

PRESS RELEASE

**Potential of Renewable Energy Outlined in Report by the
Intergovernmental Panel on Climate Change**

**Experts Underline Significant Future Role in Cutting Greenhouse Gas Emissions and
Powering Sustainable Development**

**Over 160 Scenarios on the Potential of six Renewable Energy Technologies Reviewed by
Global Team of Technological Experts and Scientists**

11th Session of Working Group III

Abu Dhabi, 9 May 2011 – Close to 80 percent of the world’s energy supply could be met by renewables by mid-century if backed by the right enabling public policies a new report shows.

The findings, from over 120 researchers working with the Intergovernmental Panel on Climate Change (IPCC), also indicate that the rising penetration of renewable energies could lead to cumulative greenhouse gas savings equivalent to 220 to 560 Gigatonnes of carbon dioxide (GtCO_{2eq}) between 2010 and 2050.

The upper end of the scenarios assessed, representing a cut of around a third in greenhouse gas emissions from business-as-usual projections, could assist in keeping concentrations of greenhouse gases at 450 parts per million.

This could contribute towards a goal of holding the increase in global temperature below 2 degrees Celsius – an aim recognized in the United Nations Climate Convention's Cancun Agreements.

The findings, launched today after being approved by member countries of the IPCC in Abu Dhabi, United Arab Emirates, are contained in a summary for policymakers of the *Special Report on Renewable Energy Sources and Climate Change Mitigation* (SRREN).

The summary is a short version of a roughly a thousand page comprehensive assessment compiled by over 120 leading experts from all over the world for IPCC’s Working Group III.

“With consistent climate and energy policy support, renewable energy sources can contribute substantially to human well-being by sustainably supplying energy and stabilizing the climate,” said Professor Ottmar Edenhofer, Co-Chair of Working Group III at the report launch. “However, the substantial increase of renewables is technically and politically very challenging” he added.

Youba Sokona, Co-Chair of the Working Group III, said: “The potential role of renewable energy technologies in meeting the needs of the poor and in powering the sustainable growth of developing and developed economies can trigger sharply polarized views. This IPCC report has brought some much needed clarity to this debate in order to inform governments on the options and decisions that

will needed if the world is to collectively realize a low carbon, far more resource efficient and equitable development path”.

Ramon Pichs, Co-Chair of the Working Group III, added: “The report shows that it is not the availability of the resource, but the public policies that will either expand or constrain renewable energy development over the coming decades. Developing countries have an important stake in this future—this is where most of the 1.4 billion people without access to electricity live yet also where some of the best conditions exist for renewable energy deployment”.

Also speaking at the launch, Rajendra Pachauri, Chairman of the IPCC, said: “The IPCC brought together the most relevant and best available information to provide the world with this scientific assessment of the potential of renewable energy sources to mitigate climate change. The Special Report can serve as a sound knowledge basis for policymakers to take on this major challenge of the 21st century.”

The report will feed into the broader work of the IPCC as it prepares its Fifth Assessment Report (AR5). The AR5 Synthesis Report is scheduled for finalization in September 2014.

The SRREN, approved by government representatives from 194 nations, has reviewed the current penetration of six renewable energy technologies and their potential deployment over the coming decades.

The six renewable energy technologies reviewed are:

- **Bioenergy**, including energy crops; forest, agricultural and livestock residues and so called second generation biofuels
- **Direct solar energy** including photovoltaics and concentrating solar power
- **Geothermal energy**, based on heat extraction from the Earth’s interior
- **Hydropower**, including run-of-river, in-stream or dam projects with reservoirs
- **Ocean energy**, ranging from barrages to ocean currents and ones which harness temperature differences in the marine realm
- **Wind energy**, including on- and offshore systems

Over 160 existing scientific scenarios on the possible penetration of renewables by 2050, alongside environmental and social implications, have been reviewed with four analyzed in-depth. These four were chosen in order to represent the full range. Scenarios are used to explore possible future worlds, analyzing alternative pathways of socio-economic development and technological change.

The researchers have also studied the challenges linked to how renewable energy can be integrated into existing and future energy systems including electricity grids and likely cost benefits from these developments.

While the scenarios arrive at a range of estimates, the overall conclusions are that renewables will take an increasing slice of the energy market.

The most optimistic of the four, in-depth scenarios projects renewable energy accounting for as much as 77 percent of the world’s energy demand by 2050, amounting to about 314 of 407 Exajoules per year. As a comparison, 314 Exajoules is over three times the annual energy supply in the United States in 2005 which is also a similar level of supply on the Continent of Europe according to various government and independent sources.

