Supporting the STEM Cluster and Young Professionals in Chittenden County
Executive Summary: Why examine the Science, Technology, Engineering and Mathematics (STEM) Cluster and Young Professionals in Chittenden County?

Growth in the STEM cluster has been recognized as a key economic development strategy for Chittenden County and Vermont. This white paper explains the important role that the STEM cluster and young professionals play in the county’s economy; examines the current conditions of the STEM cluster and young professionals in Chittenden County; explores the building blocks necessary for growing the STEM cluster economy; and offers suggestions for future work that can be undertaken by the CCRPC to help support the STEM economy.

Jobs in the fields of science, technology, engineering and mathematics are known as STEM jobs. Jobs in related fields, such as medicine, are known as STEM-related jobs. In this paper, the STEM and STEM-related fields will be referred to as the STEM cluster.

The 2013 Chittenden County ECOS Plan/ Comprehensive Economy Development Strategy (CEDS) and the Vermont Comprehensive Economic Development Strategy provide outlines for how to ensure “a healthy, vital and sustainable economy.” The Chittenden County ECOS Plan/CEDS also calls for implementation of the region’s economic development strategy, ECOS Strategy 3.2.1: “Improve and strengthen the economic systems of our region to increase opportunities for Vermont employers and employees.”

The Chittenden County CEDS identifies 4 basic types of economic development as well as 5 target sectors for economic growth in Chittenden County.1

<table>
<thead>
<tr>
<th>The 4 Basic Types of Economic Development for Chittenden County</th>
<th>The 5 Target Growth Sectors for Chittenden County</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Business/Job Creation</td>
<td>1. Information Technology, Communications and Media</td>
</tr>
<tr>
<td>2. Retention of Existing Key Employers</td>
<td>a. Information Technology</td>
</tr>
<tr>
<td>3. Expansion of Existing Economic Driver Employers</td>
<td>b. E-Commerce</td>
</tr>
<tr>
<td>4. Growth through Innovation and Entrepreneurial Development</td>
<td>c. Digital Media</td>
</tr>
<tr>
<td></td>
<td>2. High Value-Added Manufacturing</td>
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<td></td>
<td>3. Higher Education</td>
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<td></td>
<td>4. Clean Tech/Green Tech</td>
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<td></td>
<td>5. Health Care and Wellness</td>
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</tbody>
</table>

The Vermont CEDS identifies 8 Steps to Success and 12 target sectors for economic growth in Vermont.2

<table>
<thead>
<tr>
<th>The 8 Steps to Success for Vermont</th>
<th>The 12 Target Sectors for Vermont</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make Financing Accessible</td>
<td>1. Advanced Manufacturing</td>
</tr>
<tr>
<td>2. Educate a Great Workforce</td>
<td>2. Arts and Culture</td>
</tr>
<tr>
<td>4. Help Businesses Flourish</td>
<td>4. Education</td>
</tr>
<tr>
<td>5. Enhance the Vermont Brand</td>
<td>5. Financial Services and Insurance (including Captive Insurance)</td>
</tr>
<tr>
<td>6. Preserve our Working Landscape</td>
<td>6. Food Systems</td>
</tr>
<tr>
<td>7. Cultivate Innovation</td>
<td>7. Forest Products</td>
</tr>
</tbody>
</table>
The 12 Target Sectors for Vermont (continued)

9. Health Care
10. Renewable Energy and Efficiency
11. Software Development and IT
12. Tourism

At both the state and county levels, many of the identified target industries are in STEM or STEM-related fields.

The county’s workforce is aging, and both the raw number of people and percentage of the county’s population in the workforce is decreasing. Therefore, increasing the number of in participants in the workforce is key to the economy’s health in general, and ensuring an adequate number of workers with relevant skills is especially important for the STEM cluster.

Part I of this paper examines the number of STEM jobs in the region and the associated wages, in addition to the current state of the labor force and perceptions of the economic climate. With this information, we draw conclusions about the conditions of both the STEM cluster and young professionals in Chittenden County.

Part II asks how the region can create and maintain an environment where a strong STEM cluster can thrive and draw on a qualified and available workforce. Residents want a high quality of life with quality affordable housing and walkable neighborhoods with easy access to transit, services and amenities. The STEM cluster needs the ability to transport goods and services safely and efficiently, a sound and efficient communication system, and opportunities for business to begin and for existing companies to grow. This section will examine the condition of these building blocks and any needed changes.

