

## Report from the IAEE Rio International Conference

### *THE FUTURE OF ENERGY: GLOBAL CHALLENGES, DIVERSE SOLUTIONS*

By Edmar de Almeida and Helder Queiroz Pinto Jr.

In all, the 33rd IAEE's International conference received 415 technical papers. From this total, 243 papers were approved to be presented in 67 parallel sessions on key issues in energy economics. Besides these sessions, 13 plenary sessions (including one special session) were organized.

In general, one can say that the goals and objectives of the conference have been achieved. Among these achievements we can mention: bringing foreign energy specialists to Brazil, attracting a large audience; promoting contact between students, professionals and academics in the field of energy economics and academic contributions to the energy economics issues, and encouraging debate.

The 13 plenary sessions have covered all segments of energy economics (oil, gas, electricity, renewable, regulation and the environment) and it would not be possible to make a summary of each one in this paper. Instead, we want to highlight some presentations and the conclusions of some specific plenary sessions that are representative of the debate carried out during the seminar.

The inaugural session was very representative of the type of debate and research questions discussed during the seminar. The title of the inaugural sessions was, "*Why We Need a New Energy Policy?*" This session was presented by Professor José Goldemberg. His presentation was focused on three questions: i) what is the present energy order? ii) whether the present order is sustainable; and iii) if its duration can be extended. Based on these questions, Professor Goldemberg outlined his vision for a new world energy order and potential vectors to achieve this new order.

What is the present energy policy? The current energy policy is based on the predominant use of non-renewable fossil fuels: coal, oil and natural gas. Together, these three energy inputs accounted for more than three quarters of primary energy supply in the world in 2008. The evolution of the contribution of these sources in final consumption over the past 30 years was relieved by the growth of the share of electricity, but not significantly. The energy consumption in this energy policy is concentrated in the industrial, residential and transportation segments.

Is this order sustainable? Although the most debated issue of the current energy policy is global warming, Goldemberg said that this is in his view only one of five problems of equal importance, that cause the need for change. These are: (1) unequal access to energy, (2) the exhaustion of fossil fuels on the horizon of a century, (3) issues of sovereignty and security of energy supply, (4) health problems directly generated by the current energy pattern, and finally (5) global warming.

Can the duration of this energy order be extended? In his reflection on this question Goldemberg began by outlining the difference in the evolution of the energy efficiency of the U.S. state of California and the United States as a whole. In California, the energy consumption per capita has remained relatively stable since 1976. In the U.S., the consumption per capita has grown steadily over the same period. This difference is related to the California lead in regulating energy. Since the 1970s, California government has been implementing actions and programs aimed at controlling the energy efficiency of the state's economy. Therefore, the California experience shows that it is possible to control the energy efficiency with the adoption of appropriate mechanisms. He added that without the efforts already undertaken in the world for greater energy efficiency, the current energy consumption would be 58% higher.

Goldemberg argued, finally, that a new world energy order is needed to combat the problems of (i) inequality in access to energy, (ii) the massive use of an exhaustible source of energy (petroleum), (iii) the high geopolitical tensions (iv) of the health problems arising from the use of fuels and (v) of global warming. Goldemberg has showed that the duration of the current energy policy can not be extended; making sure that change is needed. He sustained that the way for this change to go through: i) rural electrification programs in the world to mitigate the problems of unequal access to power; ii) the adoption of renewable fuels in the transportation sector, especially through the increased blending of ethanol with gasoline; iii) and finally, the orientation of national energy policies toward a greater share of renewables in electricity production.

The session on the future of energy demand in transport has developed a detailed discussion on the potential for the diffusion of electric vehicles. This session was chaired by Professor Lee Schipper from Stanford University. The panelists were Lewis Fulton (IEA), Suzana Kahn-Ribeiro (from Federal University of Rio de Janeiro) and Pietro Erber (from the Brazilian Electric Vehicles Association - ABVE). Lewis Fulton tried to answer the following question – How the electric car fits into the future? Fulton

has explained that the International Energy Agency (IEA) is working with scenarios. The scenario that foresees a larger reduction of CO<sub>2</sub> is called BLUE MAP. In this scenario, to achieve the target of reducing CO<sub>2</sub> emissions by 2030, the world needs to reduce consumption of fossil fuels in vehicles by 50%. This change would be made by replacing part of the vehicle fleet today with vehicles that use biofuels and/or electricity. To achieve current CO<sub>2</sub> emissions targets it will be necessary to have 100 million plug-in hybrids cars.

