Employment in the Bay Area's Emerging Clean Economy

a brief by the

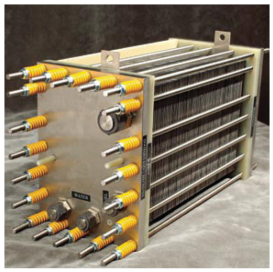
Bay Area Council Economic Institute

presenting Bay Area data from the

Brookings Institution

study entitled

Sizing the Clean Economy



July 2011

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The Brookings Institution Clean Economy Jobs Report

The clean ("green") economy is an increasingly promising source for new technologies, processes, and industries with the potential to generate significant numbers of jobs. But despite high expectations, the clean economy is still poorly measured in terms of its spatial geography, its sub-industries and the jobs they create. A better understanding of the scope and development of the clean economy is therefore important for policy makers at the national, state and metropolitan levels. This is particularly the case for cities and regions, where the vast majority of clean economy companies and jobs are located.

The Brookings Institution's July 2011 study, *Sizing the Clean Economy: A National and Regional Green Jobs Assessment,* analyzes the specific implications of the emerging clean economy for employment. The Bay Area Council Economic Institute (BACEI), the Bay Area partner in Brookings' Metropolitan Policy Program, has extracted the regional data for the Bay Area from Brookings' national report and is pleased to present it as a resource for decision makers in the region. The full Brookings report can be accessed at <http://www.brookings.edu/metro/clean_economy.aspx>.

The analysis focuses on economic activity—measured in terms of establishments and jobs that either produce goods and services with an environmental benefit, or add value as part of the supply chain. Thus, only employment in establishments that *directly produce or add value to goods and services* with environmental benefits is measured. The study then categorizes clean economy establishments into 39 segments. These include renewable energy, as well as broader categories such as organic food and farming, sustainable forestry, waste management and treatment, and public transit. Jobs in government are included. Employment and job growth from 2003–2010 is then calculated for each segment.

The Brookings analysis depicts a clean economy that encompasses a modest-sized but growing mix of diverse industries that varies widely between different metropolitan areas. Over 90 percent of clean economy jobs are in older segments that address long-recognized environmental problems. Waste management and treatment is the largest employment sector, followed by public mass transit and conservation (for example, at the U.S. Fish and Wildlife Service, the U.S. Forestry Service, the National Park Service, and in state and local government). Employment in renewable energy and energy efficiency technology is still comparatively small, led by hydropower, wind energy, and solar photovoltaic (PV) energy.

The report finds approximately 2.7 million workers in the clean economy, accounting for 2 percent of total U.S. employment. This makes it larger in terms of employment than the fossil fuel industry or bioscience, but smaller than IT. More than two-thirds of all clean economy jobs are middle-wage, falling within 20 percentage points of the national median wage of $33,190—or between $26,552 and $39,828. These "green collar" jobs offer more opportunities and better pay for low- and middle-skilled workers than the national economy as a whole, with median wages 13 percent higher than the median U.S. wage for all sectors. The clean economy also employs a higher percentage of scientists, architects and engineers (10.1 percent) than the national economy (5.4 percent).

The clean economy is also manufacturing and export intensive. Twenty-six percent of all clean economy jobs are in manufacturing, compared to 9 percent in the economy as a whole, with the intensity of manufacturing activity increasing. On a per job basis, establishments in the clean economy export twice the value of the typical U.S. job—$20,000 versus $10,000. In 2009, clean economy establishments exported $49.4 billion in goods, accounting for 5.3 percent of U.S. goods exports, and another $4.5 billion in services.

While the clean economy as a whole grew more slowly than the national economy between 2003 and 2010, its new "cleantech" segments have seen dramatic growth, outpacing the nation during the recession.

The clean economy is heavily concentrated in metropolitan regions, and varies significantly from metro to metro based on the concentration of manufacturing, services and government activity. Metropolitan areas produce 78 percent of the nation's green patents. They also support clusters that serve as catalysts for growth. Brookings finds that establishments that are part of metropolitan industry clusters grew 1.4 percentage points per year faster than establishments that were more isolated.

California

- California establishments lead the nation in clean economy employment, providing 318,156 jobs—well ahead of the next largest states, New York (185,038) and Texas (144,018).

