SUMMARY OF THE SEPTEMBER 10, 2001 AIA/VERMONT ROUNDTABLE ON BUILDING ENERGY ALTERNATIVES

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The AIA/Vermont Roundtable on Building Energy Alternatives was held on Sept 10, 2001 at the Statehouse Cafeteria in Montpelier. The discussion regarded the reasons that more extensive energy efficiency and renewable energy technologies are not more widely incorporated into new and renovated buildings. It was initiated by a question posed by Vermont's Congressman Bernard Sanders to AIAVT chapter leaders in Washington, D.C. earlier this year.

AIA President Michael Gohl and Vice President Stewart Sutcliffe brought this question to the AIA Vermont Board of Directors. A committee including Michael, Stewart, Donna Leban, and Hanne Williams bought the meeting to fruition, with assistance from Dean Corren, a legislative assistant for Congressman Sanders.

Participants included architects and engineers of various size firms, resource professionals involved in energy efficiency as well as renewable energy installations, corporate and institutional facilities managers, construction managers, contractors, developers, design/builders, and state buildings representatives.

Each participant had an equal opportunity to voice his or her opinion on each of three questions. AIA committee members moderated the discussions. The following comments were submitted in written form and cover the range of comments presented during the discussion, although they are not a transcript of the actual discussion. There is some condensing of the comments presented, but they are generally included as provided. Therefore, the comments represent the views of the participants, and not the position of AIA Vermont or its Board of Directors.

AIA Vermont hopes to continue this valuable discussion in order to further the disciplines of architectural design and engineering for sustainability. Meanwhile, we hope that participants as well as others who read these comments find issues as well as solutions on which to base future efforts, and work to incorporate energy efficiency and renewable energy resources in each and every architectural project.

The Questions (indicated in bold letters)

Participants responses (indicated in standard text)

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Why, in your opinion are cost-effective, innovative, energy-efficient design practices and alternate energy sources not more widely incorporated in building design and construction?

Based on personal observation and anecdotal evidence- including experiences with a wide variety of design teams and regular review of published work- I think the majority of building design professionals have little experience in designing green buildings. Many of us may believe that we are doing all that can be done, given the many problems associated with designing any building, but in fact may only be designing to meet code requirements. "Sustainable Design" can trigger a fear of a steep learning curve and construction cost overruns- basically the fear of the unknown. The real costs – environmental, life cycle- may not be concepts that are conveyed to a client. I'm afraid not enough professionals see the field of conservation/ renewable energy as a growth opportunity. I also believe the situation is improving because designers are running into clients that want sustainable buildings, low operating costs, etc. And there is an increased awareness among the professions thanks to continuing education programs. Situations like the California electricity crunch help to raise professional interest.

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I believe that the answer to the question can be found in the way many projects are put together. In most instances the building developer and the building occupant user are not the same entity. In the early stages of the project, cost estimates, usually based on typical square foot data are used to produce budgets. These costs frequently do not include the higher costs of energy efficient systems and practices. When the design is undertaken, the budgets cannot support these systems and practices, and they are the first things to fall to the floor.

It has been my observation over the years that true cost-effective energy conserving systems are being incorporated into the design of most building systems. However, in order to include these types of systems in a building, the owner and occupant must be made aware of the life cycle costs of energy, or more particularly of the energy wasted. This is not an easy task. Often the calculations required for such an analysis require assumptions concerning future usage patterns and fuel cost projections, both of which are subject to unforeseeable fluctuations.

In addition, the added cost of design, both for the architect and the engineer also come into play. In an ideal world, the architect and engineer would be selected based upon qualifications first and fee later. However, this is almost never the case. In order to be successful in obtaining the assignment and in making a profit on the job, the number of design hours is frequently limited by using systems and techniques that are tried and true. Design budgets simply do not have the leeway to explore alternate systems. Add to this the risk that a new or innovative system may not work as planned, the risk of damage or professional liability claims, and one can easily understand why design professionals are sometimes reluctant to be the first to try something truly innovative.

Alternate energy sources are often simply not available for direct use in building projects. A typical building will use electricity for HVAC, lighting and other smaller uses. Fossil fuels such as fuel oil, natural gas and propane are the typical fuels of choice for heating. To a lesser degree, biomass fuels such as wood provide an alternate. But when looking beyond this to sources such as solar (active and passive) or wind generated electrical energy both the costs and other regulatory road blocks make it difficult. For

example, most communities have zoning restrictions that limit the height of towers, making wind power difficult to implement.

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Vermont is already very energy efficient with respect to new construction "soft" standards for Act 250 projects. The Consolidated Guidelines are probably the most stringent energy efficiency "code" in the U.S. with its requirement of "best available technology, and Guidelines for Energy Efficient Construction for the City of Burlington basaed on the International Energy Conservation Code.

The reasons energy efficiency is not considered more than it already is in Vermont, is in part due to issues that VGS, EVT, and BED are trying to correct: a) education of designers and owners, especially those coming from out of state or from a more southern locale, b) no clear concise commercial energy code in place for the whole state of Vermont, c) some owners cannot afford the higher first cost of energy efficiency measures, especially when energy costs are low and the payback is long. Nothing spurs energy efficiency like rising energy costs. Let them go Up! Sometimes energy efficiency measures make it into the design of a building but them get value-engineered out because the owner cannot afford them, especially in a good economy where bid prices come in high because there is ample work for the contractors bidding.

