

# **Engineering Beyond Green**

**Capturing the Emerging Market for Holistic Innovation and Expertise**

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**Vermont Engineering and Environment Advisory Council  
Preliminary Report**

**February 2008**

# ENGINEERING BEYOND GREEN

## CAPTURING THE EMERGING MARKET FOR HOLISTIC INNOVATION AND EXPERTISE

*Vermont Engineering and Environment Advisory Council (VtEEAC)*

### 2008-2009

#### Actions and Investments

- √ VtEEAC planning a 2008 conference to engage higher education leaders in the need for 21<sup>st</sup> century engineering expertise
- √ VtEEAC planning a 2008 conference for international CEOs to visit Vermont and learn more about our commitment to engineering and environmental excellence, desirable work environment for top employees, and economic advantages of the “e-State”
- √ VtEEAC will develop first-in-the-nation professional certificate and explore entry-level workforce development programs in holistic engineering, design, and innovation at UVM and in state colleges
- √ VtEEAC will explore ways to creatively engage K-12 STEM (science, technology, engineering, and math) education efforts in the development of 21<sup>st</sup> century, innovative, and holistic professionals
- √ VtEEAC will work with State of Vermont to develop signature marketing materials around holistic innovation and expertise for “PursueVT” campaign
- √ VtEEAC will engage the Vermont Telecommunications Authority in coordinating efforts to develop the “e-State” infrastructure most attractive to 21<sup>st</sup> century, globally-connected science, technology, and engineering professionals

### 2008-2009

#### Recommendations to State Leaders

- √ set aside up to \$1M in Next Generation scholarship and grant allocations to holistic approaches to engineering, design, and innovation
- √ invest up to \$50,000 from the Workforce Education and Training Fund (WETF) for holistic approaches to engineering, design, and innovation
- √ set aside up a significant percentage of the Vermont Employment Growth Incentive (VEGI) fund specifically to attract highest quality engineering and environment firms to the state
- √ prioritize the hire of state-based firms for large engineering and environment projects
- √ engage VtEEAC members in new ways to promote the holistic approach to engineering in the green economy, developing a niche that leverages our existing reputation to go “beyond green” and become a global leader in holistic design and innovation expertise

Vermont Engineering and Environment Advisory Council (VtEEAC)  
*Established by State of Vermont Executive Order 03-07*

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# ENGINEERING BEYOND GREEN

## CAPTURING THE EMERGING MARKET FOR HOLISTIC INNOVATION AND EXPERTISE

*A Preliminary Report of the  
Vermont Engineering and Environment Advisory Council (VtEEAC)  
February 2008*

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### THE CHALLENGE

In his January 2007 State of the State address, Vermont Governor James Douglas unveiled an initiative to establish environmental engineering as a key economic sector in Vermont. Focused on education investment, innovations, business opportunity, and job creation, the announcement sought to leverage Vermont-based engineering expertise in the emerging environmental markets of a global, “green economy.”

With bipartisan legislative support, strong economic interest in developing Vermont’s “green valley,”<sup>i</sup> and public momentum to actively leverage Vermont’s environmental reputation into global solutions, the Vermont Environmental Engineering Advisory Council (VtEEAC) was formally established by Executive Order in April 2007.<sup>ii</sup> This diverse group of business leaders, education leaders, and state officials met throughout 2007 to craft a strategic plan for Vermont that would (1) create high-value market opportunities for Vermont business, (2) uniquely attract and retain next generation professionals and global business, and (3) lay the groundwork for establishing the State of Vermont as a global leader for 21<sup>st</sup> century engineering and environment solutions.

To meet this challenge, the VtEEAC recognized quickly that they would need to be innovative in their thinking. In a time of limited state resources, they reasoned that even the most generous financial incentive strategies – though extremely welcome – likely cannot act alone in attracting a business cluster in Vermont with the critical mass to be globally competitive. Many environmental engineering firms are already well established in Boston, New York, and many major U.S. metropolitan centers, often around an engineering school population and facilities that Vermont is still working to grow.

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*“The Council’s objective will be to establish the State as a global center of excellence for the study and application of environmental engineering and related disciplines necessary to solve environmental problems worldwide.”*

*Charge to VtEEAC, April 2007  
Executive Order 03-07*

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Candidly, the VtEEAC also conceded that while Vermont’s world-envied quality of life and “green” ethic were undoubtedly a value-added environmental and economic draw, many other states – from Colorado to North Carolina – offer similar attraction. Others are simultaneously investing in statewide “green economy” and sustainability initiatives. Finally, they recognized that several other states, including nearby New York, are already publicly announcing intent for state investments in both engineering workforce and science, engineering, and innovation initiatives<sup>iii</sup> that Vermont would find challenging to match financially.

