

**CHAPTER 7:**  
**CITIES, CLIMATE CHANGE AND URBAN ECONOMIC DEVELOPMENT**  
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Many European and US cities are in the policy vanguard in addressing the interrelated environmental problems of global warming, pollution and energy dependence. European cities, supported by layers of national and European Union policy, have undertaken multiple initiatives in energy, transportation, building and land use to reduce their carbon footprints. Absent a comprehensive national policy, US cities have begun to implement similar strategies on their own, or sometimes with assistance from state governments. One aspect of urban climate change action that has not received much attention is the connection to green economic development.

This paper explores this connection, focusing on renewable energy and energy efficiency, both of which have considerable economic development and job creation potential worldwide. One key area where cities can make this link is in their efforts to make existing and new buildings more energy efficient. Buildings consume 71% of electric power, 39% of all power and create 39% of CO<sub>2</sub> emissions in the United States, with similar percentages in Europe. To reduce their greenhouse gas emissions, cities are establishing more stringent efficiency standards for new buildings, undertaking initiatives to improve the efficiency of existing buildings and creating incentives for using renewable energy. Each has particular links to jobs and economic development. Employment opportunities start with the people doing the retrofitting and installing solar energy systems, and also include manufacturing jobs in renewable energy and green building products.

The transition to a low-carbon economy can be an engine of economic development, with jobs in many sectors. A recent United Nations Environment Programme report on green jobs estimates that 300 000 workers are employed in wind power, 170 000 in solar photovoltaic and 600 000 in solar thermal production worldwide, with a potential of increasing up to 2.1 million in wind and 6.3 million in solar photovoltaics (PV) by 2030. Comprehensive energy-efficiency measures in the building sector are projected to employ between 1 and 1.4 million people in Europe by 2030 and 827 000 in the United States by 2020 (Renner, Sweeney and Kubit, 2008). As the report suggests, these jobs will be attractive to countries, regions and cities that have lost manufacturing jobs or to underdeveloped regions and countries.

The opportunity is real. But there are also many challenges. Cities of course cannot solve the climate crisis without international treaties and national policies to support them. But national policy gets played out in particular places, and cities can employ economic development strategies to attract renewable energy and other carbon-reducing technologies. There are many outstanding questions about what cities can and should be doing to become players in what commentator Thomas Friedman calls the “energy-climate era.” (Friedman, 2008) Can cities create enough demand for renewable energy or green building products to stimulate new manufacturing jobs? Or is this the job of national policy,

with little role for city or regional planning organisations? What can national governments learn from city and regional policy? And what types of national policy are needed to stimulate economic development through climate change initiatives?

Drawing from examples in a forthcoming book, *Emerald Cities: Linking Climate Change and Economic Development* (Oxford University Press), this paper presents an analysis of national, regional and city-led initiatives to reveal the policy formation process, how linkages between climate change and economic development policy are being made, and how policy learning takes place among different levels of government. The cases were selected by a snowball sampling method based on interviews with experts in the field and the author's knowledge of city sustainability efforts.<sup>1</sup> This paper focuses on renewable energy and energy efficiency.

## **The policy framework**

Cities can link their climate change initiatives to several sectors or clusters of economic activity, including renewable energy, green building products and technologies, construction and maintenance, waste-processing technologies and transportation. Sectoral economic development strategies are well established as a means for cities, states or regions to maintain existing, or to create new, regional specialisations or clusters. The terms sectoral or cluster strategies are often used interchangeably, although sectoral strategies typically focus more on job creation.<sup>2</sup> A sector is a group of firms that produce similar products, or have shared markets, technology and workforce needs. A cluster is a bit broader in scope, defined as geographic concentrations of companies that are interconnected by the markets they serve, the products they produce, their suppliers and workforce needs (Porter, 1997). These strategies can be implemented by states, regional economic development organisations, cities and communities (see Fitzgerald and Leigh, 2003).

The OECD has analyzed regional specialisation and cluster strategies as the intersection of three policy families: regional policy, science and technology or innovation policy, and industrial/enterprise policy. All three emphasise facilitating collaborative research between industry and research institutions geared toward commercialising new (often high-tech) products (OECD, 2007). These strategies are often closely linked to urban economic development strategies. Due to their proximity to universities and research and production facilities, cities are often where these partnerships are centered and thus where the new products are developed and commercialised (OECD, 2006).

The cases examine how sectoral/cluster strategies in renewable energy and energy efficiency are playing out in practice. The analysis focuses on the interactions among various levels of government and nongovernmental actors in attempting to create regional specialisations in climate change technologies. This is the link between climate change and economic development.

## **Renewable energy: solar cities**

This section starts with Freiburg, which along with other German cities, employed a regulatory policy, the feed-in tariff, to promote solar energy. Based on the success of these cities, the German government enacted a federal feed-in tariff that is credited with Germany's status as a top exporter of solar and wind technology (see text box). The German government is now directing development of renewable energy production in eastern Germany to stimulate economies of lagging regions. Despite this targeting, Freiburg is still an innovator in solar technology and illustrates how cities can stimulate demand for products to create a regional specialisation. The Freiburg case also reveals that national policy can replicate city policy innovations. In contrast, the growing capacity in solar energy production of Philadelphia, Pennsylvania, is almost exclusively the result of state policy. In the same way that German renewable energy policy is directing the industry to lagging areas, Pennsylvania is

directing production in renewable energy to smaller, de-industrialised cities, while headquarters and other business functions are attracted to the state's premier city.

### **Freiburg**

A university town of 216 000 in the Ruhr Valley of Southwest Germany, Freiburg calls itself “the solar city.” Its green focus emerged in response to a proposed nuclear power plant in 1975. Citizen activists were successful in stopping the plant, and soon began a movement to promote solar and other renewable energy. It took until 1986 to develop a citywide strategy, when the city adopted guidelines for an energy and development policy, SolarRegion. At this point, several environmental organisations, businesses and research institutes were created to promote solar energy. Other measures are a Climate Protection Strategy passed in 1996 to reduce CO<sub>2</sub> emissions by 25% by 2010.

The three pillars of the SolarRegion strategy are energy conservation, use of new technologies and use of renewable energy. All have become economic development strategies. Freiburg is creating demand for solar technology through several policy measures, including building city-owned solar projects; a local ordinance requiring that 10% of electricity be from renewable sources by 2010; public subsidies, pilot and demonstration projects; renting roof surfaces to solar power plant operators; a feed-in tariff that allowed local residents and business to sell power back to the grid (see text box) and proactive research and economic development support. The Fraunhofer Institute for Solar Energy Systems, the largest solar research institute in Europe, employs 500 scientists, who conduct basic and applied research on solar cells, and work on off-grid power supplies, hydrogen technology and related areas.<sup>3</sup> A solar incubator, the Solar Information Center (SIC), houses small firms in renewable energy and energy efficiency. City planners are involved too. To respond to a housing shortage and demonstrate that energy-efficient neighborhoods could be built on a large scale, the city developed Vauban as a solar eco-community. Another eco-community, Rieselfeld, will be completed in 2010.

These efforts have paid off. The city now boasts employment of 700 in solar technology and 10 000 in the environmental and solar sectors. Solar-Fabrik built a zero-emissions solar module production facility in Freiburg in 1997 that employs 130 people. The majority of the thousands of photovoltaic modules the city has mounted on buildings are made in Freiburg.