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From the eye of a solar design and installation company, there are three principal impediments to the use of advanced energy technologies:

1. Emphasis on initial capital cost vs. life-cycle costs of buildings. Energy efficiency and renewable energy elements that do not show an immediate payback (for example 2 years) are not considered in most commercial buildings. Architects, engineers, and builders are usually not responsible for life-cycle building performance.
2. It takes more time, planning, and coordinated effort to integrate good efficiency and renewable elements into a project. Architects, engineers, and builders have an overwhelming financial incentive to <u>not</u> innovate and to use "tried and true" equipment and designs in order to minimize risk and maximize project throughput.
3. There is lack of technical knowledge on the part of designers and lack of awareness on the part of consumers about advanced efficiency and renewable energy technologies. This leads to lack of market demand and to underdevelopment of ths segment of the energy industry.

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This office reviews all Act 250 applications for their energy efficiency features and converses daily with designers, builders, owners, and permit specialists. I perceive two main impediments to more efficient construction:

1. First costs are higher
2. Lack of familiarity with efficient design principals and technologies

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A&E firms design around conventional heating and cooling systems because they know they work and what they cost to install and maintain. They also know that these systems can meet the appropriate energy codes. Innovative systems may not be cost effective for Vermont.

Frequently there is not enough money or time to schedule, research, and design innovative systems, which, if not properly designed, can increase liability to A&E firms. Also, the general fear of change from tried and proven technology is difficult to overcome unless compelling savings are evident.

Many times "cost effective" energy efficient designs simply shift costs from fuel purchases to the need for increased maintenance and service contracts for cleaning and calibration of high tech equipment. Quantifying the environmental degradation costs or higher maintenance and service contract costs into life cycle costs analyses when evaluating energy efficient systems or alternate fuels is a less than precise science. Therefore, many times these costs are left out of the equation.

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While architects and engineers regularly apply the efficiency techniques they already know and understand, there is a general unwillingness to admit that they are not technologically up to date enough to make the most energy effective decisions. However, local consultants are available to help inform both clients and designers, if given the chance.

There is a lack of well-publicized examples of successful, innovative energy efficient and renewably powered buildings. Such buildings should be highlighted with professional tours including technical information, as well as more general efficiency awareness raising media for the public,

An enforceable commercial energy code has yet to be adopted in Vermont. Many designers think it takes too much time and effort to perform calculations and run computer models to properly design and size building components and equipment, even though the energy savings can be significant. Clients need to be educated about the costs of properly designing a building.

Engineers are often unwilling to ask a few questions and design based on needs as opposed to generalized standards or uninformed expectations. An example, using 50 footcandles as a general requirement for lighting all areas of a manufacturing and office facility, rather than considering ambient and task lighting that could save 30-40% of initial and energy costs. Efficient buildings don't always cost more if you spend time to design thoughtfully, rather than hastily.

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1. Clients don't ask for them. A select group of building professionals propose their use out of ethical obligation to the environment. Often, because of a lack of educational background, clients place no value on it.
2. Alternate energy system and building first costs are presently more expensive than their fossil fuel-based and wasteful counterparts. Architecture, engineering and construction of green buildings is not easy and takes more time which equates to more costs.

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Cost effective, energy-efficient practices and alternate energy sources are not widely used because the term "cost effective" is a relative measurement.
First, "cost-effective" is interpreted very differently by building owners and commercial or residential tenants. Non-resident owners transfer risk by ignoring energy efficiency measures since it is their tenants that pay the long-term cost of operation. Unfortunately, it is rare that either the owner or tenant consider environmental costs.
Second, the return on investment for many more costly energy efficiency or alternative energy projects is very long. Our customers often require a return on investment of 36 months or less. When our company is able to meet or exceed that requirement, the demand for projects that lower energy consumption and energy costs is strong. As an example, our company is often able to demonstrate extremely short ROI's for peak power shaving projects and that interest in such projects is high.

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I feel that many energy efficient designs are being done today due to local and state codes, rules and regulations. I do not feel that alternative energy sources have turyly proven themselves economically

viable at this point in time. Alternate designs are only used when called upon by an owner to try to fill a particular niche.

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First costs of high-efficiency technology is beyond the clients budget.
Engineers and consumers are wary of embracing new technologies.
Engineers have "pet" methods used in all design, and are not willing to research new technology.
Association with certain suppliers affects designs.
Many projects are on such a fast track that there is insufficient time to research new methods.

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Time, Money, and Risk
Design budgets are limited financially and therefore by time, preventing complete analysis of the cost-effectiveness of alternatives. Consultants and contractors do not want to take risks on unproven techniques, reduced heating and cooling plant strategies or pay back analyses that may not deliver.

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Energy efficiency and renewables are not considered cost-effective in our culture if they have more than a 3 year payback period. Clients to not accept life cycle cost thinking, and fuel prices are being kept artificially low, which encourages wasteful use of energy.

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In most if not all cases the primary barrier is initial cost. While a school board may be interested in energy savings and doing the right thing for the environment, it is rightfully concerned about the use of taxpayer money. In addition, voters look at the price tag, and do not understand the concept of life cycle costs. Also, the requirement for acceptance of the lowest bid is a barrier to energy efficiency.

A recent occurrence in a Vermont school involved an approved, life-cycle cost effective biomass (wood chip) heating system that was scrapped in favor of a conventional fuel oil system. This was done to reduce the total initial cost of the project when delays resulted in the need to scale back the project. The fact is that what was inexpensive to install may be more costly in the long run.

