

Preface

*The earth has enough for every one's need
and not for every one's greed*
Mahatma Gandhi

Since the very beginning of human history over its evolutionary pathway, energy has been among the most important drivers, in the form of Sun, food, wood, animal work and much later fossil fuels and other sources and carriers, from the more diluted to the more concentrated forms. Humankind efforts have always been directed towards identifying and extracting new sources of energy and using them properly.

The problem of energy and its appropriate use date very far. In 1865, Sir William Stanley Jevons, Lecturer and then Professor of Economics at the Queen's College of Liverpool, published an alarming paper titled "*The Coal Question: An Inquiry concerning the progress of the Nation, and the probable exhaustion of our Coal-Mines*" in which he called the attention to the future depletion of the country's energy resources, mainly coal. His assumption, the so-called Jevon's paradox, was that the increase of energy efficiency thanks to technological development would have likely led to increased energy consumption, not its decrease, due to the expansion of the technological, economic and social system and the increase of energy-consuming devices. How prophetic those words are! The rebound effect envisaged by Jevons is haunting us now!

Very few scientific words and concepts had the venture to become as popular as *energy* did. After the oil embargo in 1973, energy became both a concern and a research topic for many, be they scientists, managers, policy makers and citizens. At that time, few were aware of the role that energy played in economic growth and its apparent scarcity gave a real shock to societies, governments and media. Many considered it a temporary aberration, largely influenced by political developments of that period and that it would be solved and forgotten very soon. Available fossil fuels, coupled with energy-conservation strategies, as well as new extraction and conversion technologies (e.g. natural gas fracking) are believed by many to be able to delay the end of the fossil fuel era, allowing for a smooth transition to the discovery of new energy resources. It is still debated whether the new patterns will be characterized by additional growth supported by newly discovered energy sources or a global and controlled downsizing of our economies, societies and population.

The energy scenario worldwide has been rapidly changing in recent years due to the impressive growth of emerging economies (called BRICS: Brazil, Russia, India, China, South Africa) and the average improvement of standard of living in many others. The redistribution of energy resources is forcing production and consumption patterns towards increased efficiency and larger use of renewables. However, statistics show a crude reality: If any energy alternative is to compete with fossil fuels, it must be able to replace at least a significant portion of the global energy use in percentages comparable to fossil fuels. The alternative solution would be a huge decrease of societal energy consumption down to levels still hard to imagine and perhaps not easily acceptable in industrialized societies. The extent and modes of such decrease is in progress and proposed solutions (degrowth, prosperous way down) are not likely to be easy.

A large effort still needs to be made for understanding the dynamics of intertwined energy, environmental and economic issues. It requires an interdisciplinary approach to dwell deeper into the system features of our societies, to understand the driving forces, the constraints, the evaluation methods, and finally the strategies to emerge out of the fossil fuel era and still be able to provide a prosperous future to the next generations as well as to all the species that inhabit the planet. This is what the International Workshop on “Advances in Energy Studies” has been about, from 1998 to-date, every other year, by gathering a critical mass of interdisciplinary scholars to stress the energy problem in its multidimensional feature, staying away from simplistic and purely technological solutions, monodimensional indicators, and “one-size-fits-all” strategies. Indeed, the guiding concept of integrated assessment requires checking the performance of the various options in relation to their biophysical feasibility, economic viability and social acceptability across multiple scales of analysis.

The main topics dealt with during the 2012 Workshop Edition include: energy technology, energy security, energy analysis and modeling, energy-related sustainability, energy efficiency issues all discussed under a multidimensional and multi-criteria point of view, with focus on process, regional and international scales. The changing global context is no doubt the main frame for the analysis: growing population, growing expectations for improved quality of life, global economy, technology improvement, increasing awareness of limitedness of fossil resources and the call for larger share of renewable sources, the need for increased energy efficiency and energy saving policies, and finally the recognition of the large uncertainty affecting energy scenarios and policies.

Bringing a volume of this nature would not have been possible without the support and cooperation of a large number of people. First, it is a pleasure to thank Prof. Mahendra Dev, Director, IGIDR, for his unstinted support and exceptional guidance to the organising of the Workshop. The Indian Renewable Development Agency Ltd, New Delhi, has sponsored the first technical session and our thanks are due to them. Our sincere thanks are also due to Sri K. Sreenivasa Rao (formerly Assistant Editor, *Journal of the Indian Institute of Science*, Bangalore, India) for improving the readability and presentation of papers presented here, and for valuable suggestions. Our deepest appreciation and thanks go to the authors of the papers included

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We hope that this volume will provoke strong reactions from its readers, both positive and negative!

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