Track 1: Climate change and energy
Session 2: Energy sustainability

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Date: February 6 (Fri), 2009, 10:30 – 14:30
Venue: Room 001, Sanjo Conference Hall

1. Background

Making the transition to a future of sustainable energy is one of the crucial challenges mankind faces in this new century. It means to secure adequate energy resources to sustain the current and future economies of developed and developing countries in a world foreseen to reach 9 billion people by 2050, according to UN estimates; it means as well to preserve the underlying integrity of essential natural systems, including avoiding dangerous climate change.
To achieve an equilibrium between the two objectives requires humankind to realize a transition to a sustainable energy system, as a main pillar for sustainable development.
Not doing that would result in a catastrophic and irreparable situation.

The current energy paradigm is in deep contrast with the idea of sustainable development: it is based on the intensive use of nonrenewable fossil fuels, causing environmental degradation and posing global risks to the integrity of essential natural systems. It is, therefore, unavoidably making future generations poorer (failing the inter-generations sustainability).
It is opposed to the intra-generation sustainability and inherent equity concept as well, when 1.6 billion people worldwide nowadays live without electricity and an estimated 2.4 billion people rely only on traditional forms of energy for their primary needs.
At the same time, securing access to vital energy resources, particularly oil and natural gas, further exacerbated by an escalating energy cost and by the competition for unevenly distributed energy resources, is a source of growing geopolitical tension and economic vulnerability for many nations.

Concerning the relationship between climate change and global energy security, the estimated global primary energy uses increase of 45% by 2030 in comparison to 2006, with a consequent 45% global emissions increase (World Energy Outlook 2008) is in clear contrast with stabilisation levels required as indicated in the last IPCCC report.
This increase in energy demand is particularly driven by the fast economic growth rate occurring in China and India and the estimated demographic increase in developing countries, apart from maintaining the current economic growth rate in OECD countries.
Fossil resources will remain dominant (80%) within this long-term scenario and global emissions from developing countries will exceed those from OECD countries starting from 2020.
Thus, it is readily evident that energy is central to both climate change problems and their resolution. According to WEC 2007, energy-related emissions (including energy used in transportation) account for over two-thirds of anthropogenic greenhouse gas (GHG) emissions and contribute to over 80% of worldwide emissions of CO_2, the main GHG, as a direct result of fossil fuel combustion. Energy also accounts for approximately one-third of the global emissions of methane, the second largest source of GHGs, in fugitive emissions, mainly from natural gas production, transportation and coal production.

However, energy is also a key driver of social and economic development.

Energy systems are therefore a necessity, and to be compatible with sustainable development they should be designed to meet sustainability criteria. There is no doubt concerning the development of developing countries, but the problem is how to “fuel” their development. The task is daunting as it is complex. Its dimensions are simultaneously social, technological, economic and political. Its perspective is also global. New methods are required to analyse the interactions among climate change, development and energy.

Sustainability Science can help in understanding those linkages, create methods and visions for analysing the trade-offs and develop policy-making support tools to solve the concomitant risks to human well-being and security.
In order to make a transition to future of sustainable energy, three solutions in three different steps should be supported:

1. A short-term solution based on energy efficiency and integration of low carbon technologies and RES,
2. A mid-term solution based on low carbon technologies and RES integration for green electricity and hydrogen aiming at zero emission.
3. A long-term solution based on zero consumption – zero waste model.

Technologies for a new sustainable energy future are either already available or can be affordably improved if appropriate policies and investments are put in place.
Changes in attitude and behaviour are also needed to effect a full sustainable energy transition

2. Aims and prospectus of the session

The session aims at analysing new scenarios, analytical methodologies and technologies according to different energy sustainability definitions - as the WEC’s 3A’s (Accessibility, Availability and Acceptability) as well as the closed cycles approach and attempts to identify strategies and policy tools for a new sustainable energy paradigm that simultaneously enhance global socio-economic development and environmental integrity.

