Virginia

Profile of the Green Economy

NGA Center for
BEST PRACTICES

The National Governors Association Center for Best Practices commissioned Collaborative Economics, Inc. to analyze and prepare reports on the emerging green economy in each state. These reports are based on green businesses across the 15 green industry segments of the core green economy and are designed to help each state make informed decisions about its workforce, economic and energy development opportunities and strategies.

For more information, contact:
Mary Jo Waits, mjwaits@nga.org, or
Sue Gander, sgander@nga.org
NGA Center for Best Practices: www.nga.org/center

Prepared by

COLLABORATIVE ECONOMICS

For more information, contact:
Tracey Grose
VP Research & Strategic Development
785 Castro Street, Suite A
Mountain View, CA 94041
650.623.3084
grose@coecon.com
www.coecon.com

VIRGINIA'S GREEN ECONOMY SUMMARY

The emerging green economy is diverse and widespread. To varying degrees, every state is witnessing growth in some green industry segment, and more often than not, this business growth is building off of existing strengths in the state. Familiar products and services are finding new uses or are taking new forms in response to new market demands. As policy makers implement new standards (e.g. building effiency standards, renewable portfolio standard), incentives and regulations, new business opportunities emerge to meet growing demand.

Analyzing a state's green economy in terms of the scope of green business activity can reveal areas of comparative advantage, promising areas for R&D investment and workforce development, and opportunities for building partnerships within and across green industry segments. Additionally, as incentives and new regulations are introduced, this information reveals the extent of a state's business base for meeting the coming demand for things such as highly efficiency appliances, renewable energy generation systems, high-efficiency building products, and low-emission fuels.

This analysis examines core green business activity and focuses on businesses that provide products and services that do the following:[1]

- Provide alternatives to carbon-based energy sources
- Conserve the use of energy and all natural resources
- Reduce pollution (including GHG emissions) and repurpose waste.

In addition, this summary provides an initial view into innovation in the fields of clean and green technology. State trends in venture capital investment and patent registrations can provide some indication for areas of future business activity.
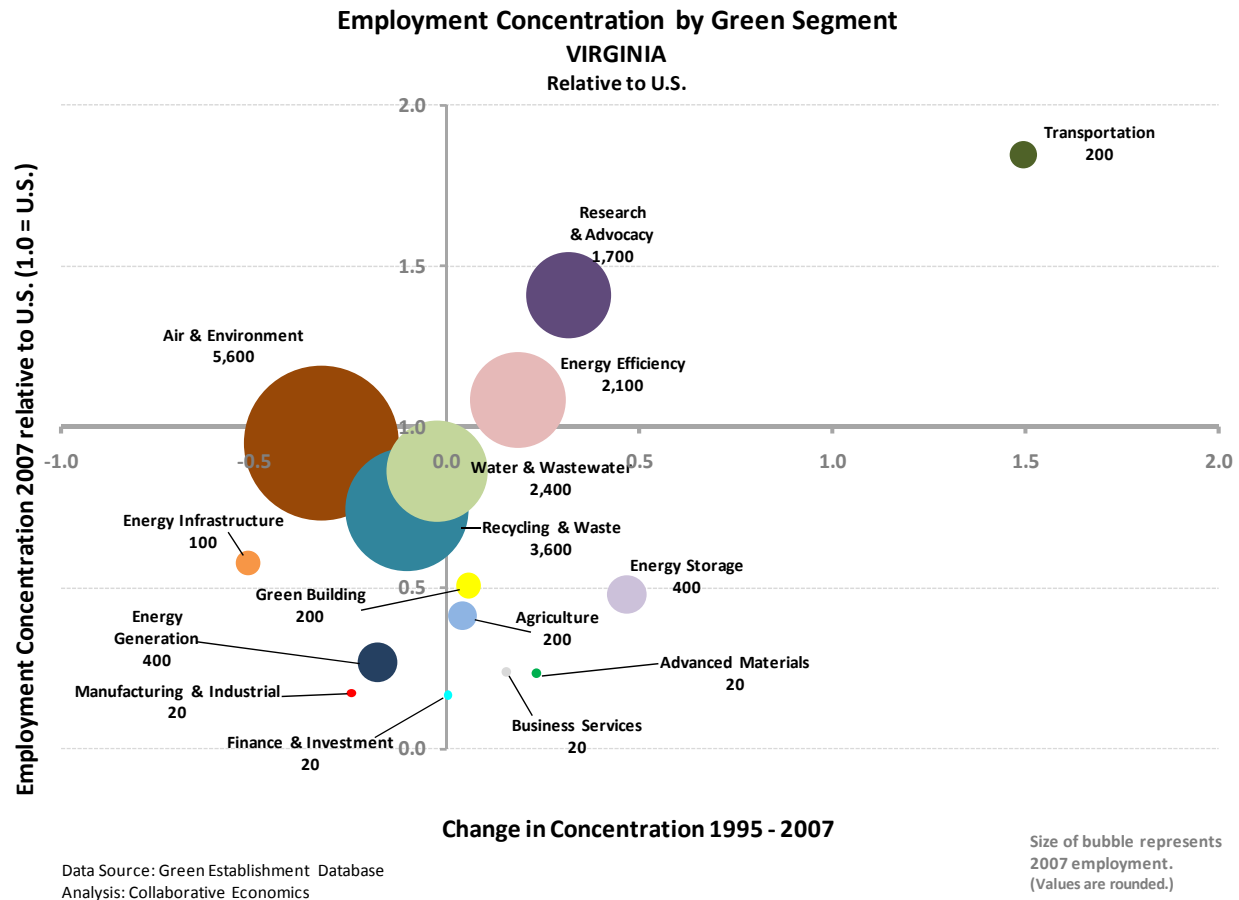
Green Business Activity