Therefore, to position Vermont as a global leader as they had been tasked, the VtEEAC realized that the first focus had to be the capture of a new and emerging engineering paradigm and market sector for the 21<sup>st</sup> century global economy – a concept and approach that Vermont’s engineering and environmental sector would be among the first to embrace, to develop and to grow. Using the model of Vermont’s globally-dominant captive insurance industry,<sup>iv</sup> they reasoned, the early adoption and development of a value-added dimension to Vermont’s “green” engineering sector could give state businesses a distinct advantage in competitive world markets and help to attract top talent and land high-quality projects. Finally, if the idea capitalized on cutting-edge trends in 21<sup>st</sup> century U.S. engineering education and innovation, the adoption would put Vermont’s graduating workforce, Vermont-based professional development programs, and Vermont educational programs ahead of the national curve.

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The VtEEAC also realized that positioning Vermont as a global leader in environment and engineering expertise would need concerted, sustained state investment over several years – a challenge in the budget climate facing both Vermont and the nation. Thinking strategically, the VtEEAC chose to launch efforts immediately with their own leadership – e.g., writing a preliminary report and investing in tangible outcomes in its first year – then focus on leveraging recommendations for future investment within existing state programs already underway in education, in state marketing programs, and – importantly – in the transformative efforts of Vermont becoming the nation’s first “e-State” by 2010.<sup>v</sup>

## THE OPPORTUNITY: HOLISTIC DESIGN AND INNOVATION

“World-class engineering, science, and technology have always been fundamental elements of U.S. innovation. But let us not forget that the management of ideas, the enrichment of R&D capabilities and the development of new business models and process innovations are crucial, as well. In today’s hyper-competitive global economy, science and technology leadership, though very important, is not enough...” -Nicholas M. Donofrio, *Executive Vice President, IBM Corporation Testimony before the Commission on the Future of Higher Education, 2006*<sup>vi</sup>

“The requirements of 21st-century engineering are considerable: engineers must be technically competent, globally sophisticated, culturally aware, innovative and entrepreneurial, and nimble, flexible, and mobile.” -from *The Millennium Project, “Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research, and Education,” 2007*<sup>vii</sup>

The emergent expertise that will give Vermont’s engineering enterprise a competitive edge in the 21<sup>st</sup> century green economy is one in which its professionals are trained with the 21<sup>st</sup> century ability to manage, analyze, and utilize complex, rapidly changing information across multiple disciplines. These professionals will be the best in their fields, designing the most effective, whole-system, integrated, innovative, and entrepreneurial solutions for our changing world.

This new **holistic approach to engineering**,<sup>viii,ix</sup> is being demanded by a 21<sup>st</sup> century, globally connected society. As engineered technology has become woven into the fabric of everyday life, politics, and community affairs, 21<sup>st</sup> century society engineers can no longer seek technical solutions

in isolation if they are to be effective or competitive. Instead, they must be trained in creativity, social-awareness, and leadership that adeptly handles political analysis, risk assessments, team management skills, and cultural sensitivity – nontraditional engineering skills rarely emphasized in today’s degrees.

The critical need for holistic engineering skills in the global green economy – and the broader knowledge economy – is undeniable. Every day, high-profile environmental engineering issues dominate the U.S. and global news cycle – from climate change to energy security to sustainable transportation – with a common headline that once-standard technological solutions face new challenges with increasing environmental awareness, socio-political concerns, and economic uncertainty. Overseas, we can simply look to the Three Gorges Dam project, where an engineering marvel is also bringing awareness to the extraordinary challenge – and cost – of human relocation, environmental damage, and cultural loss. Engineering professionals trained in holistic thinking will therefore have a competitive edge in 21<sup>st</sup> century project bids, with their training and expertise recognized worldwide as one providing integrated, innovative engineering practice that strives to avoid unintended consequences, best serves “green” markets, and better serves humanity.