3. Program

Chair : Prof. Vincenzo Naso, CIRPS, Sapienza University of Rome
Co-Chair : Prof. Fabio Orecchini, CIRPS, Sapienza University of Rome

Time	Speaker	Topics / Title
10:30 – 10:45	Prof. Vincenzo Naso CIRPS, Sapienza University of Rome	Opening remarks, session outline
10:45 – 11:05	Dr. Yvani Myriam Deraniyagala	“Energy for sustainable development – the sustainomics framework”
11:05 – 11:25	Dr. Alan Brent	“The principles of sustainability science to assess and promote alternative energy technologies”

11:25 – 11:45	Dr. Mithra Moezzi	“Energy eco-indicators in practice"
11:45 – 12:05	Dr. Katsumi Yoshida	“Shell energy scenario and hydrogen”
12:05 – 12:25	Prof. Fabio Orecchini	Energy sustainability: closed cycles of resources and the role of energy vectors"
12:25 – 12:45	< Break >	Lunch box will be served
12:45 – 13:05	Prof. Hideaki Horie	“The impact of advanced battery systems and their networks into the Future Society”
13:05 – 13:25	Dr. Masayuki Sasanouchi	“Automobile and sustainable energy”
13:25 – 13:55	Prof. Orecchini leads Discussion	Issues for energy sustainability
13:55 – 14:25	Prof. Naso leads discussion	Networks for energy sustainability
14:25 – 14:30	Prof. Naso	Wrap-up

4. Contacts

- Session Chair
Prof. Vincenzo Naso,
Director of CIRPS, Professor of Sapienza University of Rome
vincenzo.naso@uniroma1.it

- IR3S Session Coordinator
Nami Kitamura
IR3S, the University of Tokyo
nami@ir3s.u-tokyo.ac.jp

- CIRPS Session Coordinator
Francesca Farioli
CIRPS, Sapienza University of Rome
francesca.farioli@uniroma1.it

- Session Coordinating Assistant
Hirotaka Matsuda
IR3S, the University of Tokyo
matsuda@ir3s.u-tokyo.ac.jp

Prof. Vincenzo Naso:

Full Professor of Energy Systems at Sapienza University of Rome. Director of the Interuniversity Research Centre for Sustainable Development (CIRPS)- Sapienza University of Rome. Director of 2 Master Courses on "Managemnt of energy and environment" and "Renewable Energy Sources and Enegy Efficiency" at the Department of Mechanical and Aeronautical Engineering, Sapienza University of Rome

Director of Master Course on "International Development Co-operation" at CIRPS. Coordinator of the PhD Course on "Energy and Environmental Technologies for Sustainable Development". Member of several Scientific and Technical national and international Associations. Member of Scientific and Technical Committees and Expert for the European Commission and Parliament on energy and environment issues. Energy Manager of "Poloclinico Umberto I" and former Energy Manager of "Sapienza" University and Director of the Servizio di Ateneo per l'Energia (Energy Services Institute) at "Sapienza". Scientific co-ordinator of national and international research projects in the field of sustainable energy systems for stationary and mobility uses, rational use of energy, renewable energy sources and end uses of energy.

He has co-ordinated several University/SMEs collaborations, aimed at promoting and implementing technological innovation, technologies transfer, training, consulting, design and management activities.

Nami Kitamura is a Project Associate Professor (Energy Sustainability) of Integrated Research System for Sustainability Science (IR3S), the University of Tokyo since February 2007 as her external assignments of Showa Shell Sekiyu which is one of the affiliated companies of Royal Dutch Shell. Her work promotes academic-industrial alliance to contribute to building sustainable society and establish Sustainability Science from Energy point of view. She received Master of Science in Harvard School of Public Health and Master of Engineering in Tokyo Institute of Technology.

Francesca Farioli: Coordinator of the Unit "International Co-operation in Energy & Environment" at the "Interuniversity Research Centre for Sustainable Development (CIRPS)- Sapienza University of Rome

She has twelve years of experience in the field of energy and environment, specialising in evaluating sustainability and energy policies for sustainable development.

Consultant for FAO regarding bioenergy policies within the Global Bioenergy Partnership.