Finally, Part III concludes that to grow the STEM economy, Chittenden County must:

1. Promote investment in all modes of transportation, especially between areas with high planned housing density and employment centers, and prioritize those investments in order to best grow the economy;
2. Collaborate with partners like the Chamber of Commerce to enhance the Vermont brand and promote Chittenden County as a burgeoning tech center;
3. Collaborate with GBIC to promote the development of industrial space that achieves a higher level of density and greater compatibility within traditional development patterns, uses less land and provides for all modes of transportation;
4. Assist towns in meeting the challenges of the Lake Champlain Total Maximum Daily Load and associated regulations;
5. Promote housing development for all income levels in areas planned for growth by providing assistance to municipalities; and
6. Lead a regional housing conversation.
I. The Current Condition of the STEM Cluster and Young Professionals in Chittenden County

A. Condition of STEM and STEM-Related Industries

Despite Vermont’s low population, the concentration of STEM cluster industries in Chittenden County is relatively strong. The percentage of total employment made up of STEM and STEM-related jobs has remained at a steady level for the past 5 years (Table 1), and mirrors the national average. Wages for these jobs are also significantly higher than wages for non-STEM jobs (Table 2). This phenomenon occurs across the larger region (see Infographic 1, below).

Chittenden County and Vermont also have high location quotients in several STEM and STEM-related sectors (Table 3). Location quotients measure the proportion of employees in a certain location compared to the proportion of employees in that sector nationally. For example, Chittenden County has a location quotient of 4.12 for computer and electronic product manufacturing, meaning that the percentage of regional employees who work for a computer and electronic product manufacturing business is more than 4 times the

Table 1. Chittenden County Employment Trends in STEM and STEM-Related Fields

<table>
<thead>
<tr>
<th>Year</th>
<th>% of Total Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>11%</td>
</tr>
<tr>
<td>2011</td>
<td>10%</td>
</tr>
<tr>
<td>2012</td>
<td>13%</td>
</tr>
<tr>
<td>2013</td>
<td>12%</td>
</tr>
<tr>
<td>2014</td>
<td>12%</td>
</tr>
</tbody>
</table>


Table 2. Chittenden County Wages by Sector, 2014

<table>
<thead>
<tr>
<th>Sector</th>
<th>STEM</th>
<th>STEM-Related</th>
<th>Non-STEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer and electronic product manufacturing</td>
<td>$72,193.02</td>
<td>$72,815.17</td>
<td>$47,502.08</td>
</tr>
</tbody>
</table>


Table 3. Chittenden County STEM Cluster Sectors with High Concentrations of Employment, 2015

<table>
<thead>
<tr>
<th>Sector</th>
<th>Location Quotient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer and electronic product manufacturing</td>
<td>4.12</td>
</tr>
<tr>
<td>Food manufacturing</td>
<td>1.64</td>
</tr>
<tr>
<td>Ambulatory health care services</td>
<td>1.53</td>
</tr>
<tr>
<td>Electrical equipment and appliance mfg.</td>
<td>1.32</td>
</tr>
<tr>
<td>Machinery manufacturing</td>
<td>1.15</td>
</tr>
<tr>
<td>Fabricated metal product manufacturing</td>
<td>1.07</td>
</tr>
</tbody>
</table>

Source: Bureau of Labor Statistics QCEW Location Quotient Calculator

Infographic 1. STEM Employment in Neighboring Areas

BURLINGTON, VT Metro Area

ALBANY, NY Metro Area

7.5% of total workforce

$74,170 STEM Pay

$37,550 NON-STEM Pay

BOSTON, MA Metro Area

11.20% of total workforce

$61,850 STEM Pay

$45,750 NON-STEM Pay

national level. Other STEM and STEM-related sectors with high concentrations of employment in Vermont and/or Chittenden County include health care and other manufacturing fields.

In addition to having a high level of employment in STEM and STEM-related sectors, the region is also one of the most innovative places in the country, as measured by patents per capita. From 2007 to 2011, an average of 826 patents were granted every year in the Burlington-South Burlington MSA. In terms of permits per capita, the metro area is second only to Silicon Valley (the San Jose-Sunnyvale-Santa Clara, CA MSA) (Table 4, below). According to the Brookings Institute, high rates of patenting are associated with higher productivity growth, lower unemployment rates and the creation of more publically-traded companies. However, it is important to note that this high rate of patenting is largely a result of work at IBM (now Global Foundries). This demonstrates a continued need to continue to support and invest in the growth of existing and new businesses.

Table 4. Total Granted Patents and Patenting Rate by Metropolitan Area of Inventor, 2007-2011, Brookings Institute

