



**A Real Boost to Canadian Colleges Through Renewable Energy and Education, Training and Applied Research**

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# **A Real Boost to Canadian Colleges Through Renewable Energy and Education, Training and Applied Research**

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## **ABSTRACT**

This paper will look at the steps necessary to achieving broad educational curricula in our elementary, secondary and post-secondary institutions, as well as creating the partnerships necessary for successful development of such ideas. It will also consider educational concepts already in play elsewhere, and in what venues education can play a necessary role in assisting with the development and deployment of renewables. For example, the availability of trained technical personnel is a basis for successful deployment of renewable energies. Ontario alone has a shortage of some 1000 engineers and maintenance technicians needed to achieve its target of 10, 000 MW by 2010; the moment people are employed in production and installation, this will go up significantly and be in the thousands. Thus, training initiatives need to operate in concert with establishing market and policy incentives.

While institutions can lead the educational agenda for renewable energies, public education for those not within the educational system also must be considered, including continuing to educate our governments and public officials on the absolute necessity for alternative energies to become part of the mainstream. In this respect, industry and providers can assist in forwarding the agenda. But perhaps the most crucial link in the educational continuum is to make renewables education a part of everyday life, both inside and outside of the educational system.

A broad based commitment, on the part of the public and government, to all fields of alternative energy generation will push the renewables agenda forward, and we must continue to consider that it is the holistic view of alternative energies that will provide the most significant benefit to our environment, our businesses and industries, and, perhaps most importantly, our homes. However, we also need to put a strong focus on public education, starting with public awareness and an integration of renewable energies, policies and ideas into educational curricula at all levels.

## **INTRODUCTION**

It is clear that the emphasis on any educational momentum in renewable energy must include the idea that everything is related to education in one form or another. Thus, when we discuss the deployment of renewable or alternative energy technologies, education must be part and parcel of those initiatives, and on a wide variety of fronts. But it is also true that there are a number of other factors that must be considered, and the most important of these is education surrounding energy conservation. We will not succeed in respecting our environment and ourselves appropriately until we have educated ourselves regarding proper conservation practices and alternative energies, as well as our broader population. I would suggest that conservation is such an important part of the education process, that we should consider it yet another form of alternative energy. As the Ontario provincial government struggles to get sufficient energy supplies lined up, with the situation so serious that expanding atomic energy production is considered as one of the key options, we must focus on making conservation the most exciting energy option available.

At St. Lawrence College we are developing a prototype approach to how public buildings ideally can be converted from high-energy users to lean, efficient buildings using any form of possible conservation combined with feasible renewable and conventional energies. We are embarking on this project with our professors and students. The combined learning experience and the saving of energy will give us a double return. We have the ambitious goal to finish the planning of this project this winter, and should be able to present the project to the provincial Ministry of Energy as a pilot. Implemented on a large scale, just public buildings alone can save more energy than the planned production expansion into atomic energy at the cost of more than a billion dollars. Investing this kind of money could help to convert hundreds of institutions, offices, ministries, city halls, hospitals etc. within the foreseeable future. This would automatically create new industries with thousands of employees. With 100,000 private solar roofs installed in a similar fashion in Germany, more than 500 megawatts of decentralized solar generation was created at a cost of around 2 billion dollars, and more than 10,000 permanent jobs evolved from the project. With this, and almost a billion dollars of private or corporate capital that was invested into buildings and equipping a newly evolving industry, the government's spending was easily justified. Considering what it cost to create 10,000 new industrial jobs, a significant relief to the environment, and numerous other positive side effects, including the educational aspect for a whole nation, this was actually a very reasonable investment into the future with a high permanent return. It also assisted the solar industry in moving forward. The cost per KW is declining dramatically, a trend that will continue, and even accelerate, in the next few years.

Regardless of all the figures, imagine what kind of inspirational, educational and industrial impact actions like this would have in Ontario. Just as the automotive introduced a new era in Ontario, renewable energy can help us as we prepare for a new era of innovation and learning.

This would be an ideal partnership project between the Federal Government and the Province of Ontario, and would be similar to what happened in Alberta, where wind was promoted in partnership. The fact that 90 % of Alberta Government buildings are fueled by renewable energy, as well as a significant part of the public transportation system, will also have a lasting educational impact and prepare for innovation on an even grander scale.