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**ho·lis·tic**

Pronunciation: \hō-'lis-tik\

**1** : of or relating to holism

**2** : relating to or concerned with wholes or with

complete systems rather

than with the analysis of,

treatment of, or dissection

into parts

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*“In this evolving world, a new kind of engineer is needed, one who can think broadly across disciplines and consider the human dimensions that are at the heart of every design challenge. In the new order, narrow engineering thinking will not be enough. American higher education is in an unusual position to create the 21st-century engineer, an era that requires integrated and holistic thinking.”*

*Grasso and Martinelli, 2007  
“Holistic Engineering”*

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The need to actively develop holistic engineering and innovation expertise in the U.S. is also an economic reality and responsibility. As detailed in countless U.S. science and technology competitiveness reports released over the past few years,<sup>x</sup> more and more technical jobs once held by U.S. engineering talent are being outsourced to firms overseas for a fraction of the U.S. labor cost. Furthermore, holistic expertise – approaching challenges in engineering and the environment with new tools from sociology, law, and economics – is imperative in the U.S. engineering workforce we expect to lead the next generation of innovative, market-driven solutions. An ideal example of this new thinking was exemplified in a 2006 *Wall Street Journal* article, where the city of Stockholm partnered with IBM to test a unique,

behavior-driven model for traffic congestion mitigation with consumer-sensitive pricing incentives.<sup>xi</sup> When juxtaposed against more traditional solutions such as the addition of yet another new bridge, the more holistic approach significantly reduced not only congestion, but energy use and pollution as well.<sup>xii</sup> As such, the greatest competitive advantage, but also economic security, for U.S.-based engineering firms is to have access to new engineering talent – talent who are technically-skilled, yet simultaneously adept at high-level project management, entrepreneurial thinking, and understanding potential social impacts of the engineering enterprise. The holistic engineer will be a cost-competitive investment, well paid for his or her work because of the higher return on investment on complex projects, the adaptability of skills, and the ability to deliver innovative solutions for top global clients.

## *Vermont's Holistic Advantage*

The State of Vermont already has a head start towards global pre-eminence in the emerging market for holistic engineering. The ability to approach complex environmental challenges of the 21<sup>st</sup> century in a holistic way has been an intrinsic requirement of business leaders in Vermont for years as they move towards sustainability, cherish community interaction, and believe that high-quality work is “just the way we do things.” And there is no doubt that strong state environmental protection, town government engagement, and the innovative streak inherent to Vermont’s “Yankee ingenuity” have helped Vermont engineering and environmental firms embrace tenets of holism long before such new terms were coined or global markets began to demand the service.

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Vermont should therefore take advantage of this unique opportunity to own and develop holistic design and innovation as a highlight of the state’s established brand. More than ‘green’ and ‘sustainable,’ the term – and its practice – would place Vermont ahead of the national curve demanding interdisciplinary thinking and innovation. “Holistic” captures not only Vermont’s recognition in 2007 as America’s “greenest state” by Forbes Magazine,<sup>xiii</sup> but also its long-standing reputation for progressive thinking, social awareness, and a creative, innovative population. And, though known most widely throughout the state for its local manufacturing history, Vermont’s

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More than ‘green’ or even ‘sustainable,’ the term “holistic” and its practice are ahead of the national curve in the race to adopt interdisciplinary thinking and innovation.

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largest employer – IBM – is already a global leader in developing innovative, multidisciplinary engineering initiatives, as shown in the Stockholm example cited earlier. In addition, IBM is making worldwide investments not only in 21<sup>st</sup> century environmental engineering (the “Big Green” Innovation program), but also in the emerging global sector of Service Sciences, Management, and Engineering (SSME) – a highly multidisciplinary holistic field of engineering and business leadership.<sup>xiv</sup> Other, globally-dominant technology leaders from Google to Hewlett-Packard are similarly

exploring innovative, holistic solutions to environmental, energy, and transportation challenges.<sup>xv</sup>

Importantly, Vermont’s own “Environmental University” and major research institution, the University of Vermont (UVM), is already supporting transformative leadership and strategic hires in its College of Engineering and Mathematical Sciences that have the potential to position UVM as a leader in holistic engineering education, research, innovation and design. Two years ago, the College re-organized its three independent engineering departments into a single School of Engineering, fostering communication and idea sharing across the engineering disciplines. Over the past two years, the School has been working on undergraduate education reform (“Curriculum 21”) to provide more holistic curriculum to students. The new curriculum will include contributions from the College’s world-class computer science and math

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*“Engineering education needs to change to produce problem definers as well as problem solvers. The vision and mission of the College of Engineering and Mathematical Sciences at the University of Vermont is right on track with this forward thinking.”*

