

THE CHICAGO REGION'S GREEN ECONOMIC OPPORTUNITIES

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EXECUTIVE SUMMARY

The green economy is here and it is growing.



High energy costs, along with concerns about climate change and energy security, are driving rapid global growth in demand for energy-efficient products and services. In the last year, global revenue for just the wind, solar photovoltaic and biofuels subsectors grew 35% to a total market size of \$188 billion. The energy efficiency market hit \$200 billion in 2010 and researchers project it will top \$311 billion by 2015.

The greening of the economy is opening up opportunities for firms of all types. Companies across the spectrum will adopt green products and services in order to use less (or cleaner) energy and fewer resources, allowing them to save money, increase resilience against energy price shocks, attract customers and enhance productivity.

This large emerging green market presents major economic opportunities for the production side of the economy. More and more firms will participate in green sectors by directly making products or providing services that support energy and resource efficiency. Equally large opportunities are emerging for companies that would not themselves be considered green, but are part of the supply chains and clusters that support the production of green goods and services (for example, manufacturing ball bearings for wind turbine firms). *The Chicago Region's Green Economic Opportunities* identifies some of these possibilities for the Chicago region.

PHOTO CREDITS

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Understanding the Green Economy by Studying Its Clusters

What is a cluster?

A cluster is a group of interdependent firms and institutions. Each firm benefits from the presence of the others because they are linked economically, socially and technologically within a region, creating a kind of production “ecosystem.” A cluster also includes entities that support and connect the firms to each other, such as business associations, research universities, community colleges and training and professional development providers.

Clusters make existing firms more productive, and grow the local economy by attracting firms and workers from outside the region. Clusters also foster the creation of new firms, as existing employees split off from one company to form another, or entrepreneurs recognize an opportunity to fill an unmet need in the cluster.

Clusters offer valuable insight into the dynamics that make a particular regional economy efficient and productive. More than that, clusters are a real phenomenon that exist in the production side of the economy and can be identified and strengthened with the right tools.

Analyzing clusters

The Chicago Region’s Green Economic Opportunities project used a cluster framework to examine how the Chicago region’s economy is responding to the expanding green market. Using mainly quantitative data, it analyzed regional green sectors to identify potential clusters and evaluate their potential.

This “first-cut” analysis produced a list of 12 particularly promising green cluster opportunities. Many others exist, and still more are at the point of emerging. All merit further study.

As a demonstration, the project chose only one (energy-efficient lighting) for an in-depth analysis. Using this research, the project team was able to identify an emerging cluster in Integrated Lighting and Building Energy Systems (ILBES) in the Chicago region, and recommend interventions for helping it prosper.

The project offers a road map for identifying and growing green economic opportunities. With thoughtful, deliberate action, the Chicago region can compete successfully in a wide range of green sectors.

Clusters of firms share production advantages

Close proximity to each other reduces transportation costs

Firms can develop and share specialized labor pools and other common inputs

Firms share efficient access to customers, who may be geographically concentrated

Informal learning and knowledge exchange among firms (“knowledge spillovers”) facilitate innovation

Identifying the Chicago Region's Green Clusters

The table to the right describes the characteristics the project team looked for in its analysis in order to understand if a cluster exists, and to determine its potential for regional growth.

A group of firms need not demonstrate every characteristic in order to be considered a cluster. A cluster need not exhibit every criteria to be a worthy development enterprise. However, the more criteria that are met, the more likely it is that the sector is a good candidate.

More importantly, the specific characteristics of the cluster will influence the choice of appropriate tools to use for its development.

Characteristics of a Cluster	Criteria for a Promising Cluster for the Project
Geographically concentrated	Expected to grow regionally, nationally or globally
Shares suppliers	Exhibits a large employment and firm base
Shares markets and customers	Has above-average concentration of employment and/or gross product compared to the nation (and is not already dominated by another region)
Exhibits relationships between competitive firms	Builds from strong, underlying regional assets
Has related, supporting institutions	Exhibits export potential
Shares "commons assets" such as R&D institutes and specialized infrastructure, technologies, labor pools or financing sources	Exhibits existing organization and leadership
	Industry structure is well-balanced between large and small firms
	Provides quality jobs for all skill levels
	Will derive added value from intervention (in other words, the cluster is not already the focus of other efforts or market dynamics that would make intervention redundant)
	Contributes to reducing greenhouse gas emissions or otherwise benefits the environment
	Is supported by policy and local institutional environment

