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World Future Energy Summit Bulletin

A Daily Report of the World Future Energy Summit (WFES) 2011

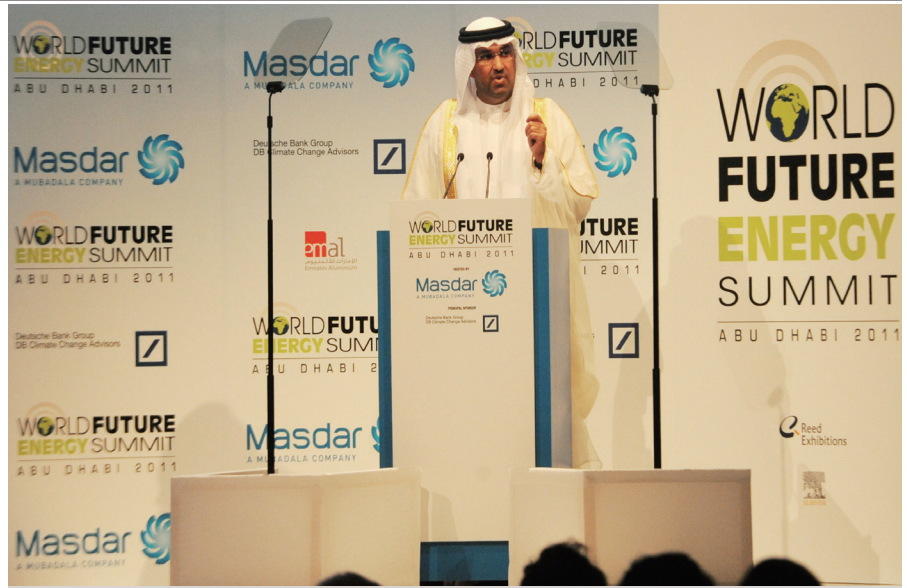
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WORLD FUTURE ENERGY SUMMIT 2011 HIGHLIGHTS:

The fourth World Future Energy Summit (WFES) 2011 opened in Abu Dhabi, United Arab Emirates (UAE), on 17 January 2011. The first day of this four-day event was organized around the theme “Policy and Strategy Forum,” and comprised opening statements from HE Sultan Ahmed Al Jaber, CEO Masdar, UN Secretary-General Ban Ki-moon, Heads of State and other dignitaries, followed by special addresses and ministerial panels. The WFES programme also includes roundtable discussions, an exhibition hall and numerous other side events and activities.



Sultan Ahmed Al Jaber, CEO, Masdar, United Arab Emirates

A BRIEF HISTORY OF MULTILATERAL PROCESSES ON RENEWABLE ENERGY

Renewable energy is emerging as a keystone for addressing climate change, energy security, green growth and poverty reduction. Therefore, there has been an emerging focus in the international dialogue regarding renewables on the need to scale-up sustainable and renewable energy, both regionally and globally. Since the UN Conference on Environment and Development (UNCED) in 1992, in Rio de Janeiro, Brazil, various UN organizations and agencies have been active on this issue, and numerous related international conferences and fora have convened, as summarized below.

WFES

Since its inception in 2008, WFES has evolved as the world’s foremost annual meeting for the renewable energy and environment industry. Abu Dhabi, UAE, has hosted WFES annually to promote innovation and investment opportunities surrounding renewable energy and environment. WFES represents a business platform bringing together project owners and solution providers with investors and buyers from both the public and private sectors. Held in Abu Dhabi, UAE, from 18-21 January 2010, the third WFES (WFES 3) brought together approximately 25,000 attendees from 148 countries.



Ban Ki-moon, UN Secretary-General, addressed WFES 2011

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UN CONFERENCES AND SUMMITS

The international community's first major attempt to develop a strategy for the use of alternative fuels was the 1981 Resolution by the 36th UN General Assembly (UNGA 36) (A/RES/36/193) on the outcomes of the UN Conference on New and Renewable Sources of Energy. UNCED, which met in 1992 in Rio de Janeiro, Brazil, adopted Agenda 21, an action plan for implementing sustainable development. Agenda 21 addresses sustainable energy in Chapter 9, which notes the increasing need to rely on environmentally sound energy systems, particularly new and renewable sources of energy.

In April 2001, in New York, US, the ninth session of the UN Commission on Sustainable Development (CSD 9) adopted Decision (E/CN.17/2001/19) on "Energy for sustainable development," addressing issues such as the role of the private sector, research and development, institutional capacities, financial support, energy accessibility and rural energy. IISD RS coverage of CSD 9 can be found at: <http://www.iisd.ca/csd/csd9/index.html>. The World Summit on Sustainable Development (WSSD), held in August-September 2002 in Johannesburg, South Africa, adopted the Johannesburg Plan of Implementation (JPOI), which addresses renewable energy in several of its chapters, including on poverty eradication (Chapter II), sustainable consumption and production patterns (Chapter III), small island developing States (Chapter VII), and Africa (Chapter VIII). IISD RS coverage of WSSD can be found at: <http://www.iisd.ca/2002/wssd>. Held in New York, US, in May 2007, CSD 15 addressed energy issues, although delegates did not reach consensus on any decisions. IISD RS coverage of CSD 15 can be found at: <http://www.iisd.ca/csd/csd15>. In December 2010, UNGA 65 adopted Resolution 65/151 proclaiming 2012 as the *International Year for Sustainable Energy for All*.

IREC PROCESS

At the WSSD, German Chancellor Gerhard Schröder invited the international community to a Conference on Renewable Energy. The International Renewable Energy Conference (IREC), "Renewables 2004," took place from 1-4 June 2004, in Bonn, Germany, and launched the series of IREC meetings. The outcomes of the conference led to the creation of the Renewable Energy Network for the 21st Century (REN21). IISD RS coverage of Renewables2004 can be found at: <http://www.iisd.ca/sd/ren2004>. The Beijing International Renewable Energy Conference (BIREC), hosted by China in November 2005, adopted the Beijing Declaration. The Washington International Renewable Energy Conference (WIREC) convened from 4-6 March 2008, in Washington DC, US, and resulted in the Washington International Action Programme, comprising over 100 pledges by countries and organizations. IISD RS coverage of WIREC 2008 can be found at <http://www.iisd.ca/ymb/wirec2008/>. The Delhi International Renewable Energy Conference (DIREC 2010) took place from 27-29 October 2010, in New Delhi, India, and concluded with the DIREC Declaration and 30 new pledges by governments and civil society under the Delhi International Action Programme. IISD RS coverage of DIREC 2010 can be found at <http://www.iisd.ca/ymb/energy/direc2010/>.

IRENA

The International Renewable Energy Agency (IRENA) was established on 26 January 2009. IRENA's statute entered into force on 8 July 2010. As of January 2011, IRENA has 149 signatories and has been ratified by 51 States. The fourth

Preparatory Commission of IRENA met in Abu Dhabi, on 24-25 October, 2010. The first session of the Assembly of IRENA will take place on 4-5 April, 2011, in Abu Dhabi, UAE.

IPCC SRREN

At its 25th session in Port Louis, Mauritius, the Intergovernmental Panel on Climate Change (IPCC) agreed to hold a scoping meeting for a special report on renewable energy sources. IISD RS coverage of IPCC 25 can be found at: <http://www.iisd.ca/climate/ipcc25/>. This scoping meeting took place in Luebeck, Germany in January 2008, and produced, among other outcomes, an outline for a special report. At IPCC 28, which convened in Budapest in April 2008, delegates agreed to the preparation of a Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN), to be completed by 2010. The approval of SRREN is scheduled for 5-8 May, 2011, in Abu Dhabi, UAE. IISD RS coverage of IPCC 28 can be found at: <http://www.iisd.ca/climate/ipcc28/>.

CLEAN ENERGY MINISTERIAL

The Clean Energy Ministerial is a US-convened, high-level global forum to promote policies and programmes that advance clean energy technology. It includes Australia, Brazil, Canada, China, Denmark, the European Commission, Finland, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea, Mexico, Norway, the Russian Federation, South Africa, Spain, Sweden, the UAE, the UK and the US. The first Clean Energy Ministerial met in Washington DC, US, from 19-20 July 2010. The second Clean Energy Ministerial will convene in Abu Dhabi from 6-7 April 2011.

REPORT OF WFES DAY 1

OPENING CEREMONY

Describing the WFES as an open global platform, HE Sultan Ahmed Al Jaber, CEO Masdar, underlined that energy solutions cannot be driven by individual countries and must rely on collaboration. On climate policy, he said the most important change in 2010 was the shift to a bottom-up approach to establishing a balanced package of decisions. He encouraged energy efficiency and conservation and fostering competition between different energy industries.

Noting that global energy needs are growing rapidly and more than three billion people rely on traditional biofuels, Ban Ki-moon, UN Secretary-General, called for a clean energy revolution that contributes to reducing poverty, mitigating climate change, empowering women, strengthening economic growth and achieving the Millennium Development Goals



Ólafur Ragnar Grímsson, President of Iceland



HRH Crown Princess Victoria, Princess of Sweden

(MDGs) and global security. He encouraged public and private spending for intellectual capital, suggesting that investment in green economies can provide an opportunity for growth and prosperity in developed and developing countries.

Ólafur Ragnar Grímsson, President of Iceland, said Abu Dhabi is among the global locations chosen to “illustrate our aspirations,” as a venue for promoting a clean energy future. He called for global cooperation on sustainable energy, and stressed that the South has the potential to become the “global leader in this necessary transformation.” Lauding the WFES, he said the Zayed Future Energy Prize has the potential to do for clean energy what “Alfred Nobel did for science and peace.”

Describing the UAE as a model for the future and Masdar its “crowning jewel,” Asif Ali Zardari, President of Pakistan, expressed his confidence that the global community has the courage, dedication and commitment to “modify our environmental indifference.” He said innovation and conservation will “reshape the energy map,” highlighting the role of solar, wind and water. He stressed that failures in energy initiatives, such as ethanol from corn, should not discourage continued innovation and experimentation.

José Sócrates Carvalho Pinto de Sousa, Prime Minister, Portugal, called the Summit “one of the most relevant forums” in the world, adding that energy policies are key to addressing climate change and ensuring economic growth. He said Portugal has achieved success through industry reforms in renewable energy, electric mobility, and through energy

efficiency and smart grid technologies. He emphasized that it is possible to make reforms and achieve results in a very short time.

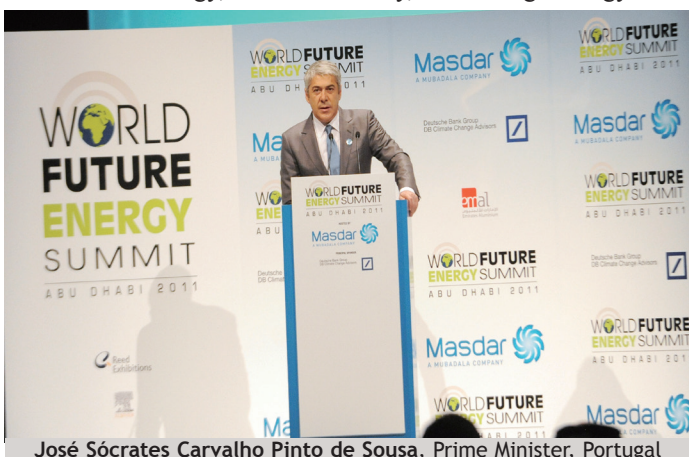
Highlighting threats to biodiversity and development from climate change, Sheikh Hasina, Prime Minister, Bangladesh, said short-term interests should be overcome. She welcomed the opportunity to renew, at the WFES, the commitment to a green future. Hasina said that, despite its negligible contribution to greenhouse gas (GHG) emissions, Bangladesh is striving for a mixed balance of all energy sources and to be ultimately GHG-free.

Noting that energy challenges are too overwhelming to be addressed by countries individually, Nikoloz Gilauri, Prime Minister, Georgia, welcomed growing global consensus that energy security is deeply linked to diversifying energy sources. He observed that his country is gaining importance on the global energy map through increasing energy exports and transit capacity.

Noting that natural resources are not inexhaustible, Crown Princess Victoria, Sweden, underlined the importance of political will in addressing climate change and other environmental issues. She commended Masdar City as an example of global renewable energy solutions and mentioned that Sweden has the highest share of renewable energy in the EU. She said innovation in products, services and human capital will be necessary to meet long-term challenges but added that adopting appropriate lifestyles is also an important way to “cope” with finite resources.

Supporting the sustainable approach to the management of global resources, Prince Guillaume, Luxembourg, highlighted the right to energy access and the role energy policy can play in lifting people out of poverty. He said it was essential that developed countries honor their commitments to development aid and make progress towards achieving the MDGs.

SPECIAL ADDRESSES: During an afternoon plenary session, participants heard a number of special addresses. Caio Koch-Weser, Vice Chair, Deutsche Bank Group, UK, welcomed renewed momentum to address climate change through developments in and around the UN Framework Convention on Climate Change (UNFCCC) 16th Conference of the Parties, highlighting: increased clarity on how to achieve US\$100 billion climate financing by 2020; developing



José Sócrates Carvalho Pinto de Sousa, Prime Minister, Portugal



L-R: UN Secretary-General Ban Ki-moon and Adnan Amin, Interim Director General, IRENA

countries taking the lead by providing bi-annual GHG inventories and creating domestic carbon markets, including in China and Brazil; and proposals for cooperation between the public and private sectors, in particular public-private climate funds.

Emphasizing that the root causes of climate change and energy insecurity must be addressed now and that there is no time to wait for top-down political processes, Adnan Amin, Interim Director General, IRENA, suggested that energy supply would no longer be a zero-sum game if the existing potential for renewable energy was harnessed. He called on governments to: create enabling conditions for renewable energy investment; stop subsidizing fossil fuels; and ensure that markets fully reflect environmental costs of different energy sources. He underscored IRENA's goal to assist developing countries.

UNFCCC Executive Secretary Christiana Figueres said Cancún opened the door to the era of low-carbon growth, but its goals can only be achieved through rapid scaling-up of renewable energy and energy efficiency technologies. She stressed that appropriate national policies must be created to operate in tandem with the international agreement.

Susan Hockfield, President, Massachusetts Institute of Technology, US, lamented that investments in climate protection have been sidelined in many countries due to anxiety about economic growth, and welcomed those countries that have stepped up efforts for clean technology research. She called for: massive increases in investment for renewable energy research, development and deployment; joint university-industry and government-industry partnerships; and cooperation between established energy companies and technology entrepreneurs.

Richard Newell, US Energy Information Administration, said fossil fuels will remain dominant in global energy use under expected market and policy trends. To reverse this trend, he emphasized efforts to spur innovation, including



Susan Hockfield, President, Massachusetts Institute of Technology, US

through: substantial and sustained support for research and development; policy signals to create rapidly growing demand for new technologies; and regulation for vibrant and competitive private sectors.

MINISTERIAL PANELS: Robin Niblett, Director, Chatham House, chaired three ministerial panels on policy challenges.

What Are the Principal Energy Challenges Facing National Governments?: In this panel, Wu Yin, Deputy Minister for Energy, China, said the main challenges for his country are: the large volume of energy use, despite *per capita* consumption being far lower than the global average; the high share of coal in primary energy use; the need for domestic energy transportation from the North-West to the South-East, which is met by railway transportation and new electricity grids; and the low level of energy efficiency compared to most developed countries.

Farooq Abdullah, Minister of New and Renewable Energy, India, said 40% of people in his country have no access to modern energy. He stressed the need for easy technology transfer to be able to develop at a rapid rate. Abdullah underscored the benefits from renewables for rural development, including access to water and education.

Amina Benkhadra, Minister of Energy, Mines, Water and Environment, Morocco, emphasized the economic growth of her country, noting that energy demand will double by 2020 and triple by 2030. Benkhadra highlighted Morocco's new strategy on renewable energy and energy efficiency, including legislation to promote private investment.

Gregory Barker, Minister of State for Energy and Climate Change, UK, emphasized the energy challenge faced by the UK, with declining oil fields in the North Sea, aging nuclear plants, and limits on coal due to climate change. He highlighted offshore wind power and CCS, and noted the UK energy system requires an investment of 100-200 billion pounds within the next two decades.

Patxi López, President of the Basque Country, Spain, outlined the Basque country strategy to reduce energy consumption, increase investment in renewables, and use green investment to generate wealth and employment. He stressed Basque leadership in windpower, solar thermoelectric energy and wave technology.

Louis Seck, Minister of Renewable Energy, Senegal, stressed the huge unrealized potential for renewables in Senegal. He underlined the importance of international and bilateral cooperation, and emphasized public-private



Christiana Figueres, during the special address on "What's next for Future Energy after COP16"



L-R: Paavo Väyrynen, Minister of Trade and Development, Finland; Iris Evans, Alberta's Minister of International and Intergovernmental Relations, Canada; Per Rune Henriksen, State Secretary, Ministry of Petroleum and Energy, Norway; Robin Niblett, Director, Chatham House; Fabrizio Hernández, State Secretary of Energy, Spain; and Walter Steinmann, Director, Federal Office of Energy, Switzerland

partnerships. Seck noted Senegal's dedicated ministry to renewable energy and his country's target of 15% renewable energy by 2020.

During the question and answer segment, discussions centered on the role of subsidies, the possibilities of a carbon capture and storage (CCS) breakthrough, and the opportunities for renewable energy leapfrogging in developing countries. Abdullah said subsidies have been fundamental for renewable energy deployment and stressed the role of green investment banks. Barker underscored the UK's interest in CCS, noting indigenous expertise and potential storage sites in the North Sea. Seck emphasized the role of small grids for rural development.

How Are National Governments Coping with Energy Challenges?: In this panel, Thomas Egebo, Permanent Secretary of State, Ministry of Climate and Energy, Denmark, said his country seeks to achieve 100% renewable energy supply by 2050, and that main investments will go to offshore wind power, biomass, large-scale geothermal plants, and the energy grid. Jürgen Becker, State Secretary, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany, emphasized that gas is the fossil fuel most difficult to replace and most compatible with renewable energy use.

Eamon Ryan, Minister for Communications, Energy, and Natural Resources, Ireland, emphasized the importance of grids, saying that their development is a key constraint to using renewable energy sources. He also referenced the need to use fossil fuels as a "saline drip" during the transition to renewables, and said that building transmission grids between countries is "fundamental."

Noting that the Republic of Korea's energy mix is heavily based on energy imports, Young-June Park, Vice-Minister, Republic of Korea, described policies used to help his country achieve global energy targets. He explained policy to increase the use of renewables and nuclear power, adding that his country has no gas reserves.



L-R: Thomas Egebo, Permanent Secretary of State, Ministry of Climate and Energy, Denmark; Jürgen Becker, State Secretary, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany; and Eamon Ryan, Minister for Communications, Energy, and Natural Resources, Ireland

José António Vieira da Silva, Minister of Economy, Innovation and Development, Portugal, described his country's efforts in energy efficiency, renewables and taking a well-balanced and integrated approach to the energy system. He said Portugal has nearly met its goal to achieve 60% electricity from renewables, and emphasized the role of changing consumer behavior in this success.

Daniel Johansson, State Secretary, Ministry of Enterprise, Energy, and Communications, Sweden, said it is important to acknowledge the cost of GHG emissions. He said benefits of a carbon tax include lower energy costs and support for renewable energies, and noted that excessive natural gas subsidies reduce market competitiveness of renewables.

What Are the Most Promising Areas for International Cooperation in Solving Future Energy Challenges?: In this panel, Paavo Väyrynen, Minister of Trade and Development, Finland, highlighted the European Union's policies for promoting sustainable development. He said that the World Trade Organization has some concerns about how to best promote renewable energy under the auspices of free trade.

Providing a perspective from an energy-producing country, Iris Evans, Alberta's Minister of International and Intergovernmental Relations, Canada, highlighted cross-boarder commitments on energy and the value of collaboration among governments, corporations and academic institutions on, among other things, CCS. She noted that shifts to renewable energy are not always driven by price concerns, but also reasons of environmental responsibility.

Per Rune Henriksen, State Secretary, Ministry of Petroleum and Energy, Norway, encouraged participants not to distinguish between producer and consumer countries, but instead to consider global challenges of energy, climate and poverty. He stressed the importance of energy access for poverty alleviation, and the need for international agreement on carbon pricing.

Fabrizio Hernández, Secretary of State for Energy, Spain, listed key areas where international cooperation is needed, including: market integration; technology transfer and sharing; energy efficiency; and regulatory frameworks. On the introduction of renewables, Hernández noted the need for agreement on the definition of property rights and appropriate terms of access in technology transfers.

Commenting on areas for regional and international cooperation, Walter Steinmann, Director Federal Office of Energy, Switzerland, suggested, the importance of common standards on energy efficiency for appliances.

Väyrynen encouraged standardization to promote free trade and reduce non-tariff barriers, and noted concerns about intellectual property rights. Evans cautioned that any move towards international standards must avoid “watering down” national standards.

