UN-Energy

2012 INTERNATIONAL YEAR OF SUSTAINABLE ENERGY FOR ALL

# Sustainable Energy in a Green Economy

Policy Brief

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UNIDO
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# 1. Introduction: energy for sustainable development

*"Energy is at the forefront of the global agenda. It is central to the issues of development, global security, environmental protection and achieving the MDGs. Profound changes are beginning to transform the way we supply, transform, deliver and use energy services – a trend that a revitalized global energy dialogue can reinforce, leading to sustainable future for all".*

*Kandeh K. Yumkella, 2010*

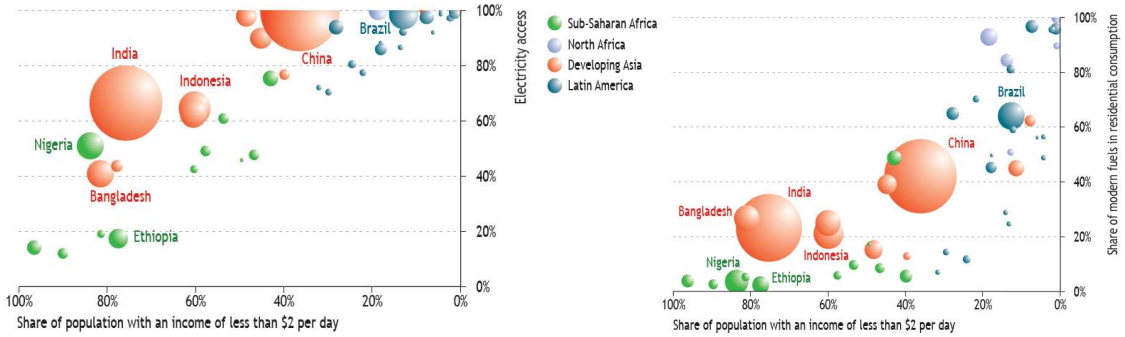
Next year, world leaders will meet in Rio de Janeiro to reaffirm their commitment to sustainable development and to provide a clear vision and way forward for the international community in implementing the sustainable development agenda in an integrated manner. Twenty years after the landmark United Nations Conference on Sustainable Development (UNCSD), which was held in Rio de Janeiro in 1992, the evidence of climate change, resource-intensive growth and persistent poverty in much of the developing word clearly demonstrate that the prevailing development paradigm is no longer sustainable (see e.g. UNEP, 2011; Huberty et al., 2011).

Although widely acknowledged in previous debates on sustainable development, energy is now widely recognized as one of **the most critical enabling conditions** for achieving sustainable development, low carbon growth and the Millennium Development Goals. Energy policies affect all of the pillars of sustainable development, i.e. economic, social and environmental.

Clean, efficient, affordable and reliable energy services are indispensable for global prosperity (AGECC, 2010). Access to reliable and modern energy services is a necessary and crucial precondition for economic development, particularly in developing and emerging economies. It needs to be dramatically expanded, if developing countries are

to reduce poverty and improve the health of their citizens, while at the same time increasing productivity, enhancing competitiveness and promoting economic growth.

*Figure 1: Household income and electricity access (left pane), and access to modern fuels (right pane) in developing countries*




*Source: IEA, UNDP, and UNIDO, 2010*

A well-performing energy system that improves efficient access to modern forms of energy would strengthen the opportunities for the poorest few billion people on the planet to escape the worst impacts of poverty. Such a system is also essential for meeting wider development objectives. Economic growth goes hand in hand with increased access to modern energy services (see Figure 1), especially in low- and middle-income economies and countries with transition economies. Underperforming energy systems adversely affect economic development. A World Bank study (World Bank, 2009) indicates that countries with underperforming energy systems may lose up to 1-2 per cent of growth potential annually as a result of electric power outages, over-investment in backup electricity generators, energy subsidies and losses, and inefficient use of scarce energy resources.

