Drying Technology. An International Journal
Guest Editorial

Urgent Need for Reduction in Greenhouse Gas Emission in Industrial Processes: Are We Past the Topping Point for Global Warming?

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In a previous Guest Editorial (Piacentini and Mujumdar, 2007) and an article (Piacentini and Mujumdar, 2009), we analyzed the relation between climate change and industrial processes, mainly related to drying. The main idea was to give scientific evidence that global warming is mainly produced by human activities through the emission of greenhouse gases (GHG) and that science and technology can significantly contribute to the reduction of this emission. In particular, by analyzing the time series of air temperature anomalies (with respect to a reference value), we determined the change in this fundamental climatic variable for the Northern Hemisphere (quite similar to the Southern one), giving a mean slope as small as 0.02 °C/century in the last millennium, but increasing sharply at the end of the 19th century, with a slope of 0.57 °C/century.

In order to improve the analysis, we made a mathematical fit of new NASA air temperature time series data (http://data.giss.nasa.gov/gistemp/graphs_v3/Fig.A.txt), available from 1880 to 2011. The fitting clearly shows nonlinear (parabolic) behavior of the air temperature increase with time (the corresponding results will be published elsewhere).

It is noteworthy that in 2007 the IPCC (Intergovernmental Panel on Climate Change) world report, received in the same year the Nobel Peace Prize for its basic contribution to mankind. From that time on, a large number of scientific publications have appeared, giving support to the human contribution to climate change and demonstrating that it is of paramount importance to take actions within the next decades (and even years) to reduce the GHG emission, to minimize deforestation, to make more efficient use of energy and materials, to change the energetic matrix to renewable energy, to slow down population increase, among other possibilities. In particular, Massachusetts Institute of Technology (MIT) re-analyzed their projections of temperature increase up to the end of the present century, obtaining a value of 3.5 °C in an optimistic scenario (corresponding mainly to a rapid reduction of GHGs), 5.2 °C in an intermediate scenario (with a moderate reduction of GHGs) and 7.4 °C in a pessimistic scenario, with a large increase in the emission of these contaminant gases, large population grow, etc. (MIT, 2009). These very important results must be compared with the projections done by the last IPCC report for similar scenarios: 1.6 °C, 3.3 °C and 6.2 °C (IPCC/WG1, 2007). Consequently, a mean increase in the predictions of the temperature change due to global warming at 2100 of 1.7 °C, for all scenarios, was obtained in the new MIT model calculations.

Significant evidence exists of the major impacts due to global warming: ice/snow melting of a large number of glaciers, the Arctic and a part of Antarctica; increase of the sea level affecting low altitude coasts and islands (Maldives is at risk in the Indian Ocean since its 1200 small islands/islets are at a maximum of 2 m above sea level); destruction and in some cases even extinction of animal and vegetable species; propagation of serious diseases (e.g. dengue, malaria, etc) to higher latitudes and altitudes; increasing frequency of extreme climatic events (droughts, floods, storms etc).

The tipping point concept is being applied more frequently over the past few years to climate change (see, for example, Chestney, 2012). It implies that the boundary system of the Earth variables (such as air temperature) can cross-over to an irreversible (non-returnable) point, if the non-renewable energy and material resources of the Earth are used in such a way that the generation of the by-products cannot be assimilated by the planet. One example is the melting of the polar ice sheets, with the consequent large increase in the sea level, as described earlier. Another interesting example is the depletion of the stratospheric ozone layer to values as low as those of the present Antarctic ozone hole by the 2060s. Newman et al. (2009) made a projection of this depletion in the situation in which the contaminant gases (mainly CFCs) were not banned as per the Montreal Protocol and Amendments. This would produce an increase in the maximum UV index (indicator of solar risk for human health) at mid-latitudes, from the present 10-12 to around 30!

In conclusion, we would like to point out that an even larger effort needs to be devoted to all industrial processes and, in particular, in drying technology as a highly energy-intensive process with large carbon footprint, to contribute to the reduction of the negative effects of global warming. If possible, at some point in future, all applications must be certified *carbon neutral*, which means that the carbon footprint of the system (see, for example, the UK National Energy Foundation carbon calculator at http://www.nef.org.uk/greencompany/co2calculator.htm) is reduced to its minimum possible value and the rest has been compensated (see http://www.ceroco2.org).

References

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