of both the Midwest and the Northeast has been improvements in drilling and completion techniques in the oil and gas industry. Specifically, horizontal drilling and new hydrofracturing technologies have enabled oil and gas companies to produce hydrocarbons from organically rich shale deposits that were laid down in sedimentary basins hundreds of millions of years ago. Previously, shale formations had been too impermeable to produce hydrocarbons in commercial quantities. Now, suddenly, vast commercially producible oil and gas reserves exist in areas of Ohio, Pennsylvania, West Virginia, North Dakota, and other places around the world. For the first time since the 1800s, the Midwest is poised to not only be self-sufficient, but even to export oil and gas.

This will of course be a badly needed shot in the arm for the flagging economies of the Midwest. Related job creation in financial and legal centers such as Pittsburgh, Cleveland, Columbus, Akron, Canton, and Youngstown has already begun. More will be coming as drilling picks up. In addition, shale development tends to be more service-industry intensive than traditional oil and gas exploration because of the relatively high cost of drilling and completing wells, and the high rate of production decline (requiring more drilling). In other words, there will be more wells and more completions, yet fewer failures, driving a robust new oil and gas service industry. Even though much of the early wealth to be generated from this industry will be for rural landowners, inevitably the urban areas of the Midwest will benefit greatly, not only from the reduced hydrocarbon prices, but also from professional service companies locating in cities to be close to a skilled workforce and to transportation hubs.

Pennsylvania has been the forerunner in economic development as a result of shale drilling. According to one study by Penn State University, the Marcellus Shale development has led directly to 44,000 jobs in 2009 in that state, creating around $3.9 billion in economic value added to Pennsylvania, with $8 billion more in 2010 and $10 billion more in 2011 (Considine, Watson, and Blumsack 2010). Likewise, in Ohio, economists have estimated that by 2014, 64,000 jobs will be supported as a result of developing the Utica Shale, adding some $4.9 billion to the state's gross domestic product (Thomas et al. 2012)

But setting aside these promising employment numbers resulting directly from oil and gas exploration, perhaps the best news for midwestern urban economies will be the long-term source of cheap natural gas. Shale gas has transformed the American energy landscape almost overnight: between 2006 and 2011, natural gas prices dropped from over $10 per mcf to under $4 per mcf (U.S. Energy Information Agency 2012a). Shale gas, which comprised less than 2 percent of the gas produced in the United States in 2000, now comprises 37 percent—and is rising (Yergin 2012). In the meantime, U.S. greenhouse gas emissions in 2012 were the lowest since 1992, due in principal part to the rapid replacement of coal with natural gas as a source of electricity (U.S. Energy Information Agency 2012b).[12]

States such as Ohio will no longer be experiencing huge trade deficits due to the purchase of oil from the Middle East. This newfound source of oil and gas promises a stable, 20–30-year supply of inexpensive hydrocarbons to heat homes, to generate electricity, and to fuel transportation. The Energy Information Agency projects natural gas prices of between $4 and $8 per mcf through 2035 as a result of the "shale gale" (U.S. Energy Information Agency 2012a). Further, petrochemical companies, which also rely on long-term, inexpensive and stable supplies of natural gas for feedstock, can justify the financial commitment to locate or expand manufacturing in the Midwest.

State and federal policies should encourage shale development. Regulation of the industry must be tight, sure, and comprehensive; any spills or contamination from wastewater generated by drilling will set back development enormously. State regulatory agencies and state geological surveys must be completely independent from the oil and gas industry under their purview and be fully funded. This can be done through severance and other taxes generated by oil and gas production and also through long-overdue taxes on imported oil, especially from those locations where U.S. military presence is required to safely transport oil to American ports. This latter policy, more than any, has the potential to provide ample resources to enable the safe production of U.S. oil and gas supplies from unconventional sources while restoring wealth to American cities.