With regard to investments and policies to attract funding, panelists considered innovative financing mechanisms, and the role of governments, international institutions, private banks and the private sector.

On the role of international cooperation in nuclear power, Steinmann pointed to existing international energy institutions, including the International Atomic Energy Agency, and Väyrynen noted some confusion about the role of nuclear power in a sustainable energy future, raising concerns about the dangers of proliferation, waste, accidents and natural disasters. Evans stressed that all politics are local, and cooperation may be difficult.

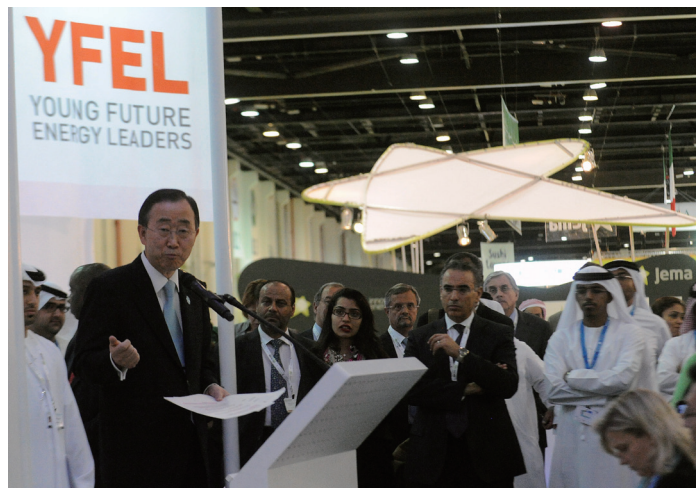
CLOSING STATEMENTS: Peter Voser, CEO, Royal Dutch Shell, the Netherlands, said there is no time to wait for international agreements, as trillions of dollars need to be invested in the next years to deliver energy with low environmental costs. He said areas for short-term cheap and quick emission reductions that industries should focus on, and governments should give incentives for, are: energy efficiency; natural gas; CCS; and biofuels.

Nobuo Tanaka, Director, International Energy Agency (IEA), recalled that IEA was created in response to the 1973 oil shock, and said current high oil prices could be a burden for the economic recovery. Tanaka said, politically speaking, climate change mitigation means doing something for someone else, while energy security means doing something for yourself, and suggested framing the mitigation discourse in terms of energy security. He emphasized the need for energy efficiency, decarbonizing the power sector through renewables, nuclear and CCS, and decarbonizing transportation.

SIDE EVENTS

Side events took place throughout the day in different venues and formats, including the Young Future Energy Leaders, Project Village and Roundtable Discussions.

YOUNG FUTURE ENERGY LEADERS: Addressing a forum of Young Future Energy Leaders, an initiative of the Masdar Institute, UN Secretary-General Ban Ki-moon cautioned against taking valuable resources for granted and emphasized the importance of climate change mitigation, green development, empowering women and improving global



Ban Ki-moon, UN Secretary-General, addressed Young Future Energy Leaders

health. He noted the need to share the “gifts of science and technology” with people in the developing world in order to achieve universal access to clean energy by 2030.

Highlighting how access to energy can improve as well as save lives, Ban observed that obstacles to energy access are not technical. He called for focused and sustained political commitment at the highest level to prioritize wise investments, particularly in renewable energy. Lauding the UAE’s visionary leadership resulting in the construction of Masdar City, an urban development powered by renewable energy, he expressed hope that experiences and ideas from this initiative would be widely shared.

PROJECT VILLAGE: At the Project Village, a section of the conference center dedicated to linking project developers with potential investors and technology providers, booths showcased a number of renewable energy projects and initiatives. Presentations on Monday included that by Ben Warren, Ernst & Young, on challenges and opportunities in renewable energy. He highlighted emerging markets and, describing global trends in renewable energy, he considered the need to attract investment, increase public engagement, reward investment in energy efficiency, and align energy policies with economic, industrial and environmental policy. Calling policy the “single most important driver for clean energy investment,” Logan Goldie-Scott, Bloomberg New Energy Finance, discussed investment trends and barriers in energy, particularly in the Middle East region. Noting both advantages and disadvantages, he highlighted policy support mechanisms, including renewable portfolio standards, tax incentives, and feed-in tariffs. Amjad Rihan, Ernst & Young, presented on the Clean Development Mechanism (CDM), and the development of carbon commerce. He noted the challenges in registering some projects under the CDM, explaining that there are countries that lack the necessary regulatory structures to meet the stipulations of the UNFCCC for potential projects.

During the discussion, participants considered, *inter alia*, policy transparency and consistency; the role of sovereign risk in emerging markets; infrastructure support for renewable energy development; failures of governments to develop a global policy on climate and energy; and the balance between risks and potential rewards for investors. Tyler Tringas, Bloomberg New Energy Finance, discussed cost comparisons of renewable energy generation using the standardized “Levelised Cost of Energy (LCOE).” He explained that this analytic approach facilitates comparisons of renewable energy with other energy generation strategies. He stressed that there are already some renewable energy sources that are economically competitive, including some applications of wind, geothermal and waste-to-energy, and that LCOEs are generally declining.

ROUNDTABLES: Nearly a dozen roundtables convened to discuss a range of specific energy topics. The topics included, among others, geothermal energy, photovoltaic (PV) technologies, air-conditioning, market investments, offshore wind farms and energy efficiency.

A roundtable convened by Mahieddine Emziane, Masdar Institute of Science and Technology, on PV Technologies for Large-Scale Deployment in the Gulf Cooperation Council. Roundtable participants included industry, academic and technical professionals. They discussed challenges of solar energy integration, manufacturing, cost and efficiency, and the need for data. They also emphasized the utility of Masdar City for experimentation and the importance of working together.



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WFES HIGHLIGHTS:

TUESDAY, 18 JANUARY 2011

On Tuesday, World Future Energy Summit (WFES) 2011 was organized around the theme of “Business Forum.” Participants heard a keynote address and panel discussion on renewable energy, featuring high-level executives, followed by parallel sessions on green cities, global energy policy and carbon capture and storage (CCS). In the afternoon, participants attended parallel sessions on wind power, business opportunities, green buildings, electric vehicles and energy efficiency. During an evening reception, the 2011 Zayed Future Energy Prize was awarded to Vestas.



L-R: Amory Lovins, Chairman, Rocky Mountain Institute; Ditlev Engel, Global CEO, Vestas; His Highness General Sheikh Mohamed Bin Zayed Al Nahyan, Crown Prince of Abu Dhabi; Christine Eibs Singer, CEO, E+Co; and Sultan Ahmed Al Jaber, Director General, Zayed Future Energy Prize

PLENARY SESSION: BUSINESS LEADERS IN RENEWABLE ENERGY

Business Leader’s Keynote Address: Truman Semans, Principal, GreenOrder, US, and former Executive Committee Member, US Climate Action Partnership (USCAP), said we are entering an age of “radical transparency,” characterized by: private regulation, in which supply chains must reveal information regarding production practices; increasing transparency of government actions; and software breakthroughs that can improve decision making processes. He contrasted the traditional model of interaction among business, government and civil society, typified by defensive actions and silo mentality, with examples of innovative engagement from USCAP, Brazil’s National Alcohol Programme (Pró-Álcool) and Masdar.



Truman Semans, Principal, GreenOrder, US; Former Executive Committee Member, US Climate Action Partnership, US

Business Leaders in Renewable Energy – Insights from the Executive Suite: Errol Barnett, CNN International, US, chaired two dialogues on this topic.

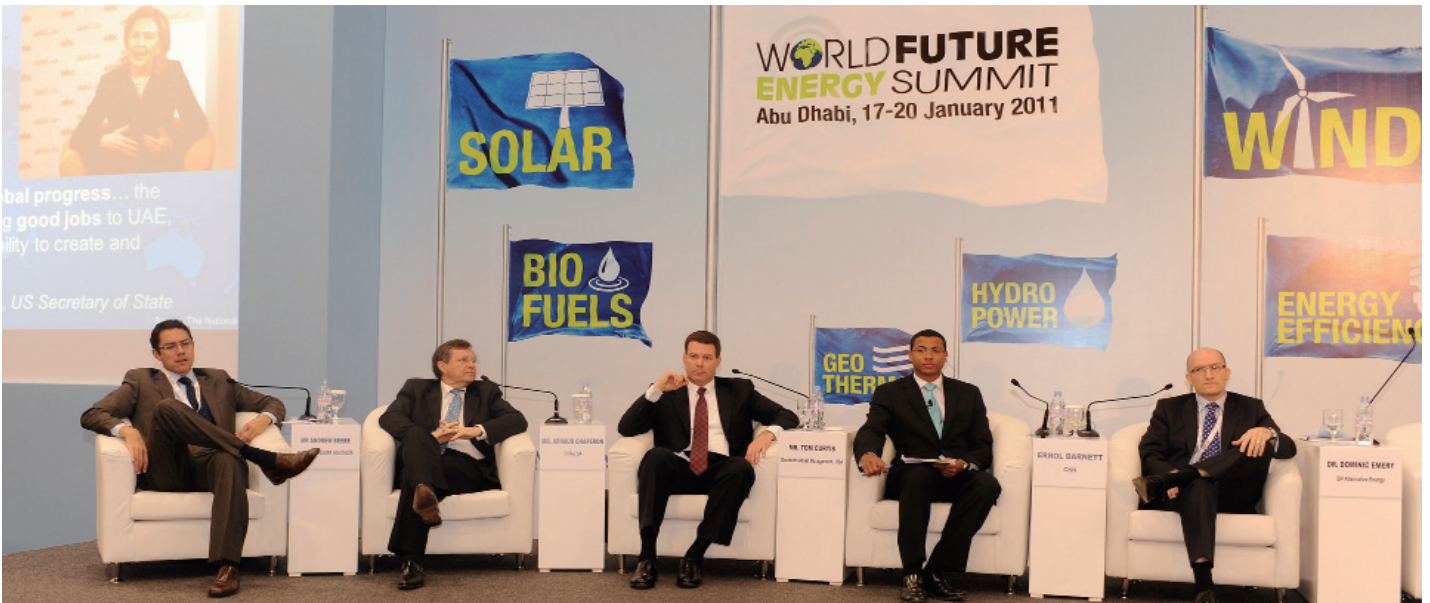
Part One: Tilman Krauch, President Construction Chemicals, BASF SE, Germany, noted that 40% of energy use is related to buildings and more than 50% of the global population lives in cities. He underscored the importance of addressing energy efficiency in buildings, suggesting that chemical companies like BASF can contribute by innovations in the production of materials such as cement to reduce emissions.

Dominic Emery, BP Alternative Energy, said BP invests in solar, CCS and biofuels, particularly Brazilian ethanol. He said BP is heartened by recent price reductions for solar products, making them more competitive. In response to Barnett’s inquiry as to whether the 2010 oil spill had increased BP’s interest in renewables, Emery replied that BP has invested about \$500 million per year in renewables over the last five years, and expects to increase this in 2011.

Tom Curtis, Managing Director, Deutsche Asset Management, US, said trillions of dollars of private capital need to be invested in clean energy in coming decades. He suggested that governments can make a difference by putting in place policies to mitigate risks and give guarantees, highlighting success in Germany and China with feed-in tariffs.

Questioned why an oil-producing country or company should be concerned with renewable energy, Arnaud Chaperon, Total, France, said Total wants to transition from an oil and gas company to an energy company, which means increasing its emphasis on renewables over the next 2-3 decades. He said Total focuses on solar energy and biofuels, which rapid

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L-R: Andrew Beebe, Suntech Power, US; Arnaud Chaperon, VP Electricity and Renewable Energies, Total, France; Tom Curtis, Deutsche Asset Management, US; Errol Barnett, CNN International; and Dominic Emery, BP Alternative Energy, UK

technological progress, especially in life and material sciences, is making more price-competitive with non-subsidized fossil fuels.

Andrew Beebe, Chief Commercial Officer, Suntech Power, US, said solar companies have created a large market and proven that they are ready for large-scale investments. He projected that 50% of energy production could come from solar power by the end of the 21st century.

Part Two: Jean-Pascal Tricoire, President and CEO, Schneider Electric, France, lamented the lack of educational programs to train students on new energy technologies. He said digital energy management is particularly important for reducing energy peaks, and added that this relies on improved measurement, automation of services and connection to smart grids.

On conservation and demand management, René Umlauf, CEO Renewable Energy, Siemens, Germany, said transmission lines and types of energy storage are important for increasing the market share of renewables. He added that hydropower and hydrogen offer potential conservation opportunities for the future, and that geothermal energy can also be a competitive future industry.

Artem Volynets, EN+ Group, Russian Federation, said China's energy demand could be met through non-coal sources if a proper transmission grid is created across eastern Siberia. On carbon neutrality, Philippe Joubert, Executive VP, Alstom, France, described their investment in wind, solar and hydropower and emphasized the need to invest in CCS and energy efficiency.

Frank Wouters, Director, Masdar Power, UAE, said the Masdar Institute will focus on educating a next generation of energy decision-makers and described Masdar's global efforts to support growth in the renewable energy industry. Responding to a question on scale, Wouters said developing countries are a great place to start new energy initiatives even if they do not have existing energy infrastructure because they can "leap frog" the delays incurred in reforming older systems.

Ditlev Engel, Global CEO, Vestas, Denmark, said the financial crisis forces short-term policies on long-term issues. Emphasizing the role of the consumer, he described the launch of a new collaboration with WWF and others to produce "WindMade," a consumer label that allows consumers to independently reduce their carbon use by choosing products produced with wind power.



L-R: Artem Volynets, Siemens, Germany; Errol Barnett, CNN International; René Umlauf, Siemens, Germany; Frank Wouters, Director, Masdar Power, UAE; Ditlev Engel, Global CEO, Vestas, Denmark; and Philippe Joubert, Alstom, France

PARALLEL SESSIONS

Participants in the “Business Forum” attended parallel sessions on green cities, global energy policy, CCS, wind power, business opportunities, green buildings, electric vehicles and energy efficiency.

GREEN CITIES: PLANNING AND INFRASTRUCTURE FOR SUSTAINABLE COMMUNITIES:

Moderator Daniel Vermeer, Duke University, asked what lessons about sustainable urban design are emerging and how broadly they apply. Susan Roaf, Heriot Watt University, UK, outlined the many challenges facing cities, cautioning that producing “green” buildings is not enough to produce sustainable cities. She stressed that the building choices made now will profoundly influence cities’ futures.

Nick Pennell, Booz & Company, explained that the “Reinventing the City” study found that success relies on the prerequisites of aggressive goals and best practice planning, innovative financing and use of the latest technologies, and on three implementing factors: a focus on livability; the relevance to local conditions; and a long-term perspective. Clay Nesler, Johnson Controls, Inc., described the effort to retrofit New York’s Empire State Building with a model that he said can be replicated elsewhere. He explained that the project resulted in a 38% energy reduction and an investment payback in 3.1 years.

Thomas Braig, Bayer Material Science, described the EcoCommercial Building Initiative, a network of companies trying to achieve zero-emission buildings through an integrated approach involving choices in design, materials, building technology and use of renewable energy. Alan Frost, Director, Masdar City, reported on challenges in building Masdar City, including how difficulties in system integration and implementation have forced design changes.

GLOBAL ENERGY POLICY – HOW POLICY IS BEING IMPLEMENTED IN DEVELOPED AND DEVELOPING NATIONS:

Rakesh Radhakrishnan, Navigant, US, chaired this session. Mohammed Al Ta’ani, Jordan Renewable Energy Society, emphasized the importance of incentivizing behavioral changes at the individual and organizational levels through awareness raising and technology transfer in Arabic countries. He called on countries to increase research on their individual future energy needs and how these can be met by renewable energies, and to develop human capital and practical solutions by strengthening universities and research institutes.

Ibrahim Oweiss, Georgetown University, Qatar, said while nuclear power remains an option and some countries have done a good job in handling both waste and proliferation, the most important future challenge is to harness the energy potential of the sun, suggesting that strong technology is already there but saying that it remains crucial to invest in further research.

Paul van Son, CEO, Desertec Industrial Initiative, said countries must develop instruments to implement energy visions and policies, and suggested that a lot of experience exists throughout countries on measures to incentivize



Paul van Son, CEO, Desertec Industrial Initiative

renewable energies. He also emphasized that subsidies for fossil fuels and nuclear power remain in many countries, and that some of these are hidden, resulting in the need for higher incentives for renewable energies, and ultimately threatening the overall objective of lowering the cost of renewable energy



Virginia Sonntag-O'Brien, Executive Secretary, REN21

production.

Virginia Sonntag-O'Brien, Executive Secretary, REN21, highlighted the strong link between incentive policies and the development of renewable energies, suggesting that investment and regulation reinforce each other in a feedback loop. She emphasized that energy policies must provide long-term stability and implementability, and must be embedded in the entire energy-planning context. She

also urged for renewable energies to play an important role in providing energy access to the poor, to avoid lock-in of high emission paths once their wealth increases.

CCS: FROM PILOT TO IMPLEMENTATION – SHARING THE KNOWLEDGE:

Jeff Chapman, CEO, Carbon Capture and Storage Association, UK, chaired the session. Sherri Stuewer, ExxonMobil, US, provided an overview of three models for CCS: enhanced oil recovery (EOR); natural gas production; and CCS in the electricity sector. Bob Pegler, Global CCS Institute, France, presented on the current status of CCS deployment and highlighted his institution’s role as a knowledge broker.

Peter Brooks, Executive Director, Worley Parsons, Australia, discussed challenges involved in developing a successful business case for CCS. He highlighted understanding the goal of CCS, political leadership, development and implementation of national CCS strategies and underwriting of critical infrastructure as key elements for enhancing the deployment of CCS. Walid Fayad, Booz & Company, Middle East, presented the business case for CCS in the Gulf Cooperation Council (GCC), observing that enhanced oil recovery has the potential to significantly offset CCS costs.

Ghaniya Bin-Dhaaer Al-Yafei, ADCO, UAE, discussed her country’s experiences with the CCS project implementation process. John Barry, Shell International Upstream, UAE, highlighted key lessons for CCS deployment, emphasizing the need for urgency, funding, knowledge sharing, public acceptance and partnerships between government, industry and academia. Bernd Holling, Linde Group, Germany discussed his company’s role in developing technologies for post-combustion capture of CO₂ from fossil-fuel power plants.

WHAT’S NEXT FOR THE WIND INDUSTRY?: Chair Steve Sawyer, Secretary General, Global Wind Energy Council, challenged panelists to identify strategies to move wind from the current 2% of global electricity supply to 20% or more. Alfonso Faubel, Alstom Wind, Spain, identified operating flexibility and integration of wind energy into the grid as two major industry challenges. Peter Jørgensen, Energinet.DK, Denmark, suggested large transmission grids could balance energy sources to compensate for fluctuating energy sources, noting this would require international coordination.

Ashok D’sa, Suzlon Energy, India, highlighted the need for industry and governments to work in concert to “unlock” markets for wind, and emphasized “bottom-up” change.



L-R: Alfonso Faubel, Alstom Wind, Spain; Peter Jørgensen, Energinet.DK, Denmark; Steve Sawyer, Secretary General, Global Wind Energy Council; Ashok D'sa, Suzlon Energy, India; and Morten Albæk, Vestas, Denmark

Morten Albæk, Vestas, Denmark, advised creating alliances with consumers to increase access to wind energy. He stressed the need to consider the social costs of energy.

Panelists discussed, *inter alia*: energy predictability and price; innovation and competition as drivers of cost reductions; feed-in tariffs and green certificates; and the potential impact of climate change on wind power generation.

TRANSFORMING INTERNATIONAL POLICY AND STRATEGY INTO REAL BUSINESS OPPORTUNITIES: Tom Curtis, Deutsche Asset Management, chaired the session. Observing that the growth of renewable energies is always linked to policies, but that countries use different measures, Neil Auerbach, Hudson Clean Energy Partners, recommended analyzing domestic resources and potentials as a starting point for designing policies, suggesting there is no scarcity in capital or technology provision.

Peter Sharratt, WSP Group, UK, said the main challenge is to de-risk top-down policies as many developments depend on a single subsidy, highlighting the political and legal framework that underlies the Kyoto Protocol targets in the EU. He called for policies to kick-start a transformative change of markets and overcome “subsidy policy farming.” Siobhan Smyth, HSBC, UK, compared renewable energy policies from an investor’s perspective, and suggested that affordability of these

policies for developing countries depends on how appropriate the technology is for the respective market. She recommended increased collective action among developing countries.

Noting that the optimal timing of a technology investment depends on how quickly its costs decline, Jürgen Weiss, The Brattle Group, US, recommended that policy makers consider subsidies for research and development as an alternative to subsidizing deployment of technologies with sharp declining costs. He also suggested considering how much support for deployment is needed to start a learning process that will drive down costs.

