Tracking Jobs in Clean Industries in New England

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Interest in "clean industries" as a source of economic development—especially as a potential source of jobs—is growing. Such industries may include products and services used to store and conserve energy, produce energy from renewable and low-carbon sources, treat waste, and conserve and manage water and other natural resources.

However, tracking jobs in clean industries—often called "green jobs"—is difficult because, unlike the high-technology sector, the clean-industries sector lacks a standard definition of which industries the sector actually comprises. This article explores four definitions of the sector: two defined by measures developed by analysts at highly respected institutions, and two defined by measures we created based on widely used databases. We use these definitions to analyze the composition and concentration of jobs in clean industries in New England and each state in the region and compare these figures with the national average. In doing so we show how the findings vary with the definition of the clean-industries sector.

Despite these differences among the various approaches, our investigation shows that New England as a whole—as well as some individual states in the region—has fairly strong concentrations of clean-industries jobs relative to the national average. If we extrapolate from recent trends, the comparison suggests that the region has the potential for job growth in several clean industries. However, measuring such growth—and the success of policies designed to promote it—will remain challenging without a standard definition of the sector.

Four Definitions of "Clean Industries"

There are inherent difficulties in estimating the number of jobs in clean industries. All four approaches documented here define the sector and the industries it comprises and then measure the total number of jobs at firms and business establishments—units of larger firms whose headquarters may be located outside the region—in these industries. This means that defining the sector narrowly is likely to underestimate the number of clean jobs, while defining it broadly is likely to overestimate the number of jobs because the definition includes industries unrelated to the provision of renewable energy, the conservation of nonrenewable energy, and other clean activities. In this article we consider a range of definitions.

In *The Clean Energy Economy* (2009), analysts at the Pew Charitable Trusts identify five industry categories in the sector and 16 industry segments in the categories, which they track from 1998 to 2007.[1] The categories include clean energy, energy efficiency, environmentally friendly production, conservation & pollution mitigation, and training & support (See Table 1). The Pew report has drawn significant media coverage.[2] However, the analysis is proprietary, making it difficult to fully replicate and update the approach.

In *Sizing the Clean Economy* (2011), analysts at the Brookings Institution define clean industries in greater detail and more transparently. They identify five general categories as well as 39 industry segments in the sector, which they track from 2003 to 2010.[3] The broad categories include energy & resource efficiency, agricultural & natural resources conservation, renewable energy, education & compliance, and greenhouse gas reduction, environmental management, & recycling (see Table 1).

The third definition of clean industries we explore is the most expansive: it includes industries that have been cited for clean activity by the Pew and Brookings analysts, and by analysts at the University of California at Berkeley, and that also have potential for growth (see Table 1). We base this definition on

Table 1. Four Definitions of "Clean Industries"

An appendix at Indicator's website provides more detail on all four definitions of clean industries: http://www.bostonfed.org/economic/neei/index.htm

Source	Includes
PEW ("clean energy")	Clean energy; Energy efficiency; Environmentally friendly production; Conservation & pollution mitigation; Training & support
Brookings ("clean economy")	Energy & resource efficiency; Agricultural & natural resources conservation; Renewable energy; Education & compliance; Greenhouse gas reduction, environmental management, & recycling
NAICS (broad measure of clean industries)	Electric power generation, transmission & distribution; Utility system construction; Ventilation, heating, air-conditioning, & commercial refrigeration equipment manufacturing; Engine, turbine, & power transmission equipment manufacturing; Navigational, measuring, electromedical, & control instruments manufacturing; Electric lighting equipment manufacturing; Other electrical equipment & component manufacturing; Architectural, engineering, & related services; Management, scientific, & technical consulting services; Scientific research & development services; Other professional, scientific, & technical services
NETS (energy services and research)	Electric power generation, transmission, & services; Energy conservation & management; Energy engineering & architectural services; Energy conservation & building products; Other

the North American Industrial Classification System (NAICS). Analysts from Moody's Analytics helped us finalize the list of industries and track data on employment in these industries using data from the U.S. Bureau of Labor Statistics (BLS), which bases its figures on NAICS.[4] These BLS data are available through 2009.

