International Conference on Sustainability Science 2009

February 6, 2009

Track 1: Climate Change and Energy

Session 2: Energy Sustainability

Chair : Prof. Vincenzo Naso, CIRPS, Sapienza, the University of Rome

ENERGY : Current human use = 15TW (1.5×10^{13})

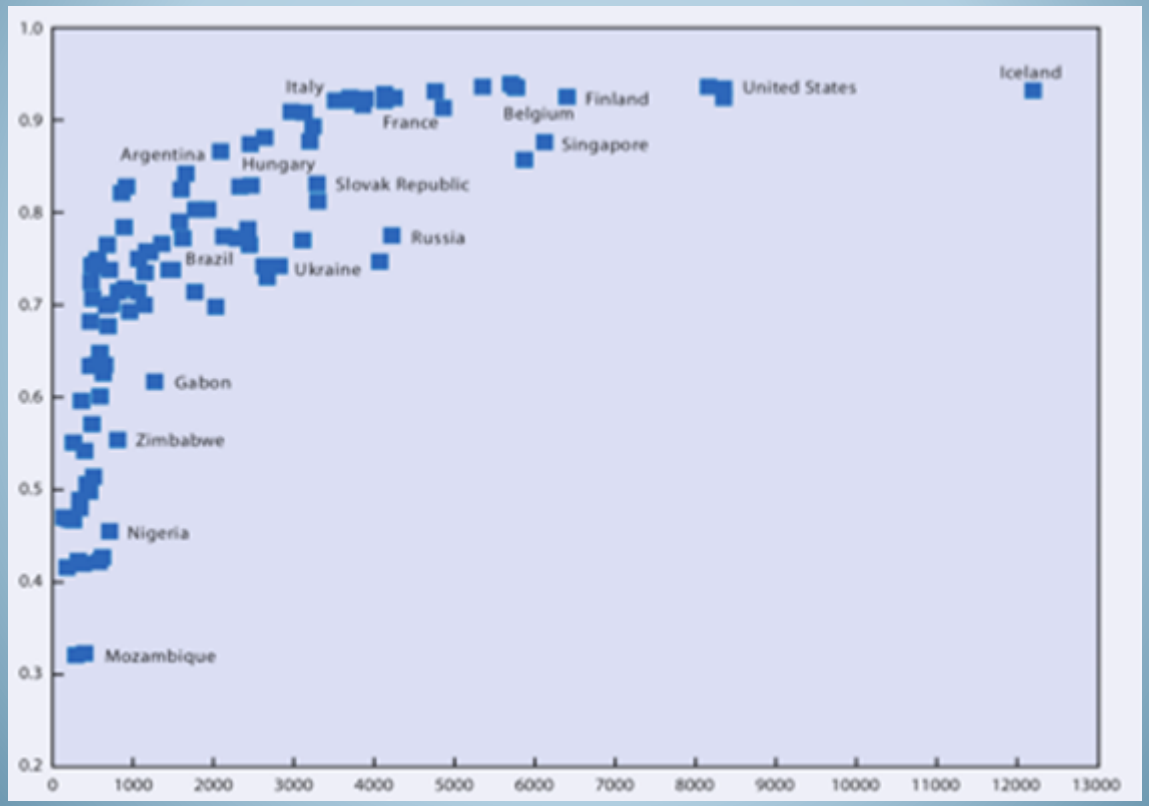
90% from fossil fuel

0.01% solar input to Earth

3×10^{22}J since 1750

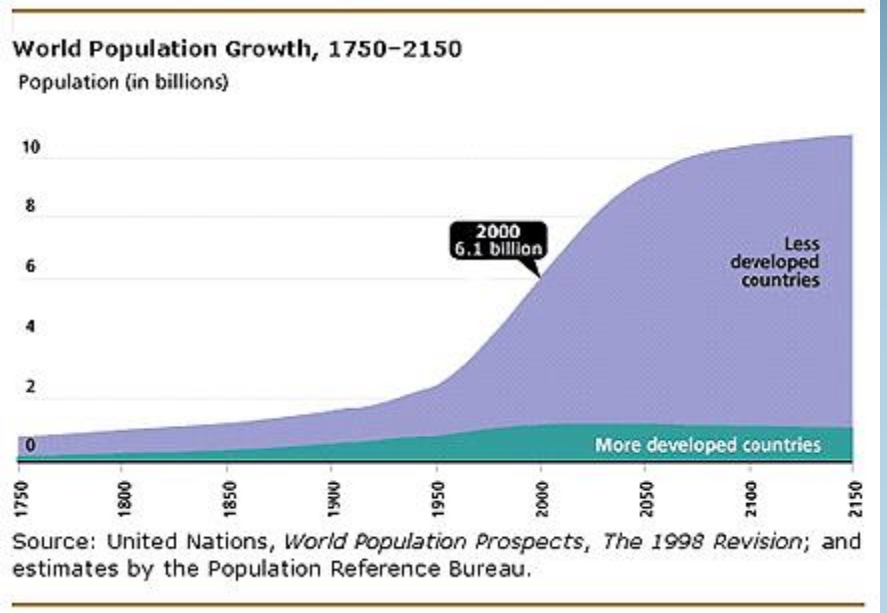
Energy is a key driver of social and economic development!

