

# **Vermont Green Sector Project**

**Prepared on Behalf of the  
Vermont Workforce Development Council**

**July 2011**

## Table of Contents

<b>Section</b>	<b>Page</b>
<b>Introduction and Conclusions</b>	<b>3</b>
<b>I. Agriculture and Forestry</b>	<b>7</b>
<b>II. Energy Generation, Research and Environmental Services</b>	<b>11</b>
<b>IIA. Traditional/Renewable</b>	<b>11</b>
<b>IIB. Post-secondary Institutions</b>	<b>18</b>
<b>III. Green Construction</b>	<b>22</b>
<b>IV. Green Manufacturing</b>	<b>26</b>
<b>V. Green Transportation</b>	<b>33</b>
<b>VI. Recycling and Waste Reduction</b>	<b>37</b>
<b>Attachment 1: Participating Organizations</b>	<b>40</b>
<b>Attachment 2: Industry Occupations</b>	<b>42</b>
<b>Attachment 3: Industry Certifications and Degrees</b>	<b>44</b>
<b>Attachment 4: Reference and Resources</b>	<b>46</b>

# Vermont Green Sector Project

## Introduction:

The **Vermont Green Project** was a statewide business assessment funded through the Workforce Development Council in FY 2010-11 and in collaboration with local representatives of economic development, community action organizations, K-16 education organizations, and WIBs.

The assessment approach consisted of a series of one-on-one business interviews with organizations that represented targeted industries throughout the state. The focus was to determine their needs for workforce for the next five years. The Workforce Development Council wanted to understand the occupations that are in demand, as well as the skills, certifications and degrees required to support this part of the economy.

The goals were as follows:

1. To aggregate demand in consumer, commercial and industrial segments. Determine if the training needs could be addressed with funding either through the VT Green grant, State training funds or other sources.

Targeted industries include:

- Agriculture and Forestry
- Energy Generation, Research and Environmental Services
- Green Construction
- Green Manufacturing
- Green Transportation
- Recycling/Remediation

(Source H.R. 6: Independence and Security Act of 2007, Green Jobs.)

2. To learn about best practices in workforce development, job placement and collaborative training partnerships. Contribute to the database of employer contacts and practices.
3. To assess new employment and work practices including career ladder and upgrade training, as well as high performance work systems. Build business network for job placement.
4. To encourage organizations to participate in the VT Green Summit through their attendance at events and/or contributions on panels or forums.

The participating companies and organizations in this report are listed in Attachment 1.

## **Definitions:**

For our project, we used the definition of “green jobs” developed by the Bureau of Labor Statistics (BLS). According to BLS, green jobs are either:

- A. Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources.
- B. Jobs in which workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources.

In addition, we used O\*Net Green Sector Definitions and those are provided with each sector report.

**Summary of Conclusions:** The conclusions or observations about opportunity in each sector are summarized below, with the industries ranked in order of current activity and need as of July 2011.

## **Manufacturing:**

- All companies included in the interview process are aggressive in their actions to become optimally efficient—driven by the need to reduce costs and consumption of resources. To this end, several corporations interviewed compete against other plant locations and/or divisions within the corporation. The corporation is thus measuring outcomes, evaluating processes and sharing internal “best practices” in order to improve efficiency corporate wide, in the true sense of “learning organizations”.
- The role and responsibilities of the facilities managers in these organizations is gaining in importance and complexity. All interviewed had about 25 years experience in which they have gained cross-disciplinary knowledge and experience. Replicating that knowledge base is recognized as a huge challenge. The desire for a career pathway and education to support that was expressed in every location. They used the term “industrial processes technology” to describe the need.
- Engineers are needed, especially electrical and mechanical. Electronics technicians are also increasing needed to support robotics and computerized machine processes.
- Many manufacturers cite difficulty in attracting young workers, however, high tech companies have much less challenge in attracting workers—their challenge is in finding the right skills and aptitude for the job.

## **Energy Generation:**

- This sector is clearly in transition from traditional sources to renewables. It feels “weighted down” by the lack of clarity on the future. Investors in renewables are struggling to get to scale and it is not really clear when the

- tipping point will occur—issues exist in both federal and state policy (approval process, incentives, tax policy, etc.); consumer acceptance and willingness to invest; and to some degree, proven technology.
- Despite this murkiness in the environment, the prevailing view is that as a society we will need to retool for renewables—it is inevitable.
  - Therefore, the outlook is positive and all are forecasting growth with the accompanying employment opportunities.
  - The knowledge base required is high at this point. The need for engineers and the engineering discipline/problem solving mind set is most often cited.
  - The role for entry-level employment is also important. A knowledgeable workforce is required to sustain gains and achieve continuous improvement.

### **Transportation:**

- First, additional outreach and depth with this industry sector would be of value. Access to public transportation was narrowly confined to busing. Key portions of the industry were not included, based on availability, such as freight companies, rail or air transportation.
- Those involved in long-term planning as well as the engineering work on the highways and bridges contributed the most interesting information. From those interviews, the challenges that lie ahead became evident.
- They see a long transition period of “strategic disinvestment” in some current facilities based on the fact that we can no longer afford the maintenance for low volume use facilities. That process will require a change in user patterns. We will need to become increasingly receptive to public transportation.
- Investments will be required and the transition will be politically challenging.
- While this sector is not considered very attractive to potential workers, we will need to prepare people to assume these roles, especially as the current workforce in this industry is reaching retirement (or past retirement). The industry is already reaching out to underutilized target populations to fill the driver positions.

### **Construction:**

- What can you say about this industry? The general lack of demand, due to the economy, is stagnating.
- At the same time, the industry is experiencing significant change in processes and materials to support the greening of construction. Those developments are exciting and offer new challenge.
- There was a feeling of some optimism—perhaps because they felt it could not get worse—but even with that, the forecasted hiring was not expected to come up to pre-recession levels.

- Weatherization is gaining strength and movement. It may be getting to the point where additional auditors and implementers are needed. Training exists and is being utilized.
- The next hurdle is to penetrate the middle class market—this will be tough because the discretionary income is modest and the incentives are not strong enough. While people are interested in the savings, the cost of the change is still a barrier.

### **Agriculture/Forestry:**

- The Farm to Plate study and initiatives are far more in-depth than this project attempted to achieve (due to the fact that there was an in-depth study underway at the time).
- Opportunities that surfaced in my interviewing were primarily in the infrastructure that supports an agricultural economy—food storage, distribution, meat cutters and marketing.
- There are signs that more “career changers” are interested in the life style and are entering the field. This is creating new entrepreneurship and creativity in product development.
- “Farmers markets” are burgeoning throughout the state. Increasingly restaurants are also becoming “locally grown and organic” and both developments are adding to the strong tourism base.
- This sector is a key part of Vermont’s heritage. It is a very positive trend to see the renewed interest in agriculture to augment our traditional dairy industry.

## **Sector Findings:**

### **I. Agriculture and Forestry**

**O\*Net Definition: This sector covers activities related to using natural pesticides, efficient land management or farming and aquaculture.**

#### **A. Companies' expectations regarding company growth or retraining needs**

In the Executive Summary of his report to the department of Education, Stuart Rosenfeld states that "Vermont has one of America's most prominent and dominant sustainable food systems and natural resources clusters, whether measured in terms of contributions to the state's economy or growth compared to national trends. Adding "sustainability" to what once was an agricultural and/or natural resource cluster takes into account the long-term ability of the land to produce food and plants, the environment to support healthy lives, the economy to generate wealth, and of the community to retain that wealth."<sup>1</sup>

Further, this report developed census data from three sources to report that the sustainable food system cluster employed 32,499 workers in Vermont in more than 11,359 establishments in 2008. This data is not captured in the Vermont Employment Data Base and so this report gives us the best available information.

Total sales reported by farms in 2007 exceeded \$672M, with dairy cattle and milk production farms accounting for \$538 million of that total. Direct sales to consumers through farmers markets and CSAs, local contracts with restaurants, stores and institutions, and sales on site have been rising steadily, from \$3.8M in 1982 to \$9.6 million in 2002, to \$22.9 million in 2007.

The Farm to Plate Strategic Plan Executive Summary, released January 2011, cites Vermont's major agricultural and food product output totaled \$2.7billion in 2007. The approach was more comprehensive, including in addition to farms, the "entrepreneurs of all stripes creating a variety of value-added products (e.g., cured meats, granola, salsa, chocolate); a number of food distribution networks; and dozens of organizations, programs, and volunteer-driven activities that provide technical assistance, education, and outreach. This recent report also quantifies the jobs in this sector at 55,581 of all private sector jobs and is connected to 10,974 of all private businesses. Retail food purchases generated over \$2billion in sales in 2008. When measured by employment and gross state product, food manufacturing is the second-largest manufacturing industry in Vermont.

This report is very comprehensive, and includes 30 specific goals for the development of the system over the coming 10 years. The report goes further to

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<sup>1</sup> Executive Summary, "Growing Jobs, Vermont-Style: Knowledge for Vermont's Sustainable Food System Cluster and Natural Resources, May 2010, Regional Technology Strategies, Inc.

identify the highest priority 10 goals that can be leveraged to create economic development. Among those were the need for education at the K-14 level, and workforce development (including health care benefits and workers comp, needs of immigrant/guest labor). The report prepared for the Department of Education offers some specific recommendations on the curriculum changes needed for both K12 programming and adult education. In combination, the two reports provide a blueprint for action to develop the Sustainable Agriculture Sector.

