

NUCLEAR ENERGY'S ROLE IN MITIGATING CLIMATE CHANGE AND AIR POLLUTION



Energy experts expect energy demand to rise dramatically in the 21st century, especially in developing countries, where today, over one billion people have no access to modern energy services. Meeting global energy demand will require a 75% expansion in primary energy supply by 2050. If no steps are taken to reduce emissions, the energy-related CO₂ emissions would nearly double in the same period. The increased levels of this greenhouse gas in the atmosphere could raise average global temperatures 3°C or more above pre-industrial levels, which may trigger the dangerous anthropogenic interference with the climate system, which the United Nations Framework Convention on Climate Change seeks to prevent.

Greenhouse Gases and Their Consequences

According to the findings of the Intergovernmental Panel on Climate Change (IPCC), a global warming of more than 3°C will lead to increasingly negative impacts in all regions of the world. In mid-latitude and semi-

arid low latitude regions, decreasing water availability and increasing drought will expose hundreds of millions of people to increased water stress.

In agriculture, cereal productivity is expected to decrease in low latitude regions. The increased productivity in mid-latitude and high latitude regions will only partly compensate for this loss. Up to 30% of all terrestrial species will be at a growing risk of extinction.

Ocean acidification will be a consequence of increased carbon emissions. Together with temperature-related coral bleaching, acidification is expected to reduce the ability of shellfish to develop, placing an essential component in the marine food chain at risk. In coastal areas, damage from floods and storms will increase.

Human health will also be affected, especially in less developed countries, by the increasing burden from malnutrition and from diarrhoeal, cardiorespiratory and infectious diseases. Increased morbidity and mortality are foreseen from heat waves, floods and droughts.

According to the WHO, air pollution causes over one million premature deaths worldwide each year and contributes to health disorders from respiratory infections, heart disease and lung cancer.

(Photo: istockphoto.com/ranplett)

The Impact of Air Pollution

The World Health Organization (WHO) has estimated that air pollution causes over 1 million premature deaths worldwide each year.* Air pollution also contributes to health disorders from respiratory infections, heart disease and lung cancer. At the regional scale, air pollutants travelling long distances cause acid rain. Acid rain disturbs ecosystems, leading to adverse impacts on freshwater fisheries and on natural vegetation and crops. Acidification of forest ecosystems can lead to forest degradation and dieback. Acid rain also damages certain building materials and historic and cultural monuments. It is caused by sulphur and nitrogen compounds. Fossil fuel power plants, particularly coal power plants, are the main emitters of the precursors of these compounds.

The amount of emissions avoided through the use of nuclear power is comparable to that avoided through the use of hydropower.

The Challenges of Reducing Greenhouse Gas Emissions

The scientific consensus is that in order to avoid adverse climate change impacts in ecological and socio-economic systems, greenhouse gas emissions must not rise after 2020, and then decline by 50–85% from today's levels by 2050. The world thus faces an enormous mitigation challenge over the next decades.

The IPCC Working Group III and the Synthesis Report from the International Scientific Congress on Climate Change: Global Risks, Challenges and Decisions, held in Copenhagen in 2009, maintain that many mitigation technologies and practices that could reduce greenhouse gas emissions are already commercially available. According to the IPCC, technical solutions and processes could reduce energy intensity in all economic sectors and provide the same output or service with lower emissions. Nuclear power is one of the mitigation options available today.

Over the past 50 years, electricity generation through nuclear power avoided significant amounts of greenhouse gas emissions around the world. Globally, the amount of emissions avoided through the use of nuclear power is comparable to that avoided through the use of hydropower. Hydropower, nuclear power plants and wind based electricity are among the lowest CO₂ emitters when emissions are considered over the entire energy life cycle.

In future, greenhouse gas emissions from nuclear energy technologies will be even lower thanks to advances in uranium enrichment technology that require much less electricity; extended nuclear power plant lifetimes (which means reduced emissions per kilowatt-hour associated with construction); and increased fuel burnup (which means reduced emissions per kilowatt-hour associated with uranium mining and manufacturing fuel).

The IPCC has estimated the mitigation potential of various electricity generating technologies and determined that nuclear power represents the greatest mitigation potential at the lowest average cost in the energy supply sector, essentially electricity generation. Nuclear power has the potential to continue to play a significant role in the effort to limit future greenhouse gas emissions while meeting global energy needs.

Air Pollution Mitigation Through Nuclear Power

Nuclear power plants emit virtually no air pollutants during their operation. In contrast, fossil fuel power plants are major contributors to air pollution. According to the WHO, a significant reduction of exposure to air pollution can be achieved by lowering the concentrations of several of the most common air pollutants emitted during the combustion of fossil fuels.

*Air quality and health, Fact sheet N°313, updated September 2011, www.who.int/mediacentre/factsheets/fs313/en/