At the national level, the German government has seen the economic development potential of renewable energy as well. In the words of Sigmar Gabriel, German Minister for Environment, “The systemic expansion of renewable energy is not only good from the environmental and climate policy point of view but also for innovation, growth and employment in Germany.”<sup>4</sup> In 1991, the German government implemented a national feed-in tariff and several other policies to catalyse growth in both wind and solar technologies (see text box). The feed-in tariff has resulted in Germany's becoming the world's largest producer of wind energy since 1997. Global wind capacity has increased, on average, more than 25% a year over the last decade, to a current level of 60 000 megawatts, 40 000 of which is in Europe.<sup>5</sup> Production totals in 2005 were 18 000 MW in Germany, 10 000 in Spain and 9 100 MW in the United States (Kammen, 2006, p. 86). About 20% of wind and 10% of German solar PV technology is exported (Runci, 2005). Germany is second only to Japan in solar PV production. The PV market increased more than ten times from 1999-2003, while the cost dropped 20% (Stryi-Hipp, 2004). Germany accounts for 55% of global solar electricity production, and combined with Japan has a 70% share of global production in solar electricity equipment. Of the 1 727 MW of solar cells manufactured worldwide in 2005, 833 MW were produced in Japan, 353 in Germany and 153 in the United States. In 2004, the German renewable energy industry employed approximately 157 000 (64 000 in wind, 57 000 in bio energy and the rest in solar and others). Additional net employment growth by 2020 will be between 73 000 and 117 000 (Dürrschmidt and van Mark, 2006).

### Box 1. Germany's renewable energy policy

Germany, like several European and other countries, has used feed-in tariffs to stimulate demand for renewable energy, and to create jobs and an export industry in renewable technology. The feed-in tariff is the dominant policy tool for promoting renewables in Europe, with 18 EU countries employing them. Feed-in tariffs require grid operators to purchase all renewable power available to them from renewable energy generators at prices set by government. The prices are set for a specified time period (varying, but usually around 20 years), with the amount of subsidy usually dropping over time (although fixed tariffs exist, they do not have the benefit of lowering costs). The idea is to guarantee suppliers of renewable energy a price above production cost, so as to create a stable market that encourages investment in technologies and reduces the unit cost of production. For most, tariffs vary for different technologies. The costs of feed-in tariffs are paid by suppliers and passed on to consumers.<sup>1</sup>

Germany's 1991 electricity feed law (EFL) set the price for wind and solar at 90% of the retail electricity rate and hydropower, landfill gas, sewage gas and biomass at 80%.<sup>2</sup> A new law, the Renewable Energy Sources Act (EEG), was enacted in 2000 to make some policy corrections and strengthen the EFL.<sup>3</sup> Its goal is to double the amount of renewable power from 1997 levels by 2010 and obtain 20% of electricity from renewable sources by 2020.<sup>4</sup> The 2000 Renewable Energies Law continues the commitment to doubling the percentage of renewable energy by 2010. And German national banks offer loans at 1% to 2% below market for the first 75% of project costs for renewable production initiatives.<sup>5</sup>

Key to the success of Germany's feed-in tariff are long-term contracts, guaranteed purchasers and pricing that provides an adequate rate of return for renewable suppliers. Further, the feed-in tariff is integrated into other long-term efforts to promote the development of an appropriate mix of renewable energy sources (Klein *et al.*, 2007). The law promotes a diverse ownership structure for renewable energy that includes power companies, municipalities, farmers (particularly with wind) and residential solar PV producers.<sup>6</sup> While critics point out that Germany's relatively low solar resources means that it can take several years for a photovoltaic cell to generate as much power as it took to manufacture it,<sup>7</sup> German companies have built expertise in building a product with enormous export potential.

#### Notes:

1. Sawin (2004). For a more detailed explanation of how feed-in tariffs work in different countries, see Sijm (2002).
2. See [www.wind-works.org/FeedLaws/Germany/ARTsDE.html](http://www.wind-works.org/FeedLaws/Germany/ARTsDE.html) (accessed 15 June 2007).
3. A key difference in the new law is that it differentiates among energy producers, with low-cost producers compensated at lower rates than higher-cost producers to provide more incentive for developing installations on lower-quality sites. This change was needed because concentration of wind energy in the northern part of the country (with higher winds) overburdened utilities there. Another difference is that grid operators are required to purchase power from local producers (an equalization program was added to reduce the cost differentials paid by grid operators in different parts of the country for renewable power). Network utilities are also compensated for supplying the grid with electricity from renewable sources.
4. Renewable Energy Sources Act [www.bmu.de/files/pdfs/allgemein/application/pdf/res-act.pdf](http://www.bmu.de/files/pdfs/allgemein/application/pdf/res-act.pdf) (accessed 15 June 2007).
5. Other policies include the Million Roofs Program, which subsidizes installation of new solar panels. This program has stimulated growth in installed PV capacity from 50 megawatts in 1998 to 350 megawatts. The Market Stimulation Program provides grants and loans to individuals, schools and businesses for installing renewable heating systems. Other grants totalling USD 270 million in 2003 were earmarked for commercialization of renewable energy systems and another USD 40 million for export promotion (Runci, 2005).
6. The tariff can be paid to commercial and residential providers. Residential users who purchase solar PV systems for their homes, for example, can feed in electricity they do not use to the grid at the subsidized rate, ensuring a payoff from their initial investment in the system.
7. Krupp and Horn (2008, p. 39). Germany's solar energy potential is approximately 1 million kilowatt hours per square metre.

The German government is directing many of the new production facilities to cities in the east, where significant infrastructure investments were made following unification. Unemployment in the east has been high, and companies are taking advantage of skilled workers at lower wages than in the west. Despite this targeting by the national government, Freiburg still benefits from its early leader status and its strength in research.

## Philadelphia

Philadelphia's pathway to becoming a solar city is almost the complete opposite of Freiburg's, in that it would not have happened without state policy. Although Philadelphia did join the Cities for Climate Protection Campaign of ICLEI-Local Governments for Sustainability in 1999, sign the US Mayors' Climate Protection Agreement in 2005, and release a climate change plan in mid-2007, the city is just becoming a leader among US cities on climate change action. The plan commits the city to reducing its greenhouse gas emissions by 10% by 2010 and to set the stage for future reductions beyond 2010. Mayor Michael Nutter has also consolidated city initiatives around climate and the environment by creating a cabinet-level director of sustainability position. Despite the lack of a climate policy and any economic development initiatives targeting renewable energy, in the past three years, Philadelphia has become the US headquarters to the Spanish wind giants Gamesa and Iberdrola, as well as German solar conglomerate Conergy and its subsidiaries SunTechnics and EPURON. All have been the result of the state's aggressive strategy to develop manufacturing capacity in renewable energy.

### Box 2. Renewable portfolio standards

Renewable portfolio standards (RPS) require utilities or suppliers to provide a specified percentage of electricity from renewable sources by a given year. At least 43 countries, 26 US states and a few cities have enacted RPS laws. The goal of the RPS is to create a market for electricity by specifying amounts to be used, with generators of renewable energy competing to supply it. For example, California's RPS stipulates that utilities must purchase 20% of their electricity from renewable sources by 2010. The premise is that market competition will drive down costs. States vary in the extent to which they specify specific types of renewable energy to be included (see Rabe, 2006, 2003). Many portfolio standards use renewable energy credits or certificates (RECs) as proof that one kWh of electricity has been generated by a renewable source. In some states, such as Texas, suppliers that do not meet requirements to purchase renewable energy credits are penalised.

The United States does not have a national portfolio standard. Compare this to the European Union, which has a 12% renewable standard for electricity production by 2010 in addition to standards in place in 25 member countries. Even operating at the state level, the RPS is having an economic impact. The American Council on Renewable Energy estimates that a national portfolio standard could create USD 700 billion in economic activity and 5 million jobs by 2025 (American Council on Renewable Energy, 2007). The Union of Concerned Scientists (UCS) estimates that about 45 gigawatts of new renewable energy capacity will be needed by 2020 to fulfill current state RPS policies, while Global Energy Advisors estimates that more than 52 gigawatts would be required, amounting to approximately 3% of United States 2020 electric sales. While seemingly modest, reaching this goal would nearly double the percentage of non-hydro renewable energy generation currently in the United States (Wiser et al., 2007, p. 10). The Lawrence Berkeley National Laboratory estimates that about half of the wind power capacity built in the United States between 2001 and 2006 was partly motivated by state renewables portfolio standards (RPS) and up to 60% for 2006 installations (Wiser and Bolinger, 2006).

