NUCLEAR *facts*

Nuclear energy and clean air

THE TOPICS OF CLIMATE CHANGE AND AIR POLLUTION HAVE ATTRACTED CONSIDERABLE ATTENTION IN RECENT YEARS. PEOPLE ARE INCREASINGLY CONCERNED ABOUT GLOBAL WARMING AND THE EFFECTS OF SMOG AND POLLUTION ON THEIR HEALTH, AND THE PLANET'S WELL-BEING. WHAT ROLE CAN NUCLEAR POWER PLAY IN REDUCING THE EFFECTS OF THESE PROBLEMS?

What are "global warming" and "climate change"?

Global warming refers to the increase in the world's average temperature observed in recent years. The term "climate change" refers to the consequent changes to our climate that a long-term rise in world average temperature might create. A large group of scientists[1] from around the world believe that both global warming and climate change are caused by the significant increase over the last few decades of "greenhouse gases", primarily carbon dioxide (CO_2) but also methane and similar gases, in our atmosphere. Those gases "trap" the heat from the sun much like windows in a sunroom.

The warming that comes from this greenhouse gas effect could cause changes in weather patterns that could result in widespread severe storms and the rise of the levels of the oceans as a result of the melting of the polar ice caps.

Ontario Power Generation's Darlington Nuclear Station can supply the electricity needs of the city of Toronto without emitting any of the gases that cause global warming or smog.

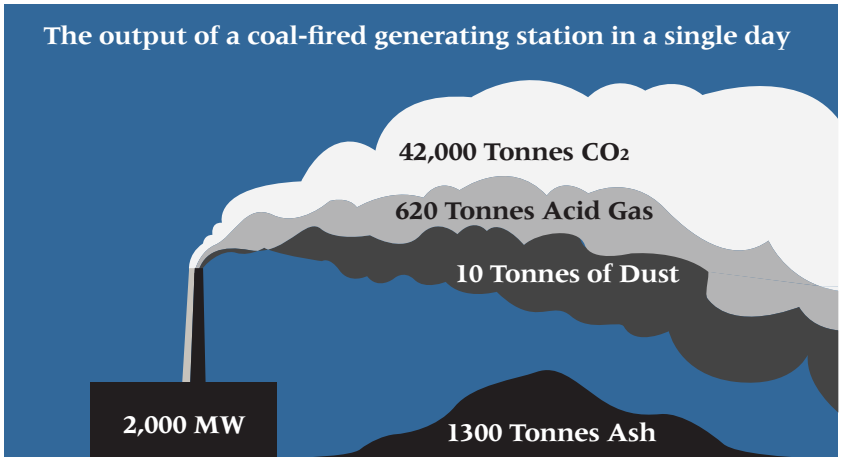
Concentrations of carbon dioxide in our atmosphere have risen from approximately 250 parts per million (ppm) to nearly 350 ppm in the past 150 years as a result of human activity. Carbon dioxide comes from many sources, some of them natural, but an increasing amount are from human activity, primarily the burning of fossil fuels such as coal, oil and gas. The largest human source is from transportation, from the combustion of gasoline and diesel fuel we use in our cars, trucks, trains, airplanes and all the other forms of transport. Another large source comes from the heating of our homes.

Then there is the generation of electricity. About two thirds of the world's electricity comes from generating plants using fossil fuels, mostly coal. That method of electricity generation creates large quantities of CO_2. Since electricity is such a desirable form of energy, this source of CO_2 has increased greatly in recent years. Coal-fired electricity generating plants worldwide discharge about 2 billion tonnes of CO_2 into the environment each year.

[1] The "Intergovernmental Panel on Climate Change" (IPCC,) set up under the United Nations, involves over a thousand scientists from around the world. Their reports can be accessed on the website: www.ipcc.ch

What about air pollution from electricity generation?

In addition to its effect on global warming, electricity generation using coal - the largest source of electricity generation in the world - also results in emissions of nitrous oxides and sulphur dioxide, resulting in smog and acid rain. Coal-fired stations also release particulate matter into the air and generate large amounts of ash waste that must be disposed of.



How does nuclear energy help?

Nuclear power reactors emit no carbon dioxide, nitrous oxides or sulphur dioxide. In nuclear power plants the energy to generate the electricity comes from a nuclear reaction entirely within the uranium fuel inside the reactor. Since there is no combustion there are no emissions. The 438 nuclear power reactors operating around the world generate about one sixth of our electricity and emit no global warming, smog or acid rain gases.

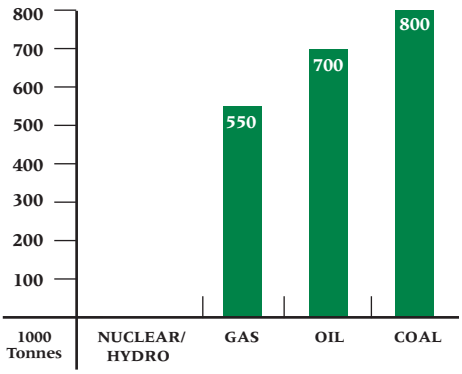
In 2009, Canada's nuclear stations generated about 15% of our electricity. The nuclear power plants in Ontario produced 55% of the electricity used in that province. If the electricity produced by Canada's nuclear power plants were generated by coal, there would be an additional 90 million tonnes of carbon dioxide emitted into our atmosphere each year. Canada's emissions of nitrous oxides and sulphur dioxide would also increase by about 10%, adding to smog and acid rain.

Can nuclear energy help in the transportation sector?

While the amount of CO_2 and air pollution emissions of fossil-fuelled electricity plants can be large, the transportation sector is a larger source of these emissions. The millions of cars, trucks, airplanes and other vehicles we use burn gasoline or similar fossil fuels and emit CO_2 and pollutants. These can be reduced. Canada is in the forefront of the development of fuel cells, which can be used to power cars and other vehicles with no emissions. Fuel cells combine hydrogen (H_2) and oxygen (O_2) to produce electricity and the only "waste" product is water (H_2O). That electricity can be used to power vehicles.

There are already fuel cell powered buses and there are a few "hybrid" cars on the market with small internal combustion engines combined with fuel cell-powered electric motors.

Tonnes of CO_2 produced per unit of electricity per TWh (terawatt hour = million megawatt hours)



Source: Atomic Energy of Canada Limited (AECL), World Nuclear Association (WNA), National Energy Institute (NEI)

However, the hydrogen needed for fuel cells must be produced. The cleanest method of producing hydrogen is by electrolysis, using electricity to break down water into hydrogen and oxygen. Nuclear power plants are an emission-free source of electricity. If they are used to supply the electricity for the electrolysis, the hydrogen can be produced without adding any greenhouse gases to the environment.

Another promising technology that is here today is plug-in electric vehicles. These use batteries as the primary power source, and they can be backed up by a small internal combustion engine for when the batteries are depleted. Plug-in electric vehicles operate emission free when running on their batteries. However, the power source for charging the vehicles plays a large part in their how clean they are. If the power source is coal or other fossil fuels, then the environmental benefit of the electric vehicle is limited. If the power source is nuclear, hydroelectric or another emission-free technology, then the electric vehicles have the potential to greatly reduce the global warming and air pollution emissions currently produced by the transportation sector.

Conclusion

Nuclear power in Canada is an important answer to the problems of climate change, smog and acid rain - now and for the future.

See also the following Web site:
www.nrcan-mcan.gc.ca

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