CASE STUDIES – GREEN BUILDINGS SHAPING OUR PHYSICAL ENVIRONMENT: Afshin Afshari, Masdar City, UAE, discussed the challenges to applying the zero-energy building concept in hot, humid climates. He particularly noted the challenge of how best to regulate “plug and process” loads, which most countries have not yet addressed. Kentaro Kawaguchi, Mitsubishi Heavy Industries, Japan, described the Eco Sky House project of “smart community housing” developed in Japan and outlined how it might be applied to the Middle East.

Mili Majumdar, The Energy Resources Institute (TERI), India, discussed the challenges for sustainable architecture in India, and the policy and programme responses taken, with an emphasis on the building rating system developed by TERI and



L-R: Siobhan Smyth, HSBC, UK; Tom Curtis, Deutsche Asset Management, US



Side events were held during the day



L-R: Henrik Fisker, CEO, Fisker Automotive, US; Herbert Kohler, Daimler, Germany; Chair Pierre Loing, Nissan International, Japan; Paul Mulvaney, ESB eCars, Ireland; Robin Voogd, LeasePlan Emirates, UAE; and Hiroshi Osawa, Mitsubishi Heavy Industries, Japan

now adopted by the Indian Government. Susan Roaf, Heriot Watt University, described the evolution and achievements of the Solar Cities movement, which she said has, among other things, led to the solar ordinance in Spain and mandatory solar water heating in China.

Matthew Plumbridge, Department of Municipal Affairs, Abu Dhabi, explained how his department is attempting to promote sustainable building through the adoption of a series of building codes, leading to an integrated green construction code including energy conservation, building and plumbing.

Session Chair Husam Al Waer, University of Dundee, emphasized that producing green buildings is not enough to produce sustainable cities. He said a focus on creating green infrastructure and sustainable communities is necessary.

e-MOBILITY – ON THE CUSP OF DEPLOYMENT:

Pierre Loing, Nissan International, opened the session. Shunichi Miyanaga, Mitsubishi Heavy Industries, stressed the need for advanced energy management systems, and said information and communication technologies (ICT) will play a big role in optimization of demand-side management. He stressed we are at the starting point of the e-mobility age.

Christine Van't Hull, City of Amsterdam, outlined Amsterdam's strategy on e-mobility. She explained Amsterdam's goal to achieve 10,000 electric cars by 2015. She underscored the need for cooperation with car manufacturers and other cities. Henrik Fisker, CEO, Fisker Automotive, US, conveyed the importance of maintaining the "fun" of driving in electric vehicles. He noted environmental concern, energy security, government support and technology advancements as drivers for consumer adoption.

Herbert Kohler, Daimler, Germany, predicted a dramatic increase in the output of electric vehicles in the coming years. He stressed that electric vehicles are based on two technologies: batteries and fuel cells. Paul Mulvaney, ESB eCars, Ireland, underscored the potential of smart electric cars for smart grids, highlighting possibilities for grid stabilization, peak reduction and reusing batteries for grid storage.

Robin Voogd, LeasePlan Emirates, UAE, noted the roles of the market, technology, government and driver's interest in realizing e-mobility plans. He said leasing companies like his represent a channel from manufacturers to large markets. Hiroshi Osawa, Mitsubishi Heavy Industries, explained Mitsubishi's vision for a low-carbon society with carbon-free energy, innovative transport systems and high-efficiency power generation. He stressed the need to shift to highly integrated energy systems.

MASTER CLASS – THE ECONOMICS OF GREEN BUILDINGS: CALCULATING THE COST AND THE VALUE:

Mili Majumdar, TERI, introduced the session, explaining the aim of providing tools to demonstrate that green buildings "make economic sense." She identified barriers to

green buildings, such as the perception of high incremental costs, lack of knowledge to carry out life cycle cost-benefit analyses and the absence of integrated design approaches.

Priyanka Kochhar, TERI, presented the results of a study comparing conventional and green-rated buildings in India, based on life cycle analysis. She outlined the study methodology, noting its consideration of discount rates, inflation and escalation costs. Presenting detailed spreadsheet calculations, she noted the model could be adapted to conduct similar assessments of buildings in other regions, and stressed that the findings reveal that green buildings have lower life cycle costs than conventional buildings.

Participants watched a video on India's green building certification system, "Green Rating for Integrated Habitat Assessment" (GRIHA), and Majumdar described a case study of a green building, highlighting energy efficiency improvements through passive design. In discussions, participants asked for, among other things: further details on the specifics of the case study buildings; clarification of study methodology and model parameters; and the distinctions between GRIHA and other green building certification systems.

ENERGY EFFICIENCY – CARBON REDUCTION: UNLOCKING THE ENERGY EFFICIENCY

POTENTIAL: Mohsen Khalil, Global Head, Climate Business Group, IFC, chaired this session. Hervé Touati, E.ON, Germany, said the question is why energy efficiency measures are not adopted. He highlighted three obstacles to adoption of energy efficiency technologies: imperfect information; upfront capital investments; and lack of stimulus. He said solutions include: raising consumer awareness; providing adapted financial tools; and providing government support for communications, targets and other actions.

Oliver Behrend, E.ON – Masdar Integrated Carbon, UAE, said barriers to energy efficiency adoption exist at the industry/project and government/policy levels. He said the price of energy is too low and the carbon market is not working. He highlighted that options such as education,



Young participants at the Summit



Stands around the venue

energy service companies, technology providers and funding exist, but stated that they are fragmented and that the lack of an integrated approach is itself a barrier.

Clemens Wolters, Deutsche Babcock Middle East, UAE, presented a case study on potential efficiency measures for a German power plant, and concluded that: industry investments are driven by return on investment (ROI); feasibility assumptions with a ROI of eight or more years are not attractive to industry; and a realistic ROI below five years could lead to industry investments.

In the discussion, Touati emphasized the need for clear national policy, integrative thinking and a change in mindset, starting at the top. Behrend said energy subsidies create the wrong incentives and that adding energy efficiency subsidies would create complications. A participant asked whether a global financial mechanism like the Clean Development Mechanism would be a good idea, and whether it should be implemented on a regional basis.

SIDE EVENTS

ROUNDTABLE DISCUSSIONS: Thirteen roundtables discussed specific energy issues throughout the day. Mustafa Hatipoğlu, UN Industrial Development Organization, convened a roundtable on hydrogen technology projects. Participants considered the status of hydrogen technology, storage, how to achieve industry breakthroughs, and hydrogen's relationship with the two degree Celsius global warming target.

Kamiel Gabriel, University of Ontario Institute of Technology, Canada, led a discussion on the hydrogen economy. Participants discussed: government and industry interest in, and plans for, hydrogen vehicle fleets; the challenges of hydrogen storage and transportation; and clean hydrogen.

Gustav R. Grob, Energy Institute, London, UK, hosted a roundtable on low carbon energy systems evolution where participants discussed aspects of the geothermal industry. Participants emphasized that renewable energy calls upon different government ministries than fossil fuels, such as environmental ministries, and this presents additional policy challenges.

Scott McGuigan and Jay Witherspoon, CH2M Hill, UAE, convened a discussion on sustainable change and innovation. Participants discussed the challenges of the water-energy nexus and water scarcity, and focused on the economic drivers for sustainable and renewable energy projects, particularly shifting subsidies to incentives.

EU-GCC CLEAN ENERGY NETWORK: The first plenary meeting of the "EU-GCC Clean Energy Network" convened as a full-day side event. In opening statements, Sam Nader, Director,

Masdar Carbon, UAE, called for policies to de-carbonize energy sources, and Eva Tvarozkova, European External Action Service, recalled past cooperation between the EU and the GCC, particularly on energy. John Psarras, National Technical University of Athens, described the network's activities. Panel discussions then considered: energy efficiency and demand side management; synergies for renewables and other clean energy technologies; financing clean energy projects; and clean energy-related education.

US PAVILION: Frank Calzonetti, University of Toledo, US, presented on his university's Wright Center for Photovoltaics Innovation and Commercialization (PVIC). He explained that the Center conducts industry-directed research to advance the commercialization of renewable technology, particularly thin film voltaics and offshore wind deployment.

YFEL: In a meeting with young future energy leaders (YFEL), Susan Hockfield, President, Massachusetts Institute of Technology, advised energy students to pursue a broad education that includes the politics and economics of energy. She said the fossil fuel industry is one of the strongest partners in renewable energy development as companies increasingly see opportunities for integrating conventional energies with renewables.

ZAYED FUTURE ENERGY PRIZE

The third annual Zayed Future Energy Prize award ceremony was held at the Emirates Palace Hotel in Abu Dhabi. The Prize celebrates achievements that reflect innovation, long-term vision and leadership in the fields of renewable energy and sustainability.

Sultan Ahmed Al Jaber, Director General, Zayed Future Energy Prize, explained that the Prize represents the legacy of the late founding father of the UAE, Sheikh Zayed Bin Sultan Al Nahyan, who championed environmental stewardship.

Underscoring the need for innovation, Rajendra Pachauri, Chairman of the Jury for the Zayed Future Energy Prize and of the Intergovernmental Panel on Climate Change, described the award recipients as "torch bearers for change." His Highness General Sheikh Mohamed Bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, then presented runner-up awards of US\$ 350,000 to E+Co, US, accepted by Christine Eibs Singer, CEO, and Amory Lovins, Chairman, Rocky Mountain Institute, US, respectively. The Zayed Future Energy Prize of US\$ 1.5 million was awarded to Vestas, Denmark, and accepted by Ditlev Engel, Global CEO. Engel announced that half of Vestas' award would be donated to the other three finalists, Barefoot College, India, First Solar, US, and Terry Tamminen, CEO and founder of 7th Generation Advisers, US.



L-R: Ditlev Engel, Global CEO, Vestas, and His Highness General Sheikh Mohamed Bin Zayed Al Nahyan, Crown Prince of Abu Dhabi



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WFES HIGHLIGHTS: WEDNESDAY, 19 JANUARY 2011

On Wednesday, the World Future Energy Summit (WFES) 2011 was organized around the “Technology Forum” theme. Participants heard a keynote address and panel discussion by technology leaders, followed by an innovators keynote address. Parallel sessions during the third day of WFES considered, *inter alia*, solar technology, hydrogen, energy storage, smart grids and super grids, carbon capture and storage (CCS), biofuels, future energy research and education, and nuclear power. Side events also took place in a variety of locations throughout WFES, including the Project Village, the Young Future Energy Leaders pavilion, roundtables, and within the exhibition forum.



Christiana Figueres, UNFCCC Executive Secretary, and Sultan Ahmed Al Jaber, CEO, Masdar, UAE, meeting with Young Future Energy Leaders

PLENARY

TECHNOLOGY LEADER’S KEYNOTE ADDRESS:

Sara Ortwein, ExxonMobil, US, emphasized the importance of high-level leadership in Abu Dhabi’s efforts to address environmental problems. She discussed future technologies for increasing oil and natural gas extraction, and emphasized new technologies for extended-reach drilling. She also highlighted Exxon’s research efforts to develop algae biofuel, and said the industry needs to focus on continuous innovation and safety.

TECHNOLOGY LEADERS IN FUTURE ENERGY – INSIGHTS FROM THE INNOVATORS: Balu Balagopal, Boston Consulting Group (BCG), US, chaired this panel discussion. Pascal Brosset, Schneider Electric, France,

highlighted the benefits of energy efficiency, noting that, due to transmission inefficiencies, one megawatt (MW) of power saved represents three MWs that do not need to be produced. He highlighted, *inter alia*: the need to address the integration of renewables into the power grid; demand management; modes of collaboration; the lack of standards; and the importance of stability in regulations and incentives.

Francesco Sessa, Enel Distribuzione SpA, Italy, described the technological needs of his company’s projects on workforce management, e-mobility and a lamp system. Bjørn K. Haugland, DNV, Norway, said barriers to the adoption of new technologies should be examined, including the need for training, education and capacity building. He noted that the Clean Development Mechanism (CDM) is a system for technology transfer and a finance system that should be further developed. He suggested focusing attention on fossil fuel subsidies, carbon pricing and CCS.

Amr Salem, Cisco, US, said the focus has been on consumption and production but not distribution, with the latter representing an area in which efficiencies should be pursued. Ernest Moniz, Massachusetts Institute of Technology (MIT), said the “door was closed” for a “coherent” carbon pricing strategy, and explained that moving forward without that policy would require: large-scale efficiency advances; substituting natural gas for coal; and paving the way for low-carbon, cost-effective technologies to be scaled-up in the future without subsidies. He added that it is important to increase natural gas science and sources and to improve battery cost per kilowatt hour. He said that CCS is the hardest and most economically unrealistic of technological innovations to achieve in the short-term without a subsidy.



Sara Ortwein, ExxonMobil, US

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Hervé Touati, E.ON, highlighted the importance of focusing on costs, noting the value of innovations to bring renewables from the “boutique” to the industry level. He advised harmonizing data standards to “industrialize” innovation capacity. Peter Vanacker, Bayer Material Science, Germany, described his company’s reductions in energy consumption and discussed, among other things, environmental and social benefits, improving building efficiency, the need for combined efforts and a combination of technologies.

During the discussion, Balagopal suggested focusing on the barriers to adoption of new, cost-effective technologies and their “disruptive” potential. He said numerous technologies are moving down the cost curve faster than many had anticipated, leaving barriers to adoption, such as the necessary infrastructure for cost-competitive biofuels and solar energy, as the main issue. Other speakers emphasized: enhancing consumer awareness of the impact of personal actions by using information technology; advances in battery research; and the need to factor in the price of managing intermittency and the need for back-up generation that accompanies some new energy sources.

INNOVATOR’S KEYNOTE ADDRESS: Mark Vachon, GE Ecomagination, US, discussed efforts to inspire a competitive energy future. He said clean energy remains a growth industry, leadership should take place through innovation and faster results can be accomplished through partnerships. He cautioned that waiting for government policy to drive innovation is a failed strategy, and said companies need to lead, particularly through demonstration projects. As a focus for further innovation, he prioritized, *inter alia*, internal combustion engines and energy efficiency.

NEW INNOVATIONS IN SOLAR TECHNOLOGY: Chair Eicke R. Weber, Fraunhofer-Institut für Solare Energiesysteme (ISE), said that recent annual photovoltaic (PV) installation has increased exponentially but that higher automatization, larger market production and new technologies are still needed. Milton Venetos, AREVA Solar, US, described new technology developments in concentrated solar power (CSP). He said Fresnel technology has grown steadily in recent years. On superheated steam generation he described a project in California designed to generate up to 482 degrees Celsius of heat.

Michael Geyer, Abengoa Solar, Spain, described Abengoa’s success in bringing CSP plants to operation, noting one integrated solar plant of 450 MW, which is the largest in Africa. He stated that CSP technology should be market-competitive by 2025. Jorge Unda, Sener, Spain, outlined Sener’s work on



Mark Vachon, GE Ecomagination, US

different thermal energy storage GE techniques, cost reduction strategies, and the status of, and vision for, technology for molten salt solar towers. He said it is effective to develop a solar park in Abu Dhabi.

Christophe Desrumaux, Concentrix-Soitec, Germany, discussed materials for solar power engineering and highlighted structural models for PV cells. He explained Concentrix-Soitec’s latest projects and partnerships that have made significant advances in solar efficiency. Jos van der Hyden, First Solar, US, thanked Vestas again for sharing the winnings from the Zayed Future Energy Prize, and announced that the money will be used to provide energy to low-income communities. He described advancements in large-scale PV technology and manufacturing, and discussed different plant capacities around the world.

ENERGY STORAGE: OVERCOMING THE TECHNOLOGY CHALLENGES: Ali Nourai, KEMA Consulting, US, noted that lowering storage costs requires developing less expensive storage technology and addressing the total “cost of ownership.” He underscored desirable properties such as plug’n play technology independence, small unit size, lower voltage; and that storage locations, including for large bulk storage, should be close to the customer.

Gene Hunt, Beacon Power, US, presented flywheels as an energy storage system on a grid-scale. He highlighted that the system’s response time of four seconds is superior to fossil fuel plants taking up to five minutes, given that signals from energy operators can change every few seconds. He said market and regulatory reform present a central challenge, suggesting the creation of an energy storage regulatory category separate from energy generation.

Michael Lippert, SAFT Batteries, France, described three storage categories: central storage to balance seasonal and weekly fluctuations; grid-integrated systems to address daily and hourly variation and enable peak shaving; and end-user storage for daily variations. He said that while bulk energy storage is maturing, small- and medium-size energy storage is just now becoming available.

Akimichi Okimoto, NGK Co., Japan, introduced his company’s battery energy storage system. He emphasized that the battery supports the application of renewable energies, and reduces carbon dioxide (CO₂) emissions by peak shaving within energy grids, and can be used at generator and production sites, and at the household level.

BIOFUELS: FINALLY DELIVERING ON THE EARLY POTENTIAL?: Chair Jeremy Woods, Imperial College, noted the controversy around the issue of biofuels. He listed



Michael Geyer, Abengoa Solar, Spain



Bjørn Haugland, Det Norske Veritas, Norway

questions for panelists to consider, including on the “food versus fuel” debate and competition between biomass for transport, heat, electricity and other uses. He said the central question is “do we need biofuels?”

Wes Bolsen, Coskata Inc., US, presented his company’s work on “Flex Ethanol,” a cellulosic biofuel technology for producing fuel-grade ethanol from a variety of input materials. He emphasized the process can utilize non-grain inputs. Ian O’Gara, Accenture, UK, highlighted Accenture’s work on “disruptive technologies” in the transport sector. He predicted changes over the next five years in the transport fuel market, suggesting it will become increasingly diverse and competitive.

Gregory Stephanopoulos, MIT, noted that terms such as “first generation,” “second generation,” and “advanced biofuels” are often used inconsistently. He stressed the world cannot afford to “throw away the potential of biomass” for producing fuel. Arnaldo Walter, State University of Campinas, agreed that biofuels are needed, and said first generation biofuels will be part of the solution. He underscored the need to diversify biomass sources and products, highlighting options such as electricity co-generation.

In the discussion, panelists further considered food security concerns, and the potential positive impacts of biofuels in providing local fuels for agriculture. Participants also discussed, *inter alia*, growing energy demands in emerging economies and assessing indirect land use change and environmental impacts from oil and biofuels.

HYDROGEN – HOW IT CAN DELIVER AS THE FUEL OF THE FUTURE: Nigel Brandon, Imperial College, chaired this panel, noting the session would address the continued challenges related to the production, distribution, storage and conversion of hydrogen. Describing hydrogen as one of the few options for transport and storage of CO₂-free energy, Jurgen Louis, Shell, the Netherlands, projected that a future energy system could involve large-scale hydrogen storage with regional pipeline networks.

Katsuhiko Hirose, Toyota, Japan, described Toyota’s commitment to fuel cell development, identifying costs and limited infrastructure as the main barriers to hydrogen-powered car deployment. He announced recent initiatives in Japan for the introduction of hydrogen fueling stations across the country. Herbert Kohler, Daimler, Germany, highlighted 2015 as the target year for Daimler in bringing hydrogen fuel cell cars to private customers, and noted efforts in Germany for providing the required infrastructure.

Jon Moore, Intelligent Energy, UK, called the shift to hydrogen vehicles “inevitable and imminent.” He stressed that fuel cells can be used for most applications that are powered by internal combustion engines or batteries. David Hart, Director, E4Tech, Switzerland, stated there are both challenges and opportunities for innovation in materials, design and implementation of hydrogen, and highlighted the need for renewed interest from policy-makers and investors.

Questions from the audience considered issues such as: synergies between hydrogen production and CCS; possibilities for producing hydrogen from renewables; competition between fuel cell and electric hybrid cars; circumstances under which hydrogen can provide storage options for intermittent renewable energy sources; and participation of the automotive industry in the WFES.

SMART GRIDS AND SUPER GRIDS – THE KEY TO RENEWABLES INTEGRATION?: Moderator Philipp Gerbert, BCG, Germany, provided a quick overview of why greater use of renewable energy, and the need to manage electricity demand and carbon emissions, is driving the move to smart grids. Frank Ackland, GE International, UAE, made the case for rapid smart grid deployment in the Middle East and discussed studies showing the potential for substantial financial and energy savings.

Richard Hausmann, Siemens, Germany, discussed four smart grid applications: demand response; distributed generation and microgrids; smart metering; and electric car infrastructure. He argued that ensuring rising electricity consumption is sustainable requires “the 4E’s”: energy efficiency; optimal energy mix; energy management with smart grids; and electro-mobility and e-products. Citing the Desertec Industrial Initiative, he discussed the need for smart “supergrids” to link areas with abundant renewable energy sources with distant consumers. Scott Henneberry, Schneider Electric, US, said demand response allows grid operators to manage demand among large users during high demand periods, and he considered it the most promising application of smart grids.