*William A. Wulf, President, National Academy of Engineering*

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faculty, maintain rigorous national accreditation,<sup>xvi</sup> and allow more exposure to environmental study, policy, business, languages, and communication skills. And the College's Complex Systems Center, now in its second year, draws university-wide faculty around expertise in 'self-aware' and "smart" systems and technologies, promising to be a key R&D platform for interdisciplinary holistic innovations. Complex systems have already been recommended as a major state investment in the 2006 Vermont Science and Technology Plan<sup>xvii</sup> and complex systems research underpins the recent \$6.7 million National Science Foundation EPSCoR grant for cutting-edge modeling of the Lake Champlain watershed.

Finally, all of University of Vermont's statewide colleagues in providing engineering education – Norwich University, Vermont Technical College and Champlain College (for software engineering) – have programs that will be well-served by the elevation of holistic design and innovation approaches. All three are also ahead of the national curve towards holism, with degrees and approaches – VTC's Sustainable Design and Technology, Norwich University's holistic emphasis on

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*“American industry needs people capable of applying technology, talent and capital in new ways to meet business and societal demands; we will need people with deep analytical skills and the ability to manage ambiguity. Overall, we will need institutions of higher learning to embrace innovation as a way to transform the U.S. system of higher education and prepare students to become innovators.”*

*Nicholas Donofrio, Executive Vice President, IBM Innovation and Technology<sup>vi</sup>*

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communication and experiential learning, and Champlain College's flexible and creative program design – that recognize the importance of interdisciplinary knowledge, teamwork, and leadership as part of graduates' engineering education.

This emerging Vermont potential should be leveraged throughout Vermont's higher education community, in Vermont's industry-education partnerships, and in business incubation programs to establish Vermont as a Center of Excellence for world-class holistic design and innovation. The value to Vermont graduates and Vermont-based engineering and environment firms who seek top talent, innovative research partnerships, and opportunities for 21<sup>st</sup> century professional development skills would be invaluable.

## **THE STRATEGY: LEVERAGING EXISTING INVESTMENTS IN EDUCATION AND WORKFORCE, MARKETING, AND THE EMERGING E-STATE**

As reiterated by both Governor James Douglas and Speaker of the House Gaye Symington in their respective 2008 addresses to the state, Vermont must continue to invest in the development, engagement, and attraction of 21<sup>st</sup> century, highest-quality workforce professionals and entrepreneurs to our state. The VtEEAC has recognized this as the highest priority in developing its charge throughout 2008, choosing a cost-effective strategy that embeds its recommendations by leveraging complementary, existing, and significant state investments already underway. These include state investments in education and workforce development, in state marketing, and – perhaps most importantly – in the unique, \$40 million “e-State” plan for Vermont to lead the nation in state wireless coverage by 2010.

### ***EDUCATION AND WORKFORCE***

The engineering and environment business sector in Vermont cannot take advantage of the 21<sup>st</sup> century global green economy, or the knowledge economy, without consistent access to highest quality professional development and new talent. And though both of these assets can, and should,

be attracted from out of state as well, it would be extremely limiting to Vermont business to not also ensure the existence and growth of Vermont's own vibrant engineering education, research, and innovation programs. For Vermont to establish itself as first to invest in holistic engineering for the environment, and to develop holistic design and innovation certifications, is an opportunity ripe for immediate investment and support.

Developing Vermont as a Center of Excellence for holistic thinking around engineering and environment issues is also an excellent opportunity to develop new resources for Vermont's K-12 science and math teachers seeking innovative and engaging STEM (science, technology, education, and mathematics) education materials for their classroom. While most direct introductions to engineering traditionally begin at college level, this does not have to be the case. As students are more and more aware of environmental challenges at a young age, we should not miss the opportunity to also engage their science and math skills in innovative problem solving – the very definition of engineering – around those same challenges as early as possible.

