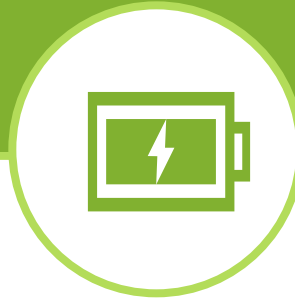


ECONOMIC IMPACT OF THE CLEANTECH SECTOR

In the Austin-Round Rock-San Marcos MSA



Prepared by:



OVERVIEW

\$2.5 Billion

Cleantech contributes \$2.5 Billion to Austin's regional GDP.

20,000 Jobs

Cleantech directly employs 20,000 people in the Austin MSA.

Rapid Growth

Employment in cleantech is projected to grow 11% in Austin by 2020.

OPPORTUNITIES



Renewables



Energy Storage & "Smart Grid" Technologies



Smart Cities & Resilient Infrastructure



Autonomous Vehicles & Connected Mobility



Water Management



Recycling & Waste Management



Advanced Manufacturing

SUMMARY

This project, commissioned by CleanTX and supported by the Austin Technology Incubator, part of the IC² Institute at the University of Texas at Austin, and Civic Analytics, represents the first attempt at describing and quantifying the clean technology (cleantech) sector in Central Texas.

In order to develop a comprehensive definition for Austin's cleantech community, CleanTX engaged an advisory group comprised of academics, business leaders, economic developers, utility executives, government officials, and non-profits. The resulting framework illustrates the diversity of solutions that are considered "cleantech" across a wide variety of industries:

The cleantech sector is a set of technologies and services developed across a number of industries in response to concerns about climate change, energy security, and resource depletion. Generally speaking, cleantech products or services are designed to achieve one or more of the following objectives:

- *Provide fuel or electricity with minimal environmental impact and greenhouse gas emissions throughout the entire lifecycle of that resource;*
- *Increase the natural resource efficiency of existing technologies or significantly reduce their greenhouse gas emissions;*
- *Drive behavioral changes that reduce the carbon and environmental footprint of an individual, organization, community, or industry.*

With the above definition in mind, a data-driven, replicable methodology was designed to calculate the economic impact of this sector in the Austin-Round Rock-San Marcos Metropolitan Statistical Area (Austin MSA). Economic impact is characterized here as direct employment in the cleantech sector (jobs) and Gross Regional Product (GRP) contribution. Similar to GDP, GRP is defined as the market value of all final goods and services produced within a metropolitan area in a given period of time. **The study found that the cleantech sector in the Austin region directly employs nearly 20,000 individuals and contributes approximately \$2.5 billion to the region's GDP.** In addition to establishing a 2014 baseline for the size and scope of this sector in the region, CleanTX intends to update this study on an ongoing basis in order to track the evolution and growth of the cleantech economy in Central Texas.

PURPOSE & GOALS

The successes of Austin's technology, music, art, food, and festival industries are well known and often celebrated. Less discussed, however, are other economic sectors and convergent technologies that have arisen as a result of the region's strong foundations in technology and advanced manufacturing. Cleantech encompasses a thriving, collaborative community of innovative professionals and businesses. Although the sector is very active in Austin, it has not been clearly defined or quantified over time, making it hard to demonstrate the impact of cleantech products and businesses on the local economy.

This challenge is not unique to Austin. In their 2011 report *Sizing the Clean Energy Economy*, The Brookings Institution noted, "The clean economy has remained elusive in part because, in the absence of standard definitions and data, strikingly little is known about its nature, size, and growth at the critical regional level."ⁱ In the same publication, Brookings articulated a broad definition of the clean economy and provided economic impact and labor force data for the nation's 100 most populous metropolitan areas for 2003-2010. In 2011, Austin's clean economy ranked 36 out of 100 metros nationwide, with 14,554 jobs attributed to Austin's clean economy growing at a rate of 5.3% per year. While the Brookings report is a fantastic resource, the data have not been updated since the publication's release.

This study, conducted as a project of CleanTX in partnership with the Austin Technology Incubator and Civic Analytics, seeks to both update and nuance the results of the Brookings Institute's 2011 effort with the guidance of an advisory group convened by CleanTX. In addition to defining the sector and measuring job-creation, this study also quantifies the economic contribution of the sector to the region (GRP).

PROJECT GOAL 1

Define and describe the cleantech sector in the Austin MSA.

Which companies and industries comprise Austin's cleantech sector? What are the relative strengths and weaknesses of the sector? Have any niche industries or specializations developed locally?

PROJECT GOAL 2

Develop and execute a replicable methodology to estimate the sector's impact on the regional economy.