Rudi Strubbe, Alcatel Lucent, Belgium, explained the possible role of the internet in transforming how grids are managed and enabling consumers to manage their own consumption. Jorge Cruz Morais, EDP, Portugal, discussed how EU policies have driven his utility to switch to smart grids and greater use of renewables, and how smart grids can enhance a utility’s relationship with consumers.

FUTURE ENERGY RESEARCH AND EDUCATION: Fred Moavenzadeh, President, Masdar Institute, chaired the session. On Abu Dhabi’s strategy for developing a vibrant intellectual community, Rafic Zein Makki, Abu Dhabi Education Council, highlighted the need to develop a high-level policy agenda, online resources and libraries. On building research and development capacity, he mentioned as requisites openness, appropriate intellectual property regulations and frameworks, and attracting and retaining talented scientists.

On expediting the development of human capital, Peter Heath, Chancellor, American University Sharjah, UAE, emphasized open, collegial dialogue among the university leadership and understanding government and private sector priorities. He advised universities to remain true to their mission and not only focus on national priorities and strategies.

Wyatt Hume, Provost, UAE University, highlighted doctoral training as a missing element in expediting the development of the intellectual community. He also mentioned the lack of



International students in a showcase debate organized by YFEL on the proposal: "The USA must be brought up on charges in the International Court of Justice to collect for the worldwide environmental, health and economic damages caused by their CO2 emissions"

external, robust, competitively peer-reviewed funding as a missing element. Turning to challenges, Hume underscored maintaining the open culture of intellectual inquiry and emphasized the need to move quickly in order to respond to commercial and public policy requirements.

On the role of universities in developing an intellectual community, Dan Johnson, Provost, Zayed University, UAE, noted the need for universities to support intellectual, cultural and religious understanding. He also discussed opportunities for universities to play a larger role in economic and social development, research and training.

CASE STUDIES – KEY SOLAR PROJECTS

AROUND THE GLOBE: Chair Fernando Oliveros, Oliver Wyman, Spain, said the session would focus on large-scale solar projects. Olaf Goebel, Masdar Power, UAE, spoke on the Shams One solar trough project in the UAE, which is supported 60% by Masdar and 40% by Abengoa of Spain and Total of France.

Sami Khoreibi, CEO, Enviromena Power Systems, UAE, reported on the largest grid-connected solar plant in the Middle East and North Africa, located in Masdar City, producing 17,500 Megawatt-hours of electricity per year. He underlined



Ambassador Hamad Al Kaabi, UAE Permanent Representative to the IAEA and Special Representative for International Nuclear Cooperation, UAE

their development of a dry brush maintenance method that does not rely on water, calling it an important technology for water-scarce areas.

Wolfgang Knothe, CEO, Flagsol, Germany, presented on the Andasol CSP projects in Spain, and described molten salt and solar thermal technologies. Robert Seiter, Ernst and Young, Germany, discussed the country attractiveness index methodology, which evaluates regulatory and financial infrastructure and the technological parameters for different renewables. He also presented on the PV value chain and the cost breakdown of CSP plants. Paul van Son, CEO, Desertec, emphasized the large potential of renewables and underlined the importance of power grid interconnectivity. He also discussed Desertec's work with governments.

KICK-STARTING A CCS FUTURE – OVERCOMING THE REGULATORY AND FINANCIAL BARRIERS:

Bob Pegler, Global CCS Institute, chaired the session. Barbara Nance McKee, Office of Fossil Energy, Department of Energy, US, highlighted obstacles and challenges to CCS, observing that: CCS costs are currently high; financial incentives are mostly transitional; legal and regulatory frameworks in many countries are absent; and public awareness and acceptance of CCS is limited.

Andrew Beatty, Partner, Baker & McKenzie, Australia, provided an overview of the CCS project phases, including: planning; financing and contracting; construction; capture; transportation; and storage. On public-private partnerships, Jamie Carstairs, Linnfall Consulting, UK, observed that it would be some time before power generation incorporating CCS is viable, and therefore government support is required. He noted that effective public-private partnership contracts will require clear understanding between policy-makers, agents, contractors and financiers, which takes time to build. He also underscored CCS under the CDM as a game changer, which would provide revenues for additional countries. Carstairs also noted that enhanced oil recovery (EOR) can provide substantial additional revenues for CCS.



L-R: Chair Bob Pegler, Global CCS Institute, France; Masaki Iijima, Mitsubishi Heavy Industries, Japan; Jamie Carstairs, Linnfall Consulting, UK; Andrew Beatty, Baker & McKenzie, Australia; and Hermann Kremer, Siemens, Germany

Masaki Iijima, Mitsubishi Heavy Industries, Japan, offered a technology provider perspective. He observed that development innovation and technology improvement would continue if the correct market signals are in place, which would lead to widespread commercial adoption of CCS. Observing that CCS is a prerequisite of the 450 parts per million (ppm) climate change scenario, Hermann Kremer, Siemens, Germany, explained that in order to reduce CO₂ emissions, power plants have to run at the highest possible efficiency. He emphasized the need for "best in the class" carbon capture technology, such as post-combustion.

NUCLEAR INDUSTRY UPDATE: Fahad Al Qahtani, Emirates Nuclear Energy Corporation, UAE, chaired the session. Ambassador Hamad Al Kaabi, UAE Permanent Representative to the International Atomic Energy Agency (IAEA) and Special Representative for International Nuclear Cooperation, said the renaissance of the nuclear industry is driven by the objective of energy independence and security, and by climate change concerns. He emphasized that the maintenance of safety is fundamental for performance of and support for UAE's nuclear programme.

Gianluca Marini, Director, CESI, Italy, noted that 80% of installed capacity is located in the EU, Japan and the US, while 75% of the reactors under construction will be in the Far East, the Russian Federation, and possibly the UAE. He also observed that the main driver of nuclear's low price compared to other energy sources, with climate change concerns and the security of supply and system stability gaining importance.

Václav Bartuška, Ambassador-at-Large for Energy Security, Czech Republic, suggested that nuclear energy is not experiencing a "renaissance" but a "comeback," after 30 years of being in a "coma," and expressed concern that the EU is pushing itself out of the market since only two of over 60 new reactors are planned in the region. Mike Tynan, CEO, Westinghouse, US, observed that people generally accept electricity generation from nuclear plants and that concerns focus mainly on nuclear waste. He called for greater cooperation between national regulators on waste. Regarding uranium availability in the light of a growing number of nuclear plants, he noted that ample resources exist and that there is additional potential for more efficient material use.

SIDE EVENTS

ROUNDTABLES: Participants continued to participate in roundtables throughout the day.

Integration of Coal-Fired Power Plants with Carbon Capture: Leading a discussion on how systems engineering modeling can guide technology choices for carbon capture in coal-fired power plants, Ali Abbas, University of Sydney, Australia, emphasized that models show that heat reintegration would prove best and competitive if carbon pricing is introduced and that membrane modules might involve less selectivity than currently believed. Participants discussed the potential environmental and health pitfalls of reliance on solvent absorption and possible tools for real-time decision making on when to activate carbon capture.

Incorporating Renewable Energy into Disaster Planning and Response: Thearin Wendel, Nova Environmental Associates, US, discussed the challenges of incorporating renewable energy into disaster planning and response. He highlighted renewables advances such as portability, continuity, quiet operation and reduced waste generation, and identified several uses such as water supply, portable power, communications, lighting and road signaling. Noting challenges in deployment, he underscored the importance of pre-disaster planning.

YOUNG FUTURE ENERGY LEADERS (YFEL): A number of discussions took place at the YFEL Pavilion on Wednesday.

Debate: Moderated by Ken Volk, Masdar Institute, UAE, two teams of international students at the YFEL Pavilion debated whether to sue the US in the International Court of Justice for environmental damages caused by CO₂ emissions. One team cautioned that no enforcement mechanism exists, and advocated developing reward systems rather than punishing a single country. The audience approved the second team's proposal to hold the US legally responsible for its actions, based on the argument that the US is aware of the problems it causes and has refused to cooperate within the UN system.



Electric car charging station

Discussion with the UNFCCC Executive Secretary:

Addressing the YFEL, Christiana Figueres, Executive Secretary, UNFCCC, observed that the new technological revolution would have to be driven by the multilateral process to address global timelines. Highlighting the recent Cancún Climate Change Conference, she described the outcomes, including on finance and the establishment of a technology mechanism, and said they represent “by far the largest collective effort to reduce emissions.” Figueres, however, acknowledged the outcome’s insufficiencies, given the magnitude of change required.

PROJECT VILLAGE: As part of Wednesday’s Project Village programme on “Clean Energy Financing, from Venture Capital to Projects,” Loay Alfi and Raed Bkayrat, King Abdullah University for Science and Technology (KAUST), Jeddah, Saudi Arabia, outlined the University’s collaborative research efforts, goals of technological advancement and commercialization, and several solar projects. Bkayrat highlighted, among other initiatives, the main campus’ 2MW PV power generation facility and the “New Energy Oasis” for solar testing and demonstrations.

PAVILIONS AND BOOTHS: Many of the booths at the trade show organized presentations to share information regarding their activities.

Japan Pavilion: Ji Eon Lee, Japan Business Alliance for Smart Energy Worldwide (JASE), pointed to the high energy efficiency in Japan. She said JASE enables energy

conservation by promoting Japanese smart energy products and technologies, including energy saving solutions, heat pumps and inverters, and PV and geothermal power. Representatives from Japanese companies then presented several of these technologies.

ExxonMobil Pavilion: Nazeer Bhore, ExxonMobil, presented his company’s 2030 energy outlook. He discussed the effects of carbon emissions and fossil fuel prices on the economic competitiveness of different energy sources. Stating “we are never going to sell again as much gasoline in the US as we sold last year,” he projected that light-duty vehicle energy demand will remain flat globally by 2030, and will decline in the US.

Masdar Smart Grid Panel: Bryan Walsh, Time Magazine, moderated a panel of representatives from 3Tier, Siemens, Masdar and Abu Dhabi Water and Electricity Authority, in a discussion on smart grids in Masdar and elsewhere. The panel highlighted: the importance of smart grids in accommodating intermittent power supply from wind and solar; necessary technical and policy conditions; obstacles impeding smart grid growth; the possible use of electric vehicles as a storage network for smart grids; and how smart grids can help consumers moderate energy consumption.

Masdar Theater: At Masdar Theater, in a presentation on “Creating a Clean Tech Cluster in Masdar City,” Mohammed Al Fardan, Masdar City, described Masdar City as a living laboratory to accelerate innovations in clean energy, green products and sustainable development, with the objective of providing residents and commuters with the highest quality of life for the lowest environmental footprint. He noted Masdar City will be a tax-free special economic zone, with 100% foreign ownership allowed.

Attendees at a presentation on “Innovations in CSP Development: The Torresol Energy Story” learned that the Torresol solar energy project uses central tower plants with molten salt storage. The presenter said additional features include: two independent systems for storage and generation; 15 hours of storage capacity; and generation capacity of 110,000 MWh/year.



Highlighting the recent Cancún Climate Change Conference, Christiana Figueres, UNFCCC Executive Secretary, speaking to the Youth Future Energy Leaders, described outcomes, including finance and the establishment of a technology mechanism



SUMMARY OF THE WORLD FUTURE ENERGY SUMMIT 2011: 17-20 JANUARY 2011.

The Fourth World Future Energy Summit (WFES) 2011 took place in Abu Dhabi, United Arab Emirates (UAE), from Monday 17 to Thursday 20 January 2011, under the patronage of H.H. General Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Supreme Commander of the UAE Armed Forces, and hosted by Masdar. WFES was attended by over 25,000 participants, including 3,000 Summit delegates.

WFES included a Summit with 29 sessions, two exhibitions, a Young Future Energy Leaders Programme (YFEL), approximately 90 roundtable discussions, as well as numerous side events, industry and investment seminars, and corporate meetings.

The Summit was convened around a high-level segment focused on policy and strategy, and three forums on business, technology and finance. The issues considered by WFES participants included: international future energy policy; financing future energy; solar energy; green cities; sustainable buildings; wind energy; biofuels; e-mobility; energy storage; hydrogen; carbon capture and storage; energy efficiency; smart grids; and nuclear energy.

In addition, many WFES participants attended the award ceremony for the Zayed Future Energy Prize for long-term vision and leadership in renewable energy and sustainability, which was awarded to Vestas of Denmark.

The following report contains a summary of the WFES sessions, as well as a selection of side events, roundtables and seminars. Summaries of the plenary sessions are in chronological order; summaries of the parallel sessions are organized based on conference topics. More detailed information and photographs can be found at: <http://www.iisd.ca/yimb/energy/wfes/wfes2011/>.



Sultan Ahmed Al Jaber, CEO, Masdar, UAE

various UN and international organizations and agencies have been active on this issue, and numerous related international conferences and fora have convened, as summarized below.

WFES

Since its inception in 2008, WFES has evolved as the world's foremost annual meeting for the renewable energy and environment industry. Abu Dhabi, UAE, has hosted WFES annually to promote innovation and investment opportunities surrounding renewable energy and environment. The Summit brings together project owners and solution providers with investors and buyers from both the public and private sectors. Held in Abu Dhabi, UAE, from 18-21 January 2010, the third WFES brought together approximately 25,000 attendees from 148 countries.

UN CONFERENCES AND SUMMITS

The international community's first major attempt to develop a strategy for the use of alternative fuels was the 1981 Resolution by the 36th UN General Assembly (UNGA 36) (A/

A BRIEF HISTORY OF MULTILATERAL PROCESSES ON RENEWABLE ENERGY

Renewable energy is emerging as an essential element for addressing climate change, energy security, green growth and poverty reduction. Therefore, there has been an emerging focus in the international dialogue regarding renewables on the need to scale-up sustainable and renewable energy both regionally and globally. Since the UN Conference on Environment and Development (UNCED) in 1992, in Rio de Janeiro, Brazil,

IN THIS ISSUE

A Brief History of Multilateral Processes on Renewable Energy	1
Report of the Meeting	2
Plenary Sessions	2
Parallel Sessions	9
Side Events	16
Zayed Future Energy Prize	19
Upcoming Meetings	19
Acronyms	21

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RES/36/193) on the outcomes of the UN Conference on New and Renewable Sources of Energy. UNCED, which met in 1992 in Rio de Janeiro, Brazil, adopted Agenda 21, an action plan for implementing sustainable development. Agenda 21 addresses sustainable energy in Chapter 9, which notes the increasing need to rely on environmentally sound energy systems, particularly new and renewable sources of energy.

In April 2001, in New York, US, the ninth session of the UN Commission on Sustainable Development (CSD 9) adopted Decision (E/CN.17/2001/19) on "Energy for Sustainable Development," addressing issues such as the role of the private sector, research and development, institutional capacities, financial support, energy accessibility and rural energy. IISD RS coverage of CSD 9 can be found at: <http://www.iisd.ca/csd/csd9/index.html>.

The World Summit on Sustainable Development (WSSD), held in August-September 2002 in Johannesburg, South Africa, adopted the Johannesburg Plan of Implementation, which addresses renewable energy in several of its chapters, including on poverty eradication (Chapter II), sustainable consumption and production patterns (Chapter III), small island developing States (Chapter VII), and Africa (Chapter VIII). IISD RS coverage of WSSD can be found at: <http://www.iisd.ca/2002/wssd>.

Held in New York, US, in May 2007, CSD 15 addressed energy issues, although delegates did not reach consensus on any decisions. IISD RS coverage of CSD 15 can be found at: <http://www.iisd.ca/csd/csd15>.

In December 2010, UNGA 65 adopted Resolution 65/151 proclaiming 2012 as the International Year for Sustainable Energy for All.

IREC PROCESS

At the WSSD, German Chancellor Gerhard Schröder invited the international community to a Conference on Renewable Energy. The International Renewable Energy Conference (IREC), "Renewables2004," took place from 1-4 June 2004, in Bonn, Germany, and launched the series of IREC meetings. The outcomes of the conference led to the creation of the Renewable Energy Network for the 21st Century (REN21). IISD RS coverage of Renewables2004 can be found at: <http://www.iisd.ca/sd/ren2004>.

The Beijing International Renewable Energy Conference (BIREC), hosted by China in November 2005, adopted the Beijing Declaration.

The Washington International Renewable Energy Conference (WIREC) convened from 4-6 March 2008, in Washington DC, US, and resulted in the Washington International Action Programme, comprising over 100 pledges by countries and organizations. IISD RS coverage of WIREC 2008 can be found at <http://www.iisd.ca/yimb/wirec2008/>.

The Delhi International Renewable Energy Conference (DIREC 2010) took place from 27-29 October 2010, in New Delhi, India, and concluded with the DIREC Declaration and 30 new pledges by governments and civil society under the Delhi International Action Programme. IISD RS coverage of DIREC 2010 can be found at <http://www.iisd.ca/yimb/energy/direc2010>.

IRENA

The International Renewable Energy Agency (IRENA) was established on 26 January 2009. IRENA's statute entered into force on 8 July 2010. As of January 2011, IRENA has 149 signatories and has been ratified by 51 States. The fourth

Preparatory Commission for IRENA met in Abu Dhabi, UAE, on 24-25 October, 2010. The first session of the Assembly of IRENA will take place on 4-5 April 2011, in Abu Dhabi, UAE.

IPCC SRREN

At its 25th session in Port Louis, Mauritius, the Intergovernmental Panel on Climate Change (IPCC) agreed to hold a scoping meeting for a special report on renewable energy sources. This scoping meeting took place in Lübeck, Germany in January 2008, and produced, among other outcomes, an outline for a special report. IISD RS coverage of IPCC 25 can be found at: <http://www.iisd.ca/climate/ipcc25/>.

At IPCC 28, which convened in Budapest, Hungary, in April 2008, delegates agreed to the preparation of a Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN), to be completed by 2010. The approval of SRREN is scheduled for 5-8 May 2011, in Abu Dhabi, UAE. IISD RS coverage of IPCC 28 can be found at: <http://www.iisd.ca/climate/ipcc28>.

CLEAN ENERGY MINISTERIAL

The Clean Energy Ministerial is a US-convened, high-level global forum to promote policies and programmes that advance clean energy technology. It includes Australia, Brazil, Canada, China, Denmark, the European Commission, Finland, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea, Mexico, Norway, the Russian Federation, South Africa, Spain, Sweden, the UAE, the UK and the US. The first Clean Energy Ministerial met in Washington DC, US, from 19-20 July 2010. The second Clean Energy Ministerial will convene in Abu Dhabi, UAE, from 6-7 April 2011.

ZAYED FUTURE ENERGY PRIZE

The Zayed Future Energy Prize, named after the late founding father of the UAE, Sheikh Zayed Bin Sultan Al Nahyan, celebrates achievements in the fields of renewable energy and sustainability that reflect three criteria: innovation; long-term vision; and leadership. It was first awarded during WFES 2009 to Dipal Chandra Barua, founding managing director of Grameen Shakti, Bangladesh, for his efforts to bring renewable energy to rural populations. The Prize was awarded in 2010 to Toyota Motor Corporation, Japan, for its Prius hybrid vehicle.

REPORT OF THE MEETING

PLENARY SESSIONS

The World Future Energy Summit (WFES) 2011 opening ceremony took place on Monday. Plenary sessions were held on Monday afternoon, Tuesday and Wednesday morning, and Thursday morning and afternoon.

OPENING CEREMONY

On Monday morning, H.E. Sultan Ahmed Al Jaber, CEO, Masdar, opened the meeting. Describing WFES as an open global platform, he underlined that energy solutions cannot be driven by individual countries and must rely on collaboration. On climate policy, he said the most important change in 2010





Asif Ali Zardari, President of Pakistan

was the shift to a bottom-up approach to establishing a balanced package of decisions. He encouraged energy efficiency and conservation and fostering competition between different energy industries.

Noting that global energy needs are growing rapidly and that more than three billion people rely on traditional biofuels, UN Secretary-General Ban Ki-moon, called for a clean energy revolution that contributes to reducing poverty,

mitigating climate change, empowering women, strengthening economic growth and achieving the Millennium Development Goals (MDGs) and global security. He encouraged public and private spending for intellectual capital, suggesting that investment in green economies can provide an opportunity for growth and prosperity in developed and developing countries.

Ólafur Ragnar Grímsson, President of Iceland, said Abu Dhabi is among the global locations chosen to “illustrate our aspirations,” as a venue for promoting a clean energy future. He called for global cooperation on sustainable energy, and stressed that the South has the potential to become the global leader in this necessary transformation. Lauding the WFES, he said the Zayed Future Energy Prize has the potential to do for clean energy what Alfred Nobel did for science and peace.

Describing the UAE as a model for the future and Masdar its “crowning jewel,” Asif Ali Zardari, President of Pakistan, expressed confidence that the global community has the courage, dedication and commitment to “modify our environmental indifference.” He said innovation and conservation will reshape the energy map, highlighting the role of solar, wind and hydro energy. He stressed that failures in energy initiatives, such as ethanol from corn, should not discourage continued innovation and experimentation.