The RPS is too new and varied a policy instrument for its impact to be definitively evaluated. Modelling of wind capacity growth in states with different types of policy against states with no policy suggests that having a RPS in place does stimulate the early development of wind production (Blair et al., 2006; Menz and Vachon, 2006). Preliminary evaluations suggest that successful RPS laws include: clear targets for in-state production; political support and regulatory commitment; predictable long-term purchase obligations; automatic enforcement penalties;<sup>1</sup> flexibility mechanisms; certificate trading; and development of adequate transmission capacity (see Wiser, Porter and Grace, 2004; Wiser and Langliss, 2001).

**Note: 1.** Blair et al suggest penalties must be at the level of USD 20 per megawatts to be effective. One of the strictest of current penalties is Texas at the lesser of 5 cents per missing kilowatt hours or 200% of the mean trade value of certificates in the current compliance period (Deyette and Clemmer, 2005, p. 8).

Pennsylvania's two-pronged strategy for building a renewable energy sector is to grow its own companies and to attract international companies to jump-start job creation and create the critical mass needed for agglomeration. Underpinning these strategies is a commitment to revitalising the state's diverse manufacturing sector and lagging cities and regions.<sup>6</sup> As defined by Kathleen McGinty,

Secretary of the Pennsylvania Department of Environmental Protection (the state agency responsible for developing and deploying energy technologies), “What makes us different from other states promoting clean energy and efficiency is that for us, it is a means to revitalise manufacturing and be an engine of job creation, rather than being first and foremost an environmental strategy. We only put state dollars in energy investments that create jobs.”<sup>7</sup>

Appointed by Governor Edward Rendell shortly after he took office in 2003, McGinty immediately began linking energy and economic development policy. Aware of the lack of national policy to drive the growth of renewable energy, McGinty began promoting the state policies that would be needed to drive industry growth. She and her team knew the state needed a renewable portfolio standard (see text box), but also knew that getting one passed could not lead the renewable economic development strategy because it did not have political support in the legislature. Although the RPS would be essential to the second prong of the strategy, attracting a big player in both wind and solar technology, the opening salvo had to be one that would build both industry and political support for renewable energy in a state dominated by coal.

One of the administration’s first initiatives was to establish the Pennsylvania Energy Harvest grant program. In its first year, the program allocated almost USD 6 million in grants to companies to encourage investment in renewable energy, energy-saving production processes and alternative energy production. Most of the grants were to help businesses become more efficient, rather than investing in production of renewable energy. Since then, the program has invested USD 21 million leveraging USD 51.9 million in private investment in wind, solar, biomass, waste coal and recycled energy projects.

The success of this small program enabled the governor to persuade the legislature to do something bigger. At Rendell’s request, the legislature reactivated a defunct state agency and energy program, the Pennsylvania Energy Development Authority (PEDA), to invest even more in the jobs-energy strategy. Approved in April, 2004, PEDA provides grants and loans to support projects across the clean energy spectrum. In its first two years, PEDA awarded USD 15 million in grants and loans for 41 clean energy projects expected to leverage USD 200 million in private investment and 1 558 permanent and construction jobs. In 2007, PEDA awarded USD 6.1 million to sixteen clean energy projects from its USD 4 025 954.95 in funds. To date, PEDA has awarded approximately USD 31 million in 80 projects.

All the while, an economic case was being made to pass a RPS. Both state houses were controlled by Republicans, so bipartisan support was essential. After two years of negotiations to bring on board reluctant elected officials, utilities and the coal industry, the RPS passed in November 2004.<sup>8</sup> It requires that 18% of all retail energy generated by 2021 come from clean and efficient sources, broadly defined. The standard calls for 8% of energy to come from Tier I sources, which include wind and solar and 10% from Tier II, which includes waste coal and other nonrenewable sources.<sup>9</sup> The portfolio standard requires utilities to purchase about 850 megawatts of solar capacity by 2021 – the fourth-largest requirement for solar energy among the 25 states that have portfolio standards. Industry experts project that the new standard will catalyze about 850 MW of solar generating capacity in Pennsylvania and support 14 000 jobs, one-third of which will be in the state (Rosey, 2006).

In early 2003, Gamesa, the world’s second-largest wind energy company, began looking for a US site. McGinty approached the company to present Pennsylvania’s assets, including wind capacity, a well-trained labor force, proximity to major wind markets and a strong electrical grid. Gamesa officials were impressed, and in September 2004, they announced that the company would build a USD 40 million plant in Ebensburg, Pennsylvania, to produce blades and towers for commercial-scale wind turbine generators and assemble the nacelles that house the turbines. Within days, Gamesa also

announced that the company would build additional manufacturing facilities in the state and locate its US headquarters, marketing office and a training facility in Philadelphia. To top off the investment, Gamesa also committed to building 18 wind farms.

These investments provided the jump-start Pennsylvania would need to be a leader in wind energy. When all of the facilities are up and running (excluding the wind farms, which operate under another division of the company), Gamesa will have invested USD 175 million and created more than 1 100 jobs in Pennsylvania, of which about 900 are in manufacturing.

The ambitious portfolio standard was key to the decision of Gamesa officials to locate in Pennsylvania. Needing a regional market for its turbines, company executives wanted the state to commit to being a major purchaser of alternative energy. Gamesa's wind power division will sell 400 megawatts of power to Pennsylvania utilities, enough to power about 135 000 homes. The state, together with the three utilities, agreed to purchase about 1 100 MW from two of the Gamesa facilities.

It did not take long for another wind giant to take advantage of Pennsylvania's policies. In 2006, the US division of Spanish-owned Iberdrola Renewable Energies USA acquired Community Energy and set up its US headquarters in Radnor, in suburban Philadelphia. Attracted by the RPS and related renewable energy policies, Iberdrola will be developing new wind projects in the state.

And in November, 2006, Pennsylvania landed German-based Conergy AG, the world's largest solar power integration company. The company committed to locating the North American headquarters of its financial subsidiary, Voltwerk (now Epuron), and the East Coast operations of its solar engineering and installation subsidiary, SunTechnics, in Pennsylvania. Conergy supplies solar water pumps and photovoltaic and solar thermal components to a world market, but wanted to have a presence near customers in the eastern United States.<sup>10</sup>

The inclusion of wind, solar and biodiesel in the RPS was attractive to Conergy because its subsidiaries distribute all three. Secretary McGinty explains that the ambitious solar provision in the state RPS was established specifically with the goal of attracting a big solar player. As with wind, the idea was that the first large company would create momentum and result in other investments following. McGinty examined the growth potential of several companies, identified Conergy as a strategic attraction option and invited Conergy officials to come to Pennsylvania. The company decided to locate in Pennsylvania, and in February 2007, SunTechnics Inc. announced that it had acquired Mesa Environmental Sciences Inc. The new company, SunTechnics, installs solar systems and will be the East Coast headquarters for the company (*Philadelphia Business Journal*, 2007).

Conergy's US financial headquarters subsidiary, Epuron, located in Philadelphia. With the acquisition of MESA Environmental, Conergy has renewable engineering company headquarters in Pennsylvania, with offices in Philadelphia and Malvern. In total, Conergy will create up to 50 engineering, financing and management jobs and up to USD 100 million in clean energy deals over the next three years.

In April 2007, another start-up solar company announced it would open a production facility and headquarters at a brownfield site in Bucks County, in the Philadelphia metropolitan area. AE Polysilicon Corporation manufactures the polysilicon used in solar cells and modules. Landing the company was a coup for Pennsylvania, as it is one of only ten polysilicon manufacturers in the world. Like Gamesa, the company will receive tax benefits for locating in a Keystone Opportunity Improvement Zone, where special tax abatements and other incentives are available. The benefits are part of a USD 1.92 million financial package created by the Department of Community and Economic

Development, which includes a USD 1 million loan from PEDA, and USD 65 000 for customised job training. The company has also applied for a USD 5.8 million low-interest loan from the Citizens Job Bank program (created for companies that create jobs or expand existing employment in the state). The company broke ground a year later and expects to create 145 permanent jobs.

