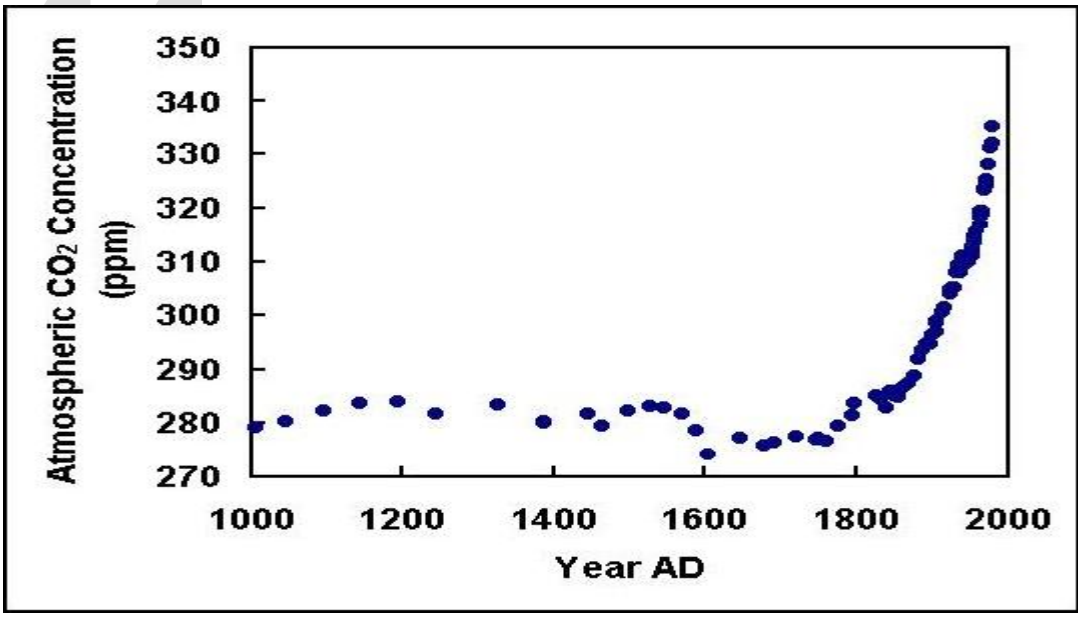
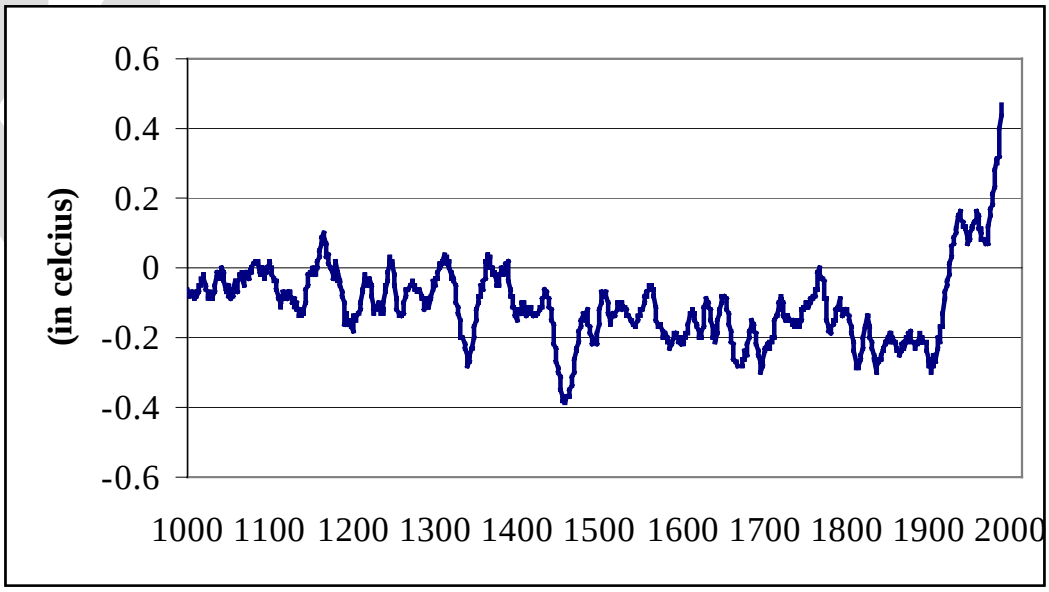
Atmospheric carbon dioxide concentration