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<u>Reluctance to change standard building practices</u>

- History from uninsulated to insulated construction, leading to indoor air quality and durability problems
- Solving these requires new techniques
- Design and construction requires team effort which is often lacking
- Low cost of energy does not encourage improved construction practices

<u>Cost of "cost-effective"</u>

- As with most matters in the design and construction of buildings, cost is the driving factor in the integration of energy efficient elements. Most building budgets are barely realistic and do not allow room for alternatives.
- Long-term paybacks do not work with most business models.
- Costs more to re-invent, model, design, and test new systems, cannot compete with traditional systems.
- Added expense to maintain and operate alternative systems

Risk and Liability

-Unwilling to assume risk of trying something new.
-Unable to Bond or Insure new methods or systems.
-Difficult for an owner to finance alternative methods.

Delivery Method

-Typical architecture and construction processes are needs-based (service provider) not ideas-based.
Designs and construction are driven by owner's needs, schedule, cost, not by ideas.
-Scheduling
-Compensation for size of project not for creative solutions.
-Competitive bid process drives solutions back to time-tested systems and methods.

Knowledge and Education

-Status Quo "works", components are familiar and reliable to clients and professionals
-Alternative issues become Code problems
- Current standards and expectations unrealistic
-Indoor comfort levels – tolerate more variability
-Lighting supplemented with daylighting (adds cost)
-Code requirements unrealistic and inflexible
-Incentive programs add work for minimal return

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Limited Financial Resources

All organizations and individual make strategic decisions regarding spending. In business, Mazlow's hierarchy of needs is at work because the survival and growth needs of the organization are number one. If these needs are met, then there might be remaining resources considered discretionary. However, the prevailing wisdom in American business is to evaluate investments on their short term return on investment potential. Long-term ROI opportunities are usually scoffed at in the business community. Our Taxation system does not stimulate long-term investment in capital-intensive projects.

Energy-wise systems and infrastructure is a capital-intensive investment. It is very easy to show good life-cycle cost effectiveness and substantial Net Present Value Savings on energy investments. However, businesses tend to make all financial discisions based on short-term payback.

Among government clients that are required to consider life-cycle cost effectiveness, many times projects are cost effective, but the legislated budgets are insufficient to support these needs.

Among some health care clients that are similarly advised to consider life-cycle cost effectiveness, many times the facility investments are measures against energy wasteful buildings during their certificate of need review and found to be "out of line" and too financially burdensome for an "entitlement funded" facility. Isn't that ironic?

The bottom line is that our taxation policy, which has a significant impact on business-investment decisions, needs to accommodate wise, capital intensive, long-term energy investments.

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I have been an owner of a building design engineering firm, and have represented major clients on large construction projects, sell renewable energy and energy conservation equipment and systems, and consult on renewable energy and energy conservation. One of the reasons I sold my interest in the consulting firm and developed Global Resource Options was due to the inability to have a strong influence on most building design projects. Although I have won international awards for energy conservation in buildings, projects that allowed strong energy conservation and efficiency were the exception, not the rule.

Some architects and engineers ARE incorporating state of the art energy conservation / efficiency / generation measures into their designs, sometimes. Some of those folks are here. But, in general, the broader industry is not. Reasons are noted below. Many of these reasons are myths, but some are not. We need both Cultural Education and Practical Education to change these cultures.

- Owner's culture
  - This building should be like the last one- it worked. (need to redefine what "works" means.)
  - I don't want to pay any more for architectural and engineering fees than I did last time, and that was too much. (The energy savings can be used to pay increased fees, although fees do not increase much)
  - Energy costs are down the road, we'll sell soon, or the tenants will pay for them. (how do we change this culture?)
  - That "new stuff" doesn't work, doesn't help rent space, won't pay off becuasae energy prices will go down, etc. (New stuff DOES work, and a distinctive building attracts tenants.)
  - These items cannot be competitively bid, and I'll get bad pricing. (Pricing can be developed during the budget phase, as is done for many other items in many projects)
- Architects and Engineers Culture
  - My fee is too small to invent new ways of ding the buildings. (Need to get increased fees)
  - If I do something different, my liability is higher. (Owners need to understand what is proven, and what is a trial)
  - It will take me more time to sell a new concept to an owner, and it may not fly, and where's the benefit to my firm? (Owners need to be educated)
  - These energy conservation / efficiency / generation measures take money away from aesthetics. I will not get more commissions unless my buildings have "flash" and my signature design elements. (This may be true. Priorities for funds may change. But energy efficient buildings do not need to be ugly.)
  - The budget does not allow it. (The budget DOES allow it, if it is a design goal of the project)
  - They don't pay off in acceptable time freames. (Who defines acceptable time. Who defines which items need to pay off, and which, like fancy trim, have "intrinsic value"?)
  - If the building shell does not perform the way it needs to, I'll be sued. (Disseminate envelope technology tht exists. Current envelopes also do not always work)
  - I didn't get involved earl enough in the building design to integrate the design well. (Involve engineers at the pre-concept phase)
  - Whenever I need to do pay-back calculations, I know it will be used to delete the item being studied. (Reduce reliance on short term pay back calculations. Look at true life cycle costing)
  - I must provide a "perfect" indoor environment for the building (100% air conditioning), otherwise I'll be sued. (Realize that most of us, especially in Vermont, lived without air conditioning until the past 20 years. Put environmental comfort into perspective.)
- Contractor's culture
  - Charge more for unfamiliar construction techniques. (educate contractors)
  - Bid projects to build them the same as last time, even if the drawings are different. (Require compliance with construction documents. Pay architects and engineers to spend more time on site during construction)
  - Persuade the owner to build it the cheapest way so my profit can be maximized. (Change the rules that rewards long term higher operating costs)
  - Skimp on the hidden details, they will not be seen when the project is complete. (Provide more on-site time for the architect and engineers during construction)

- Don't ask questions about details that I don't understand that will cost me money. (Require compliance)
- I can make as much or more money building with standard construction details. New methods and systems may cost me money. I' afraid they will not work, and there will be callbacks, meetings, and maybe a suit. (Educate contractors. Show how energy conservation and efficiency can make systems more reliable)

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Building owners lease more new buildings to clients than they occupy. Therefore, the owner does not pay the energy costs. Additionally, newly constructed buildings are significantly more efficient than buildings constructed only 10 years ago, and the additional cost to upgrade the building incorporating high efficiency equipment may be prohibitive to the completion of the project.