Importantly, midwestern cities should not use the newfound hydrocarbon wealth to go back to business as usual. While the oil and gas reserves located in shale beds in the Midwest and the Northeast provide a more climate-friendly alternative to burning coal, they are still an exhaustible resource that emits large amounts of carbon into the atmosphere. These reserves should be considered as a bridge to an economy based on hydrogen, electric transportation, and renewable energy generation—an economy where oil and gas are used primarily in the petrochemical sector rather than the energy sector. Policymakers in the Midwest have an opportunity to do something that their counterparts in Texas, Louisiana, and even the federal government have failed to do with their respective oil and gas largesse: plan for the inevitable transition to alternative energy supplies without a massive disruption of the economy.

Policies That Reflect the Actual Costs of Transportation and Power Delivery

For some 80 years our energy policies have placed the burden of growth in rural locales on the urban areas. That policy must be reversed. Now it is time for the rural areas, or at least the suburbs, to support growth in the inner city. The same sort of program that led to the development of rural electrification should now be put into place in our inner cities: subsidized loans and grants for DG and access to cheap, federally supported electricity. Municipal utilities in particular would benefit from having priority for the cheapest electricity available, from which savings could be used to attract business, industry, and residents back to the city.

Monetizing some of the external costs of power generation and gasoline consumption would also help cities, especially in the Midwest. For instance, if the actual cost of air conditioning were passed on to consumers, manufacturing management might reach a different conclusion about the benefits of relocating operations from the Midwest to the South or Southwest. Similarly, if the total cost of transportation were passed on to commuters, residents might reach a different conclusion about the benefits of moving ever farther from the city.

Just as we have seen decades of policy subsidizing rural electrification over urban electrification, we have also seen decades of policy subsidizing rural transportation over urban transportation. This is another policy that must be reversed. We cannot now abandon our reliance on interstate highways. However, we can fund programs that make life easier for residents of midwestern cities. This begins with better transportation systems.

Better, faster, and more comfortable public transportation would certainly be a major first step. It will require a significant and continuous subsidy to sustain such a program, because it will take decades to see the demographic response. In many of the Great Lakes cities, the hardest part about transportation is driving in snow. Public transportation could alleviate much of this problem.

Winter travel is problematic not just for commuting, however; it is also a problem for walking in the city. Many midwestern cities cannot afford to effectively plow and salt roads and sidewalks, and walking becomes an adventure. Funds should be directed to cities to enable them to respond quickly to winter storms. Sidewalks and crosswalks can be heated by underground steam systems to keep them free of ice. Better still, underground passageways can be built connecting downtown urban centers such as universities, museums, sports venues, commercial districts, arts districts, and office parks. Houston has such an underground tunnel system in its downtown, and it is used mostly in the hot, humid summer. A number of Canadian cities have downtown indoor walkways; Montreal's underground complex is so vast that it is known as the *ville intérieure*, the "indoor city." Midwestern cities could have a similar system in their downtown areas for winter activities. To be sure, these sorts of programs are not easily accomplished, especially in a bad economy. But the rural electrification program was established in a far worse economy. It will take the same sort of effort to rebuild midwestern cities to their former glory.

Regional Energy Planning

The Midwest today has an opportunity to reimagine sustainable industrialization. More than anything else, a return to a healthy manufacturing base would lead to a revitalization of urban areas. Manufacturing has long been the lifeblood of the midwestern urban economy, but it is also an energy-intensive business, especially for such industries that produce aluminum, steel, chemicals, and glass. Manufacturers account for roughly one-half of U.S. natural gas and 30 percent of its electricity consumption. Accordingly, a secure, reliable, and affordable source of electricity is a top priority for midwestern manufacturers. Those manufacturers for which electricity costs make up an especially significant portion of their product costs are most vulnerable to rapid rate increases (Ohio Manufacturers' Association 2010). The ongoing decline in manufacturing jobs throughout America has accelerated in recent years, reflecting not just high electricity costs, but also the return to $100 per bbl oil and the "high priced fuel syndrome." Ohio has lost some 117,000 manufacturing jobs in the the period of 2008–2012 alone—the second highest total in America (Thomas 2012).

