Energy, Climate, and Future Welfare – Changing Global Dynamics

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The global dynamics of societies is presenting us with challenges that are all mentioned in the title of this conference:

Economic growth and our current prosperity in the industrialized world depended and still depend to a large degree on the availability of large amounts of inexpensive energy. In the middle of the 19th century each human being has lived with an energy consumption of roughly 150 watt hours. This has increased to about 2000 Wh today but with a very unequal distribution between the industrialized and the developing world.

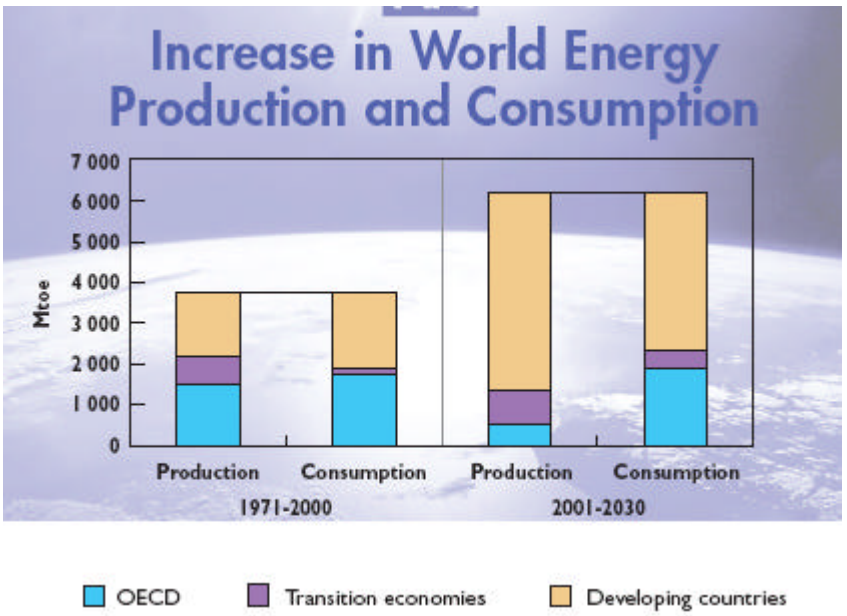
This energy consumption has changed the global dynamics of the carbon cycle with consequences that are being under investigation. Climate change as far as we know today will affect terrestrial as well as marine systems. Temperature increases, changing precipitation patterns with an increasing threat of water scarcity in many parts of the world, and threats to the biodiversity are expected. Worst of all, the latest findings indicate that previous predictions about the negative impacts have been too low. The possibility of irreversible changes such as the melting of the Greenland ice sheet or the freeing of methane kept in the permafrost imply climate changes that surely nobody wants his children and grandchildren to experience.

Today about about 25.000 people die every day from insufficient nutrition, 6.000 – mostly children – die every day from water-related diseases. These are urgent needs that can only be met if economic growth supported by better management also benefits the people living in the poor parts of the world.