What is the current state of activity in the sector as measured by direct employment and contribution to GRP?

PROJECT GOAL 3

Identify future opportunities for growth and development of the cleantech sector in the region.

What emerging industries can be supported by the CleanTX network of businesses and organizations? How do trends in convergent technologies as applied to the smart cities, automotive and mobility, and water management sectors relate benefit from the network inherent in the cleantech economy?

FINDINGS

This analysis found that the cleantech sector is responsible for nearly 20,000 jobs and contributes approximately \$2.5 billion to the Central Texas economy. The data also show that the sector is expected to grow significantly in the region over the next six years. From 2014-2020, cleantech employment is projected to grow 11.24% in the Austin MSA, as compared with 9.3% growth in the sector over the same period at the state level, and 6.37% nationally.

This analysis demonstrates that the cleantech sector in the Austin MSA is dominated by three industry groups: (1) Manufacturing, (2) Professional, Scientific, and Technical Services, and (3) Construction. At a more granular level, the top ten industries in the sector (listed below) represent over 50% of the jobs and value added by the sector overall. The sector is vibrant and growing. From 2014-2020, significant growth in employment is projected in all but one of the top-ten cleantech industries. Because cleantech is characterized by a diverse set of industries, jobs in this sector span a wide variety of occupations, wages, and educational and professional backgrounds. The benefits of employment gains in this sector, therefore, are shared broadly across the region.

Figure 1. Top 10 Industries by 2014 Cleantech Jobs, Austin MSAⁱⁱ

NAICS	Description	Median Hourly Wage May 2014	2014 Jobs Estimate	2020 Jobs Projection	% Job Change 2014-2020
5413	Architectural, Engineering, and Related Services	\$31.27	2,386	2,744	15.00%
2382	Building Equipment Contractors	\$22.14	1,872	2,126	13.56%
5415	Computer Systems Design and Related Services	\$37.88	1,217	1,443	18.57%
3341	Computer and Peripheral Equipment Manufacturing	\$42.38	1,211	1,035	-14.57%
5416	Management, Scientific, and Technical Consulting Services	\$29.36	1,095	1,385	26.40%
3344	Semiconductor and Other Electronic Component Manufacturing	\$26.01	1,027	1,109	7.95%
5621	Waste Collection	\$16.98	766	950	24.04%
2361	Residential Building Construction	\$18.75	756	857	13.40%
4239	Miscellaneous Durable Goods Merchant Wholesalers	\$16.39	720	831	15.49%
4851	Urban Transit Systems	\$17.69	641	740	15.40%

Source: Civic Analytics; EMSI 2014.4 – QCEW Employees, Non-QCEW Employees, and Self-Employed; Bureau of Labor Statistics (See also: *Methodology*, p8)

This report highlights a robust network of semiconductor, software, and professional services firms that function as the foundation for the cleantech economy in Central Texas (Figure 2). In addition to these employers, iconic cleantech brands such as SunPower, Nest Labs, and CLEAResult also have significant offices in the Austin region. From an energy production perspective, Austin Energy, Pedernales Electric Coop, E.ON Renewables, RES Americas, and NRG are all major local employers who promote clean and renewable sources of energy as well as energy efficiency programs.

Energy storage and energy management are both significant subsectors in the regional cleantech economy. Valence Technology, Active Power, Younicos, Draker Energy, Incenergy, and KLD Energy represent a wide range of storage solutions and applications. Siemens Infrastructure and Cities, Honeywell, Schneider Electric, and Johnson Controls all contribute to the energy management and controls conversation. The solar installation industry—Meridian Solar, Circular Energy, and Revolve Solar, among others—is also growing rapidly. In addition to established brands, the cleantech entrepreneurship community, anchored by the Clean Energy Incubator at the Austin Technology Incubator, is also vibrant. Notable graduates of the Clean Energy Incubator include Ideal Power Converters, Omni Water, Yan Engines, and Ridescout.