**Rutland Area Farm and Food Link (RAFFL)** is an outgrowth of Rutland Regional Planning Commission's work in agriculture. Two of the Commission's former employees have developed a non-profit organization dedicated to supporting the economic viability for farms in this area, which is geographically a bit larger than Rutland County. With a well-established national pricing scheme for the USA's highly efficient industrial food system, area farmers have little control over the profitability of their operation. RAFFL's efforts are twofold—to help nurture local farmers and to create a more resilient local food supply.

The primary purpose in meeting with RAFFL was to understand the key players to talk with on the topic of sustainable agriculture. One of the value added outcomes of RAFFL's effort is the creation of a regional database/inventory of farms. There are other agencies in the state that have also done this work.

- ACORN, Addison County
- CAE, Center for Agriculture Economy, Hardwick
- Intervale, Burlington/Winooski
- Greater Falls Food Hub
- Vermont Sustainable Jobs Fund, Research document, "Farm to Plate Initiative"

RAFFL also collects relevant area data, such as statistics on the Rutland Farmers Market and growth in local food retail outlets:

- Number of Vendors has increased from 45 to 90.
- Annual sales are now out grossing Burlington's City Market/Onion River Co-op
- The Winter Farmers Market, adjacent to the Food Co-op in Rutland, has created revenue increases to the Food Co-op from \$600,000 to \$1.4M in the last year.
- The number of farmers markets in Rutland County is also on the rise. In 2010, markets have opened in Mt. Tabor/Danby, Wells, and Castleton.

One trend noted is that more people are taking up farming. Some supports are in place—such as business planning (UVM Extension) and VHCB will help farms at the 3.5-year stage in their growth. There may be a gap in support for new farmers. Often these new farmers are operating on a small scale.

**Addison County Re-localization Network (ACORN)** is an organization committed to a goal of responsible, sustainable living. It was founded by a core group of citizens who are concerned with the effects of globalization, primarily that our dependency on the oil producing countries and the expansion of global trade is leading to the loss of some key skills in our local communities. As a result, we are losing the ability to meet our local needs. The organization has identified many potential initiatives; the focus is on food and energy production within Addison County.

Addison County is the leading agricultural region in Vermont. It has diversity in the variety of crops. Key farms include Monument Farms (vertically integrated dairy), Misty Knoll, Maple Meadow, Agrimark and several orchards. Addison County also boasts the highest direct sales of local food in the state, with 12 CSA's, many farmers markets and a strong combination of demand and supply. The key advantage of its geography is the soil, promoting grass fed produce, and the ample water supply.

**University of Vermont's Center for Agriculture** provides the state with a research and education mission, executed in a variety of ways, including

- Communication with farmers
- Classes
- Webinars
- Newsletters
- Facilitation of learning communities

They look at and assess the financial, environmental, social, nutritional, social justice issues as well as food access and the working landscape. They have been involved in the Vermont Sustainable Jobs Fund "Farm to Plate" initiative, a 10-year plan with 30 specific goals. The Executive Report was released in early January 2011.

## **B. Challenges in Agriculture:**

The Vermont brand and seal of quality are both very important. They need to be safeguarded and marketed.

How do we move from boutique to mainstream. We need to increase the scale of the operation. How do we build a process for wholesale operation and distribution? It is a new skill set. We also have some infrastructure needs to support agriculture.

Federal policy favors cheap food and does not encourage "right" practices.

There are bottlenecks in the food processing system:

- Meat Producers are in short supply
  - Number of slaughterhouses
  - Meat cutters/butchers
  - Meat smoking facilities

- Vegetable growers face a shortage of processing, storage and distribution capability (Black River Produce and Upper Valley Produce have grown quickly—still a shortage)
- Labor Shortage
  - Dairy farms need to import labor
  - Apple Orchards also need to import labor
- Land Access: Farms are small. The state needs some who are willing to gear up to a mid-size capability. That will take capital investment. Renting is easier and quicker than owning the land.
- Since the season is short, growers need to invest in hoop houses and row covers to extend the growing season.
  - Pete’s Greens in Craftsbury is a good example of how to make season extension work
  - Champlain Orchards in Shoreham is another good example—it has an air controlled storage facility.
  - Woods Market Garden in Brandon is another area example.

“Farming has fallen out of favor as a **vocation of choice**. People who are entering the occupation are **choosing a life style**. The movements to *sustainability, Localvore, and green* are increasing interest in making this a choice.”

The sustainable agriculture programs, for example offered at Green Mountain College, are attracting people. However, at this point, **organizations such as Green Mountain College, pursuing a goal to acquire a specific amount of their food from local sources, are finding many obstacles to meeting that goal.**

Studying the small countries of Europe, for example Austria and Switzerland, should provide good models for Vermont. But, we still need to connect students with basic skills.

**C. Skills and Knowledge:**

- Business planning
- Knowledge of machinery
- Marketing
- Plant and Animal Sciences
- Building Connections/networks
- Supervision of labor

Work ethic

## SECTOR FINDINGS:

### II. Energy Generation

**O\*Net Definition: This sector covers activities related to developing and using energy sources such as solar, wind, geothermal, and biomass. This sector also includes traditional, non-renewable sources of energy undergoing significant green technological changes (e.g., oil, coal, gas, and nuclear).**

This sector is broad and a challenge to summarize concisely. Included are organizations whose mission is energy generation. I have included a subset of colleges due to their work to implement new systems and strategies for sustainability. For example, several are leading the way in installing biomass energy systems and are continuing to evaluate other renewable sources of energy generation for their own use on campus. Post-secondary institutions are including sustainability in their educational missions. They are serious about walking the talk.

It is clear to see that these organizations extend their sustainability practices across nearly all functions. In addition, they all make consumer education a key part of their responsibilities as corporate citizens.

#### **IIA. Traditional/Renewable Energy Generation, Energy Services**

##### **A. Companies' expectations regarding company growth or retraining needs:**

**AllEarth Renewables** is a Vermont company that specializes in the design manufacture and installation of complete grid-connected wind and solar renewable energy systems that lessen the dependence on nuclear and fossil fuels and reduce greenhouse gas emissions. The company's goal is to provide turnkey products that harness the power of wind and sun for homes and businesses while creating sustainable, well-paying jobs.

AllEarth employs 25 full-time staff and four seasonal staff, and has installed 382 AllSun Trackers generating 2 million kWh of electricity per year. The AllSun Tracker is a grid-connected solar electric system, which is pole-mounted and uses a GPS and a dual axis rotation to keep the solar panels at a perpendicular angle to the sun's rays throughout the day. In addition, AllEarth Renewables has more than 20 direct-drive wind turbine test sites around the state for its residential-scale Earth Turbine.

The company uses partners (outsources) for the manufacture of components. The company assembles the units as kits and then contracts the installation. In-house (non outsourced) operations include customer service, sales, technical support and documentation, quality assurance, field inspection and verification as well as normal administrative functions. Partners include NSA Industries in St. Johnsbury and J. A. Morrissey, Inc. in Williston. They also use Vermont Works for Women. They are in the process of developing a dealer network.

Dealers need to understand the technology and have the capacity for technical sales, installation and service. They look for dealers in alternative energy systems.

**Integrated Solar** was established in 1975 and is located in Brattleboro. It designs and installs renewable energy systems for consumers and small businesses. The typical project is \$50,000 and takes under two weeks to complete. Systems include solar thermal, small wind, biomass, photovoltaic and geo-thermal. Owner Andy Cay notes that about 40% of the business is now a competitive bid situation, a trend that is expected to increase due to the new entrants into this field. His established company, significant resources and experience is a key difference in these competitive situations.

In the next 5 years he expects to see significant change as our society retools for renewables. The technologies are proven. What are required for this growth are good policy, public education and appropriate incentive structure. The 30% federal tax credit is important.

Some of the competition could come from **Soveren, a similar company to Integrated Solar**, launched in 2008. **Soveren** focuses on solar electric, solar heating and solar hot water systems., specializing in solar combi-systems. The company believes the benefits to solar—high reliability and low maintenance—will make it a winner with consumers. Also, the federal investment tax credit of 30% of the cost of the system, with no upper limit, will stimulate sales.

**Pellergy LLC** is a Vermont manufacturer of wood pellet burners and bulk-storage units. The Pellergy wood pellet burners can replace an oil burner in an existing boiler or furnace or can be used in a new installation. Rather than source heating that is provided by a pellet stove or wood stove, this is a central heating solution with automated operation, controlled though a home's thermostat. In addition to manufacturing, Pellergy trains local home-heating companies' technicians to install and service wood pellet central heating systems and supports them with 24-hour a day, seven days a week technical support. Pellergy assists with the initial setup of the system, troubleshooting and routine maintenance whenever questions may arise. It was noted that the wood pellet and appliance industry is not the sexy face of renewable energy. Both solar and wind offer more incentives. For example, the federal tax credit is down from \$1,500 to \$500 combined with other improvements.

**Central Vermont Public Service Corporation** is engaged in the purchase, production, transmission, distribution and sale of electricity. The Company serves about 159,000 customers in 163 towns, villages and cities in Vermont. The Company's Vermont utility operation is its core business. The Company generates its revenues through retail electricity sales. It also sells excess power, if any, to third parties in New England and to the operators of the region's bulk power system and wholesale electricity markets. It is an investor-owned utility and plays an integral role in Vermont's economic, electric and energy future.