The state's efforts have only yielded 3 000 renewable energy jobs so far, but the future economic development potential could be enormous, depending on whether supply chains can be developed to create true clusters in renewable energy. Part of the rationale for providing subsidies to jump-start particular industries is not just the direct employment, but employment in supplier firms to the industries. Many of the projections of millions of new jobs in renewable energy assume that the firms will use regional suppliers (see Sternzinger and Stevens, 2006; Sternzinger, Stevens and Svrcek, 2006) and Sternzinger and Svrcek, 2005). Unfortunately, that has not been the case in either the wind or solar industries, both of which are highly concentrated. The top five largest wind turbine manufacturers, for example, control 82.2% of the world market (and only one, G.E., is a US company). The top four solar companies control 50% of the market. And in both wind and solar, foreign companies are buying up US companies to control sources of component supply (Glasmeier, 2007). Most are not using US suppliers. A spokesman for Spanish-owned Gamesa, which has 28% of its turbine manufacturing capacity in the United States, notes that the company imports its major component parts from overseas because US capacity is lacking. Likewise, the new Vestas turbine plant in Colorado imports almost all its component parts because it has long-established relationships with its European suppliers.

Time will tell whether the decline in the value of the dollar against the euro will motivate more use of US suppliers. Higher oil costs have increased the cost of shipping goods enough to motivate some offshore manufacturing back to the United States.<sup>11</sup> Much manufacturing infrastructure in the United States has been decimated, so states like Pennsylvania that have attempted to keep manufacturing jobs may have an advantage. Pennsylvania's attraction strategy begs the question of whether renewable energy is on its way to stimulating a new round of smokestack-chasing among the states and on an international level. In any case, for different reasons, renewable energy will continue to be the economic underpinning of climate change strategies in Freiburg and Philadelphia.

## **Energy efficiency**

A negawatt, a term coined by Amory Lovins, is a unit of conserved energy. It is the cheapest source of energy available – every dollar spent on using less electricity saves USD 2 in investment in increasing electric supply. McKinsey & Co. estimates that worldwide energy demand could be cut in half by increasing energy productivity. Investment in energy efficiency can stimulate employment in two ways – by creating jobs for those doing the retrofitting and by stimulating demand for new energy-saving and pollution-fighting products.

EU directives and the EU commitment under the Kyoto Protocol have stimulated energy efficiency efforts in member states. Germany's Alliance for Work and Environment is one response to its commitment under the Kyoto Protocol to reduce greenhouse gas reductions by 21% from 1990 levels by 2012 and to stimulate the lagging construction sector. In contrast, the United States has not undertaken a national effort to improve efficiency of this magnitude. But several cities and regions see potential for revitalising manufacturing by promoting energy efficiency. These regions see the demand for efficient building systems and other green building products increasing and are positioning themselves to take advantage of expanding markets. Although these approaches are often mutually exclusive in practice, they need not be. In fact, connecting them is essential to creating economic opportunity out of climate change initiatives. The initiatives described in US rustbelt cities Syracuse and Pittsburgh would be helped considerably by a commitment from the US government to spend billions on efficiency as recommended by former Vice President Al Gore's WE initiative and the

Apollo Alliance, a coalition of business, labor, environmental and community leaders seeking to catalyse a clean energy revolution in the United States.<sup>12</sup>

### ***Germany and energy efficiency***

The German Alliance for Work and the Environment was created in 2001, with the dual goal of increasing energy efficiency and stimulating employment in the lagging construction sector. This collaborative of government, unions, NGOs and employer federations has achieved impressive results. A public investment of EUR 1 billion stimulated EUR 5 billion in investment, retrofitted 200 000 apartments, created 25 000 full-time jobs and saved 116 000 jobs in the construction sector. The initiative has created EUR 4 billion in new tax revenues and savings in unemployment benefits and reduced annual building emissions by 2%. Further, the initiative has created a market for new technologies that are being produced in Germany, including: low-temperature heating boilers; fuel cells, photovoltaic and solar thermal systems, heat exchangers for ventilation systems and triple-glazed windows with inert gas and thermal insulation material. Building on this success, the German government increased funding to 1.5 billion euros in 2005 (Renner, Sweeney and Kubit, 2008, p. 70; Dupressoir *et al.*, 2007).

An analysis of the program's impact in stimulating manufacturing jobs producing new efficiency-related products has not been undertaken. Unlike renewable energy policy, this program does not target specific cities or regions.<sup>13</sup> To the extent that it reduces utility payments, however, it clearly frees up money in city budgets to spend on other items.

### ***U.S. cities and energy efficiency***

With no major federal efficiency initiatives to tap into, a few US cities are experimenting with comprehensive energy efficiency initiatives that do not rely on government funding. The Cambridge (Massachusetts) Energy Alliance was created by the city to organise and implement the nation's first city-wide energy-efficiency initiative. The program is unprecedented in both its scale and its funding model – its costs will be derived from the energy savings it produces – no government subsidies are involved. Two private foundations, Kendall and Barr, offered USD 250 000 each, and other institutional investors have raised USD 100 million to create a revolving fund to finance energy-efficiency improvements in commercial, residential and municipal buildings. The fund will finance 80% of the initiative; the remaining 20% will be derived from conservation fees on utility bills and a statewide utility rate increase. As the program demonstrates success, additional funding will be sought from the state's public benefit fund (state programs created to support energy efficiency and renewable energy projects, funded by small surcharges on utility bills). The Phase 1 goal is to achieve 50% participation in each of the three sectors (that is 23 000 residential, commercial and institutional buildings), which will reduce the city's total greenhouse gas emissions by 10% by 2011, reduce its peak power load by 15% and reduce CO<sub>2</sub> emissions by 150 000 tons a year. The Alliance estimates consumers will realise USD 160 million in savings over 10 years.

The Cambridge Energy Alliance, a non-profit organisation, is designing, marketing, financing and managing the program. The Alliance has hired energy consultants to conduct efficiency audits and make recommendations for improvements and retrofits. An approved contractor will then do the installations. Rather than paying up front, property owners receive low or zero-interest loans that are paid back through the savings on their utility bills. The Cambridge Energy Alliance will also monitor efficiency improvements.

The City of Milwaukee and the Center on Wisconsin Strategy (COWS) at the University of Wisconsin are organising a similar initiative, Milwaukee Energy Efficiency (Me<sup>2</sup>), which is attempting to raise USD 500 million for a private capital fund to finance retrofits. The fund will be paid back over

ten years from the energy savings realised also in instalments on utility bills. The pilot of the program, which will focus on residential retrofits, started in the fall of 2008. Consumers will repay the cost of the efficiency improvements through a tariff on their utility bills. A feature of the program is that the repayment obligation is attached to the property rather than the property owner, eliminating any disincentive owners might have if they are planning to relocate. Me<sup>2</sup> will verify all work and performance. Even with the repayment, consumers benefit from reduced energy consumption costs on their utility bills. A key difference in the programs is a focus on employment. COWS estimates that Me<sup>2</sup> will create 4 300 person-years of employment and save residents and commercial property owners about USD 120 million annually in utility costs.

A few other cities are attempting similar initiatives on a smaller scale. They illustrate the capacity for innovation among cities to achieve greenhouse gas reduction and energy-savings goals in the absence of national policy. In fact, the Cambridge Energy Alliance has spurred the state of Massachusetts to expand the program to five other cities and eventually take it statewide. Like Freiburg and other cities implementing incentives for renewable energy, it is cities that are leading the way in energy efficiency in the United States. But the real economic development opportunity in energy efficiency may be in manufacturing, as we see in initiatives in Syracuse, New York and Pittsburgh, Pennsylvania. Both are collaborative policy initiatives that emphasise connecting university research to new product development. A key difference is that the Pittsburgh initiative operates separately from the city government, while in the Syracuse region, several cities are involved.

### ***Pittsburgh***

Even though it does not produce much steel these days, steel is what most people think of when Pittsburgh, Pennsylvania is mentioned. Few would guess that Pittsburgh ranks fifth among US cities in the number of its green buildings. Nearly 100 green building projects are completed or under way in the area. And it is not just new buildings – Pittsburgh has renovated 155 historic buildings to make them more efficient, four of which are certified green buildings. But all this green building and retrofitting is not the result of city policies or the vision of a mayor – it was not until 2007 that Pittsburgh passed an ordinance to provide incentives for green building.<sup>14</sup> And to date, Pittsburgh has not passed an ordinance requiring green certification through Leadership in Energy and Environmental Design (LEED) or other rating system.<sup>15</sup> Nor has the city thought of connecting all this green building activity to an economic development strategy.

