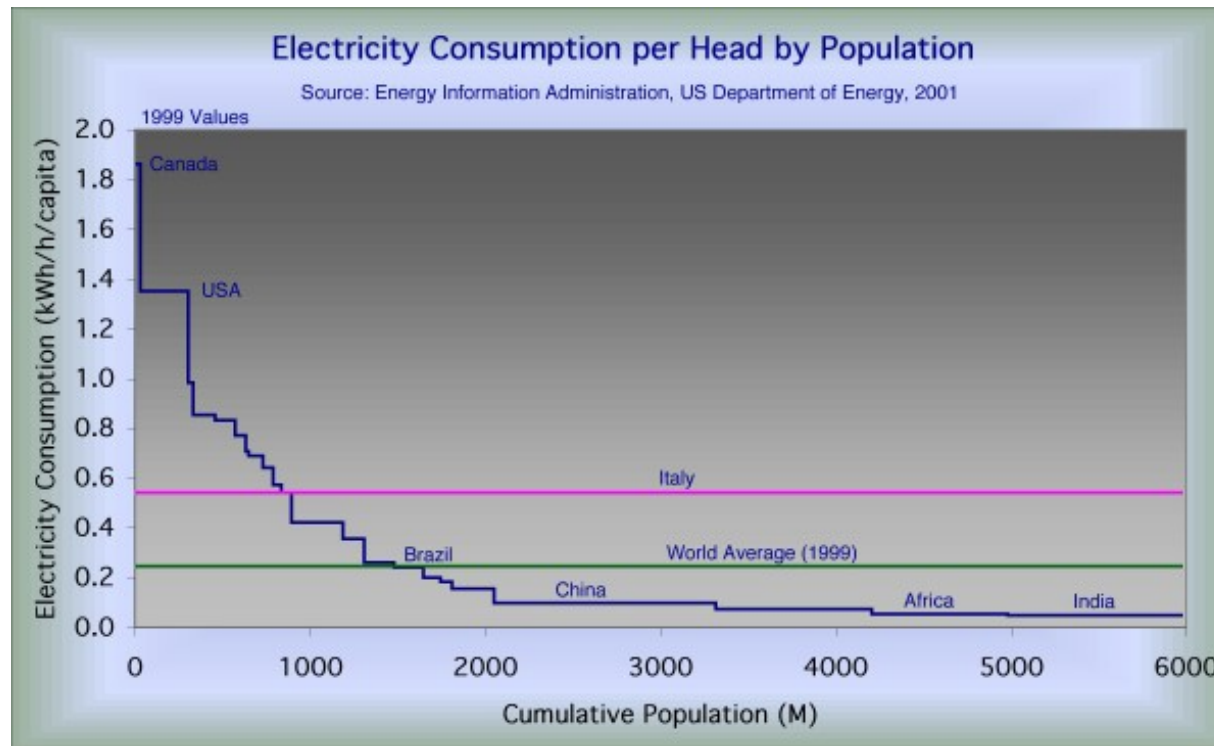


Energy Needs, Developing Countries and ICTP*

K.R. Sreenivasan
Abdus Salam Research Professor
Director, ICTP

*ICTP is administered by UNESCO under a tripartite agreement that includes IAEA and the Government of Italy.

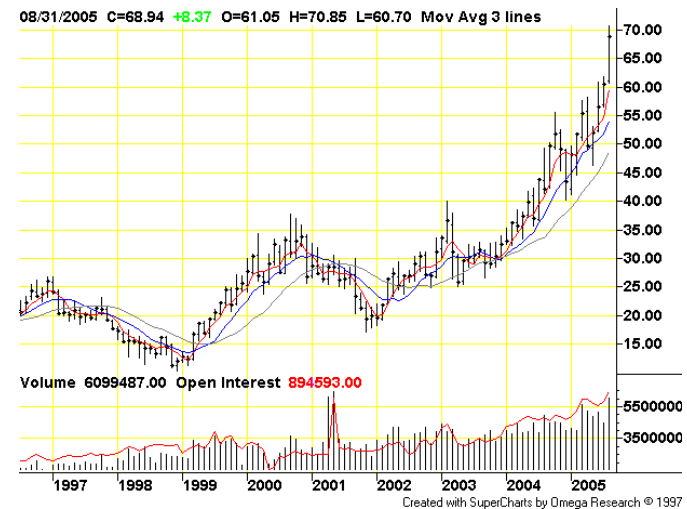
1. Energy consumption in the near future will go up at a more rapid rate than before



About four billion people use little energy today (1.6 billion are without electricity). The energy consumption will increase partly because more of them will begin to use more energy and partly because the population will increase (to an estimated 10-12 billion in the steady state).