<table>
<thead>
<tr>
<th>Metropolitan Area of Inventor</th>
<th>Patents per million residents, 2007-2011</th>
<th>Average Granted Patents per year, 2007-2011</th>
<th>Largest subcategory of patents</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Jose-Sunnyvale-Santa Clara, CA</td>
<td>6,066</td>
<td>9,237</td>
<td>Computer Hardware &amp; Peripherals</td>
</tr>
<tr>
<td>Burlington-South Burlington, VT</td>
<td>3,951</td>
<td>826</td>
<td>Semiconductor Devices</td>
</tr>
<tr>
<td>Rochester, MN</td>
<td>3,300</td>
<td>606</td>
<td>Computer Hardware &amp; Peripherals</td>
</tr>
<tr>
<td>Corvallis, OR</td>
<td>2,319</td>
<td>194</td>
<td>Semiconductor Devices</td>
</tr>
<tr>
<td>Boulder, CO</td>
<td>2,274</td>
<td>666</td>
<td>Communications</td>
</tr>
<tr>
<td>Poughkeepsie-Newburgh-Middletown, NY</td>
<td>1,829</td>
<td>1,226</td>
<td>Semiconductor Devices</td>
</tr>
<tr>
<td>Ann Arbor, MI</td>
<td>1,697</td>
<td>590</td>
<td>Motors, Engines &amp; Parts</td>
</tr>
<tr>
<td>San Francisco-Oakland-Fremont, CA</td>
<td>1,638</td>
<td>7,003</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>Austin-Round Rock-San Marcos, TX</td>
<td>1,503</td>
<td>2,497</td>
<td>Computer Hardware &amp; Peripherals</td>
</tr>
<tr>
<td>Santa Cruz-Watsonville, CA</td>
<td>1,204</td>
<td>310</td>
<td>Computer Hardware &amp; Peripherals</td>
</tr>
<tr>
<td>Seattle-Tacoma-Bellevue, WA</td>
<td>1,174</td>
<td>3,968</td>
<td>Computer Software</td>
</tr>
<tr>
<td>Raleigh-Cary, NC</td>
<td>1,164</td>
<td>1,273</td>
<td>Computer Hardware &amp; Peripherals</td>
</tr>
<tr>
<td>Rochester, NY</td>
<td>1,149</td>
<td>1,198</td>
<td>Optics</td>
</tr>
<tr>
<td>Durham-Chapel Hill, NC</td>
<td>1,120</td>
<td>552</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>Trenton-Ewing, NJ</td>
<td>1,073</td>
<td>393</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>Sheboygan, WI</td>
<td>1,045</td>
<td>120</td>
<td>Invalid USPTO Code</td>
</tr>
<tr>
<td>San Diego-Carlsbad-San Marcos, CA</td>
<td>1,041</td>
<td>3,165</td>
<td>Communications</td>
</tr>
<tr>
<td>Albany-Schenectady-Troy, NY</td>
<td>981</td>
<td>846</td>
<td>Power Systems</td>
</tr>
<tr>
<td>Ithaca, NY</td>
<td>959</td>
<td>97</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>Minneapolis-St. Paul-Bloomington, MN-WI</td>
<td>945</td>
<td>3,068</td>
<td>Surgery &amp; Medical Instruments</td>
</tr>
</tbody>
</table>

Source: Brookings analysis of Strumsky Patent Database and American Community Survey. One patent is assigned to a metro area if at least one Inventor lives there. Year refers to year of application, not grant.

B. Business Climate and Employment

Both Vermont and Chittenden County suffer from negative perceptions of the business climate. Chittenden County workers worry about their ability to find jobs, while employees worry about their ability to find employees. A 2011 survey of 75 employers in Chittenden County, conducted as part of the ECOS Plan, found that business owners rate the regulatory environment in Chittenden County as less than good. The survey also revealed frustration with the high cost of doing business and the difficulty of construction permitting. This negative view of the business climate is similar across Vermont. While Vermont has a well-educated workforce and a high quality of life, the state compares poorly to the rest of the country in a number of factors related to the cost of doing business and the cost of living (see Section G). According to the Economic Competitive Assessment completed as part of the State CEDS,
Vermont ranks 45th and 48th in the nation in the two major business climate indices that focus on the direct costs of taxes and regulation.⁶

Recent statewide business surveys, conducted in 4th quarter 2015/1st quarter 2016 by the Vermont Business Roundtable/Economic Policy Resources (VBR/EPR) and in February 2016 by Davis and Hodgdon Associates, reinforce these perceptions. Surveyed employers revealed neutral to negative perceptions of the state’s overall business climate outlook. The surveys also demonstrated that employers are not confident about their ability to hire new employees as they are needed. 46% of respondents in the Davis and Hodgdon Associates survey identified “finding quality employees” as a key challenge, and 62% of respondents to the VBR/EPR survey had negative outlooks about their ability to hire for available positions⁸. These negative outlooks may partially be due to the skills mismatch that is present in Vermont with regards to middle-skills jobs. Chittenden County has a highly educated population. 54.2% of residents have an associate, bachelor’s or master’s degree, compared to 41.3% of Vermont residents overall and 35.7% of US residents. However, data from the National Skills Coalition (Figure 1, below) show that while there are more high-skill workers than high-skill jobs, and more low-skill workers than low-skill jobs, there are more middle-skill jobs than middle-skill workers in the state⁹.

**Figure 1: National Skill Coalition Analysis**

Unemployment in Chittenden County is low. In January 2016, unemployment in Chittenden County was 2.9%¹⁰, compared to the US average of 4.9%¹¹. However, Vermont’s percentage of “underutilized” workers is 8.2%, much higher than the unemployment rate. Workers who are unemployed, involuntarily part time, or marginally attached fall into this category.¹² Although the economy has improved greatly since the highest unemployment rates of the recession, and although Vermont’s rate of underutilized workers is lower than the national average (10% in 2015), many Vermonters are still searching for a job that fits their skills and economic needs.

