Appendix to UN Statement

UN General Assembly Interactive Thematic Dialogue

Energy Efficiency, Conservation and New and Renewable sources of Energy

Energy systems should safeguard the environment

New York, 18th June 2009[1]

This Appendix provides further information on the energy efficiency and renewable energy strategies that should be incorporated as the foundation for sustainable development and as the groundwork for a reliable energy portfolio consistent with growing global demand.

Energy Efficiency

Aggressive deployment of energy efficiency measures can be expected to reduce the world's projected energy needs in 2050 by one third, with associated reductions in GHG emissions. Energy efficiency can be achieved on a broad scale through comprehensive efficiency standards for appliances, and efficiency requirements incorporated into building codes and transportation. With respect to capital requirements, most energy efficiency measures pay for themselves over time through the savings generated by reduced energy consumption. For utilities investing in energy efficiency, for example, the costs can be recovered by holding customer bills constant and using the cost savings from reduced consumption to pay for the energy efficiency measures.

Appliance Standards: Adoption of appliance standards can produce significant reductions in energy use while saving consumers and businesses billions of dollars. The International Energy Agency estimates, for example, that switching to the best, most energy efficient appliance technologies would save at least 40% of residential electricity consumption in most appliance categories. With respect to the U.S. experience, appliance standards had reduced U.S. electricity use in 2000 by approximately 88 billion kWh and reduced U.S. total energy use by approximately 1,200 trillion Btus, representing savings of 2.5% and 1.3% of U.S. electricity and energy use in 2000, respectively. With respect to peak generating needs, appliance standards produced a reduction of approximately 21,000 MW — equivalent to displacing seventy 300 MW power plants. Over the preceding 10-year period, standards produced reductions to consumer energy bills by approximately $50 billion. As old appliances and equipment wear out and are replaced, savings from existing standards will steadily grow. By 2010, savings will total more than 250

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billion kWh (6.5% of projected electricity use) and reduce peak demand by approximately 66,000 MW (a 7.6% reduction).

Building Codes: Approximately 43 percent of the CO_2 emissions from fossil fuel combustion in the U.S. are the result of energy services such as lighting, appliances, and heating and cooling systems in commercial, industrial, and residential buildings. There is a vast potential for emission reductions simply by increasing energy efficiency in buildings. A recent study by McKinsey & Company finds that fully developed efficiency technologies could provide between 710 and 870 megatons of emissions annual abatement potential (in CO2-equivalents) by 2030 *at negative costs*—saving money while reducing emissions. Examples of these technologies include lighting retrofits; improved heating, ventilation, and air conditioning systems; building envelopes; higher performance appliances and electronic equipment; and use of advanced information and communication technologies to monitor and optimize energy use in buildings.

Lighting: Semiconductor-based light-emitting diodes (LEDs) use much less power than traditional bulbs, do not contain mercury like fluorescents, and they last for years, sometimes even decades. The Department of Energy has estimated that LEDs could reduce national energy consumption for lighting by 29% by 2025. That would save U.S. households $125 billion on their electric bills.

Industrial Processes: Industrial process efficiency is affected by a number of factors: technology design, age and sophistication of equipment, materials of construction, mechanical and chemical constraints, inadequate or overly complex designs, and external factors such as operating environment and maintenance and repair practices. Processes typically use a lot more energy than the practical minimum energy that is required. Technologies under development focus on removing or reducing process inefficiencies, lowering energy consumption for heat and power, and reducing the associated greenhouse gas emissions. In the U.S., for example, the industrial sector consumes approximately one-third of energy use and accounts for 28 percent of domestic GHG emissions. Much of this energy is used in processes that are common across numerous industries. By developing and promoting technologies that can be applied in many industrial settings across the most energy-consuming manufacturing processes, significant energy efficiency savings can be captured and thereby achieve corresponding GHG emissions reductions.