Her Ph.D. is on the "The implications of the Clean Development Mechanism for Sustainable Development: prospects for Developing Countries" and her M.A. is in Political Sciences, both from Sapienza University of Rome.

Hirotaka Matsuda is a project research associate of TIGS/IR3S. He graduated Department of Economics Otaru University of Commerce in 1997, and received Master of Agriculture and PhD of Agriculture from Hokkaido University in 1999 and 2003 respectively. His area of specialty is Agricultural Economics and Development Economics. Food security, biofuel and the technological progress in agriculture are center of his current research area.

Energy for sustainable development – the sustainomics framework

Yvani Deraniyagala
Research and Training, Munasinghe Institute for Development (MIND), Sri Lanka
yvani@mindlanka.org

Sustainomics is "a transdisciplinary, integrative, comprehensive, balanced, heuristic and practical framework for making development more sustainable." Unlike other traditional disciplines, it focuses exclusively on sustainable development. Thus, the main principle of the framework seeks to make ongoing and future development efforts more sustainable, as a first step towards the ultimate goal of sustainable development. Other key principles stress: (a) balanced consideration of the three dimensions of the sustainable development triangle (social, economic and environmental); (b) better integration by transcending conventional boundaries imposed by discipline, space, time, stakeholder viewpoints, and operational needs; and (c) practical application of innovative methods and tools throughout the full cycle from data gathering to policy implementation and feedback.

Decision makers normally focus their attention on conventional development strategies like growth and poverty alleviation. Sustainable development (SD) is considered a special (and rather obscure) subset of conventional development. The environment is only one aspect of SD, and finally climate change (including adaptation and mitigation) is itself seen as a minor subset of the environment.

The AIM approach analyses key economic-environmental-social interactions to identify potential barriers to making development more sustainable (MDMS) - including climate change. It also helps to determine the priority macro policies and strategies in economic, environmental and social spheres that facilitate the implementation of climate change adaptation and mitigation to overcome the effects of climate change. Thus, such a matrix helps to promote an integrated view, meshing both development decisions and climate change effects.

The preliminary matrix identifies broad relationships, provides a qualitative idea of the magnitudes of the key interactions, helps to prioritize the most important links, and facilitates integration of climate change adaptation and mitigation responses within the overall national sustainable development strategy.

Yvani Deraniyagala
Have been working in the field of sustainable development and climate change for over 10 years. Graduate and Postgraduate Degrees in Environmental Economics and Environmental Management. Experience in conducting training workshops on capacity building for climate change in many countries in Asia and Africa.

The principles of sustainability science to assess and promote alternative energy technologies

Alan Brent
Council for Scientific and Industrial Research (CSIR), South Africa
abrent@csir.co.za

Conventional research in alternative energy technological (AET) systems addresses fundamental and applied knowledge for the problems of sustainable development. These include the concerns of the efficiency of energy conversion from alternative energy sources and the efficiency of utilization as work, access to energy for development, and the reduction of global warming emissions. Success with these technical concerns is not enough as they do not address social-ecological systems complexity, i.e. the interactions between systems. Therefore, additional, practical indicators to measure the sustainable development performances of such systems should address the conceptual framework of the emerging field of sustainability science, i.e. the study and integration of particular issues and aspects of radical, systemic approaches to innovation and learning for ecological and social sustainability. Sustainability science recognises feedback loops associated with social-ecological systems and technology, and the role of technological life cycles to enhance the sustainability of complex social-ecological systems, i.e. concentrating on the design of devices and systems to produce more social good with less environmental harm. This paper subsequently investigates how the understanding of the principles of sustainability science may lead to the better management of technological systems. More specifically, the objective of the paper is to establish a method to prioritise assessable sustainability indicators for AET systems that can be used upfront, in the technology management cycle, by designers and decision-makers of such technologies. The prioritisation is based on hierarchy theory as it relates to sustainability science. A model is introduced that integrates the principles of sustainability science, i.e. transdisciplinarity, a focus on the resilience and complexity of systems, and adaptive capacity and management within systems; the model allows the prioritisation of sustainability aspects, as perceived by stakeholders that interact with implemented AET systems, through a learning cycle. A mini-hybrid AET system that was implemented in a traditional community in rural South Africa is used as a case study to investigate and demonstrate the introduced model.