There appears to be a concern among potential employees that the concentration of STEM cluster companies is not high enough for career mobility. A lack of concentration of other STEM and STEM-related companies can limit workers’ ability to find new jobs and move upwards in their careers. There are no quantitative data available to support this, but local STEM and STEM-related companies cite
difficulty in recruiting or retaining employees for this reason, or because there are not many job options for a potential employee’s spouse, regardless of his or her field. The Lake Champlain Regional Chamber of Commerce and the Greater Burlington Industrial Corporation are currently planning to conduct a survey of employers and employees that may provide more quantitative data on these issues.

Additionally, even though the unemployment rate is low, shifting demographics and other economic factors are leading to a drop in the labor force participation rate over time. The US labor force participation rate has been dropping since its peak in 2000, and the labor force participation rate has been dropping in Vermont since the state’s peak in 2006. Nationally, about half of this decrease has been caused by the aging of the population—as workers age, they begin to leave the labor force. In Vermont, population aging likely accounts for a larger portion of the drop in labor force participation, given Vermont’s older population. Nationally, other factors have also contributed to the decrease in labor force participation, such as increasing numbers of young adults enrolled in post-secondary education, increased levels of long-term unemployment caused by the Great Recession, and increasing rates of adults who are disabled and receiving Supplemental Security Income (SSI) or Social Security Disability Income (SSDI). Vermonters receive SSDI at a rate higher than the national average—In 2015, 6.15% of Vermonters received SSDI, compared to 4.8% of the national population. The percentage of Vermonters receiving SSDI benefits has also increased over recent years. This is especially true for Vermonters under the age of 35. Due to these factors, information about the low unemployment rates in Vermont and Chittenden County should be examined more closely before it is used to measure the health of the economy.

**D. Workforce Population**

While the population of Chittenden County is increasing, it is also aging, and the proportion of the population in the workforce is decreasing. From 2005 to 2014, the total population of Chittenden County grew 12.9%. During that time, the proportion of the population made up of young adults (ages 18-29) and older adults (ages 60+) grew, but the core workforce (ages 30-59) and population of children (0-14) decreased (Figure 2, below).

*Figure 2. Change in Age Cohorts, 2005-2014*

Source: American Community Survey 1-year estimates, Table S0101
Analysis of federal tax returns shows that people under the age of 34 are most mobile and the most likely to both move into and out of Vermont. While there has been an increase in young adults, as shown in Figure 2, much of this is population “churn” rather than growth. In 2013, for example, 9% of Vermonters ages 18-34 moved out of the state, but there was an 8% increase in the number of people ages 18-34 moving into the state from elsewhere.

Addressing the decline in workforce population is a serious concern. Retaining students who attend high school and/or college in Chittenden County, as well as attracting recent graduates, is key to maintaining and increasing the population of workers in Chittenden County. This is especially important for the STEM cluster.
II. The Building Blocks for a Strong STEM Cluster

Given these conditions, how can the region create and maintain an environment where a strong STEM cluster can thrive and make sure there are enough people to work in it? Residents want a high quality of life with quality affordable housing, and walkable neighborhoods with easy access to transit, services and amenities. The STEM cluster needs the ability to transport goods and services safely and efficiently, a sound and efficient communication system, and opportunities for business to begin and for existing companies to grow. This section will examine the condition of these building blocks and any needed changes.

A. Initiatives Supporting Growth in the STEM Cluster

There are many organizations and opportunities for companies and employees in the STEM cluster in Chittenden County to develop and grow. With two offices in Chittenden County, the Vermont Center for Emerging Technologies (VCET) is widely recognized as the state’s most important organization facilitating innovation and supporting the development of new STEM cluster companies. VCET works with local businesses, which are offered a range of services, from a place in VCET’s co-working spaces to business training. VCET also administers the Vermont Seed Capital Fund, a $5 million revolving equity fund that offers initial investments of $25,000 to $250,000 to selected Vermont-based start-ups. Since 2005, VCET has assisted 903 startups and has been ranked #11 in the world and #5 in the United States by the UBI Index, an organization analyzing business incubator performance. The ranking was based on a survey of 500 incubators around the world, and VCET clearly exceeded average incubator performance. VCET generated 2.4 times more jobs per client business, graduated businesses earned 3.3 times higher revenues, and had more than twice the number of client businesses who remained in the region after graduating.

In addition, numerous events, organizations and programs exist in the county and across the state to provide opportunities for businesses and employees to learn new skills, share recent innovations, gain funding, and network. Some key examples are:

- **BTV Ignite** is a new organization dedicated to bringing next generation gigabit internet to homes, businesses and institutions in Burlington. The organization was instrumental in having Burlington named as a Tech Hire City by the White House in March 2016. As part of this designation, a public-private collaborative will train and place 75 STEM cluster workers this year and another 400 STEM cluster workers by 2020. The organization’s projects also include marketing and branding of the Burlington area, finding creative ways to accelerate startup activity, and creating a continuum of STEM experiential learning opportunities for students from kindergarten through college.