Financial institutions may not agree to lend money to a project having an "alternate energy source" as the primary energy systems such as solar for space and water heating. Therefore, the alternate system requires a redundant system and is strictly an additional cost to the project.

The market is not demanding more efficient buildings. Energy costs are not a large enough percentage of total operating costs to warrant additional time and resource spending in existing buildings.

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A large percentage of work in Vermont is renovation/rehab. Improving the existing conditions is the focus instead of a push for state of the art. Code compliance and owner needs for cost feasibility becomes the first priority.

Contractors and A&E charge more for the unfamiliar methods and products involved in high efficiency and renewable energy installations. This will change slowly. Owners commitment to new methods (Green and sustainable) is paramount for success. Few can be convinced in the short design process.

What energy efficient design approaches and alternate energy sources do you currently use? What resources do you rely on for information and technical assistance?

This varies widely with the project, including building type and client objectives. A recently completed project included: air tight envelope design, fresh ari ventilation with energy recovery, wood chip district heating, recycled content in building materials, local materials, green certified forest products, recycling operation during construction, daylighting, water conservation, btu metering to monitor performance, etc. The client is an environmental organization with very ambitious performance goals and assembled a team with considerable green building experience. Resources we use for information include trade journals like Energy Design Update, Environmental Building News, Solar Today, the Green Building Council (LEED), and e-mail connection to environmental organizations. Also there are excellent seminars increasingly available regionally – well attended by architects for continuing education credits!

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As a Professional Electrical Engineer, one of the systems I design is the building lighting system. We routinely use several computer modeling programs to evaluate various combinations of lighting fixtures, sources, and layouts to provide a good lighting level at as low a watts per square foot as possible. We use life cycle cost analysis to evaluate transformer losses and specify transformers with the lowest losses consistent with reasonable payback. I have also designed several small scale cogeneration systems to obtain a greater overall efficiency for fuel usage.

Life cycle cost analysis is a technique that is not new. In fact, I was first introduced to it in an Engineering Economics course taken in 1968. Evaluating the operating costs of various systems, particularly those that use large amounts of energy should be part of every design. In designing building systems, it is my practice to evaluate most of the critical systems. However, even when the analysis has been done, it may be subject to elimination if the project bids come in over budget. It is difficult to compare actual construction costs to projected savings based upon a set of volatile variables.

In performing life cycle cost evaluations of a detail electric distribution system, with nearly 500 transformers, the results indicated that the most expensive transformers had the lowest life cycle costs. The building trades simply do not perform this type of analysis which could save significant energy. Rather, equipment is selected by minimums allowed by the National Electric Code.

The sources of information are almost limitless. First, I depend on equipment vendors to provide reliable specifications and performance information for their equipment. Next, through the use of the Internet, I can access research and data from all over the world, although some must be used with care. Professional organizations such as the Institute of Electrical and Electronics Engineers, and some of their technical societies such as the Power Engineering Society and the Industrial Applications Society provide a wealth of both theoretical and practical information. Lastly, through my involvement with several Professional societies on a national level, I have acquired a large number of contacts with other engineers working with solar, wind, hydroelectric, cogeneration and traditional energy sources.

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We have been successful with a number of energy efficient design approaches. The first is thoughtful site planning with energy matters as major design considerations. This is the easiest "sell" to clients because the thoughtful site planning is free.

The next energy efficient design approach is the proper assembly of standard construction materials. Putting a building together with energy conservation in mind requires more discipline than money, therefore is appealing to clients. Proper detailing and specifying low energy or recycled materials often rely mor eon research than cost, thus are easy to integrate into a design project.

After the first two approaches, energy conservation techniques become "cost and benefit" related. Our office has been successful in using both passive and active energy efficient systems. Natural ventilation and daylightng have been the most successful from both an energy conservation and indoor air quality standpoint. In general, the need to economically quantify the savings to the client (both short and long term) is a very important step in the design process. Many energy efficient techniques are very hard to "pin down" in financial terms. It helps when building user heat/well-being can be factored in.

Dependable resources for energy efficient materials and techniques ar few and far between. We have used energy consultants, but they are often seen by clients as "fringe" entities that do not have a total picture of the building project. Unfortunately, we often need to rely on product manufacturers, but constantly need to remind ourselves that they may inflate energy savings claims. EVT has been very helpful in the recent past, and we hope to contrinue working with them in the future.

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Vermont Gas promotes the use of the following high efficiency equipment:

- High efficiency condensing heating equipment
- Ventilation heat recovery
- Modulating burners
- Direct digitally controlled burners, and highers efficiency dreict contact water heaters for high capacity systems.

VGS does not promote alternate energy systems because they are probably very expensive or not cost-effective.
Resources include manufacturers literature, periodicals, and industry standards, like ASHRAE. We verify all of our efforts on state-of-the-art building simulation programs, and refer to actually utility bills of similar systems.