In a city leadership vacuum, the connection between green building and economic development is being made by a non-profit organisation, the Green Building Alliance (GBA), which began in 1993 as an informal coalition of professionals interesting in green building. In 1997, a new executive director, Rebecca Flora, focused the organisation on economic development. To examine the extent to which green building could be an economic driver, the GBA conducted a study to examine the possibilities. The 2006 report, *Green Building Products: Defining and Verifying the Opportunity for Western Pennsylvania*, identified 1 800 building supply manufacturers in the region, with total employment of more than 68 000 (Flora, 2006). Flora's concern was that most of the region's building supply companies were unaware of the transformation taking place in their industry.<sup>16</sup> If building products manufacturers are not retooling to make advanced products such as fiber-optic daylighting, pollution-removing systems and making products from recycled material, she feared, the United States could actually lose jobs as contractors look to European and Asian suppliers, which are already making the transition.

So Flora launched the GBA's Green Building Product Initiative in November 2006 to make western Pennsylvania a regional center for manufacturing green building products. Aware of the economic development opportunity, the Heinz Endowments granted the initiative USD 250 000, and the Ben Franklin Technology Development Authority, Pennsylvania's technology-based economic

development provided another USD 1 million.<sup>17</sup> One part of the initiative is the Pennsylvania Green Growth Partnership, formed by GBA and Philadelphia University to retain and create jobs by helping building products manufacturers transition into green products. A research network associated with the partnership includes Carnegie Mellon, Drexel, Pennsylvania State, Pittsburgh, Temple and Villanova universities, to conduct research to support technological innovation and commercialisation of new green products and production methods. The partnership hosts annual forums to connect university researchers to corporate sponsors to commercialise their products.<sup>18</sup>

Through the initiative, the GBA is offering grants to companies, university researchers and partnerships of both to develop new green building products. Two rounds of grants totaling USD 588 000 have been given out to 10 projects. The projects represent a wide array of green building products, including:

- Ductmate GreenSeam II to further develop a product to reduce duct leakage
- Tegrant Corporation and University of Pittsburgh to test the performance of and production methods for insulated concrete forms
- Villanova University for developing a superlattice solar cell prototype
- Geothermal Energy Systems and Carnegie Mellon University for testing heating and cooling systems for a neighborhood of buildings
- Temple University for ReD, a type of window for large-scale commercial buildings made of a material that shifts from transparent to translucent to maximise light while reducing heat loss and solar heat gains.

To the extent that these and other products prove marketable, the GBA will catalyze an expansion of the rapidly growing green building supply market in western Pennsylvania and throughout the state.

But Pittsburgh and even the state have to take action to stimulate demand for these green products if the GBA strategy is to work. The city is just beginning to take a few small steps, such as a 2007 ordinance that provides incentives for green building.<sup>19</sup> The Pittsburgh Urban Redevelopment Authority (URA) offers lower interest rates for projects that earn LEED certification on its urban development loan programs.<sup>20</sup> The higher the LEED rating, the bigger the interest rate reduction (up to 2.5%). The loan program is part of the URA's Sustainability and Green Design Policy, which applies to its own office operations and to the development of large-scale mixed-use developments. In November 2007, the city council approved changes in the city's building code that offers sustainable development density bonuses. Developers of nonresidential projects that earn basic LEED certification can add 20% more floor area and 20% more height to their projects.<sup>21</sup> To date, Pittsburgh has not passed an ordinance requiring LEED for new construction. And Flora notes that there are still code and cost barriers that hinder implementation of some green building technologies and strategies. Pittsburgh is the largest city in western Pennsylvania, and no other cities in the western half of the state are undertaking efficiency initiatives or investing in green building.

The lesson of the Pittsburgh story is that demand needs to catch up with supply. The city and local non-profit groups can catalyse invention of new, greener products and technologies, but they need a mass market that is not produced by private supply and demand, because of well-known market failures in the pricing of energy efficiency.

## *Syracuse*

In contrast to Pittsburgh, elected officials and city and regional planners in the Syracuse area have focused on green manufacturing for some time as an area with growth potential. Yet city efforts to stimulate demand in green building have lagged behind the economic development strategy. Syracuse is pursuing a traditional sectoral strategy based on research partnerships aimed at new product development and attracting new companies. The city has begun to move on the green building front, but here too, it is not clear how much demand can be stimulated in a largely rural region. And the one development that could stimulate considerable demand for green products, the world's largest green shopping mall, is plagued with fiscal and political problems. But if successful, Syracuse could provide hope for many Rust Belt cities that manufacturing economies can be revitalised in the energy-climate era.

Mayor Matthew Driscoll wants Syracuse to be the “green capital of the world”. Creating a green economy may be a way to help the city stem the loss of manufacturing jobs and reduce the metropolitan area's 16% poverty rate. To its advantage is a strong economic base in higher education and a base of companies that could be suppliers to green building and retrofitting industries. Old-line companies such as Carrier, best known as a maker of air conditioners, hope to transform themselves into a 21<sup>st</sup> century industry focused on “indoor environmental quality”.

In 1996, the Metropolitan Development Association (MDA) of Syracuse and Central New York targeted identified indoor environmental quality as one of seven sectors on which to focus its efforts. While the area's largest employer in this area, Carrier, now produces its air-conditioning systems abroad, the region still has a strong base of firms and employees in this sector, with average annual earnings of about USD 54 000.

To get started, the MDA tapped into state government programs to stimulate growth in lagging upstate regions. The first was a USD 15.9 million grant from the state's Strategically Targeted Academic Research (STAR) Centers program, to create the STAR Center for Environmental Quality Systems in partnership with Syracuse University. In 2002, the MDA received funds from the Centers of Excellence, a statewide network of centers created to stimulate economic development in declining upstate regions by supporting research centers in emerging technologies.<sup>22</sup> The centers are charged with facilitating joint industry-university research, technology transfer and commercialisation of products in defined sectors.<sup>23</sup> With an additional USD 22 million from the federal Environmental Protection Agency, the STAR center became the Center of Excellence in Environmental Systems. And in 2004, the focus of the Center was expanded to include energy systems and became the Center of Excellence in Environmental and Energy Systems (Syracuse CoE).<sup>24</sup> MDA Director Rob Simpson notes that CoE is the top lab facility in the country for research on indoor environmental quality and on the international level, second only to one in Denmark.

The Syracuse CoE describes itself as a federation with more than 140 institutional and business members. Several large companies anchor the federation, such as Pall Corporation, an international leader in the air-filtration industry, and Carrier Corporation, a leader in heating, air conditioning and ventilation systems. Although Carrier moved its two Syracuse manufacturing facilities, employing 1 200 people, to Asia in 2003, it still employs 1 600 in research and development (Luo and Polgreen, 2003). In 2006, Carrier started a research center, the Indoor Air Quality Key Competency Group, in Syracuse, and also contributed USD 1.5 million to the Syracuse CoE to build and operate a Total Indoor Environmental Quality Laboratory.

Even with high levels of state support and key businesses on board, the MDA is fighting an uphill battle. A 2007 study by the consulting firm Battelle revealed that the region is still losing jobs in the

targeted sectors. Environmental services employed more than 10 000 people in central upstate New York in 2001, but declined by almost 28% by 2005, compared to only 5.6% nationally (this large loss is due to the Carrier plant closings in 2003). During the same period, employment in green building design declined 16%, to 2 500 workers. Indoor Environmental Quality declined by 43%, to 2 400 (Battelle, 2007). So, in addition to stemming employment loss, the CoE has to focus on catalyzing new start-up companies and attracting companies into the region.

CoE grants to several start-up companies for product research and development have paid off. Hapcontrol LLC (Syracuse) produces “bio-furniture” that does not release harmful gases. Phytofilter Technologies (Saratoga Springs) is testing a plant-based system for removing volatile organic compounds from indoor air, and Isolation Systems Inc. (Tonawanda) is developing air purification and room air management systems.