The final definition of the clean-industries sector we consider is the narrowest of the four: it encompasses business establishments in energy services and research industries that Berkeley analysts included in a 2010 research paper on the green economy (see Table 1).[5] We drew information on employment at business establishments in these industries from the National Establishment Time-Series Database (NETS).[6] NETS data are available through 2009.

We used 2007 data from all these sources for most of our analysis, because 2007 was the last year included in the Pew report. Where available, more recent data appear in an appendix to this report, posted on the *New England Economic Indicators* website: http://www.bostonfed.org/economic/neei/index.htm.

Where the Clean-Industries Jobs Are

The distribution of clean-industries jobs varies with the definition of the sector. Under the Pew approach, conservation & pollution mitigation accounts for well over one-half of all employment in clean industries, in both the region and the nation (see Figure 1). The region records the strongest concentration of clean-industries jobs relative to the nation in training & support (10.2 percent versus 6.8 percent).[7] The region also has a higher concentration of jobs in both energy efficiency and clean energy relative to the nation, under the Pew approach.

Under the Brookings definition, well over one-third of all clean-industries jobs are in greenhouse gas reduction, environmental management, & recycling, in both New England and the nation (see Figure 2). The education & compliance industry provides the second-largest share of clean-industries jobs. The region records the strongest concentration of jobs relative to the nation in agricultural & natural resources conservation (10.0 percent versus 4.8 percent), under the Brookings approach.

According to the NAICS definition, the largest share of clean-industries jobs occurs in architectural, engineering, & related services, in both New England and the nation: 22.3 percent and 27.0 percent, respectively (see Figure 3). The region records the highest concentration of clean jobs relative to the nation in navigational, measuring, electromedical, & control instruments manufacturing (15.9 percent versus 8.4 percent) and in scientific research & development services (16.3 percent versus 11.3 percent) under the NAICS definition.

According to the NETS definition, a large majority of clean-industries jobs occurs in electric power generation, transmission, & services in both the region and the nation (see Figure 4). However, the share of regional jobs in that industry trails the national share (73.6 percent versus 82.5 percent). The region records the highest concentration of clean-industries

Figure 1. - Share of Total Jobs in Various Clean-Industry Categories, under the Pew Definition, 2007

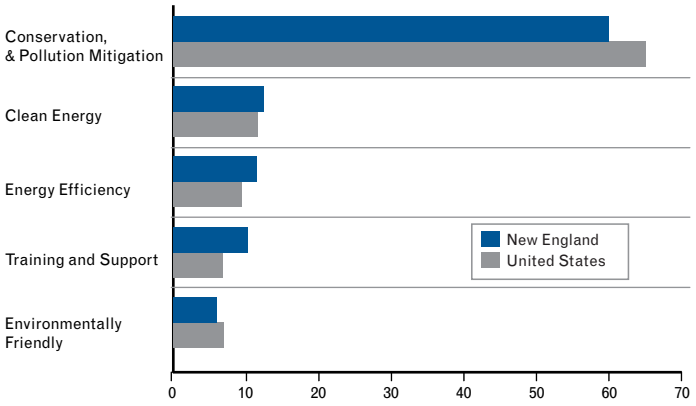


Figure 2 - Share of Total Jobs in Various Clean-Industry Categories, under the Brookings Definition, 2007