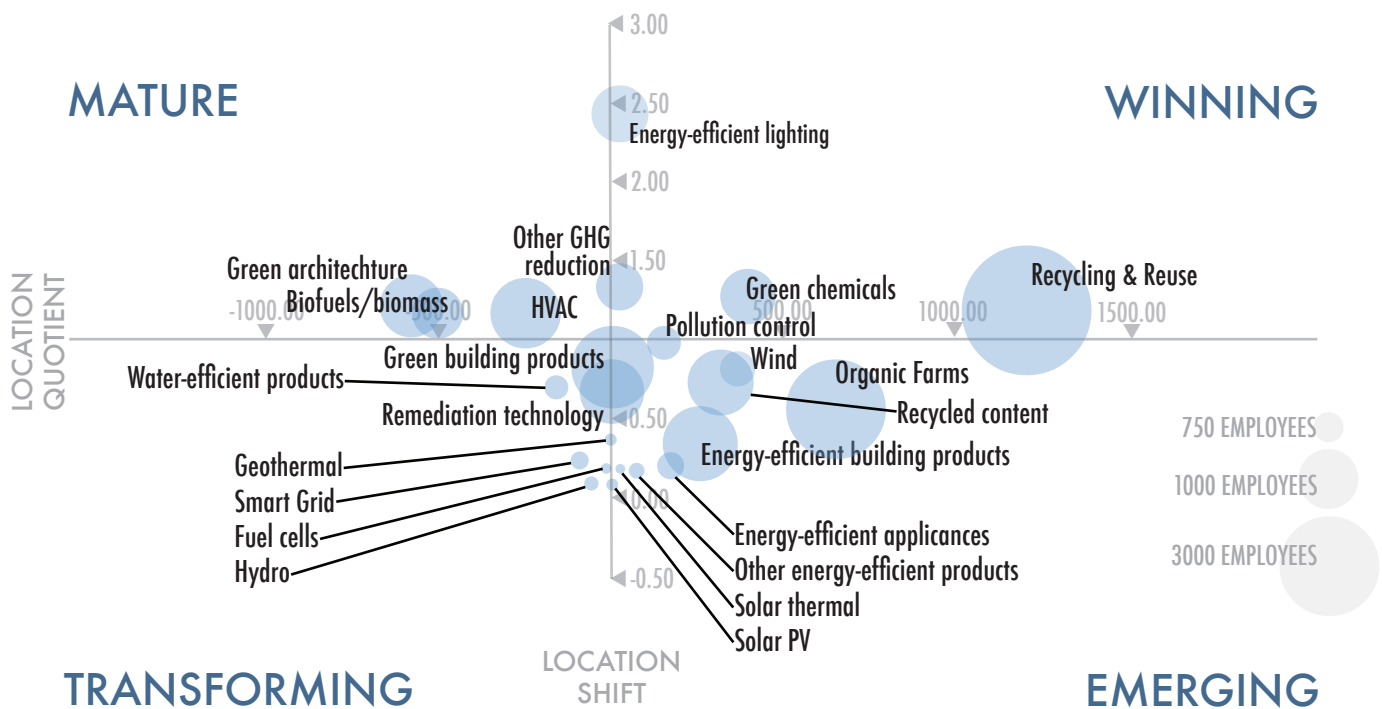
The project team considered two distinct questions: which sectors are clustering? and which of these are promising clusters?

The universe of potential clusters for the project began with Brookings and Battelle's list of green sectors in their recent *Sizing the Clean Economy* report.* The project team investigated each sector using NAICS data, sector-specific data from Brookings and Battelle, industry research, a review of proprietary firm-level data and interviews with experts. The bubble chart below illustrates the absolute size, the relative concentration and the regional growth of Chicago's green sectors.

12 PROMISING GREEN SECTORS IN THE CHICAGO REGION

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Chicago Region Green Economy Bubble Chart



* Note that the data used in this process was preliminary, and may not perfectly match the version of data released by Brookings and Battelle in July 2011. The overall trends remain accurate.

