Just Lather, That's All!

It's amazing - this will be the last ISTNEWS of 1994, we're approaching the half way point of the decade and it doesn't seem as if much has happened on the greenhouse gas issue. Raised in 1988 in Toronto, discussed in 1990 in Vancouver and "signed" in 1992 in Rio de Janeiro, this was the first year that I felt like anybody was doing anything about greenhouse gas reduction - and it was only words, words about how little we've done up to now (COGGER report) and about what we should do to hold back the CO₂ emissions tide (Climate Change Task Force and the Canadian Emissions Modelling Forum). There are those who are analysing the 1990-1993, data hoping that it will show an autonomous reduction in energy intensity and CO₂ emissions, since there weren't really any substantial emissions reducing programs in place. Some analysts, including those at ERG, generate output concerning the policies and regulations required to stem the CO₂ flood. It seems that we would have far greater impact helping others reduce CO₂ generation (say, in third world countries) than force our industry, residential, commercial and transportation sectors to toe some regulatory or policy line. Others are still convinced that the greenhouse warming issue is just a hoax; that, even if it were true, it would probably be more beneficial than harmful. One frame of thought suggests that there is nothing we can do, short of reducing output (i.e.: live more ascetic lives, resisting the trend to and temptation of materialism, small is beautiful, local is better), to sufficiently reduce CO₂ production in any consequential way.

In any case, it has taken us four years to begin some analysis and it will take at least a few more to initiate some action - if anything gets done at all. In the mean time, our emissions levels are increasing and the degree of reversal (because the goal is to not exceed 1990 levels by 2000 and be 20% less by 2010!) becomes greater. It's politically sensitive, a threat to personal security (especially if it's your job on the line), and may not auger well for our standard of living. Even the fear generated by the precautionary principle (what might the cost be if we don't do anything) seems to worry no one; they've thrown (pre)caution to the wind! In the mean time, we generate more reports, do more estimates of the impacts of certain measures, determine what BC or Ontario, or whoever, has to do to have some positive effect on the levels of emissions generated.

Hernando Téllez tells a story of a barber in the old west who has a hated gun-man and executioner sit in his barber's chair. Bearing his sharpest razor, he seethes inside, debating whether or not he should rid the town of this "problem" by ending the man's life with a quick slash while shaving his beard. But after discussing it with himself, he winds up letting the man go unharmed - it was just lather, that's all. Perhaps we too are guilty; it's just lather, that's all.

John Nyboer, Editor

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**The REM Energy Research Group, the ERG**

Dr. Mark Jaccard - Director  
John Nyboer - Executive Director, Ph.D. Candidate  
Alison Bailie - Researcher  
John Dawson - REM Masters Student  
Lee Failing - REM Masters Student  
Sharon Lacy - REM Masters Student  
Hao Liu - REM Masters Student  
Andrew Pape, REM Masters Student  
Bruce Roberts, REM Ph.D. Student  
Cathy Strickland - REM Masters Student  
Shelley Wennaas - Economics Masters Student  
Andrew Seary - APL Programmer  

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**New REM Year, New REM Students**

Last year we welcomed a couple of new students, both in the Masters program here at the
School of Resource and Environmental Management (REM). This year we welcome two students as well, but for the first time we welcome a Ph.D. candidate, one of the first in the new Ph.D. program at REM. You’ll see their names in the REM ERG listing in the shaded box above, Andrew Pape and Bruce Roberts. As we do with all new students who come into ERG at REM, a brief introduction.

Andrew Pape, REM Masters student

Andrew is a graduate of the Systems Design Engineering programme (94) at Waterloo. He focused his studies on energy conversion, energy modelling, and renewable energy technology. His fourth year project involved an analysis of mechanical wind-pumping technology to provide water for market gardening in the “Sahel” region of west Africa. Using a computer simulation model and meteorological data, he assessed the merits of the technology in particular regions. His interest in renewable energy prompted work on the analysis of solar-thermal energy systems for domestic water heating as part of his course of studies, and while working at the Queens University, Solar Calorimetry Laboratory on a national monitoring programme, S2000. His undergraduate programme included a minor in Peace and Conflict Studies, looking at North-South issues and international development. He has worked in several countries including Mali (west Africa), Costa Rica and Japan through exchanges and on NGO projects.

Andrew’s interest for research within the ERG focuses on policy development to facilitate increased use of renewable energy technologies in Canada in several sectors. Such alternative policies will be assessed in a supply model (and demand model, if appropriate), to predict economic and environmental impacts of renewable energy development in Canada. Results of the analysis would include development of a greenhouse-gas abatement curve (change in CO₂ concentration vs. cost) for each alternative, rates of penetration of technologies, economic impacts and other similar technology information.

Andrew is currently looking for industry and institutional partners who are interested in participating in this work in terms of devising objectives for the study and providing information relevant to the study.

Bruce Roberts, REM Ph.D. student.

After Bruce obtained a degree in Civil Engineering from the University of Manitoba in 1980, he began as a project and design engineer for Acres International Ltd. Work focused on several heavy civil projects related to water resource development, including the structural design of buildings, dams, pipelines, canals, spillways, gates and other structures related to irrigation and water handling. Much of the work involved analysis of the economic feasibility of proposed development projects and included the preparation and monitoring of project budgets.

In order to increase his knowledge of the financial, budgetary components in project design, Bruce went on to study at the University of Calgary to obtain a Masters of Business Administration. During this study period, he researched and taught several courses in Operations Management at the undergraduate level.

After completing the degree, Moneco AGRA Ltd. hired Bruce as an analyst and a management consultant in 1988. Much of the consulting work remained focused on resource management both overseas (Thailand, China) and locally (Alberta, BC and northwestern US). A lot of the work centered on electricity generation, electricity distribution (import / export), independent power producers and emission management (both SO₂ and NOₓ).