In this context, the Secretary-General of the United Nations, Mr. Ban Ki-moon is vigorously engaged to ensure high-level political support and commitment in the area of climate change and energy. One of the results of this effort was the report that the UN Secretary-General's Advisory Group on Energy and Climate Change (AGECC) published in 2010, which outlines recommendations at the global scale in these areas. This influential report sets out two ambitious, but achievable, global energy goals:

- ***Ensure universal access to modern forms of energy by 2030****:* Provide universal access to clean and affordable energy with low greenhouse gas emissions for cooking, lighting, heating and cooling, and productive uses, through both centralized and decentralized energy technologies and systems. This will help to ensure sustainable livelihoods and be consistent with the need for affordability by the poorest countries and communities.
- ***Reduce global energy intensity by 40 per cent by 2030****:* Establish an internationally coordinated energy efficiency programme. The effort should focus on developing in-country capacity to implement effective policies, markets, business models, investment tools and regulations. This goal should be met by doubling the average rate of global energy intensity improvement to 2.5 per cent per year.

  A transition to renewables-based energy systems is looking increasingly more likely, as their costs decline and markets and policy instruments continue to evolve. Inspired by the recent progress in renewable energy technologies and markets (BNEF, 2011), a third, complementary goal, in line with those set out by AGECC, has been formulated specifically around renewable energy:

- ***Increase the share of renewable energy in the global energy mix to 30 per cent by 2030:*** Renewable energy will have to play a central role in the global transformation towards low-carbon growth and development. While the potential is huge, expanding the share of renewable energy in the global energy mix hinges critically on strategic policy responses, such as integrating and mainstreaming renewable energy into sustainable development strategies for poverty reduction, green growth, education, gender equality and health and providing supportive national frameworks, procurement policies, a level playing field, and access to affordable long-term project finance.

The United Nations Industrial Development Organization (UNIDO) is working with its partners in UN-Energy[1], and International Renewable Energy Agency (IRENA) to build on the analytical foundation for this goal provided by the recent IPCC Special Report on Renewable Energy Sources (Edenhofer, 2011).

[1] UN-Energy is the UN interagency mechanism on energy issues. Its membership consists of 20 UN agencies and programmes, which are active in the energy field. UN-Energy was established to ensure coherence in the UN system's multi-disciplinary response to WSSD and to foster cooperation with non-UN stakeholders.

UNIDO is actively involved in the delivery of technical assistance, capacity building and policy advice in support of access by developing countries to clean and efficient energy and is leading the UN system-wide effort in support of expanding international cooperation in the field of energy for development. The UNIDO Director-General, Mr. Kandeh K. Yumkella, has been championing the cause of sustainable energy for all since the beginning of his mandate, and has chaired UN-Energy for the past four years. Under his leadership, the group has been able to significantly advance the issues of access to modern energy services, energy efficiency and renewable energy.

Sustainable energy is central to a green economy. This policy brief provides the framework for the discussion on energy for sustainable development, roughly one year ahead of the Rio+20 Conference. The outline of this document is as follows: after this introduction, access to modern energy services is described as a pre-requisite for economic and social development; section 3 explains how the reduction of global energy intensity and the expanded use of renewable energy are ways to the meet the growing energy demand, while mitigating carbon emissions and limiting the damage to the environment; and finally, section 4 argues the need for a renewed global effort to make energy a pillar of a Green Economy.

## 2. Access to energy and the energy-poverty nexus

*"The two great challenges facing the world this century are managing climate change and overcoming poverty. If we fail on one, we will fail on the other[2]."*

*Lord Nicholas Stern, March 2011*

Access to modern, sustainable, affordable, and reliable energy services is central to addressing many of today's global development challenges, including poverty, gender inequality, climate change, food security, health and education. Yet nearly one-third of humanity lacks access to modern energy forms and services (IEA, 2009).

The AGECC report made it clear that "current energy systems are inadequate to meet the needs of the world's poor and are jeopardizing the achievement of the Millennium Development Goals (MDGs)". Although energy is not an explicit part of the MDGs, the provision of modern energy services is recognized as a critical foundation for sustainable development (e.g. UN-Energy, 2005; Modi et al., 2005; UNDP, 2005). Typically, the absence of reliable energy services hinders the proper functioning of health clinics, schools, and water and sanitation systems. Food security is also adversely affected, often with a devastating impact on vulnerable populations.