- The City of Burlington Generator Space provides access to equipment such as computers with advanced software, a laser cutter and a machine shop, as well as classes in subjects like prototype manufacturing and 3D modeling.

- The Lake Champlain Regional Chamber of Commerce HackVT is a coding event in which teams compete to solve a problem and win prizes and recognition.

- Vermont companies that make eligible research and development expenditures in Vermont may be able to claim a Research and Development Tax Credit for some of their spending.
• The South End Arts and Business Association supports artists and entrepreneurs in Burlington’s South End.
• The University of Vermont’s FabLab provides a space for researchers and students affiliated with the College of Engineering and Mathematical Sciences to use fabrication materials such as 3D printers for projects. For researchers and entrepreneurs seeking a more professional fabrication process, the university’s Instrumentation and Model Facility can assist in creating prototypes.
• The University of Vermont’s Office of Technology Commercialization offers a number of resources to both UVM faculty and students and businesses outside of the university, including assistance with patenting and marketing, seed funding and education. The office also facilitates the UVM I2V Conference, which focuses on teaching innovators how to “protect, develop and finance” ideas.
• The Vermont Center for Emerging Technologies is described below.
• Vermont Code Camp brings together professionals and students to learn about new or unfamiliar software and technology during a full day of sessions and talks annually.
• The Vermont Employment Growth Inventive (VEGI) is an incentive program for growth in all business sectors that offers cash payments to growing businesses whose growth “would not occur, would not occur in Vermont, or would occur in a significantly different and less desirable manner, except for the incentive provided.” Higher rates of payment may be available for “Green” projects.
• Vermont HITEC offers educational programs for the employees of partner organizations in Vermont and the Upper Valley of New Hampshire, and offers training in healthcare, information technology and advanced manufacturing industries, as well as STEM fields.
• The Vermont Manufacturing Extension Center works to “help improve and grow manufacturing in Vermont and strengthen the global competitiveness of the state’s smaller manufacturers” through training and education for manufacturers.
• The Vermont Tech Jam is an annual two-day job fair and tech expo that brings together job seekers and recruiters to network, learn and advertise programs.
• The Vermont Technology Council connects researchers at colleges and universities, entrepreneurs and the State of Vermont. The Council also coordinates an internship program by providing an online portal to connect tech companies seeking interns with college students seeking internships.
• The Vermont Training Program offers grants that cover up to 50% of the cost of training for employees of Vermont businesses, with priority given to businesses in the State CEDS target sectors.
• Vermont Works for Women offers 16+ week classes to train women in the basics of working in information technology or skilled manufacturing.

B. Preparedness of Workforce for STEM and STEM-Related Jobs

Preparation for participation in the STEM and STEM-related workforce begins during elementary and high school. Currently, most students in Chittenden County are not considered proficient in math and science, according to the New England Common Assessment Program (NECAP) test results for high school students. During the 2012-2013 school year, an average of 40.7% of students at each of the county’s 8 public high schools tested as proficient or above in science,\(^{26}\) and 42.2% tested proficient or above in math.\(^ {27}\) However, there is an extremely wide range in proficiency rates between schools. For
example, while 57% of Essex High School students were proficient or above in science, only 8% of Winooski High School students were. This achievement gap is largely correlated with larger issues of socioeconomic disparity. This lack of proficiency is a concern for local employers, as revealed by surveys completed for the ECOS plan.

In addition to a wide range of proficiency levels in math and science, there is also wide disparities in rates of post-secondary enrollment of students from Chittenden County high schools. In 2014, 45.7% of Winooski High School graduates enroll in post-secondary education programs, compared to 73% of Essex High School students. Other high schools fell between those two numbers.

To address the need for STEM workers, various programs are available to young learners interested in STEM subjects. At the high school level, institutions including Essex High School and the Burlington Technical Center offer programs to prepare high schools students for work in STEM and STEM-related fields. The STEM Academy at Essex High School allows students to supplement regular high school classes with “an opportunity to explore their passion in the areas of science, technology, engineering and mathematics” by creating a STEM electronic portfolio, attending lectures, interning in the community and completing a senior capstone project. The Burlington Technical Center offers training for Chittenden County high school students in a broad range of programs, ranging from auto repair to medical and sports sciences. Some programs offer students the opportunity to work towards professional certification, or to earn college credit.

Other extracurricular and in-school programs exist to increase STEM enrichment, organized by municipal parks and recreation departments, institutions of higher education or independent entities. However, it should be noted that many of these programs have high costs associated with them, which may prevent access. A few examples are:

- **Girl Develop It** provides short, affordable classes for women to gain skills in vital components of web and software development.
- The **LEtGO Your Mind** offers summer programs for children to learn about machinery and robotics using Legos in Burlington and Essex Junction.
- The University of Vermont **STEM K-12 Outreach Initiative** offers a wide range of summer and after-school programs for students interested in STEM, as well as free STEM-related curricula and professional development opportunity for STEM teachers.
- The **Vermont Afterschool STEM Initiative** works to support STEM programming in after-school, summer and expanded learning programs.
- **Young Hacks Academy** is a tech leadership camp for Ages 9-14, where young people can use a blend of computer programming, problem-solving, and teamwork to solve today's greatest local and global problems. YHA day camps are held throughout Vermont over the summer.