José Sócrates Carvalho Pinto de Sousa, Prime Minister, Portugal, called the Summit one of the most relevant forums in the world, adding that energy policies are key to addressing climate change and ensuring economic growth. He said Portugal has achieved success through industry reforms in renewable energy, electric mobility, and through energy efficiency and smart grid technologies. He emphasized that it is possible to make reforms and achieve results in a very short time.

Highlighting threats to biodiversity and development from climate change, Sheikh Hasina, Prime Minister, Bangladesh, said short-term interests should be overcome. She welcomed the opportunity to renew, at the WFES, the commitment to a green future. Hasina said that, despite its negligible contribution to greenhouse gas (GHG) emissions, Bangladesh is striving for a mixed balance of all energy sources and to be ultimately GHG-free.



HRH Princess Victoria of Sweden at the YFEL Pavilion.

Noting that energy challenges are too overwhelming to be addressed by countries individually, Nikoloz Gilauri, Prime Minister, Georgia, welcomed growing global consensus that energy security is deeply linked to diversifying energy sources. He observed that his country is gaining importance on the global energy map through increasing energy exports and transit capacity.

Crown Princess Victoria Ingrid Alice Désirée, Sweden, noted that natural resources are not inexhaustible, and underlined the importance of political will in addressing climate change and other environmental issues. She commended Masdar City as an example of global renewable energy solutions and mentioned that Sweden has the highest share of renewable energy in the EU. She said innovation in products, services and human capital will be necessary to meet long-term challenges but added that adopting appropriate lifestyles is also an important way to “cope” with finite resources.



Caio Koch-Weser, Vice Chairman, Deutsche Bank Group, United Kingdom



José Sócrates Carvalho Pinto de Sousa, Prime Minister, Portugal

resources.

Supporting a sustainable approach to the management of global resources, Prince Guillaume, Luxembourg, highlighted the right to energy access and the role energy policy can play in lifting people out of poverty. He said it was essential that developed countries honor their commitments to development aid and make progress towards achieving the MDGs.

SPECIAL ADDRESSES

Participants heard a number of special addresses on Monday afternoon. Caio Koch-Weser, Deutsche Bank Group, UK, welcomed renewed momentum to address climate change through developments in and around the Cancún UN Conference on Climate Change, highlighting: increased clarity on how to achieve US\$100 billion climate financing by 2020; developing countries taking the lead by providing biannual GHG inventories and creating domestic carbon markets, including in China and Brazil; and proposals for cooperation between the public and private sectors, in particular public-private climate funds.

Adnan Amin, Interim Director-General, International Renewable Energy Agency (IRENA), emphasized that the root causes of climate change and energy insecurity must be addressed now, and that there is no time to wait for top-down political processes. He suggested that energy supply would no longer be a zero-sum game if the existing potential for renewable energy were harnessed. He called on governments to: create enabling conditions for renewable energy investment;



Adnan Amin, Interim Director-General, IRENA



WORLD FUTURE ENERGY SUMMIT
 DHAHA 2011
WORLD FUTURE ENERGY SUMMIT
 UNFCCC Executive Secretary Christiana Figueres

stop subsidizing fossil fuels; and ensure that markets fully reflect the environmental costs of different energy sources. He underscored IRENA's goal to assist developing countries.

Christiana Figueres, Executive Secretary, UN Framework Convention on Climate Change (UNFCCC), said the Cancún UN Climate Conference opened the door to the era of low-carbon growth, but climate goals can only

be achieved through rapid scaling-up of renewable energy and energy efficiency technologies. She stressed that appropriate national policies must be created to operate in tandem with the international agreement.

Susan Hockfield, President, Massachusetts Institute of Technology (MIT), lamented that investments in climate protection have been sidelined in many countries due to anxiety about economic growth. She praised those countries that have stepped up efforts for clean technology research. She called for: massive increases in investment for renewable energy research, development and deployment; joint university-industry and government-industry partnerships; and cooperation between established energy companies and technology entrepreneurs.

Richard Newell, US Energy Information Administration, said fossil fuels will remain dominant in global energy use under expected market and policy trends. To change this trend, he emphasized efforts to spur innovation, including through: substantial and sustained support for research and development; policy signals to create rapidly growing demand for new technologies; and regulation for vibrant and competitive private sectors.

Peter Voser, CEO, Royal Dutch Shell, the Netherlands, said there is no time to wait for international agreements as trillions of dollars need to be invested in the next years to deliver energy with low environmental costs. He highlighted energy efficiency, natural gas, carbon capture and storage (CCS), and biofuels as areas for quick short-term and cheap emission reductions on which industries should focus, and for which governments should provide incentives.

Nobuo Tanaka, Executive Director, International Energy Agency (IEA), recalled that the IEA was created in response to the 1973 oil shock, and said current high oil prices could be a burden for economic recovery. Tanaka said, politically speaking, climate change mitigation means "doing something for someone else," while energy security means "doing something for yourself," and suggested framing the mitigation discourse in terms of energy security. He emphasized the need

for energy efficiency, decarbonizing the power sector through renewables, nuclear and CCS, and decarbonizing transportation.

MINISTERIAL PANELS

On Monday afternoon, Robin Niblett, Director, Chatham House, UK, chaired three ministerial panels on energy policy challenges at the national and international level.

What Are the Principal Energy Challenges Facing National Governments?:

In this panel, Wu Yin, Deputy Minister for Energy, China, said the main challenges for his country are: the large volume of energy use, despite *per capita* consumption being far lower than the global average; the high share of coal in primary energy use; the need for domestic energy transportation from the north-west to the south-east, which is met by railway transportation and new electricity grids; and the low level of energy efficiency compared to most developed countries.

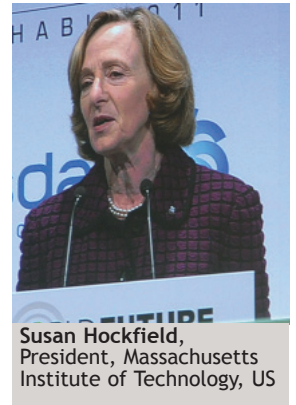
Farooq Abdullah, Minister of New and Renewable Energy, India, said 40% of the people in his country have no access to modern energy. He stressed the need for technology transfer to be made easier. Abdullah underscored the benefits from renewables for rural development, including access to water and education.

Amina Benkhadra, Minister of Energy, Mines, Water and Environment, Morocco, underscored the economic growth of her country, noting that energy demand will double by 2020 and triple by 2030. Benkhadra highlighted Morocco's new strategy on renewable energy and energy efficiency, including proposed legislation to promote private investment.

Gregory Barker, Minister of State for Energy and Climate Change, UK, emphasized the energy challenge faced by the UK, with declining oil fields in the North Sea, aging nuclear plants, and limits on coal due to climate change. He highlighted offshore wind power and CCS, and noted the UK energy system requires an investment of £100-200 billion within the next two decades.

Patxi López, President of the Basque Country, Spain, outlined the Basque Country strategy to reduce energy consumption, increase investment in renewables, and use green investment to generate wealth and employment. He stressed Basque leadership in windpower, solar thermoelectric energy and wave technology.

Louis Seck, Minister of Renewable Energy, Senegal, stressed the huge, unrealized potential for renewables in Senegal. He underlined the importance of international and bilateral cooperation, and emphasized public-private



WORLD FUTURE ENERGY SUMMIT
 Susan Hockfield, President, Massachusetts Institute of Technology, US



PaL-R: Jürgen Becker, State Secretary, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany; Eamon Ryan, Minister for Communications, Energy and Natural Resources, Ireland; Robin Niblett, Director, Chatham House; and Young-June Park, Vice Minister, Republic of Korea



L-R: Paavo Väyrynen, Minister of Trade and Development, Finland; Iris Evans, Alberta's Minister of International and Intergovernmental Relations, Canada; Per Rune Henriksen, State Secretary, Ministry of Petroleum and Energy, Norway; Robin Niblett, Director, Chatham House; Fabrizio Hernández, State Secretary of Energy, Spain; and Walter Steinmann, Director, Federal Office of Energy, Switzerland

partnerships. Seck noted Senegal's dedicated renewable energy ministry and his country's target of 15% renewable energy by 2020.

How Are National Governments Coping with Energy Challenges?: In this panel, Thomas Egebo, Permanent Secretary of State, Ministry of Climate and Energy, Denmark, said his country seeks to achieve 100% renewable energy supply by 2050, and that main investments will go to offshore wind power, biomass, large-scale geothermal plants, and the energy grid.

Jürgen Becker, State Secretary, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany, emphasized that gas is the fossil fuel most difficult to replace and most compatible with renewable energy use.

Eamon Ryan, Minister for Communications, Energy, and Natural Resources, Ireland, emphasized the importance of grids, saying that their development is key to using renewable energy sources. He also referenced the need to use fossil fuels as a "saline drip" during the transition to renewables, and said that building transmission grids between countries is "fundamental."

Noting that his country's energy mix is heavily based on energy imports, Young-June Park, Vice-Minister for Trade and Energy, Republic of Korea, described policies used to help his country achieve domestic energy targets. He outlined policies in the Republic of Korea intended to increase the use of renewables and nuclear power.

José António Vieira da Silva, Minister of Economy, Innovation and Development, Portugal, described his country's efforts in energy efficiency, renewables and taking a well-balanced and integrated approach to the energy system. He said Portugal has nearly met its goal to achieve 60% of its electricity from renewables, and emphasized the role of changing consumer behavior in this success.

Daniel Johansson, State Secretary, Ministry of Enterprise, Energy and Communications, Sweden, said it is important to acknowledge the cost of GHG emissions. He said benefits of a carbon tax include lower energy costs and support for renewable energies, and noted that excessive natural gas subsidies reduce market competitiveness of renewables.

What are the Most Promising Areas for International Cooperation in Solving Future Energy Challenges?: In this panel, Paavo Väyrynen, Minister for Foreign Trade and Development, Finland, highlighted the EU's policies for promoting sustainable development. He said the World Trade Organization has some concerns about how to best promote renewable energy under the auspices of free trade.

Providing a perspective from an energy-producing country, Iris Evans, Alberta's Minister of International and Intergovernmental Relations, Canada, highlighted cross-border commitments on energy and the value of collaboration among governments, corporations and academic institutions on, among other things, CCS. She noted that shifts to renewable energy are not always driven by price concerns, but also by environmental responsibility.

Per Rune Henriksen, State Secretary, Ministry of Petroleum and Energy, Norway, encouraged participants not to distinguish between producer and consumer countries, but instead to consider global challenges of energy, climate and poverty. He stressed the importance of energy access for poverty alleviation, and the need for an international agreement on carbon pricing.

Fabrizio Hernández, Secretary of State for Energy, Spain, listed key areas where international cooperation is needed, including: market integration; technology transfer and sharing; energy efficiency; and regulatory frameworks. On the introduction of renewables, Hernández noted the need for agreement on the definition of property rights and appropriate terms of access in technology transfers.

Commenting on areas for regional and international cooperation, Walter Steinmann, Director, Federal Office of Energy, Switzerland, stressed the importance of common standards on energy efficiency for appliances.

BUSINESS LEADERS IN RENEWABLE ENERGY

This plenary session convened on Tuesday morning, and was chaired by Errol Barnett, CNN International, US.



Pavilion of the Ministry of Foreign Affairs, United Arab Emirates



Olafur Ragnar Grimsson, President of Iceland

Keynote speaker Truman Semans, Principal, GreenOrder, US, and former Executive Committee Member, US Climate Action Partnership (USCAP), said we are entering an age of “radical transparency,” characterized by: “private regulation,” in which supply chains

must reveal information regarding production practices; increasing transparency of government actions; and software breakthroughs that can improve decision-making processes. He contrasted the traditional model of interaction among business, government and civil society, typified by defensive actions and silo mentality, with examples of innovative engagement from USCAP, Brazil’s National Alcohol Programme (Pró-Álcool) and Masdar.

Tilman Krauch, President, Construction Chemicals BASF SE, Germany, underscored the importance of addressing energy efficiency in buildings, suggesting that chemical companies like BASF can contribute innovations in the production of materials such as cement to reduce emissions.

Dominic Emery, BP Alternative Energy, said BP is heartened by recent price reductions for solar products, making them more competitive. He stressed BP’s investment of \$500 million per year in renewables over the last five years, and said he expects to increase this in 2011.

Tom Curtis, Managing Director, Deutsche Asset Management, US, said trillions of dollars of private capital need to be invested in clean energy in the coming decades. He suggested that governments can make a difference by putting in place policies to mitigate risks and give guarantees, highlighting success in Germany and China with feed-in tariffs.

Questioned on why an oil-producing country or company should be concerned with renewable energy, Arnaud Chaperon, Total, France, said Total wants to transition from an oil and gas company to an energy company, which means increasing its emphasis on renewables over the next two-to-three decades.

Andrew Beebe, Suntech Power, US, said solar companies have created a large market and proven that they are ready for large-scale investments. He projected that 50% of production could come from solar power by the end of the 21st century.

Jean-Pascal Tricoire, President and CEO, Schneider Electric, France, lamented the lack of educational programmes to train students on new energy technologies. He said digital energy management is particularly important for reducing energy peaks, and added that this relies on improved measurement, automation of services and connection to smart grids.

René Umlauf, CEO Renewable Energy, Siemens, Germany, said transmission lines and types of energy storage are important for increasing the market share of renewables. He added that hydropower and hydrogen offer potential conservation opportunities for the future, and that geothermal energy can also be a competitive future industry.

Artem Volynets, CEO, EN+ Group, Russian Federation, said China’s energy demand could be met through non-coal sources if a proper transmission grid is created across eastern Siberia.

Philippe Joubert, Executive VP Alstom, France, described his company’s

investment in wind, solar and hydropower and emphasized the need to invest in CCS and energy efficiency.

Frank Wouters, Director, Masdar Power, UAE, said the Masdar Institute will focus on educating a new generation of energy decision-makers and described Masdar’s global efforts to support growth in the renewable energy industry. Wouters said developing countries are a great place to start new energy initiatives even if they do not have an existing energy infrastructure because they can leapfrog the delays incurred in reforming older systems.

Ditlev Engel, Global CEO, Vestas, Denmark, said the financial crisis forces short-term policies on long-term issues. Emphasizing the role of the consumer, he announced the launch of a new collaboration with WWF and others to produce “WindMade,” a consumer label that allows consumers to independently reduce their carbon use by choosing products produced with wind power.

TECHNOLOGY LEADERS IN RENEWABLE ENERGY

Balu Balagopal, Boston Consulting Group (BCG), US, chaired this panel discussion on Wednesday morning.

Keynote speaker Sara Ortwein, ExxonMobil, US, emphasized the importance of high-level leadership in Abu Dhabi’s efforts to address environmental problems. She discussed future technologies for increasing oil and natural gas extraction, and emphasized new technologies for extended-reach drilling. She also highlighted Exxon’s research efforts to develop algae biofuel, and said the industry needs to focus on continuous innovation and safety.

Keynote speaker Mark Vachon, GE ecomagination, US, said clean energy remains a growth industry, leadership should take place through innovation and faster results can be accomplished through partnerships. He cautioned that waiting for government policy to drive innovation is a failed strategy, and said companies need to lead, particularly through demonstration projects. As a focus for further innovation, he prioritized, *inter alia*, internal combustion engines and energy efficiency.

Pascal Brosset, Schneider Electric, France, highlighted the benefits of energy efficiency, noting that, due to transmission inefficiencies, one megawatt (MW) of power saved represents three MWs that do not need to be produced. He highlighted, *inter alia*: the need to address the integration of renewables into the power grid; demand management; modes of collaboration; the lack of standards; and the importance of stability in regulations and incentives.



René Umlauf, CEO Renewable Energy, Siemens, Germany



L-R: Pascal Brosset, Schneider Electric, France; Francesco Sessa, Enel Distribuzione SpA, Italy; Bjørn Haugland, Det Norske Veritas, Norway; Balu Balagopal, Boston Consulting Group, US; Amr Salem, Cisco, UAE; Ernest Moniz, Massachusetts Institute of Technology (MIT); Hervé Touati, E.ON, Germany; and Peter Vanacker, Bayer MaterialScience, Germany

Francesco Sessa, Enel Distribuzione SpA, Italy, described the technological needs of his company's projects on workforce management, e-mobility and a lamp system. Bjørn K. Haugland, Det Norske Veritas (DNV), Norway, said barriers to the adoption of new technologies should be examined, including the need for training, education and capacity building. He noted that the Clean Development Mechanism (CDM) is a system for technology transfer and finance that should be further developed. He suggested focusing attention on fossil fuel subsidies, carbon pricing and CCS.

Amr Salem, Cisco, UAE, said the focus has been on consumption and production but not distribution, with the latter representing an area in which efficiencies should be pursued. Ernest Moniz, MIT, said the "door was closed" for a "coherent" carbon pricing strategy, and explained that moving forward without that policy would require: large-scale efficiency advances; substituting natural gas for coal; and paving the way for low-carbon, cost-effective technologies to be scaled-up in the future without subsidies. He added that it is important to increase natural gas science and sources and to improve battery cost per kilowatt hour. He said that CCS is the hardest and most economically unrealistic of technological innovations to achieve in the short-term without a subsidy.

Hervé Touati, E.ON, Germany, highlighted the importance of focusing on costs, noting the value of innovations to bring renewables from the "boutique" to the industry level. He advised harmonizing data standards to "industrialize" innovation capacity. Peter Vanacker, BayerMaterial Science, Germany, described his company's reductions in energy consumption and discussed, among other things, environmental and social benefits, improving building efficiency, the need for combined efforts and a combination of technologies.

During the discussion, Balagopal suggested focusing on the barriers to adoption of new, cost-effective technologies and their "disruptive" potential. He said numerous technologies are moving down the cost curve faster than many had anticipated, leaving barriers to adoption, such as the necessary infrastructure for cost-competitive biofuels and solar energy, as the main issue. Other speakers emphasized: enhancing consumer awareness of the impact of personal actions by using information technology; advances in battery research; and the need to factor in the price of managing intermittency and the need for back-up generation that accompanies some new energy sources.

FINANCE LEADERS IN RENEWABLE ENERGY

This session was convened on Thursday morning and chaired by Michael Liebreich, Chairman and CEO, Bloomberg New Energy Finance, UK.

Keynote Speaker Fatih Birol, IEA, emphasized that the framework for renewable energy development is the world energy system, and in this context, he underscored that: demand growth is mainly driven by China, where economic and population growth are legitimate drivers of energy use, but fossil fuel subsidies lead to inefficiencies; the relative costs of oil imports have risen sharply in the EU, US and Japan, and will remain high given oil price projections; subsidies required for renewable energies are expected to rise, but costs of clean energy will strongly decrease; and recent climate policies can make a difference, but fall short of what is needed.

Nicholas Stern, London School of Economics, said a new industrial revolution is required, noted that the last five industrial revolutions have been dynamic, creative periods, and said this revolution will be different from past ones because it needs to be led by public policy. He said the Stern Report underestimated the risks of climate change and the attractiveness and co-benefits of investment to address it.

Morgan Bazilian, United Nations Industrial Development Organization (UNIDO), recalled that the UN Secretary-General's High-level Energy and Climate Change Advisory Group developed recommendations regarding universal access to energy and energy efficiency. He suggested that approaching energy issues from a national security perspective will provide an impetus to national policy making.

Kenneth Bateman, National Energy Board of Canada, discussed the perspective of and challenges for regulators, who, he said, struggle to introduce the right mechanisms to produce the incentives and price signals needed to bring about the desired outcome.

Rob Bradley, Ministry of Foreign Affairs (MOFA), UAE, said the Middle East is attractive for renewables due to resource availability, vital energy needs, and strong political will to encourage clean technology industries. He also addressed carbon finance as the "great unknown," lamenting that strong ambition on the supply side is not met by sufficient effort to strengthen demand.



Morgan Bazilian, UN Industrial Development Organisation (UNIDO)



Chair Kirsty Hamilton, Chatham House, UK

Frank Beckers, Deutsche Bank, UAE, said that, while sufficient proven clean technologies exist to scale-up supply, new technologies that are also needed will only scale-up if political frameworks and subsidies allow returns that justify investor risks. On the acceptability of subsidies, he noted that there is no alternative

to investors and project developers making money, but that returns should not be too high.

Alex O’Cinneide, Masdar Capital, UAE, lamented that policy makers do not get investment frameworks right, and innovators consequently are not paid for innovations.

INTERNATIONAL POLICY – LEVERAGING GLOBAL FINANCE TO FUND DEVELOPMENT

Kirsty Hamilton, Chatham House, UK, moderated this session on Thursday afternoon.

Shane Tomlinson, E3G, UK, said that while the mechanisms agreed in Cancún provide ways to tackle key issues, implementing details will affect whether they properly mobilize capital. He called for: facilitating more public-private partnerships; changing outdated policy thinking about technology flows; and building a business perspective into policy.