Figure 2. Top 10 Industries by 2013 Cleantech GRP, Austin MSAⁱⁱⁱ

NAICS	Description	Representative Employers <i>Austin MSA</i>	Cleantech GRP 2013
3341	Computer and Peripheral Equipment Manufacturing	Dell; 3M; Cisco Systems	\$353.24M
3344	Semiconductor and Other Electronic Component Manufacturing	Freescall Semiconductor; Samsung; Cirrus Logic; Novati Technologies; Intel Corp.	\$268.05M
5413	Architectural, Engineering, and Related Services	STG Design; ACR Engineering; EEA Consulting Engineers; Page	\$251.01M
5415	Computer Systems Design and Related Services	IBM; Rockwell Automation; Siemens Infrastructure and Cities	\$149.46M
2382	Building Equipment Contractors	Airco Mechanical; Lighthouse Solar; Freedom Solar Power; Brandt; Borrego Solar	\$144.68M
5416	Management, Scientific, and Technical Consulting Services	CLEAResult Consulting; Sage Environmental Consulting; Signature Science; ReSolved Energy Consulting; Pecan Street, Inc.	\$127.49M
5621	Waste Collection	Texas Disposal Systems; Waste Management; Balcones Resources; Go Green International	\$88.58M
4239	Miscellaneous Durable Goods Merchant Wholesalers	Ringdale; Battery Wholesale Distributors	\$83.27M
2361	Residential Building Construction	Native; Burt-Watts Industries; Green Places; Solid Green Industries	\$59.30M
4851	Urban Transit Systems	Capital Metro; CleanAir Limo; Car2Go North America	\$39.42M
Total GRP, Top 10 Industries			\$1.56B

Source: Civic Analytics; EMSI 2014.4 – QCEW Employees, Non-QCEW Employees, and Self-Employed

CLEANTECH ECOSYSTEM

Although Austin is often referred to as Silicon Hills, its proximity to Houston, a global energy hub, provides the cleantech cluster in the region access to both the technology and energy economies. As a result, Austin has become a fertile proving ground for novel energy solutions enabled by new technologies.

The growth and development of a cleantech cluster from a technology foundation was not inevitable. A series of consistent, thoughtful investments from both the public and private sectors over the past 15 years have shaped the local environment for cleantech innovation and investment. At this stage, the cleantech ecosystem in Austin is best described as a web of interconnected organizations that support and complement one another and the local businesses in the industry. Austin Energy, the City of Austin, the University of Texas at Austin, the Austin Technology Incubator, the State Energy Conservation Office, and the Greater Austin Chamber of Commerce have each played a pivotal role in formulating and supporting the development of this industry. Distinctive assets and events, such as Pecan Street, Inc. and the Pike Powers Commercialization Lab, SXSW Eco, and the Defense Energy Summit illustrate ongoing collaboration among these organizations. The organizations, events, and projects that characterize the current ecosystem include:



OPPORTUNITIES & NEXT STEPS

This report demonstrates the impact of the cleantech sector regionally and illustrates the relationship between cleantech and other emerging sectors characterized by convergent technologies. Below, a few of the opportunities for CleanTX to support the evolution of Austin's cleantech cluster are identified.



Renewables: CleanTX will continue to promote the development and adoption of solar, wind, and other renewable sources of electricity generation. The Austin region has a strong track record in this space and should build on existing momentum. For instance, Austin Energy has a stated goal of achieving 55% renewable energy resources by 2025, including 950 MW of solar.^{iv} Just north of Austin, the City of Georgetown's municipal utility announced in March 2015 that it would rely exclusively on wind and solar energy to meet all of its customers' power needs, making it the first city-owned utility to make that leap in Texas, and one of a handful in the nation. In addition to promoting renewables, CleanTX will work with industry partners to identify and develop innovative business models and financing mechanisms aimed at accelerating the adoption of renewables by lowering the barriers to entry.



Energy Storage & "Smart Grid" Technologies: Austin has long been at the forefront of solving the technical challenges associated with distributed generation. The University of Texas at Austin is home to renowned research programs in lithium ion battery, microgrid, flywheel, compressed air storage, and fuel cell technologies. These novel battery technologies will catalyze a revolution in electric vehicle development, distributed residential/commercial storage, and utility 2.0 grid management applications. CleanTX will continue to act as a conduit for stakeholders, startups, and utilities to partner on energy storage innovation and commercialization.



Smart Cities & Resilient Infrastructure: This report illustrates the interconnected web of semiconductor, computer systems design, architecture, construction, and engineering firms that comprise a significant portion of the cleantech sector in Austin. More specifically, Austin tech giants such as Dell, IBM, Qualcomm, Intel, ARM, and Silicon Labs are enabling the creation of smarter cities and infrastructure through the development of more efficient chips and processors. In next-generation urban environments, distributed renewable energy will be deployed to power electricity, telecom, water, and transportation networks. Internet of Things (IoT) technology will, in turn, enable enhanced communication and resilience within and among those networks in the case of natural disasters, power outages, and other disruptions. In recognition of this opportunity, CleanTX will develop and support programming around Smart Cities and Resilient Infrastructure by creating more connective tissue among Austin's cleantech-IT entities, urban planning associations, and demonstration projects (such as Pecan Street, Inc). CleanTX will also codify and share best practices from Austin's experience in this sector.