Bruce has not yet determined the focus of his thesis work, but there is no shortage of topics. As one of the first of the Ph.D. students in the program, all the details have not yet been worked out. Future issues of ISTNEWS will, no doubt, carry articles related to his work and keep the reader up to date.

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Pulp and Paper Possible Potential Potent

As avid readers of ISTNEWS will recall, ERG is currently involved in a project aimed at establishing appropriate energy efficiency targets for the six largest energy consuming industries across Canada. As one of the initial steps in this project, ISTUM-I for the pulp and paper industry, the refinery industry, and the mining industry have been re-evaluated and changed based on new information on energy consumption, available technologies, and behavioural responses due to various demand-side management programs. ERG has completed preliminary ISTUM-I runs for the pulp and paper industry and the results are included below. Similar runs for the petroleum refinery and mining industries will be finished by the end of October. Meanwhile, Willis Energy Services Ltd. is researching background information on the other three major industries, wood products, cement, and chemical
products. Preliminary runs for these industries may be available by the end of November. Consultations with the various industries on the results of these initial runs is expected to lead to further simulations aimed at answering specific questions.

ERG’s simulation of the Canadian pulp and paper includes British Columbia, Ontario, Quebec, New Brunswick, Newfoundland, and Nova Scotia. Each of the first three regions was modelled separately to account for differences in factors such as energy prices and processes. The final three provinces were combined into a single region. The four regional models cover over 90% of national production. The prairie provinces were not modelled in this project due to lack of reliable data on production and energy consumption for the base year (1990).

Figure 1 shows the total energy consumed, aggregated over all regions, for each of four scenarios, frozen, natural or business-as-usual, social economic and a technical best. Figure 2 includes the breakdown by type of energy for 1990, 2000, and 2010.

![Figure 1. Total Energy, Pulp and Paper](image1)

Figure 1. Total Energy, Pulp and Paper

While space limitations prohibit detailed analysis here, major differences between the scenarios have been identified. In the frozen efficiency scenario, total energy increases by about 55% between 1990 and 2010. This increase is mostly due to increased demand for pulp and paper products. By 2010, the energy demand in the natural change run is 11% lower than the frozen efficiency energy demand. This decrease in energy demand is driven partly by the increased penetration of more efficient auxiliary equipment and motors. As shown in figure 2, the total energy share of oil increases (from 23% to 27%) while natural gas decreases (from 23% to 16%). This fuel switching, occurring mostly in boilers, results from the higher cost of natural gas relative to oil.

![Figure 2. Energy by Type, Pulp and Paper](image2)

Figure 2. Energy by Type, Pulp and Paper

Energy demand in the economic run exceeds energy in the natural change run and is only 3% lower than the frozen efficiency energy demand. The requirements of the economic scenario, that the lowest cost technology, based on a 7% discount rate, will capture all of the new market, leads to a large penetration both of hog fuel boilers and of paper drying equipment that use steam. These technologies require more energy than competing technologies that use other fuels. Although energy efficiency improvements occur in other end-uses such as auxiliary equipment, the increase in energy demand from the hog fuel and steam technologies overwhelms the decreased energy demand resulting from efficiency improvements.

The technical scenario energy demand is 42% lower than the frozen efficiency scenario but only 9% lower than 1990 levels. In this scenario, where the least energy consumptive technology gains all of the new market, electricity shares increase greatly between 1990 and 2010 (from 32% to 49%). For the technical scenario, ISTUM-I only evaluates secondary energy thus electric technologies tend to be viewed as more efficient than other technologies that experience combustion losses.

Although only minor differences occur between the regions modelled, large differences appeared between different products. Figures 3 and 4 show the energy intensity (energy per unit output) for chemical pulp and other paper respectively. Other paper refers to linerboard, coated paper and uncoated paper (the full analysis of the results also included determining energy intensities for mechanical pulp, tissue paper, and newsprint). The energy intensities
are rough estimates but the relationships between the lines (representing the various scenarios) provide an accurate representation of the model simulations. The frozen efficiency scenario and the technical scenario intensities are similar in both graphs: the frozen efficiency intensity remains constant, by definition; the technical run energy intensity decreases by 38\% for chemical pulp and 42\% for other paper. However, the natural and economic scenario energy intensities differ significantly between the two products. For chemical pulp, these energy intensities are about 13\% below the frozen efficiency scenario while, for other paper, the intensities are about 6\% greater.

![Chemical Pulp Energy Intensities](image3)

Figure 3  Chemical Pulp Energy Intensities

Technology mixes provide the key to understanding the differences between the products. For chemical pulp, energy savings occur in the natural and economic scenarios due to increased penetration of technologies such as computer control and cogeneration, Tomlinson recovery boilers, oxygen and chlorine displacement bleaching, and kraft continuous batching. For other paper, increased energy consumption results from decreased penetration of efficient disc refining and screening technologies, replaced by standard conical refining and screening.

![Other Paper Energy Intensities](image4)

Figure 4  Other Paper Energy Intensities

Alison Bailie, researcher

What's Going On?

The ISTUM-PC user group is open to all, is growing and includes ERG, BC Hydro, Natural Resources Canada (NRCan), the Ontario Ministry of the Environment and Energy, the Saskatchewan Energy Conservation and Development Authority and Willis Energy Services, Ltd.

Most of the ERGers are involved with the completion of their program-required projects. Often projects are undertaken for interested utilities and other organizations. New projects requested by various energy focused organizations are always considered, and may be completed depending of the availability of student and supervisory time.

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