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ABSTRACTS for
PARALLEL SESSION 3-1-1 on ENERGY TECHNOLOGY SYSTEMS ANALYSIS
and
PARALLEL SESSION 3-1-2 on NUCLEAR ENERGY: FUSION AND FISSION

CHAIRPERSONS: *Shunsuke Mori and Hal Turton*

A Socio-technical Perspective of Energy Models and Scenarios

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Energy systems, which experts project through their models, appear hardly sustainable in the long-term. Every proposed mix of energy vectors and technologies has benefits as well as drawbacks. Furthermore, it is impossible in economic terms to reconcile basic criteria such as economic development, security of providing energy services, environmental protection and climate change mitigation into an universally acceptable ranking. Waiting for breakthroughs, which might open the technological path towards sustainability, social paths have to be undertaken.

The presentation will discuss what analysts should derive from their systems analyses, in order open a dialogue with the public at large, making use of some public participation methods developed so far by social scientists.

Keywords: energy–environment scenarios, technical–economic models, long–term, public participation methods, social sciences

Development of emissions scenarios database for the IPCC Fourth Assessment Report and Regional Mitigation Analysis: A Review of post-SRES scenarios

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We have been updating the current emissions scenarios database to contribute for the IPCC Fourth Assessment Report. The objective of this study is to review emission and mitigation scenarios and analyze various mitigation scenarios since the IPCC Third Assessment Report (TAR). By developing the current database, it becomes available to assess characteristics of mitigation scenarios and conduct quantitative analyses on GDP, population, carbon intensity, energy intensity, carbon tax etc in multiregional aggregations. In particular, while global level analyses were in general taken into account in TAR, this study focuses on regional level analyses as well as global level analyses.

Keywords: Greenhouse gases, Emission scenarios, Mitigation scenarios, Integrated assessment models, Post-SRES

Technological Change: Exploring its Implication for the Economics of Atmospheric Stabilisation: Lessons from a Modelling Comparison Exercise

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This study summarises the main finding of the Innovation Modelling Comparison Project (IMCP). IMCP aims at comparing different models with the special focus on induced technological change. This paper evaluates the economics of atmospheric stabilisation with and without the inclusion of endogenous technological change. Modelling endogenous technological change has been heralded as the key to improve the assessment of mitigation costs of climate policy. This paper compares and analyses results from a broad range of energy-economy-environment models paying especial attention to the following questions: What are the impacts of induced technological change on discounted macroeconomic costs under different stabilisation scenarios in different regions? More specifically, what are the contributions of different carbon mitigation options in achieving an overall climate protection target?

Preliminary results suggest that in some models mainly energy consumption and gross world product are reduced while we find that in other models the reduction of carbon-intensity is predominant. Here, the introduction of backstop-technologies, and the transformation of the fuel mix in general are major drivers of the reduction of carbon-intensity. The paper investigates the economic dynamics of induced technological change in some detail.

Analysis of CO₂ Emissions in Long-Term National Scenarios for Climate Stabilization

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Many EU countries have released national long-term scenarios aiming at more than 50% reductions from current levels. This paper analyzes the CO₂ emission in the long-term national climate stabilization scenarios in other countries and the medium-term scenarios. In this study, CO₂ emission is decomposed with an extended Kaya identity and a Reduction Balance Table is developed. The research shows that in order to achieve the ambitious target, the pace of energy intensity improvement and carbon intensity decrease must be 2-3 times greater than the previous 40-year historical change, and the change rates need to be maintained for 50 years.

Keywords: CO₂ emission, Energy intensity, Carbon intensity, carbon capture and storage

Scenario Development of Japan Low Carbon Society toward 2050: Research Framework and Current Results

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It has become clear that drastic reductions in GHG emissions in the latter half of 21st century would be required to avoid critical climate change impacts. This research focuses on developing scenarios to establish the possibility of economically viable, socially acceptable, and technically possible low carbon society in Japan toward 2050. One such scenario is a 60-80% reduction in GHG emissions over 1990 levels for the country. This exercise simulates quantitative parameters such as GDP, service demand, energy demand and supply, and technological diffusion developed using both top-down economic model and bottom-up technology model under the narrative storylines.

Keywords: Low carbon society, Scenario development, 2050, Japan, Model simulation

Inherently Safe Nuclear Reactors for Reducing Greenhouse Emissions

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Nuclear power has outstanding attributes as a clean, safe, reliable source of electricity with very low greenhouse emissions over the full energy cycle. However, it has had two major disadvantages in the past: high capital costs and poor public perception.

A new generation of nuclear reactors addresses both of these problems. These are the small, simple, inherently safe reactors, characterised by South Africa's proposed Pebble Bed Modular Reactor. They have low capital costs and quick construction time. They are ideal for developed and developing countries alike. They can be used for electricity production, hydrogen production and water desalination.

Keywords: nuclear, inherently safe, greenhouse gases

Short- and Long-term Scenarios for Nuclear Energy: Closing the gap

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Many scenarios published in recent years explore the driving forces and assess plausible ranges of global energy use and the resources they draw on. Some scenarios focus on the next decade or two and project the evolution of world energy demand, supply, and the resources, technologies and prices to match them. Other scenarios explore the long term with a view to resource availability and depletion, technological transformations, or environmental concerns, predominantly climate change. A persistent gap can be observed in the projections for nuclear energy: near-term scenarios typically project a flat or slightly declining contribution of nuclear energy to the world energy supply whereas medium- and long-term scenarios anticipate significant increases. The presentation (and the ensuing paper) explores the analytical frameworks and the underlying assumptions to explain this apparent gap. It offers possible approaches to close the gap and establish consistency between short- and long-term global energy projections.

Keywords: global energy resources, scenarios, energy technologies, nuclear energy

Impact of ETL on the Future Role of Nuclear Fusion

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Within the Socio-Economic Research on Fusion (SERF) Programme, the potential role of fusion power is being studied. Using the TIMES model generator a global single-regional energy system model including Endogenous Technological Learning has been developed by the ITP of the TU-Graz in co-operation with the IPP Garching. Using this model, the impact of endogenous technological progress on the role of fusion power in various scenarios have been studied and discussed, and results will be presented. The work has been carried out within the EFDA framework in close cooperation with the IPP Garching.

Keywords: Nuclear Fusion, EFDA, SERF, MARKAL, TIMES, energy model, Endogenous Technological Learning

Japan's Long-term Energy Scenarios and the Role of Nuclear Energy

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A study was made on the evolution of energy demand and supply toward the year 2050 and on the potential benefits of nuclear energy utilization in Japan. For this purpose, assumptions were made on future economic growths, improvement in energy intensity, and availability and costs of energy sources and energy technologies. Then, based on these assumptions, three cases of long-term energy scenarios were developed with a different scale of nuclear energy utilization, and the possible role of nuclear energy was analyzed through their comparison. It was indicated from this study that expansion of nuclear energy utilization will contribute to reduce dependency on imported fossil energy, and therefore, to increase stability of energy supply, and to control carbon dioxide emissions at significantly low levels with acceptable costs.

Keywords: Energy demand and supply, Energy scenarios, Nuclear energy, Fossil energy, Carbon dioxide, Costs
