Is it Global Warming or Global Warning?

Dr. Ibrahim Dincer
Editor in Chief, *International Journal of Global Warming*
Professor of Mechanical Engineering
University of Ontario Institute of Technology (UOIT), Faculty of Engineering and Applied Science
2000 Simcoe Street North, Oshawa, Ontario L1H 7K4, Canada
Tel: 905-721-8668 ext.: 5723; Fax: 905-721-3370
E-mail: Ibrahim.Dincer@uoit.ca

Abstract
This article gives an overview of global warming issues and discusses the key goals in successfully combating global warming. It also proposes some potential energy solutions as part of the sustainable energy portfolio.

Introduction
Let's first look at the common definitions of global warming and climate change. Global warming is an average increase in the earth’s temperature due to the greenhouse effect as a result of both natural cycles and human activities. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from essentially human activities, e.g. carbon dioxide, methane, water vapour and fluorinated gases, which act like a greenhouse around the earth, trapping the heat from the sun in the earth’s atmosphere and increasing the earth’s temperature.

Climate change refers to any significant changes in climate through temperature, precipitation, wind, etc. for an extended period (decades or longer) as a result of natural processes (e.g. the sun's intensity, ocean circulation) and human activities causing changes in the atmosphere's composition through, for example, burning fossil fuels and deforestation. The term “climate change” is often used interchangeably with the term “global warming”, but the above definitions clearly indicate that if we want to focus on the impact of human activities, we should use the term “global warming”, since the global issues are considered under this title.

Of course, if one is asked about the percentages of impacts which result from natural cycles and human activities, how do we distinguish these? It is very difficult – almost impossible, in fact – to give a precise answer. One thing is very clear, though: that we, human beings, have played a major role in polluting the earth and causing drastic damages. So it becomes our utmost responsibility to provide local and global solutions to current energy, environment and sustainability problems.

In a recent study, Duffey and Dincer (2009) discussed global warming issues, especially those caused by the increase of greenhouse gas emissions through human activities since the industrial revolution. The picture of sustainability for future generations was portrayed as complex and sombre, and the authors adopted a medical analogy by defining the world as a patient with fever. They observed that we need to find the right doctor for determining the right diagnosis and treatment, and provide the right prescription as the cure. The authors looked at current local and global symptoms, the diagnosis and prognosis, and provided policy-related prescriptions and treatment options. As a result, this work provided some key guidance on how to implement the correct energy strategies and policies in light of the above facts.

Recently, I have posed the following question in various platforms: *Is it global warming or global warning?* Unprecedentedly catastrophic recent climatic anomalies and catastrophic events have shown that this problem has gone beyond global warming. It is essentially a “global warning” communicated through blazing hot summers, brutal winters, hurricanes, typhoons and cyclones from North America to Africa and from Asia to Europe. It is now agreed by the overwhelming majority of scientists that global warming is the most important threat to humanity. It has become increasingly apparent that humanity may be facing more drastic problems in the near future as a result of global warming, which will be unavoidable unless great
Primary Goals and Potential Solutions

In order to address local and global issues it is necessary to look at the bigger picture and approach the problems correctly. In this regard, I essentially approach the problem from an energy perspective. I primarily define six key targets (the “six main pillars”) from a system level to a global scale in whatever we can do in order to achieve a sustainable future as follows:

- better efficiency;
- better cost-effectiveness;
- better energy and resources use;
- better system design and analysis;
- better energy security;
- better environment.

We have long been in a fossil fuel era and have ended up in a desperate situation. The key question here is: how do we cure this problem? While people all over the world are coming together to tackle global warming, tactics/methods are still being used to try to divide the scientists and the public by diverting us from the major source of the problem. In a simple but effective analogy, the patient is about to die.

Therefore, it is now the time to change our diet from junk food to a healthy diet, and our habits and lifestyle from extravagant and wasteful to conscientious. This is very crucial in combating global warming as individuals. Large scale and long term solutions require genuine infrastructural changes; not superficial changes of wrapping paper to green and claims of contribution to the solution. Some try to take a pain killer pill and claim that they are curing the illness – but they are not, as what the patient actually needs is surgery. In this sense, infrastructural changes have become crucial. Each day we fail to take the essential responsibility for the most important problem and compromise our communities and our future.

We need to find the right doctor to get the right prescription for the cure, and the correct implementation of the prescription will cure the problem. One can find not one but many treatment options. The prescription may be quite long, but the focus will be on some key solutions as follows:

- **Renewables**: Renewable energy sources (e.g. solar, wind, geothermal, small hydro, biomass, tidal) can play a major role in addressing environmental and sustainability issues since they are considered to be environmentally benign and sustainable.