Human Development Index



Per capita energy consumption (kgoe/capita)

Source: UNDP 2004



Source: United Nations, *World Population Prospects, The 1998 Revision*; and estimates by the Population Reference Bureau.

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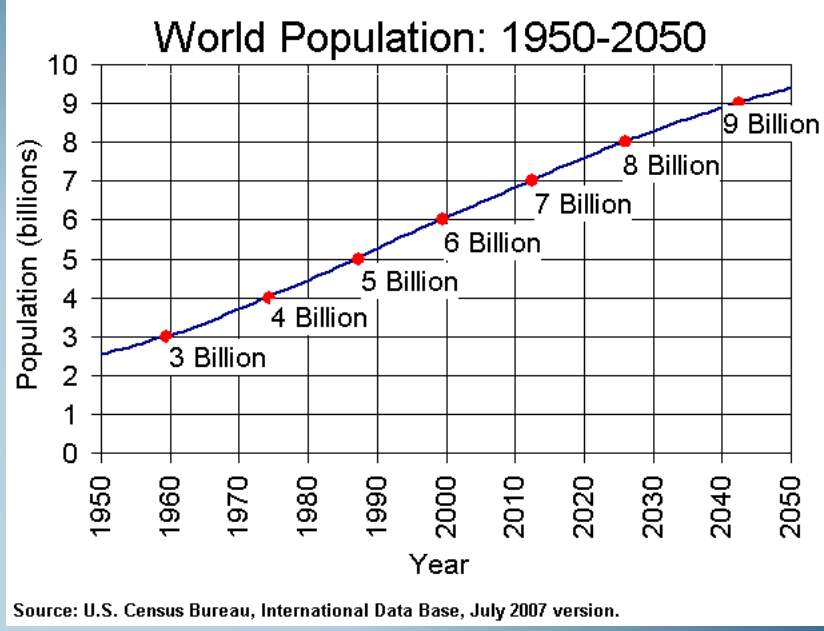