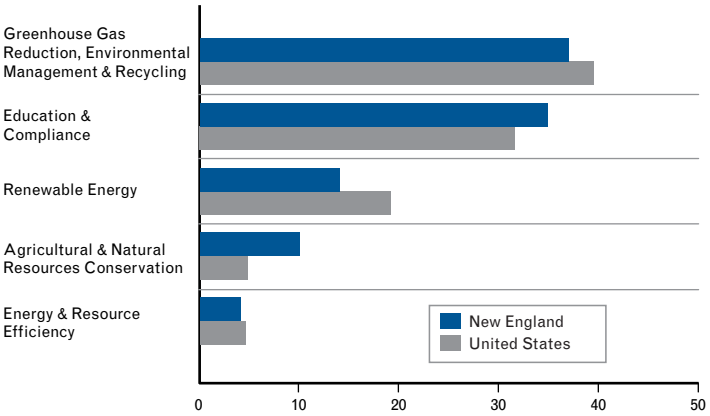
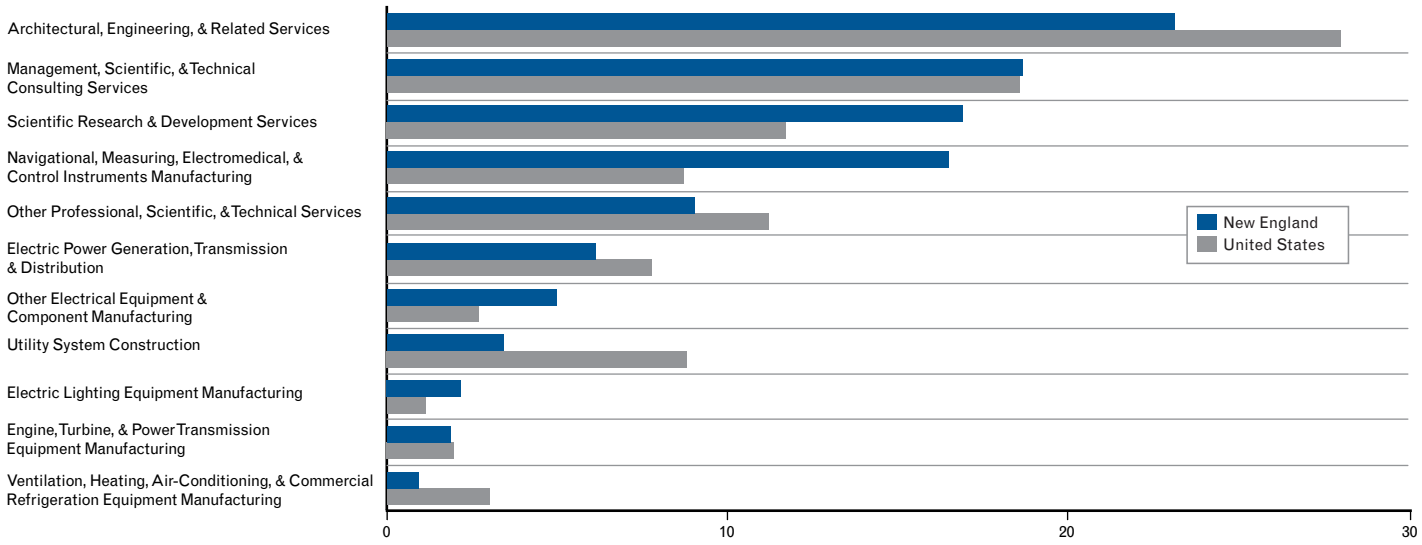


Figure 3. Share of Total Jobs in Various Clean Industries, under the NAICS Definition, 2007



jobs relative to the nation in energy conservation & management (12.9 percent versus 5.4 percent). The region also has a higher concentration of jobs in energy engineering & architectural services and energy conservation & building products than the nation.

The total number of jobs in clean industries in New England varies widely with the definition of the sector (see Table 2). In 2007, this total ranges from 12,418 under the NETS definition to 310,900 under the NAICS definition. Similarly, the number of clean-industries jobs in each state in the region varies with the definition. Under the NAICS measure, Massachusetts had 177,860 clean-industries jobs in 2007, but under the NETS measure, the state had just 3,905 jobs (see Figure 5). (For changes in job totals over time under the four definitions, see Table A5 in the online appendix.)

The share of clean-industries jobs in total employment is a better measure of the relative strength of the sector than are the raw employment numbers. As with the raw numbers, the share of clean-industries jobs in New England varies with the definition of the sector, ranging from 0.2 percent under the NETS definition to 4.4 percent under the NAICS definition (see Figure 6). The Pew and Brookings estimates are in between, at 0.7 percent and 1.8 percent of total employment, respectively. The four definitions appear in the same order when ranking the national share of employment devoted to clean industries, ranging from 0.2 percent to 3.9 percent.

How does the percentage of clean-industries jobs in New England compare with the national average? Under the Pew and NAICS definitions, the region's share of clean-industries jobs in total employment is higher than the national share. Under the Brookings and NETS definitions, the regional share is virtually the same as the national average.