At the time of the writing of this report, the company was “in play” and considering two proposals from companies that were interested in acquiring CVPS. The implications for job loss are significant, especially in the executive levels, under either scenario. The impact of those losses would be felt in Rutland County. Ownership would transfer out of Vermont to Canada. Additional operational changes are not known. At this time, CVPS is making many internal “green” changes.

Green Initiatives include:

- Changing to hybrid vehicles/trucks in the CVPS fleet, Plug ‘n Go program
- Introduced the use of Terrasolve, a biodegradable hydraulic fluid now used in all new bucket and digger trucks.
- Green Oil program in the forestry department started in June of 2010. Dozens of VCPS-contracted tree-trimming crews were required to use new biodegradable chain and bar oil made from animal fat. The product is produced by Green Earth Technologies. CVPS uses seven different tree companies and typically has up to 55 tree crews working statewide at any given time.
- Joined Vermont Business Environmental Partnership, a state program that recognizes businesses for environmental stewardship in 2010. A business must meet eight standards to become a partner in VBEP. There is an internal sustainability committee that works with a team of professional arborists and ensures focus on the goal of doing that with minimal environmental impacts.
- Cow Power program promotes a manure management system that provides clean, renewable energy and strives to help solve numerous environmental problems. Customers can choose to receive all, or a portion, of their energy through Cow Power and pay a premium of 4 cents per kilowatt-hour. It goes to participating farm producers.
- Green IT: Live-link system. This is an electronic information and retrieval system that is enabling CVPS to move from paper to central storage. It is a huge change for managers, requiring them to change behaviors on information management (no paper, no local storage). A new department was created, “Information and Access” to create and manage the enterprise system. This is continuing to have a profound affect on employees. It is also a new way of measuring project management—measuring in bytes. Goal is not to use as much energy.
- Smart Grid: Will cause reduction in workforce. Will change the skill sets of meter readers. Will impact other jobs. Need computer skills. The meters are changing to new technology; will require the ability to repair electronic devices. There will also be new software, such as an IPOD app that enables people to control home devices remotely. Appliances will have software to enable them to be controlled. Changes the way we train people.

**Vermont Gas** is the state’s only natural gas distribution company. It was established in 1965 and serves 40,000 customers in Chittenden and Franklin

Counties. Natural gas is transported from Alberta Canada. Vermont Gas is part of a corporate family, GAZ Metro of Montreal who owns Northern New England Energy Corporation, which owns Vermont Gas.<sup>2</sup>

Natural gas has some benefits. It is delivered in pipeline—not trucks. Once the pipeline is in place, the delivery is clean and efficient. However, pipeline is expensive to install--\$1.5M per mile. Therefore, it is available only in areas with sufficient population density so that it is cost effective.

It is a clean fuel, with fewer emissions than propane, oil or wood. It is the lowest carbon fuel. It is renewable by capturing the natural gas emitted in the process of breaking down such things as cow manure and solid wastes.

Natural gas efficiency is over 90%, so you use less fuel to generate the heat.

It costs less than other commonly used fuels: 30% less than oil and 50% less than electricity.

There is a 100-year reserve on natural gas. New technology, directional drilling, makes “shale gas” accessible.

Green Initiatives include:

- Vermont Gas is working with Casella Waste Management on the Compressed Natural Gas (CNG) vehicles. As this technology expands, there will be requirement for CNG Fueling stations. Those require CNG Fueling Station Design Certification Course offered by Natural Gas Vehicle Institute (NAVi)
- Vermont Gas would like to serve Rutland and potentially other areas in Southwestern Vermont. There have been proposals in the past but for a variety of reasons they have not been successful.

**Fleming Oil** is representative of the network of retail distributors of petroleum products for transportation, home heating oil and plumbing/heating system design and repair. Fleming Oil describes itself as a retail business and will offer what the market demands—if that becomes solar, pellets or electric cars, they will make that change. Their service area includes Vermont, western Massachusetts and western New Hampshire.

The proposed development of the former Green Mountain Race Track in Pownal, VT into the **Southern Vermont Energy Park**<sup>3</sup> would consist of several components:

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<sup>2</sup> Vermont Gas and its parent company is one of the companies offering to purchase CVPS. If successful, that could potentially enhance their plan to extend a pipeline to Rutland.

<sup>3</sup> This project has been withdrawn. A similar, though smaller project, is proposed and moving forward for Fair Haven, VT.

1. 2.2 Megawatt Solar Farm developed by EOS Ventures in Hanover, MA, consisting of 1008 arrays with 8016 solar panels.
2. 29 Megawatt Biomass Power Generation and wood pellet manufacturing facility, developed by Beaver Wood Energy, LLC in Maine
3. Recreation, special events space on 90 acres.
4. Diesel fuel stop with general store

The plant is expected to operate with a payroll of \$3.4M for the full time employees and almost \$10M for contactors (construction, loggers, etc.).

The recreation space would continue to host special events, such as antique auto shows, a motorcycle course, a driving school and an antiques center in the renovated horse barns. This development will occur over the next 5 years.

The Southern Vermont Energy Park would provide renewable energy generation from solar, biomass and pellet production.

The project is expected to create 45-50 new production workers in Biomass Plant.

**Montpelier Municipal Department of Planning and Community Development** is working on a current project to build a district energy plant on renewable harvested biomass technology. This project recently got the “green light” to proceed, but it was not easy. Municipalities could do more to stimulate the green movement, but they feel they are battling the state (regulations, tax policy) and private lenders (who don’t want the competition from the municipality.) As a result, they feel hamstrung to move green projects along. “It is not the skills we are lacking...it is the money and the policy contradictions that hamper our movement and delay the creation of green jobs.”

Examples of the municipal projects include

- Electric charging stations for green transportation and plug-in hybrids
- District energy plants, with a public/private partnership.
- Local “green” transit
- City construction codes for green construction
- Waste water code

**Pathways Consulting, LLC** is a civil engineering, planning and environmental organization, working with local, state and federal organizations. In the next 5 years, the challenge is to convince local municipalities to move on energy alternatives and projects that support sustainability. The approval process in NH and VT is very similar. The concept of designated growth centers (housing near transportation and jobs) is slow to take hold. From their perspective, most municipalities are not welcoming to these concepts. We are not thinking about the common good—more political pendulum.

**Resource Systems Group** is also a consulting company that supports transportation, natural resources, technology and business. In the environmental sector, their work provides air quality analysis, noise/acoustical analysis, modeling of carbon emissions footprints, building design energy evaluation and power plants.

**Sustainable Energy Resource Group** is a tax-exempt 501©(3) organization that promotes energy conservation, efficiency and renewables through the formation of **town energy committees** to help residents, businesses and the municipalities reduce energy consumption save money, increase the sustainable use of renewables, strengthen the local economy and improve the environment. Bob works in Vermont and New Hampshire. Goals include:

- Increase community awareness of and participation in energy issues.
- Reduce fossil fuel consumption and associated pollution
- Increase use of local renewable sources of energy
- Decrease overall energy expenditures.
- Increase circulation of energy dollars locally.

The consulting practice expects the work to continue and expand. Volunteers are actively recruited to carry on the work.

**Control Technologies and Kilawatt Technologies** are two energy management service companies who work to monitor and manage the use of energy. **Kilawatt Technologies** provides information and analytical resources to uncover building operational improvements and guide changes in commercial and institutional buildings. **Control Data** provides clients with innovative solutions for web-based facility automation, control of building environments, multi-site facilities management and energy and operational costs reduction.

Green Initiatives include:

- Control Data is creating a new “Network Operating Center” on site that will provide the interface between Fault Detection & Diagnostics (FDD’s) in the Cloud, and the facilities person who does the fix on site.
- Smart Grid is a service provided by the Cloud. It will deliver real time pricing so that the consumer can make decisions about usage to conserve energy and/or reduce cost by delaying the usage to a lower cost time period.
- Control Data offers training sessions for building operators who are using their products. Tuitions range from \$369 for a one-day course to \$629 for a 3-day program.
- Kilawatt Technologies offers Enersuite™ Technology, EKilawatt conservation engineering and energy optimization services, and facilities management.
- Cloud computer technology will become the standard for web-based energy management. That field requires new skills and is creating new occupations within the IT field.

## **B. Challenges in Energy Generation:**

There are many traditional and renewable energy generation options and it is clear that consumers are gaining interest in exploring those options as the price of fossil fuels increases and/or is fluctuating. Advances in technology will also play a key role in consumer approval. Workable models exist in northern Europe that appears to be similar in scope and scale to the needs of our state and to be similar to the environmental conditions present in Vermont.

Vermont Yankee's future weighs heavily on Vermont, as does the future of CVPS. The closure of Vermont Yankee will eliminate 600 +/- high paying jobs affecting Windham County and the sale of CVPS will eliminate a core group of high paying jobs in Rutland County. As the traditional energy generation industry transitions to the future, we will experience the typical cycle of uncertainty relative to careers and workforce.

Development of renewable energy will still face challenges in getting established due to the complexity of the approval/permitting process, political winds and size of the capital investment required.