Progress is far behind what is needed. Worldwide, approximately 3 billion people rely on traditional biomass for cooking and heating[3], and about 1.5 billion have no access to electricity. Up to a billion more have access only to unreliable electricity networks. If current trends continue, more people will be without access to modern energy services in 2030 than at present (IEA, 2009), a situation that is clearly unacceptable.

[2] Lord Stern comment on the announcement of the "Green Fund" by the IMF, Nairobi, Kenya, March 2011

[3] UNDP and WHO ( 2009) estimates that over 3 billion people lack access to modern fuels for cooking and heating, while IEA (2009) estimates this number at 2.5 billion.

*Figure 2: Number of people without access to electricity and relying on the traditional use of biomass*

Number of people without access to electricity and relying on the traditional use of biomass, 2009 (million)

| | Number of people lacking access to electricity | Number of people relying on the traditional use of biomass for cooking |
|---|---|---|
| Africa | 585 | 657 |
| *Sub-Sharan Africa* | *585* | *653* |
| Developing Asia | 799 | 1 937 |
| *China* | *8* | *423* |
| *India* | *404* | *855* |
| *Other Asia* | *387* | *659* |
| Latin America | 31 | 85 |
| Developing countries* | 1 438 | 2 679 |
| World** | 1 441 | 2 679 |

*includes Middle East countries. **Includes OECD and transition economies.
Source: IEA databases and analysis.

*Source: IEA, 2010b*

Access to electricity and modern energy services is of key importance in future efforts at poverty reduction and development. While significant differences exist between rural and urban areas, poverty is linked not only to deprivation of income, but also lack of access to resources and assets, social networks, voice, and power. The "energy-poor" suffer the health consequences of inefficient combustion of solid fuels in inadequately ventilated buildings, as well as the economic consequences of insufficient power for productive income-generating activities and for other basic services such as health and education. In particular, women and girls in the developing world are disproportionately affected in this regard. Recent estimates (IEA, UNDP, UNIDO, 2010) indicate that indoor air pollution caused by combustion of fuel wood will be responsible for over 4,000 premature deaths per day in 2030 (more than malaria, tuberculosis or HIV/AIDS).

There tends to be a two-way causal relationship between the lack of access to adequate, affordable, and appropriate energy forms and poverty. Households that lack access to appropriate energy are often trapped in a vortex of deprivation, which is why the terms "energy–poverty nexus" or "vicious cycle of energy poverty" are often used to describe this phenomenon. The lack of energy, in addition to insufficient access to other key services and assets, affects productivity, time budgets, opportunities for income

generation, and more generally, the ability to improve living conditions. The low productivity and livelihood opportunities, in turn, result in modest earnings and no or little surplus cash for these people. This contributes to the poor remaining poor and consequently, also energy poor since they cannot afford to pay for improved energy services (often neither the fuel nor the equipment). Thus the problem of poverty remains closely intertwined with the lack of energy.

Moreover, energy services have a profound effect on productivity, health, education, safe water, and communication services. Therefore, it is no surprise that access to energy has a strong correlation to social and economic development indices (e.g. Human Development Index, life expectancy at birth, infant mortality rate, maternal mortality, and GDP per capita).

## 3. Energy and the environment: the role of energy efficiency and renewables in a green economy

*"Improving energy efficiency is paramount if we are to reduce greenhouse gas emissions. It can also support market competitiveness and green innovation"*

*Ban Ki-moon, April 2010*

Meeting universal access to modern energy services by 2030, as advocated in the AGECC report (AGECC, 2010), would undisputedly contribute to poverty reduction and global economic and social development. Yet, if current patterns of energy production and consumption are followed, the adverse impacts on the environment of the soaring energy demand will increase significantly. The energy system – supply, transformation, delivery and use – represents today approximately 60% of the world's total current greenhouse gas (GHG) emissions. Emissions from the combustion of fossil fuels are major contributors to climate change, and to urban air pollution and acidification of land and water.

