

# Climate Change and Adaptation

## The Engineering Reality

Richard L Rogers

From Vancouver to Vladivostok, and the Arctic to Antarctica, something's up with the weather: what once seemed science fiction appears to have become science fact. And in the face of international scientific consensus on the reality and risks of climate change and global warming, Canada's engineers have decided it's time deal with the impacts, which are already being felt in many regions of the country.

Specifically, in February 2004 following consultation with its constituent members, the Canadian Council of Professional Engineers (CCPE) board of directors gave final ratification to its Climate Change Impact and Adaptation Action Plan.

Characterizing the issue as "perhaps the greatest challenge to the engineering profession in the 21<sup>st</sup> century," the plan emphasizes the need to adapt engineering techniques, standards and practices to the realities of climate change, asserting that this phenomenon has profound implications for the way engineers

design and build infrastructure and facilities intended to withstand climatic variables for many generations.

And, ignoring the sometimes acrimonious debate over causes, the plan offers a pragmatic blueprint outlining how the profession as a whole can begin to deal with very real effects.

"We don't want to get into a debate about causes as opposed to saying, 'open your eyes, it's here,'" says Dr Troy Vassos PEng, President of Vancouver-based NovaTec Consultants and a member of the CCPE Environment and

Sustainability Committee that developed the plan.

### Present and Future Impacts

The genesis of the CCPE action plan was a two-day workshop on "Adapting to Climate Change: the Role of Canada's Engineers" held in early 2003 that drew together more than 60 scientists and engineers.

Participants focused on the reality of rising global mean surface temperature, the growing number and costs of natural disasters around the world (Canada alone has experienced the 1998 ice storm, flooding in Manitoba and Quebec, drought and forest fires in western Canada, and storm surges in Atlantic Canada during the past decade), and atmospheric CO<sub>2</sub> concentrations that have increased 30% since pre-Industrial Revolution times (and are unprecedented in the 400,000 year ice core records).

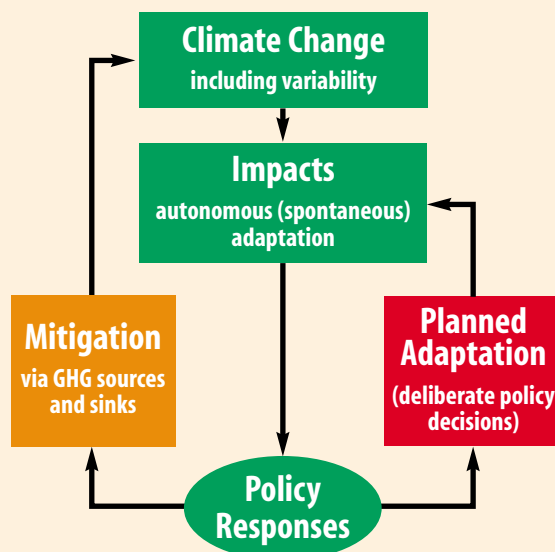
Workshop participants also heard about the potential long-term effects of climate change in Canada including wetter winters, drier summers, retreating glaciers and sea ice, rising sea levels, and more frequent and intense extreme weather events like floods, droughts and storms.

Among the potentially affected sectors of key importance to Canada — identified by government as water resources, agriculture, forestry, fisheries, the coastal zone, energy, transportation and human health — water resources is one of the highest priority issues since

## Addressing Climate Change: Mitigation and Adaptation

**Mitigation:** an intervention to reduce the sources of, or enhance the sinks for, greenhouse gases that are a driver for climatic change; used to slow the rate of climatic change.

**Adaptation:** an adjustment in natural or human systems in response to actual or expected climatic impacts; moderates harm or exploits beneficial opportunities.







problems like water supply shortages, floods and associated water quality issues are expected to become more common as a result of climate change.

In BC, many potential regional impacts have been identified including lower summer flows in some streams and rivers (meaning less water for agriculture, hydropower generation, industry and communities); coastal flooding in low-lying areas (threatening urban drainage systems and putting waterfront infrastructure and floodplain dyking systems at risk); increased landslides in unstable regions (endangering natural resources and manmade structures); higher levels of smog in major urban centres (creating health problems); rising summer river temperatures (affecting salmon populations); and increased forest fires, disease and pest infestations.

#### Action Plan Elements

The question of climate change and its causes has been bandied about for three decades or more. Much effort has been expended by both engineers and scientists to mitigate the problem by curbing GHG emissions through energy conservation/efficiency measures as well as new technologies like alternative fuels and renewable energy.