(Slide 1) This chart shows average atmospheric concentrations of CO2 since the Middle Ages. Note that for most of the intervening period concentrations have ranged between 270 and 290 parts per million. Since about the middle of the 19th century, however, they have shot up dramatically, and are now close to 360 parts per million -- almost 30% higher than pre-industrial levels.

Emissions of CO2 from the burning of fossil fuels are mainly to blame. These emissions increased by a factor of seven during the 20th century and continue to rise at an accelerating rate.

Climate Change



Surface temperatures of the Northern Hemisphere over the last millennium

(Slide 2) Average temperatures have also risen over the last millennium. The chart shows annual changes in the Northern Hemisphere as a whole. There have been variations, reflecting the relative influence of natural phenomena such as solar intensity and volcanic activity. Viewed over a period of centuries, however, the general trend seems to have been downward until near the end of the 19th century.

Beginning around the year 1900, temperatures started rising steeply. The rate of increase has accelerated over the last 25 years, such that current average temperatures are believed to be close to 0.8ºC -- 1.4ºF -- above the trend.

Some parts of the planet have warmed more than others. Notable is the Antarctic Peninsula, where average temperatures have risen by 2.5ºC over the last 25 years.

These temperature increases might not sound like much, but on a global scale they represent a tremendous cumulative warming. Imagine what it would take to try to heat the earth even a fraction of a degree by turning on all the heating units in all the houses in the world and leaving the windows open. I am advised that we could not achieve it even over the course of a decade. The latest draft report by the Intergovernmental Panel on Climate Change (IPCC) concludes that global temperatures could rise as much as an incredible 6.1ºC over this century. The report projects that my country, Canada, as well as other regions of North America, will experience temperature increases in the range of 40% above the global mean taking into account the projected increases.

We are engaged, in short, in a perilous experiment with nature that is unprecedented in the history of humankind.

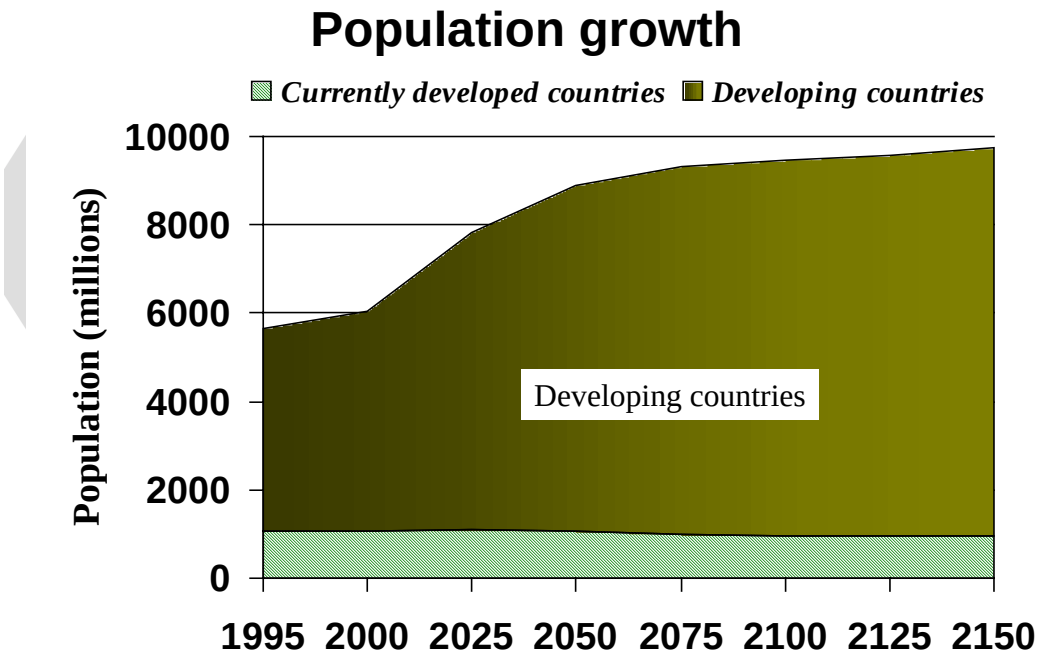
Does it matter? How could anyone shrug it off? If the climatic events we have witnessed following modest temperature increases are an indication, the potential effects of radical climate change are indeed frightening! We already see frequent extreme events –violent storms, periods of extreme heat and intense cold, with concomitant flooding and drought and loss of life. You have felt it: a severe ice storm in North Eastern America; a windstorm that destroyed much of France's forests last December with 140,000 mature trees uprooted just in two Paris parks.