Reducing the carbon intensity of energy – that is, the amount of $CO_2$ emitted per unit of energy consumed – is a key objective in reaching long term climate goals. As long as the primary energy mix and the currently available energy technologies are primarily based on fossil fuels, ambitious climate mitigation goals will be difficult to achieve. Given that the world economy is expected to double in size over the next twenty years, the global energy consumption will also increase. A transition towards a green economy will require a shift away from current production and consumption patterns, including stronger incentives to reduce GHG emissions on the supply side and increase end-use efficiency. This is achievable through improved process- and end-use **energy efficiency**, and increased adoption of cleaner **energy** sources.

Since 1990, global energy intensity[4] has decreased at a rate of about 1.3 per cent per year due to both structural effects and physical energy efficiency improvements. Energy efficiency is the key to driving incremental reductions in energy intensity. It is one of the few "no-regret" policies that can offer a solution across challenges as diverse as climate change, energy security, industrial competitiveness, human welfare and economic development. While it offers no net downside to energy-consuming nations, the benefits have proved difficult to capture (AGECC, 2010).

Governments worldwide are designing and implementing policies and regulations to foster the development and use of energy-saving technologies and systems. Firms too are changing approaches to manufacturing, considering new business models, and embracing the benefits of energy efficiency. Utilities are playing a leadership role in creating awareness, developing technologies and systems, and designing incentives to enhance energy efficient behaviors. Improving energy efficiency, particularly in the industrial sector, is one of the most cost-effective measures to help supply-constrained developing and emerging countries meet their increasing energy demand and loosen the link between economic growth and environmental degradation, such as climate change. More specifically, energy efficiency in industry contributes to decoupling economic growth and environmental impact while reducing industrial energy intensity and improving competitiveness (McKane et al., 2007).

[4] Energy intensity is defined as the amount of energy consumed per unit of GDP. It depends on the economic structure of a country (some sectors are more energy-intensive than others) and on the energy efficiency of processes and products.

Manufacturing industry accounts for about one third of total energy use worldwide. Roughly three quarters of industrial energy use is related to the production of energy-intensive commodities such as ferrous and non-ferrous metals, chemicals and petrochemicals, non-metallic mineral materials, and pulp and paper. In these sectors, energy costs constitute a large proportion of total production costs, so managers pay particular attention to driving them down. As a result, the scope to improve energy efficiency tends to be less in these most energy intensive sectors than in those sectors where energy costs form a smaller proportion of total costs, such as the buildings and transportation sectors. This limits the overall potential for carbon dioxide ($CO_2$) reductions through energy efficiency measures in industry to 15% - 30% on average.

Industrial production is projected to increase by a factor of four between now and 2050. Energy efficiency improvements, alongside renewable energy and low-carbon technology development, represent a key climate mitigation strategy in industry.

Both developed and developing countries need to build and strengthen their capacity to implement effective policies, market-based mechanisms, business models, investment tools and regulations with regard to energy use. This will require the international community to harmonize technical standards for key energy-consuming products and equipment, to accelerate the transfer of know-how and good practices, and to catalyze increased private capital flows into investments in energy efficiency. The successful adoption of these measures will be instrumental for reducing global energy intensity by about 2.5 per cent per year, approximately double the historic rate (AGECC, 2010).

Increased international cooperation is key to tapping the huge energy efficiency potential worldwide. It would be important to broaden the discussion from direct technical energy efficiency improvements to all the indirect and policy options that can help to reduce energy intensity[5]. Reduction of energy subsidies, prices that include

[5] To enhance energy efficiency measures several policy options are available. They encompass energy or carbon taxation; subsidies to encourage investment in energy efficiency measures; emission trading; energy efficiency standards that prescribe minimum technical requirements for energy conversion systems and energy end-use systems; voluntary agreements (VAs), energy efficiency labeling informing buyers or users of the equipment about the energy performance; governments-fostered R&D on energy efficiency. Furthermore, the identified barriers can be overcome through information and awareness raising, training programmes, innovative financing mechanisms and technology research and demonstration.

externalities, more efficient use of water, and materials are examples of such new approaches. New business models must be developed to deploy efficiency through the commercial market. The urgency of the climate crisis and the need for substantially accelerated intensity improvements that are needed to meeting the 2030 goal necessitate close consideration of all available options. South-South cooperation deserves special attention.