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*“For Vermont's economy to produce quality, high-paying jobs in the future, we must be competitive with countries around the globe. Our ability to compete depends on our education system.”*

*Vermont Governor James Douglas  
2008 State of the State Address*

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Education and Workforce: Actions and Recommendations To advance holistic design and innovation as a centerpiece of Vermont's brand in U.S. and global markets, education investments must be comprehensive and must complement existing state investment in higher education, workforce development, and K-12 STEM education. Therefore, with existing resources, the VtEEAC will take a lead on the following actions in 2008:

- √ planning a Vermont-wide, higher education conference around holistic engineering, design, and innovation to further introduce the concept, explore national and global trends, and engage immediate green economy opportunity;
- √ developing a UVM-based effort to create a first-in-the-nation professional certificate in holistic approaches to engineering;
- √ exploring ways to build capacity for entry-level, holistic design and innovation engineering workforce expertise in continuing education programs statewide; and
- √ exploring ways in which holistic design and innovative thought can be most helpfully made available to Vermont's K-12 community and STEM educators, seeking input from Vermont's excellent teacher training programs and existing K-12 math and science teaching collaboratives.

For 2008 and beyond, the VtEEAC will call on Vermont decision-makers to ensure that holistic design and innovation is recognized as an invaluable investment and highlighted in existing state investments through strategic targeting of existing funding initiatives towards the effort, including:

- √ targeting up to \$1M in Next Generation scholarships and grants to holistic design and innovation for engineering and the environment;
- √ investing at least \$50,000 from the Workforce, Education and Training Fund (WETF) towards professional development of engineering and environment professionals receiving value-added holistic design and innovation training;

- √ setting aside a significant percentage of the Vermont Employment Growth Incentive (VEGI) fund for aggressive recruitment of engineering and environment firms to the state; and
- √ prioritizing the hire of existing, creative, and comprehensive Vermont engineering firms for state engineering and environment projects.

### *MARKETING*

Just as it realized a globally-dominant captive insurance industry, a key to realizing Vermont’s leadership in holistic design and innovation expertise is to strategically capture the market and develop the product, taking every opportunity to promote the Green Mountain State as a natural home with a value-added, opportunity-rich future.

The State of Vermont is well served by high-quality, innovative, and aggressive marketing initiatives that focus on workforce recruitment and development and Vermont’s overall brand position in the northeast, U.S. markets, and overseas. The positioning of the state as a leader in holistic expertise will thus rely heavily on these professional marketing campaigns to ensure that Vermont’s emerging, holistic ingenuity and identity are part of the intellectual capital and competitive promise we promote in both national and global markets.

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*“We need to build our economy in a way that is consistent with our strengths and that takes advantage of opportunities unique to Vermont.”*

*Gaye Symington, State of Vermont  
Speaker of the House, January 2008*

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[Marketing: Actions and Recommendations](#) To ensure holistic approaches to engineering, design, and innovation are emphasized in Vermont marketing campaigns, the VtEEAC intends to use existing resources and take a lead on the following key initiatives in 2008:

- √ develop signature holistic design and innovation marketing materials that can be showcased in the Department of Economic Development’s “PursueVT” campaign. Materials and outreach efforts will highlight Vermont’s emerging expertise in holistic approaches to engineering and the environment, detail Vermont’s commitment to the engineering and environment sector, showcase incentives for developing environmental services business in the state,<sup>xviii</sup> and stress the potential for Vermont business to have global connectedness in rural Vermont with the imminent “e-State.”
- √ develop a high-level conference for international environmental engineering CEOs, showcasing holistic approaches to engineering, Vermont’s natural beauty and the economic potential for Vermont-based offices and workforce relocation

### *LEVERAGING THE E-STATE*

Finally, attracting and retaining today’s highly skilled, mobile professionals – a generation with the ability to move anywhere in the world to their best advantage – is a challenge for all states. It is also a challenge for business, whose top talent is rarely wedded to the firm itself, but may choose job opportunities solely on the lifestyle a business and its geographic location offers to the individual and his/her family. As business leaders know, the 21<sup>st</sup> century professional increasingly expects the best of all worlds – high paying jobs, flexible work hours, recreation access, safe communities for children, and – of course – instant global internet access and phone at the push of a button.

Vermont has the potential to offer all of this – and more – to the world’s best and brightest engineering and environment professionals. As the “e-State” vision becomes fully realized, the promise of Vermont as an ideal, 21<sup>st</sup> century “e-commuting hub” that helps attract and retain top talent is an unparalleled opportunity, where individuals and their families can live and work in the beauty and health of Vermont, yet be seamlessly connected to clients, business partners, and emerging opportunities around the world.

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As the “e-State” vision becomes fully realized, the promise of Vermont as an ideal, 21<sup>st</sup> century “e-commuting hub” that helps attract and retain top talent is an unparalleled opportunity

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The “e-State” also ideally ensures the Vermont capture of an emerging holistic design and innovation market that can benefit communities statewide. With telecommunications quality increasing each day – and the stilted video conference of only last year already becoming nearly seamless internet interactions of today (and only improving every moment) – a wireless infrastructure throughout the state will allow professionals and firms to choose locations well beyond Vermont’s most populous counties.