The Bay Area

- Brookings finds that the Bay Area—composed of the San Jose-Sunnyvale-Santa Clara Metropolitan Statistical Area and the San Francisco-Oakland-Fremont Metropolitan Statistical Area—is a national leader in the clean economy and in cleantech employment in particular.

San Jose-Sunnyvale-Santa Clara Metro

- With 18,868 clean economy jobs in 2010, the San Jose-Sunnyvale-Santa Clara Metropolitan Statistical Area was ranked 26th among regions nationally.
- Its largest segment is Wind Energy which supported 3,000 jobs in 2010, followed by Air/Water/Sewage/Solid Waste Management & Treatment.
- Its fastest growing segments from 2003 to 2010 were Fuel Cells (24.7 percent) and Wind Energy (17 percent.)
- Despite a disappointing annual average growth rate of -0.4 percent from 2003–2010, due in part to the impacts of the economic downturn on construction, it ranks high in exports per clean economy job, with $726.8 million in total exports and $38,521 in exports per job in 2009.

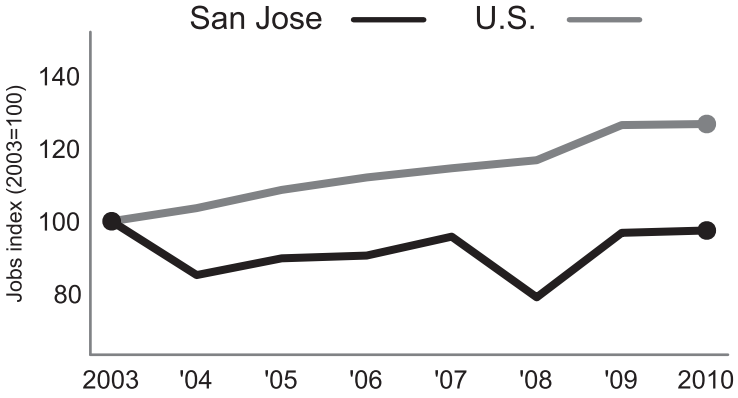
Largest Segments of San Jose's Clean Economy, 2010

Segment	Jobs 2010	Job Change, 2003–2010	Annual Average Job Change, 2003–2010 (%)
Wind	3,000	+2,000	+17.0%
Waste Management and Treatment	2,947	+554	+3.0%
Energy-saving Consumer Products	2,347	-3,432	-12.1%
Solar Photovoltaic	1,988	+1,005	+10.6%
Public Mass Transit	1,637	+217	+2.1%

Fastest Growing Segments of San Jose's Clean Economy, 2003–2010

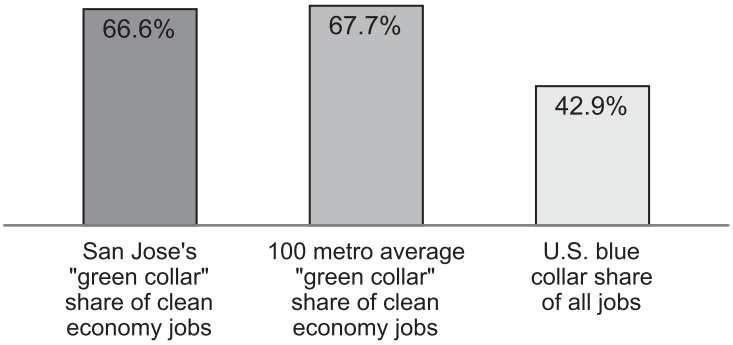
Segment	Jobs, 2010	Job Change, 2003–2010	Annual Average Job Change, 2003–2010 (%)
Fuel Cells	272	+214	+24.7%
Wind	3,000	+2,000	+17.0%
Remediation	100	+66	+16.7%
Green Consumer Products	131	+83	+15.4%
Green Building Materials	75	+43	+12.9%

Clean Economy Job Growth, 2003–2010



Note: Changes in employment do not include jobs lost from establishment closings. Some establishments in the database exhibited extreme employment changes, possibly exaggerating a place's growth curve (see report website for a listing of these cases).