With foresight and planning, the Midwest can develop energy policies to help reverse this trend. As outlined in this chapter, forces are coming together today that necessitate rethinking industrialization in the Midwest. Rising electricity capacity charges, EPA Boiler MACT laws, carbon emission reduction mandates, and the development of shale gas all demand that midwestern policymakers formulate strategies for enabling DG and a conversion of transportation fleets to natural gas or electricity.

Urban areas would benefit from collaboration between local governments and industries to develop regional energy-planning scenarios. This will be especially important in older, more densely populated areas of the Great Lakes and the Midwest, where DG holds so much promise. DG, especially CHP, will not be a "one size fits all" application; every situation requires an analysis specific to those circumstances. However, planning can help manufacturers identify strategies to use "off the shelf" technologies when possible.

In particular, for regions with a large variety of manufacturing and other electricity-intensive users, a coordinated CHP program can be useful to organizations trying to find a fit for their power and heat needs. Such a program might be set up to address three strategic areas:

1) commercial buildings and small industrial applications—deploying similar equipment and similar financial goals and capabilities;
2) institutional facilities—usually with larger power and heat requirements and with much longer-term financing abilities, which are more amenable to Energy Savings Company (ESCO) savings structures (arrangements whereby energy savings realized are used to fund efficiency upgrades); and
3) major industrial and district heating CHPs, where large-scale power is generated, visibility is high, and the returns to the districts and industries involved are potentially great.

The development of an energy master plan might begin with a Geographical Information System–based "energy map" that is prepared at a neighborhood, local authority, or subregional scale. It would include an assessment of existing building energy demands as a baseline, identify likely locations for new business development, and assess effects on energy demand. It might also include a "heat map," identifying anchor heat loads, such as large public buildings (King and Shaw 2010).

These energy maps could reveal CHP-generated district heating opportunities that local authorities or project managers might be willing to support. They may also inform growth options and serve as the starting point for energy planning for developers. A decentralized energy master plan could include technical, planning, financial, and legal support—all better enabling manufacturers to evaluate DG opportunities.

Local energy planning can provide a road map for manufacturing to identify strategies for developing on-site DG opportunities. For the reasons discussed earlier, transactional costs threaten small-scale generation. Manufacturers are generally unwilling to spend hundreds of thousands of dollars identifying potential DG projects. Regional energy planning reduces these costs for manufacturers by identifying not only potential projects, but also possible collaborators and sources of funding.

Traditionally, regional energy plans have been developed in the United States to address climate action plans and to decrease reliance on fossil fuels.[13] However, the type of energy-mapping strategies that were developed for London, England, will be required to enable manufacturing to identify opportunities to provide district heating through CHP projects. That approach included a 10-stage undertaking with, among other things, data gathering, project identification, financial modeling, and feasibility studies (King and Shaw 2010). This sort of information would significantly enhance manufacturing's appetite for undertaking DG.

Finally, any regional energy study should include an investigation into the transformation of transportation fleets to compressed or liquefied natural gas and to electric vehicles. Notwithstanding the advent of oil development from shale formations such as the Bakken in North Dakota and the Utica in Ohio, the United States will continue to be an oil-importing nation. By substituting natural gas or electricity for gasoline and diesel for our transportation fleets, we can reduce our nearly billion-dollar-per-day trade deficit (Bureau of Economic Analysis 2013), and in the process decrease greenhouse gas emissions. With natural gas trading for a fraction of the cost of oil for the foreseeable future, this transition would save money and repatriate dollars domestically.

Urban areas can facilitate this change by identifying infrastructure needs and by developing strategic locations for refueling and recharging stations. In areas where shale gas is abundant, additional planning may enable the development of refueling stations near gathering, transportation, compression, storage, and distribution infrastructure. Water use and discharge planning would further enhance shale development, as would road use and maintenance planning.

CONCLUSIONS

In American society, policy is set by advocacy. Unfortunately, under this system, those entities with a preference toward maintaining the status quo have a significant advantage in setting policy—even when that course of action is not in the general public interest. No field of enterprise suffers from this problem more than does the energy industry, in which the stakes are enormous, and change can be disruptive. Incumbent industries have propagated the notion that we cannot replace our current energy models with new ones. Even when unbiased information is set forth, the public struggles to understand it; an unsuspecting citizenry is unable to differentiate between a vested interest and an independent expert.