These are but a few examples. Even as we meet here the United Kingdom is faced with some of the heaviest rainfalls and flooding on record. There seem to be unusual weather patterns all over the globe with serious results for the environment and human welfare.

Global warming will no doubt have catastrophic effects on ecosystems and biodiversity. It will certainly have an impact on our economies and on human health. Rising sea levels will render uninhabitable the world's low lying sea coasts. We will have to contend with the broad spread of tropical diseases. There is even serious concern that the Gulf Stream, and the larger "conveyor belt" of ocean currents could come to an abrupt halt, plunging Europe into a new ice age... even while the rest of the world experiences warmer temperatures. If current warming trends continue, serious consequences of this kind could begin within the remaining lifetime of our children, in addition to the weather aberrations we are already experiencing!

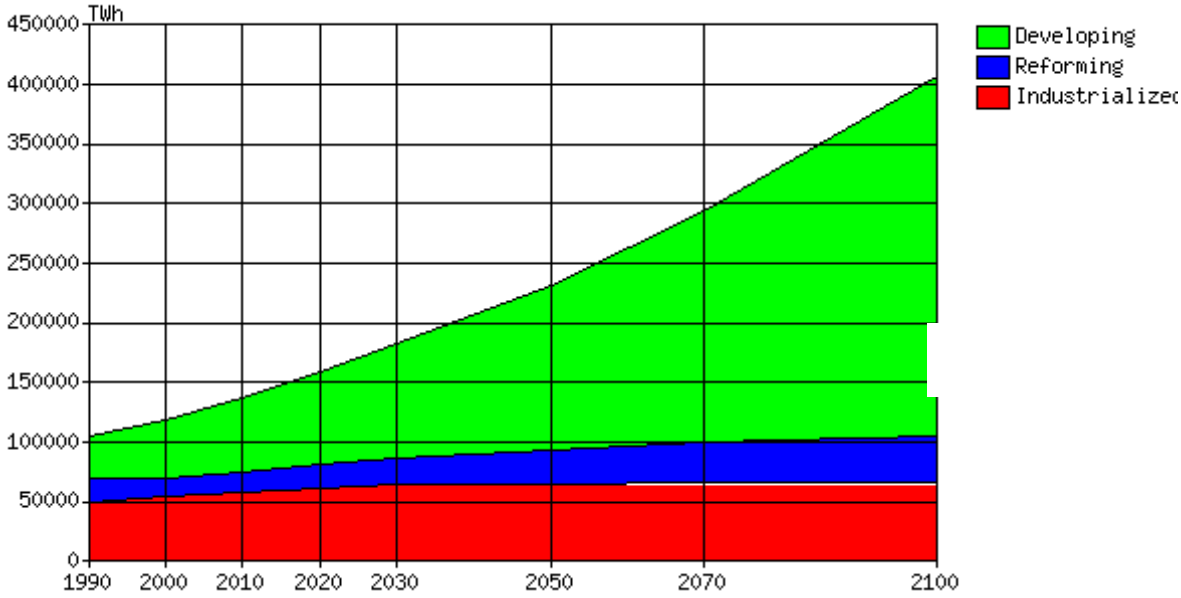
Can we do something to turn around the situation? Yes, of course we -- that is, the developed, industrialised countries of the world -- can. After all, our populations have stabilised, and we are probably rich enough and smart enough to develop clean, safe energy technologies that can deliver our current level of material welfare while cutting emissions-- if we rise to the challenge.