Autonomous Vehicles & Connected Mobility: The transportation sector will also be transformed by embedded intelligence. Cars will have the ability to talk to each other, avoid collisions, manage heavy congestion autonomously, and even park and pick up passengers on their own. Although this sector is nascent, the development of autonomous and connected vehicles represents a significant opportunity to reduce carbon emissions and create greener, more efficient urban spaces. CleanTX will convene a working group to explore opportunities for the diverse players in the automotive and mobility technologies sector to collaborate. Strategic partners in the Austin region include the GM Innovation Center, Freescale Semiconductor, the Circuit of the Americas (COTA), Ridescout, MobilityATX, and Austin Energy, among others.



Water Management: Austin is a pioneer in the development, testing, and deployment of smart grid technologies. Since 2010, Pecan Street, Inc. and the Pike Powers Commercialization Lab have built the world's preeminent research network of energy and water customers. In response to persistent drought across the country and the water/energy nexus, local industry expertise in resource measurement and management is now being deployed to develop a smart grid for water. This initiative is led by Pecan Street, Inc., the Pike Powers Commercialization Lab, the Energy Institute at the University of Texas at Austin, and the Austin Technology Incubator. CleanTX will offer support by hosting educational workshops and convening working groups around the theme of water management technologies and strategies for financing and implementation.



Recycling & Waste Management: CleanTX will support education, networking, and innovation in the recycling and waste management industry through educational programming, startup pitch competitions, and joint programming with the City of Austin to promote its Eco-Industrial Park.



Advanced Manufacturing: This study demonstrates the intricate relationship between the cleantech economy and the manufacturing industry in the Austin region. CleanTX will partner with the Austin Regional Manufacturers Association (ARMA) and the Austin Technology Incubator to support cleantech entrepreneurs through the prototype phase of commercialization. This partnership will also connect the cleantech community with established, large-scale manufacturers in the region who serve the cleantech market both nationally and globally. Workforce development, STEM education, and the efficient management of resources (energy, water, etc.) in manufacturing processes represent ongoing opportunities for collaboration between the two professional organizations and other community partners (such as Skillpoint Alliance).

METHODOLOGY

DEFINITION

Before it can be reliably quantified, the “cleantech” sector must first be defined. Unlike other sectors that have discrete industry classifications, the clean economy represents segments of existing industries, and therefore is often obscured by traditional methods of quantifying job creation and revenues.

To develop a definition for this study, definitions proposed in other reports were first considered, including:

- *Sizing the Clean Energy Economy*, Brookings Institution, 2011

The clean economy is economic activity—measured in terms of establishments and the jobs associated with them—that produces goods and services with an environmental benefit or adds value to such products using skills or technologies that are uniquely applied to those products.^v

- Cleantech Group (formerly the Cleantech Venture Network), 2005

Cleantech is new technology and related business models offering competitive returns for investors and customers while providing solutions to global challenges. Where greentech, or envirotech, represents the highly regulatory driven, “end-of-pipe” technology of the past with limited opportunity for attractive returns, cleantech is driven by market economics therefore offering greater financial upside and sustainability. The concept of cleantech embraces a diverse range of products, services, and processes across industry verticals that are inherently designed to provide superior performance at lower costs, greatly reduce or eliminate negative ecological impact, and improve the productive and responsible use of natural resources.^{vi}

An advisory group of academics, business leaders, economic developers, utility executives, government officials, and non-profit executives was also convened by CleanTX to guide the creation of a local definition of the cleantech sector. With these diverse perspectives in mind, the following definition was developed:

The cleantech sector is a set of technologies and services developed across a number of industries in response to concerns about climate change, energy security, and resource depletion. Generally speaking, cleantech products or services are designed to achieve one or more of the following objectives:

- *Provide fuel or electricity with minimal environmental impact and greenhouse gas emissions throughout the entire lifecycle of that resource;*
- *Increase the natural resource efficiency of existing technologies or significantly reduce their greenhouse gas emissions;*
- *Drive behavioral changes that reduce the carbon and environmental footprint of an individual, organization, community, or industry.*

INDUSTRY IDENTIFICATION

This study's methodology is driven by the definition of "cleantech" proposed here. While certain industries are inherently cleantech (e.g. solar or wind), others, like semiconductor manufacturing, generate a number of cleantech products and services and support a large cleantech workforce although the industry as a whole would not be classified as cleantech.