The distribution system for new energy alternatives for transportation is not yet developed at this point. We have a well-established distribution system for gasoline and diesel fuels but not for some of the new alternative fuels. That will need to be addressed before the public "buys in" to the new alternative powered vehicles in a significant way.

On the energy conservation front, challenges exist to increase penetration of energy efficiency renovations, especially for the middle class. Work needs to be done to get the financial mechanisms in place. There are companies who do their work, with compensation coming from the energy savings.

## **C. Skills and Knowledge Needed:**

***"Next generation workers will need to be computer adept, engineering driven. They will need to show competency with sciences, math and technology; there is a heavy focus on electrical, mechanical, civil, environmental, chemical, nuclear engineering. Also important are interpersonal skills of problem solving, change and change management, and quality management."***

***"The toughest job to fill is "power planning engineer". Best current source is Europe, but there are challenges to the immigration process—it is expensive and time consuming. This course of study is no longer offered in US colleges."***

***"The post-secondary environmental programs need to be oriented to skills—current programs are too heavily weighted towards policy. We need people who know how to solve problems, how to execute and make things happen."***

*“Vermont has low carbon mix. For home heating, we have some solutions. For transportation, it is tougher to deal with. Economic forces will change that— incentives.”*

*“The missing piece is the Cloud training. There is a growing need for Building Automation Engineering with strong ties to computer science.”*

*“Dealers need to understand the technology and have the capacity for technical sales, installation and service. They look for dealers in alternative energy systems.”*

*“Currently there are enough trained auditors to meet demand. However, people who are certified to do retrofits are on the fine edge. A bit more demand could create quite a backlog. VTC is starting to do installer training—still working to get local BPI certification.*

### **IIB: Post-Secondary Institutions, Leading the Way**

**Bennington College** was established in 1932. It now serves 664 undergraduate students and 144 graduate students. The core curriculum is in the performing arts, writing and literature and in teaching/education.

Five years ago Bennington College hired a consulting firm to work with them to identify opportunities for energy conservation. They have been working against that initial list of opportunities for about three years, focusing on insulation of the envelope of buildings, window replacements and so forth. They Bennington College made the investment in Biomass. That took about 2 years from beginning to completion and they are now saving about \$200K per year. They are evaluating a potential hydro facility as well, as a next step.

The Facilities department has 3 managers and 35 employees for the day-to-day requirements. Large sustainability projects are outsourced to contractors.

Established in 1834, the tag line for **Green Mountain College** is “living the environmental liberal arts”. The College now has 830 undergrads in 22 majors and 27 minors. All students complete a 37 Credit Core Curriculum that is related to the environment. Looking ahead, they expect enrollment to be at about 1,000 in five years.

GMC has launched a new Sustainable Agriculture major and it is popular. There is also a concentration within the environmental studies major that focuses on energy policy, analysis, ethics, economic policy.

“It s an essential part of our product that we walk the talk.” Over the next five years Green Mountain College expects to significantly accelerate the following areas:

- Purchasing
- Transportation

- Renewable energy

**Middlebury College** has a long history with environmental studies—launching the first program in 1965. It is described as being part of the organizational culture.

The biomass plant went online in 2009 and has replaced fossil fuel with renewable energy generation. They use 20K tons of wood chips and source most of it within 75-mile radius. They use established logging companies. Students drove this initiative and were very involved with the emissions inventory. The biomass installation reduced their carbon emissions by 40%.

Investments are made for the educational value first and then other tangibles. For example, the solar array has a payback of 40 years. Apart from its educational value, it would not be a priority. Middlebury College can be leading edge in sustainability and use that knowledge to help others develop.

**The University of Vermont** has established a set of internal measures to guide and evaluate evidence of environmental responsibility in many quarters. It is a leading land-grant university in environmental education environmental research, and institutional environmental practices. There are three primary categories:

1. Land and water use
2. Energy and air pollution
3. Solid and hazardous waste.

In the Tracking UVM Report 1990-2000, published in December 2002, it was noted that despite the significant efforts taken during the period, many of the measurements increased over the decade. For example, despite aggressive energy conservation and solid waste recycling programs, UVM's trash and energy use levels increased, although at rates lower than national trends. This report is currently being updated and more information is available at [www.uvm.edu/greening](http://www.uvm.edu/greening).

Policy actions taken since 2002 include a pledge of support for regional gas reductions in 2004; establishing a green building policy aiming for LEED Silver certification for all new buildings and major renovations in 2005; and in 2007, signing onto the **American College & University Presidents' Climate Commitment** which is a national intent to move campuses towards carbon neutrality.

**Vermont Law School** is ranked by US News and World Report as the top environmental law school in the US. That designation carries a huge benefit to Vermont. Many students are attracted to school and many want to then stay in Vermont. Most VLS students begin their careers in full-time legal or law-related positions. They are evenly spread across a range of positions including law firm associates, judicial law clerks, legislative aides, government specialists and environmental advocates. There are three-degree programs offered which address environmental issues.

- Masters on environmental policy, offered on-line.
- J. D. —law degree in environmental law/policy
- LLM—same focus, but post J. D.

Increasingly, occupations in environmental law are cross-disciplinary—they need skills/knowledge in addition to the understanding of the law. “Jobs are more numerous in the energy sector/renewables. Successful candidates need legal groundwork and knowledge of energy.”

Selected Green Initiatives at the Vermont colleges include, but are not limited to the following examples as they work to “walk the talk”:

- Middlebury College dining services has committed to a goal of purchasing 25% of their food from local sources. There are 40 farms in the local network. Challenges include storage and pricing. Food is a hot topic with students who are reacting to the industrial food supply. Students are very involved.
- Middlebury College’s goal is to be carbon neutral by 2016. There is Environmental Council comprised of 21 members from faculty, staff and students. Strategies to get there include:
  - Renewable fuels
  - Efficiency/conservation
  - Land management (6,000 acres land and forest)
  - Other sources.
- Facilities Services Green initiatives:
  - Operate a state of the art Biomass Gasification Facility
  - Have adopted Sustainable Design Guidelines and building principles
  - Achieved LEED Platinum Certification for the renovation of the Franklin Environmental Center
  - Developed nationally recognized Recycling and Composting Programs
  - Implemented Green Cleaning practices
  - Received a 2008-09 Middlebury College Environmental Council grant to install a community weather station.
- Green Mountain College is trying to “green” the entire institution. Strategies include
  - Farm & Food Project: supply our dining hall with local foods; establish a curriculum of sustainable agriculture; and foster community outreach with the Family Farm Forum Series.
  - ZIP Car available for transportation to faculty and students
  - Member of Eco-League: Consortium of environmental liberal arts colleges with a robust exchange program (students can transfer and retain home institution. Project based learning connected with region. Allows students to experience different environments in a hands-on project.)

- Students work with regional organizations to document outcomes, create case studies. Example: Working with Neighborworks of Western Vermont to build case studies following energy remediation.
- UVM's Transportation Research Center is a hub for innovative and interdisciplinary research, education and outreach on sustainable transportation system solutions.
- Vermont Law School has implemented many green projects and abuilding improvements to the campus. However, their location (rural) and lack of campus housing, require most students to commute daily. That is not a green practice—ideally housing should be near work and services. They have worked with Stagecoach to offer public transit routes that have helped to mitigate this issue.

## **Sector Findings:**

### **III. Green Construction**

**O\*Net Definition: This sector covers activities related to constructing new green buildings, retrofitting residential and commercial buildings, and installing other green construction technology.**

Overall, construction employs 10,650 in Vermont, as of February 2011 and is one of the hardest hit by the recession of the past few years. Several companies were included in the assessment and range from architectural firms to general contractors and specialty firms. All firms offered green products and services. Companies range in employment from 6 to 150. Most work within a 60-mile radius of their home base; the largest full service construction firms will extend the geographic scope well beyond that boundary.

#### **A. Companies' expectations regarding company growth or retraining needs**

All companies are cautiously optimistic about the future growth of their business, as they are slowly coming out of a deep recession in construction. Those included in the survey anticipate growth in employment in the next 5 years, but do not expect to reach the employment levels prior to the current recession. If they reach 90% of pre-recession employment, that is viewed as the high side of the expected range.

The Vermont Short Term Industry Projections for 2009-11 predict a 3.0% growth for Construction of Buildings, a 6.5% growth for Heavy and Civil Engineering construction and a 12.8% growth for Specialty Trade Contractors.

In recent years, the green projects have been primarily at college and hospitals. For example, Dartmouth, Champlain, UVM and Middlebury colleges and Rutland Regional Medical Center and the hospital at Nashua, NH. Those "new build" projects are hard to find now, but the demand for building renovation and retrofitting is expected to gain momentum as people gain more confidence in the economy.

Relative to green construction, they all noted the tremendous change in materials and technology that is enabling greater energy efficiency, but also requiring ongoing training and investment. Those who are early adopters find the support and resources for training are hard to find in Vermont, although that is changing at this time.

Sustainable design will be institutionalized in the architectural, design and build firms. Many have a parallel interest in historic preservation, citing a need to appreciate and value what came before. This will be key as companies and organizations, such as colleges and public facilities, begin to focus on deferred maintenance and facilities upgrades.

As the industry moves to green construction, the need for increased documentation is presenting some of the key challenges. The “old-timers” in construction, and/or those who are independent contractors, may find the changes hard to accommodate. Solid back-office skills and/or support are required to meet the demands for documentation, reporting, billing, applying for tax credits and incentives, to name a few of the needs. These may be in the category of unintended consequences—but will add expense and skill development to the workforce. People who have received grants to do this work find that those skills are not covered in the grant.