How to pay for this? Electric cars are very expensive. The batteries cost between \$18,000 and \$24,000. Between 5 and 10 years, this figure may drop to somewhere around \$ 9,000. Now the costs are greater than the energy savings that is done. But when the battery price drops to around \$ 9,000, electric vehicles will be economically viable.

For the world to achieve the commitments of CO<sub>2</sub> emissions in 2030, all continents need to have electric cars. In this case, 10% of all passenger cars should be electric or plug-in hybrids. Therefore, it is necessary that the battery cost is reduced and that cities improve their infrastructure.

Suzana-Kahn Ribeiro has stressed that, currently, global CO<sub>2</sub> emissions are 40-45 Gt CO<sub>2</sub> per year. To reduce the current temperature in 2°C, as agreed in Copenhagen, emissions should be 18 Gt of CO<sub>2</sub> per year. Transport is the most important contributor for CO<sub>2</sub> emissions, especially road transport (even if one considers only private vehicles). In 2030, there will be an even greater demand for transportation.

The challenge in the transportation sector should consider improvements in vehicle weight, materials used, and the air resistance and so on. The combination of electric vehicles and vehicles powered by biofuels is also a great solution. But it is essential to improve vehicle technology. Electric vehicle batteries still have little ability to store energy, limiting the autonomy of the vehicles, besides having a very long recharge time.

Pietro Erber has explained that electric cars are not exactly new technology. In 1900, in the United States, 38% of cars were electric. When discussing the implementation of electric cars on the road, one must take into consideration some issues such as: (i) reducing emissions by climate change in accordance with the GHG Protocol, (ii) improved urban environment, (iii) preservation of urban mobility, (iv) security of energy supply, and (v) technological and industrial development.

Some factors are still limiting for marketing the electric car. There is a high initial cost to purchase an electric vehicle since the batteries are expensive and there are no economies of scale for the current production. The low autonomy of the electric car, the high recharge time and lack of infrastructure for recharge limit the diffusion of technology. The risk of obsolescence of technology is an obstacle to initial investment, thus, there was a resistance to innovation. Moreover, it would be necessary to implement technologies that would ensure that the recharge was made out of peak hours of energy consumption (as the smart grid).

The ABVE estimates that electric vehicles will have a market penetration of 30% of all vehicles by 2030. Hybrid cars (HEV) would be 30% of the total and the remaining 40% would be divided between the cars plug-in hybrids (PHEV) and only the battery-powered (BEV).

In the session on Energy Regulation, Einar Hope, chair of this session and President of IAEE, highlighted the main future challenges to be faced by regulatory bodies:

- Establishing a Market Design for the electricity sector;
- The regulation of sectors characterized by natural monopoly;
- The environmental regulation associated with electricity production;
- The challenges of regulation related to the issue of energy security.

Regarding the definition of Market Design, Professor Hope highlighted the need for clear rules to separate competitive segments to those characterized by natural monopolies (unbundling regulation) in order to stimulate competition in energy production and trade. In turn, he emphasized the need for better regulation of transmission and distribution networks, especially in non-vertically integrated market structures in order to ensure the expansion of investment in this infrastructure.

On environmental issues, the need for reconciliation between the market of CO<sub>2</sub> and other environmental policies (taxes, subsidies, etc.) was stated. Moreover, it was emphasized the importance of the electricity market in environmental policy.

The plenary session dedicated to OPEC debated the history and the role of OPEC in the oil market. These debates discussed the future role of the organization in a world driven by sustainable practices and a respect for the environment. According to Mr. Majid Moneef (OPEC's Governor for Saudi Arabia), OPEC has been of paramount importance in the international geopolitical relations for 50 years and will probably keep this role for quite some time. The member countries are responsible for approximately

40% of world oil production, holding approximately 79% and 50% of world oil and gas reserves, respectively

In this context, Mr. Rachid Bencherif, senior analyst for planning the OPEC Fund for International Development (OFID), states that, contrary to what is commonly thought, OPEC is not a cartel. He explains that the organization's power to affect prices fluctuated over time. Mr. Bencherif explained that there were always specific reasons for OPEC production policies, either by supply constraints, or influenced by macroeconomic, political and market conditions variables. Several academic studies have extensively studied OPEC's behavior and have not identified a strict cartel behavior, except some papers in the 1980s.

It was stressed that OPEC is a mature and unique organization. Despite OPEC's influence over members' production decisions, it respects its members national sovereignty and has great ability to adapt to a changing international context. It also presents an intense cooperation with key players and sector regulators, showing initiative in seeking greater transparency in terms of data and information.