To identify a subset of industries that could be considered part of the cleantech sector, the North American Industry Classification (NAICS) industry code lists from the Bureau of Labor Statistics Green Goods and Services program (BLS-GGS) was consulted. The BLS-GGS program measures US employment associated with "green jobs," or "jobs in businesses that produce goods and provide services that benefit the environment or conserve natural resources."^{vii} The BLS-GGS has flagged 325 six-digit NAICS industries as potential green goods and services producing industries. This list was refined to reflect the Austin cleantech sector by cross-referencing NAICS codes with existing area businesses listed in an inventory maintained by the Greater Austin Chamber of Commerce. Through this exercise, 102 4-digit NAICS industries were identified across 15 broad industry sectors.

CALCULATING IMPACT

Economic impact is measured in both employment (total number of jobs) and the share of the revenues generated in the region (GRP) from companies in those industries that can be attributed to cleantech. To calculate the share of cleantech employment and GRP embedded in the 102 selected industries, total employment and GRP estimates for the selected industries were first pulled from EMSI, an economic modeling program. Then, these estimates were modified to reflect the industry percentages in the BLS-GGS program. This approach is frequently used to estimate the impact of sectors characterized by multiple industries and/or convergent technologies.

For example, if EMSI estimated that there were 10,000 jobs attributable to the computer and peripheral equipment manufacturing industry (NAICS 3341) and GGS claimed that 5% of the jobs in NAICS 3341 are green jobs, then 500 cleantech jobs would be estimated for that industry. For industries that are not assigned a GGS total employment percentage, the report employs the GGS program's overall percentage estimate for the number of private sector green jobs in the U.S.—2.3% per the most recent data from the BLS.^{viii}

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ABOUT CLEANTX

CleanTX is the cluster development organization for cleantech in Central Texas. Headquartered in the capital city of Austin, CleanTX is uniquely positioned at the nexus of government, industry, academia, utility, and community interests. Through the advancement of public-private partnerships, community education and thought leadership, and networking among industry stakeholders, CleanTX supports the region's rapidly growing cleantech economy.



ABOUT THE AUSTIN TECHNOLOGY INCUBATOR

The Austin Technology Incubator (ATI) is the startup incubator of the IC² Institute of The University of Texas at Austin. ATI works with seed and pre-seed-stage companies, helping prepare these businesses for commercial success, with a particular focus on helping startups compete in the capital markets. The Incubator has operated since 1989 with a dual mission: create jobs and wealth in Central Texas through technology entrepreneurship, and provide distinctive teaching and research opportunities to the UT-Austin community. Over the past 10 years, ATI companies have created more than 6,500 jobs, nearly \$1 billion in economic impact, and over \$20 million in tax revenues in Central Texas.



ABOUT CIVIC ANALYTICS

Civic Analytics LLC is an Austin-based economic research and consulting firm that specializes in economic and labor market research for private and public sector clients.



ⁱ Brookings Institution: Muro, M., Rothwell, J., & Saha, D. (2011). Sizing the clean economy: a national and regional green jobs assessment. p.3

ⁱⁱ Civic Analytics; EMSI 2014.4 – QCEW Employees, Non-QCEW Employees, and Self-Employed. Bureau of Labor Statistics, "May 2014 National Industry-Specific Occupational Employment and Wage Estimates," 2015 (<http://www.bls.gov/oes/current/oesrsci.htm>)

ⁱⁱⁱ Civic Analytics; EMSI 2014.4 – QCEW Employees, Non-QCEW Employees, and Self-Employed

^{iv} Austin Energy, "Austin Energy Resource, Generation and Climate Protection Plan to 2025: An Update of the 2020 Plan," 2014 (<http://austinenenergy.com/wps/wcm/connect/461827d4-e46e-4ba8-acf5-e8b0716261de/aeResourceGenerationClimateProtectionPlan2025.pdf?MOD=AJPERES>)

^v Brookings Institution: Muro, M., Rothwell, J., & Saha, D. (2011). Sizing the clean economy: a national and regional green jobs assessment. p.3

^{vi} See the Cleantech Group, quoted in Cnet, "What is Clean tech?" 2008 (<http://www.cnet.com/news/what-is-clean-tech/>).

^{vii} See Bureau of Labor Statistics, "Green Goods and Services Overview," 2013 (<http://www.bls.gov/ggs/ggsoverview.htm>)

^{viii} Bureau of Labor Statistics, "Employment in Green Goods and Services – 2011," 2013 (<http://www.bls.gov/news.release/pdf/ggqcew.pdf>)