



## INTERNATIONAL WORKSHOP ADVANCES IN CLEANER PRODUCTION

"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

### The role of energy in sustainable development

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"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundlund Commission 1987).

Looking at sustainable development through the lens of energy can help clarify the definition above, because the nature of energy systems offers a response to the thorny question of how many "future generations" we should consider.

Exhaustible fossil fuels (oil, coal and gas) represent 80.1 percent of the present world energy supply, nuclear energy 6.3 percent and renewables, 13.6 percent. Due to the dominance of fossil fuels in the world's energy supply and their limited expected lifetime, they cannot be considered the world's main source of energy for more than one or two generations – thus providing a metric to the aim of "not compromising the ability of future generations to meet their own needs".

A sustainable energy system must comprise four components, characterized as

- Physical (related to securing supplies adequate to meet future energy needs and extending their life – essentially an energy supply problem);
- Environmental (related to the use of present sources of supply at the local, regional and global levels, including averting global warming and catastrophic climate change);
- Geopolitical (related to security risks and conflicts that could arise from escalating competition for unevenly distributed energy resources) and
- Equity (not strictly an energy problem, but similar to the problem of access to food and other amenities provided by modern civilization).

The technological options that are being considered to meet these characteristics are:

- More efficient use of energy, especially at the point of end use in buildings, transportations and production processes

- Increased reliance on renewable energy sources.
- Accelerated development and deployment of new energy technologies particularly next-generation fossil fuel technologies that produce near-zero harmful emissions, but also nuclear technologies if the issues surrounding their use can be resolved.

In the industrialized countries concerted efforts were mounted in the last few decades to improve energy efficiency and reduce carbon intensity. The worldwide introduction of price signals for carbon emissions – with consideration of different economic and energy systems in individual countries – has not occurred yet but is being actively negotiated among countries.

Regarding developing countries, rather than mimicking the industrialized nations and going through the economic development road they followed in the past that is dirty and wasteful – creating an enormous legacy of environmental pollution – developing countries should “leapfrog” over some of the steps followed by them and incorporate early in their process of development currently available modern and efficient technologies.

The substitution of gasoline (a fossil fuel) by ethanol from sugarcane (a renewable fuel) in Brazil is an important example of a “leapfrogging” strategy followed by a developing country.