Colleges and universities in the county also offer a significant amount of STEM education. 54% of all degrees or certificates conferred by Chittenden County’s institutions of higher education are in STEM or STEM-related fields (Table 5, below). This number will likely increase as UVM completes construction of its new STEM complex.
The Community College of Vermont (CCV) offers a unique opportunity for students to start their degrees at a lower-cost institution and then transfer after completing prerequisites. CCV also offers a STEM Studies program, an associate’s degree specifically designed to prepare students “to succeed in key scientific and technical economic sectors in Vermont.” CCV has articulation agreements with many local colleges and universities, including the University of Vermont and Vermont Technical College. These agreements allow for easy transfer of credits and, in some cases, guaranteed admission for students in good academic standing.

Though not every institution collects data about how many graduates stay in Chittenden County after graduation, Champlain College’s survey of the Class of 2014 offers valuable information. The college prides itself on importing and retaining talent. 42% of four-year students stay in Vermont after graduating, though only 21% lived in Vermont before enrolling. Part of this success is likely due to the strong career focus of the College. 95% of Champlain College students complete at least one internship or other experiential learning program while enrolled, and around 25 companies in Vermont have formal “internship pipeline” agreements with the College, which help qualified students find positions. 95% of students graduating with degrees from the college’s Division of Information Technology and Sciences are employed within 12 months of graduating, and 95% of those employed are in jobs using their degree.

At St. Michael’s College, 31% of the 2015 graduating class reported living in Vermont six months after graduating. While the college has no formal internship partnerships with any companies, 61% of those students had completed an internship while attending the college.33 While it is unclear how these statistics compare to other educational institutions in Chittenden County, or elsewhere, retaining these educated young adults in Vermont is an important component of addressing the workforce gap.

### C. Transportation Infrastructure

Adequate transportation infrastructure is key to the economy of Chittenden County. Without it, employees cannot get to work, and companies cannot transport products to markets. Chittenden County’s location offers easy highway access to the large markets of Montreal, Boston and New York
City. A number of large metropolitan areas can be reached by a commercial truck driver in one day. Local employers rated trucking and overnight mail and package delivery services as “good” in the ECOS competitive assessment study. Trucking costs, however, were rated as “less than good.” While easy highway access is a benefit, roadway condition is rated poor or worse for over half of the arterial highway mileage in Chittenden County.\textsuperscript{34}

Access to air transportation from the Burlington International Airport is one of the many unique advantages available in Chittenden County compared to the rest of the Vermont. Airfreight service was rated as “good” by area employers, but those surveyed also expressed concern about the high cost of airfreight and the lack of air service to Boston, a key market. Neither passenger nor freight rail are seen as advantages by local employers. Freight rail has limited service and is expensive. Passenger rail is also expensive and prohibitively time consuming.

The costs associated with maintaining and improving this infrastructure exceeds the fiscal capacity of municipalities or the state to fully address it. Transportation infrastructure is as important to residents as it is to businesses. When it comes to meeting the transportation needs of residents, roads are not the only concern: Neither municipalities nor the state have sufficient funds needed to sufficiently grow transit capacities, walking/biking infrastructure, and Transportation Demand Management (TDM) programs in response to growing populations. Non-automobile transit is of particular concern to the region’s residents. Surveys show that Chittenden County residents prioritize preserving the condition of existing infrastructure (including sidewalks, bike paths and public transit) and improving bike/walk facilities above all other transportation issues.\textsuperscript{35}

\textbf{D. High Speed Internet Connectivity}

High speed internet is one of the most important utilities for STEM and STEM-related work. Connectivity is available for most Chittenden County residents. As mentioned in Part III.A, BTV Ignite is a new organization dedicated to bringing next generation Internet 2.0 gigabit internet to homes, businesses and institutions in Burlington. According to BTV Ignite, the University of Vermont will work with US Ignite and BTV Ignite install a Global Environment for Network Innovations (GENI) rack that links the campus with high-speed Internet.\textsuperscript{36} This extremely high speed connection will allow for greater innovation in general, and in STEM and STEM-related fields in particular.

\textbf{E. Water and Wastewater Infrastructure}

Lack of adequate water and wastewater infrastructure is a limiting factor to economic development in some Chittenden County municipalities. Municipalities such as Colchester, Essex Junction, Hinesburg, Huntington, Westford and Williston raised this concern during development of the ECOS Plan. The number of municipalities concerned about wastewater treatment has now grown as a result of new phosphorus reduction regulations. The EPA’s Draft Lake Champlain Total Maximum Daily Load (TMDL) for phosphorus, Vermont’s Draft Phase 1 TMDL Implementation Plan, and the Vermont Clean Water Act (2015 Act 64) established a variety of regulatory programs to address phosphorus reduction, including mandatory reductions at some of the county’s wastewater treatment plants. Municipalities with wastewater treatment facilities that may be affected include Burlington (3 plants), Essex Junction (1 municipal plant and the privately owned plant at Global Foundries), Hinesburg, Richmond, Shelburne (2 plants), South Burlington (2 plants), and Winooski.
F. Industrial and Commercial Space

Office and retail space in Chittenden County is generally readily available. The market for retail space is currently somewhat undersupplied, but is considered generally well-balanced, while the market for office space is oversupplied. After a spike from 1994-2000, growth of industrial space in Chittenden County has slowed. Industrial space is currently more difficult to find than other commercial space. The market is undersupplied, and has been for the past four years. Adequate supplies of industrial space are necessary for growth in industrial businesses. Projections indicate that the market will continue to be undersupplied through 2016.