Rupert Edwards, Climate Change Capital, UK, said international climate finance mechanisms are only emerging and pledges remain uncertain. He emphasized that reducing emissions entails costs that have to be paid for, and that private investors want to know how these are met before investing capital.

Paul Curnow, Baker & McKenzie, Australia, observed that attracting renewable energy investment is not a capital shortage problem, but depends on investment conditions. He

recommended: “long, loud and legal” policy frameworks; domestic frameworks compliant with international policies; and public finance that leverages private money instead of competing with it.

Pedro Marin, former Secretary of State for Energy, Spain, listed several reasons why renewable energies are particularly appropriate for developing countries. He called for assessing how the international context can help to scale-up renewables deployment.

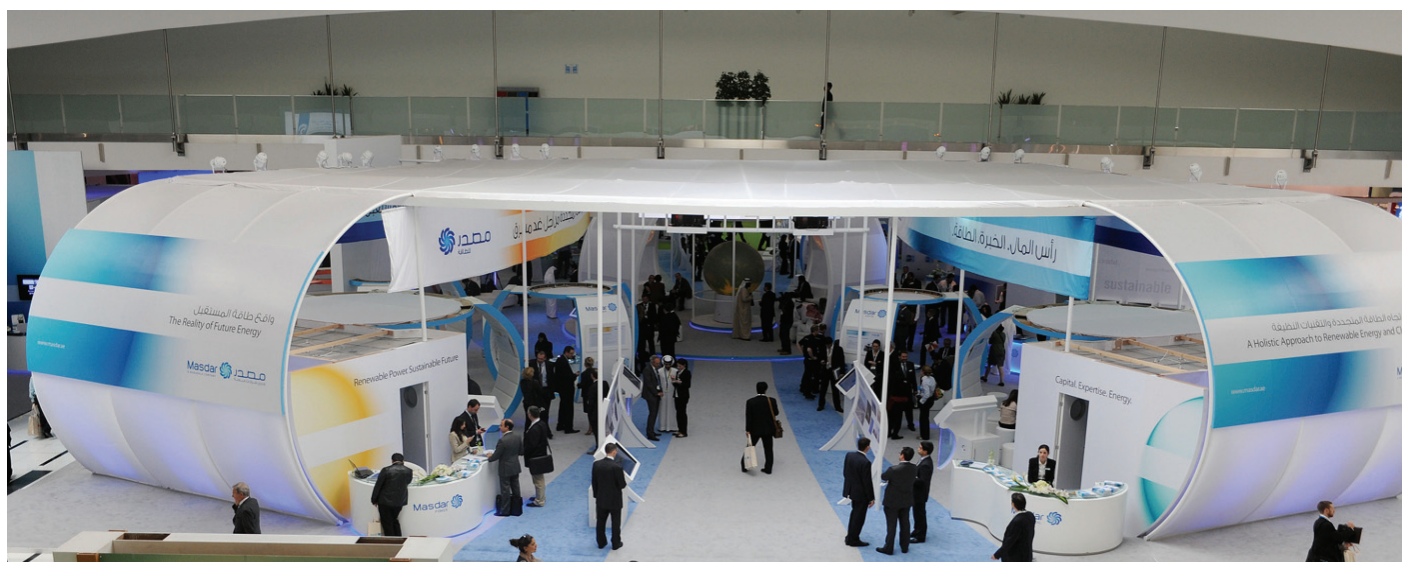
Christine Eibs Singer, CEO, E+Co, US, addressed the “missing middle” in developing country finance. To quicken technological implementation and make human capital sufficient, she said markets must have: a policy environment that does not “attack” entrepreneurs; availability of risk capital from a foundation or government; and a strong businesses sector.

Panelists identified priorities such as: preparing emerging markets to handle funding in a broad or sectoral way instead of project-by-project; having a price for externalities; scaling up start-up-funds; developing an underwriting mechanism for carbon that goes beyond the Organization for Economic Cooperation and Development (OECD) need for offsets; more information and capacity building at all levels; further development of renewable energy technologies to give them correct scale and affordability; more focus on the scale and speed at which funds are distributed; and being more innovative in thinking about public finance and private capital use.

CLOSING CEREMONY

In the closing ceremony on Thursday afternoon, Virginia Sonntag-O’Brien, Executive Secretary Renewable Energy Policy Network for the 21st Century (REN21), invited speakers from the business, technology and finance themes to reflect on the Summit, and to offer suggestions for WFES 2012 given potential future directions in renewable energy.

Eicke Weber, Director, Fraunhofer-Institut für Solare Energiesysteme (ISE), Germany, said the WFES shifts discussions on emissions reductions in a positive direction, by highlighting the potential to increase renewables in the



Masdar Pavilion at WFES

global energy mix. He praised participants for the enthusiasm demonstrated at the meeting, but advised them not to lose sight of the continued work needed, particularly in policy.

David Hart, Director, E4tech, Switzerland, identified uncertainty and complexity as common issues across the sessions, and stressed that vision is required to address the challenges. He pointed to the need for new business models, partnerships and policy support to enable the necessary risk-taking, and encouraged the next WFES to hold sessions that integrate policy, technology, finance and business themes.

Kirsty Hamilton, Chatham House, UK, called for: stronger reflection of diverse country conditions when planning energy policies; identification of best practices from other sectors; and clarification of the terms of the debate, suggesting that people refer to different things when they talk about climate finance.

Sonntag-O'Brien then thanked participants and delegates for their attendance and closed WFES at 3:54pm.

PARALLEL SESSIONS

Parallel sessions took place on Tuesday and Wednesday morning and afternoon, and on Thursday afternoon. In the following summary, parallel sessions are organized based on the conference themes.

INTERNATIONAL FUTURE ENERGY POLICY

Global Energy Policy – How Policy Is Being Implemented in Developed and Developing Nations:

Rakesh Radhakrishnan, Navigant Consulting, US, chaired this parallel session on Tuesday morning. Mohammed Al Ta'ani, Jordanian Renewable Energy Society, emphasized the importance of incentivizing behavioral changes at the individual and organizational levels through awareness raising and technology transfer in Arabic countries. He called on countries to increase research on their individual future energy needs and how these can be met by renewable energies, and to develop human capital and practical solutions by strengthening universities and research institutes.

Ibrahim Oweiss, Georgetown University, Qatar, said while nuclear power remains an option and some countries have done a good job of handling both waste and proliferation, the most important future challenge is to harness the energy potential of the sun, suggesting that advanced technology is already there but saying that it remains crucial to invest in further research.

Paul van Son, CEO, Desertec Industrial Initiative, said countries must develop instruments to implement energy visions and policies, and suggested that a lot of experience exists throughout countries on measures to incentivize renewable energies. He also emphasized that subsidies for fossil fuels and nuclear power remain in many countries, and that some of these are hidden, resulting in the need for higher

incentives for renewable energies, and ultimately threatening the overall objective of lowering the cost of renewable energy production.

Virginia Sonntag-O'Brien, Executive Secretary, REN21, highlighted the strong link between incentive policies and the development of renewable energies, suggesting that investment and regulation reinforce each other in a feedback loop. She emphasized that energy policies must provide long-term stability and implementability, and must be embedded in the entire energy-planning context. She also urged for renewable energies to play an important role in providing energy access to the poor, to avoid lock-in on high emission paths once their wealth increases.

Transforming International Policy and Strategy into Real Business Opportunities:

Tom Curtis, Deutsche Asset Management, US, chaired this session on Tuesday afternoon.

Observing that the growth of renewable energies is always linked to policies, but that countries use different measures, Neil Auerbach, Hudson Clean Energy Partners, US, recommended analyzing domestic resources and potentials as a starting point for designing policies, suggesting there is no scarcity in capital or technology provision.

Peter Sharratt, WSP Group, UK, said the main challenge is to de-risk top-down policies as many developments depend on a single subsidy, highlighting the political and legal framework that underlies the Kyoto Protocol targets in the EU. He called for policies to kick-start a transformative change of markets and overcome "subsidy policy farming." Siobhan Smyth, HSBC, UK, compared renewable energy policies from an investor's perspective, and suggested that affordability of these policies for developing countries depends on how appropriate the technology is for the respective market. She recommended increased collective action among developing countries.

Noting that the optimal timing of a technology investment depends on how quickly its costs decline, Jürgen Weiss, The Brattle Group, US, recommended that policy makers consider subsidies for research and development as an alternative to subsidizing deployment of technologies with sharply declining costs. He also suggested considering the level of support for deployment needed to start a learning process that will drive down costs.

FINANCING FUTURE ENERGY



L-R: Paul van Son, CEO, Desertec Industrial Initiative; Rakesh Radhakrishnan, Navigant, US; Virginia Sonntag-O'Brien, Executive Secretary, REN21; Mohammed Al-ta'ani, Jordanian Renewable Energy Society; and Ibrahim Oweiss, Georgetown University, Qatar



Cynthia Cannady,
IP*SEVA, US

Patents and R&D Collaborations in New Energy Technologies: Critical Tools for International Competitiveness: Saleh Al Shunnar, Centre for British Teachers for Education, UAE, chaired this parallel session on Thursday morning. He said having an intellectual property (IP) strategy is the single most important aspect for a country's investment climate and future. Bertram Huber, Intellectual Property for Sustainable

Energy Ventures (IP*SEVA), Germany, explained what patents are, how they apply to energy technology products and processes and how to align patents and IP in business strategy.

Referencing the "Patents and Clean Energy: Bridging the Gap Between Evidence and Policy" report produced by the European Patent Office, the UN Environment Programme, and the International Centre for Trade and Sustainable Development, Heinz Goddar, Boehmert and Boehmert, Germany, discussed the role of patents in the transfer of clean energy technology. He described energy technology patents that have been filed and identified the key global energy patent-holders. He emphasized that patent growth is: highest for solar photovoltaic (PV) and wind; steady for hydro/marine electricity; dramatically increasing for biofuels; and still in decline for CCS.

Cynthia Cannady, IP*SEVA, US, discussed the importance of patents in research and development (R&D) and in collaborations. She gave examples of agreements for different patented energy technologies, underlining that collaborations in R&D are ubiquitous and that patent ownership is growing dramatically in a number of green technology fields. She said business IP strategy should be developed to foster continuous innovation and outlined the IP*SEVA model for green technology IP strategy collaboration.

The Challenges for Venture Capitalists in Clean Tech Investing: Gil Forer, Ernst & Young, US, chaired this session on Thursday morning. He highlighted growth in clean energy investment, with US\$243 billion invested in 2010, and said that clean technology development cannot be sustained by venture capital, but must shift to private equity and other financial sponsors.

During the discussion, panelists considered, among other things: innovation in venture capital; regional differences in enabling environments; market conditions for initial public offerings; the need for "risk adequate returns"; the extension of the innovation cycle and length of holding periods in the clean technology sector; and regulatory incentives. Panelists agreed on the need to distinguish between types of clean technologies.

Ralf Schnell, CEO Siemens Venture Capital, Germany, said the venture capital investment model remains unproven for clean technology, cautioning that its testing will require time. Ben Cotton, Earth Capital Partners, UK, highlighted the need to "bridge the gap" between venture capital and private equity in clean technology financing, noting the highly capital-intensive "proof of concept" stage in many clean technology projects. Describing the global financial system as "highly leveraged and highly risky," Tayeb Al Dajani, Atlas International Company, UK, highlighted characteristics of the Islamic banking system that he said could be beneficial for clean technology investment.



L-R: Bertram Huber, Intellectual Property for Sustainable Energy Ventures (IP*SEVA), Germany; Heinz Goddar, Boehmert & Boehmert, Germany; Cynthia Cannady, IP*SEVA, US; Chair Saleh Al Shunnar, Centre for British Teachers for Education, UAE

On technologies of note for 2011, Ennis Rimawi, Catalyst Private Equity, Jordan, encouraged a focus on practical and affordable technologies like solar and waste-heat driven systems. Karin Larsen Burns, Ambata Capital Partners, US, advised clean technology entrepreneurs to consider not only technology, but also to develop viable business models and foster strong teams.

Innovation in Renewable Energy Financing: Dima Rifai, Paradigm Change Capital Partners, UK, chaired this session on Thursday morning. She described challenges for renewable energy financing, including putting in place appropriate investment frameworks, as markets and capital markets are constantly changing, and determining where different risks are located and who is taking them as the basis for distributing returns. Martin Billhardt, CEO, PNE WIND AG, Germany, observed the need for equity finance in the initial phase of developing wind projects, as it takes several years to receive debt finance. He added that it is crucial to understand the interests and risk profiles of investors and to eliminate as many financing risks as possible to attract debt financing.

Marie-Athena Papathanasiou, EMEA Sun Power, Switzerland, noted the pressure on companies to use innovative finance products due to strong movements in financial markets. She also described experience with a solar bond issued by her company, that attracted the interest of investment banks. Daniel Calderon, Masdar Power, UAE, explained that the vertical integration of Masdar for technology development allows different units, like technology developers and the venture capital element, to learn each others' needs. He added that the company meets its constant demand for finance by working with project and non-project finance companies.

Jules Kortenhorst, European Climate Foundation, the Netherlands, described financial challenges in developing policy plans for decarbonizing the EU's power sector and the African Renewable Initiative. He recommended that governments address the political, regulatory and currency risk of investors, and suggested that R&D for innovative financing should come from the financial sector rather than project developers.

SOLAR ENERGY

New Innovations in Solar Technology: In this panel on Wednesday morning, Chair Eicke Weber, Fraunhofer-Institut für Solare Energiesysteme (ISE), said that recent annual PV installation has increased exponentially but that greater automation, larger market production and new technologies are still needed. Milton Venetos, AREVA Solar, US, described new technology developments in concentrated solar power (CSP). He said Fresnel technology has grown steadily in recent years. On superheated steam generation, he described a solar project



Michael Geyer, Abengoa Solar, Spain

in California designed to reach up to 482 degrees Celsius of heat.

Michael Geyer, Abengoa Solar, Spain, described Abengoa's success in bringing CSP plants to operation, noting one integrated solar plant of 450 MW, which is the largest in Africa. He stated that CSP technology

should be market-competitive by 2025. Jorge Unda, SENER, Spain, outlined SENER's work on different thermal energy storage techniques, cost reduction strategies, and the status of, and vision for, technology for molten salt solar towers. He said the solar park in Abu Dhabi is effective in advancing energy technology.

Christophe Desrumaux, Concentrix-Soitec, Germany, discussed materials for solar power engineering and highlighted structural models for PV cells. He explained Concentrix-Soitec's latest projects and partnerships that have made significant advances in solar efficiency. Jos van der Hyden, First Solar, US, thanked Vestas for sharing the winnings from the Zayed Future Energy Prize (see final section of this report), and announced that First Solar will use the money to provide energy to low-income communities. He described advances in large-scale PV technology and manufacturing, and discussed different plant capacities around the world.

Case Studies – Key Solar Projects Around the Globe:

Chair Fernando Oliveros, Oliver Wyman, Spain, said this session on Wednesday afternoon would focus on large-scale solar projects. Olaf Goebel, Masdar Power, UAE, spoke on the Shams One solar trough project in the UAE, which is supported 60% by Masdar and 40% by Abengoa of Spain and Total of France.

Sami Khoreibi, CEO, Enviromena Power Systems, UAE, reported on the largest grid-connected solar plant in the Middle East and North Africa, located in Masdar City, producing 17,500 MW-hours of electricity per year. He underlined their development of a dry brush maintenance method that does not rely on water, calling it an important technology for water-scarce areas.



ISD stand within the International Renewable Energy Agency (IRENA) pavilion

Wolfgang Knothe, CEO, Flagsol, Germany, presented on the Andasol CSP projects in Spain, and described molten salt and other solar thermal technologies. Robert Seiter, Ernst & Young, Germany, discussed the country attractiveness index methodology, which evaluates regulatory and financial infrastructure and the technological parameters for different renewables. He also presented on the PV value chain and the cost breakdown of CSP plants. Paul van Son, CEO, Desertec, emphasized the large potential of renewables and underlined the importance of power grid interconnectivity. He also discussed Desertec's work with governments.

GREEN CITIES

Green Cities: Planning and Infrastructure for

Sustainable Communities: Moderator Daniel Vermeer, Duke University, chaired this session on Tuesday morning. He asked what lessons about sustainable urban design are emerging and how broadly they apply. Susan Roaf, Heriot Watt University, UK, outlined the many challenges facing cities, cautioning that producing "green" buildings is not enough to produce sustainable cities. She stressed that the building choices made now will profoundly influence cities' futures.

Nick Pennell, Booz & Company, Germany, explained that the "Reinventing the City" study found that success relies on the prerequisites of aggressive goals and best practice planning, innovative financing and use of the latest technologies, and on three implementing factors: a focus on livability; the relevance to local conditions; and a long-term perspective. Clay Nesler, Johnson Controls, US, described the effort to retrofit New York's Empire State Building with a model that he said can be replicated elsewhere. He explained that the project resulted in a 38% energy reduction and an investment payback in 3.1 years.

Thomas Braig, Bayer Material Science, Germany, described the EcoCommercial Building Initiative, a network of companies trying to achieve zero-emission buildings through an integrated approach involving choices in design, materials, building technology and use of renewable energy. Alan Frost, Director, Masdar City, reported on challenges in building Masdar City, including how difficulties in system integration and implementation have forced design changes.

SUSTAINABLE BUILDINGS

Case Studies – Green Buildings Shaping Our Physical

Environment: Husam Al Waer, University of Dundee, UK, chaired this parallel session on Tuesday afternoon. He emphasized that producing green buildings is not enough to produce sustainable cities. He said a focus on creating green infrastructure and sustainable communities is necessary. Afshin Afshari, Masdar City, UAE, discussed the challenges to applying the zero-energy building concept in hot, humid climates. He particularly stressed the challenges for regulating energy loads not related to illumination or space heating and cooling, also known as "plug and process" loads, noting most countries have yet to address this issue.. Kentaro Kawaguchi, Mitsubishi Heavy Industries, Japan, described the Eco Sky House project of "smart community housing" developed in Japan and outlined how it might be applied to the Middle East.

Mili Majumdar, The Energy Resources Institute (TERI), India, discussed the challenges for sustainable architecture in India, and the policy and programme responses taken, with an emphasis on the building rating system developed by TERI and now adopted by the Indian Government. Susan Roaf, Heriot

Watt University, UK, described the evolution and achievements of the Solar Cities movement, which she said has, among other things, led to the solar ordinance in Spain and mandatory solar water heating in China.

Matthew Plumbridge, Department of Municipal Affairs, Abu Dhabi, explained how his department is attempting to promote sustainable building through the adoption of a series of building codes, leading to an integrated green construction code including energy conservation, building and plumbing.

Master Class – The Economics of Green Buildings:

Calculating the Cost and the Value: Mili Majumdar, TERI, India, introduced this session, held on Tuesday afternoon, explaining the aim of providing tools to demonstrate that green buildings “make economic sense.” She identified barriers to green buildings, such as the perception of high incremental costs, lack of knowledge to carry out life cycle cost-benefit analyses and the absence of integrated design approaches.

Priyanka Kochhar, TERI, India, presented the results of a study comparing conventional and green-rated buildings in India, based on a model that considers the life-cycle of buildings. She outlined the study methodology, noting its consideration of discount rates, inflation and escalation costs. Presenting detailed spreadsheet calculations, she noted the model could be adapted to conduct similar assessments of buildings in other regions, and stressed that the findings reveal that green buildings have lower life cycle costs than conventional buildings.



Matthew Plumbridge, Department of Municipal Affairs, Abu Dhabi, UAE

Participants watched a video on India’s green

building certification system, “Green Rating for Integrated Habitat Assessment” (GRIHA), and Majumdar described a case study of a green building, highlighting energy efficiency improvements through passive design. In discussions, participants asked, among other things: for further details on the specifics of the case study buildings; clarification of study methodology and model parameters; and the distinctions between GRIHA and other green building certification systems.

WIND ENERGY

What’s Next For the Wind Industry?: Steve Sawyer, Secretary General, Global Wind Energy Council (GWEC), chaired this parallel session on Tuesday afternoon. He challenged panelists to identify strategies to move wind from the current 2% of global electricity supply to 20% or more. Alfonso Faubel, Alstom Wind, Spain, identified operating flexibility and integration of wind energy into the grid as two major industry challenges. Peter Jørgensen, Energinet.DK, Denmark, suggested large transmission grids could balance energy sources to compensate for fluctuating energy sources, noting this would require international coordination.

Ashok D’sa, Suzlon Energy, India, highlighted the need for industry and governments to work in concert to unlock markets for wind, and emphasized bottom-up change. Morten Albæk, Vestas, Denmark, advised creating alliances with consumers to increase access to wind energy. He stressed the need to consider the social costs of energy.