Figure 4. - Share of Total Jobs in Various Clean Industries, under the NETS Definition, 2007

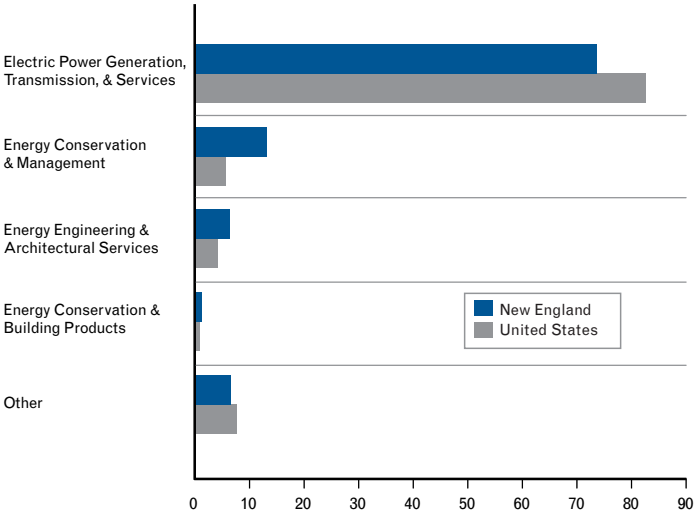
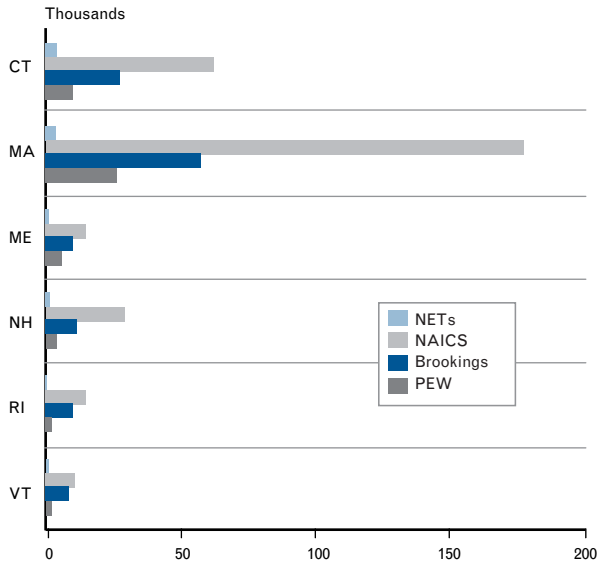


Figure 5. - Number of Jobs in Clean Industries in the New England States, 2007



Clean-Industries Jobs as a Share of Total Employment: New England States

We can also use the four definitions to compare the share of clean-industries jobs in each New England state with the national average. According to the Pew analysis, all the New England states except Rhode Island have concentrations of clean-industries jobs at or above the national average of 0.6 percent (see Figure 6).[8] At 0.5 percent, Rhode Island's share of these jobs lags the national average slightly, with the state's share of clean-industries jobs lower than the national average in all five of Pew's clean-industries categories. (That is, Rhode Island is not particularly weak or strong in any one category.)

According to the Pew analysts, Maine has the highest concentration of clean-industries jobs among the New England states (1.0 percent of total employment). This ranking reflects Maine's relatively high concentration of jobs related to energy efficiency, which account for 40 percent of Pew's clean-industries jobs in this state.

According to the Brookings analysts, Vermont has the highest share of clean-industries jobs in the region (2.8 percent)—and this share is substantially higher than the national average. Vermont's high concentration reflects the state's relatively high percentage of jobs in organic food & farming, conservation, and waste management & treatment. All the other New England states have shares of clean-industries jobs closer to the national average under this measure, with Rhode Island and New Hampshire above the national average, and Massachusetts, Maine, and Connecticut slightly below the national average.