What we need is a holistic educational approach, from cradle to grave, that includes formal educational practices within our school systems, at all levels, in addition to public education for consumers, for business and industry, and for politicians and government. It is telling that, throughout the Green Power Workshop series, hosted by Pollution Probe and the Summerhill Group across the country in 2003-2004, education kept coming up as a key point to push renewable energy forward, and yet there was initially not sufficient space to discuss the applications necessary to make education in this field a national priority. This paper will attempt an introduction to some of the key ideas we need to address in order to bring renewable energy education into the mainstream of daily life.

## **POLICY CONCERNS AND CHALLENGES**

As Canada has no central federal government ministry or agency responsible for education, establishing educational policies regarding alternative energies will have to proceed provincially, which poses some interesting challenges in terms of government buy in, pedagogical issues, and the difficulty of dealing with decentralization. Just as it is difficult to achieve consensus on how best to define, create and deploy green power, as the recent cross country workshops organised by Pollution Probe and the Summerhill Group have shown, the same challenges present themselves when dealing with setting up a life long educational curriculum in these areas. Specific lobbying efforts will be needed to target sympathetic politicians and bureaucrats in the areas that renewable energy typically finds its champions,

as well as in the more traditional educational circles. Federal and provincial standards and policies on energy of any kind are also badly needed!

In addition, we will have to continue to emphasise the holistic approach that must be taken. Education in renewable energy is another facet of healthy living, just as proper nutrition and health care. This dimension must not be lost if we are to be successful in creating a lifelong learning “package” for renewable energies and practices.

## **LEADERSHIP: THE TIME IS NOW**

In seeking a broad based commitment to renewable energy education, the support of a number of levels of the population must be sought. In particular, governments must be wooed at all levels in order to support appropriate policy creation, the purchasing of green power as motherhood idea, and assistance in creating new public initiatives not only at the policy level, but also on the level of public education, whether it be a significant curricula direction or something as focused as workshop groups for interested homeowners.

Next, industry must work together with renewable energy providers in order to “advertise” appropriate messaging to a public that will, hopefully, be hungry for news and innovation.

Providers must work together as much as possible. Speaking with one voice is not something we have accomplished well, to this point, in Canada, but I believe that is changing rapidly.

And, last but not least, the public must be engaged in the dialogue along with all of those whose interests are vested in renewable energy, for it is the public that will gain the most benefit in terms of healthier living, in the long run. Everyone must be encouraged to participate in publication education, and public awareness campaigns will be a large part of this area.

## **TARGETTING SPECIFIC AGES AND GROUPS; FROM FORMAL EDUCATION TO LIFELONG LEARNING**

When we talk about public awareness campaigns, we must also be aware that making the leap from knowledge to application is not easy. People avoid change for many reasons, and so the cost of change can be high. This is why it is imperative that early education on renewable energies, in the most holistic of ways, is the logical foundation on which to build an educational model that will serve us well in the future. In this way, we can look at breaking the educational continuum in Canada down into sections, discussing what might be most appropriate at each level in order to achieve specific outcomes that will ultimately enshrine an awareness for and appreciation of renewable energies into everyone’s everyday consciousness. For the purposes of this discussion, we will be considering ECE/Kindergarten, primary/elementary education through to junior high school, high school, and then programs in Colleges and Universities. After the more formal notion of educational curricula, we must also discuss the best way to approach public education in the broadest possible sense; for example, who are the interested audiences, and what is the best way of reaching them in a timely and efficient manner.

Of prime importance, no matter what level of the population or age group with which we are dealing with, is the need to make educational resources a commonplace, both easily available and accessible to the community and its visitors. We need to make people understand that the buy in begins with the individual: it all begins with YOU!

## **KINDERGARTEN/ECE**

If we truly want to make a difference in education, we must start with the youngest and most impressionable of our citizens: those who are either in early childhood education programs, or in the first years of the elementary school system. If we succeed in making renewable energy a commonplace factor in these young lives, there will be no question, as they reach adulthood that they will understand and accept the influence that our energy choices have on nature and thus humankind. Materials will need to be provided that explain, in a way that is simple, understandable, and fun, how our environment works, the role of energy in our world, the impact that our choices have on the whole system, and the importance of conservation.

Better still, if we can come up with materials and curricula that make it play for our youngest children, they won't understand why their parents and other adults have different thought processes, and in turn they will be a significant influence on the adults around them. Hands-on activities that explain "how things work" will be important to this age group, which is often concerned with taking things apart to understand how it all functions. We need to engage their spirit of connection and exploration of the world.