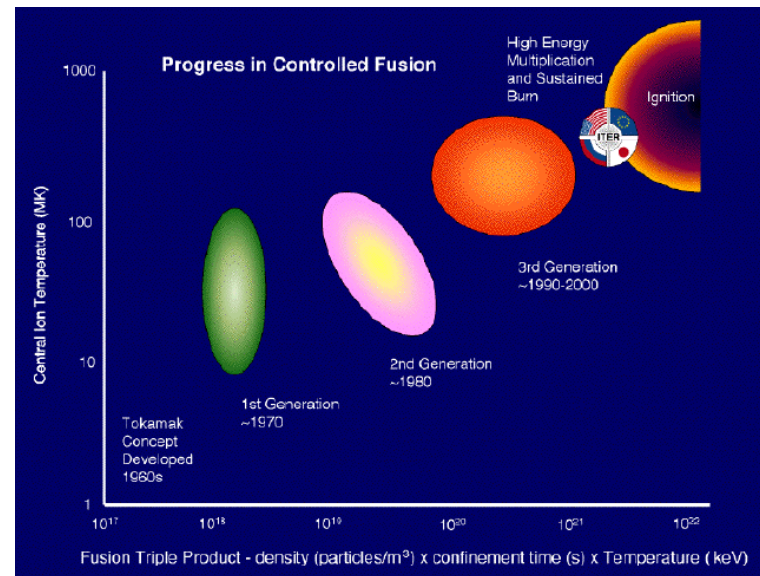
2. Dependence on fossil fuels cannot continue as now

- Supplies are limited
- Availability will become a greater vagary as sources dry up
- Greenhouse effects may make them less useful even sooner (e.g., each automobile uses 3-4 times its weight of CO₂ per year, roughly some 25,000 million tons per year)



3. Sustainable energy options will have to be a mix

- **Fossil fuels (dependence at a reduced rate)**
- **Nuclear (fission and fusion)**
 - Fission: disposal and proliferation issues
 - Fusion: ~ 50 years on
- **Renewable sources**
 - Solar, wind
- **Conservation**
- **Others**
 - hydrogen?

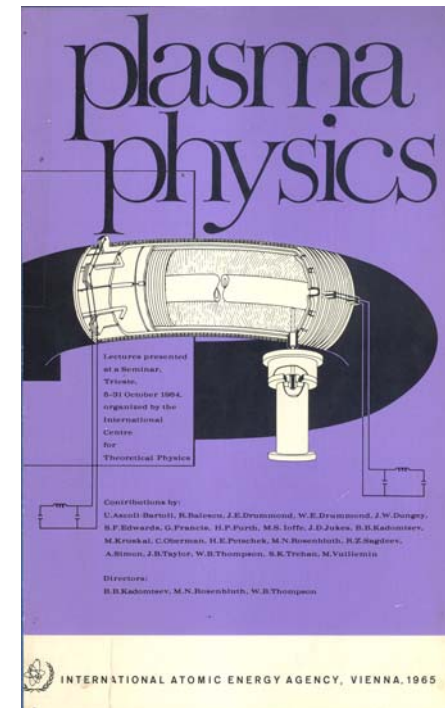


4. Participation of developing countries and dialogue with them are essential

- DCs cannot follow the same path to progress as industrialized countries did in the past
- Greater ingenuity is needed, which calls for greater investment in science
- Industrialized countries have a large responsibility because unsustainable development in the developing part of the world will adversely affect every other part

ICTP's involvement

- Dialogue: Dedicated scientific workshops over the years (some in cooperation with IAEA) with considerable participation from DC
- TRIL Fellows over the years
- New section on Earth System Physics (consolidating energy issues as well)



COURSES IN RENEWABLE ENERGIES AT ICTP (SINCE 1977)

- 1977:** Workshop on Solar Energy Conversion (September) Total Participation: 100
1978: Workshop on Solar Energy Storage (September) Total Participation: 60
1979: Workshop on Non-Conventional Energy Sources (September) Total Participation: 120
1980: Séminaire sur l'Energie Solaire (September) Total Participation: 50
1981: Workshop on Non-Conventional Energy (July - August) Total Participation: 90
1982: Workshop on Non-Conventional Energy Sources (July) Total Participation: 60
Séminaire sur l'Energie Solaire (September) Total Participation: 50
1983: Workshop on Non-Conventional Energy Sources (June - July) Total Participation: 90
1985: Conference and Workshop on the Physics of Non-Conventional Energy Sources and Material Science for Energy (2-20 September) Total Participation: 190
1986: Colloque International sur la Science des Matériaux pour L'Energie (August - September) Total Participation: 72
1987: Workshop on Non-Conventional Energy Sources and Material Science for Energy (August - September) Total Participation: 196
1987: Workshop on Interaction between Physics and Architecture in Environment Conscious Design (September) Total Participation: 89
1987: Workshop on Economics, Modelling, Planning and Management of Energy (September) Total Participation: 106
1989: Workshop on Materials Science and Physics of Non-Conventional Energy Sources (September) Total Participation: 205
Workshop on Interaction Between Physics and Architecture in Environment Conscious Design (September) Total Participation: 46
1992: Workshop and Conference on Global Change and Environmental Considerations for Energy System Development (April - May) Total Participation: 71
1993: Workshop on Materials Science and Physics Non-Conventional Energy Sources (August - September) Total Participation: 124
1995: Workshop on Materials Science and Physics of Non-Conventional Energy Sources (September - October) Total Participation: 131
1996: Workshop on Biomass Production and Utilization (May) Total Participation: 56
2005: After about 10 years, the tradition of Renewable Energy at the ICTP has been resumed.

21 courses or workshops, about 2000 participants, since 1977