- **Hydrogen**: Hydrogen appears to be a unique energy carrier and fuel option for overcoming the global warming problem due to its no-carbon content. If one looks at how mankind has used energy historically, she/he will see that mankind started with wood (with the highest carbon/hydrogen ratio) and continued with coal (after the industrial revolution), then moved on to oil in the 19th Century and to natural gas in the 20th Century. So the carbon/hydrogen ratio has decreased enormously. We are now moving towards a carbon-free society. This society will not be possible without hydrogen since it has no carbon!

- **Efficient energy use/energy conservation**: It is equally important to implement energy efficiency and energy conservation measures for more efficient and effective use of resources and systems.

- **Cleaner technologies for fossil fuels**: Cleaner technologies for carbon reduction and capturing as well as storage are necessary for the transitional period to reduce greenhouse gas emissions.

- **Combined/hybrid systems for multi-generation purposes**: Combining and hybridising energy systems for multi-generation purposes is necessary in order to make the existing systems more
efficient, more cost-effective, more environmentally benign and more sustainable. This can, for example, easily be done by hybridising solar and wind power systems.

- **Integrated fuel cell systems**: Fuel cell-based power generation has received increasing attention from researchers and technologists as a potential solution to current problems. Integrating such fuel cell-based systems with renewable energy systems provides an opportunity for better efficiency and better environment.

- **Biofuels**: Although some consider biofuels as a threat for food commodities, they represent a significant part of alternative fuel options. Of course, careful planning is necessary in order not to jeopardise food needs.

There are also two potential tools for analysis, design and assessment.

- **Exergy analysis**: Exergy analysis is an effective thermodynamic method for using conservation of mass and conservation of energy principles together with the second law of thermodynamics for the design and analysis of thermal systems. It is an efficient technique for revealing whether or not and by how much it is possible to design more efficient thermal systems by reducing their inefficiencies. Recently, significant attention has been directed towards the use of exergy analysis in the assessment of thermal and other industrial processes and their environmental impacts, since exergy analysis is an effective tool both for achieving efficient energy utilisation with reduced environmental and sustainability impact and for providing optimum design and operation.

- **Life cycle assessment (LCA)**: Life cycle assessment is a potential tool used to assess the environmental burden of products at the various stages in their life cycle. In other words, LCA examines such products 'from cradle to grave'. The term 'product' is used in this context to mean both physical goods as well as services.

**Closing Remarks**

Finally, it is really important to implement a diversified energy portfolio which will largely cover the items listed above and provide a unique solution to current issues. It is also necessary to bring all disciplines together, from engineering to sciences and from business to social sciences and art, for such solutions. It must be our ultimate objective to build a better consensus by bringing engineers face-to-face with those from all other disciplines to address a broad range of issues yet to be tackled for ultimate solutions.

This article is an open invitation to invite researchers, scientists, engineers, practitioners, policy makers and politicians from all over the world to work together to exchange information, present new technologies and developments, and discuss the future directions, strategies and priorities in the field of global warming and climate change. The attitude required is captured by modifying a well-known slogan: “THINK BOTH LOCALLY AND GLOBALLY, AND ACT BOTH LOCALLY AND GLOBALLY.”

As a forum for such discussion on global warming issues, Inderscience Publishers publish the *International Journal of Global Warming*, [www.inderscience.com/ijgw](http://www.inderscience.com/ijgw), an ISI-indexed title. *IJGW* focuses on nine main pillars: better remediation, better avoidance, better efficiency, better cost-effectiveness, better design, better resource utilisation, better environmental quality, better energy security, and better sustainable development. It also addresses issues related to global changes as a direct and/or indirect result of climate modification, and strategies for adaptation to such changes. A free sample issue is available on the journal’s website. *IJGW* is part of the substantial and significant portfolio of Inderscience energy, environment and sustainable development journals listed at [www.inderscience.com/eesd](http://www.inderscience.com/eesd).

**References**

Biographical Sketch:
Ibrahim Dincer is a full professor of Mechanical Engineering in the Faculty of Engineering and Applied Science at UOIT. He is Vice-President of the World Society of Sustainable Energy Technologies (WSSET) and International Association for Hydrogen Energy (IAHE). Renowned for his pioneering work in the area of renewable/sustainable energy technologies, he has authored and co-authored numerous books and book chapters, more than 700 refereed journal and conference papers, and many technical reports. He has chaired many national and international conferences, symposia, workshops and technical meetings, and has delivered over 200 keynote and invited lectures. He is an active member of various international scientific organisations and societies, serves as Editor in Chief for the International Journal of Energy Research (Wiley), and the International Journal of Exergy and International Journal of Global Warming (Inderscience), and is associate editor, regional editor, and editorial board member for various prestigious international journals. Professor Dincer has received several research, teaching and service awards, including a Premier's Research Excellence Award in Ontario, Canada in 2004. He has made innovative contributions to the understanding and development of sustainable energy technologies (particularly renewables), and has been actively working in the areas of hydrogen and fuel cell technologies, with his group having developed various novel technologies, methods, etc.