## **PRIMARY/JUNIOR HIGH**

By the time our young people reach elementary school grades, through to the junior high school years, they are already learning much about their place in the world and their importance in it. Curricula at this level will still need to have an element of fun, but it also, in turn, must motivate in a practical way. Hands-on activities will continue to be important, not just from a play perspective, but also in ways that children can test and experiment with different aspects of renewable energy. It would be worthwhile, for example, to have small, simple demonstration units of the available technologies, so that children can see for themselves how they work. An expanded range of literature on the subject will also be important, contributing to increased technological literacy. And, a program like "Biotech in a box" which I will discuss in some detail in the high school section is also useful here.

As with the younger children in kindergarten, it will be important to show how our individual choices have an impact on our environmental systems. In Sudbury, at Science North, there is a wonderful new interactive video/object theatre that hammers home the impact that overuse of fossil based resources has on our environment. Narrated by sheep in a field (voiced by Rick Mercer, one of Canada's young and very popular comedians) *The Climate Change Show*<sup>1</sup> walks children through how our atmosphere came to be, and how our use of electricity and fossil resources jeopardizes our future for everyone, including sheep!

As with Science North's other Object Theatres, *The Climate Change Show* is a multimedia event designed to use video along with special effects, relevant objects, and lighting changes to appeal to various senses that draw the audience into the experience. Object Theatres have been popular exhibits at Science North, offering high quality education and entertainment to audiences.

The *Climate Change Show* was conceptualized at the beginning of 2001 to address a serious topic worldwide: global warming. With a goal of increasing public understanding of the dynamic nature of climate change, revealing the present and future impact of global warming and empowering visitors towards positive action, a team of Science North staff began work to bring the idea to reality.

One of the challenges in developing this object theatre was how to best to bring this serious topic forward in a way that navigated the muddy waters of social, economic, cultural and political issues that are associated with global warming and climate change. Thus an animated narrator – a talking sheep – speaks plainly about climate change, while the media of a cartoon character allows opportunity for humour throughout the presentation. Stunning special effects recreate weather patterns, including a storm effect with wind, rain, thunder and lightning, reinforce the message being relayed by the show.

Such an approach could easily be translated to renewable energies (which are already an integral part of the above show) and the broad appeal of this medium is indisputable.

## **HIGH SCHOOL**

In high school, the curricula we must consider need to be broader, more demanding and overarching. These age groups are not only being educated, but they are also at a point in their lives when they will start considering employment. Given that Canada lags behind the rest of the world in terms of having enough trained people to create and maintain renewable energy installations and networks, informing this age group about potential future work opportunities is critical.

I mentioned “Biotech in a Box” earlier. In the Kingston area the community-incubated, “Biotech in A Box” program delivers portable biotechnology labs for three school boards located in a wide radius around Kingston, including Trenton, Cornwall and Vankleek Hill. The labs provide students access to the sophisticated biotechnology experiments and techniques that few school boards can afford to provide on their own.

The two “boxes” consist of a DNA electrophoresis lab and the polymerase chain reaction lab, each containing equipment, materials and instruments necessary to perform industry standard biotechnology experiments in the classroom.

The program grew out of an innovative partnership between St. Lawrence College, the Kingston Economic Development Corporation’s (KEDCO) biotechnology action plan, Queen’s University, the local public and Catholic school boards and local biotechnology firms in 1999. “Biotech in a Box” was designed to do something proactive that would benefit our local students and the local economy. We quickly realized that science teachers embraced the emerging biotechnology disciplines with enthusiasm coupled with the frustration that they lacked the means and resources to provide their students a window into this new field.

The Biotech in a Box model provides secondary school teachers with a crash course in biotechnology through workshops offered by St. Lawrence College before demonstrating the labs at their high schools. There is still a waiting list for the workshops, another indicator of its popularity. The Kingston biotechnology action plan has resulted in the city becoming a recognized bio-cluster in Ontario and “Biotech in a Box,” certainly seems to be a good investment for its future success. This success could certainly be repeated in the area of renewable energy

To date, seven schools from three school boards have utilized the labs throughout southeastern Ontario. Thirty-one teachers have been trained to deliver the workshops and more than 230 students have been exposed to the program’s experiments.