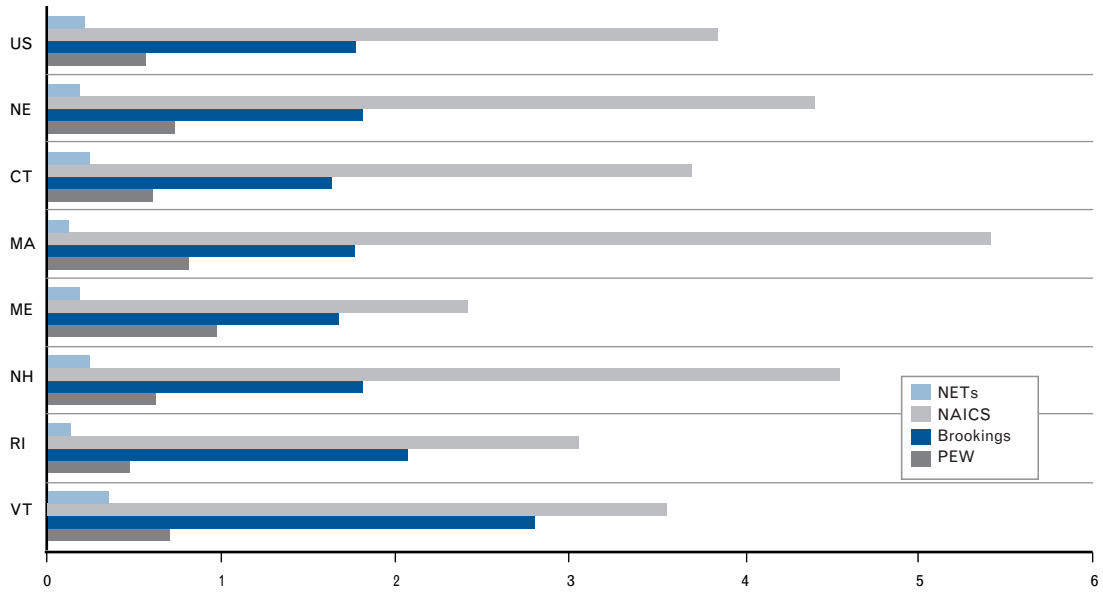
Under the NAICS-based definition, Massachusetts has the highest concentration of clean-industries jobs in the region (5.4 percent). This high concentration reflects the state's strong position in scientific research & development services, and architectural, engineering, & related services. With clean industries representing only 2.4 percent of total employment, Maine lags considerably behind the other New England states under the NAICS definition. This reflects a relatively weak position in several of the state's manufacturing-based clean industries, which are more heavily represented in the NAICS-based measure than in the other measures.

Under the NETS-based definition, Vermont again has the highest share of clean-industries jobs in the region (0.4 percent). Vermont's strength reflects the fact that local producers of electricity provide a high share of the state's power. In fact, the amount of electricity these producers generate is nearly one-third higher than total retail sales

Table 2. Total Jobs in Clean Industries, New England and the Nation, 2007

	PEW	Brookings	NAICS	NETS
New England	51,343	126,275	310,900	12,418
United States	765,060	2,418,207	5,261,130	282,467

Figure 6. - Clean-Industries Jobs as a Share of Total Employment: New England and the Nation, 2007



in the state, so Vermont's electricity producers are net exporters.[9] The state's two largest employers under the NETS definition are both in industry segments that encompass electricity generation, including nuclear power (see the online appendix). Massachusetts, by contrast, is an electricity importer and the only state in the region where retail electricity sales are higher than net electricity generation. This contributes to the state's having one of the lowest shares (0.1 percent) of NETS clean-industries jobs in New England.

Is Employment in Clean Industries Growing?

We can further use the four definitions to examine the growth of employment in clean industries. The challenge here is that the Brookings analysts used data that begin in 2003, while the other three definitions are based on data that begin in 1998.