Share of Clean Jobs Offering Good Pay for Modest Education, 2010



Note: Within the clean economy, occupations paying mid-level wages are referred to as "green collar" occupations and include jobs in the following occupational categories: production, transportation, installation, construction, office administration and support, protective services, and social services. The green collar designation is specific to the clean economy; when looking at the overall economy (clean or otherwise), these occupations are typically referred to as "blue collar."

San Jose-Sunnyvale-Santa Clara Metropolitan Statistical Area

Data developed for the Brookings-Battelle Clean Economy Database.

Clean Category	Clean Segment	Total Segment Jobs, U.S., 2010	Total Segment Jobs, MSA, 2010	Total Segment Jobs, MSA, 2003	Annual Average Job Change for Segment in the MSA, 2003–2010
Greenhouse Gas Reduction, Environmental Management & Recycling	Air and Water Purification Technologies	24,930	89	53	0.0768598
Energy & Resource Efficiency	Battery Technologies	16,129	13	30	-0.1126041
Renewable Energy	Biofuels/Biomass	20,680	39	17	0.1259433
Greenhouse Gas Reduction, Environmental Management & Recycling	Carbon Storage and Management	391	80	0	
Agricultural & Natural Resources Conservation	Conservation	314,983	489	388	0.0336033
Energy & Resource Efficiency	Electric Vehicle Technologies	15,711	47	0	
Energy & Resource Efficiency	Energy-saving Building Materials	161,896	656	574	0.019259
Energy & Resource Efficiency	Energy-saving Consumer Products	19,210	2,347	5,779	-0.1207865
Energy & Resource Efficiency	Fuel Cells	7,041	272	58	0.2470311
Energy & Resource Efficiency	Green Architecture and Construction Services	56,190	19	0	
Greenhouse Gas Reduction, Environmental Management & Recycling	Green Building Materials	76,577	75	32	0.1293914
Greenhouse Gas Reduction, Environmental Management & Recycling	Green Consumer Products	77,264	131	48	0.1542238
Energy & Resource Efficiency	HVAC and Building Control Systems	73,600	201	299	-0.0551547
Energy & Resource Efficiency	Lighting	14,298	1,228	3,412	-0.1358314

Clean Category	Clean Segment	Total Segment Jobs, U.S., 2010	Total Segment Jobs, MSA, 2010	Total Segment Jobs, MSA, 2003	Annual Average Job Change for Segment in the MSA, 2003–2010
Agricultural & Natural Resources Conservation	Organic Food and Farming	129,956	874	764	0.0194019
Greenhouse Gas Reduction, Environmental Management & Recycling	Pollution Reduction	9,986	11	14	-0.033865
Energy & Resource Efficiency	Professional Energy Services	49,863	659	617	0.0094522
Greenhouse Gas Reduction, Environmental Management & Recycling	Professional Environmental Services	141,046	353	228	0.064437
Energy & Resource Efficiency	Public Mass Transit	350,547	1,637	1,420	0.0205233
Greenhouse Gas Reduction, Environmental Management & Recycling	Recycled-Content Products	59,712	331	343	-0.0050745
Greenhouse Gas Reduction, Environmental Management & Recycling	Recycling and Reuse	129,252	773	508	0.0618058
Education & Compliance	Regulation and Compliance	141,890	45	0	
Greenhouse Gas Reduction, Environmental Management & Recycling	Remediation	56,241	100	34	0.1666258
Energy & Resource Efficiency	Smart Grid	15,987	40	0	
Renewable Energy	Solar Photovoltaic	24,152	1,988	983	0.1058461
Renewable Energy	Solar Thermal	5,379	54	0	
Agricultural & Natural Resources Conservation	Sustainable Forestry Products	61,054	350	356	-0.0024253
Education & Compliance	Training	266	10	0	
Greenhouse Gas Reduction, Environmental Management & Recycling	Waste Management and Treatment	386,116	2,947	2,393	0.0301955
Renewable Energy	Waste-to-Energy	3,320	10	10	0
Renewable Energy	Wind	24,294	3,000	1,000	0.1699308