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GREEN SECTORS T

Organic Farms & Food Production

Chicago's longstanding strengths in food production make this sector a natural fit, but the region's transition to organics has been slower than competitors' on the West Coast. Chicago's growth in this sector is likely to be driven by existing firms as they recognize the market opportunity in organics and add/convert some of their production capacity accordingly. A comprehensive industry strategy could accelerate this process.

Green Chemicals

This sector includes companies making a wide variety of chemicals, from paint to machine lubricants, to cleaning products, to food and beverage chemicals. It has both an above-average LQ and positive growth trends in the Chicago region. A unified cluster strategy for this promising but diverse sector is well worth investigating.

Biofuels/Biomass

Firms in this sector produce energy from biological material such as plants and waste. The sector is relatively small in the Chicago region, though it has a higher-than-average regional concentration. Biomass was identified as promising in a 2008 cluster study, though a lack of Chicago-based R&D and funding hampered its potential.

Wind Energy

Made up of wind turbine manufacturers, wind farms and suppliers of thousands of different parts, this sector stands out for its promising trends in the Chicago region. Anecdotal evidence also suggests that its presence may be larger than the available data indicates. Proximity to the Plains states, the windiest parts of the country, makes the Chicago region an especially attractive location for wind companies. It is home to many wind energy headquarters, and its manufacturing base includes many companies that already supply wind companies, and still more that may be able to transition to the supply chain.

Smart Grid

Smart Grid technologies use two-way, real-time communication to improve the efficiency and flexibility of the electrical grid. This sector is so new that its presence in the Chicago region is hard to judge using available data, but it consists of at least 100 participants including non-profits, utilities, midsize firms and small IT and software companies. Recently passed state legislation will accelerate the deployment of Smart Grid elements in Illinois, and create a "Smart Grid test bed" with potential to spur innovation in hardware, software and applications. Illinois could become a national Smart Grid leader.

Water Purification & Treatment

Chicago has many important assets for a water cluster: an existing firm base, research institutions, companies with large water purification needs and access to clean water. Proximity to Milwaukee's dynamic water cluster offers Chicago-area firms an opportunity to grow as part of a larger, multi-region cluster.

WATCH

Vehicle Electrification

This sector includes electrification or hybridization of traditional vehicles and the creation of high-capacity batteries. While several companies in this sector have headquarters in Chicago, fewer locate their factories here. Still, some Chicago companies may have an opportunity to supply larger clusters in neighboring states. The Chicago area is investing heavily in fast-charge infrastructure for electric vehicles. Further support could make the region a very attractive early test site for electric vehicles, and could promote cluster growth.

Solar Thermal Energy

Solar thermal systems typically work by harnessing the sun to heat water, either for direct use or to turn it into steam that drives an electricity generator. The sector is still very small in Chicago but has grown significantly over the last seven years, a trend that is expected to continue. While it is possible that Solargenix, a strong local firm, will jumpstart a solar thermal cluster here, Chicago is competing with regions that already have a strong base of solar companies, more sunlight and greater local demand.

Recycled Products

This is a growing sector—recycled materials used in US packaging went from around 150 million lbs. in 2002 to over 400 million in 2009. Chicago's Waste to Profit Network is a national model of "byproduct synergy," helping businesses save money by turning one company's trash into another's products. Chicago's large manufacturing base in recyclable materials provides the region with an opportunity to lead innovation in recycled products.

Green Building

This sector encompasses a wide array of economic activity: green architecture and construction, green materials production, energy-efficient appliances, lighting and HVAC equipment manufacturing, etc. In the Chicago region, rapidly expanding demand for new green buildings and retrofits of existing buildings offers an important opportunity to link the local market for green construction with the traded market for energy-efficient products. If this link can be cultivated in the Green Building sector, Chicago's Building Energy Management and Energy-Efficient Lighting sectors both stand to benefit.

Building Energy Management

Firms in this sector create heating, cooling and lighting control systems and energy-monitoring software. The Chicago region already has an above-average concentration of jobs in this sector and the R&D capacity, entrepreneurs and software talent to form a competitive cluster. Demand is on the rise, and Seattle and Philadelphia already have plans in place to develop next-generation technologies. To compete, the Chicago region will need a plan for building on its unique strengths.