In fact, Vermont has the opportunity to capitalize on a holistic engineering approach to green economy challenges with the “e-State” development itself. Supporting clustered location in existing downtown centers of the infrastructure demanded by 21<sup>st</sup> century professionals – from internet cafes to modern office spaces, the holistic engineering of Vermont’s green economy and e-State are maximized. And by maximizing the use of Vermont-based building materials, minimizing the environmental footprint of new commerce, and innovatively investing in Vermont’s rural economy, the “e-State” itself becomes critical to the capture, development, and promotion of the holistic brand.

[Leveraging the E-State: Actions and Recommendations](#) Given the unparalleled economic development promise of Vermont’s “e-State” effort, the VtEEAC will actively take a lead in 2008 to:

- ✓ engage the Vermont Telecommunications Authority membership in developing strategies that promote investment in Vermont “e-State” development and serve to attract 21<sup>st</sup> century, holistic and innovative engineering and environment professionals;
- ✓ explore “e-State” infrastructure opportunities that complement the holistic approach to engineering, design and innovation: e.g., minimizing energy use and carbon “footprints,” maximizing use of Vermont-grown and produced materials, and focusing on 21<sup>st</sup> century, community-based investments such as internet cafes and professional, wireless office clusters developed in existing Vermont town centers.

## **CONCLUSION: ENGINEERING BEYOND GREEN**

The engineering and environmental professionals that will be in greatest demand throughout Vermont, the nation and world in the 21<sup>st</sup> century will be individuals trained to think beyond “green” and “sustainable,” recognized as holistic, creative leaders in an innovation-led economy. While there is growing, widespread recognition that this new generation of engineering and environmental professionals are exactly what our global society needs, there is currently no hub for holistic engineering training, development, and promotion anywhere in the world.

The State of Vermont has a unique opportunity to capture the market for holistic engineering expertise, design, and innovation – a niche that will add unique Vermont value to the engineering

and environment enterprise in the global green economy. With countless national reports calling for a global transformation in engineering education toward a more holistic experience, this opportunity for Vermont to be first will not last long. The State of Vermont should embrace the concept and invest in its development, promotion, and advancement throughout the state with allocations from existing education and workforce programs, as well as leveraging its marketing campaigns and “e-State” development to aid the effort.

This preliminary report from the state-authorized Vermont Engineering and Environment Advisory Council (VtEEAC) has outlined the opportunity for the state as well as several strategic, cost-effective actions already being planned (and led by the VtEEAC itself) to capture and promote the idea over the coming year. In addition, this preliminary report makes recommendations to state decision-makers to strategically invest more activity towards this effort through targeted, smart, meaningful investments within existing state programs throughout 2008 and 2009.

Vermont’s reputation for high-quality products, its intellectually creative workforce, and its workday travel access to major U.S. and Canadian commerce centers (Boston, Montreal, New York) make our Green Mountain State uniquely poised to corner any number of emerging global markets and business opportunities. As there is no doubt that the demand for engineers with holistic training and interdisciplinary skills will only increase over the next decade, especially in the environmental engineering sector, this opportunity for the State of Vermont to become a true global leader and innovator should not be missed.