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Solar Works has specialized in renewable energy design and system integration for the past twenty years using the following technologies:

1. Solar Electricity or Photovoltaics- direct conversion of sunlight into electricity.
2. Solar Thermal- active collection systems for water and space heating
3. Passive Solar Design- solar heating and cooling through building elements

Our most valuable technical resources are the National Renewable Energy Lab and Sandia Laboratories.

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Building codes and equipment standards are helping eliminate those situations where builders/designers might otherwise use the worst equipment. Efficiency Vermont, the energy efficiency utility, is helping with education, technical assistance, and financial incentives to overcome the barriers of cost and lack of knowledge, and to guide developers to better choices.

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Currently, I specify high efficiency lighting systems, high efficiency boilers and mechanical systems, and heat recovery with the help of utility rebates. Envelope specified to meet or exceed energy standards. Alternate energy sources are not used due to cost and supply considerations. Information is obtained from architects and engineers who have considerable past tested designs. Efficiency Vermont is a resource as well.

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New and renovated buildings must achieve the energy efficiency dictated in ASHRAE 90.1 and the 1991 Vermont Energy Code, and we are also abiding by the new VT Commercial Building Energy Std. Based on the International Commercial Energy Efficiency Code. Energy management systems and "Smart Controls" and building setbacks are incorporated into all of our designs. Other energy efficiency initiatives include high efficiency motors, lighting, air to air heat exchangers, heat recovery systems, improved building envelope design, minimizing the building envelope heat losses and incorporating high efficiency windows. In 1973 the Montpelier Complex heat plant was converted from oil to woodchips, and in 1985 the Waterbury State Complex was converted from oil to wood too. Currently, nearly 50% of state buildings heat requirements statewide is provided using woodchips or chunk wood.

We are presently in the design stages for a large co-gen facility fueled by liquid natural gas for the Southern State Correctional Facility in Springfield and a geothermal heating system for a new office building in Bennington. The new Vermont Vietnam Veterans Memorial Rest Area in Sharon is being designed as a "green and sustainable" building utilizing a number of innovative strategies for heat and power. Also, it will have its own "living machine" which is an innovative sewage treatment system which recirculates treated water for flushing toilets, thereby reducing water consumption and sewage disposal requirements.

We rely heavily on the private engineering consultants to work with us on building systems designs. Recently we have teamed with Efficiency Vermont to look for ways to achieve cost-effective energy savings.

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Holistic sustainable approach to building design which includes considerations for:

Site Selection
Building Design (a loved building is a preserved one)
Time Tables (taking the time to do things right the first time, the lost American skill)
Project Costs (being mature enough to think long term, the other lost American skill)
Resource Efficient Materials Selection
Occupant Health
Alternate Energy Production
Energy Conservation and Daylighting Modeling
Construction Practices
End User / Staff Training

Alternate energy sources:

Solar PV and Domestic Hot Water Systems
Passive Solar Heating and Cooling
Biomass Woodchip Boiler Systems
Geothermal Heat Pumps
Microhydro Electric Turbines
Energy Efficient daylighting design
High Efficiency Mechanical, Plumbing, Electrical and Structural Systems

What resources do you rely on for information and technical assistance ?

North East Sustainable Energy Association
Environmental Building News
LEED and VBG Rating Programs
Qualified System Designers and Installers
Sustainable design periodicals
Internet Green Building Association interaction
Various Vermont resources and conferences – BSR, VBSR, Building Solutions
Software programs – Energy 10, VisualDOE, GreenSpec
Personal Research
(See Attached List)

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Our company's energy focus is on efficiencies available through improved automation and appropriate application of proven technologies, including:

Distributed generation
Process and facility energy management systems, biomass energy projects
Combined heat and power applications and
Peak power shaving

Distributed generation is locating small generating systems such sa wind turbines, fuel cells, or micro turbines at the point of energy use instead of transmitting that energy over long distances. To put just the distributed generation in perspective- losses on the New England electric transmission system are 730 MW at times of peak load. That is equivalent to 135% of htte generating capacity of Vermont Yankee or the requirements to serve more than 250,000 homes.

Distributed generation avoids transmission losses; can have much higher overall efficiencies when used as part of a combined heat and power application; defers the dispatch of older fossil fueled, peak power plants; can be used to avoid the pollution from spinning reserves and often adds increased reliability. To meet these goals, distributed generation must be available instantaneously whenever it is demanded.

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Design Solutions put in place:

-Ambient daylighting
-Lighting controls
-Energy-efficient light fixtures and automatic controls
-DDC controls for HVAC systems
-Super-insulation, thermally efficient detailing
-Heat recovery systems (air and waterside)
-Variable air ventilation
-Solar domestic hot water
-Photovoltaics
-Constructed wetlands sewage treatment
-Low toxicity materials
-Heat pump heat recovery systems
-District heating and cooling
-Geothermal heat pumps
-Cogeneration
-Wood burning and dual fuel
-Water conservation devices with guaranteed savings

Design Solutions considered but not implemented:

-More efficient HVAC systems
-Solar/Photovoltaics (long payback)
-Wind Power Generation (hard to sell, resisted for aesthetic reasons)
- Low-pressure air distribution systems
- Passive/Convective cooling systems
- Desiccant cooling

Resources:

-Environmental Building News
-ASHRAE Guidelines
-Environmental+Design Magazine
-Manufacturers literature and specifications
-State and local Building Codes
-Efficiency Vermont
-U.S.G.B.C. – LEEDS Program
-Federal programs such as BEPS, etc.
-Energy Rated Homes/ Vermont Energy Star Homes
-Books, databases, and consultants

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Approaches and Sources: Efficiency / conservation first, generation second, except that we DO need to generate with such technologies as SolarWall, and efficient generation technology. We use: super-insulation, super windows, passive solar orientation, woo/biomass heat, efficient lighting, efficient

appliances, turn off "vampire" loads, solar hot water with propane instantaneous backup, net metered photovoltaics.