Virginia's green economy summary displays a diverse array of green businesses with different levels of specialization. Virginia is clearly a national leader in Transportation (see Employment Concentration by Green Segment graph, commonly called a "bubble chart"). Other areas of growing comparative advantage are in Research & Advocacy, Energy Efficiency, and Energy Storage.

Each "bubble" represents one of the 15 green segments, and its size represents the **employment size**.[2] (The segments are described in a detailed table below.) With roughly 5,600 jobs, Air & Environment accounts for the largest employment of Virginia's green segments.

High **employment concentration** in a particular green segment indicates an area of strength and comparative advantage for a state. This means that the percentage of total employment in a particular segment is higher than the national average.[3] For example, Virginia's Transportation is nearly twice as concentrated as the U.S. average, and Research & Advocacy is 1.4 times as concentrated.

Between 1995 and 2007, some segments have witnessed a **change in concentration** either by becoming more specialized over time or diminishing in concentration. This change is displayed by the placement along the horizontal axis (i.e. x-axis). Between 1995 and 2007, Virginia's concentration in Energy Storage increased by 40 percent. Employment concentration increased by 29 percent in Research & Advocacy and 20 percent in Energy Efficiency.

Areas with high and increasing levels of concentration typically signal promising areas for targeting investment in R&D and commercialization, building university centers of excellence, as well as areas for focusing workforce development.

Employment Concentration by Green Segment
VIRGINIA
Relative to U.S.

Employment Concentration 2007 relative to U.S. (1.0 = U.S.)

Transportation
200

Research
& Advocacy
1,700

Air & Environment
5,600

Energy Efficiency
2,100

Water & Wastewater
2,400

Energy Infrastructure
100

Recycling & Waste
3,600

Energy Storage
400

Green Building
200

Energy
Generation
400

Agriculture
200

Advanced Materials
20

Manufacturing & Industrial
20

Business Services
20

Finance & Investment
20

Change in Concentration 1995 - 2007

Data Source: Green Establishment Database
Analysis: Collaborative Economics

Size of bubble represents
2007 employment.
(Values are rounded.)

Taken together, these three dimensions represented in the bubble chart help to illustrate the characteristics of Virginia's green economy. A more extensive green economy profile of Virginia could compare growth in the green economy to that of the economy as a whole. Deeper analysis of Virginia's leading segments such as Transportation would reveal detailed areas of specialization within the segment by the specific transportation technologies or by the types of activities such as R&D or component manufacturing. A deeper analysis could also result in a set of company snapshots that not only describe what the company does but also what its related industries are. For example, because the technologies are closely related, much of California's solar industry emerged from its semiconductor industry.

Green Technology Innovation

Since the global energy crisis in the 1970s, technology innovation in fields related to renewable energy sources and energy efficiency have taken place in waves. These waves reflect changes in public policy such as in research priorities set for federal funding (e.g. solar in the 1970s) as well as technological advance which spurred innovation in battery technology for small, remote devices like laptops and cell phones in the 1990s.

Regional variations exist in terms of where technological breakthroughs are taking place and where the adoption of new technology and practices is being spurred. Patent registrations and venture capital investment in technologies and processes that support alternatives to the carbon-based economy are two ways to track green technology innovation.

From 2007 to 2008, cleantech venture capital (VC) investment in Virginia grew by 61 percent, with total investment reaching $33.4 million in 2008.

United States venture capital (VC) investment in clean technology reached an all-time high of $6 billion in 2008. Between 2007 and 2008 alone, total U.S. cleantech VC grew by 51 percent. In terms of the top segments attracting investment dollars, Energy Generation is the largest U.S. cleantech segment, accounting for 59 percent of total U.S. cleantech VC investment, followed by Energy Efficiency (8%), Energy Infrastructure (7%) and Energy Storage (7%). Energy Infrastructure is the fastest growing segment, increasing by $273 million from 2007 to 2008. Other top growing segments include Energy Generation, Manufacturing/Industrial, and Energy Generation.