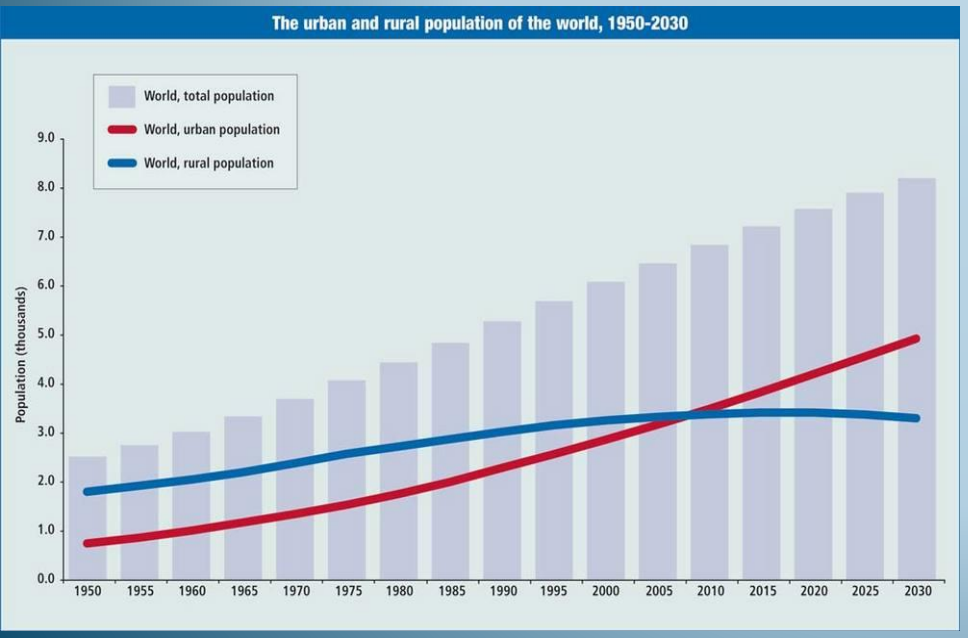
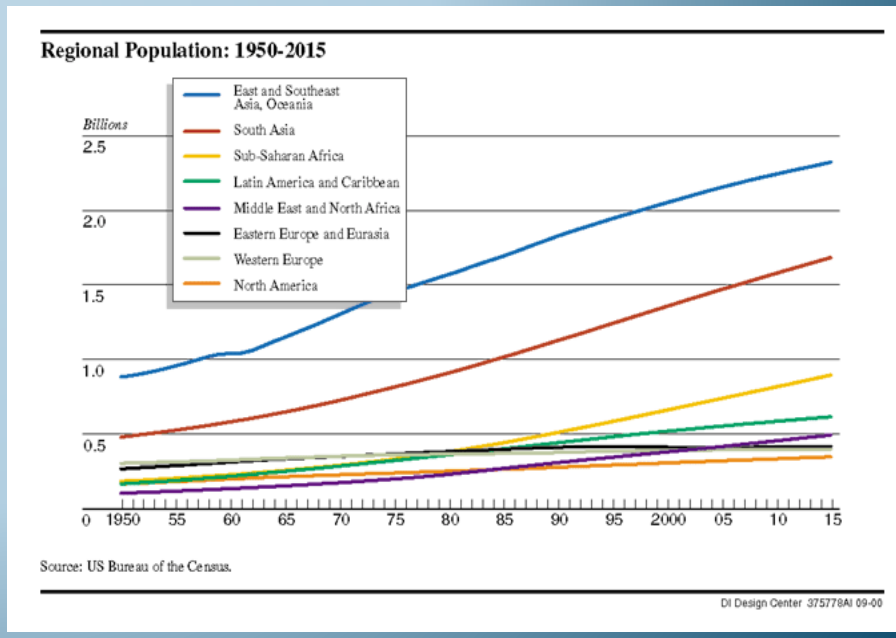
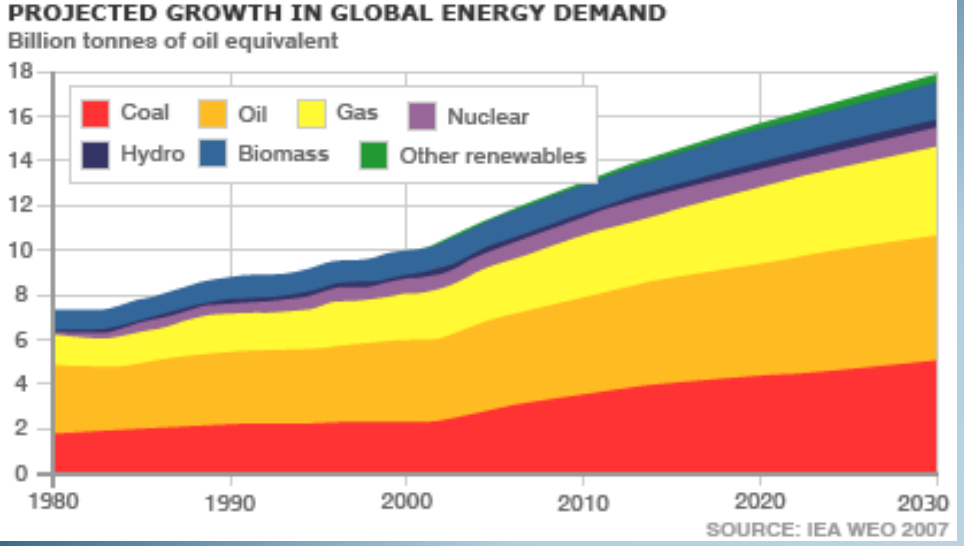


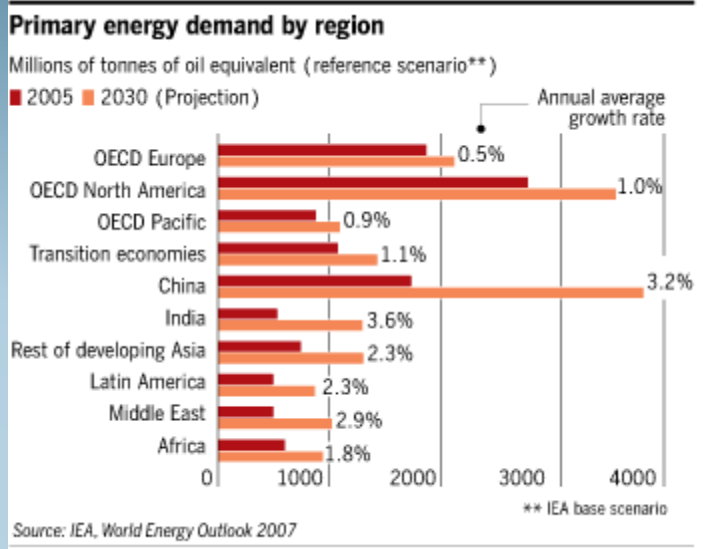
Source: U.S. Census Bureau, International Data Base, July 2007 version.