Figure 3. Industrial Vacancy Rate, 1994-2015

Source: December 2015 Allen and Brooks Report, GBIC

G. Quality of Life Versus Cost of Living

Chittenden County’s high quality of life is a unique strength for the region. The county is often recognized for its culture, amenities and for embodying the Vermont “brand.” These qualities are based on characteristics such as sense of community, access to nature, peaceful rural nature and a high level of civic engagement. Chittenden County regularly receives accolades for its high quality of life, from being named “One of the Top 100 Places to Live in America” to being recognized for high levels of volunteerism, outdoor recreation and sustainability. High quality of life is extremely important for attracting and retaining both STEM and STEM-related businesses and young professionals.

The aesthetics of the built environment and the amenities that are offered within a community are also vital ingredients for a high quality of life. Young professionals prefer a compact, walkable environment where they can live and travel without a car. A number of the region’s municipalities have recently adopted or begun working on form based code zoning that directs new development to attractive pedestrian friendly public realms, including Burlington, Colchester, Jericho, South Burlington, Shelburne, Westford and Winooski.
However, despite Chittenden County’s high quality of life, cost of living is a challenge for both businesses and residents. In 2014, cost of living in Chittenden County was 26.8% above the US average.\textsuperscript{44} However, wages were not comparatively high. Average STEM wages in Chittenden County were 10% lower than the US average in 2014, and total mean income was only 11% higher than the US average.\textsuperscript{45}

H. Housing Costs

Though many things contribute to cost of living, cost of housing is a significant factor. Housing costs in Chittenden County are 58% above the national average.\textsuperscript{46} Employers interviewed as part of the ECOS Plan ranked the cost of housing as the most challenging of all quality of life factors in Chittenden County, as the high cost of housing makes it difficult to recruit and retain employees.\textsuperscript{47} 55% of renter households\textsuperscript{48} and 30% of owner households\textsuperscript{49} spend more than 30% of their incomes on housing. (30% of income spent on housing is considered the standard for affordability by the US Department of Housing and Urban Development.)

Housing supply is also limited, as reflected in the low rental vacancy rates for rental units. As reported by Allen and Brooks, 2015 was the first time in 15 years that the county-wide rental vacancy rate reached 3% (See Figure 4, below). This is largely the result of 534 units being built and available for lease in Burlington and Winooski at the end of 2015. These units were absorbed quickly by the market, and the vacancy rate dropped again in June 2016. The long-term average rental vacancy rate for the county is still extremely low at 1.6%.\textsuperscript{50} A healthy vacancy rate is between 3-5%.

\textbf{Figure 4. Rental Vacancy Rates}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{rental_vacancy_rates.png}
\caption{Rental Vacancy Rates}
\end{figure}

In addition to the low rental vacancy rate, Multiple Listing Service data show that between 2009 and 2015, the months of inventory of both homes and condominiums available for ownership has decreased (See Figure 5, below). A healthy and balanced housing market has six months of inventory.\textsuperscript{51}
There is a need for more housing options for residents in all stages of life. The Vermont Housing Finance Agency has found that households of 1 and 2 people are growing faster than those of 3 or more people. These households are both young professionals and “empty-nesters.” Therefore, increasing the housing stock of apartments and condominiums is important in addition to building more traditional multi-bedroom homes. Conceivably, if “empty-nesters” are able to downsize to a condominium, then some of the housing stock they have been occupying will become available for young families hoping to move to a larger home and stay in the region.

In 2014, the Lake Champlain Regional Chamber of Commerce worked with its Burlington Young Professionals group to survey approximately 400 young professionals on their experiences in the housing market. Almost half of respondents (48%) reported being dissatisfied with their housing situation. Of those who were dissatisfied, 56% responded that they wished to own a home but could not afford to. Owning a home becomes more desirable as young adults age. For example, 74% of those ages 20-25 wished to rent a home in a multi-family building, while 66% of those ages 36-40 wished to live in a single-family home. Increasing opportunities for young families to buy homes may be a strategy to help stabilize the decreasing population of adults ages 35 to 59, and therefore to stabilize the workforce.