## **B. Challenges in Green Construction:**

- Cost of getting certifications and equipment (door blowers, IR cameras, “hasmat” suits) Cost about \$25-30K—expensive.
- Computer skills for reporting
- Lack of office support for customer service and reporting, billing, etc.
- Building to LEED standards and gaining the certification is expensive; customers are interested, but few are willing to go the distance due to cost.
- Remaining current with new materials, such as highly insulated wall systems, dry wall, concrete mix, concrete form, aluminum alloy form, fiberglass form.
- Remaining current with new work processes, such as pre-finishing in a shop environment and transporting to the site for installation.
- Drawings are more detailed, there are more specifications; the need to install to manufacturers specifications is much more critical as systems become increasingly complex.
- Consumer education and consumer incentives are important to driving demand. But most important is the cost of energy—when it spikes, people make investments in alternatives—sometimes irrationally.

## **Observations:**

“With the right political approach, Vermont could be a the forefront of the environmental movement.”

“Subcontractors need to be licensed. The general contractor does not—however they need to be regulated. There should be some requirement for continuing education. For example, there is a residential energy code. A lot of builders do not know it. It is not enforced. There is a need for more consistency. It is very hard to keep up as the field is rapidly changing.”

“Technology and building codes have changed so much. Case in point, a \$30M job that would require 30 carpenters, now takes 20. We are now more installers than tradesmen. Many products come pre-assembled in a shop environment.”  
Carpenter’s Brotherhood

“Consistent enforcement of codes would help. “ Local 693

“An architectural firm thinks about buildings differently (than an energy auditor, for example) and this is important when doing building evaluations for energy conservation. An architect would go back to what was the intent of the design, and ask, why is it not working?”

“Efficiency Vermont has been very helpful, providing incentives, information, training/meetings.”

“We know how to make a tight house. What we need are the management skills and systems, accounting functions, and computer skills.”

“New York and New Jersey have state programs to nurture renewables. Vermont is not doing enough to promote and generate demand. “

“Efficiency Vermont is transitioning its reporting program from H-Pro to Hero before the end of the year. There has been no training on the new system at this point (Oct. 4, 2010).”

“Many/most of the contractors do not have a “back office” to provide support in scheduling, reporting, tracking outcomes, invoicing, etc.”

Attraction of young people into the trades is a challenge. More outreach to schools with an emphasis on positives such as, “licensure = mobility” and “one wage earner can support a family”, would help.

### **C. Skills and Knowledge:**

- Design/Build
- Historic Preservation
- Applicable building code.
- Communication skills—with clients, colleagues, workers
- Knowledge of market areas (hospital, college, commercial, residential)
- Site Evaluation
- Estimating
- Construction Management
- OSHA 10Basic construction skills, such as framing, doors and window installation, stairs, installation of cabinets and molding.
- Blueprint reading
- Operation of construction tools and heavy construction equipment
- Metrology
- Advanced Graphics
- Waste disposal
- Roofing
- Soldering pipe joints

- Sealing fittings
- Connecting Wiring
- Create weather sealed connections
- Willing to follow directions
- Scaffoldings
- Aerial lift
- Fork lift
- Best Practices

College Relationships: use interns

- University of Montana
- Norwich
- Vermont Technical College
- Syracuse
- Rhode Island School of Design
- Wentworth
- Clarkson

## SECTOR FINDINGS:

### IV. Green Manufacturing

**O\*net Definition:** This sector covers activities related to industrial manufacturing of green technology as well as energy efficient manufacturing processes.

**The companies included in this assessment represent “green” from both perspectives of the definition.**

#### **A. Companies’ expectations regarding company growth or retraining needs:**

**Energizer:** Established in the late 1800’s, the plant in Bennington manufactures batteries for watches and hearing aids. Both customers and suppliers for the product are global.

Sustainability is part of their internal measurement scorecard. They have top-down driven goals at the plant. They formed a sustainability team to assist the organization in achieving those goals.

Customers are beginning to demand “green” products. This trend, driven by customers such as Wal-Mart, will continue. As a response to the green economy, they have redesigned the hearing aid battery to be mercury and lead free. Now this technology is applied to other products. Customers are increasingly demanding changes in packaging to be more environmentally friendly.

Demand for their product is down and the long-term trend for the watch batteries is lower. This is attributed to the increasing use of cell phones for timekeeping.

The facility employs 200 and is now at a stable level. This year they filled vacancies from an early retirement program last year. There were many applicants; they interviewed 10% of the applicant pool and hired 1%. Finding good people is not a problem right now.

Energizer works closely with Efficiency Vermont to bring down their energy usage. Best Practice: “Efficiency Treasure Hunt” --an idea that was suggested by the engineering staff at headquarters. They brought in key people (Efficiency Vermont, boiler person, engineers, etc.) for the weekend and while the plant was idle, worked to identify a wide range of potential savings. They found hundreds of energy saving ideas. They are now working to implement those ideas.

**GE Aviation** manufactures the turbine blades used in the aeronautics industry. They are the sole source of the low pressure turbines (LPTs) used in the GENX engine for the Boeing Dreamliner. After some initial delays in production at Boeing, GE is now ramping up quicker than initially planned. The GENX engine is credited with achieving the sizeable fuel economy targets for the Dreamliner. It is expected

that there will ultimately be a market for retrofitting current planes with the new engine. This should be a long run for GE Aviation. Currently the “green” product represents 25% of their revenues. It is expected to grow to 80% within the next 3-5 years.

This growth is now creating new jobs in production starting in 2011. GE Aviation will be able to increase production with fewer people due to the huge use of robotics; they still expect to increase their production workforce from about 900 today to about 1,000 within 5 years. In addition, retirements will create the need to backfill about 100 positions. This represents a total hiring requirement of about 200 jobs. These will be high skilled technical people. Successful candidates will have an associate degree or equivalent.

Another key strategy to remain at a competitive size is that GE Aviation will work to its core competencies and outsource or contract to others for some significant portions of the job. This is expected to create opportunities for others in the region.

GE Aviation also has specific efficiency targets that are established by the Corporate Headquarters Group. Each year the targets are increasingly challenging. The plant facilities group is charged with leading a culture change for sustainability and efficiency. They have won the “Eco Award” from GE Corporate for the work they have done in Rutland to reduce scrap, improve efficiency and reduce their carbon footprint. In 2011 they have formalized a competition with their internal “green team” and will be awarding prizes for winning green initiatives.

**Composites Cluster in Bennington:** Three companies were included in the assessment: Plasan North America, Plasan Carbon Composites and Vermont Composites. Each company serves different markets and those customers define the nature of the business model. A common denominator is the nature of the material used in the fabrication of the end products—a carbon composite material that provides excellent strength at a modest weight making it especially desirable for green transportation applications—automotive and aerospace. The material has other characteristics that make it an attractive choice for additional applications as well. The outlook for products made from composites is very favorable and while there is expected competition, the growth will allow many companies to do well in the future.

Another common factor is that each company is engineering driven. The culture requires the engineering approach, incredibly high standards of production, an inquiring and problem solving mind, the ability to reinvent, a passion for outcomes, an interest in the environment and so forth.

In aggregate, employment in this cluster is about 425 and growing steadily. The expectation is that the workforce will double in five years. Each of the three companies is well established in their respective markets, and so the Bennington region is also well positioned to capitalize on this significant growth. That is, if the

community can assure a well-trained supply of workers to meet the growing demand.

**IBM:** IBM's character has been formed over nearly 100 years of doing business in the field of information handling. Nearly all of the company's products were designed and developed to record, process, communicate, store and retrieve information—from its first scales, tabulators and clocks to today's powerful computers and vast global networks.

IBM helped pioneer information technology over the years, and it stands today at the forefront of a worldwide industry that is revolutionizing the way in which enterprises, organizations and people operate and thrive.

The interview touched on the uses of the semiconductor wafers and chips into products that provide control over a wide range of systems. It is difficult to say what percentage of the product is currently used in green application, however, known applications exist. A reasonable estimate is 25% at present. They are on the technology side of the "smart" devices used to monitor and control usage. This application is viewed as a huge growth area, as the Internet is used to provide feedback loops for energy efficiency—SMARTGRID, for example.

The focus of the interview was on the complexity of managing the facility to assure the maximization of resource efficiency. Areas of management concern include water, energy, CO<sub>2</sub> emissions, solid waste and hazardous waste reduction. In addition, there is a large need to manage the automation of manufacturing processes and assure the optimal functioning of very complex equipment. Energy costs range from \$35M-42M annually.

This IBM facility is an end-to-end semiconductor supplier consisting of Semiconductor Assembly and Packaging, Manufacturing, Engineering, and Test/Characterization organizations. As many as 135 solid, liquid and gaseous materials are used in different processes to create integrated circuits. Ultimately, a raw silicon wafer the size of an average dinner plate will be converted into devices with circuit dimensions ranging from 90nm down to 32nm—dimensions slightly bigger than the size of a single strand of human hair.

The vehicle and track system that is at the heart of the manufacturing process is similar to a rail network. There are approximately 300 vehicles that take the wafers and transport them to the tools. At any point, hundreds of wafers are being processed in different tools and for different purposes, for both IBM internal use and sale to external customers.