This problem helps to explain why programs such as subsidies for rural electrification continue to exist some 40 years after 99 percent of American farms have been connected to the grid. It also is a cautionary message to policymakers who may want to rectify the imbalance: energy policies that enable and encourage migration from the cities, especially from those in the Midwest, will be very difficult to change. Not only do these cities face the problem of overcoming vested interests, they are also dealing with reduced political might as a result of decades of population and wealth flight. It will require considerable political courage for policymakers to undertake the sort of long-term commitments to energy policy that will be needed for midwestern cities to return to the robust economies they once enjoyed. But this starts by recognizing the complicity that long-existing energy policies have had in creating the decline of urban economies in the first place.

Notes

The author gratefully acknowledges research and editing support for this chapter from Su Gao and Srikanth Sivashankaran.

1. The federal portion of this does not vary; it is around $0.18 per gallon. For a discussion of the history of the excise tax, see Pirog (2010).
2. As noted in Slivinski (2009), rural electricity is just one of a number of utility services subsidized by urban dwellers.
3. California was also the location for the first failures in deregulation. A combination of fixed retail prices and rising costs of generation, together with some market manipulation by Enron and others, nearly left several California utilities insolvent.
4. Pfiffner (2009) argues that the current partisan culture has its roots in the demographic change brought on by the advent of air conditioning.
5. Berry (1991) argues that massive change following technical innovation accelerates during times of “stagflation,” such as we are arguably experiencing in America today. This acceleration in growth comes as a result of a combination of investors recognizing opportunity in depressed prices and public officials recognizing that help is needed to get the economy moving again. Both forces are at work today.
6. According to Policy Matters Ohio (2012), as many as 20,000 jobs could be created from cogeneration, and the release into the atmosphere of 13 metric tons of carbon dioxide would be avoided.

7. The Ohio Public Utilities Commission resolved in February 2012 to develop an educational forum to begin a pilot program to advance and share information about combined heat and power as a strategy for compliance with the new Boiler MACT rules. "Boiler MACT" refers to the set of adjustments to the Clean Air Act that the U.S. Environmental Protection Agency instituted December 20, 2012, specific to certain categories of boilers and solid waste incinerators. The adjustments made include emission limits for certain pollutants specifically targeted at categories of boilers and solid waste incinerators, changes to the subcategories of boilers in establishing standards, a revised implementation timeline, and adhering to established standards for the "highest emitting of the highest 0.4 percent of boilers" (EPA 2013).
8. Compliance coals run around $90 per ton, or $3.60 per mmbtu (million British Thermal Units, which measure energy content); 1 million btus are roughly equivalent to 1,000 cubic fee (mcf) of natural gas. If a boiler were 75 percent efficient, this means that the cost of delivered steam would be $4.80 per mmbtu.
9. Ohio's original net-metering law was enacted in 1999 as part of the state's electric-industry restructuring legislation. The Public Utilities Commission of OHIO (PUCO) later revised its net-metering rules in March 2007, prompted by the federal Energy Policy Act of 2005. Initially, PUCO required utilities to credit customers' net excess generation at the utility's full retail rate. However, in June 2002, the Ohio Supreme Court ruled that each utility must credit excess generation to the customer at the utility's unbundled generation rate. See http://energy.gov/savings/net-metering-29 (accessed October 24, 2013).
10. This policy of allocating costs when possible to the grid rather than to generation, in addition to ensuring the cost-plus return, makes certain that the utility generation is highly competitive in the wholesale market.
11. For purposes of this discussion, nongrid-connected microgrids are not considered, although these may have some application in more isolated areas.
12. Not all observers agree that shale gas has been a significant contributor to this trend. See Howarth (2011).
13. See, for example, Kane County (2011) and San Diego Association of Governments (1994).

References

American Petroleum Institute. n.d. Oil and Natural Gas Overview: API Key Tax Issues. Washington, DC: API. http://www.api.org/oil-and-natural-gas-overview/industry-economics/tax-issues/api-key-tax-issues (accessed April 17, 2013).