In addition to high housing costs, transportation costs can also be prohibitively expensive. A partnership led by the Vermont Natural Resources Council recently undertook a study on the combined cost of housing and transportation in Chittenden County and surrounding areas. The study examined how much a hypothetical family making 80% of the Area Median Income in different municipalities might spend on transportation and housing costs, based on factors such as commuting distances to areas with concentrations of jobs and the availability of public transportation. The study found that, outside of the urban core of Chittenden County, over 45% of income may be spent on combined housing and

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\[A\] Area Median Income measures the median amount of income earned by a household, as reported by the American Community Survey 1-year estimates. In 2014, Area Median Income was $62,004/household in Chittenden County. 80% of AMI would be $49,603.
transportation costs. It would be beneficial to increase the availability of housing within the County where transportation costs are lower.

Meanwhile, the number of Chittenden County employees who live outside the county is increasing. There are now 7,329 fewer workers living here than in 2002, even though the number of jobs in Chittenden County has remained relatively steady. Only 65% of county employees lived in the county in 2014, down from 75% in 2002 (See Figure 6, below). While more evidence is needed to draw a conclusion about why employees are living outside the county, a likely factor is the lack of available, affordable housing within the county.

![Figure 6. County of Residence for Chittenden County Employees](image)

Source: U.S. Census Bureau Longitudinal Employer-Household Dynamics

I. Housing Policy Implementation

Many organizations throughout Chittenden County are working to increase the availability of housing. Nonprofit organizations, such as the Vermont Housing Finance Agency, Housing Vermont and the Champlain Housing Trust, promote affordable housing development and availability across Chittenden County and the state. In response to high demand and low vacancy rates, market rate developers are also building an increasing number of units across the county. Between 2000 and 2015, an average of 224 market rate apartments were built each year (units designated as affordable are not included, but units designated as senior housing (age restricted for residents 55 and over) without services are included). In 2015, however, 534 market rate apartments were constructed, and 600 apartments are projected to be built in 2016. Total housing construction, including units for ownership, has averaged 450 units per year over the past five years (based on municipal planning and zoning records). The county’s housing stock must continue increasing to maintain a healthy housing market, a necessary ingredient to attracting and maintaining the county’s workforce.

Efforts are being made to address this issue on many fronts. In 2015 the Vermont Legislature established a Down Payment Assistance Program for Vermont residents. The program enables the Vermont Housing Finance Agency to offer loans of up to $5,000 to first time home buyers to cover down payment and closing costs. Most municipalities in the county are taking steps to make affordable housing development possible, from increasing density in their land use regulations to creating specific plans and task forces to deal with the issue of housing affordability. Two examples are Burlington and South
Burlington. Burlington recently adopted a Housing Action Plan to attempt to increase the amount of affordable housing in the city, and has an inclusionary zoning ordinance mandating affordable units in all new rental housing developments over 5 units. South Burlington recently approved new land use regulations that include an inclusionary zoning provision, and has established a local housing trust fund.

The CCRPC assists municipalities with zoning and town plans that enable affordable housing creation and works to align transportation infrastructure with areas of residential development, and will continue to do so. This work is called for in ECOS Strategy 3.2.2, “strive for 80% of new development in areas planned for growth, which amounts to 15% of our land area.”
III. Identified Challenges and Recommendations for CCRPC Actions

Strengthening the building blocks of the STEM and STEM-related economy is essential to Chittenden County’s economic development. While some of the essential building blocks are strong, Chittenden County still faces some key challenges, including high housing costs and insufficient stock to meet housing demand, a decreasing workforce, and continued investment in existing and proposed infrastructure.

Many of CCRPC’s local, regional and state partners are also working to improve the building blocks of the STEM and STEM-related economy. Potential projects to be undertaken with partners include:

1. Promote investment in all modes of transportation, especially between areas with high planned housing density and employment centers, and prioritize those investments in order to best grow the economy;
2. Collaborate with partners like the Chamber of Commerce to enhance the Vermont brand and promote Chittenden County as a burgeoning tech center;
3. Collaborate with GBIC to promote the development of industrial space that achieves a higher level of density and greater compatibility within traditional development patterns, uses less land and provides for all modes of transportation (per ECOS Strategy 1, Action 2);
4. Assist towns in meeting the challenges of the Lake Champlain Total Maximum Daily Load and associated regulations;
5. Promote housing development for all income levels in areas planned for growth by providing assistance to municipalities; and
6. Lead a regional housing conversation: The purpose of the regional housing conversation is to identify the number and types of units needed for residents in all economic groups and stages of life and lead a collaboration to help identify how we can build more housing to meet these needs in Chittenden County.

To lead the regional housing conversation, CCRPC will work in collaboration with regional partners to identify the number of housing units needed in Chittenden County. After working with partners to determine specific needs, the group will work to identify how those needs can be met. CCRPC hopes that group will develop a final set of actions and set priorities, identify lead organizations, develop timelines and determine potential funding sources by December 2016. After the conversation has been completed, CCRPC and partners will use the results to conduct outreach to Selectboards/Village Trustees/City Councils and to other key organizations. The group will also determine if any policy changes should be advocated for during the legislative session, or if any related projects should be added to the CCRPC FY18 UPWP or to future versions of the ECOS Plan.

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