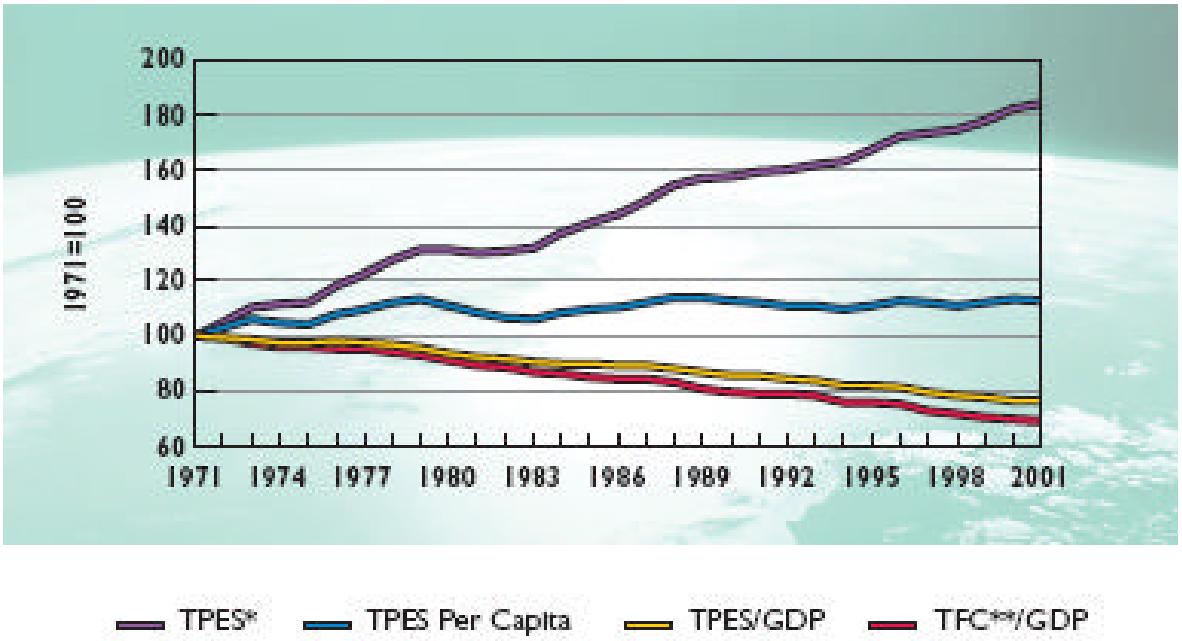
The challenge is therefore clear: Promoting economic growth for the poorest of the world whilst protecting the climate system from changes that become dangerous for future generations. Translated into energy it means more energy consumption in the Third World whilst at the same time reducing emissions from fossil fuels, the major source of energy today.

Energy:

- Energy consumption is steadily rising. Business as usual would lead to a further increase by at least 50%.



- The additional energy will predominantly come from fossil sources (Coal, gas, oil)
- The dependency on oil will increase most in Asia. The import share of China of about 35% in 2000 will rise to over 80% in 2030. Europe's from 50% in 2000 also to over 80% in 2030.
- About 1% of world GDP needs to be invested in energy infrastructure over the next 25 years. This small number means $550 bn per year.
- Security concerns: Future oil supplies will predominantly come from the Middle East. Gas from Russia and the Middle East.
- Only coal in ample supply is more evenly distributed across the earth, however it is the major contributor to CO_2 –emissions.
- Up to now improvements in energy efficiency have just compensated population increases as is evident from the constant per capita energy consumption over the last 30 years. At the same time energy consumption overall has increased by 80%. Today a Dollar of GDP is produced with 30% less energy than in 1970.



TPES=Total primary energy supply

The challenge in terms of welfare and energy is to supply safe energy in sufficient amounts to provide the basic needs for a sizable proportion of the worlds population that still lives with less than a dollar per day.

Climate:

- The increase in energy consumption has been accompanied by increasing CO_2-emissions.
- The CO_2 has a long half life in the atmosphere, hence the CO_2 concentration in the atmosphere increases as long as we are emitting more the 1 or at most 2 Giga tons of Carbon. Today emissions are roughly 7 Gigatons per year!
- CO_s concentrations have over the last 500 thsd. to 1 million years varied between 200 and 280 ppmv. Homo sapiens since about 30.000 years had the pleasure to have for the last 10.000 years an almost constant temperature.
- Now CO_s concentrations are at 380 ppmv and expected to rise to 700 or in the worst case to 1.000 ppmv. Such an experiment with the earth has not been observed in millions of years. Its outcome is open, however the signs emerging already today are alarming.
- Recent research indicates potentially irreversible processes like the melting of the Greenland Ice Sheet, possibly resulting in several meters of sea level rise although not in our generation but several hundred years in the future.
- The oceans take up about 40% of our CO_s-emissions and also show first signs of reaction. The Thermohaline Circulation (i.e. the Gulf Stream) is changing, the acidity in the oceans is increasing and they are warming as well. With a reaction time of several thousand years, such processes have long term consequences and can most likely only be slowed down but not stopped.

The challenges for energy and climate:

- How can energy demand satisfied while at the same time “preventing dangerous climate change” (UNFCCC, Art.2)?
- Options:
    - Using energy more efficiently
    - Consuming less energy
    - Developing “clean energy sources”
    - Capturing CO_2
    - Sequestering CO_2 from the atmosphere into safe deposits