San Francisco-Oakland-Fremont Metro

- The San Francisco-Oakland-Fremont Metropolitan Statistical Area supported 51,811 jobs in 2010, ranking 5th among regions nationally.
- It is a major center for smart grid development but also specializes in temperature control equipment, solar PV, electric vehicles, architecture, environmental research, solar thermal power, and remediation.
- Its largest segment is Professional Energy Services, which supports 7,532 jobs, followed by Air/Water/Sewage/Solid Waste Management & Treatment, which supports 6,278 jobs.
- The fastest growing segments from 2003 to 2010 were Wind Energy at 113 percent, and Fuel Cells at 100 percent.
- Employment grew at an average annual rate of 5.3 percent between 2003 and 2010. San Francisco performed well in exports per clean economy job, with $1 billion in total exports and $20,705 in exports per job in 2009.

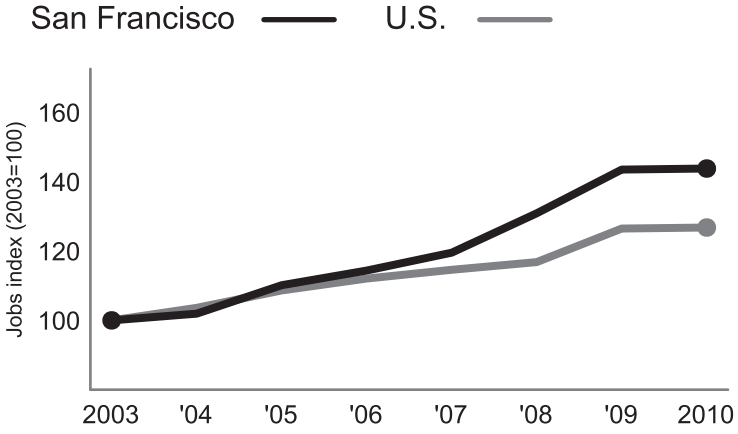
Largest Segments of San Francisco's Clean Economy, 2010

Segment	Jobs, 2010	Job Change, 2003–2010	Annual Average Job Change, 2003–2010 (%)
Professional Energy Services	7,532	-1,081	-1.9%
Waste Management and Treatment	6,278	+627	+1.5%
Professional Environmental Services	5,319	+982	+3.0%
Public Mass Transit	4,791	+492	+1.6%
Conservation	4,417	+1,814	+7.8%

Fastest Growing Segments of San Francisco's Clean Economy, 2003–2010

Segment	Jobs, 2010	Job Change, 2003–2010	Annual Average Job Change, 2003–2010 (%)
Wind	202	+201	+113.5%
Fuel Cells	130	+129	+100.4%
Smart Grid	2,861	+2,811	+78.3%
Solar Thermal	184	+178	+63.1%
Battery Technologies	178	+164	+43.8%

Clean Economy Job Growth, 2003–2010



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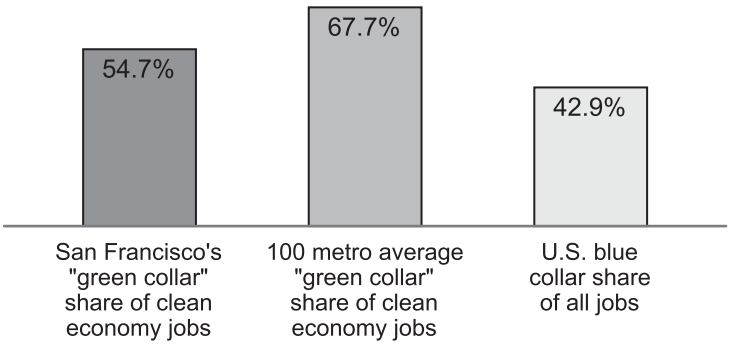
Share of Clean Jobs Offering Good Pay for Modest Education, 2010



Note: Within the clean economy, occupations paying mid-level wages are referred to as "green collar" occupations and include jobs in the following occupational categories: production, transportation, installation, construction, office administration and support, protective services, and social services. The green collar designation is specific to the clean economy; when looking at the overall economy (clean or otherwise), these occupations are typically referred to as "blue collar."

San Francisco-Oakland-Fremont Metropolitan Statistical Area

Data developed for the Brookings-Battelle Clean Economy Database.