Between 2006 and 2008, 29 patents were registered in green technology by inventors located in Virginia. The number of green technology patents increased by 81 percent between the periods 1994-1996 and 2006-2008.

For the U.S. as a whole, a total of 2,391 green technology patents were registered

Venture Capital Investment in Clean Technology
VIRGINIA

Data Source: Cleantech Group™, LLC (www.cleantech.com)
Analysis: Collaborative Economics

Green Technology Patents
VIRGINIA

Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File
Analysis: Collaborative Economics

by American inventors between 2006 and 2008. Battery technology accounts for the largest share of patents (35%) registered in the U.S., followed by Fuel Cell technology (31%), and Hybrid Systems (11%). Growing by 61 percent over the recent periods, Wind Energy was the fastest growing area of green technology patent registrations (three-year periods 2003-05 to 2006-08).

While not provided in this summary, a "deeper-dive" into a state's green economic profile could include the following:

- Cleantech Venture Capital Investment, by Segment
- Patent Registrations in Green Technology, by Technology Area
- Adoption of Green Technology (e.g. the percentage of energy generation from renewable sources, the percentage of vehicle registrations that are for alternative fuel vehicles)
- Energy Efficiency and Intensity (e.g. energy consumption, electricity consumption, greenhouse gas emissions relative to economic growth)
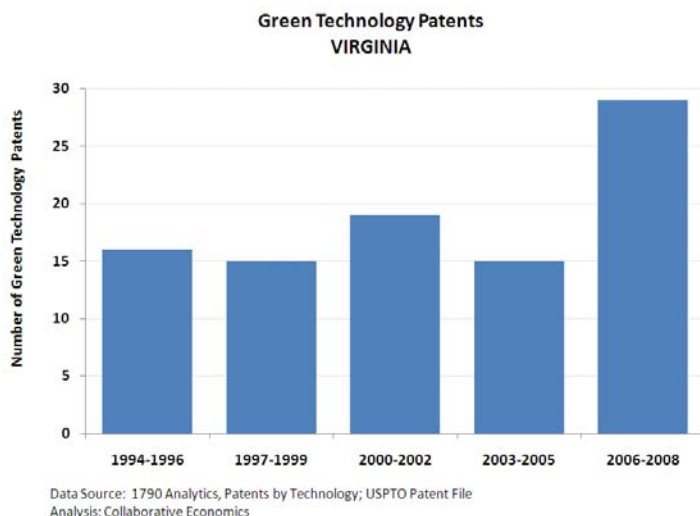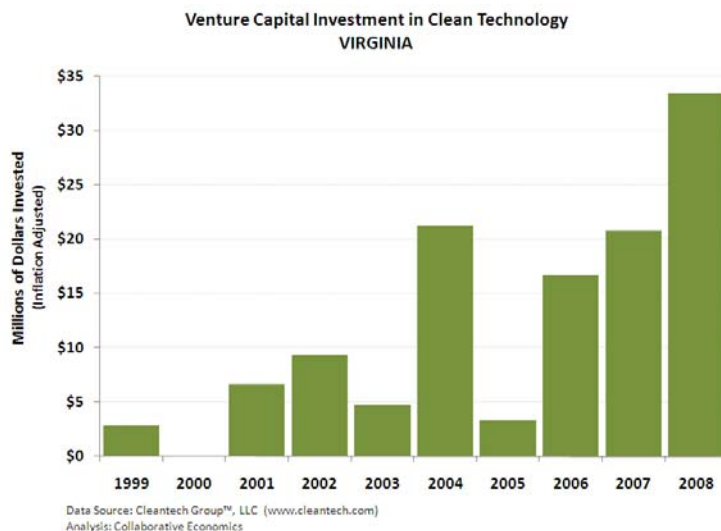
Fifteen Segments of the Green Economy

As published in Next 10's 2009 *California Green Innovation Index*:

GREEN SEGMENT	DESCRIPTION
1. **Energy Generation**	• Renewable energy generation (all forms of solar, wind, geothermal, biomass, hydro, marine & tidal, hydrogen, co-generation) • Associated equipment, controls, and other management software and services • Renewable energy consulting services • Research & Testing in renewable energy
2. **Energy Efficiency**	• Energy conservation consulting and engineering services • Building efficiency products and services • Alternative energy appliances (solar heating, lighting, etc.) • Energy efficiency research • Energy efficiency meters & measuring devices
3. **Transportation**	• Alternative fuels (biodiesel, hydrogen, non-corn-based ethanol) • Motor vehicles & equipment (electric, hybrid, and natural gas vehicles, diesel technology)
4. **Energy Storage**	• Advanced batteries (Li-Ion, NiMH) • Battery components & accessories • Fuel cells
5. **Air & Environment**	• Emissions monitoring & control • Environmental consulting (environmental engineering, sustainable business consulting) • Environmental remediation
6. **Recycling & Waste**	• Consulting services • Recycling (paper, metal, plastics, rubber, bottles, automotive, electronic waste and scrap) • Recycling machinery manufacturing • Waste treatment
7. **Water & Wastewater**	• Water conservation (control systems, meters & measuring devices) • Development and manufacturing of pump technology • Research and testing • Consulting services • Water treatment and purification products and services
8. **Agriculture**	• Sustainable land management and business consulting services • Sustainable supplies and materials • Sustainable aquaculture
9. **Research & Advocacy**	• Organizations and research institutes focused on advancing science and public education in the areas of: renewable energy and alternative fuels and transportation.
10. **Business Services**	• Environmental law legal services • Green business portals • Green staffing services • Green marketing and public relations
11. **Finance & Investment**	• Emission trading and offsets • Venture capital and private equity investment • Project financing (e.g. solar installations, biomass facilities, etc.)
12. **Advanced Materials**	• Bioplastics • New materials for improving energy efficiency
13. **Green Building**	• Design & construction • Building materials • Site management • Green real estate & development
14. **Manufacturing & Industrial**	• Advanced packaging • Process management • Industrial surface cleaning
15. **Energy Infrastructure**	• Consulting and management services • Cable & equipment

DATA NOTES

Green Business Activity

The nationwide analysis of green business activity was designed and conducted by Collaborative Economics, Inc. on behalf of the Pew Charitable Trusts. The methodology built off of earlier work carried out on behalf of Next 10, a California-based nonprofit, and published in the *California Green Innovation Index* (2008, 2009). The Pew Center on the States reformatted the results of the analysis and developed the report, *The Clean Energy Economy* (June 2009).

The accounting of green business establishments and jobs is based on multiple data sources (including New Energy Finance and the Cleantech Group^{TM}, LLC) for the identification and classification of green businesses and also leveraged a sophisticated internet search process. Collaborative Economics designed the parameters of the internet search platform which was engineered by QL2, a Seattle-based developer of business intelligence tools. The National Establishments Time-Series (NETS) database based on Dun & Bradstreet business-unit data was sourced to extract business information such as jobs. The operational definition of green is based primarily the definition of cleantech defined by the Cleantech Network. This sample offers a conservative estimate of the industry.

Green Technology Innovation

The Cleantech Group™, LLC provided venture capital investment data in Cleantech for all disclosed deals. The Cleantech Group™, LLC describes Cleantech as new technology and processes, spanning a range of industries that enhance efficiency, reduce or eliminate negative ecological impact, and improve the productive and responsible use of natural resources. Investment values were adjusted for inflation and are reported in 2008 dollars using the U.S. city average Consumer Price Index (CPI) of all urban consumers, published by the Bureau of Labor Statistics, U.S. Department of Labor.

Patent registrations in green technology are based on tailored search of U.S. Patent & Trade Office data performed by 1790 Analytics, a firm specializing in intellectual property evaluation services. Collaborative Economics defined the search parameters, and 1790 Analytics provided the search results for patents in the following fields of green technology: geothermal, hydro, solar & wind energy generation, energy storage, fuel cells, hybrid systems, batteries, and energy infrastructure.

END NOTES

[1] Nuclear energy generation is not included in their definition of the core green economy. However, CEI can carry out a state-level analysis of the nuclear energy industry.

[2] The jobs numbers reported in this analysis reflect all jobs at these business locations. In the case of multi-establishment companies, only the green establishments are included. While this approach does not examine specifically green occupations that are appearing across the entire economy (such as Chief Sustainability Officer), it does account for the businesses behind the products and services that these new professionals need to use in their jobs (such as advanced metering devices, co-generation equipment, and various high-efficiency materials).

The lack of standardized industry data with information on "green" products, services and occupations has resulted in the development of multiple methodological approaches to defining "green jobs" and the green economy. The definitions of green vary largely depending upon the underlying unit of measurement (i.e. data). Some approaches focus on the activities of occupations. Other approaches focus on businesses offering "green" products and services, while others focus on businesses that operate in a "green" manner regardless of the end products and services they sell. All of these approaches are valid and, from different vantage points, contribute to a better understanding of the emerging green economy.

[3] The employment concentration is represented in the placement of the bubble along the vertical (i.e. y-axis). A concentration of 1 indicates that the percentage of the state's green business employment in a given segment is equal to that for the U.S. as a whole.