Yet Allan Dakin PEng, Vice President of North Vancouver-based Piteau Associates Engineering and chair of CCPE's Environment and Sustainability Committee, thinks that most engineers (himself included), while peripherally aware of the climate change issue, believed that its implications were "a long way into the future." However, the CCPE workshop and his own research convinced him otherwise.

"I realized that climate change, no matter what we do, is going to occur whatever the cause, be it natural or human. It's real, its impacts are happening and we

engineers should be doing something about it," he says.

Two days of sobering presentations and discussions convinced those attending the CCPE workshop that the time had come to address some of the potentially dire consequences of climate change. The resulting draft plan in September 2003 outlined a step-by-step approach to advance the issue within the engineering profession:

- **Education/CPD** — educating engineering students and professional engineers about climate change impacts and engineering adaptation.
- **Communication** — raising awareness about the need for adaptation within the profession and among industry, decision makers and the public.
- **Guidelines, codes and standards** — developing and updating guidelines, codes and standards to ensure good engineering design and practices that integrate adaptation concepts.
- **Networking** — establishing formal and sustained links between engineers and scientists to exchange information and communicate the needs of engineers for research and predictive modeling, particularly at a regional and more detailed level.
- **Funding** — developing funding sources to support the above strategies.

#### Adaptation and Mitigation

Both Vassos and Dakin confirm that the response of constituent associations to the plan has been extremely positive; Vassos says it appears to have struck a nerve among engineers in all regions.

"The response has been not only that it's a good thing, but 'wow, there are other people who are concerned about this; it's not just me.' It definitely has made a very big impression on engineers," he says.

The plan makes a distinction between two recognized strategies to respond to climate change impacts: adaptation (actions to adjust human or natural systems to minimize the negative impacts of climate change as well as take advantage of possible opportunities) and mitigation (actions to minimize GHG emissions and therefore the rate and overall magnitude of climate change). The plan places a clear emphasis on adaptation, noting that "engineers are already participating vigorously in the pursuit of knowledge and application and development of techniques to minimize climate change."

This adaptation focus has prompted some criticism, but Dakin says the committee felt there was already sufficient information available on mitigation.

"We didn't feel there was much more we could really add to the general body of knowledge. There are plenty of articles about mitigation in the professional publications and so on, but there was virtually nothing on the issue of adaptation — and that's where we felt it was important to focus," he says.

Vassos adds an even more pragmatic reason for the emphasis on adaptation: "We felt it was something that everybody could agree on and that we could move forward with."

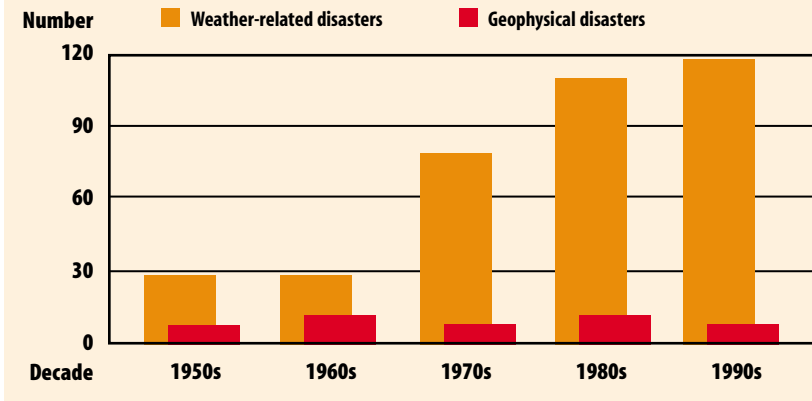
#### Moving Forward

And moving forward it is. Two of the plan's key elements involve awareness and education. On the awareness side, the committee has already produced what Dakin calls a "generic" PowerPoint presentation containing a wealth of information on climate change, its effects and the need to adapt.

"We've had invitations from many constituent associations to give presentations on the plan and some of the issues," says Dakin. "It's also our intent to make copies of the presentation available



## Canadian Natural Disasters



to constituent members so they can tailor it somewhat and make their own local presentations. You need to get the proverbial snowball rolling and that way get the message out."

There are also moves, through CCPE's Canadian Engineering Accreditation Board, to incorporate the issue of climate change in some way into the engineering curriculum as soon as possible.

"During accreditation visits to the universities," says Vassos, "one of the key issues is the inclusion of environment and sustainability topics as part of the program. We hope this year to introduce, within the curriculum, the concept of climate change as an important part of that particular element."

To that end, says Dakin, "We're also in the early stages of working with a committee of university educators to see if we can develop education materials that will make it easier for universities to include some elements of climate change adaptation in their courses."