Information and Technical Assistance: We provide information and technical assistance on renewable energy and conservation / efficiency. We look to HomePower, Energy Design Update, Environmental Building News, several e-mail lists, Efficiency Vermont, and our manufacturers.

What impediments to including energy efficient building design approaches and alternate energy sources do you typically encounter? How could these be overcome?

Lack of enthusiasm and/or skepticism from owners, contractors, and other design professionals is not uncommon. In highly technical areas, such as the relatively new field of building science, consultants are few and far between. Education is at the heart of many of the issues. Professional schools could do a lot more in this area. Continuing education programs with mandated requirements for maintaining registration is effective. Cost effective high performance projects in the region, if adequately publicized, could help considerably. Incentives mentioned in Congressman Sander's memo would be helpful. It is encouraging that the level of interest is increasing without high energy prices. Those with a memory of the 70's will recall what an innovative period that was.

Alternate energy funding at the federal level should be adequate to allow solar and wind to compete on a level playing field with oil, coal, and gas; or remove subsidies from latter. The federal government must keep pressure on raising efficiency standards. Promote policies that encourage reuse of existing structures and infrastructure. The ultimate recycling is recycling buildings. Enormous energy advantage/surplus over new construction. Often "new" means building out of town, on the fringes leading to urban sprawl and transportation energy waste.

Change the perception in Washington DC that conservation is for wimps! The potential is enormous. Savings are equivalent to a huge oil reserve and once in the infrastructure will continue to "produce" for the life of the structure.

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The two impediments we most often face are the need to quantify cost/benefits and the conservative nature of the construction industry. Any help or information source that can provide assistance in energy cost savings in real money terms would be of great help. Obviously, rebate or incentive programs for energy savings products and techniques would also be a big help.

As for the conservative nature of the construction industry, any information resource that keeps track of alternative construction techniques and offers unbiased critiques and "hard" analysis would be informative and may offer a comfort level to owners, designers, and contractors.

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The upfront cost of designing buildings with other than the traditional lighting and HVAC systems is probably the most significant impediment to creating the energy efficient design and implementation of alternate systems. Engineers are reluctant to propose these systems knowing that their fee's will not cover the cost and that it is likely that if te project comes in over budget the alternate systems will be the first to go. In addition, the possibility that a new or alternate system may not work as planned resulting in a legal claim does little to encourage risk taking.

Even the most energy efficient design will work only as well as it is constructed and operated. The engineer has little control over both. Consider the following example. An architect proposes to design a very energy efficient building. The design details haow the various elements of the building will go together in a manner that will reduce outside air infiltration to an absolute minimum. Based upon this, the engineer is asked to design a heating system, complete with heat recovery and ventilation. However, the design should recognize the reduced air infiltration and equipment should be sized exactly on the calculations.

The building is constructed, but the exacting detail needed to control the air infiltration is not followed due to variety of issues. Now, the heating system does not work and both the engineer and architect are accused of faulty design, while the actual problems is hidden and difficult to determine with certainty.

Often, other regulatory agencies have conflicting rules that make implementation of higher efficiency systems difficult to justify. I have encountered resistance to the installation of distributed generation in buildings in the form of obsolete rate tariffs that ended up penalizing the installation to the point that it is uneconomic to install. Yeet, in another area of the state, the serving utility was cooperative and developed new rates that accounted for the installation. Zoning and planning may indirectly prohibit certain alternate energy sources. Yet such requirements are necessary and not all sources will be acceptable in all locations.

These issues can only be solved by continued education of the end user of the value of the energy that is purchased but not used. We can discuss all the "socially responsible" reasoning for saving energy, but it is the economic impact that will ultimately make the difference. By making the connection between the "avoided usage" of energy conservation and the cost savings that it represents we will ultimately reach the goal of maximizing the efficient use of our resources.

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- Lack of money on the part of owners/developers. Consider tax breaks for renewable energy investments, and let energy costs reflect their true costs to society. Equipment mfrs would put more money into designing and building more efficient equipment if energy prices were higher.
- Lack of knowledge regarding the availability of higher efficiency products. Programs like Efficiency Vermont, VGS, and BED are trying to help with this problem, as are manufacturer reps and equipment sales people.
- Distrust of cutting-edge technology, perhaps based on prior experiences with efficient equipment. Incentives are needed to overcome this reluctance to try newer products.
- Lack of communication between owner, developer, designers, and sub-contractors. Equipment may be installed that contractor considers "equal", but is less energy efficient. EVT, BED, and VGS are helpful with this problem, since the owner is more motivated to follow through with energy efficiency measures.
- Energy Efficiency zealots may overstate energy savings and recommend measures that are not cost effective. This creates distrust among building owners and the design community. Look for instances where new technology has been successfully incorporated.
- No clear commercial energy efficiency code in Vermont. One minimum energy standard should be the same for everyone and is clear and concise.

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1. Require life-cycle energy costing for all building projects that must undergo design review. A revenue neutral "fee-bate" system could impose fees on developers that do not meet a certain level of life-cycle energy costs and give rebates or incentives to innovative designs that do minimize life-cycle costs.