All of these automated processes are monitored by software systems that run the tools, activate the processes and ensure that the wafers are in the right tool at the right time. The full automation allows both development and manufacturing to occur on the same toolset. Nearly 700 tools are laid out in different parts of the

factory floor. Each tool is designed to perform a certain function in the nearly 1,000-step process.

**Copeland Furniture** manufactures natural hardwood furniture from Vermont. Their wood supply is within a 300-mile radius in New Hampshire, Vermont, Canada and Pennsylvania.

“Preservation and stewardship are values that run deep in Vermont. We take pride in the quality of the environment and the natural beauty that surrounds us. We also interact with the natural environment in a more intimate way than our friends in more developed areas. Many of us make our living working with the land and the forests and even more of us hike, canoe, fish and hunt. Taking care of that which surrounds us and feeds, clothes, and shelters us is an ethic that spans generations and is held by Vermonters in all walks of life.”

Copeland uses sustainably harvested hardwoods from the American Northern Forest. The Forest Stewardship Council (FSC) certifies Copeland. As such, their suppliers must certify that the wood comes from forests that:

- Are not threatened
- Do not have high conservation significance
- Do not contain genetically modified trees.

Internal processes are also green:

- Heat from heating ovens is recirculated to the plant
- The wood finish is a water-based product, which reduces VOCs.
- The plant is heated with wood waste, which reduces oil consumption.

Their green focus was initially to save money. That is still a driving factor. They do market the furniture as being “green,” but they are not sure that the end user will pay more for that. It has a marginally perceived benefit.

This location is their main manufacturing plant. There is a showroom in Bradford. Most business is wholesale. Design Within Reach, Circle Furniture in Boston, and Vermont Bed Stores and others carry the furniture. They used to be carried by Crate and Barrel and Pottery Barn. Those retailers have gone “down market” and are importing product.

**Windstream:** Windstream manufactures pedal power generators and permanent magnet DC generators for small-scale independent power production. It is a global market. Its biggest customers are located in the US, Canada, Denmark, Sweden, and Germany. The company’s goal is to provide small, portable self-generated power systems as well as information about

electricity, and how it is developed. It is used in educational venues and incorporated in many ways.

The company's location is a machine shop and small office space for Windstream and Clean Earth Technology. (Separate report)

The primary way to market the product is through the website. There is a huge undercurrent of interest in this technology and the company taps into that market.

The founder (retired) is a physicist and engineer who developed the technology. He started it in the 1970's and catered to people living off grid, sailing vessels and other remote locations. By 1999, with the threat of Y2K, the market had developed to include people wanting back up power generation. Windstream and Clean Earth Technology operate under the umbrella of Bowles Corporation who employs 14 people that share responsibilities for both companies with a growth projection of 14 – 18 within 5 years. The goal is to increase the scope of marketing and build demand. One strategy is to develop a curriculum for use in schools.

#### **B. Challenges in Green Manufacturing:**

From a workforce perspective, the challenges in the green manufacturing sector are not unique to being "green." All companies included in the study are very committed to lean manufacturing, quality/continuous improvement and sustainability. All companies have aggressive targets relative to energy efficiency and those are generally driven from the top down as part of the strategic planning process. These companies compete in a global marketplace and must remain price competitive to survive. Every aspect of the manufacturing process is continuously assessed for better processes and use of technology. As a result, the "bar" for skills and knowledge is continuously rising.

The skill of buildings/facilities technicians needs to be much higher. This need applies to not only industrial sites but also public buildings, schools and colleges, hospitals—any large, complex system that need so manage its usage of energy, water, CO2 and waste streams.

The needed skill sets represent a melding of electronics, IT, mechanical, electrical, chemical disciplines. Also required is an understanding of controls technology—how to interpret the vast amount of data available on each of the systems. Those currently in the field cited years of experience to gain the knowledge and skill required by the job. They also believe the occupation is changing and it would be very helpful to develop a field of study for the occupation. "Industrial processes technology" has grown well beyond a "checklist" for facilities maintenance.

Environmental science is involved both from the perspective of understanding the “legalese” of regulations, as well as the technical application side of the environmental science. We don’t have quite the right mix at our state colleges—there is a bit too much focus on policy and not enough of the “hands on “ application.

**It has become difficult to attract young workers into the manufacturing industry** and the average age of the incumbent workforce is increasing. A major challenge to these employers will be to recruit a workforce with highly technical skills for the environment of the future. Robotics will take the routine tasks, leaving the problem solving, complex tasks to humans.

**Accessibility to high tech manufacturing training programs is also a challenge in the southern regions of Vermont.** Companies address this by working with the regional career centers, which can provide some of the technical training for production workers. The Apprentice programs offered through a collaboration of Department of Labor, Vermont Technical College and Stafford Technical Center are an example of training that is working well. In the Southern part of the state, Southwestern Vermont Career Development Center does not offer the apprentice program, but is working to develop a composites technician program. Employees who want/need to continue their education and achieve a degree will have some opportunity through Hudson Valley Community College or Rennselear Polytechnic Institute.

Recruiting employees with engineering and advanced degrees is an additional challenge. Vermont’s rural characteristics are a factor—strong appeal to some but a turn-off to others.

### **C. Skills and Knowledge:**

Employers and experts cite the following characteristics and skills as necessary for success and advancement in manufacturing:

- Strong literacy and communication skills, especially around technical content
- Ability to work with existing technologies and learn new technologies
  - Operate automated equipment
  - Computer literacy
  - CAD/ SolidWorks
  - CNC Operation
  - Welding
- Strong math and science skills
  - Understanding of metrology
- Teamwork/interpersonal skills
- Flexibility and desire to learn new skills
- Cross-functionalism — the ability to transfer skills and learn new ones in order to perform many functions in the workplace
- Professional skills (such as work ethic, finishing assignments, dressing appropriately, having a positive attitude, self motivation)

- Multicultural awareness
  - Teambuilding/problem-solving
  - Blueprint and/or diagram reading
  - Lean manufacturing knowledge, Kaizen, ISO certification/understanding
- Marketing

## SECTOR FINDINGS:

### V. Green Transportation

**O\*Net Definition:** This sector covers activities related to increasing efficiency and/or reducing environmental impact of various modes of transportation including trucking, mass transit, and freight rail.

#### **A. Company's expectations regarding company growth or retraining needs:**

**Local Motion** is a Greater Burlington 501(c) 3 organization promoting bicycling, walking, running, inline skating and the facilities that make such travel safe, easy and fun. It was started in 1999. Transportation is the most challenging “nut to crack” from an environmental standpoint. They are advocating for, and helping communities build, more bike and pedestrian facilities in northern Vermont—multi-use trails, sidewalks, bike lanes and safe streets.

Local Motion partners with car sharing and transit entities to help improve the network of transportation choices for Vermonters.

#### **Green Initiatives: Internal Operations**

- Over 10 years, built a powerful movement to transform our communities into better places to walk, bike, run and cross-country ski.
- Before Local Motion, a number of schools discouraged walking and biking to school. Today, through the VTRANS Safe Routes To School program, 22 schools in Chittenden County are working to increase walking and biking.
- Before Local Motion, US Census trends showed fewer adults walking and biking in our region. Today, the data shows more adults do that.
- 1000 households joined Local Motion in 2009- a 20% increase.

**Stagecoach Transportation Services, Inc.** is a non-profit organization, funded through a grant by VTRANS. It offers fixed schedule routes for the general public. It also provides a social service network, in collaboration with 8 partners, to serve the needs of the elderly and disabled. This is offered through the Agency of Human Services.

There are 35 volunteer drivers who use their own cars plus 2 taxicab companies.

Ridership averages a total of 120,000 trips annually. It is fairly consistent but is affected by the price of gas. In 2008, with gas over \$4/gallon, there was not enough capacity. Weather is also a factor, leading to heavier demand in the winter.

**Marble Valley Transit** provides a comparable service in Rutland County, with North/South along route 7 connecting Middlebury to Bennington. The East/West route is along route 4 connecting Poultney and Castleton to Killington. The portion of the route from Rutland to Killington is the most heavily used.

## Company's expectations regarding company growth or retraining needs

Expected to grow. Contributing factors:

- Higher price for gasoline and energy products
- Aging population
- Programs such as the "Smart Commute" program will be more aggressively advocated in the future.
- Promoting convenience, safety and disciplined time structure.
- Employer partners –contribute so employees can ride at reduced rate. For example, published rate is \$3.50 each way, but an employee of Dartmouth Hitchcock can ride for \$1. Need employer commitment.
- Want to increase service for underserved corridors—Rte. 4 for example.
- Try new technology for information sharing and increasing connectivity between providers.

**Dubois and King** is a consulting engineering firm offering clients engineering, planning, development and management services. They work primarily in New England, concentrating in Vermont and New Hampshire. Thirty-five percent of their revenue is from transportation related projects—highways, roads and bridges. They address ways to make highways and the public transportation system more "green." Approaches deal with the type of pavement used; mitigating storm water run-off; and landscape design and implementation.

The company is also involved in building services, systems planning, design and construction; environmental documentation and permitting; storm water management; civil works, water resource and transportation engineering; and public works, including municipal engineering.