———. 2013. Oil and Natural Gas Overview: Motor Fuel Taxes. Washington, DC: API. http://www.api.org/oil-and-natural-gas-overview/industry-economics/fuel-taxes (accessed April 18, 2013).

American Public Power Association. 2012. Retail Electric Rates in Deregulated and Regulated States: 2011 Update. Washington, DC: APPA. http://www.publicpower.org/files/PDFs/RKW_Final_-_2011_update.pdf (accessed April 16, 2013.

Arsenault, Raymond. 1984. "The End of a Long Hot Summer: The Air Conditioner and Southern Culture." *The Journal of Southern History* 50(4): 597–628.

Berry, Brian J.L. 1991. "Long Waves in American Urban Evolution." In *Our Changing Cities*, John Fraser Hart, ed. Baltimore: Johns Hopkins University Press, pp. 31–50.

Brakey, Mike. 2012. "Skyrocketing FirstEnergy-Ohio Capacity Costs: Revolutionary Pricing, Contracting, and Consumption of Electricity." Cleveland, OH: Brakey Energy. Available by request at http://www.brakeyenergy.com.

Bureau of Economic Analysis. 2013. U.S. International Trade in Goods and Services, May 2013. News Release. Washington, DC: U.S. Bureau of Economic Analysis. http://www.bea.gov/newsreleases/international/trade/tradnewsrelease.htm (accessed July 31, 2013).

Carrier. n.d. Carrier History. Farmington, CN: Carrier. http://www.carrier.com/carrier/en/us/about/history (accessed April 17, 2013).

Casten, Sean. 2003. "Are Standby Rates Ever Justified? The Case Against Electric Utility Standby Charges as a Response to On-Site Generation." *The Electricity Journal* 16(4): 56–65.

———. 2012. "EPAs Boiler MACT Is an Economic Growth Opportunity." *Grist*, June 15. http://www.grist.org/article/epas-boiler-mact-is-an-economic-growth-opportunity/ (accessed April 17, 2013).

Considine, Timothy J., Robert Watson, and Seth Blumsack. 2010. "The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update." University Park, PA: Department of Energy and Mineral Engineering, Pennsylvania State University. http://www.marcelluscoalition.org/wp-content/uploads/2010/05/PA-Marcellus-Updated-Economic-Impacts-5.24.10.3.pdf (accessed April 17, 2013).

Consortium for Energy, Economics, and the Environment. 2008. "An Ohio Perspective on Energy and Climate Change." Athens, OH: Voinovich School of Leadership and Public Affairs, Ohio University.

Cooper, Gail. 1998. *Air-Conditioning America: Engineers and the Controlled Environment 1900–1960*. Baltimore: Johns Hopkins University Press.

Cox, Stan. 2007. "Air-Conditioned Nation." *Synthesis/Regeneration* 42(Winter). http://www.greens.org/s-r/42/42-08.html (accessed April 17, 2013).

D'Ambrosio, Peter, and Kevin O'Brien. 2009. Nuclear Power Projects—New Risks Require New Approaches. Chicago: American Bar Association. http://www.winston.com/siteFiles/Publications/Nuclear_Power_Projects_D%27Ambrosio_Article.pdf (accessed July 31, 2013).

Diamond, Rick, and Mithra Moezzi. n.d. "Changing Trends: A Brief History of the U.S. Household Consumption of Energy, Water, Food, Beverages, and Tobacco." Berkeley, CA: Lawrence Berkeley National Laboratory. http://www.epb.lbl.gov/homepages/Rick_Diamond/docs/lbn/55011-trends.pdf (accessed April 17, 2013).

Economist. 2010. "Oil and the Current Account." February 10. http://www.economist.com/blogs/freeexchange/2010/02/americas_trade_deficit (accessed April 16, 2013).

El Nasser, Haya. 2011. "Suburban Growth Focused on Inner and Outer Communities." *USA Today*, May 5. http://www.usatoday30.usatoday.com/news/nation/2011-04-26-suburbs-growth-census-demographics_n.htm (accessed April 16, 2013).