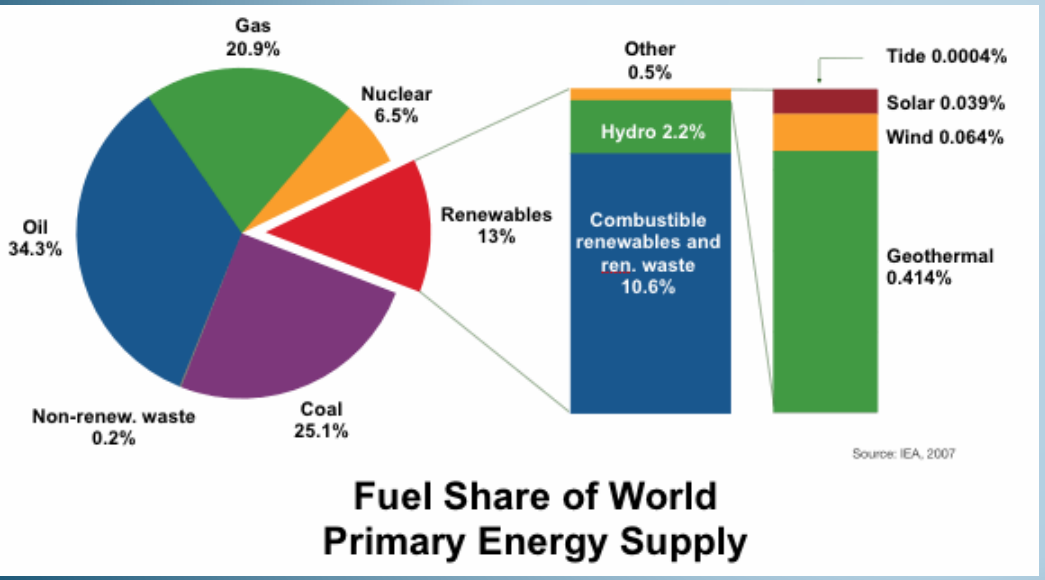




Source: United Nations, *World Population Prospectus, The 2005 Revision*







Fuel Share of World Primary Energy Supply

World's energy consumption is projected to expand by 60% by 2025. Two thirds of this increase will be produced by emerging countries, in particular Asian countries.
Source : *IEA 2006*

80% of the present global energy market demand is satisfied by fossil fuels, 6.5% by nuclear plants and 13 by renewables.