NuClimate Air Quality Systems in East Syracuse received a Syracuse CoE grant to test and build a prototype for its “Q” Air Terminal, a highly efficient heating, cooling and ventilation unit for large public buildings such as schools and hospitals.

Several of these and other businesses funded by the CoE are certified or are seeking certification as eligible products under the LEED rating system, which offers points for commercial interiors that use products and furniture that have no or low emission of volatile organic compounds (VOCs).

Other green product start-ups were developed through research at Cornell University, such as e2e Materials, which has an exclusive license to patent materials created with its natural fibre glue made with a soy resin.<sup>25</sup> The company just developed a particle board that has the same strength as the traditional product, but only one-third the weight. It is inherently flame retardant, meaning it does not require the addition of chemicals that release VOCs. Given that more states and cities will follow the lead of California and New York City in banning formaldehyde resin, the product should be in demand once it finds its way into more building materials. A second Cornell-initiated start-up, Novomer, received USD 6.6 million in venture-capital funding in 2007 for scaling up production of biodegradable plastic made with carbon dioxide that breaks down naturally in as little as six months. The product is price-competitive with traditional plastic.

While these start-ups offer encouragement that the strategy can work, it’s a long-term process – it took Govang and a Cornell University professor 15 years to develop e2e’s natural fibre glue. And there is stiff competition. Two other companies, Metabolix, in Cambridge, Massachusetts, and Minnesota-based NatureWorks, already produce biodegradable plastic, but Novomer hopes that its advantage is that its feedstock is cheaper than the corn-based feedstocks these companies use (Patel-Predd, 2007). Several other regions of the country are trying to build the same strengths, and a few are ahead of Syracuse.<sup>26</sup>

To build a cluster, Syracuse will have to attract a few big players, and to that end, the MDA identified 340 US and international companies with potential interest in locating in the area. The MDA and Syracuse CoE have assigned 90 partners (including every economic development agency in the county) to a “green team” that is contacting the companies on the prospect list. It is paying off already. In February, 2008, BITZER Scroll, a German manufacturer of energy-efficient air compressors for state-of-the-art air-conditioning systems located near Syracuse. Several state and local economic development organisations worked together to attract the company, which was considering sites throughout the world.<sup>27</sup> A skilled workforce and the region’s strength in indoor environmental quality research were key factors in the location decision, as were business incentives including USD 1.4 million from Empire State Development and a USD 100 000 grant from the Syracuse CoE for a research and development project that will be conducted by faculty and students at Syracuse

University. For its part, the company pledged to invest USD 30 million in its operation and to create 289 jobs over five years at an average annual salary of USD 60 000.

But Syracuse is behind other cities in instituting climate change policies that could support the MDA's economic development efforts. The city didn't pass a green building ordinance until September, 2007. And it is weak in that it only requires LEED silver certification, and only for major renovations or new construction of public buildings. On the plus side, the ordinance does include public schools, and Syracuse is just starting on a USD 927 million, 10-year renovation plan for 35 of the 42 buildings in the Syracuse City School District, which will follow the requirements of LEED for schools.<sup>28</sup>

Syracuse looks to two other developments to stimulate green product demand, its Near West Side Initiative and a controversial green entertainment complex, Destiny USA. The Near West Side initiative is redeveloping three census tracts that are among the poorest in the country. The goal is to transform the area into a green arts and technology corridor.<sup>29</sup> Destiny is an expansion of the regional Carousel Mall, which would be the largest green building project in the nation if it is built.

The revitalisation of the Near West Side is well under way. It started with two newcomers moving in, King and King Architects, a 140-year-old local firm, and a public television station WCNY, which has broken ground on a USD 17.5 million building. The Syracuse CoE is building a new green headquarters on a brownfield site in the neighborhood. Syracuse University is also building in the area as part of a broader commitment to revitalising downtown Syracuse under Chancellor Nancy Cantor. The university relocated its School of Architecture and College of Visual and Performing Arts in an old furniture warehouse in Armory Square, the entrance to Near West Side.<sup>30</sup> Finally, Home Headquarters is using a USD 4.2 million grant from the Syracuse Neighborhood Initiative to retrofit and renovate an eight-block residential area in the Near West Side containing 147 properties.<sup>31</sup>

Although the city's green building ordinance does not stipulate it, the MDA is encouraging developers in the area to build to LEED gold standards and has provided some assistance in helping them comply. The Syracuse Office of Community Development offers technical assistance to contractors on building deconstruction (LEED points are awarded for deconstructing and recycling rather than demolishing buildings), but Syracuse has not gone as far as cities like New York, which require recycling of construction waste. The Near Westside Initiative is projected to create more than 800 construction jobs and an additional 300 jobs in five green technology companies that will locate in the district, according to Marilyn Higgins, who chairs the initiative.

Another potential driver of green development is Destiny, a proposed USD 20 billion green regional shopping and entertainment center that includes a USD 450 million, 1 342-room hotel and conference center, an aquarium, a golf course and other amenities. It is an expansion of the Carousel Center shopping mall, the top tourist attraction in Syracuse. Originally proposed in three phases, it has gone through numerous revisions, the most recent being a proposal for a 1.5-million square-foot complex that would meet LEED platinum standards and would be powered entirely by renewable energy. Project planners estimate it will create as many as 122 000 construction jobs at an average wage of USD 31 000 and 250 000 permanent jobs after construction.

But many question its green credentials and its employment projections. For starters, Destiny is only accessible by car.<sup>32</sup> For many green buildings, the additional energy used for cars to reach them exceeds the energy savings realised by about 30%.<sup>33</sup> If the project succeeds as a tourist destination, it will create a lot of traffic. The developer, Robert Congel, defends the project's "greenness" by pointing out that the Carousel Center sits on what was a highly polluted brownfield site. He points to

support from Rick Fedrizzi, a Syracuse native and president of the US Green Building Council, to defend his position. And the United States Environmental Protection Agency describes Destiny as “the world’s largest structure to be built from recycled industrial materials”, referring to the more than 3 000 tons of coal ash that will be incorporated into sidewalks and other concrete elements. Congel says he plans to make Destiny a showcase for green products and to that end, will create a green research and development center that he lightheartedly refers to as the “Rehabilitation Center for Petroleum Addiction” (McKnight, 2007). Mayor Driscoll also defends the project, saying it “will be a trigger to development elsewhere in the city” and will help fight sprawl (quoted in Senville, 2007).

Even more controversial is the staggering amount of federal, state and local subsidies Destiny has received. In addition to a 30-year exemption from city and county property taxes, state tax credits under the state Empire Zone and Brownfield Cleanup programs and federal Empowerment Zone tax credits, Destiny is also receiving subsidy under a federal program created exclusively for its benefit. A corporate tax cut bill, the American Jobs Creation Act of 2004, authorised up to USD 2 billion of tax-exempt private “green bonds”, a low-cost financing program that allows developers of brownfield sites to borrow billions of dollars at very low interest rates. Funding for the green bond program made its way into 2004 National Energy Bill as a result of heavy lobbying by Robert Congel, Senators Hillary Clinton and Charles Schumer, then-Governor George Pataki, and several Congressional representatives. Only Destiny and three other shopping mall developments in the country fit the green bonds eligibility requirements.<sup>34</sup> Destiny is eligible to borrow up to USD 1.04 billion through the program. Congel contributed heavily to lobby for the legislation.<sup>35</sup> The bill passed, and in January 2006, Destiny became eligible for more than USD 1 billion in federal “green bonds.” A year later, the Syracuse Industrial Development Authority issued USD 323 million in bonds as part of a USD 540 million financing package for Destiny. Fedrizzi announced that the United States Green Building Council would purchase a USD 50 000 bond to demonstrate support for the project.<sup>36</sup>

**Figure 1. Proposed Destiny entertainment complex**



Source: Planning Commissioner’s Journal, accessed 18 June 2008, [http://pcj.typepad.com/planning\\_commissioners\\_jo/2007/11/whats-syracuses.html](http://pcj.typepad.com/planning_commissioners_jo/2007/11/whats-syracuses.html).