### Forging Networks

Vassos says the plan's call for updated codes and practice standards that reflect the new realities — for instance, higher snow and wind loads, or 100-year floods becoming 10-year events — is particularly important, but he believes engineers will have to work harder to keep up with current climate information which, as things now

stand, can be a challenge.

He points out that Canadian researchers have been doing "a lot of really good work" in the field. In BC alone, research investigating the effects of climate change on a variety of sectors within ecosystems and human economic and social systems are being planned, are in progress or have been completed, and there is a plethora of work underway at the universities. However, Vassos says that often the results of that work have not been flowing into the hands of the engineers who can use it — at least not in a timely fashion.

"When we started asking questions like how does data on rainfall or snowfall, for instance, feed through the engineering process, nobody could answer. Nobody could say who was responsible for taking Environment Canada climate data and examining it to see whether the variations have a significant impact on structural design, for example. And that's just structural. If you look at other areas of engineering, the problem is compounded and magnified because of all the disciplines that are affected."

The action plan's call for greater contact between the white coats and hard hats explicitly recognizes this problem and Dakin foresees the CCPE playing an important role as a type of clearinghouse to facilitate the two-way flow of information.

"A lot of this work is federally funded and it makes sense that an Ottawa-based umbrella group of engineers will work best to interface with Environment Canada [which does most of the country's climate research] or the individual researchers it funds," Dakin says. "The committee sees this as an excellent opportunity to build a good relationship between scientists and engineers."

### A Matter of Urgency

Vassos thinks there is little time to waste in dealing with the issue of climate change.

"I think there is significant urgency in that within the next 12 months we need to dramatically increase awareness of climate change with respect to the engineering profession.

"Also within that time frame, leading into 18 months, we must start examining our institutional framework, how meteorological data is used within the research realm of design, how it feeds

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into the practice of engineering to ensure that we're using the right types of statistical summaries, and ensure that the data analysis and re-review of the data against design parameters is kept current."

Vassos believes that the CCPE action plan is an excellent reflection of the "can-do" engineering attitude and the tremendous opportunities available for engineering innovation.

"One engineer dealing with one situation and coming up with a good solution is great, but when five or six engineers who are likely to be dealing with that situation over the next couple of years put their heads together they're going to develop better solutions. Engineers like to collaborate and we understand the power of shared problem solving," he says.

For Dakin, the plan and its hoped-

for results are a logical extension of an engineer's job and ethical obligation.

"Our role, I believe, is to understand what science is out there," he says, "and, where appropriate, apply that science to our engineering judgment in day-to-day practice." ▀

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## Further Reading

*CCPE Climate Change Impact and Adaptation Action Plan* (draft, June 2003) [www.apeg.bc.ca/library/sustainability/guidelines.html](http://www.apeg.bc.ca/library/sustainability/guidelines.html) (follow links to Sustainability website, New + Now)

*Impacts of Climate Change on Architectural and Engineering Practices: A Preliminary Investigation* (September 2003)  
[ftp.pwgsc.gc.ca/rpstech/ClimateChange/pwgscCC.pdf](http://ftp.pwgsc.gc.ca/rpstech/ClimateChange/pwgscCC.pdf)

*Climate Change Impacts and Adaptation: A Canadian Perspective* (2004)  
[http://adaptation.nrcan.gc.ca/perspective\\_e.asp](http://adaptation.nrcan.gc.ca/perspective_e.asp)

*Indicators of Climate Change for British Columbia 2002*  
<http://wlapwww.gov.bc.ca/air/climate/indicat/pdf/indcc.pdf>

*APEGBC Sustainability Primer Part 4: Climate Change* (2003)  
[www.apeg.bc.ca/library/sustainability/guidelines.html](http://www.apeg.bc.ca/library/sustainability/guidelines.html) (follow links to Sustainability website, Primer)

Government of Canada  
[www.climatechange.gc.ca](http://www.climatechange.gc.ca)

Environment Canada  
[www.ec.gc.ca/climate](http://www.ec.gc.ca/climate)

Natural Resources Canada  
[www.adaptation.nrcan.gc.ca](http://www.adaptation.nrcan.gc.ca)

Water, Air and Climate Change Branch/BC Ministry of Water, Land and Air Protection  
<http://wlapwww.gov.bc.ca/air/climate/>

Canadian Climate Impacts and Adaptation Research Network  
[www.c-ciarn.ca](http://www.c-ciarn.ca)

Canadian Institute for Climate Studies, University of Victoria  
[www.cics.uvic.ca](http://www.cics.uvic.ca)

Intergovernmental Panel on Climate Change [www.ipcc.ch](http://www.ipcc.ch)

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