Combined Heat and Power (CHP): CHP, also known as cogeneration, is the concurrent production of electricity or mechanical power and useful thermal energy (heating and/or cooling) from a single source of energy. CHP is first and foremost an energy efficiency resource, as it allows users to produce needed electricity, heat, and mechanical energy while using as little fuel as possible. As an efficiency technology, CHP can lower overall energy demand, reduce reliance on traditional energy supplies, make businesses more competitive, cut GHG emissions, and reduce the need for infrastructure improvements. Because of its inherent efficiency, performance, and reliability, CHP is an effective near-term solution that can address a nation's current and future energy needs. CHP is a type of distributed generation, which, unlike central station generation, is located at or near the point of consumption.

District Energy Systems: District energy systems can integrate multiple energy users within the same energy infrastructure as efficiently as possible by relying on CHP technology or renewable fuel sources, such as geothermal or biomass. District energy systems in the United States, for example, have served up to 400 customer buildings; the technology is highly beneficial to densely clustered establishments like universities or industrial compounds. These systems also can achieve massive economies of scale, as they can employ an optimal, diverse fuel selection at any given time that otherwise would be economically unfeasible or technically impossible, thereby providing benefits directly to customers in the form of enhanced energy efficiency, avoided capital costs, consistently reliable energy service, and decreased power demand. In Denmark, 60 % of all households are heated with district heating, and half of all electricity is produced by CHP.

Renewable Energy Sources

The displacement of expensive fossil-fired sources with renewable energy sources provides cost savings, promotes more diversity in the fuel supply, achieves dramatic reductions in GHG emissions, and can eliminate crippling dependence on foreign sources of petroleum. An additional feature of renewable energy is the ability to deploy these technologies on a smaller, more localized scale (referred to as “distributed generation”), which offers the opportunity for capacity building within local communities. Large, central generating stations, on the other hand, require considerable investment in a transmission grid and the resulting inefficiencies from transmitting power over long distances. Of particular concern is increased deforestation or the displacement of human populations for access to the energy sources or land needed to support renewable energy projects. Therefore, careful planning is needed to ensure that development goals are reached sustainably and are consistent with human rights standards.

Wind: Wind generation is one of the fastest growing sources of clean, renewable energy. Installations of wind turbines do not require huge areas like fossil fuel industries, but rather can be configured on farms or ranches in the rural areas and farmers can still work on the land. Small wind turbines can also be built on individual houses in remote locations. At the same time, wind has a relatively high initial capital cost, and the sites with the greatest wind potential are often in remote locations far from the load. Wind is an intermittent resource (*i.e*., the level of generation depends on the extent of wind currents). Wind energy continued its growth in 2008 at an increased rate of 29 %. All wind turbines installed by the end of 2008 worldwide are generating 260 TWh annually, which represents more than 1.5 % of the global electricity consumption. Wind production has also proven to generate jobs, and has created 440,000 jobs worldwide. China continues its role as the most dynamic wind market in the year 2008, more than doubling the installations for the third time in a row, with today more than 12 GW of wind turbines installed. Based on accelerated development and further improved policies, a global capacity of more than 1.5 million MW is possible by the year 2020.

Solar: Photovoltaics (PV) is a solar power technology that uses solar cells or solar photovoltaic arrays to convert light from the sun directly into electricity. The manufacture of photovoltaic cells has expanded dramatically in recent years. Photovoltaic production has also been doubling every two years, increasing by an average of 48% each year since 2002, making it the world’s fastest-growing energy technology. At the end of 2007, according to preliminary data, cumulative global production of solar PV systems was 12.4 gigawatts. Roughly 90% of this generating capacity consists of grid-tied electrical systems. Such installations may be ground-mounted (and sometimes integrated with farming and grazing) or building integrated. Financial incentives, such as preferential feed-in tariffs for solar-generated electricity and net metering, have supported solar PV installations in many countries including Germany, Japan, and the United States. The European photovoltaic market is consistently growing, outpacing other regions worldwide. The growth in the overall European market has been principally driven by the dynamism of the German market. The cumulative solar PV installed capacity in Germany increased from 195 MW in 2001 to 5,337 MW in 2008, making Germany the largest market for photovoltaic installations worldwide with a global market share of 35% in the year 2008. Germany has positioned itself as an excellent location for solar energy investments due to strong governmental support, the availability of a highly-qualified workforce, and a plentiful supply of scientific research centers and universities.