The company works in a very multi-disciplinary environment. What they see emerging is a need for more multi-disciplinary occupations—such as facilities managers for colleges, city managers, hospitals, state facilities and so forth. They expect growth of their business in the coming years, but they are currently down from a high employment of 100 to a current level of 65.

**UVM Transportation Research Center** received a \$979,829 grant in 2008 from the U. S. Department of Transportation as part of a \$1.01 million Transportation Education Development Pilot Program (TEDPP). The transportation industry forecasted employment growth in transportation and material moving occupations of 1.1million between 2004 and 2014. Two-fifths of the new jobs are expected in truck drivers and driver/sales workers.<sup>4</sup> There are four pilot programs within the scope of that grant. Three of those programs are aimed at attracting and retaining

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<sup>4</sup> U. S. Bureau of Labor Statistics, 2006-7 Career Guide to Industries.

skilled workers. The underlying issue is the aging of the current workforce, more than the transition to green initiatives. Non-traditional labor sectors are provided with transportation career awareness and skill building. The remaining program has assessed the capacity of community colleges nationwide to participate in transportation workforce development. There are numerous partners involved in the New England region. These programs have created the following initiatives.

- The Transportation Systems Institute (TSI) is a training program offered by Vermont Technical College for incumbent state transportation workers in Vermont, New Hampshire and Maine.
- The Transportation Systems Academy (TSA) was created to generate a unique workforce pipeline into the transportation sector, drawing on non-traditional labor pools. Community High School of Vermont students completed the first pilot of the TSA. Future sessions will focus on students from the technical high schools.
- Second Careers in Transportation (SCT) is partnered with AARP-VT and Vermont Associates for Training and Development to focus on attracting retirees and the growing “over 50” population to focus on bringing their skills from other industries to the 21<sup>st</sup> century challenges in transportation.
- The Community College program was designed to determine the role of community colleges in supporting the transportation workforce development efforts. This project has been completed and a set of best practices has been determined.

## **B. Challenges in Green Transportation:**

There are many challenges to establishing a transportation network that is efficient for users and cost effective for operators. Many of the parties interviewed expressed their view that this area is perhaps the toughest to tackle. Population density is a clear challenge to designing any system and achieving goals of efficiency for the operator and convenience for the user. The required investments are very high.

***One of the central assumptions of our society is that we would have a supply of cheap energy.*** It has been an underlying assumption of the way we grow our communities. We have not needed to be efficient with the way in which we design and locate housing, retail and business development. The result, especially in rural areas, will present a planning challenge for our region. As our residents age, they will not be able to afford to drive as they do today. Reliance on public or shared options will increase. For communities, they may find they can no longer afford to maintain all roads and some will be dropped from their area of responsibility. Housing that is remote from access to services will lose its value. We will need to create more affordable and convenient housing options. All of this combined suggests another industry dynamic that will impact consumers and reshape our national economy. This transition period of “strategic disinvestment” could extend for 10 – 15 years and will create considerable political tension, as we have to make tough choices that impact the taxpayer in yet another critical area.

With that in mind, it was also noted that real land use law—Act 250 is out of date; it does not deal with transportation. We need to develop the state with an eye to easy access to services and develop multi-modal approaches.

From the standpoint of workforce development, it is very tough to find professional engineers—in any discipline. Vermont could do more to nourish and encourage young people to go into engineering. Also, incumbent worker training is important, as engineers need to renew licenses. Programs require CEU credit, but annual meetings and seminars can count.

There is also a challenge in successfully changing consumer behavior and habits from personal vehicles to public transportation. Vermonters are not faced with high costs of parking, tolls/fees, traffic delays and congestion and other issues linked to personal travel that are found in high-density areas. To be sure, Vermonters notice the increase in fuel prices as they drive considerable distances, due to the rural nature of the region.

Finally, it is projected that between 40 and 50% of the transportation workforce will retire within the next decade. This is coupled with the trend of fewer people going into the key transportation fields.

### **C. Skills and Knowledge Needed:**

- Municipal Transportation
- Construction Math
- Customer Service
- Diversity/Sensitivity Training
- Marketing
- Project Management
- Drivers with CDL License
- Business Management
- Diesel Mechanics/fleet maintenance

## Sector Findings:

### VI. Recycling and Waste Reduction

**O\*Net Definition:** This sector covers activities related to solid waste and wastewater management, treatment and reduction, as well as processing recyclable materials.

#### A. Companies' expectations regarding company growth or retraining needs:

Founded in 1975, **Casella Waste Systems** is a vertically integrated company. It provides resource management expertise and services to residential, commercial, municipal and industrial customers, primarily in the area of solid waste collection, transfer, disposal and recycling services. Casella operates in 14 states.

The vision of the organization is to build a sustainable and profitable company by transforming traditional solid waste streams into renewable resources. The long-term strategy is to create economically beneficial uses for waste streams through resource transformation solutions. To be successful, they are focusing on lowering the cost of resource transformation solutions by reducing its recycling processing operating costs, examining ways to mitigate commodity prices fluctuations and developing new processing technologies.

Company goals are "0" landfill, although they will accept incineration. "The world is not ready for 0 waste; the technology has to evolve. There are huge education challenges; this needs to be part of the education system."

In 2009 the company piloted a new dynamic fleet routing software program in its largest market area and yielded meaningful reductions in labor and truck operating hours by more efficiently routing vehicles. Casella has 1600 trucks on the road and 900 off-road construction vehicles. Other "green" operating initiatives include:

- Use of Compressed Natural Gas (CNG) to fuel trucks. A refuse truck has a 12-year life cycle. To retrofit it with CNG costs an additional \$40K per truck.

#### Green products produced

- Recycling—Core of business. Upgrading to single stream process increased usage from 18%-46%. Process @ 1M tons of recyclables. "Zero-Sort Recycling: A Casella Program"
- Business Development: Consult with towns to form public/ private partnerships aimed at recycling and energy recovery.
- New England Organics: the next frontier. Deals with the food waste, which needs to be pulled out of the waste stream. It creates methane. R&D investments are here. Opportunity to generate renewable energy—like Cow Power.
- Green Transportation:

- On-Board recycling system for engine oil requires less frequent oil changes
- Anti-idling policy, tracked on the inboard system
- Non-hazardous radiator fluids
- Purchase only retread tires
- Evaluating synthetic fluids for hydraulic fluids
- Testing diesel particulate filters for exhaust treatment
- Evaluating CNG in more locations. (Europe has 11M vehicles on CNG; US has a few thousand. Requires investment in vehicles, refueling stations.)
- Testing hybrid vehicles.

**Chittenden Solid Waste District (CSWD)** was established in 1987 by the Vermont legislature in Act 78. It is a government entity, interregional government, and serves all 18 communities in Chittenden County.

CSWD provides efficient, economical and environmentally sound management of solid waste generated by towns, cities and business. It serves a population of 155,000. With an operating budget of \$9.1M annually, CSWD is funded by the sale of materials (\$2.5M), fees (\$3.4M) and tax on trash (\$2.6M). The principle on taxing is to tax the “bads” to promote “goods”.

Intervale Compost Products is CSWD’s commercial composting facility, located in Burlington. It accepts food scraps and yard debris and uses them to make high quality compost approved for use in organic agriculture. Finished compost is sold in bulk by the yard at ICP and in bulk and by the bag at local retailers.

McNeil Wood & Yard Waste Depot is a division of the Burlington electric Department and accepts brush, tree limbs, wood pallets and construction lumber that has never been painted stained, treated, or glued. The wood will be burned as fuel.

The Environmental Depot accepts hazardous waste free for residents; businesses pay a fee. Leftover paint brought to the Depot is sorted, blended and filtered to make Local Color, a 100% premium, re-blended latex paint. It comes in 50 shades of interior and exterior colors in 2 and 5-gallon pails. A 2-gallon pail costs \$16-18 and 5-gallon pails cost \$35 – 42. A bargain!

**Windham County Solid Waste District** is similarly authorized to Chittenden. This facility differs significantly in scope of work from Chittenden SXMD. It is a recycling facility, but does not have the hauling capacity. Brattleboro Salvage and Triple T do that work. Both are family owned businesses.

## **B. Challenges in Recycling and Waste Management:**

- The trend is towards product stewardship, materials management and resource optimization. Society cannot afford to waste natural resources. Copper for example is a crucial element and is now in short supply.
- One of the significant business development opportunities open to Casella Waste Management is to expand consulting to towns and municipalities. The educational requirements for experts in this area are a minimum of a Masters degree in environmental science and/or planning. The demand is expected to grow from 5 at present to 50 in 5 years.
- There is a big change in the business mindset of municipalities in regards to waste management. They used to be the operators. Now the tendency is to outsource this function to private contractors. The problem with this approach is that the profits go with the contractor. As a result, the municipality will not have the funds to reinvest for improvements. There is money to be made in the business.
- Carbon Harvest in Brattleboro is a very forward-looking operation. They intend to do a green house and a fish and algae farm. They will use the landfill gas to produce electricity, grow food, grow fish and grow algae for the fish. Their model has potential for others.
- The industry will be developing gasification, anaerobic digestion, and physical sorting technologies.
- The higher skill jobs are harder to fill at municipal pay. The lower skill jobs are easy—starting wage is \$14 per hour plus good benefits.
- For the future, there is a need for thinkers, collaborators, entrepreneurs, basic science and chemists. There is a need for understanding the strategic value of materials.