Energy Policy Conservation Act, Pub. L. No. 94-163, 89 Stat. 871 (1975).

Environmental Protection Agency. 2013. "Emission Standards for Boilers and Process Heaters and Commercial/Industrial Solid Waste Incinerators." Research Triangle Park, NC: EPA. http://www.epa.gov/airquality/combustion/actions.html (accessed April 17, 2013).

Evans, Stephen. 2005. "How Air-Conditioning Keeps Changing the U.S." *BBC News*, July 19. http://www.news.bbc.co.uk/2/hi/4697519.stm (accessed April 17, 2013).

Fergusson, James. 2006. "A Brief History of Air-Conditioning." *Prospect*, September 24. http://www.prospectmagazine.co.uk/magazine/abriefhistoryofairconditioning/ (accessed April 17, 2013).

Funk, John. 2012. "FirstEnergy Will Spend $1 Billion on High-Voltage Transmission Lines and Substations." *cleveland.com*, May 18. http://www.cleveland.com/business/index.ssf/2012/05/firstenergy_will_spend_1_billi.html (accessed April 17, 2013).

Great Achievements. 2013. Air Conditioning and Refrigeration Timeline. Washington, DC: National Academy of Engineering. http://www.greatachievements.org/?id=3854 (accessed April 17, 2013).

Howarth, Robert. 2011. "Greenhouse Gas Footprint of Shale Gas Obtained by High-Volume, Slick-Water Hydraulic Fracturing." Ithaca, NY: Howarth/Marino Lab at Cornell University. http://eeb.cornell.edu/howarth/Marcellus.html (accessed April 17, 2013).

Hultman, Nathan, Dylan Rebois, Michael Scholten, and Christopher Ramig. 2011. "The Greenhouse Impact of Conventional Gas for Electricity Generation." *Environmental Research Letters* 6(4): 1–9. http://www.iopscience.iop.org/1748-9326/6/4/044008/pdf/1748-9326_6_4_044008.pdf (accessed April 17, 2013).

International Center for Technology Assessment. 2005. Gasoline Cost Externalities: Security and Protection Services. Washington, DC: ICTA.

Kane County. 2011. “2040 Energy Plan.” Geneva, IL: Kane County, Illinois. http://www.countyofkane.org/Documents/Office of Community Reinvestment/Energy Efficiency and Conservation Block Grants/Kane County 2040 energy Plan/KC2040EnergyPlan_final.pdf (accessed April 17, 2013).

King, Michael, and Rob Shaw. 2010. Community Energy: Planning, Development, and Delivery. London: Town and Country Planning Association. http://tcpa.org.uk/data/files/comm_energy_plandevdel.pdf (accessed April 17, 2013).

Lesser, Jonathan A., and Leonard R. Giacchino. 2007. *Fundamentals of Energy Regulation*. Vienna, VA: Public Utilities Reports.

Lovins, Amory. 2001. “Small Is Profitable: The Hidden Economic Benefits of Distributed Generation (and Other Distributed Resources).” Snowmass and Boulder, CO: Rocky Mountain Institute. http://www.rmi.org/Knowledge-Center/Library/U01-13_SmallIsProfitable (accessed April 17, 2013).

Malone, Laurence J. 2001. “Commonalities: The R.E.A. and High-Speed Rural Internet Access.” Oneonta, NY: Hartwick College. http://www.arxiv.org/ftp/cs/papers/0109/0109064.pdf (accessed April 16, 2013).

Margonelli, Lisa. 2010. “The Case for Gray Power.” *The Nation*, February 15. http://www.thenation.com/article/case-gray-power# (accessed April 17, 2013).

Meunier, Guy. 2010. “Capacity Choice, Technology Mix, and Market Power.” *Energy Economics* 32(6): 1306–1315.

Miller, Graeme. 2012. “Iowa On-Site Generation Tariff Barrier Overview.” Chicago: U.S. Department of Energy Midwest Clean Energy Application Center. http://www.iaenvironment.org/documents/energy/TariffBarrierOverview.pdf (accessed August 16, 2013).