Clean Category	Clean Segment	Total Segment Jobs, U.S., 2010	Total Segment Jobs, MSA, 2010	Total Segment Jobs, MSA, 2003	Annual Average Job Change for Segment in the MSA, 2003–2010
Greenhouse Gas Reduction, Environmental Management & Recycling	Air and Water Purification Technologies	24,930	387	216	0.086875
Energy & Resource Efficiency	Appliances	36,608	128	111	0.0205658
Energy & Resource Efficiency	Battery Technologies	16,129	178	14	0.4379904
Renewable Energy	Biofuels/Biomass	20,680	390	173	0.1231331
Agricultural & Natural Resources Conservation	Conservation	314,983	4,417	2,603	0.0784688
Energy & Resource Efficiency	Electric Vehicle Technologies	15,711	925	600	0.0637897
Energy & Resource Efficiency	Energy-saving Building Materials	161,896	1,159	805	0.0534466
Energy & Resource Efficiency	Energy-saving Consumer Products	19,210	244	401	-0.0685106
Energy & Resource Efficiency	Fuel Cells	7,041	130	1	1.004435
Renewable Energy	Geothermal	2,720	70	22	0.1798065
Energy & Resource Efficiency	Green Architecture and Construction Services	56,190	3,028	1,340	0.1235146
Greenhouse Gas Reduction, Environmental Management & Recycling	Green Building Materials	76,577	163	160	0.0026573
Greenhouse Gas Reduction, Environmental Management & Recycling	Green Chemical Products	22,622	99	65	0.0619477
Greenhouse Gas Reduction, Environmental Management & Recycling	Green Consumer Products	77,264	190	88	0.1162282
Energy & Resource Efficiency	HVAC and Building Control Systems	73,600	3,459	600	0.2843566
Renewable Energy	Hydropower	55,467	5	0	

Clean Category	Clean Segment	Total Segment Jobs, U.S., 2010	Total Segment Jobs, MSA, 2010	Total Segment Jobs, MSA, 2003	Annual Average Job Change for Segment in the MSA, 2003–2010
Agricultural & Natural Resources Conservation	Organic Food and Farming	129,956	2,537	2,366	0.0100186
Greenhouse Gas Reduction, Environmental Management & Recycling	Pollution Reduction	9,986	96	59	0.0720197
Energy & Resource Efficiency	Professional Energy Services	49,863	7,532	8,613	-0.0189765
Greenhouse Gas Reduction, Environmental Management & Recycling	Professional Environmental Services	141,046	5,319	4,337	0.0295867
Energy & Resource Efficiency	Public Mass Transit	350,547	4,791	4,299	0.0156
Greenhouse Gas Reduction, Environmental Management & Recycling	Recycled-Content Products	59,712	88	43	0.1077215
Greenhouse Gas Reduction, Environmental Management & Recycling	Recycling and Reuse	129,252	2,055	1,618	0.034745
Education & Compliance	Regulation and Compliance	141,890	1,767	443	0.2185217
Greenhouse Gas Reduction, Environmental Management & Recycling	Remediation	56,241	1,615	1,183	0.0454723
Renewable Energy	Renewable Energy Services	1,981	7	0	
Energy & Resource Efficiency	Smart Grid	15,987	2,861	50	0.7827
Renewable Energy	Solar Photovoltaic	24,152	1,438	145	0.3878469
Renewable Energy	Solar Thermal	5,379	184	6	0.6307258
Agricultural & Natural Resources Conservation	Sustainable Forestry Products	61,054	49	14	0.1959803
Education & Compliance	Training	266	2	0	
Greenhouse Gas Reduction, Environmental Management & Recycling	Waste Management and Treatment	386,116	6,278	5,651	0.0151448
Renewable Energy	Waste-to-Energy	3,320	10	0	
Energy & Resource Efficiency	Water Efficient Products	13,066	8	0	
Renewable Energy	Wind	24,294	202	1	1.134695