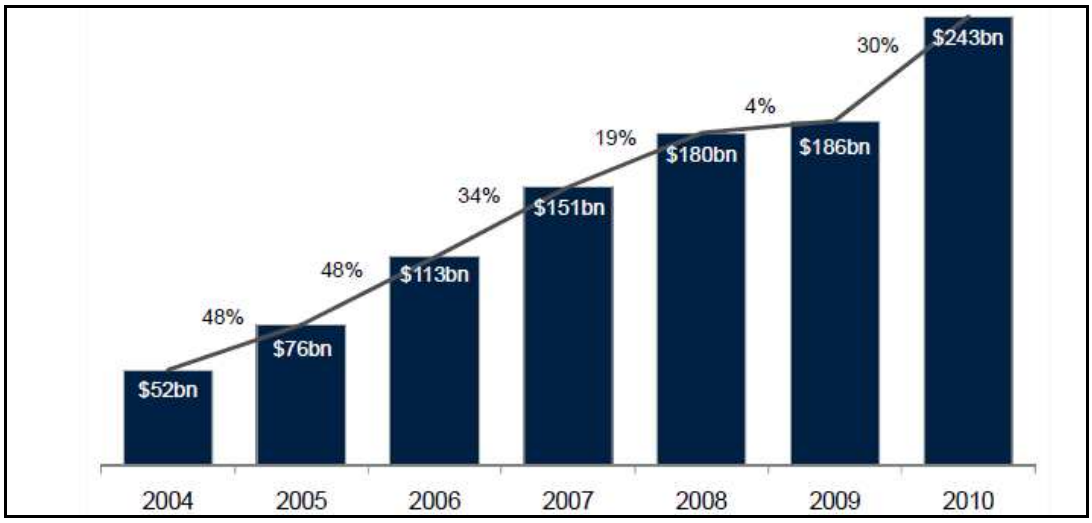
The United Nations, acting through its programmes, funds, specialized agencies and system-wide coordination mechanisms, such as UN-Energy, is well placed to support developing countries to assess and prioritize their efficiency actions, help strengthen institutional and policy frameworks and provide targeted support for the development of bankable energy efficiency projects and investments. These could focus on the deployment of successful policies and strategies, as well as legislation and programmes to address the barriers to energy efficiency market transformation, in particular the informational, institutional, policy, regulatory and market-based barriers[6]. Such actions are likely to create enabling environments for the implementation of energy efficiency technologies, practices and measures by all stakeholders, including the private sector.

Meeting the goal of reducing energy intensity by 40% by 2030 will contribute in a decisive manner to the long term reduction of GHG emissions. Complementarily, a reduction in the carbon intensity of energy can also be achieved by increasing the share of renewable energy (RE) in the energy mix. Despite the evident environmental benefits that an increased use of renewable energy brings, only a small fraction of the technically available potential from renewable energy sources has been tapped so far (REN 21, 2010; Edenhofer et al., 2011). However, in the past few years, notwithstanding a

[6] To save large quantities of energy at low cost by greater deployment of energy efficiency, a range of associated barriers and market imperfections and significant gaps in existing policies need to be addressed such as: Higher initial capital costs and customer discount rates; Lack of awareness, capacity and skills to assess the benefits of energy efficiency policies and programmes; Non-economic pricing of energy, and resulting inappropriate tariff structures, and difficulty of quantifying external benefits; Inadequate regulatory or legal frameworks to support market-based energy savings approaches and private sector participation, such as through energy service companies; The lack of supportive enabling environments for technology transfer; Smaller sized and dispersed projects and therefore high transaction costs; Uninformed investors with little familiarity and experience of, and high risk perception with, savings-based financing (compared to traditional, asset-based financing); Limited access to systems and skills for MRV; and Principal agent problems, that is, split incentives for investments and savings.

persisting global economic crisis, almost all renewable energy industries have grown significantly (see Figure 3).