But there is a major obstacle to success: poverty and population growth in the rest of the world.



UN projections of world population to 2150 (medium scenario)

Energy use projections



Total primary energy consumption by region
(IIASA reference projection scenario B in teraWatt-hours)

(Slide 4) The central, reference scenario for primary energy consumption by region as projected out to the year 2100 by the International Institute for Applied Systems Analysis (IIASA) predicts an increase by a factor of 4, almost all of it occurring in the developing world.

How is that demand for energy going to be met?

Let us look at fossil fuels -- the fuels largely responsible for anthropogenic emissions of greenhouse gases. Many experts expect that production of petroleum-based oils will peak some time before mid-century and start to decline thereafter. Coal, which will remain abundant, can easily fill the gap. For geological reasons, natural gas is more abundant than oil and can be expected to increase in absolute terms and then stabilise. Under this "business-as-usual" scenario, IIASA predicts that the use of fossil fuels will double over the next century.

Given the strong links between fossil-fuel combustion and growth in atmospheric CO2 concentrations that we have seen already, can we actually envisage continuing to burn fossil-fuels at current or expanding levels over the next century? The consequences for global warming and climate change would be intolerable.

What about clean renewable sources of energy like solar or wind or harnessing the ocean currents? There is certainly room to further develop wind power and solar panels and perhaps ocean currents and tidal power, but as contributors to basic energy needs they are likely to remain minuscule. For example, I recently read that to provide the City of Toronto with its present power needs, about 40,000 one megawatt wind generators would be required and they would cover an area three times the size of Canada's smallest province, Prince Edward Island, or 5656 square kilometres. And of course the wind does not always blow nor does the sun always shine, so storage of such energy adds another dimension which has only begun to be explored.

RADIATION EXPOSURES

Source	Radiation Dose Millirem/year
Natural Radioactivity	240
Natural in Body (75kg)*	40
Medical (average)	60
Nuclear Plant (1GW electric)	0.004
Coal Plant (1GW electric)	0.003
Chernobyl Accident (Austria ~ 1988)	24
Chernobyl Accident (Austria 1996)	7
* Included in the Natural Total	

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In his speech he offered a table (Slide 5) that shows radiation exposures from a number of sources. Speaking about levels of radiation exposure, he points out:

"Natural radioactivity is the largest. Of that total, about a sixth comes from natural radioactivity in the body itself. The natural radioactivity in our bodies gave a dose about a factor of two larger than the Chernobyl accident gave in Austria in the year of the accident. Nuclear power plants and coal fired power plants give about the same average dose for the same power."

Dr. Richter also cites an article by a German group entitled "Health Risks of Energy Systems" which presents extensive data and from which Richter concludes...

" In years of life lost per terawatt hour of plant operation, the only thing better than nuclear power is wind power.

There is concern about the disposition of radioactive waste. I think virtually all scientists would say that this is not a problem. It can be disposed of geologically in many ways. Not all countries have the proper geological formations to do such disposal, but international burial sites could be developed to handle the radioactive waste of the entire world without any difficulty. The worst scenarios dreamed up by the opponents of nuclear power for radiation release from long term storage give negligible years of life lost compared to the continued use of our conventional