Biotech in a Box has allowed students “to consider biotechnology as a career option and to connect with the biotechnology firms in the community,” says Barbara Heins, the first teacher to use the

labs at her Frontenac Secondary School. Heins believes the labs were helpful for the genetics modules of the grade 11 and 12 biology curricula. But for most the thrill “was the chance to use highly sophisticated equipment not accessible to high school students normally. And it was great fun.”<sup>2</sup>

The program will be expanded in 2003 to include the students’ perspective and the social component of biotechnology, in order to make students aware of the broad range of career opportunities. As with renewables, there is more to the career side than just science. There is a regulatory side to the industry, and it will need people who understand the legalities of the new technologies. In addition, we’ll need to educate people to communicate about the field. This is a great age to give idealistic people a good look at what they might accomplish in the field of renewable energy. This is also a neat way to help students, who are undecided and lacking direction, to activate a passion and a self-motivation to learn and feel part of a real life experience

## **COLLEGES AND UNIVERSITIES**

Perhaps the area that needs the least convincing that we must teach more about renewable energy is the college and university sector, but even here there needs to be broader application of knowledge. As it stands today, there are specific departments and faculties that address renewables and their technologies, but what is now needed is an “Applied” function, particularly in general course work, that can create an awareness of the practical aspects that need to be addressed. Post secondary education has a number of functions here: it can create awareness through community education and outreach, it can create applied research, it can provide education and training, it can grow partnerships and commercialization, and it can help with consulting for governments.

Practically speaking, the availability of trained technical personnel is a basis for successful deployment of renewable energies. Ontario alone has a shortage of some 1000 engineers and technicians for maintenance alone needed to achieve its target of 10,000 MW by 2010. For production, installation and marketing/sales, additional thousands of qualified people are needed if we seriously want to develop our own products. Thus, training initiatives need to operate in concert with establishing market and policy incentives. The background document for Workshop 5 of the Green Power Workshop series strongly recommends that an able work force is needed to support the emerging green power industry in Canada.<sup>3</sup>

For example, St. Lawrence College offers a program in environmental assessment, at the technician level. But this offering could easily be expanded to include a more general, continuing education sort of training that could easily benefit members of the general public who are interested in lifelong learning. It would then gain momentum not only as a field of employment, but also as an area for contract training and lifelong learning.

Educational institutions, particularly those closely tied to their communities like St. Lawrence College, need to be places where technology around renewables can be explained in an open and non-threatening way. Not only are we the venue for training those who will build and maintain the equipment, through our programs in Electrical Engineering Technology, but we are also the venue that can best give access to the community.

The Association of Canadian Community Colleges is also paying close attention to these developing trends. They have teamed up with several Canadian renewable energy associations to develop a strategy for renewable energy training. With support from Natural Resources Canada and working with CanWEA, CanSIA, CanBIO and the Earth Energy Society of Canada, ACCC is set to develop curricula for several pilot training courses, initially focusing on wind power, photovoltaics, biomass and heat

pumps. ACCC is researching the needs of each sector in order to identify competency gaps that need to be filled by training technical personnel. Moreover, the program aims at the implementation of renewable energy technology pilot projects at colleges, outreach to communities and the general public, and the development of a national strategy for green power training in order to leverage support for setting up new training programs.<sup>4</sup>

At St. Lawrence College, we are committed to a significant number of environmental and alternative energy initiatives. We believe that the best way to effect change is to lead, and that is why our Cornwall Campus has a demonstration wind turbine in operation. At the Kingston Campus, there is some exciting research taking place combining two solar technologies. A cooling effect is created through the installation of a solar wall underneath the photovoltaic generating panel, which can increase the power generation efficiency of the active photovoltaic array and at the same time the extracted heat can be used in exchangers, either in the heating or cooling cycle, or for heated fresh air intake.

However, I believe that “Energy House” will be our most important contribution to the community in these areas. Energy House is a public education partnership involving St. Lawrence College of Applied Arts and Technology, the school boards in the Kingston area and the general public. It will be a facility to make alternative energy concepts and products accessible to everyone in the Kingston area – particularly students. Educating the next generation so they understand and embrace alternative energy is key to the future of our environment. Technology is developing at a very rapid pace and becoming more complex but also more competitive. Energy House will focus on alternative energy concepts and products that individuals can use in their homes and in their work such as solar heating, heat pumps, photovoltaic systems, energy efficiency in construction and in appliance usage.

St. Lawrence College will create a stand-alone facility to incorporate a number of alternative energy technologies to be used as demonstrators and for applied research. The building will be relatively small and in itself energy self-sufficient. We will likely use a portable type building and will incorporate a solar wall air heating system, solar hot water heating, photovoltaic panels for electricity, energy efficient reconstruction of some wall and roof elements, air or ground source heat pump and the possibility of a small wind turbine and/or a residential fuel cell.