The Bay Area Compared Nationally

- The Bay Area has one of the nation's most competitive clean economy sectors, due in part to its many research facilities and professional services base. In contrast to places that rely heavily on a single segment (such as Knoxville, whose strength derives principally from the location of Oak Ridge National Laboratory), the clean energy economy in San Francisco is highly diversified. Like Atlanta, Boston, and Dallas, less than 30 percent of jobs are concentrated in the two largest segments. By comparison, New York and Washington are highly specialized in public-goods-providing segments. The former derives over 50 percent of its clean jobs from public mass transit and waste management and treatment. Washington derives roughly 48 percent of its jobs from conservation and regulation and compliance activities.
- Like Los Angeles, New York and Albany, San Francisco is a leader in clean economy exports, totaling over $1 billion per year. The leading clean economy exports from Los Angeles are organic food, green building products, green consumer products, recycled content products, and water efficient products. New York's exports consist largely of green consumer products, organic food, professional environmental services, and recycled products. Wind energy dominates in Albany. San Francisco exports clean products from a diverse group of segments, including HVAC and building control systems, professional energy services, and electric vehicles.
- New York and Los Angeles have the nation's largest concentrations of clean economy jobs with 152,000 and 89,600 respectively. Chicago comes in third with 79,388, and Washington, D.C. fourth at 70,828. San Francisco ties Philadelphia for the nation's fifth largest number of clean economy jobs, with over 50,000, while San Jose ranks 25th with 18,868. Atlanta, Boston, Houston, and Dallas round out the top 10. If job totals in San Francisco and San Jose are combined (70,679), the Bay Area ties Washington, D.C. for the fourth largest clean economy employment concentration in the nation.
- San Francisco and San Jose don't rank high in terms of the clean economy's share of all jobs. Albany tops the nation with a clean share of all jobs at 6.3 percent while the Sacramento metro area places third with 4.5 percent. This is primarily due to those metro areas' roles as state capitals providing state-run services and the greater size and diversity of the Bay Area's economy.

- San Jose, despite its innovation prowess, was ranked a relatively low 95th for job growth in the clean economy from 2003 to 2010. Large losses during the recession—which heavily affected construction and impacted thousands of jobs in lighting and energy-saving consumer products—outweighed the substantial job gains in wind and solar PV. San Jose experienced negative average job growth between 2003 and 2010 of -0.4 percent compared to 5.3 percent growth in San Francisco.
- The Bay Area, including San Francisco and San Jose, has continued to successfully attract high-impact cleantech firms: 39 of the 58 highest-impact cleantech firms in the country are headquartered in just four metros characterized by vibrant clean economy industry clusters—Boston, San Francisco, San Jose, and Los Angeles.
- Both the San Francisco and San Jose metro areas offer high average annual wages at $59,862 and $55,827; compared to $43,133 nationally. One of the most important findings has to do with the growth-promoting role of regional industry concentrations. Job growth in the clean economy has been significantly faster in regional industry clusters than elsewhere. In the San Francisco metro area, 23.3 percent of traded sector establishments are clustered, while the San Jose metro area comes in at an impressive 37.1 percent—placing third behind San Diego (56.5 percent) and Seattle (44.8 percent).

The Bay Area's Aggregate Clean Economy

	San Francisco-Oakland-Fremont	San Jose-Sunnyvale-Santa Clara	100 Largest Metros
Jobs 2003	36,027	19,360	1,276,388
Jobs 2010	51,811	18,868	1,705,897
Annual average change in jobs, 2003–2010 (%)	5.3	-0.4	4.2
Clean economy share of all metro jobs 2010 (%)	2.7	2.2	1.9
Median age of establishment (in years) 2010	15	12.5	15
Exports per job (2009)	$20,705	$38,521	$17,255
Share of jobs held by workers with a high school diploma or less, 2010 (%)	37.1	44.9	43.6
Share of jobs that are green collar, 2010	54.7	66.6	67.7
Average annual wage, 2009	$59,862	$55,827	$43,133
Share of traded sector establishments that are clustered, 2010 (%)	23.3	37.1	18.8

Cleantech

Brookings defines cleantech producers as clean economy companies with a median birth year of 1996 or later, including wave/ocean power, solar photovoltaic, wind, biofuels/biomass, carbon storage and management, renewable energy services, battery technologies, electric vehicle technologies, solar thermal, professional energy services, fuel cells, smart grid, and geothermal.

