

# Guest Editorial

## Climate change is real and we need to urgently lower the emission of greenhouse gases

- Dr Ruben Piacentini\* & Prof Arun Sadashiv Mujumdar\*

In the past climate change was due to natural causes; for the first time after the Industrial Revolution and most significantly from the beginning of the last century, human activities are also modifying the global climate, mainly due to extensive industrial processing and land use. The main evidence for this climate modification is the large change in slope in the mean global ambient temperature rise, from a low value of  $-0.02^{\circ}\text{C}/\text{century}$  in the period from year 1000 to around 1900AD, to a large positive slope of  $0.57^{\circ}\text{C}/\text{century}$  in the 20th century. The temperature data showing this jump were obtained from different sources, e.g. tree rings, stalactites/stalagmites and even from the thermal behavior of the soil which has risen in the past centuries by about  $1^{\circ}\text{C}$ . Also, temperature measurements available from about the middle of the 19th century, also show the same mean increase as other sources of data.

Another important evidence of global warming is the large increase of sea level by about 20cm in the last century. A detailed analysis of the temperature and other climate change variables is available in the IPCC (Intergovernmental Panel on Climate Change) Fourth Assessment Report, Working Group I (The Physical Science Basis), that it is available at [www.ipcc.ch](http://www.ipcc.ch).

The increase in temperature due to human (anthropogenic) activity has its origin in the increase of the greenhouse gases (GHG), that contributes significantly to trapping the heat in the earth's atmosphere. The most important culprits are:  $\text{CO}_2$ , mainly produced by fossil fuel (oil, natural gas and coal) combustion and deforestation,  $\text{N}_2\text{O}$  generated by agricultural activity,  $\text{CH}_4$  produced by decaying waste, animals, agriculture and in energy production, HCFCs (hydrochlorofluorocarbons) released mainly by the refrigeration and airconditioning systems etc.

The main contributors to the increase in ambient temperature due to emission of huge quantities of GHGs are: buildings, cement industry, power generation, transportation, among others. In particular, the International Council for Chemical Associations (ICCA) determined for the Chemical Industry that the corres-

ponding  $\text{CO}_{2\text{equivalent}}$  (that take into account all GHGs) emission attained about 3.3 gigatons in 2005, but at the same time it contributed to a large mean reduction in the emission of these GHGs of 7.7 Gtn $\text{CO}_{2\text{equivalent}}$ , mainly due to introduction of "green" products and technologies for consumers and other industries. Chemical industry should continue to accelerate work on greener chemistries introducing greener products even by revisiting existing products and processes.

In recent years the concept of "tipping point" is gaining ground in the climate change scientific community. For a given system, it defines irreversibility in its time evolution. Some examples are the disappearance of the Chacaltaya glacier in the Bolivian Andes mountains (once the highest ski center in the world), and of islands, like Maldives. Many published articles and reports have appeared in recent years related to this type of (tipping point) events, alerting on their negative consequences if no mitigation measures are urgently applied.

Some of the *mitigation* measures related to this phenomenon (since temperature will continue to increase due to the inertia of the Earth system even if no  $\text{CO}_{2\text{equivalent}}$  were emitted) are: use of non-polluting energy sources such as renewable (solar, wind, hydro power, geothermal, etc); the application of energy efficiency measures in all systems that use energy; the development of low impact (sustainable) industrial processes; the education of the population and authorities, among others. Due to accelerating climate change, several *adaptation* measures have been suggested by the IPCC, Working Group II (Impacts, Adaptation and Vulnerability).

The whole global population must be involved in effecting significant reductions in the emission of greenhouse gases into the atmosphere. If, only limited actions are taken in the present century, by 2100 it is expected that the mean global (Earth atmosphere) temperature will increase by up to about  $3^{\circ}\text{C}$  (with uncertainty range of about  $1^{\circ}\text{C}$  to  $6^{\circ}\text{C}$ ).



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Irrational fears, fanned due to insecurities and lack of confidence, by motivated interest groups and vested interests, keen on perpetuating the status quo and by parliamentarians who are out of sync with the new found aspirations of the emerging majority of youthful population of Indians, have led to obstructing any new thinking, technology or novel introductions, whether into business, industry or in R&D. So whether it is foreign direct investment in retail or nuclear power or Bt crops or siting an industrial project, a vocal minority erupts with objections.

Why do we raise imaginary fears and bogeys, just about on any new or novel introductions?! Why is a nation that is considered as one of the fastest growing economies even now, and that had gained considerable self confidence post-