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The present energy paradigm

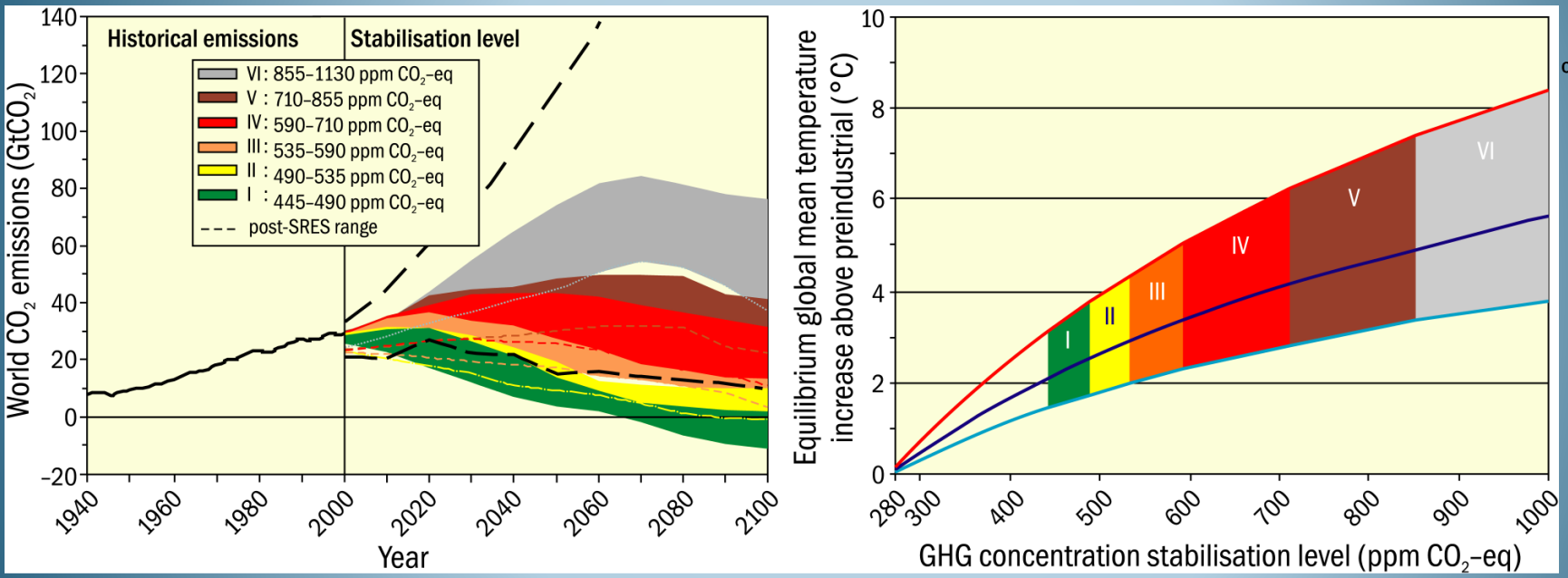
The present energy paradigm is posing a serious threat to the ability of future generations. Most of the energy chain – from the extraction of resources to the provision of energy services – produces pollutants, waste and emissions. Moreover, this paradigm is mainly based on finite resources.

Fossil fuels combustion is responsible for urban pollution, regional acidification and global climate change. According to WEC 2007, energy-related emissions (including energy used in transportation) account for over two thirds of anthropogenic greenhouse gas (GHG) emissions and contribute well over 80% of worldwide emissions of CO2.

Nuclear power involves a great number of concerns related to the safety of nuclear installations, disposal of radioactive waste and nuclear weapons proliferation.

The challenge (threat) of Climate Change

World CO2 emissions and global mean temperatures increase scenarios



Source: IPCC 2007

Sustainability:

"We do not inherit the earth from our ancestors, we borrow it from our children" (Ancient Indian proverb)

Reformulating the Brundtland definition of sustainable development specifically for energy, "sustainable energy" results as: "*The provision of energy such that it meets the needs of the future without compromising the ability of future generations to meet their own needs*"

WEC's 3A's criteria for defining and achieving a sustainable energy future : Accessibility, Availability and Acceptability.

They reflect the critical issues which global sustainability must resolve – i.e., population, poverty and pollution.

Closed cycle sustainability definition:"Zero consumption is a necessary condition for sustainability, and brings about as a side effect the highly desired ''zero-waste'' result." (Orecchini 2007: 245)

Towards a transition/ (Transitions towards sustainability)

In order to make a transition to a sustainable energy future, three solutions in three different steps should be supported:

1. A short - term solution based on Energy Efficiency and integration of low carbon technologies and RES,
2. A mid - term solution based on low carbon technologies and RES integrating green electricity and hydrogen aiming at zero emission.
3. A long - term solution based on zero consumption – zero waste model.

G8 University Summit 2008: Sapporo Sustainability Declaration

From Point 3: **The role of universities**

> "All universities have an important role in problem-solving to bequeath a sustainable world to future generations."

From Point 4: **The need to restructure scientific knowledge**

> "(..) the development of a truly comprehensive vision of a sustainable society will require new scientific knowledge, restructured to reverse past tendencies toward stratification and fragmentation in research, and to foster an integrated approach to solving problems by accelerating inter-disciplinary research activities."

From Point 5: **The need for a network of networks**

> "Essential to such a framework is the creation of a "network of networks" (NNs) that links the various discipline-specific research networks already in place, thereby utilizing and augmenting their respective strengths and knowledge bases."

From Point 7: **The role of higher education for sustainability**

> "Universities have a critical role to play in educating future generations, disseminating information about sustainability, and particularly by training leaders with the skills to solve regional and local problems from a global and interdisciplinary perspective. "

Session expectations: Epistemological and ontological contribution to Sustainability Science with focus on energy:

Theory: Principles, Definitions, Indicators

Scenarios

Possible solutions: Technologies, Consolidated experiences, Policy Recommendations