Energy-Efficient Lighting

Energy-Efficient Lighting refers primarily to LED and fluorescent lighting. The Chicago region consistently has a very high LQ for Energy-Efficient Lighting and for related industries such as Lighting and Electrical Equipment Manufacturing and Lighting Fixture Manufacturing. Industry trends support a rapid transition to more efficient lighting technologies across the board, spurred in part by federal regulations. The Chicago region's existing base in lighting firms and expected growth in this sector offer great potential.

More analysis on pages 8–11

Case Study: The Energy-Efficient Lighting Sector

To demonstrate the benefits of a careful cluster analysis, the project took a deeper look at only one of the high-potential green sectors it identified in the Chicago region: Energy-Efficient Lighting.

Lighting is a major source of electricity use in the US. Higher energy costs and environmental concerns are causing consumers to demand lighting products that use less energy.

The most important dynamic in this market will be the increased market share of LEDs (light-emitting diodes), semiconductor devices that convert electricity to

light. LEDs are also called “solid state lighting” (SSL) because the light is emitted from a solid object.

While LEDs now have a relatively small share of the general lighting market, they are expected to grow to dominate the market, potentially achieving a 60%+ market share by 2020.

The LED advantages that will drive this market growth include:

LIFE SPAN: LEDs can last up to 10 times as long as CFLs and 50 to 100 times longer than incandescent bulbs.

EFFICIENCY: LEDs are 3 to 4 times more efficient than incandescent and halogen light sources.

DURABILITY: Because they have no filament, LEDs are more durable and less prone to damage.

NO MERCURY: Mercury disposal is a major issue for fluorescents of all types.

LESS HEAT: LEDs produce 3.4 BTUs per hour, compared to 85.0 for incandescent bulbs.

Comparison of costs over time for incandescent, compact fluorescent (CFL) and light-emitting diode (LED) light sources in a residential setting

	💡	CFL	LED
Light bulb projected lifespan	1,200 hours	10,000 hours	50,000 hours
Watts per bulb (equiv. 60 watts)	60	14	10
Cost per bulb	\$1.25	\$3.95	\$35.95
KWh of electricity used over 50k hours	3000	700	300 to 500
Cost of electricity (@ 0.10 per KWh)	\$300	\$70	\$50
Bulbs needed for 50k hours of use	42	5	1
Equivalent 50k hours bulb expense	\$52.50	\$19.75	\$35.95
Total cost for 50k hours	\$352.50	\$89.75	\$85.95
Over 50k hours in a household with 25 bulbs:			
Total cost of bulbs and energy	\$8,812.50	\$2,443.75	\$2,143.95
Savings by switching from incandescents	\$0	\$6,568.75	\$6,668.95

Eartheasy, “LED Light Bulbs: Comparison Charts” (http://eartheasy.com/live_led_bulbs_comparison.html). Note that costs per bulb vary considerably for each type of light source, and that LED prices in particular may already be considerably lower than those reflected above.

Compared to many other sectors, the lighting industry is very complex and highly fragmented, including many types of industry players.

Manufacturers

Philips, GE and OSRAM Sylvania dominate the global lighting manufacturing sector. The remainder of the market is occupied by a very wide variety of niche manufacturers; many are expanding their product lines to include new technologies like LEDs.

Material & component suppliers

LEDs have a more complex supply chain than other lighting technologies. The most important component is the LED chip itself. Other components include connectors, diodes, drivers, lenses, wires, etc.

Architects, engineers & designers

The architecture and engineering industry plays an important role in influencing lighting choices, primarily in the commercial building sector.

Software & controls

Because LED technologies offer a wider range of dimming options, lighting control systems are increasingly important.

Distributors & installers

Many different kinds of firms distribute and install lighting products, including “big box” retail stores, manufacturers’ representatives, electrical contractors and supply houses.

Energy management integrators

New lighting technologies like LEDs have high up-front costs that can be a barrier to customer acquisition. Energy Performance Contracting (EPC), where a third-party Energy Services Company (ESCO) covers the capital cost of installation in return for compensation through savings, can be an effective way of overcoming this barrier. This niche includes traditional “super-ESCOs” such as Siemens, Ameresco, Johnson Controls and Honeywell, as well as specialized energy management companies and companies that focus only on lighting management.