Controversy also emerged over the question of whether Destiny’s green expansion qualified for tax abatements granted when the Carousel Mall was developed. If the abatements were granted, the city would lose up to USD 310 million in lost property-tax revenues. The state program provides state tax credits of between 10% to 22% of cleanup costs and redevelopment of polluted brownfield sites, which would realise between USD 200 million and USD 720 million in state-subsidised tax credits for Destiny (Lassman, 2008). In both cases, the New York Supreme Court ruled that Destiny was entitled to the tax benefits.<sup>37</sup>

What would the region get for its investment? Congel claims that Destiny will attract millions of tourists and generate USD 65 billion in net taxes over 30 years, in addition to the jobs. And Destiny managers claim the huge demand for energy from solar, fuel cells, biodiesel and wind power created by the project would create economies of scale for renewable energy large enough to drive down prices. The 32 megawatts of solar electricity that Destiny would produce and consume, according to project managers, would make it the world's largest solar installation, accounting for one-third of the total solar capacity installed annually in the country.<sup>38</sup>

It is not clear that even a project as large as Destiny could influence demand for green products or power. Thomas Leyden, a vice president with the solar development firm PowerLight Corporation (which has since been purchased by SunPower), one of Destiny's potential energy partners, concluded, "It may be the biggest solar installation and renewables project in the world, but there's no way Destiny will move markets to that extent within a decade, or even move markets in any substantial way."<sup>39</sup> Another doubter is state senator John DeFrancisco, who points out that Congel is "legally bound to build only a fraction of the square footage of his plan," and notes that "Congel could reap extraordinary tax benefits without actually meeting his goals." (Little, 2005). He notes that Phase One was supposed to be completed six years ago and is still not enclosed. Further, he points out that the proposed mall addition has no tenants to date and concludes that Destiny will probably never be built.<sup>40</sup>

## Conclusions

In these examples, we see a combination of partnerships seeking to create regional advantage in renewable energy or green building products production. In Pittsburgh, a non-profit organisation engaged the private sector and universities to pursue joint research using funds from a private foundation and a state economic development agency. In Syracuse, the university was the leader of a partnership created entirely with state funds. In Freiburg, city government created what is still a leading research institution on renewable energy in Germany. With the exception of Philadelphia, the common element in these cases is the facilitation of collaborative research between industry and research institutions to commercialise new products and technologies.

With the research element in place, what determines success in establishing regional specialisations is the extent to which local and national policy creates incentives to support the commercialisation of the new technologies. There are successes in supporting new start-up companies, but they do not employ many people. NuClimate Air Quality Systems employs only five people and is unlikely to expand as it subcontracts most of its work (Palmeeter, 2007). The economic development opportunity is in the supply chains. For example, e2e only employs seven people, but Patrick Govang, the CEO, focuses less on the employment expansion possibilities of his company and more on its becoming part of a regional economic cluster that allows him to realise his triple bottom-line goals.<sup>41</sup> The key input to the glue is soy meal, and to obtain it locally, Govang located the company on the property of Empire AgriFuel, a planned soybean and canola crushing and biodiesel production facility in Cortlandville.<sup>42</sup> Soy meal is the byproduct of the extraction and crushing process to obtain soy oil. Govang notes that the byproduct of e2e's process could be used for animal feed. Govang is seeking assistance from the MDA, the regional economic development organisation, in finding a local market for his byproduct. His hope is that the MDA will facilitate a regional supply network among businesses in the cluster.<sup>43</sup>

Neither Syracuse nor Pittsburgh has policies in place to stimulate demand in green building products, but it is unlikely that they have large enough markets to influence the location of firms producing green products. What seems to have attracted the larger firms to Syracuse is the research network centered at CoE.

In addition to stimulating demand, government policy is attempting to create a stable investment environment to support continued innovation. In Germany, national government policies, starting with the feed-in tariff, are creating a stable investment environment. Pennsylvania's renewable portfolio standard was critical to attracting the wind and solar firms that headquartered in Philadelphia. The question for cities and regions that are creating regional specialisations in renewable energy production and technology is whether they can maintain it in these highly concentrated industries.<sup>44</sup> And it is not clear that supply chains will develop – which is where the majority of the jobs will be. To date, many of the foreign wind and solar companies that have located in the United States are not using many local suppliers for parts. Even in Germany, many producers are subcontracting many components for solar and wind systems to China. The industry is changing fast, and it is not clear who the winners and losers will be.

## NOTES

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1. This paper draws from a broader research project. The selection of United States cities was based on published rankings and studies of urban sustainability efforts and the researcher's judgment based on interviews with leading practitioners and elected officials. The first cut was made from the top 15 cities in overall sustainability ranking and also the top 15 on "green economy" as rated by SustainLane, an online media company that provides information on green products and a ranking by National Geographic. While the methodology of these rankings is flawed, it provided a good first-cut list of cities. Five of the cities are included in a more methodologically sophisticated analysis of city sustainability efforts conducted by Professor Ken Portney of Tufts University (see Portney, 2003). The European cities for the studies were selected after discussions with policy experts and heads of various international sustainable city organizations in the United States and the EU.
  2. Conway *et al.* (2007, p. 13) note that a sector is an employment strategy that has economic development ramifications, while a cluster is an economic development concept that has employment ramifications.
  3. It is one of 80 research centers in the Fraunhofer-Gesellschaft, Germany's primary applied research organization.

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4. Cited in a press release from the German Federal Ministry for the Environment, [www.erneuerbare-energien.de/inhalt/39983/4592/](http://www.erneuerbare-energien.de/inhalt/39983/4592/).
  5. Other European countries have realized the same results with feed-in tariffs. Europe now produces 40 gigawatts of wind power – about 75% of world capacity (see Pernick and Wilder, 2007).
  6. The Steel Valley Authority's Strategic Early Warning Network (SEWN) was highlighted at the Summit for retaining 482 jobs in the last year. SEWN, primarily sponsored by the Pennsylvania Department of Labor and Industry, assists at-risk enterprises by introducing professional turnaround and buyout efforts. Already, the SVA has intervened in over 300 factories from Pittsburgh to Erie to Johnstown. The SVA has expanded to help other regions in the state in build retention networks to avert layoffs. To date, SEWN has helped more than 12 million workers in western Pennsylvania. The SVA has become a nationwide model for community response to economic dislocation and has provided technical assistance to cities and states across the United States. As the author of the federal government's first "Layoff Aversion Guidebook", the SVA has also helped shape national policy. The Guidebook, released by the United States Department of Labor, has influenced several states to strengthen their job retention efforts (available in summary form at [www.steelvalley.org/guidebook.asp](http://www.steelvalley.org/guidebook.asp)).
  7. Personal interviews with Katherine McGinty, September, 2006.
  8. As a result of compromises with the Pennsylvania Coal Association, Pennsylvania has the only RPS in the country that includes fossil fuels in the form of generation fired with waste coal.
  9. The state's utilities must purchase 8% of electric power from Tier I sources by 2020. These include low-impact hydropower, burning toxic landfill gas, wind, coal-mine methane, animal waste digesters, burning trees and crops, poultry waste incineration and solar energy (0.5%). Ten per cent must be obtained from Tier II sources, which include waste coal burning, new coal plants (with gasification technology), trash and industrial waste incineration, wood and paper mill waste, large-scale hydropower, energy efficiency and distributed generation.
  10. According to the company's web site: "The Conergy Group is number one in sales among European solar power firms, with a global presence in 22 countries. With a vertical integration strategy that positions the company strongly in each component of the renewable energy value chain and local-market offices in California, New Mexico and Colorado, the company expects global revenues to continue to rise in 2007 and 2008 by at least another 50%". See [www.conergy.de/en/DesktopDefault.aspx/tabid-181/316\\_read-5561](http://www.conergy.de/en/DesktopDefault.aspx/tabid-181/316_read-5561).
  11. Aeppel (2008). Aeppel cites economist Jeff Rubin, who estimates that every 10% increase in distance adds 4.5% in energy costs for shipping.
  12. See <http://apolloalliance.org/about.php>.
  13. These data are being collected for the Emerald Cities research project.
  14. The Pittsburgh Urban Redevelopment Authority (URA) just began offering lower interest rates for green building projects on its urban development loan programs. These include the Urban Development Fund, Technology Zone/Enterprise Zone and the Pittsburgh Business Growth Fund. For more details on the programs go to [www.ura.org/bdcFinancingPrograms.html](http://www.ura.org/bdcFinancingPrograms.html) and [www.ura.org/technology\\_ZoneBackground.html](http://www.ura.org/technology_ZoneBackground.html). In November 2007, the city council approved changes in the city's building code that offer sustainable development density bonuses. Developers of non-residential projects that are green certified can add 20% more floor area and 20% more height to their projects.
  15. The LEED green building rating system is a nationally accepted benchmark for the design, construction and operation of high-performance green buildings. LEED's whole-building approach to sustainability recognizes performance in five key areas: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. See [www.usgbc.org/DisplayPage.aspx?CategoryID=19](http://www.usgbc.org/DisplayPage.aspx?CategoryID=19) (accessed 3/20/07).
  16. Personal interview, 18 December 2006.
  17. The Ben Franklin gave another USD 1 million to Philadelphia University to lead the same activities in the eastern part of the state.
  18. [www.paggp.org](http://www.paggp.org).
  19. Due to the death of Pittsburgh's Mayor Bob O'Connor seven months into his term, there had not been a permanent mayor in office for over a year, a partial explanation for the leadership vacuum on climate change generally and green building specifically.