L-R: Mili Majumdar and Priyanka Kochhar, TERI, India

Panelists discussed, *inter alia*: energy predictability and price; innovation and competition as drivers of cost reductions; feed-in tariffs and green certificates; and the potential impact of climate change on wind power generation.

BIOFUELS

Biofuels: Finally Delivering on the Early Potential?:

Jeremy Woods, Imperial College, UK, chaired this session on Wednesday morning. He noted the controversy around the issue of biofuels. He listed questions for panelists to consider, including on the “food versus fuel” debate and competition between biomass for transport, heat, electricity and other uses. He said the central question is “do we need biofuels?”

Wes Bolsen, Coskata Inc., US, presented his company’s work on “Flex Ethanol,” a cellulosic biofuel technology for producing fuel-grade ethanol from a variety of input materials. He emphasized that the process can utilize non-grain inputs. Ian O’Gara, Accenture, UK, highlighted Accenture’s work on “disruptive technologies” in the transport sector. He predicted changes over the next five years in the transport fuel market, suggesting it will become increasingly diverse and competitive.

Gregory Stephanopoulos, MIT, noted that terms such as “first generation,” “second generation,” and “advanced biofuels” are often used inconsistently. He stressed the world cannot afford to “throw away the potential of biomass” for producing fuel. Arnaldo Walter, State University of Campinas, agreed that biofuels are needed, and said first generation biofuels will be part of the solution. He underscored the need to diversify biomass sources and products, highlighting options such as electricity co-generation.

In the discussion, panelists further considered food security concerns, and the potential positive impacts of biofuels in providing local fuels for agriculture. Participants also discussed, *inter alia*, growing energy demands in emerging economies and assessing indirect land use change and environmental impacts from oil.

E-MOBILITY

e-Mobility – on the Cusp of Deployment: Pierre Loing,

Nissan International, Switzerland, chaired this session on Tuesday afternoon. Shunichi Miyanaga, Mitsubishi Heavy Industries, Japan, stressed the need for advanced energy management systems, and said information and communication technologies



Peter Jørgensen, Energinet.DK, Denmark

(ICT) will play a big role in optimization of demand-side management. He stressed that we are at the starting point of the e-mobility age.

Christine Van't Hull, City of Amsterdam, the Netherlands, outlined Amsterdam's strategy on e-mobility. She explained Amsterdam's goal to achieve 10,000 electric cars by 2015. She underscored the need for cooperation with car manufacturers and other cities, among others. Henrik Fisker, CEO, Fisker Automotive, US, conveyed the importance of maintaining the "fun" of driving in electric vehicles. He noted environmental concerns, energy security, government support and technology advancements as the drivers for consumer adoption.

Herbert Kohler, Daimler, Germany, predicted a dramatic increase in the output of electric vehicles in the coming years. He stressed that electric vehicles are based on two technologies: batteries and fuel cells. Paul Mulvaney, ESB eCars, Ireland, underscored the potential of smart electric cars for smart grids, highlighting possibilities for grid stabilization, peak reduction and reusing batteries for grid storage.

Robin Voogd, LeasePlan Emirates, UAE, noted the roles of the market, technology, government and driver's interest in realizing e-mobility plans. He said leasing companies like his represent a channel from manufacturers to large markets. Hiroshi Osawa, Mitsubishi Heavy Industries, Japan, explained Mitsubishi's vision for a low-carbon society with carbon-free energy, innovative transport systems and high-efficiency power generation. He stressed the need to shift to highly integrated energy systems.

ENERGY EDUCATION AND INNOVATION

Future Energy Research and Education: Fred Moavenzadeh, President, Masdar Institute, chaired this session on Wednesday afternoon. On Abu Dhabi's strategy for developing a vibrant intellectual community, Rafic Zein Makki, Abu Dhabi Education Council, UAE, highlighted the need to develop a high-level policy agenda, online resources and libraries. He identified openness, appropriate IP regulations and frameworks, and attracting and retaining talented scientists as requisites for building R&D capacity.

On expediting the development of human capital, Peter Heath, Chancellor, American University of Sharjah, UAE, emphasized open, collegial dialogue among the university

leadership and understanding government and private sector priorities. He advised universities to remain true to their mission and not only focus on national priorities and strategies.

Wyatt Hume, Provost, UAE University, highlighted doctoral training as a missing element in expediting the development of the intellectual community. He also mentioned the lack of external, robust, competitively peer-reviewed funding as a missing element. Turning to challenges, Hume underscored maintaining the open culture of intellectual inquiry, and emphasized the need to move quickly in order to respond to commercial and public policy requirements.

On the role of universities in developing an intellectual community, Dan Johnson, Provost, Zayed University, UAE, noted the need for universities to support intellectual, cultural and religious understanding. He also discussed opportunities for universities to play a larger role in economic and social development, research and training.

ENERGY STORAGE

Energy Storage: Overcoming the Technology Challenges: In this session on Wednesday morning, Chair Ali Nourai, KEMA Consulting, US, noted that lowering storage costs requires developing less expensive storage technology and addressing the total "cost of ownership." He underscored desirable properties such as "plug'n play" technology independence, small unit size and lower voltage and said that storage locations, including for large bulk storage, should be close to the customer.

Gene Hunt, Beacon Power, US, stressed that flywheel technology has the potential to provide electricity storage capacity at the grid-scale level. He highlighted that the system's response time of four seconds is superior to fossil fuel plants taking up to five minutes, and can better respond to signals from energy operators, which can change every few seconds. He said market and regulatory reform present a central challenge, suggesting the creation of an energy storage regulatory category separate from energy generation.

Michael Lippert, SAFT Batteries, France, described three storage categories: central storage to balance seasonal and weekly fluctuations; grid-integrated systems to address daily and hourly variation and enable peak shaving; and end-user



L-R: Chair Jeremy Woods, Imperial College, UK; Ian O'Gara, Accenture, United Kingdom; and Wes Bolsen, Coskata, US



L-R: Dan Johnson, Provost, Zayed University; Wyatt Hume, United Arab Emirates University; Chair Fred Moavenzadeh, President, Masdar Institute, UAE; Peter Heath, Chancellor, American University Sharjah, UAE; and Rafic Zein Makki, Abu Dhabi Education Council

storage for daily variations. He said that while bulk energy storage is maturing, small- and medium-size energy storage is just now becoming available.

Akimichi Okimoto, NGK Co., Japan, introduced his company's battery energy storage system. He emphasized that the battery supports the application of renewable energies, and reduces carbon dioxide (CO₂) emissions by peak shaving within electricity grids, and can be used at generator and production sites, as well as at the household level.

ENERGY EFFICIENCY

Energy Efficiency – Carbon Reduction: Unlocking the Energy Efficiency Potential: Mohsen Khalil, Global Head, Climate Business Group, International Finance Corporation (IFC), chaired this session on Tuesday afternoon.

Hervé Touati, E.ON, Germany, said the question is why energy efficiency measures are not adopted. He highlighted three obstacles to adoption of energy efficiency technologies: imperfect information; upfront capital investments; and lack of stimulus. He said solutions include: raising consumer awareness; providing adapted financial tools; and providing government support for communications, targets and other actions.

Oliver Behrend, E.ON – Masdar Integrated Carbon, UAE, said barriers to energy efficiency adoption exist at the industry/project and government/policy levels. He said the price of energy is too low and the carbon market is not working. He highlighted that options such as education, energy service companies, technology providers and funding exist, but stated that they are fragmented and that the lack of an integrated approach is itself a barrier.

Clemens Wolters, Deutsche Babcock Middle East, UAE, presented a case study on potential efficiency measures for a German power plant, and concluded that: industry investments are driven by return on investment (ROI); feasibility assumptions with a ROI of eight or more years are not attractive to industry; and a realistic ROI below five years could lead to industry investments.

In the ensuing discussion, Touati emphasized the need for clear national policy, integrative thinking and a change in mindset, starting at the top. Behrend said energy subsidies create the wrong incentives and that adding energy efficiency subsidies would create complications. A participant asked whether a global financial mechanism like the CDM would be a good idea, and whether it should be implemented on a regional basis.

HYDROGEN

Hydrogen – How It Can Deliver as the Fuel of the Future: Nigel Brandon, Imperial College, chaired this panel on Wednesday afternoon, noting the session would address the continued challenges related to the production, distribution,

storage and conversion of hydrogen. Describing hydrogen as one of the few options for transport and storage of CO₂-free energy, Jurgen Louis, Shell, the Netherlands, projected that a future energy system could involve large-scale hydrogen storage with regional pipeline networks.

Katsuhiko Hirose, Toyota, Japan, described Toyota's commitment to fuel cell development, identifying costs and limited infrastructure as the main barriers to hydrogen-powered car deployment. He announced recent initiatives in Japan for the introduction of hydrogen fueling stations across the country. Herbert Kohler, Daimler, Germany, highlighted 2015 as the target year for Daimler in bringing hydrogen fuel cell cars to private customers, and noted efforts in Germany for providing the required infrastructure.

Jon Moore, Intelligent Energy, UK, called the shift to hydrogen vehicles "inevitable and imminent." He stressed that fuel cells can be used for most applications that are powered by internal combustion engines or batteries. David Hart, Director, E4tech, Switzerland, stated there are both challenges and opportunities for innovation in materials, design and implementation of hydrogen, and highlighted the need for renewed interest from policy-makers and investors.

Questions from the audience considered issues such as: synergies between hydrogen production and CCS; possibilities for producing hydrogen from renewables; competition between fuel cell and electric hybrid cars; circumstances under which hydrogen can provide storage options for intermittent renewable energy sources; and participation of the automotive industry in the WFES.

CCS

CCS: From Pilot to Implementation : Jeff Chapman, CEO, Carbon Capture and Storage Association, UK, chaired this session on Tuesday morning. Sherri Stuewer, ExxonMobil, US, provided an overview of three models for CCS: enhanced oil recovery (EOR); natural gas production; and CCS in the electricity sector. Bob Pegler, Global CCS Institute, France, presented on the current status of CCS deployment and highlighted his institution's role as a knowledge broker.



Hervé Touati, E.ON, Germany



L-R: Bernd Holling, Linde Group, Germany; John Barry, Shell International Upstream, UAE; Walid Fayad, Booz & Company, Middle East; Jeff Chapman, CEO, Carbon Capture and Storage Association, UK; Bob Pegler, Global CCS Institute, France; Sherri Stuewer, ExxonMobil, US; and Peter Brooks, Executive Director, Worley Parsons Energy Services, Australia

Peter Brooks, Executive Director, Worley Parsons, Australia, discussed challenges involved in developing a successful business case for CCS. He highlighted understanding the goal of CCS, political leadership, development and implementation of national CCS strategies, and underwriting of critical infrastructure as key elements for enhancing the deployment of CCS. Walid Fayad, Booz & Company, Middle East, presented the business case for CCS in the Gulf Cooperation Council, observing that EOR has the potential to significantly offset CCS costs.

Ghaniya Bin-Dhaer Al-Yafei, ADCO, UAE, discussed her country's experiences with CCS project implementation. John Barry, Shell International Upstream, UAE, highlighted key lessons for CCS deployment, emphasizing the need for urgency, funding, knowledge sharing, public acceptance and partnerships between government, industry and academia. Bernd Holling, Linde Group, Germany discussed his company's role in developing technologies for post-combustion capture of CO₂ from fossil-fuel power plants.

Kick-Starting a CCS Future – Overcoming the Regulatory and Financial Barriers: Bob Pegler, Global CCS Institute, France, chaired this session on Wednesday afternoon. Barbara Nance McKee, Department of Energy, US, highlighted obstacles and challenges to CCS, observing that: CCS costs are currently high; financial incentives are mostly transitional; legal and regulatory frameworks in many countries are absent; and public awareness and acceptance of CCS is limited.

Andrew Beatty, Baker & McKenzie, Australia, provided an overview of CCS project phases, including: planning; financing and contracting; construction; capture; transportation; and storage. On public-private partnerships, Jamie Carstairs, Linnfall Consulting, UK, observed that it would be some time before power generation incorporating CCS is viable,

and therefore government support is required. He noted that effective public-private partnership contracts will require clear understanding between policy-makers, agents, contractors and financiers, which takes time to build. He also underscored CCS under the CDM as a “game changer,” which would provide revenues for additional countries. Carstairs also noted that EOR can provide substantial additional revenues for CCS.

Masaki Iijima, Mitsubishi Heavy Industries, Japan, offered a technology provider perspective. He observed that development innovation and technology improvement would continue if the correct market signals are in place, which would lead to widespread commercial adoption of CCS. Observing that CCS is a prerequisite of the 450 parts per million (ppm) climate change scenario, Hermann Kremer, Siemens, Germany, explained that in order to reduce CO₂ emissions, power plants have to run at the highest possible efficiency. He emphasized the need for “best in the class” carbon capture technology, such as post-combustion.

SMART GRIDS

Smart Grids and Super Grids – the Key to Renewables Integration?: Philipp Gerbert, BCG, Germany, moderated this session on Wednesday afternoon. He provided a quick overview of why greater use of renewable energy, and the need to manage electricity demand and carbon emissions, is driving the move to smart grids. Frank Ackland, GE Energy Services, UAE, made the case for rapid smart grid deployment in the Middle East and discussed studies showing the potential for substantial financial and energy savings.

Richard Hausmann, Siemens, Germany, discussed four smart grid applications: demand response; distributed generation and microgrids; smart metering; and electric car infrastructure. He argued that ensuring the sustainability of



L-R: Chair Bob Pegler, Global CCS Institute, France; Masaki Iijima, Mitsubishi Heavy Industries, Japan; Jamie Carstairs, Linnfall Consulting, UK; Andrew Beatty, Baker & McKenzie, Australia; and Hermann Kremer, Siemens, Germany

rising electricity consumption requires “the 4E’s”: energy efficiency; optimal energy mix; energy management with smart grids; and electro-mobility and e-products. Citing the Desertec Industrial Initiative, he discussed the need for smart supergrids to link areas with abundant renewable energy sources with distant consumers. Scott Henneberry, Schneider Electric, US, said demand response allows grid operators to manage demand among large users during high demand periods, and he considered it the most promising application of smart grids.

Rudi Strubbe, Alcatel Lucent, Belgium, explained the possible role of the internet in transforming how grids are managed and enabling consumers to manage their own consumption. Jorge Cruz Morais, EDP, Portugal, discussed how EU policies have driven his utility to switch to smart grids and greater use of renewables, and how smart grids can enhance a utility’s relationship with consumers.

NUCLEAR ENERGY

Nuclear Industry Update: Fahad Al Qahtani, Emirates Nuclear Energy Corporation, UAE, chaired this session on Wednesday afternoon. Ambassador Hamad Al Kaabi, UAE Permanent Representative to the International Atomic Energy Agency (IAEA) and Special Representative for International Nuclear Cooperation, said the renaissance of the nuclear industry is driven by the objective of energy independence and security, and climate change concerns. He emphasized that the maintenance of safety is fundamental for performance of and support for UAE’s nuclear programme.

Gianluca Marini, Director, CESI, Italy, noted that 80% of installed capacity is located in the EU, Japan and the US, while 75% of the reactors under construction will be in the Far East, the Russian Federation, and possibly the UAE. He also observed that the main driver of nuclear energy is its low price compared to other energy sources, with climate change concerns and the security of supply and system stability gaining importance.

Václav Bartuška, Ambassador-at-Large for Energy Security, Czech Republic, suggested that nuclear energy is not experiencing a “renaissance” but a “comeback,” after 30 years of being in a “coma,” and expressed concern that the EU is pushing itself out of the market since only two of over 60 new reactors are planned in the region. Mike Tynan, CEO, Westinghouse, US, observed that people generally accept electricity generation from nuclear plants and that concerns focus mainly on nuclear waste. He called for greater cooperation between national regulators on waste. Regarding uranium availability for a growing number of nuclear plants, he noted that ample resources exist and that there is additional potential for more efficient resource use.

SIDE EVENTS

Side events held throughout WFES took place in numerous venues over the course of the summit, including the Young Future Energy Leaders forum, the Project Village, the Masdar Theatre, the Technology Showcase Seminar, the Roundtables, and in many pavilions, booths and meeting rooms.

YOUNG FUTURE ENERGY LEADERS (YFEL)

The Young Future Energy Leaders (YFEL) is a programme of the Masdar Institute that seeks to engage young people in alternative energy and sustainability activities. The initiative supported 150 students and young professionals to attend the WFES, and hosted a number of addresses by world leaders and politicians in its dedicated conference area. A selection of YFEL events are summarized below.



During a YFEL event on Monday afternoon, UN Secretary-General Ban Ki-moon cautioned against taking valuable resources for granted and emphasized the importance of climate change mitigation, green development, empowering women and improving global health. He noted the need to share the “gifts of science and technology” with people in the developing world in order to achieve universal access to clean energy by 2030. Highlighting how access to energy can improve as well as save lives, Ban observed that obstacles to energy access are not technical. He called for focused and sustained political commitment at the highest level to prioritize wise investments, particularly in renewable energy. Lauding the UAE’s visionary leadership resulting in the construction of Masdar City, an urban development powered by renewable energy, he expressed hope that experiences and ideas from this initiative would be widely shared.

Susan Hockfield, President, MIT, US, met with young future energy leaders on Tuesday morning. She advised energy students to pursue a broad education that includes the politics and economics of energy. She said the fossil fuel industry is one of the strongest partners in renewable energy development as companies increasingly see opportunities for integrating conventional energies with renewables.

A debate, moderated by Ken Volk, Masdar Institute, UAE, took place on Wednesday morning. Two teams of international students debated whether the US should be sued in the International Court of Justice for environmental damages caused by CO2 emissions. One team cautioned that no enforcement mechanism exists, and advocated developing reward systems rather than punishing a single country. The audience approved the second team’s proposal to hold the US legally responsible for its actions, based on the argument that the US is aware of the problems it causes and has refused to cooperate within the UN system.

Christiana Figueres, Executive Secretary, UNFCCC, addressed YFEL on Wednesday afternoon. She observed that the new technological revolution needs to be driven by the multilateral process to address global timelines. Highlighting the recent Cancún UN Climate Change Conference, she described the Conference outcomes, including on finance and the establishment of a technology mechanism, and said they represent “by far the largest collective effort to reduce emissions.” Figueres, however, acknowledged the outcome’s insufficiencies, given the magnitude of change required.

Afolabi Otitoju, Aberdeen Business School, discussed on Thursday morning the key drivers for the development of Masdar City, which he said range from the need to address the effects of climate change to the desire for long-term economic diversification.

PROJECT VILLAGE

The WFES Project Village enabled 20 small companies to showcase a centerpiece project in a “village” setting which included networking space. Over the four days of the Summit, some participants showcased renewable and low-carbon energy projects at booths. The Village also hosted over 25 project presentations under one of three module themes: renewables and support mechanisms; supply chain opportunities for the Middle East and North Africa region; and venture capital for clean energy projects. There were projects of different scales and energy types, including: non-terrestrial wind power prototypes; integrated bioenergy systems; and fuels sourced from plastics and rubber. A selection of the presentations is summarized below.

Presentations on Monday included that by Ben Warren, Ernst & Young, UK, on challenges and opportunities in renewable energy. He highlighted emerging markets and, describing global trends in renewable energy, he considered the need to attract investment, increase public engagement, reward investment in energy efficiency, and align energy policies with economic, industrial and environmental policy. Calling policy the “single most important driver for clean energy investment,” Logan Goldie-Scot, Bloomberg New Energy Finance, UK, discussed investment trends and barriers in energy, particularly in the Middle East region. Noting both advantages and disadvantages, he highlighted policy support mechanisms, including renewable portfolio standards, tax incentives, and feed-in tariffs. Amjad Rihan, Ernst & Young, Middle East, presented on the CDM, and the development of carbon commerce. He noted the challenges in registering some projects under the CDM, explaining that there are countries that lack the necessary regulatory structures to meet the stipulations of the UNFCCC for potential projects.

Tyler Tringas, Bloomberg New Energy Finance, US, discussed cost comparisons of renewable energy generation using the standardized Levelised Cost of Energy (LCOE). He explained that this analytic approach facilitates comparisons of renewable energy with other energy generation strategies. He stressed that there are already some renewable energy sources that are economically competitive, including some applications of wind, geothermal and waste-to-energy, and that LCOEs are generally declining.

Presentations on Wednesday included those from Loay Alfi and Raed Bkayrat, King Abdullah University for Science and Technology, Saudi Arabia. They outlined the University’s collaborative research efforts, goals of technological advancement and commercialization, and several solar

projects. Bkayrat highlighted, among other initiatives, the main campus’ 2MW PV power generation facility and the “New Energy Oasis” for solar testing and demonstrations.