Cleantech jobs in the nation grew 8.3 percent between 2003 and 2010, compared to 4.2 percent growth for all jobs. The cleantech average annual wage in 2010 was $43,343, compared to the U.S. average annual wage of $38,616.

The San Francisco Metropolitan Statistical Area has the most cleantech jobs of any region in the nation. Eleven percent of all U.S. cleantech jobs are located in either the San Francisco or San Jose Metropolitan Statistical Areas. Cleantech accounted for .7 percent of both the San Francisco and San Jose MSAs' total jobs in 2010. By comparison, Albany-Schenectady-Troy and Knoxville had cleantech concentrations of 2.3 percent and 2.5 percent respectively. The differences principally reflect the larger size and greater diversity of the Bay Area's economy.

Metropolitan Areas with the Most Cleantech Jobs

Rank	Metro Area	Cleantech Jobs, 2010
1	San Francisco-Oakland-Fremont, CA	13,917
2	Albany-Schenectady-Troy, NY	10,092
3	Knoxville, TN	8,184
4	Chicago-Joliet-Naperville, IL-IN-WI	7,642
5	San Jose-Sunnyvale-Santa Clara, CA	6,192
6	Los Angeles-Long Beach-Santa Ana, CA	4,302
7	Boston-Cambridge-Quincy, MA-NH	4,259
8	Kansas City, MO-KS	3,932
9	Atlanta-Sandy Springs-Marietta, GA	3,853
10	New York-Northern New Jersey-Long Island, NY-NJ-PA	3,844

Cleantech employment grew at an average annual rate of 5.4 percent in San Francisco between 2003 and 2010, and 12.6 percent in San Jose.

Conclusion

The Brookings data confirms that the clean economy is delivering on its potential to generate a diverse array of quality jobs. While starting from a small base, the Bay Area's cleantech sector is experiencing particularly strong growth. The Bay Area is far from alone in its focus on the emerging clean economy. The Brookings study shows that metropolitan regions across the country have a similar drive and are enjoying success. Because the Brookings data includes jobs in government and agriculture, some metropolitan areas with large government sectors rank high in the data. The diversity of the Bay Area's clean economy and its fast-growing private sector base distinguish it and place it in the top tier of metropolitan regions in the national clean economy.

Increasing environmental needs and the rise of national and international competition will require policy-makers to focus on how the region and the state can sustain and build on this momentum. The Brookings study makes a number of recommendations for how governments can do this at the national, state and regional/metropolitan levels.

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The Bay Area Council Economic Institute is a public-private partnership of business, labor, government and higher education that works to support the economic vitality and competitiveness of California and the Bay Area. Its work builds on the twenty-year record of fact-based economic analysis and policy leadership of the Bay Area Economic Forum, which merged with the Bay Area Council in January 2008. The Association of Bay Area Governments is a founder and key institutional partner. The Economic Institute also supports and manages the Bay Area Science and Innovation Consortium (BASIC), a partnership of Northern California's leading scientific research institutions and laboratories. Through its economic and policy research and partnerships, the Economic Institute addresses major issues impacting the competitiveness, economic development and quality of life of the region and the state, including infrastructure, globalization, science and technology, and governance. Its Board of Trustees, which oversees the development of its products and initiatives, is composed of leaders representing business, labor, government, higher education, science and technology, and philanthropy.

The Bay Area Council is a business-sponsored, public-policy advocacy organization for the nine-county Bay Area. The Council proactively advocates for a strong economy, a vital business environment, and a better quality of life for everyone who lives here. Founded in 1945, as a way for the region's business community and like-minded individuals to concentrate and coordinate their efforts, the Bay Area Council is widely respected by elected officials, policy makers and other civic leaders as the regional voice of business in the Bay Area. Today, more than 275 of the largest employers in the region support the Bay Area Council and offer their CEO or top executive as a member.

The Association of Bay Area Governments (ABAG) is the official comprehensive planning agency for the San Francisco Bay Area region. ABAG's mission is to strengthen cooperation and coordination among local governments. ABAG addresses social, environmental, and economic issues that transcend local borders, such as land use, growth management, housing, and economic competitiveness. All nine counties and 101 cities within the Bay Area are voluntary members of ABAG, representing nearly all of the region's population.

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