At both the College and University levels, there needs to be this sort of introductory direction, regardless of the field in which students are studying. Aspects of the environment and renewable energy could easily become a common credit. Multipurpose courses could then lead to credits in other areas as well; for example, there could certainly be a shared curriculum with medicine and healthy living. In Northern Europe, for example, technical universities have such mandatory courses and it is a part of society. The same can be done here.

In addition to the technical aspects, we must also be considering the environment and renewable energy in a philosophical way. How and why do we apply renewable energy technologies? How could we best build our houses? The Canada Mortgage and Housing Corporation, for example, has an interesting publication in this area, but it needs to be simplified and made more accessible. All of these things are ideas that could be considered in post-secondary education, along with medicine, law, and business, as well as science and technology. It is for this reason that I would argue that a mandatory half-credit in such an area could contribute enormously to economic development.

## **INFORMAL EDUCATION AND LIFELONG LEARNING**

Clearly I have touched on a number of these areas earlier on, and you can see how much of our discussion can apply to those who are consumers, interested in access to programs that are of interest to

them without necessarily being tied to accreditation. I'd like to mention a few types of initiatives that we should consider as being integral to lifelong learning, however. We need to focus on energy awareness courses for the public and for private sector companies. We need to educate consumers on the appropriate attitudes to energy use and conservation. We need to work within our communities, setting up common interest groups, encouraging volunteers, perhaps, to become community energy advisors. We need to help work with our communities in terms of advising them how best to secure funding for renewable projects they may be interested in developing. We can provide presentations to those who are interested. We cannot take for granted that the public knows anything about what we are talking about. Vision Quest, Canada's largest wind power operator and retailer, has shown that while wind and solar are accepted as "green" energies, for example, hydro and biomass-based generation requires some education before it is accepted as such.<sup>5</sup>

## CONCLUSIONS

A broad based commitment, on the part of the public and government, to all fields of alternative energy generation will push the renewables agenda forward, and we must continue to consider that it is the holistic view of alternative energies that will provide the most significant benefit to our environment, our businesses and industries, and, perhaps most importantly, our homes. However, we also need to put a strong focus on public education, starting with public awareness and an integration of renewable energies, policies and ideas into educational curricula at all levels.

At the last Green Power workshop, education and training were identified as crucial requirements for a comprehensive green power strategy. As the document states, education of the general public is required to increase support for green power in Canada, which in turn will enhance political support for, and reduce local resistance to, green power projects. This can be achieved through various means, starting with public forums, ad campaigns, and also power source disclosure on utility bills. Education of the financial sector, governments and investors, is also needed to create a paradigm shift and momentum to move to a more diversified energy economy.<sup>6</sup>

In many ways, all of the ideas discussed indicate a significant need to change our lifestyle, and we are at a point in our history, here in Canada, where we have a unique opportunity to do so. Other countries such as Germany, Scandinavia, the Netherlands, Spain and Japan are already showing us the way. We have ignored change so far because we have been blessed with an overabundance of resources, but the impact on the environment has been significant and detrimental to our way of life. Now it is time to redress that impact by making renewable energies part of everyday life, and the best way to accomplish this is to make it part of everyday education and lifelong learning. We need to educate teachers and counselors to show our students new and better directions. We cannot differentiate between renewables; no one technology is better than others, and they all have their appropriate place, as well as strengths and weaknesses. We need to show people the best and most appropriate use for these technologies.

As the Green Power Workshops identified, education should be an integral part of a national strategy on renewable energy.<sup>7</sup> I would also argue that a national policy on education would make such work much easier and more effective.

However, it is the necessity of the holistic view that is most crucial. We must all work together to support each other. In this holistic view, conservation must play a major role, without question, and needs to be treated as a renewable energy all on its own. Thus, changing our lifestyles and attitudes becomes a major part of what we must do; self-education is as important as formal education. The more we do, the better our quality of life becomes!

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<sup>3</sup> Martin Tampier. “Background Document for the Green Power Workshop Series: Workshop #5” for Pollution Probe and the Summerhill Group. April 3, 2004. p. 123.

<sup>4</sup> Association of Canadian Community Colleges. “ACCC Renewable Energy Program” [http://www.accc.ca/english/services/renewable\\_energy.cfm](http://www.accc.ca/english/services/renewable_energy.cfm) July 2004.

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<sup>6</sup> Martin Tampier. “Background Document for the Green Power Workshop Series: Workshop #5” for Pollution Probe and the Summerhill Group. April 3, 2004. p. 52.

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