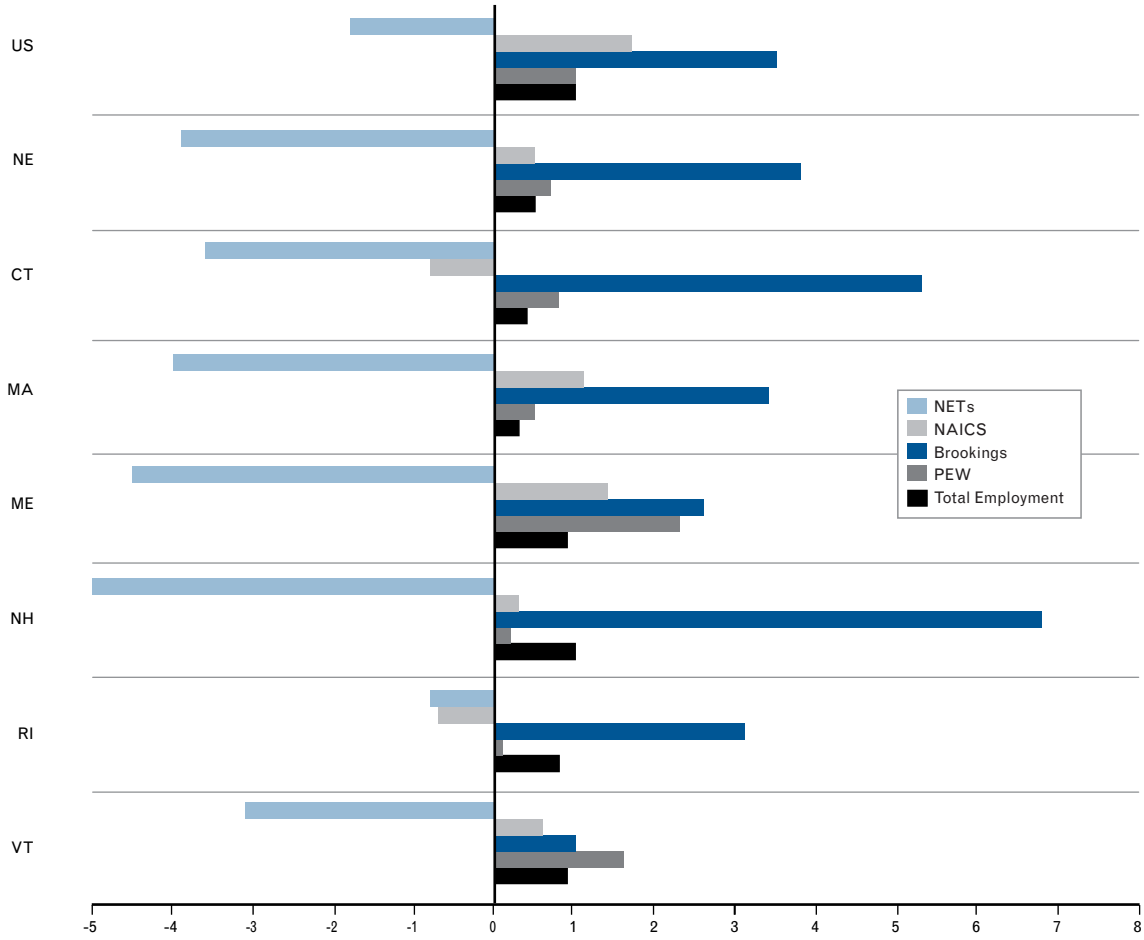
Annual total employment growth in the nation and New England averaged 1.0 percent and 0.5, respectively, from 1998 to 2007, and 0.7 and 0.5 percent, respectively, from 2003 to 2007. It is important to keep in mind the lower growth in the latter period when comparing figures from Brookings with those under the other definitions.

The Pew analysts found that clean-industries employment grew faster in the nation than in New England (1.0 percent versus 0.7 percent annual average from 1998 to 2007). Clean-industries employment growth was the same as overall employment growth nationally (1.0 percent), but was somewhat faster than overall employment growth in the region(0.7 percent compared to 0.5 percent).

Among the New England states, Maine and Vermont had the highest employment growth in Pew-defined clean industries from 1998 to 2007. These two states have been among the most active in the nation in tackling climate change and spurring the development of clean industries, through efforts such as state climate adaptation plans and public benefit funds, which are used to support investments in clean energy. These policies may have proved especially beneficial in boosting the share of clean-industries jobs in these states because of their relatively small initial employment base in this sector.[10]

As with the Pew definition, employment in NAICS-defined clean industries grew faster in the nation than in New England from 1998 to 2007 (1.7 versus 0.5 percent annual average). Clean-industries employment grew more slowly in Massachusetts, Maine, New Hampshire, and Vermont than in the nation, and actually declined in Connecticut and Rhode Island. These drops could reflect the overall weakness of the industrial and high-tech sectors in the latter two states, rather than a shortcoming in clean industries in particular.