## **C. Skills and Knowledge Required**

- Drivers: CDL Class A
- Electronic technicians to support multiple maintenance facilities
- Diesel mechanics and technicians
- Dispatching with computerized routing
- Organics
- Hazardous waste
- Recycling
- Waste water sludge
- Chemists
- Environmental Scientists
- Marketing/Product Development

## Participating Organizations

### Agriculture and Forestry:

Rutland Farm and Food Link	Tara Kelly	
ACORN	Jonathon Corcoran	238220
UVM Extension	Linda Berlin	

### Energy Generation:

All Earth Renewables	Joyce Dicianna	
Alteris Renewables	Chip Paustian	238211
Bennington College	Bill Tronson	611310
Central Vermont Public Service	Melissa Norman	221122
Control Technology	Terrence Reynolds	
Efficiency Vermont	Alan Hebert	541620
Fleming Oil	Rick Fleming	
Green Mountain College	Bill Throop	611310
Integrated Solar	Andy Cay	
Kilawatt Technologies	Greg Johnson	
Middlebury College	Jack Burn, Mike Moser	
Montpelier Municipal Dept. of Planning and Community Development	Gwendolyn Hallsmith	
Pathways Consulting	Jeffrey Goodrich	
Pellergy LLC	Andy Boutin	
Resource Systems Group	Mara Rivera	
Southern Vermont Energy Park	Chip Paustian	
Soveren	Peter Thurrell	
Sustainable Energy Resource Group	Bob Walker	
VHB Environmental	Jeffrey Nelson	
Vermont Energy Investment Corp	Beth Sachs	541690
Vermont Gas	Donald Gilbert, Jr.	
Vermont Law School	Abby Armstrong	
Windstream Power	Sheila Kerr	237130

### Green Construction:

NAIC

Bluetime Collaborative	Robert Swinburne	
Blue Heron Construction	Jim Goodine	236115
BMA Architects	Jeff Goldstone	541310

Energy Wise Homes	Ted Taylor	541690
Gristmill Builders	Brendan O'Reilly	
Homebuilders Assoc. of Southern Vermont	Keith Abbott	813910
The McKernon Group	Jack McKernon	236118
Friends of the Sun	Bob Borello	442299
Neighborworks of Western VT	Ludi Biddle	
Breadloaf Corporation	Jim Pulver	236220
Engelberth Construction	Jena Catanzarita	236220
UA Local 693 (Plumbers, Pipefitters)	Ann M. Ross	238220
IBEW	Matthew Lash	
United Brotherhood of Carpenters	Dana Goldsmith	
Vermont Works for Women	Erin Galloway	
UVM	Robert Vaughn, Michelle Mullarkey	

### **Green Manufacturing:**

Copeland Furniture	Mark Burzynski, Eric Coburn	
Energizer	Matt Smith	
GE Aviation	Glen Traverse	336412
Plasan NA	Pam Salo	339112
Plasan Carbon Composites	Robert Murch	339112
Vermont Composites	Michael Tierney	334517
Seventh Generation	Sara Lord	423220
IBM	John O'Kane Marion Lawler	

### **Green Transportation**

Dubois & King	Richard Goodall	
Local Motion	Chapin Spencer	
Marble Valley Transit	Saskia Hagen Groom	
UVM Transportation Research Center		
Stagecoach Transportation Services, Inc.	David Palmer, Holly Brown	
Vermont Clean Cities Coalition	Tom McGrath	

### **Recycling and Waste Reduction:**

Casella Waste Management	Paula Calabrese	562111
Chittenden Solid Waste	Tom Moreau	924110
Clean Earth Technologies	Sheila Kerr	
Windham County Solid Waste	George Murray	

**Industry Occupations**

<b><u>Agriculture and Forestry</u></b>	<b><u>Energy Generation</u></b>	<b><u>Green Construction</u></b>	<b><u>Green Mfg.</u></b>	<b><u>Green Transportation</u></b>	<b><u>Recycling/Waste Reduction</u></b>
Dairy Farmers	Biomass Operator	Architects/Sustainable Design	Business Management	Business Manager	Chemists
Food Distribution	Construction Management	Building Evaluation and Forensics	CDC Waste Operations	Customer relations/Out reach	Compost Experts
Food Processors	Dealer Network Development	CAD Technician	Electronic Technician	Drivers/CDL License	Diesel Mechanics
Food Storage Operators	Drivers: CDL	Carpenters	Engineers: Mechanical, Electrical and Manufacturing	Fleet Maintenance	Drivers: CDL
Growers	Electrical Technician	Construction Management	Machinists	Marketing	Engineers: Environmental, Civil
Livestock Producers	Engineer-substation maintenance and Construction	Development Consulting Financial Officer	Maintenance Technician	Operations	Hazardous Waste Experts
	Facilities Maintenance	General Contractors	Mechanical Technician	Professional engineer	Manufacturing stream Consultants
	Fleet Maintenance	HVAC	Process Engineering Professional	Project Manager	Marketers
	Hydro Maintenance Operator	Laborers	Product design/Engineering Professional		Operators: Optical sorters, electronics
	Information Technology	Licensed Electrician	Production Operation		Resource / waste reduction auditors
	Materials Management	Licensed Plumber	Supply Chain Engineering Professional		Sales Consultants
	Plumbers/heating design/maintenance	Marketing/Sales	Quality Technician		Scale House Operator

<b><u>Agriculture and Forestry</u></b>	<b><u>Energy Generation</u></b>	<b><u>Green Construction</u></b>	<b><u>Green Mfg.</u></b>	<b><u>Green Transportation</u></b>	<b><u>Recycling/Waste Reduction</u></b>
	Product Promotion/Marketing	Permitting			Sorters
	Project Managers	Project Estimator			Web site developers
	Software developers	Specialty Trades			Welders
	Software modelers	Superintendents			
	Technical Writers				
	Telecommunication Technician				
	Transmission Line Worker				

## Green Certifications and/or Degrees

### I. Agriculture and Forestry

- Forestry and Natural Resources
- OSHA 10
- Associate Degree in Dairy Farm Management
- Associate Degree in Agribusiness Management
- Associate Degree in Culinary Arts
- Bachelor Degree in Animal Nutrition and food Sciences
- Bachelor Degree in Plant and Soil Sciences
- Bachelor Degree in Natural Resources
- Environmental Law
- Forest Certification
- Biomass Energy Crop Certification
- Certification of Emission Trading

### II. Energy Generation and Services

- CNG Fueling Station Design Certification, NAVi
- IT, Network Operating Center Operations
- Cloud Computing: Cloud Architect, Cloud Security, Cloud Developer, Cloud Infrastructure Manager, Provider specialist
- Operator Qualification (OQ), Northeast Gas Association
- Associate Degree (sciences, math and technology), Vermont Technical College
- Bachelors degree in environmental studies
- Engineering degrees (electrical, mechanical, civil, environmental, chemical, nuclear, and power planning)
- NABCEP Certified Solar Thermal Installer
- NERC Certification, System Operator Certification Program

### III. Green Construction

- LEED, design and construction
- NABCEP
- BPI
- Energy Star
- American Institute of Architects (AIA)
- National Council of Architectural Registration Boards (NCARB)
- Construction Specifications Institute (CSI Certification)
- EPA Certification for Lead Paint

- Renewable Energy Vermont-Solar Thermal Partnership (REV)
- National Certification for installing wood burning appliances—insurance requirement
- State propane license for commercial systems—insurance requirement
- CDL License
- Construction Management

#### **IV. Green Manufacturing**

- Vermont Electrical Apprenticeship Program
- Associate Degree with Technical/Mechanical Ability
- GE Apprentice Program
- Program Management Professional
- Associate of Applied Science (AAS)
- Associate of Science (AS)
- Associate of Occupational Studies (AOS) linked to specific trade
- Bachelor of Science

#### **V. Green Transportation**

- CDL License, HAZMAT, air brakes, tanker
- First Aid/CPR Certification
- Work Zone/Flagging Certification
- OSHA Certification

#### **VI. Recycling and Waste Reduction**

- Bachelor's degree in environmental studies, biology, life sciences, marketing, chemistry
- Civil engineering
- Masters degree in environmental science and/or planning
- CDL Class A
- Diesel Mechanic
- Associate of Applied Science (AAS)
- Associate of Science (AS)
- Associate of Occupational Studies (AOS) linked to specific trade
- Electrical Engineer
- Bachelor of Science—technical and financial concentrations.
- Information Technology

## Reference and Resources

“Growing Jobs, Vermont-Style: Knowledge for Vermont’s ‘Sustainable Food System Cluster; and Natural Resources”, May 2010 for the Vermont Department of Education, prepared by Stuart Rosenfeld, Principle, Regional Technology Strategies, Inc., Carrboro, North Carolina.

“Farm to Plate Strategic Plan”, Vermont Sustainable Jobs Fund, January 2011.

“Tracking UVM: 1990-2000”, UVM Office of Sustainability Website

American College & University Presidents’ Climate Commitment,  
[www.presidentsclimatecommitment.org](http://www.presidentsclimatecommitment.org)

Green to Gold, Daniel C. Esty and Andrew S. Winston, John Wiley & Sons, Inc., Hoboken, NJ., 2006, 2009.

The Green Collar Economy, Van Jones, Harper Collins, 2008.

Strategies for the Green Economy, Joel Makower, McGraw Hill, 2009.