77 percent is up from just under 13 percent of the total primary energy supply of around 490 Exajoules in 2008. Each of the scenarios is underpinned by a range of variables such as changes in energy efficiency, population growth and per capita consumption. These lead to varying levels of total primary energy supply in 2050, with the lowest of the four scenarios seeing renewable energy accounting for a share of 15 percent in 2050, based on a total primary energy supply of 749 Exajoules.

While the report concludes that the proportion of renewable energy will likely increase even without enabling policies, past experience has shown that the largest increases come with concerted policy efforts.

Though in some cases renewable energy technologies are already economically competitive, the production costs are currently often higher than market energy prices. However, if environmental impacts such as emissions of pollutants and greenhouse gases were monetized and included in energy prices, more renewable energy technologies may become economically attractive.

For most of them, costs have declined over the last decades and the authors expect significant technical advancements and further cost reductions in the future, resulting in a greater potential for climate change mitigation.

Public policies that recognize and reflect the wider economic, social and environmental benefits of renewable energies, including their potential to cut air pollution and improve public health, will be key for meeting the highest renewables deployment scenarios.

Increasing the share of renewables requires additional short-term and long-term integration efforts. Studies clearly show that combining different variable renewable sources, and resources from larger geographical areas, will be beneficial in smoothing the variability and decreasing overall uncertainty for the power system.

There is a need for advanced technologies to optimize the infrastructure capacity for renewables. Additionally, there is a need for balancing supply and demand, like advanced demand and supply forecasting and plant scheduling.

“What is unique about this assessment is that the IPCC allows us to draw on and bring together a broad spectrum of experts on each of the technologies reviewed in collaboration with scientists studying energy systems as a whole. It represents a systemic, broad, impartial and state of knowledge report on the present and future potential of a low carbon, more resource efficient energy path,” says Professor Edenhofer.

Key Findings from the Summary for Policymakers

- Of the around 300 Gigawatts (GW) of new electricity generating capacity added globally between 2008 and 2009, 140 GW came from renewable energy.
- Despite global financial challenges, renewable energy capacity grew in 2009—wind by over 30 percent; hydropower by three percent; grid-connected photovoltaics by over 50 percent; geothermal by 4 percent and solar water/heating by over 20 percent. The annual production of ethanol increased to 1.6 Exajoules (76 billion litres) and biodiesel by 0.6 Exajoules (17 billion litres) by the end of 2009.

Meanwhile developing countries host more than 50 percent of current global renewable energy capacity.

- Most of the reviewed scenarios estimate that renewables will contribute more to a low carbon energy supply by 2050 than nuclear power or fossil fuels using carbon capture and storage (CCS).
- The technical potential of renewable energy technologies exceeds the current global energy demand by a considerable amount—globally and in respect of most regions of the world.
- Under the scenarios analyzed in-depth, less than 2.5 percent of the globally available technical potential for renewables is used—in other words over 97 percent is untapped underlining that availability of renewable source will not be a limiting factor.
- Accelerating the deployment of renewable energies will present new technological and institutional challenges, in particular integrating them into existing energy supply systems and end use sectors.
- According to the four scenarios analyzed in detail, the decadal global investments in the renewable power sector range from 1,360 to 5,100 billion US dollars to 2020 and 1,490 to 7,180 billion US dollars for the decade 2021 to 2030. For the lower values, the average yearly investments are smaller than the renewable power sector investments reported for 2009.
- A combination of targeted public policies allied to research and development investments could reduce fuel and financing costs leading to lower additional costs for renewable energy technologies.
- Public policymakers could draw on a range of existing experience in order to design and implement the most effective enabling policies--there is no one-size-fits-all policy for encouraging renewables.

Key Renewable Energy Technologies and Their Potential

Bioenergy technologies can generate electricity, heat and fuels from a range of ‘feedstocks’.

Most current bioenergy systems, including liquid biofuels, result in greenhouse gas emissions reductions, concludes the summary for policymakers.

Others, such as advanced conversion systems, which for example convert woody wastes into liquid fuels, can deliver 80 percent to 90 percent emission reductions compared to fossil fuels.

Bioenergy, mainly for traditional cooking and heating in developing countries, currently represents over 10 percent of global energy supply or ca. 50 Exajoules per year.

While the share of bioenergy in the overall renewables mix is likely to decline over the coming decades, it could supply 100 to 300 Exajoules of energy by 2050, the expert review concludes.