ROUNDTABLES

WFES hosted 46 energy roundtables enabling small group discussions on a variety of popular and emerging energy issues. Topics ranged from technological presentations on energy models, trends, and capacities to theoretical conversations on the direction of energy policy, finance and industry. The roundtables covered, among other topics, geothermal, CSP, PV, air-conditioning, market investments, heliostats, offshore wind, hydrogen, biofuels, biomass, CCS, grid systems and efficiency. Members of government, academia, industry, and business led and participated in these events, a selection of which is summarized below.

Large-scale PV: A roundtable convened on Monday, led by Mahieddine Emziane, Masdar Institute of Science and Technology, on PV Technologies for Large-Scale Deployment in the GCC. Participants discussed challenges of solar energy integration, manufacturing, cost and efficiency, and the need for data. They also emphasized the utility of Masdar City for experimentation and the importance of working together.

Low-carbon Energy Systems: Gustav R. Grob, Energy Institute, UK, hosted a roundtable on Low Carbon Energy Systems Evolution on Monday, where participants discussed aspects of the geothermal industry. Participants emphasized that renewable energy calls upon different government ministries than fossil fuels, such as environmental ministries, and this presents additional policy challenges.

Change and Innovation: Scott McGuigan and Jay Witherspoon, CH2M Hill, UAE, convened a discussion titled Sustainable Change and Innovation on Monday. Participants discussed the challenges of the water-energy nexus, considered water scarcity and focused on the economic drivers for sustainable and renewable energy projects, particularly shifting subsidies to incentives.

Hydrogen Technology: Mustafa Hatipoglu, UN Industrial Development Organization (UNIDO), convened on Tuesday a roundtable on Hydrogen Technology Projects for Clean Future. Participants considered the status of hydrogen technology, storage, how to achieve industry breakthroughs, and hydrogen’s relationship with the two degree Celsius global warming target.

Hydrogen Economy: Kamiel Gabriel, University of Ontario Institute of Technology, Canada, led a roundtable discussion on Tuesday. Participants discussed: government and industry interest in, and plans for, hydrogen vehicle fleets; the challenges of hydrogen storage and transportation; and clean hydrogen.

Integration of Coal-fired Power Plants with Carbon Capture: On Wednesday, Ali Abbas, University of Sydney, led a discussion on how systems engineering modeling can guide technology choices for carbon capture in coal-fired power plants. He emphasized that models show that heat reintegration would prove best and most competitive if carbon pricing is introduced and that membrane modules might involve less selectivity than currently believed. Participants discussed the potential environmental and health pitfalls of reliance on solvent absorption and possible tools for real-time decision making on when to activate carbon capture.

Incorporating Renewable Energy into Disaster Planning and Response: On Wednesday, Thearin Wendel, Nova Environmental Associates, US, discussed the challenges



Roundtable participants discussed a range of energy issues.

of incorporating renewable energy into disaster planning and response. He highlighted renewables advances such as portability, continuity, quiet operation and reduced waste generation, and identified several uses such as water supply, portable power, communications, lighting and road signaling. Noting challenges in deployment, he underscored the importance of pre-disaster planning.

Smart Buildings: Sascha Brozek, Siemens, Switzerland, led a roundtable on Thursday on the theme “Smart buildings - the missing link in the smart grid technology.” The roundtable focused on how making buildings “smart” to better control their energy consumption and communicate with the grid is key to realizing smart grids’ full potential and to achieving the goal of zero net emission buildings. Among the issues discussed were: the danger of automation reducing personal responsibility for managing consumption, and the problem of building systems and grid operators using different information technology systems that do not communicate.

PAVILIONS AND BOOTHS

Side events were also held in pavilions, booths and meeting rooms throughout WFES. A selection is summarized below.

US Pavilion: On Tuesday, Frank Calzonetti, University of Toledo, presented on his university’s Wright Center for Photovoltaics Innovation and Commercialization. He explained that the Center conducts industry-directed research to advance the commercialization of renewable technology, particularly thin film photovoltaics and offshore wind deployment.

EU-Gulf Cooperation Council (GCC) Clean Energy Network: The first plenary meeting of the “EU-GCC Clean Energy Network” convened as a full-day side event on Tuesday. In opening statements, Sam Nader, Director, Masdar Carbon, UAE, called for policies to de-carbonize energy sources, and Eva Tvarozkova, European External Action Service, recalled past cooperation between the EU and the GCC, particularly on energy. John Psarras, National Technical University of Athens, described the network’s activities. Panel discussions then considered: energy efficiency and demand side management; synergies for renewables and other clean energy technologies; financing clean energy projects; and clean energy-related education.

Japan Pavilion: On Wednesday, Ji Eon Lee, Japan Business Alliance for Smart Energy Worldwide (JASE), pointed to the high energy efficiency in Japan. She said JASE enables energy conservation by promoting Japanese smart energy products and technologies, including energy saving solutions, heat pumps

and inverters, and PV and geothermal power. Representatives from Japanese companies then presented several of these technologies.

ExxonMobil Pavilion: On Wednesday, Nazeer Bhore, ExxonMobil, presented his company’s 2030 energy outlook. He discussed the effects of carbon emissions and fossil fuel prices on the economic competitiveness of different energy sources. Stating “we are never going to sell again as much gasoline in the US as we sold last year,” he projected that light-duty vehicle energy demand will remain flat globally by 2030, and will decline in the US.

Masdar Smart Grid Panel: On Wednesday, Bryan Walsh, Time Magazine, US, moderated a panel of representatives from 3Tier, Siemens, Masdar and the Abu Dhabi Water and Electricity Authority, in a discussion on smart grids in Masdar City and elsewhere. The panel highlighted: the importance of smart grids in accommodating intermittent power supply from wind and solar; necessary technical and policy conditions; obstacles impeding smart grid growth; the possible use of electric vehicles as a storage network for smart grids; and how smart grids can help consumers moderate energy consumption.

NYU/Ministry of Foreign Affairs Climate Finance Roundtable: Bryce Rudyk, New York University (NYU), chaired this roundtable on Thursday. Rob Bradley, MOFA, UAE, observed that climate change finance delivery under the UNFCCC has fallen short of developing countries’ aspirations. Highlighting fast-start finance of US\$30 billion for 2010-2012 and long-term finance pledges of US\$100 billion per year by 2020, he noted that decisions need to be made on how money will be spent and managed, adding that climate funds are difficult to deliver on politically and technically hard to detect.

Richard Stewart, NYU, UAE, observed that delivery of climate finance by existing institutions would be pluralistic, fragmented and diverse, which he said creates governance challenges and opportunities. He also highlighted a NYU proposal to develop a global climate finance register to track delivery and use of funds.

Jacob Werksman, World Resources Institute (WRI), US, gave an overview of the Cancún outcome on finance, highlighting: the Green Climate Fund; the establishment of a fund board comprising 24 members from developed and developing countries; and the invitation to the World Bank to serve as the interim trustee of the Fund. He also discussed WRI’s three-dimensional analysis framework for institution design, comprising power, responsibility and accountability.



L-R: Rob Bradley, Ministry of Foreign Affairs, UAE; Richard Stewart, New York University, UAE; and Jacob Werksman, World Resources Institute, US

MASDAR THEATRE

The Masdar Theater, located within the Masdar booth in the exhibition area, offered a series of presentations throughout WFES 2011 on topics related to Masdar City, Masdar Power, Masdar Carbon, Masdar Capital, and the Masdar Institute. Two presentations are summarized below.

Masdar City: Mohammed Al Fardan, Masdar City, described Masdar City as a living laboratory to accelerate innovations in clean energy, green products and sustainable development, with the objective of providing residents and commuters with the highest quality of life for the lowest environmental footprint. He noted that Masdar City will be a tax-free special economic zone, with 100% foreign ownership allowed.

CSP: Attendees at a presentation on “Innovations in CSP Development: The Torresol Energy Story” learned that the Torresol solar energy project uses central tower plants with molten salt heat storage. The presenter said additional features include: two independent systems for storage and generation; 15 hours of storage capacity; and generation capacity of 110,000 MWh/year.

TECHNOLOGY SHOWCASE SEMINAR

The WFES Technology Showcase Seminar hosted over 35 business presentations on topics ranging from engineering of household technology to algae biofuels science to creating sustainability in urban systems.

ZAYED FUTURE ENERGY PRIZE

The third annual Zayed Future Energy Prize award ceremony was held at the Emirates Palace Hotel in Abu Dhabi, UAE on Tuesday evening. The award ceremony hosts, Noura Al Kaabi, Head of TwoFour54, Tawasol, and Stephen Sedgwick, CNBC EMEA, explained the selection process, in which a review committee shortlisted 40 candidates from 391 nominees. A jury then selected the six finalists and, eventually, the winner and two runners-up.

Sultan Ahmed Al Jaber, Director General, Zayed Future Energy Prize, underscored that the Prize represents the legacy of Sheikh Zayed Bin Sultan Al Nahyan by recognizing leadership in the field of clean energy. Underscoring the need for innovation, Rajendra Pachauri, Chairman of the Jury for the Zayed Future Energy Prize and of the Intergovernmental Panel on Climate Change, described the award recipients as “torch bearers for change.”

His Highness General Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, then presented runner-up awards of US\$350,000 each to E+Co, US, accepted by its CEO Christine Eibs Singer, and Amory Lovins, Chairman, Rocky Mountain Institute, US. The Zayed Future Energy Prize of US\$1.5 million was awarded to Vestas, Denmark, and accepted by Ditlev Engel, Global CEO. Engel announced that half of Vestas’ award would be donated to the three other finalists: The Barefoot College, India; First Solar, US; and Terry Tamminen, President and founder of 7th Generation Advisors, US.

UPCOMING MEETINGS

Preparatory Meeting for the Clean Energy Ministerial:

The meeting will lay the groundwork for the second Clean Energy Ministerial (CEM2) set for 6-7 April 2011 in Abu Dhabi, United Arab Emirates. **dates:** 14-15 February 2011 **location:** London, UK **contact:** Clean Energy Ministerial Secretariat **e-mail:** secretariat@cleanenergyministerial.org **www:** <http://www.cleanenergyministerial.org/>

Intergovernmental Preparatory Meeting for CSD

19: The Intergovernmental Preparatory Meeting (IPM) will prepare for the policy-year session of the UN Commission on Sustainable Development (CSD), which will negotiate policy options related to the thematic cluster for the CSD 18-19 cycle: transport; chemicals; waste management; mining; and the Ten-Year Framework of Programmes on Sustainable Consumption and Production Patterns (SCP). The SCP discussion is expected to include consideration of sustainable cities and sustainable buildings. **dates:** 28 February-4 March 2011 **venue:** UN Headquarters **location:** New York, New York, US **contact:** UN Division for Sustainable Development **phone:** +1-212-963-8102 **fax:** +1-212-963-4260 **e-mail:** dsd@un.org **www:** http://www.un.org/esa/dsd/csd/csd_csd18.shtml

CIF Partnership Forum: The Climate Investment Funds (CIF) Partnership Forum will meet to discuss the CIF, a unique pair of financing instruments designed to support low-carbon and climate-resilient development through scaled-up financing channeled through major development banks. **dates:** 14-18 March 2011 **location:** Tunis, Tunisia **contact:** CIF Administration Unit **phone:** +1-202-458-1801 **email:** CIFAdminUnit@worldbank.org **www:** http://www.climateinvestmentfunds.org/cif/partnership_forum_2011_home

Joint Expert Meeting of IPCC WGII and WGIII on Human Settlement, Water, Energy and Transport Infrastructure - Mitigation and Adaptation Strategies: This



L-R: Amory Lovins, Chairman, Rocky Mountain Institute; Ditlev Engel, Global CEO, Vestas; H.H. General Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Supreme Commander of the UAE Armed Forces; Christine Eibs Singer, CEO, E+Co; and Sultan Ahmed Al Jaber, Director General, Zayed Future Energy Prize



H.H. General Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Supreme Commander of the UAE Armed Forces

expert meeting of the Intergovernmental Panel on Climate Change (IPCC) will further explore issues related to human settlements and infrastructure as an input to the AR5 process. **dates:** 22-24 March 2011 **location:** Calcutta, India **contact:** IPCC WG II Technical Support Unit **phone:** +1 650-462-1047 x 229 **fax:** +1 650-462-5968 **e-mail:** tsu@ipcc-wg2.gov **www:** <http://www.ipcc-wg2.gov/meetings/EMs/index.html> - 5

First Session of the IRENA Assembly and Fifth Preparatory Commission for IRENA: The fifth session of the Preparatory Commission for the International Renewable Energy Agency (IRENA), which will take place on 3 April 2011, will be followed by the first session of the Assembly of IRENA, on 4-5 April 2011. **dates:** 3-5 April 2011 **venue:** C 67 Office Building Khalidiyah (32nd) Street Opposite Al Khalidiyah Ladies & Children's Park **location:** Abu Dhabi, UAE **www:** <http://www.irena.org/>

Clean Energy Ministerial 2011 (CEM2): CEM is a high-level global forum to promote policies and programmes that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. At CEM2 Ministers will evaluate progress since CEM1 and meet with stakeholders from the private sector to identify ways to work together. **dates:** 6-7 April 2011 **location:** Abu Dhabi, UAE **contact:** Clean Energy Ministerial Secretariat **e-mail:** secretariat@cleanenergyministerial.org **www:** <http://www.cleanenergyministerial.org/>

Second Meeting of the Group of Experts on Global Energy Efficiency: The Group of Experts was created under the auspices of the UN Economic Commission for Europe's (UNECE) Committee on Sustainable Energy to advise the Steering Committee of the UN's Global Energy Efficiency 21 project (GEE21). GEE21 aims at developing systematic exchange of experience on capacity building, policy reforms and investment project finance through the UN's five regional commissions in order to promote self-financing energy efficiency improvements. At its second meeting the Group of Experts will examine a draft of the Global Strategy for Energy Efficiency Market Formation. **date:** 18 April 2011 **location:** Geneva, Switzerland **contact:** Viktor Badaker, Project Manager GEE21 **e-mail:** viktor.badaker@unece.org **www:** http://www.unece.org/energy/se/enef_gee21.html

CSD 19: This policy-year session of the CSD will negotiate policy options related to the thematic cluster for the CSD 18-19 cycle: transport, chemicals, waste management, mining and the Ten-Year Framework of Programmes on SCP. The SCP discussion is expected to include discussion of sustainable cities and sustainable building. **dates:** 2-13 May 2011 **venue:** UN Headquarters **location:** New York, New York, US **contact:** UN Division for Sustainable Development **phone:** 1-212-963-8102 **fax:** 1-212-963-4260 **e-mail:** dsd@un.org **www:** <http://www.un.org/esa/dsd/index.shtml>

11th Session of IPCC Working Group III: This meeting of WGIII is scheduled to take place immediately prior to IPCC 33. The WGIII is due to sign off on the Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) for IPCC Plenary approval. **dates:** 5-8 May 2011 **location:** Abu Dhabi, UAE **contact:** IPCC Secretariat **phone:** +41-22-730-8208/54/84 **fax:** +41-22-730-8025/13 **e-mail:** ipcc-sec@wmo.int **www:** http://www.ipcc.ch/calendar_of_meetings/calendar_of_meetings...

World Renewable Energy Congress 2011 (WREC 2011): The series of World Renewable Energy Congresses (WRECs) are organized by the World Renewable Energy Network (WREN) affiliated with the UN Educational, Scientific and Cultural Organization (UNESCO). WREC 2011 will focus on future trends and applications in renewable energy technologies and sustainable development. **dates:** 8-13 May 2011 **location:** Linköping, Sweden **venue:** Linköping University **contact:** Tina Malmström, WREC 2011 Secretariat **e-mail:** info@wrec2011.com **www:** <http://www.wrec2011.com/index.html>

UNFCCC Subsidiary Bodies June 2011: The 34th sessions of the UNFCCC Subsidiary Body for Implementation (SBI) and Subsidiary Body for Scientific and Technological Advice (SBSTA) will take place in June 2011, along with meetings of the *Ad Hoc* Working Groups. **dates:** 6-17 June 2011 **location:** Bonn (Nordrhein-Westfalen), Germany [tentative] **contact:** UNFCCC Secretariat **phone:** 49-228-815-1000 **fax:** 49-228-815-1999 **e-mail:** secretariat@unfccc.int **www:** <http://www.unfccc.int>

Vienna Energy Conference 2011 (VEC 2011): The Conference, organized by the UN Industrial Development Organization (UNIDO), will facilitate an international dialogue on providing universal energy access and on the multiple co-benefits of increasing energy efficiency, under the banner "Energy for All: Time for Action." **dates:** 21-23 June 2011 **location:** Vienna (Wien), Austria **contact:** Energy and Climate Change Branch **phone:** +431-26026-3018 **www:** <http://www.unido.org/index.php?id=1001185>

Sixth Dubrovnik Conferences on Sustainable Development of Energy, Water and Environment Systems (SDEWES): The Dubrovnik Conference is a biannual event patronized by UNESCO dedicated to the improvement



and dissemination of knowledge on methods, policies and technologies for increasing the sustainability of development regarding energy, transport, water, environment and food production systems and their many combinations. The Sixth Conference will examine, among other things, the Green New Deal, decarbonization, carbon capture and storage, energy policy, nuclear energy, alternative energy (including biofuels and hydrogen), energy efficiency, electric vehicles, smart energy networks and sustainable architecture. **dates:** 25-29 September 2011 **location:** Dubrovnik, Croatia **fax:** +385 1 6156940 **e-mail:** dubrovnik2011@sdeswes.org **www:** <http://www.dubrovnik2011.sdeswes.org/>

Third Meeting of the Group of Experts on Global Energy Efficiency: The Group of Experts will continue work on the Global Strategy for Energy Efficiency Market Formation. **dates:** 17-18 October 2011 **location:** Geneva, Switzerland **contact:** Viktor Badaker, Project Manager GEE21 **e-mail:** viktor.badaker@unece.org **www:** http://www.unece.org/energy/se/enef_gee21.htm

World Sustainable Building Conference (SB11): This Conference aims to find new solutions which can enhance sustainable ways of living and working within built environments. The Conference is co-organized by the International Council for Research and Innovation in Building and Construction (CIB), the International Initiative for a Sustainable Built Environment (iSBE) and UNEP's Sustainable Buildings and Climate Initiative (SBCI). **dates:** 18-21 October, 2011 **location:** Helsinki, Finland **contact:** Ville Raasakka, Finnish Association of Civil Engineers (RIL) **phone:** +358 50 366 8687 **e-mail:** ville.raasakka@ril.fi **www:** <http://www.sb11.org>

UNFCCC COP 17 and COP/MOP 7: The 17th session of the UNFCCC Conference of the Parties (COP 17) and the 7th session of the Meeting of the Parties (MOP 7) to the Kyoto Protocol will take place in Durban, South Africa. **dates:** 28 November-9 December 2011 **location:** Durban (Kwazulu-Natal), South Africa **contact:** UNFCCC Secretariat **phone:** +49-228-815-1000 **fax:** +49-228-815-1999 **e-mail:** secretariat@unfccc.int **www:** http://unfccc.int/meetings/unfccc_calendar/items/2655.php?ye...

2012 International Year for Sustainable Energy for All: In December 2010, the UN General Assembly adopted a resolution proclaiming 2012 as the "International Year for Sustainable Energy for All" (Resolution 65/151), aimed at creating "an enabling environment for the promotion and use of new and renewable energy technologies, including measures to improve access to such technologies." **date:** 1 January-31 December 2012 **location:** worldwide

World Future Energy Summit 2012: The fifth World Future Energy Summit is scheduled to take place in 2012 in Abu Dhabi, UAE. The specific dates, themes and agenda for WFES 2012 have not been announced. **location:** Abu Dhabi, UAE **venue:** Abu Dhabi National Exhibition Center **www:** <http://www.worldfutureenergysummit.com>

ACRONYMS

BIREC	Beijing International Renewable Energy Conference
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CO2	carbon dioxide
CSD	UN Commission on Sustainable Development
CSP	concentrated solar power
DIREC	Delhi International Renewable Energy Conference
EOR	enhanced oil recovery
GCC	Gulf Cooperation Council
GHG	Greenhouse gases
GWEC	Global Wind Energy Council
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IP	Intellectual Property
IPCC	Intergovernmental Panel on Climate Change
IREC	International Renewable Energy Council
IRENA	International Renewable Energy Agency
MDGs	Millennium Development Goals
MOFA	Ministry of Foreign Affairs
MW	megawatt
PV	photovoltaics
R&D	Research and Development
REN21	Renewable Energy Policy Network for the 21st Century
SRREN	IPCC Special Report on Renewable Energy Sources and Climate
UNCED	UN Conference on Environment and Development
UNFCCC	UN Framework Convention on Climate Change
UNGA	UN General Assembly
WFES	World Future Energy Summit
WIREC	Washington International Renewable Energy Conference
WSSD	World Summit on Sustainable Development
YFEL	Young Future Energy Leaders



Christiana Figueres, UNFCCC Executive Secretary, and Sultan Ahmed Al Jaber, CEO, Masdar, UAE, meeting with Young Future Energy Leaders