Utilities

Utilities are increasingly important players in this sector as Energy Efficiency Portfolio Standards (EEPS) generate capital to subsidize energy-efficient lighting technology installation. EEPS programs use ratepayer funds to pay for part of the cost of energy-efficiency measures for residential and commercial customers.

Governments

Many countries are investing in R&D to advance their lighting industries. In addition to the US, Japan, South Korea, Taiwan and China have made significant national investments in LED R&D. The US Department of Energy’s Building Technology Program sponsors a Solid State Lighting (SSL) initiative, established by the Energy Policy Act of 2005. The SSL initiative supports a broad range of strategies to advance the sector. Governments are also major customers for energy-efficient lighting technologies.

Trends in the Chicago Region's Energy-Efficient Lighting Sector

The disruption this kind of shift can produce should not be underestimated. The value of the LED market will more than quadruple in the next 5 years.

Disruptive transformation

The lighting sector has been a traditional and conservative sector and is now undergoing significant change.

Growth burst in the next 5 years

As costs continue to fall and performance and quality continue to rise, the large burst in LED growth will come in the next 2 to 5 years. By 2020, LED lights are expected to account for up to 60% of the overall lighting market.

Technological integration

Unlike incandescent bulbs and other traditional lighting sources, LEDs are often integrated into the design of the light fixture and sold as a unified product.

Distribution changes

Distributors of energy-efficient lighting technology will have more technical and design knowledge, more direct distribution and a larger role for energy management companies and integrators of energy-efficient products and technologies.

New entrants

Many new players will enter the market, throwing industry leadership up for grabs.

Niche opportunities

There will be many new opportunities for players with customized niche applications.

Non-manufacturing markets

The market for lighting design, controls and energy management will experience substantial growth, much of it driven by regional players.

US manufacturing opportunities

While most commodity manufacturing will be done overseas, the economics of domestic production are favorable for niche products with smaller lot sizes and shorter lead times.

Strong regional presence

The Chicago region has a large concentration of lighting firms, covering a broad range of technologies, products, services and markets. Many of these companies are actively transforming their business models to adapt to new green market realities.

RECOMMENDATIONS

In the Chicago region, emerging green markets are creating economic growth opportunities in many sectors. While the project team focused on Energy-Efficient Lighting in particular, its work demonstrates ways to identify opportunities and interventions across the full spectrum of the green economy.

Based on its in-depth study of the Chicago region's Energy-Efficient Lighting sector, the project team recommends the following:

1. *Focus on the broader Integrated Lighting & Building Energy Systems (ILBES) cluster*

Trends in Energy-Efficient Lighting point towards increased integration of lighting design, controls and management, and greater integration of lighting with other energy-efficiency products and services. This indicates that the region's emerging cluster and opportunity is not narrowly in Energy-Efficient Lighting but rather in a broader cluster focused on commercial and institutional building energy efficiency. An Integrated Lighting & Building Energy Systems (ILBES) cluster combines building energy management software and automation with energy-efficient products such as LED lighting. A broad range of Chicago-region firms are already clustering in this field, including: architecture/design; building engineering; property management; energy-efficiency management; building controls and management systems; and Smart Grid integration.

2. *Make Chicago the easiest place in the world to do real-world applied R&D on building energy-efficiency technologies*

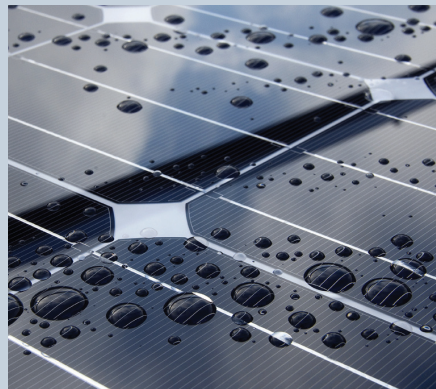
To nurture its emerging ILBES cluster, the Chicago region could create a cluster-specific applied R&D network. This would provide its manufacturers with an opportunity to prove their product quality at demonstration sites; to develop relationships with new/more important distribution players such as designers, energy services companies (ESCOs), utilities and commercial building managers; and to use these relationships to build the trust that leads to market acceptance. It would also provide opportunities for manufacturers of related products to integrate with one another. Chicago's unique assets in the commercial building sector make it the perfect place to test this strategy.

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