Direct Solar Energy technologies include photovoltaics and concentrating solar power (CSP). They can produce electricity, heat and light.

Currently, direct solar contributes only a fraction of one percent to total global energy supply.

Potential deployment scenarios range from a marginal role of direct solar energy in 2050 to one of the major sources of energy supply. The actual deployment will depend on continued innovation, cost reductions and supportive public policies.

In the most ambitious climate stabilization scenarios solar primary energy supply by 2050 reaches up to 130 Exajoules per year, which can be attributed to a large extent to photovoltaic electricity generation. In some scenarios, its share in global electricity generation reaches up to a third by 2050, but in the majority of scenarios remains below one tenth.

Geothermal Energy utilizes heat stored in the Earth's interior directly or to generate electricity, with currently about 0.7 Exajoule per year.

By 2050, geothermal deployment could meet more than 3 percent of global electricity demand and about 5 percent of the global heat demand.

Global geothermal technical potential is comparable to the global primary energy supply in 2008. However, Geothermal Energy does not reach the technical potential limit in any of the scenarios analyzed, with the deployment rate remaining below 5 percent for both the regional and global level.

Hydropower projects encompass dam projects with reservoirs, run-of-river and in-stream projects and range from small to large scale.

The installed capacity by the end of 2008 contributed 16 percent of worldwide electricity supply, making hydropower the largest renewable energy source in the electricity sector.

According to long term scenarios, hydropower's share in global electricity supply may decrease to 10 to 14 percent. Despite absolute growth in hydropower supply, the expected energy demand growth and continuing electrification could result in a decreasing share.

Ocean Energy technologies are diverse and use the kinetic, thermal, and chemical energy of seawater. Most are at the demonstration and pilot project phases.

Due to its nascent stage of development, they are unlikely to significantly contribute to global energy supply before 2020.

Ocean energy is currently only represented in very few scenarios. As shown by the review, projected deployments could result in energy delivery of up to 7 Exajoules per year by 2050.

Wind Energy's primary application of relevance to climate change mitigation is to produce electricity from large wind turbines located on land or offshore.

The wind power capacity installed by the end of 2009 met close to two percent of worldwide electricity demand.

The review shows a high expansion rate in Europe, North America and, more recently, in China and India. A greater geographical distribution of deployment is likely to be needed to achieve the higher deployments indicated by the scenario literature.

Under the demand projection of some scenarios global wind power share grows to more than 20 percent by 2050.

Notes to Editors

1. The Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) assesses the potential contribution of renewable energy sources to climate change mitigation.

Following the AR4, many governments as well as important actors in civil society and the private sector asked for more substantial information and broader coverage of all questions pertaining to the use of renewable energy. The 25th Plenary Session of the IPCC at Mauritius decided to hold a scoping meeting for a possible Special Report. Following the scoping meeting in Lübeck, Germany in January, 2008, IPCC Plenary in Budapest in April, 2008 decided to prepare an IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) and agreed on its outline. The Summary for Policymakers of the SRREN was approved by the Eleventh Plenary Session of IPCC Working Group III in Abu Dhabi, United Arab Emirates, 5 - 8 May 2011 and was launched on 9 May.

2. The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to review and assess the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data. The UN General Assembly endorsed the action by WMO and UNEP in jointly establishing the IPCC.
3. The IPCC Plenary is open to all member countries of the United Nations and WMO. Currently 194 countries are members of the IPCC. Governments participate in the review process and the Plenary Sessions, where main decisions about the IPCC work programme are taken and reports are accepted, adopted and approved. The IPCC Bureau Members, including the Chair, are elected during the Plenary Sessions.
4. The Working Group III (WGIII) 'Mitigation of Climate Change' of the IPCC assesses all relevant options for mitigating climate change through limiting or preventing greenhouse gas emissions and enhancing activities that remove them from the atmosphere. WGIII analyses the costs, benefits and risks of the different approaches to mitigation, considering also the available domestic instruments and policy measures as well as international arrangements. The WGIII is co-chaired by Ottmar Edenhofer of the *Potsdam Institute for Climate Impact Research*, Germany, Ramon Pichs of the *Centro de Investigaciones de la Economía Mundial*, Cuba, and Youba Sokona (Mali) of the *Africa Climate Policy Center* in Ethiopia.

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Useful links:

SRREN Website

www.srren.org

Intergovernmental Panel on Climate Change

www.ipcc.ch

Working Group III Mitigation of Climate Change

www.ipcc-wg3.de