Moulton, Sean. n.d. “Gas-Guzzler Loophole: SUVs and Light Trucks Drive Off with Billions.” Washington, DC: Friends of the Earth. http://www.electrifyingtimes.com/gasguzzlerloophole.html (accessed April 17, 2013).

National Highway Traffic Safety Administration (NHTSA). 2013. “CAFE Fuel Economy.” Washington, DC: NHTSA. http://www.nhtsa.gov/fuel-economy (accessed April 17, 2013).

Natural Gas Policy Act, Pub. L. No. 95-621, 92 Stat. 3350 (1978).

Neville, Angela. 2008. “Microgrids Promise Improved Power Quality and Reliability.” *Power*, June 15. http://www.powermag.com/business/Microgrids-promise-improved-power-quality-and-reliability_134_p3.html (accessed April 17, 2013).

New York Times. 2011. “The Clear Case for the Gas Tax.” *New York Times*, August 15. http://www.nytimes.com/2011/08/16/opinion/the-clear-case-for-the-gas-tax.html (accessed April 16, 2013).

Ohio Manufacturers' Association. 2010. "Retooling Ohio: A Bulletin for Leaders on Policy Issues Critical to Ohio Manufacturers." Columbus, OH: Ohio Manufacturers' Association.

Pfiffner, James P. 2009. "Partisan Polarization, Politics, and the Presidency: Structural Sources of Conflict." In *Rivals for Power: Presidential Congressional Relations*, James A. Thurber, ed. Lanham, MD: Roman and Littlefield, pp. 37–60.

Pipe Doctor Plumbing, Heating, and Air Conditioning. n.d. The History of Air Conditioning. HVAC Professionals. http://www.superhvac.com/learn/the-history-of-air-conditioning (accessed April 17, 2013).

Pirog, Robert. 2010. "The Role of Federal Gasoline Excise Taxes in Public Policy." Report prepared for members and committees of Congress, No. 7-5700. Washington, DC: Congressional Research Service. http://www.fpc.state.gov/documents/organization/130217.pdf (accessed April 16, 2013).

PJM. 2012. "PJM Capacity Auction Secures Record Amounts of New Generation Demand Response, Energy Efficiency." News release, May 18. Norristown, PA: PJM. http://www.pjm.com/~/media/about-pjm/newsroom/2012-releases/20120518-pjm-capacity-auction-secures-record-amounts-of-new-generation-demand-response-energy-efficiency.ashx (accessed April 17, 2013).

Plummer, Bradford. 2010. "Fossil-Fuel Subsidies Still Dominate." *The New Republic*, August 3. http://www.newrepublic.com/blog/the-vine/76750/fossil-fuel-subsidies-still-dominate (accessed April 18, 2013).

Policy Matters Ohio. 2012. "Capturing Energy Waste in Ohio: Using Combined Heat and Power to Upgrade Our Electric System." Cleveland and Columbus, OH: Policy Matters Ohio. http://www. policymattersohio.org/combined-heat-power-march2012 (accessed April 17, 2013).

Public Utilities Regulatory Act, Pub. L. No. 95-617, 92 Stat. 3117 (1978).

San Diego Association of Governments. 1994. San Diego Regional Energy Plan. San Diego: San Diego Association of Governments. http://energycenter.org/uploads/energy_plan.pdf (accessed April 17, 2013).

Segedy, Jason. n.d. "Moving Beyond 1956 . . . A New Vision for Transportation." Akron, OH: Akron Metropolitan Transportation Study. http://www.amatsplanning.org/2010/08/13/moving-beyond-1956-a-new-vision-for-transportation/ (accessed April 16, 2013).

Shumsky, Neil. 1996. *Urbanization and the Growth of Cities*. New York: Garland Publishing.

Slivinski, Steven. 2009. *Rural Subsidies*. Washington, DC: CATO Institute. http://www.downsizinggovernment.org/agriculture/rural-subsidies (accessed April 17, 2013).