Figure 7. - Annual Average Percent Changes in Clean-Industries Jobs and Total Employment: New England and the Nation, 1998–2007



Notes: The figures represent average annual changes from 1998 to 2007, except for the Brookings figures, which represent average annual changes from 2003 to 2007.
Growth rates in total employment from 2003 to 2007 were 0.7 percent in the nation, 0.5 percent in New England, 0.0 percent in Connecticut, 0.1 percent in Massachusetts, 1.6 percent in Maine, 1.2 percent in New Hampshire, 1.4 percent in Rhode Island, and 1.2 percent in Vermont.

In contrast to the Pew analysis, the NAICS definition shows clean-industries employment rising as a share of overall employment nationwide, but maintaining a constant share of overall employment in the New England region from 1998 to 2007. Massachusetts and Maine were the only two New England states where the NAICS definition indicates that clean industries gained employment share during this period.

According to the NETS definition, clean-industries employment declined in the nation, and even more dramatically in New England from 1998 to 2007 (-1.8 percent versus -3.9 percent annual average). The decline in the NETS measure employment in the nation and region could reflect energy conservation and efficiency efforts coupled with industry downsizing and measures to improve productivity, with the sharper decline in the region reflecting lower population growth and greater energy conservation and energy efficiency effort in New England than the national average. The more modest decline in Rhode Island could partly reflect the fact that the state began with the lowest share of clean-industries jobs in 1998, according to this definition.

Under the Brookings definition, with the more limited time frame, employment in clean industries grew faster than total employment in both New England and the nation from 2003 to 2007 (see Figure 7). However, employment in clean industries grew faster in New England than in the nation (3.8 percent versus 3.5 percent, as an annual average during that time), while total employment grew more slowly in New England than nationally (0.5 percent versus 0.7 percent).

New Hampshire saw the most significant job growth in clean industries in the region, according to Brookings, averaging 6.8 percent annually from 2003 to 2007—well above the U.S. average (3.5 percent).

New Hampshire's relatively rapid growth occurred in regulation & compliance and renewable energy The rise in regulation & compliance may reflect New Hampshire's adoption of policies designed to combat climate change, although other states in the region have also enacted such legislation. Connecticut's growth in Brookings-defined clean industries (an average of 5.3 percent per year) also exceeded the U.S. rate of growth by a substantial margin.

After 2007, overall economic conditions deteriorated during the Great Recession. Total annual employment fell for three consecutive years, both nationally and in New England, with the steepest declines occurring between 2008 and 2009. How did clean industries weather this downturn?

The three available sources differ in their answers.[11] Under two of the three definitions, clean industries fared better than other sectors of the economy. Clean industries fared worse than overall employment only under the narrow NETS definition, with clean-industries' shares of total employment declining from 2007 to 2009 in the nation and New England.

The Brookings analysis shows more jobs in clean industries in 2010 than in 2007 nationally, in New England, and in each New England state except Rhode Island. Brookings definition clean-industries shares also rose in the nation and in all of the New England states, including Rhode Island.

The NAICS-based analysis generally shows net decreases in clean-industries employment from 2007 to 2009. The only exception is a slight increase in clean-industries jobs in Massachusetts. However, clean-industries shares of total employment rose in the nation, New England, and all states in the region except Connecticut and New Hampshire from 2007 to 2009. This means that clean industries fared better than other sectors of the economy during this period under the NAICS definition.

Conclusion

This investigation shows that the level, concentration, and growth of jobs in clean industries in New England vary significantly with the definition of the sector. Considered together, the four measures suggest that clean industries account for anywhere from 0.2 percent to more than 4 percent of jobs today. If the general patterns of the 1990s and 2000s continue, these industries have good potential to provide more employment in the future—particularly in segments other than the energy supply industry.