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## Notes and References

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- <sup>i</sup> The “green valley” concept is one in which Vermont develops a reputation as a world-recognized hub for green technologies and services, similar to “Silicon Valley” in California. A January 2006 essay in *The Montpelier Bridge* ([http://www.vecgreenvalley.org/mont\\_bridge\\_jan2006.htm](http://www.vecgreenvalley.org/mont_bridge_jan2006.htm)) by Vermont Environmental Consortium (VEC) Director Daniel Hecht noted that the original “green valley” concept and phrase were first coined by Paul Hawken in 1997, then further articulated for Vermont in 2002 by the VEC’s founding president, Peter Murray. Throughout his tenure, Lieutenant Governor Brian Dubie has also actively championed the Vermont “green valley” idea publicly as a platform for economic development and Governor Douglas embraced the idea in his 2006 State of the State address.
- <sup>ii</sup> State of Vermont Executive Department Executive Order 03-07, April 30, 2007. Advisory council members subsequently chose to update their name to the “Vermont Engineering and Environment Advisory Council” to ensure the broadest of economic opportunities were considered for emerging engineering and environmental services sectors in Vermont.
- <sup>iii</sup> Arenson, Karen, “New York higher education proposal created \$3 billion science fund,” *New York Times*, December 18, 2007: B6; Krieger, Lisa, “California initiative aims to increase ranks of state engineers,” *Contra Costa Times*, January 1, 2008.
- <sup>iv</sup> The Vermont Captive Insurance Association (VCIA) is the largest trade association for captive insurance in the world. Established in 1985, the Vermont Captive Insurance Association has served an important role in establishing Vermont not only as the premiere U.S. captive domicile, but as one of the world’s largest and most desirable domiciles. The Association has grown to provide lobbying support on both the state and federal levels for its 522+ member companies. In addition, it hosts and supports professional education opportunities for the industry at large. (adapted from VCIA website: <http://www.vcia.com/>)
- <sup>v</sup> In 2007, Vermont Governor James Douglas proposed that Vermont be the first true “e-state” in the U.S. by 2010, with universal cellular and broadband coverage within the state borders. With bipartisan support, legislation to create the e-state and create a Vermont Telecommunications Authority passed in the 2007 legislative session.
- <sup>vi</sup> Testimony of Nicholas M. Donofrio, Executive Vice President, Innovation and Technology, IBM Corporation, Before the Commission on the Future of Higher Education, San Diego, CA, February 2, 2006.
- <sup>vii</sup> Duderstadt, James, *Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research and Education: The Millennium Project* (University of Michigan, 2007; <http://milproj.dc.umich.edu/>)
- <sup>viii</sup> Lih, Marshall, *Engineering Education Innovators Conference Best Practices Summary Report*, Engineering Education and Centers Division, Directorate of Engineering, National Science Foundation, Arlington, Virginia, 1997 (<http://www.nsf.gov/pubs/1998/nsf9892/start.htm>).
- <sup>ix</sup> Grasso, Domenico and David Martinelli, “Holistic Engineering,” *The Chronicle of Higher Education*, March 16, 2007: Volume 53, Issue 28, Page B8.
- <sup>x</sup> The National Academies, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, 2006; Duderstadt, James, *The Engineer of 2020: Visions of Engineering in the New Century*, 2007.
- <sup>xi</sup> Abboud, Leila and Clevstrom, Jenny, *Stockholm’s Syndrome: Hostages to Traffic, Swedes Will Vote on High-Tech Plan To Untangle Snarls With Tolls*, *Wall Street Journal*, August 29, 2006.
- <sup>xii</sup> Grasso and Martinelli, 2006.
- <sup>xiii</sup> Wingfield, Brian and Marcus, Mirriam, *America’s Greenest States*, *Forbes*, October 17, 2007.
- <sup>xiv</sup> Service Systems, Management, and Engineering (SSME) is a new field uniquely combining computer science, operations research, industrial engineering, business strategy, management sciences, social and cognitive sciences, and legal sciences. See IBM SSME website: <http://www.research.ibm.com/ssme/>
- <sup>xv</sup> “Google.org Announces Core Initiatives to Combat Climate Change, Poverty and Emerging Threats,” Google Press Center, January 17, 2008; Grose, Thomas, *Bringing Science to Life*, *U.S. News and World Report*, August 2007.
- <sup>xvi</sup> National standards for engineering program accreditation are set by ABET, the non-profit organization recognized as the U.S. accreditor of post-secondary degree programs in applied science, computing, engineering and technology.
- <sup>xvii</sup> See [http://www.uvm.edu/EPSCoR/pdfFiles/Vermont\\_Science\\_&\\_Technology\\_Plan.pdf](http://www.uvm.edu/EPSCoR/pdfFiles/Vermont_Science_&_Technology_Plan.pdf), Vermont State Science and Technology Plan, Recommendation 1.3; Vermont Technology Council, August 2006
- <sup>xviii</sup> Vermont Governor Jim Douglas State of the State address, January 10, 2008.