2. Develop "market-based" incentives that help overcome the inherent barriers to adoption of energy efficiency and renewable energy technologies. These incentives should reward successful design, building construction, and building operational skill that minimize energy use and maximizes use of renewable, sustainable energy sources.
3. Redirect more of the work of NREL and Sandia National Labs toward commercialization of existing technologies rather than R&D on future technologies. Overcoming educational, market, and financial barriers is currently more of a necessity than technological improvement and will yield greater energy and economic benefits to the country.

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We need to hold developers – those who build space to lease- to a high standard where they otherwise might compromise on efficiency. Certainly there are roles for improved energy standards, tax credits carefully applied and programs where advanced design is rewarded.

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The single biggest impediment to including energy efficient design approaches is budget constraints. Given that new technology generally requires the installation of redundant systems and innovative systems are at least perceived to be more expensive, there increased capital costs and operating costs associated with high tech or innovative designs.

Other impediments besides costs are the need to build fast with proven technology that both A&E's and installers are comfortable installing and guaranteeing. One of the best ways to overcome this obstacle would be for the state or federal government to offer monetary incetives for including such innovative technology in building designs.

Many of the early energy conservation measures undertaken to tighten building envelopes and reduce heating requirements resulted in the Indoor Air Quality dilemma that many building owners find themselves in. Until such time as high technology and innovative systems become commonplace, there will bee a perceived need to have redundant systems to backup those which may experience premature failure.

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The lack of current technological understanding of some engineers and architects can be addressed by programs in continuing education. Architects currently are required to obtain annual Continuing Ed credits in Vermont. Engineers should be required to do the same.

Architects, Engineers, and Owners should, as part of preliminary design, begin thinking, and coordinating strategies for energy efficiency and renewables. Bring in an energy consultant early to help educate the client and the team about life cycle costing and help keep these strategies intact through the design process.

To the extent that money talks in this society, support efficient design with tax credits. Also, create additional utility line charges for customers who exceed building energy standards or who use energy for luxuries such as non-renewable pool heating and snow melting systems.

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Our company faces three primary obstacles to increased acceptance of energy efficient designs and alternative energy projects.

First, companies often require very short return on investment for most expenditures- including energy efficiency and alternate energy projects. Any effort that improves ROI for these projects will result in their increased acceptance.

Second, there is a "not in my back yard" or NIMBY requirement placed on many alternative energy projects. Our society in general wants the energy but not the energy source. All creatures, including humans, modify their environment. We need to educate and facilitate society to accept that modifying our immediate environment in selected ways, is preferable to the global environmental impact of the status quo.

Third, our company works continuously inside many different facilities. We know exactly what unique steps are required to lower energy use within each of these facilities. However, we are frequently excluded from access to funds that are dedicated to energy efficiency measures. In addition, public funds that are applied are used inefficiently because other organizations are paid to learn what we already know. Streamlining access to existing energy efficiency funds would correct this problem.

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Utility or efficiency programs that could perform payback analysis on envelope measures and could contribute towards investments in building envelopes instead of equipment. This is my main beef with the way things are right now. We are spending a great deal of time and money changing light bulbs that will have to be replaced in three to five years instead of making investments in the thermal envelopes of our buildings, which would provide returns throughout the life of a building.

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Lack of knowledgeable clients and a lack of long term financial thinking. Current fuel prices need to be higher to spur development and implementation of future energy sources.

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Impediments include:

- Lack of information
- Perceived risk
- High initial cost premiums
- Lack of incentives that place renewables on the same level (ie, subsidized) playing field as conventional energy sources
- Additional time to learn about and specify
- Limited pool of experienced sub-contractors

How to overcome:

- Provide good information/technical assistance sources
- Create financial incentives for contractors to offer and install energy efficient and renewable technologies (such as grants or low interest loans to get trained and purchase specialized diagnostic equipment, such as blower doors to test air infiltration)
- Create financial incentives for building owners to incorporate these technologies through tax credits.

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In order to overcome barriers to more efficient building design an alternate energy sources, develop a revolving 0% interest loan fund for energy efficiency improvements for schools. In this way, if an energy efficiency improvement has a simple payback of 7 years, and there is a 7 year loan, the loan would be

paid for by the ongoing energy savings. At the end of the term of the loan, savings would accrue to the school. In Vermont, where there is a form of statewide funding for schools, all taxpayers would benefit. The only costs would be the administration of the loan fund, and the effect of inflation on the value of the dollar.

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Easier funding of energy savings investments and better management of energy usage guidelines. Creative an coopeative efforts by competitive energy suppliers on synergistic energy systems (co-gen), reduced demand penalties for alternative energy systems, and acceptance for strategic energy independence in our national energy policy.

Funding availability could be improved if energy investments were considered separate of normal "certificate of need" and other financial comparison evaluations of construction budgets. Creation of an "Accelerated Depreciation of Capital Investment in Energy Saving Measures" accounting procedure that is acceptable to the IRS. This would still require the funding to come from the investor, but would service as an equalizing force that stimulates the owners to consider more closely these longer-term financial investments.

Many projects in Vermont are built using the process of Design=Build without proper use of Qualified Designers. Labor and Industry regulations have removed specific clauses in the state Building Code that require stamped drawings for projects over a certain size (under pressure from lobbying efforts). In my opinion, the energy efficiency of these projects or buildings suffer. The major focus of these projects by the developer is to minimize the investment, because the majority of these buildings are speculative. Long-term energy concerns are the least of these investors worries. As engineers and indoor air quality consultants, we are brought into some of these buildings on advisement. We have found many instances that key elements of the building codes have been ignored. These projects account for a significant percentage of the building energy consumption in the state. All non-single family residential and all commercial and industrial new construction and renovation projects should be stamped by a building design professional to assure that the plans and final installation meet the state and local energy and building code requirements.