*Figure 3: Global Total New Investment in Clean Energy, $ billions*




*Source: BNEF (2011)*

Volatile fossil fuel prices, at historic high rates, combined with declining costs of RE power generation, and the impact of "green" stimulus packages on clean energy production provide economic explanation to the sharp increase in renewable energy deployment. With a global RE power capacity of 1,230 gigawatts in 2009, renewable energy supplies about a fifth of global final energy consumption. World RE capacity grew at rates of 10–60% annually for many technologies from 2004 to 2009 (REN 21, 2010).

Nevertheless, there are several barriers that still hinder renewable energy technologies from scaling up. The intermittent nature of solar electricity generation, the landscape damage of inland windmills, the "food vs. fuel" debate in biofuels production, the environmental and social impact of large hydropower projects represent a few illustrative issues. Yet the most relevant disincentive to investment in renewable energy is certainly the cost. Under the current circumstances and despite a significant decline over the last decades, the costs associated with most RE technologies are in most cases still considerably higher than conventional energy sources. For this reason, the

deployment of renewable energy technologies on a larger scale critically depends on government incentives.

Fossil fuels subsidies often[7] worsen the economic case for renewables (BNEF, 2011; IEA, 2010). Renewable energy is, however, already cost competitive in many cases, and especially if a price for $CO_2$ emissions is taken into account as a means to reflect their long-term economic and environmental impact. IEA (2010) notes that "the investors' choice of a specific portfolio of power generation technologies will most likely depend on financing costs, fuel and carbon prices, as well as the specific energy policy context (security of supply, $CO_2$ emissions reductions, market framework)." Current best practice shows the conditions under which the successful deployment of renewables can take place; those insights can serve to guide future policy making.

Research, development and deployment (RD&D) and cost reductions through economies of scale represent crucial elements of a transition towards cleaner energy systems. RD&D spending on clean energy technologies grew by 24% to $ 35.5 billion in 2010 (BNEF, 2011). The cost of financing is another key driver RE cost. "Clean energy projects are particularly sensitive to interest rates as they have large upfront and minimal marginal costs" (BNEF, 2011). As the world economy recovers from the recent slowdown, it is likely to expect that a decrease in interest rates will trigger a sharp increase in RE investment.

In this context, policy measures will still be necessary in the coming decades to promote the use of renewable energy sources, to structure the energy pricing in a way that includes the health- and environmental costs (such GHG emissions and other pollutants) of energy use, which would certainly make RE prices more competitive. The increased use of renewable energy sources is a fundamental building block of any low carbon economic model. The IEA estimates that the total government support for renewable energy was $205 billion, averaging 0.08% of global GDP in the 2007-2009 period. This share is projected to grow to 0.17% of world GDP in 2035.

Although renewable energy has received a good deal of attention for power generation and for residential applications, its use in industry has attracted much less attention. Renewable energy plays only a relatively small role in industry today. Biomass

[7] IEA (2010) suggests that "no single electricity generating technology can be expected to be the cheapest in all situations."

currently makes by far the most significant renewable energy contribution to industry, providing around 8% of its final energy use in 2007.

UNIDO (2010) analyzes the long-term potential for renewable energy in industrial applications. The study suggests that up to 21% of all final energy use and feedstock in manufacturing industry in 2050 can be of renewable origin. This would constitute almost 50 exajoules a year (EJ/yr), out of a total industry sector final energy use of around 230 EJ/yr in the baseline projection used for this particular study. It includes 37 EJ/yr from biomass feedstock and process energy and over 10 EJ/yr of process heat from solar thermal installations and heat pumps.