Promising areas include scientific research & development services, measurement & control instruments manufacturing, energy conservation & management, and agriculture & natural resources conservation. Taken together, this analysis also suggests that Vermont, Maine, and Massachusetts have the strongest clean industries in the region, while Rhode Island lags the other New England states in this arena. State policymakers may want to consider these strengths, weaknesses, and opportunities when designing their economic development strategies.

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Endnotes

1 Pew Charitable Trusts, The Clean Energy Economy, Washington, DC, 2009. Online at http://www.Pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf.

2 See "Greening the Rustbelt," Economist, August 13, 2009; Michael Burnham, "Green Sector Jobs 'Poised for Explosive Growth,' Study Says," New York Times, June 10, 2009; "New Map: The Economics of Clean Energy in 50 States," Washington, DC, Center for American Progress, online at http://www.americanprogress.org/issues/2009/10/50_state_energy.html; Jim Tankersley and Don Lee, "China Takes Lead in Clean Tech Investment," Los Angeles Times, March 25, 2010; Dan Shapley, "The Five Best Cities for Green Jobs," Huffington Post, March 18, 2010, online at http://www.huffingtonpost.com/2010/01/11/the-5-best-cities-for-gre_n_415133.html; and Ron Pernick, The Clean Tech Market Authority, Clean Tech Job Trends, October 2009.

3 Mark Muro and Jonathan Rothwell, Sizing the Clean Economy: A National and Regional Green Jobs Assessment, Washington, DC: Brookings Institution, 2011, online at http://www.brookings.edu/metro/Clean_Economy.aspx. For citations, see Jack Spencer, "Media Loves 'Green Jobs,'" July 31, 2011, online at http://www.michigancapitolconfidential.com/15486; Douglas McIntyre, "Where the Green Jobs Are Growing in the U.S.," MSNBC, July 21, 2011, online at http://www.msnbc.msn.com/id/43774081/ns/business-going_green/t/where-green-jobs-are-growing-us; and "American Cities with the Fastest Green Jobs Growth," FoxBusiness, July15, 2011, online at http://www.foxbusiness.com/markets/2011/07/15/american-cities-with-fastest-green-jobs-growth/.

4 For more on NAICS, see http://www.census.gov/eos/www/naics/. For more on Moody's Analytics, see http://www.moodys.com/Pages/atc003.aspx.

5 Karen Chapple, Cynthia Kroll, T. William Lester, and Sergio Montero, Innovation in the Green Economy: The Mix of Innovation, Industries, and Regions in an Emerging Industry. Paper presented to the annual conference of the Industry Studies Association, Chicago, May 7, 2010. Online at http://www.industrystudies.pitt.edu/chicago10/2010%20Papers/Kroll%20-%20InnovationGreen.pdf.

6 Analysts can purchase information from NETS, a private database created by Walls and Associates and Dun and Bradstreet. See http://youreconomy.org/nets/NETSDatabaseDescription.pdf.

7 Training & support are jobs, businesses, and investments that provide specialized services to the other four Pew categories in the clean energy economy. Examples of jobs include financial analysts and consultants specializing in clean-industries investments; lawyers and paralegals providing legal services to the sector; and vocational teacher training new workers for the clean energy economy. All figures in the text and figures are rounded to one decimal place.

8 The figures presented here on Pew jobs as a percent of total employment differ slightly from those in The Clean Energy Economy. This is because we relied on figures for total 2007 employment from Moody's Analytics that reflect recent revisions from the U.S. Bureau of Labor Statistics. Thus the clean-industry shares of total employment in this report are generally lower than those in the Pew report.

9 U.S. Energy Information, Administration. http://www.eia.gov/cneaf/electricity/st_profiles/e_profiles_sum.html.

10 See Pew Center on Global Climate Change, U.S. Climate Policy Maps, March 2011. Online at http://www.Pewclimate.org/what_s_being_done/in_the_states/state_action_maps.cfm.

11 The Appendix includes data on clean-industries' performance during the Great Recession, from 2007 to 2010, under the Brookings, NAICS, and NETS definitions. Data under the Pew definition are available only from 1998 to 2007. See http://www.bostonfed.org/economic/neei/index.htm.