Alan Brent is a chemical engineer by background with a Masters degree in environmental sciences and a PhD in engineering management. He has consulted to a variety of industries in South Africa and other developing countries, on environmental engineering and management, for over ten years. Currently he is tasked to lead research within the Natural Resources and the Environment unit of the South African Council for Scientific and Industrial Research that aims to incorporate sustainable development concepts into technology management practices in the energy sector, and specifically the development and application of appropriate technology assessment methods. To this end he is also appointed as an extraordinary professor of sustainable life cycle management in the Graduate School of Technology Management of the University of Pretoria.

Energy eco-indicators in practice

Hélène Connor, represented by Mithra Moezzi
HELIO International, France
mmmoezzi@gmail.com

Since 1996, France□based NGO think-tank HELIO International has developed indicators measuring the contribution of energy policies to ecodevelopment. Among these are a set of indicators focusing on assessing the status and progress of national energy policies, another set designed to assess Clean Development Mechanism projects, and an emerging set of indicators assessing the vulnerability of energy systems to global climate change and their resilience, currently being tested in ten African countries. These indicators have been developed to serve and reflect five pillars of sustainability: society, environment, economics, science and technology, and civic. Over sixty country reports have been produced to date. The paper presents these indicators relative to the five pillars, reviews their historical development and implementation, and analyses them relative to other key indicator systems and trends. But many sets of sustainability indicators compete in the current "Indicator Zoo", with 840 sustainability indicator initiatives, over 130 of them on energy, identified in the IISD's compendium of initiatives. Beyond a technical discussion of HELIO indicators, this paper traces how these indicators "live", retaining their closeness to policy-makers and policy questions, and supporting qualitative assessments that capture necessary complexity where numbers cannot. HELIO methodology's vitality is provided through a world-wide network of in-country observers and reporters who calculate, critique, deploy, and further develop these indicators. Through this network, the indicators are not static descriptions but tools for those who want to look at the bigger picture and help promote energy policies to be more conducive to ecodevelopment for all. We illustrate this particularly with HELIO's approach to, and definition of, energy security, designed to sustain bottom-up approaches to local resilience.

Mithra Moezzi is a member of the board of HELIO International. She has twenty years of experience in the field of energy and environment, specialising in combining quantitative and qualitative approaches. Her Ph.D. is Anthropological Folkloristics and her M.A. is in Statistics, both from University of California Berkeley.

Shell energy scenario and hydrogen

Katsumi Yoshida
Showa Shell Sekiyu K. K., Japan
Katsumi.Yoshida@showa-shell.co.jp

Last year, Shell developed two future energy scenarios that describe alternative ways it may develop. In the first scenario – called Scramble – policymakers pay little attention to more efficient energy use until supplies are tight. Likewise, greenhouse gas emissions are not seriously addressed until there are major climate shocks. In the second scenario – Blueprints – growing local actions begin to address the challenges of economic development, energy security and environmental pollution. A price is applied to a critical mass of emissions giving a huge stimulus to the development of clean energy technologies, such as carbon dioxide capture and storage, and energy efficiency measures. The result is far lower carbon dioxide emissions. In this speech, the scenarios will be introduced and the role of hydrogen will be discussed.

Katsumi Yoshida joined Showa Shell in 1990 and has been involved in hydrogen energy projects in Showa Shell for these 10 years, including demonstration project of a refueling station in Tokyo. Also he has participated in Shell Hydrogen's business development activities. He has degrees in MEng from Tokyo Institute of Technology and in MSc from Imperial College, London.

Energy sustainability: closed cycles of resources and the role of energy vectors"

Fabio Orecchini
Interuniversity Research Centre for Sustainable Development (CIRPS) – Sapienza University of Rome, Italy
Fabio.Orecchini@uniroma1.it

What's beyond the era of fossil fuels? Many ask this question, and many have been trying to give answers looking at different primary energy resources, from nuclear, to renewables, to new ways of extracting more and more difficult fossil resources from oil sands, deep seas, arctic fields.