Biomass/Biofuels: Biomass is plant matter such as trees, grasses, agricultural crops or other biological material. It can be used as a solid fuel, or converted into liquid or gaseous forms for the production of electric power, heat, chemicals, or fuels. A variety of biomass conversion processes can take place in one facility called a biorefinery. Cost-effective, environmentally friendly biomass conversion technologies are renewable energy sources that can reduce GHG emissions, support local, rural economies, and reduce a nation’s dependence on foreign oil. Different countries specialize in certain types of biofuels, according to their climate and other agricultural conditions. In Europe, it is rapeseed, wheat and sugar beet, while the first-generation, conventional biofuels in the U.S. are primarily corn and soybeans. Sugar cane tends to be grown in Brazil and a huge amount of palm oil comes from south-east Asia. First-generation biofuels are controversial and have been accused of contributing to the displacement of land used for food production in order to grow biofuels. This in turn has contributed to increased food costs and food shortages. Thus, the current emphasis is on the second-generation biofuels, which are produced from a much wider range of substances that do not compete with food consumption, such as manure, food waste, wood, straw, and sewage. There are particularly high hopes pinned on algae and jatropha, an ancient toxic bush found in the Americas, Africa and Asia. Some second-generation biofuels are already in use, while experts say it may be five to ten years before more advanced biofuels become commercially viable. It is essential that biofuel development incorporate best practices that build upon the collective experience of conventional biofuels, including guidelines for sustainable development and the protection of human rights and land rights, especially those of indigenous peoples.

Hydro: Hydroelectric power or hydropower is generated by kinetic power of flowing water as it moves. Generally, there are three types of hydropower facilities: impoundment, diversion, and pump storage. Micro hydro plants can produce as little as 100 kilowatts, while large hydro facilities can exceed 1000 MW. China is currently the leading hydropower producer in the world, with 172 million kW of installed capacity, with plans to increase this figure to 300 million kW by 2020. A distinct advantage of hydropower is its load-following ability, *i.e.*, the water is run through the turbines to generate electricity as needed. Hydro projects can have adverse environmental impacts, such as fluctuation in water quality and flow, and affect biodiversity as a result of loss of land and natural habitat. Fish populations can also be adversely affected if they cannot migrate past impoundment dams to spawning grounds or cannot access the ocean. A large dam can also cover land and river habitat with water displacing human populations.

Emerging Water Power Technologies: Marine and hydrokinetic devices offer the potential to capture energy from waves, tides, ocean currents, and the natural flow of water in rivers, as well as marine thermal gradients, without building new dams or diversions. Ocean currents, for example, contain a remarkable amount of kinetic energy and have potential worldwide capability.

Geothermal: Electricity and other forms of power can be created from hot gases escaping near the Earth's surface. Additionally, this hot water can be piped directly into buildings and factories for heat. Worldwide, geothermal power is being generated in more than 20 countries including Canada, Iceland, Italy, France, New Zealand, Mexico, Nicaragua, Costa Rica, Russia, The Philippines, Indonesia, China, Japan, the rift valley of Africa and the U.S. Iceland in particular has been using its geothermal power for decades, which is relied on for heating about 90% of all homes and to produce roughly one quarter of Iceland's electrical needs.

Waste to energy (WTE): WTE, including landfill gas operations, is another economical and practical form of energy generation for developing countries. These plants simultaneously offset fossil fuel use, increase energy efficiency, decrease GHGs, and offer a reasonable solution to many countries' solid waste management disposal issues. Particularly in the case of developing countries, governments and physical infrastructure are unable to absorb the exponential increase in waste from economic development and population growth. For example, a major city like Mumbai – responsible for much of India's financial growth but plagued by abject living conditions for many as a result of over-capacity landfills – could benefit from a WTE plant. WTE plants have been shown to reduce oil use by 45 gallons for every one ton of municipal solid waste combusted, as compared to coal which offsets only .28 tons. While currently only 130 million tons of municipal solid wastes are combusted annually across the world, the potential for hundreds of millions of tons more can be easily realized. Similarly, the potential for monetizing landfill gas emissions – namely methane – is very promising. Policy directives limiting the amount of biodegradable waste permitted in landfills, usually mandated in conjunction with a landfill tax, are necessary political strategies.