



World Future Energy Summit Bulletin

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

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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 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