The proposed answer to the "big question" is simple, as well as revolutionary. After the era of primary energy resources (wood, coal, oil, natural gas, nuclear, renewable energies) we are entering "the era of energy vectors". The capacity to store and transport energy from one point to another, and to swift its usability from the time of availability to the time of necessity is the key for future new energy systems.

The realisation of Closed cycles of resources can be achieved in the energy sector by exploiting renewable resources and structurally integrating energy vectors. The inclusion of energy vectors (to be produced from several primary resources) in the energy system chain becomes a key concept of the entire human development model.

Fabio Orecchini
Professor of Energy Systems. Co-ordinator of GEA - Energy and Environment Group at CIRPS - Interuniversity research centre for sustainable development, Sapienza University of Rome.
Scientific co-ordinator of national and international research projects in the field of sustainable energy systems for stationary and mobility uses.
Author of scientific books and publications on the Energy systems, the concept of "Closed cycles of resources" and the importance of Energy vectors.

The impact of advanced battery systems and their networks into the future society

Hideaki Horie
Research into Artifacts, Center for Engineering, the University of Tokyo, Japan
horie @ race.u-tokyo.ac.jp

Advanced rechargeable battery systems have been evolving in the last two decades, initially for applications to electronic gadgets to innovate information technologies and networks dramatically on the globe, and today we might be potentially approaching a decisive point for the next indispensable challenge, i.e. materialization of environmentally-friendly vehicles like electric vehicles, hybrid electric vehicles and wide-spread use of them. For a long time it could not be conceivable to maintain both high energy efficiency and energy reuse. Meanwhile with technical advancements it would be rather reasonable to adopt electrically-driven units to marvelously improve energy efficiency compared with internal combustion engines, and that could rationally lead to accommodate energy conservation and reuse through superbly advanced rechargeable batteries. The materialization of electrical energy conservation system would not remain just within automotive applications in the future, but also could propagate and enhance irreversible impacts to every single industrial sector throughout 21st century, which would completely change the feature of the next society to come synthesizing unbounded information and unlimited power indivisibly.

Dr. Hideaki HORIE studied naval architecture and graduated from the University of Tokyo in 1983. He received the master's degree in physics from the graduate school of science, the University of Tokyo. He joined Nissan in 1985 and developed automotive exhaust gas catalysts for five years. He was aware of the potential huge impacts on advanced batteries in the future, thus launched studies on lithium-ion batteries from February of 1990. He actually conducted the first lithium-ion battery system for electric vehicles and then verified a lithium-ion battery could exhibit high power performance, which eventually lead to successful developments of hybrid electric vehicle battery systems during 1990s. He earned his doctoral degree in engineering from the University of Tokyo in 1999. He has started his study at the University of Tokyo since 2006, and would keenly like to design and establish a new artifacts concept over intelligence-and-power-synthesized society.

Automobile and sustainable energy

Masayuki Sasanouchi
Toyota Motor Corporation, Japan
masayuki_sasanouchi@mail.toyota.co.jp

WBCSD believes that mobility is an essential human need, and human survival and societal interaction depend in profound ways on the ability to move people and goods. Automobiles play a major role of it. In order to make them sustainable, 3E, 3A and 3C are necessary. 3E stands for energy security, environment and economy, 3A for accessibility, acceptability and affordability, and 3C for convenient, clean and cost. From such a point of view, various fuels such as gasoline, diesel, biofuel, hydrogen and electricity will be discussed.

Mr. Masayuki Sasanouchi received bachelor's degree of electric engineering (1974 Keio Univ.) and has spent his professional career of 34 years in Toyota Motor Corporation. Currently he serves as Senior General Manager of CSR Environmental Affairs Division since its establishment decided by the top management in January 1998.

Mr. Sasanouchi was a member of working group of Keidanren Industrial Technology Committee from 1994 to 1998. He is currently a liaison delegate of WBCSD, the chairperson of the sub-committee on environmental policy of the Environment Committee of Japan Automobile Manufacturers Association, and Working Group on Global Environment Strategy of Nippon Keidanren.