Sovacool, Benjamin J., and Charmaine Watts. 2009. “Going Completely Renewable: Is It Possible? (Let Alone Desirable)?” *Electricity Journal* 22(4): 95–111.

Steinmetz, Katy. 2010. “Air-Conditioning.” *Time*, July 12. http://www.time.com/time/nation/article/0,8599,2003081,00.html (accessed April 17, 2013).

Thomas, Andrew R., Iryna Lendel, Edward W. Hill, Douglas Southgate, and Robert Chase. 2012. “An Analysis of the Economic Potential for Shale Formations in Ohio.” Cleveland, OH: Cleveland State University. http://www.urban.csuohio.edu/publications/center/center_for_economic_development/Ec_Impact_Ohio_Utica_Shale_2012.pdf (accessed April 17, 2013).

Thomas, G. Scott. 2012. “Long-Term Manufacturing Decline Affects All States.” *The Business Journal: On Numbers*, July 11. http://www.bizjournals.com/bizjournals/on-numbers/scott-thomas/2012/07/longterm-manufacturing-decline-affects.html?page=1 (accessed April 17, 2013).

Tverberg, Gail. 2012. “High-Priced Fuel Syndrome.” *Our Finite World*, September 26. http://ourfiniteworld.com/2012/09/26/high-priced-fuel-syndrome/ (accessed April 16, 2013).

U.S. Census Bureau. 2010. *Resident Population Data—Population Change*. Washington, DC: U.S. Census Bureau. http://www.census.gov/2010census/data/apportionment-pop-text.php (accessed October 29, 2013).

U.S. Energy Information Agency. 2012a. “Projected Natural Gas Prices Depend on Shale Gas Resource Economics.” *Today in Energy*, August 27. Washington, DC: U.S. Department of Energy. http://www.eia.gov/todayinenergy/detail.cfm?id=7710 (accessed April 17, 2013).

———. 2012b. “U.S. Energy-Related CO2 Emissions in Early 2012 Lowest Since 1992.” *Today in Energy*, August 1. Washington, DC: U.S. Department of Energy. http://www.eia.gov/todayinenergy/detail.cfm?id=7350 (accessed April 18, 2013).

Vaitheeswaran, Vijay V. 2004. *Power to the People: How the Coming Energy Revolution Will Transform an Industry, Change Our Lives, and Maybe Even Save the Planet*. New York: Farrar, Strauss, and Giroux.

Ward’s Automotive Group. 2012. U.S. Car and Truck Sales. Southfield, MI: Ward’s Automotive Group. http://www.wardsauto.com/keydata/historical/UsaSa01summary (accessed April 17, 2013).

Washington, R.A. 2011. “Energy Prices Tax Away Vulnerability.” *The Economist*, February 23. http://www.economist.com/blogs/freeexchange/2011/02/energy_prices (accessed July 31, 2013).

Weston, Rick, Joel Bluestein, Bruce Hedman, and Rod Hite. 2009. “Standby Rates for Customer-Sited Resources: Issues, Considerations, and the Elements of Model Tariffs." Report prepared for the U.S. Environmental Protection Agency. Montpelier, VT: Regulatory Assistance Project, and Arlington, VA: ICF International. http://www.epa.gov/ehp/documents/standby_rates.pdf (accessed April 17, 2013).

Wissman, Kim. 2012. "CHP and PUCO." Columbus, OH: Public Utilities Commission of Ohio Workshop on CHP. http://www.puco.ohio.gov/puco/index.cfm/industry-information/industry-topics/combined-heat-and-power-in-ohio/ (accessed August 16, 2013).

Yacobucchi, Brent D., and Robert Bamberger. 2007. "Automobile and Light Truck Fuel Economy: The CAFE Standards." Prepared for members and committees of Congress. Washington, DC: Congressional Research Service. http://www.fpc.state.gov/documents/organization/82504.pdf (accessed April 17, 2013).

Yergin, Daniel. 2012. "America's New Energy Reality." *New York Times*, June 9. http://www.nytimes.com/2012/06/10/opinion/sunday/the-new-politics-of-energy.html?pagewanted=all (accessed April 18, 2013).