Overall, an increase in renewable energy in industry has the potential to contribute about 10% of all expected GHG emissions reductions in 2050. At nearly 2 gigatonnes (Gt) of $CO_2$, this represents 25% of the total expected emission reductions of the industry sector. This is equivalent to the total current $CO_2$ emissions of France, Germany, Italy and Spain, or around one third of current emissions in the United States.

## 4. The need for a global effort

*"Addressing these challenges is beyond the reach of governments alone. It will take the active engagement of all sectors of society: the private sector; local communities and civil society; international organizations and the world of academia and research."*

*Ban Ki-moon, April 2010*

The world still faces the task of providing energy services to the poor for basic needs for lighting, cooking, and heating, and for use in activities that can generate income. Recognizing the centrality of improving energy access for the poor, several governments and regional bodies have already set national targets to improve access.

The goal of achieving universal energy access by 2030 has been put forward. To some, this may appear unattainable, but the technologies and examples of successful policies to achieve this already exist. The challenge to meet such an access target is greater but can have even more significance for the rural populations of the world (AGECC 2010). Changing this trend requires **international political commitment** that goes beyond abstraction and sets out challenging, but achievable targets, actions and associated benchmarks.

Energy plays a critical role in the global response to Climate Change, and in achieving progress in environmental and Development agenda. The international debate on sustainable development reflects its importance. In December 2010, the UN General Assembly approved the Resolution A/Res/65/151, which designates **2012** as the **International Year of Sustainable Energy for All**. In this resolution, the United Nations:

*"Encourages all Member States, the United Nations system and all other actors to take advantage of the Year to increase awareness of the importance of addressing energy issues, including modern energy services for all, access to affordable energy, energy efficiency and the sustainability of energy sources and use, for the achievement of the internationally agreed development goals, including the Millennium Development Goals, sustainable development and the protection of the global climate, and to promote action at the local, national, regional and international levels."*

UNIDO and UN-Energy are fully engaged in bringing the priorities of the global energy agenda into the Rio+20 debate and making sure that the outcome of the Rio+20 Conference will provide a framework for implementation of concrete actions on the ground. The time is right and the circumstances conducive for a higher level of ambition for sustainable energy for all.

In view of the above, UNIDO is pleased to host this Ministerial Meeting and to advance the discussion on energy and green industry, and for ensuring the adequate reflection of those issues in the preparatory process and the outcome of the Rio+20 Conference. What is now required is a sustained political focus. The topic of sustainable energy in a green economy must move up the political and development agendas to become a central priority.

# 5. Conclusions

The world in 2030 - some twenty years down the road from the upcoming Rio+20 Conference - will look very different. Nowhere will this be more obvious than in the way we cater for our energy needs.

There is clear recognition that current energy systems are unfit to deal with contemporary challenges such as poverty alleviation and climate change. There are no insurmountable obstacles to achieving a vision of sustainable energy for al. There is a general recognition that renewable energy is no longer a fringe technology, but a reality that becomes more and more affordable and available to people in developing countries. It brings a promise of access to sustainable energy for all, which mean that developing countries can continue on the path of growth and industrialization and much needed job-creation in higher value-added sectors, while at the same time drastically reducing the environmental impact of industrialization. Fuelled by clean, sustainable energy, a transition towards Green Industry will bring about new opportunities, new technologies and new business openings for manufacturers and suppliers.

What is needed is a political commitment at the highest level to make this vision a reality. UNIDO in partnership with UN-Energy and other stakeholders is pleased to offer for your consideration a set of challenging, yet achievable, time-bound goals to be adopted as an internationally-shared framework for global, regional and country-level action in support of sustainable energy for all by 2030. Furthermore, the United Nations General Assembly has declared 2012 as the International Year of Sustainable Energy for All (GA Res. 65/151). The Year will mark the launch of a global Sustainable Energy for All campaign to end energy poverty and combat global warming, with these high-level 2030 goals[8]:

- To achieve universal access to modern energy services;
- To improve global energy intensity by 40 per cent;
- To produce 30 per cent of global energy supplies from renewable sources.

Support the 30/30/30 Agenda!

[8] Also referred to as the 30/30/30 Agenda

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