Renewable energy systems should be allowed to take advantage of alternative metering strategies. These systems should be able to contribute to the overall energy delivery of the community. When these systems experience abnormal disruption, the electrical demand penalties can wipe out an entire tow months worth of energy savings. There needs to be a realistic economic penalty for this occurrence in order to improve our move toward energy independence. The move toward hybrid vehicles is a parallel example of the benefit of small electrical generation plants. There are real opportunities for this kind of energy management. What is required is the realization that these modalities fit into our national energy policy.

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Personal acceptance of the principles behind energy conservation and more sustainable building is key to changing the current state of building today. We cannot convince building owners that these issues are important if our actions are not reflecting our beliefs.

There were many indications from representatives to the Roundtable that subsidies and tax credits are needed to level the playing field between traditional non-renewable energy sources and renewable energy sources. This would be a step in the right direction, however I believe that eliminating the subsidies that exist for many non-renewable fuels and making sure that the ancillary costs of these fuels is reflected in their prices is a better way of doing business. These ancillary costs include environmental degradation, pollution, and human health issues.

Education is key to the process. Until everyone involved in designing, building, maintaining and owning buildings understands why it is important to change to more energy and resource efficient methods of building, it will be very difficult to implement change.

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Partnerships within the business community (UVM/FAHC/Champlain College) impedes innovative practices.
As a consusmer, I need to see proven technology working in a health care setting. Data from salespeople or engineering companies is insufficient. Site visits are ideal.
Most facility professionals are so involved in crises management that little time is available for researching best new efficient equipment.
Availability of financing would help alleviate the initial cost outlay for efficiency measures and renewables.
Training and education of building operators needs to be improved.

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Time, Knowledge, Openness & Willingness, Budget Priorities (not restraints, priorities), and Code mandates.

We recommend the following immediate actions:

- Implementation of a program where paid, trained personnel visit architectural and engineering offices on a frequent basis (1-2 times monthly, depending on firm size) These personnel provide free consulting service to the architect for implementation of energy efficiency, conservation, and renewable energy generation in current projects. They do not perform all design, but provide concepts and assistance on site, as well as by telephone and email. This program should last at least 2 yeears, and should employ at least 5 consultants on a contract basis.
- Updating codes to require a much higher level of conservation, efficiency, and generation to new and renovated facilities.
- Adoption by the state of even higher standards for conservation, efficiency, and generation in new and renovated facilities.
- Dramatically increasing the current Systems Benefits Charge to cover a much braoder range of energy conservation, efficiency, and generation.
- Legislation for implementation of a 60% tax credit for renewable energy systems.

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- The "de-value engineering" process initiated by short-term, first-cost oriented, uneducated clients, realtors, designers, engineers, and conservative mortgage companies that do not place sufficient value on energy efficiency or understand that global warming is real and that continued fossil fuel consumption will eventually put the U.S. at risk. (no one ever "produced" a barrel of oil.)
- The average architect, engineer, and contractor has no time to add the skill of "green building" to their business plans. An architect designing a building in 1960, for example, produced fewer drawings and abbreviated specifications, had no ADA concerns, had no computer technology to keep up with, had more simplistic building codes to deal with, simpler contracts, and made higher relative fees than they do today. Adding sustainable and energy efficient design to their responsibilities makes little business sense. Other than those few practitioners who see energy efficiency as an ethical, not financial decision.
- The lack of properly enforced energy efficient building code requirements at the federal and state levels, which are consistent with realistic predictions of future global energy dilemma.

- Alternate energy system first costs are presently more expensive than their fossil-fuel counterparts.

To overcome:

- Government funding for development of easily usable life-cycle assessment tools for building professionals and end-users to see the consequence and true cost of short term thinking. Shift our fossil fuel-based economy to an energy-producing economy if we are going to survive.
- Federal and state govt funding of educational, development, and implementation programs which make it easier for building industry professionals to learn and apply energy efficiency to their projects without large time investments. Grants should be easily available to those invested professionals for research and product/procedure development to the benefit of non-profit or government organizations such as NREL, VT Dept of Public Service, NESEA, and VBG.
- Clients should hire design and construction professionals on the basis of long-term value.
- The U.S. government should fund renewable energy development as a security and peace-keeping measure, redirecting the cost of several large military defense purchases.
- Subsidized mortgage interest rates for buildings that are certified by sustainable design and construction rating systems such as LEED or VBG.
- Education for clients and end-users about the true costs of their decisions based on life-cycle cost analysis and other intangible project value such as employee satisfaction.
- Educate legislators about the true cost of building energy efficiently, and allot construction budgets accordingly.

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No resources for reliable information on embodied energy comparisons for materials.
The construction industry has an abysmal research and development track record. For such a significant part of the economy, we fund very, very little research.

Skills. Architects understanding of the integration of systems as a total design strategy must start in school, but become a more important part of practice - including the licensing exam. Contractors need training to understand new methodologies and have the ability to employ skilled workers.

Need more PR on energy efficient / renewable energy successes in buildings. Need to pass a state-wide energy code. Engineers need to start working with architects at the building conceptual design stage to ensure the budget and design complies with energy efficiency goals.

Our culture needs to change to think of building as a legacy to the future. Buildings need to be designed with a life-cycle of 50-100 yrs minimum.

Renewable energy and innovative energy efficiency systems may have poor cost/benefit ratios using current energy costs. Solution: Create regulations that require energy efficiency calculations bee based on projected real long term energy costs and societal costs.