20. These include the Urban Development Fund, Technology Zone/Enterprise Zone and the Pittsburgh Business Growth Fund. For more details on the programs go to [www.ura.org/bdcFinancingPrograms.html](http://www.ura.org/bdcFinancingPrograms.html) and [www.ura.org/technologyZoneBackground.html](http://www.ura.org/technologyZoneBackground.html).
21. LEED for New Construction or LEED for Core and Shell certification.
22. The New York legislature has funded eight Strategically Targeted Academic Research (STAR) Centers. The Centers of Excellence were created by then Governor George Pataki to revitalize the Rust Belt cities of upstate New York. The other centers focus on bioinformatics and life sciences, nanoelectronics, photonics and microsystems, small scale systems integration and packaging (microelectronics), and wireless and information technology (see New York State Foundation for Science, Technology and Innovation, [www.nystar.state.ny.us/coes.htm](http://www.nystar.state.ny.us/coes.htm) (accessed 19 August 2008).
23. The other centers are: Buffalo, Center of Excellence in Bioinformatics and Life Sciences; Albany, Center of Excellence in Nanoelectronics; Rochester, Center of Excellence in Photonics and Microsystems; Binghamton, Center of Excellence in Small Scale Systems Integration and Packaging; and Stony Brook, Center of Excellence in Wireless and Information Technology. Computing and data mining critical to genomics and other data intensive areas, Internet applications, wireless telecommunications, health care applications and workforce development programs.
24. In addition to indoor environmental quality, the CoE focuses on clean and renewable energy and water resources.
25. The company's first commercial product is not a green one, its skateboards. When a California skateboard company, Comet, discovered the material, company officials tried to lure e2e Materials to relocate. When company president Pat Govang turned him down, the company moved to New York and is now the first subsidiary of e2e Materials.
26. This conclusion is based on the location quotient, a measure of economic advantage in a given industry or sector. A score of less than one means that the region does not produce enough of a service or product and has to import it. A score above 1 means the region exports the service or product. The Central Upstate New York region's location quotient of 0.97 indicates the area is not a net exporter, while the Eugene, Oregon region's is 1.67 (Battelle Memorial Institute, 2007).
27. The attraction effort was led by the Central New York office of Empire State Development in partnership with Syracuse CoE, CoE partner National Grid and Syracuse University. Other partners of the recruitment team included the New York State Energy Research and Development Authority (NYSERDA), New York State Foundation for Science, Technology and Innovation (NYSTAR), Onondaga County Industrial Development Agency and the Central New York Technology Development Organization.
28. Syracuse received USD 135 million from state and federal sources for this project.
29. The West Street Initiative is a part of a larger Syracuse Arts Initiative project, sponsored by Syracuse University, the City of Syracuse and Onondaga County.
30. The university plans to invest an additional USD 13.8 million in the area as a result of a debt restructuring agreement with the state. The debt restructuring requires the university to invest money owed on a state loan in an operating fund for the redevelopment. The university will be repaying approximately USD 8 million of the USD 13.8 million debt by creating the Syracuse Arts, Technology and Design Quarter. The university will purchase and renovate warehouses in a three-block area into artist live-and-work space.
31. In addition to private development, the city received a USD 10 million state economic development grant for the USD 56 million revitalization.
32. A proposal that has not yet been added to the project is a USD 750 million monorail that would link Destiny to the airport and downtown.
33. The study, conducted by *Environmental Building News*, estimates that commuting by office workers accounts for 30% more energy than the building itself uses (Wilson, 2007).
34. The other projects are in Georgia, Louisiana and Colorado (Milligan, 2004). Eligible projects must be at least 1 million square feet or on 20 acres of brownfield land. Projects must create at least 1 million construction jobs in most states and at least 1 500 full-time permanent jobs. At least 75% of the square footage of commercial buildings in the project must be registered for the LEED green building rating system. State and local governments must contribute at least USD 5 million to a project, which can include tax abatements and in-kind contributions (see [www.cdfa.net/cdfa/cdfaweb.nsf/pages/greenbuildingfactsheet.html](http://www.cdfa.net/cdfa/cdfaweb.nsf/pages/greenbuildingfactsheet.html)).
35. In addition to his own USD 69 084 in contributions to the 2004 Bush campaign and to congressmen promoting the energy bill, Congel's political action committee, the Green Worlds Coalition Fund, raised USD 82 897, which mostly went to the same campaigns. Other project advocates spent USD 200 million over two years lobbying Congress to approve the green bonds proposal (Milligan, 2004).

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36. United States Green Building Council. See [www.usgbc.org/News/USGBCInTheNewsDetails.aspx?id=2971](http://www.usgbc.org/News/USGBCInTheNewsDetails.aspx?id=2971) (accessed 18 June 2008).
37. In March 2006, the New York Supreme Court ordered the city to maintain the tax abatement. In June 2008, the same court ruled that the state (New York Department of Environmental Conservation) could not deny Destiny the brownfield tax credits.
38. Company official cited in Miller (2005).
39. [www.grist.org/news/muck/2005/05/20/little-destiny/index.html](http://www.grist.org/news/muck/2005/05/20/little-destiny/index.html).
40. Personal interview 25 July 2008. Indeed, Destiny's construction has gone through a number of starts and stops. First proposed in 1997, construction for Phase I did not start until March 2007. Hotel construction started in October, 2002, but stopped a few months later. In January, 2006 Destiny laid off 190 out of 210 workers due to uncertainties in the retail sector and disputes with the city and state on tax abatements. In February 2007 the Syracuse Industrial Development Agency sold USD 322.59 million in industrial bonds to complete the financing of the project. In March, 2008, 45 workers were laid off, again, due to financing delays [http://blog.syracuse.com/news/2006/01/destiny\\_usa\\_lays\\_off\\_190.html](http://blog.syracuse.com/news/2006/01/destiny_usa_lays_off_190.html) (accessed 20 August 2008).
41. Triple bottom line refers to cost accounting that incorporates economic, environmental and social goals.
42. The plant will begin at a capacity of about 200 tons of soy or canola per day and produce up to 5 million gallons of biodiesel.
43. Personal interview, 20 April 2008.
44. For example, the top five largest wind turbine manufacturers control 82.2% of the world market. As in solar energy, foreign companies are buying up US solar and wind companies at a record pace to control sources of component supply. And many are not using US suppliers. A spokesman for Gamesa, a Spanish-owned company that has 28% of its turbine manufacturing capacity in the United States, notes that the company imports its major component parts from overseas because US capacity is lacking. Likewise, a new wind turbine plant in Colorado built by a Danish firm, Vestas, imports almost all its component parts.