Charge to Vermont Engineering and Environment Advisory Council  
State of Vermont  
Executive Order No. 03-07  
April 30, 3007

**STATE OF VERMONT EXECUTIVE DEPARTMENT**  
**EXECUTIVE ORDER**

WHEREAS, in the last 30 years, industrialized nations have begun to identify a broad range of environmental problems within and outside their borders, many of which require responses employing new complex processes and technologies to cleanup or mitigate past environmental impacts as well as to reduce or prevent future environmental degradation; and

WHEREAS, the key discipline required to successfully clean up or mitigate past environmental problems and to reduce or eliminate future environmental impacts is the field of environmental engineering; and

WHEREAS, the field of environmental engineering is an established discipline dating back to the middle 1800's that has its roots in civil, chemical, and mechanical engineering as well as the supporting disciplines of mathematics, the sciences, public health, environmental law and the humanities; and

WHEREAS, environmental engineering is playing an ever-increasing international role in working to identify and implement solutions to problems associated with ground and surface water contamination, air pollution, hazardous waste, toxic materials, contaminated sites, water supply, public health and safety, wastewater management, stormwater management and a variety of other challenges; and

WHEREAS, the development of public policy and environmental law has been a critical factor in helping countries recognize and address their environmental challenges, but it has been the work of the environmental engineer to adapt scientific discovery to real world problems and deploy mechanisms to remediate environmental impacts; and

WHEREAS, Vermont is exceptionally well-poised to serve as the link between problem solvers educated and working here in professional firms and decision makers in countries seeking to resolve environmental challenges, as we are known worldwide both for our environmental responsibility as well as our environmental innovation; and

WHEREAS, the State of Vermont's economic development efforts have focused on supporting the vast array of firms located within or having offices in Vermont that provide environmental related products and services to the global market; and

WHEREAS, a significant group of environmental engineering firms in Vermont form the basis for an industry cluster that, if supported in appropriate ways, will grow and add good paying, skilled jobs to our economy; and

WHEREAS, a concerted effort to support the field of environmental engineering in Vermont will advance the State of Vermont's much broader effort aimed at improving issues of affordability through increasing the number of good-paying skilled jobs, as well as strengthening education at all levels, with emphasis on the disciplines often leading to quality employment -- math, science and technology.

NOW, THEREFORE, BE IT RESOLVED THAT I, James H. Douglas, by virtue of the authority vested in me as Governor of the State of Vermont, do hereby establish a Vermont Environmental Engineering Advisory Council (the Council), whose composition and duties shall be as follows:

1. The Council shall be comprised of thirteen members, including:
  - A. Seven members, ex-officio, as follows:
    - i. the Chair of the Vermont Technology Council;
    - ii. the Dean of Engineering of the University of Vermont;
    - iii. the Dean of Engineering of Norwich University;
    - iv. the President of Vermont Technical College;
    - v. the State's Chief Marketing Officer;
    - vi. the Chair of the Board of Directors of the Vermont Environmental Consortium;
    - vii. the Secretary of the Agency of Commerce and Community Development;
  - B. Four members appointed by the Governor;
  - C. One member appointed by the Speaker of the House of Representatives; and
  - D. One member appointed by the Committee on Committees of the Senate.

2. Appointed members shall be chosen from the fields of engineering or marketing or from engineering, science, mathematics or technology academia.

3. The Chair of the Council shall be appointed by the Governor from among the Council's members. The Council shall meet at the call of the Chair. Administrative support to the Council shall be provided by the Agency of Commerce and Community Development.

4. The Council is charged with the following responsibilities:

A. The Council shall serve as an advisory group to the Governor and the Secretary of the Agency of Commerce and Community Development as well as to any consultants working for the State on recruitment, retention, and expansion of employment in Vermont;

B. The Council's objective will be to establish the State as a global center of excellence for the study and application of environmental engineering and related disciplines necessary to solve environmental problems worldwide; and

C. The Council shall support and enhance the efforts of the Agency of Commerce and Community Development to identify and recruit engineering firms to Vermont.

D. The Council shall work with identified stakeholders to establish the infrastructure needed to support the environmental engineering industry in Vermont, such as making Vermont an education leader in math, science and technology, supporting universal high-speed internet access for all of Vermont, mitigating affordability challenges due to the lack of housing, a heavy tax burden, rising health care costs and other related costs of living that erode the renowned quality of life in Vermont.

This Executive Order shall take effect upon execution and shall expire on June 30, 2010.

Witness my name hereunto subscribed and the Great Seal of the State of Vermont hereunto affixed at Montpelier this 30th day of April, A.D. 2007.

**James H. Douglas, Governor**

By the Governor: Kiersten Bourgeois, Secretary of Civil and Military Affairs  
Executive Order No. 03-07

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**Vermont Engineering and Environment Advisory Council (VtEEAC)**

*Comments and Questions*

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