The challenges for OPEC in the future will be: (i) energy security - influenced by the uncertainties regarding investments and the need for coordination between consumers and producers, (ii) climate change - directly affecting member countries, (iii) transition of the energy mix in the long run (iv) combating poverty – it is a proven link between energy and development, and in this sense, universal energy access becomes crucial.

Mr. Ivan Sandra, international vice president of strategic affairs in E&P at Statoil, discussed OPEC's challenges regarding the issue of reducing global dependence on fuel. Mr. Sandra has questioned if it was possible to imagine a radically different world in terms of energy consumption. He stressed that the transportation sector will maintain its dependence to oil, even though major innovations could change this scenario. Mr. Sandra has also questioned whether there would be limitations on available resources which accelerate the need for an energy transition. In this respect, the scenarios produced by different agencies showed large differences, demonstrating the difficulty to make projections that include paradigm shifts in consumption and technology.

Finally, the presentation by Mr. Bassam Fattouh from the Oxford Institute for Energy Studies, focused mainly on financial issues and markets. He pointed out that price signaling is crucial to the functioning of the markets. Mr. Fattouh stressed that OPEC often does not produce good price signals, complicating the understanding of its actions and goals. He also stressed that after the last international financial crisis, market signals from OPEC have been coherent and clearly understood by the agents in the oil market. OPEC has clearly presented the principles (focal point) of its market strategy, which can be explained by better leadership in Saudi Arabia. What could change this type of behavior are mainly changes in policies for the environment and energy security.

It is important to mention the Special Session dedicated to the presentation of the EIA-DOE's International Energy Outlook. This presentation was performed by Dr. Richard Newell, the Administrator of EIA-DOE. The Chair of this session, Joseph Dukert, stressed that though Outlook is prepared by the U.S. Energy Information Administration, it is not biased because the studies are done independently of the White House or other political pressure.

Although the EIA's International Energy Outlook contains three long-term scenarios (baseline, high economic performance and low economic growth), Dr. Newell presented only the reference scenario. This scenario assumes that current legislation and regulations will be maintained. Dr. Newell highlighted the impact of the recession in 2007 and the projected demand by 2035. According to Newell, the economic crisis has negatively affected the global demand for energy, which shrank 1.2% in 2008 and 2.2% in 2009. This downward trend, however, should not be maintained in the long run. The prospect is that energy consumption will grow 49% between 2007 and 2035. However, this growth is uneven across countries. While in non-OECD countries, total demand for energy will increase 84%, in OECD countries the increase should be only 14%. The main reason for the strong growth in energy consumption in non-OECD countries is the fast and also strong economic growth. According to Newell, the economic growth of developing countries should correspond on average to 4.4% per year, in contrast to 2% per year in OECD countries. Energy consumption should increase the use of all energy sources, and fossil fuels (coal, natural gas, petroleum and petroleum products) should continue to meet most demand. However, despite continuing as the main source, the share of fossil fuels in global energy production should decrease from 35 to 30% in 2035. This decline can partly be explained by the expected increase in oil prices from \$79 per barrel in 2010 to U.S. \$133 per barrel in 2035. This increase will foster a greater diversification of energy sources.

Newell mentioned that the reduction in the proportion of fossil fuels in different sectors depends on

the technological and policy ability to replace them with other sources. For now, the transportation sector is the largest consumer of fossil fuels, especially in non-OECD countries, as a result of rising incomes and urbanization in these countries. In fact, the energy consumption for the transportation sector in non-OECD countries should grow 2.6% annually between 2007 and 2035, while in OECD countries is the expected growth is only 0.3% in the same period. This low growth rate is due in large extent to the greater efficiency of fuel used.

The participation of the transport sector in the consumption of liquid fuels should increase from 53% in 2007 to 61% in 2035, accounting for 87% of the total increase in consumption of liquid fuels in the world. Thus, understanding the dynamics of the transportation sector is essential to project the future demand for energy in the case of liquid fuels.

With respect to emissions of greenhouse gases, Newell stressed that emissions should continue to grow but at lower rates due, among other factors, to greater energy efficiency. Again, the non-OECD countries should provide higher growth rates. Anyway, Newell argues that any projection of long-term emissions involves many uncertainties.

On the supply side, it is projected that OPEC will increase its production capacity for liquid fuels in order to maintain its market share by approximately 40% of the total production of liquids by 2035. The production from unconventional sources of liquid fuels should reach 12% of the total production match in 2035. Most of this increase will be related to the production of biofuels in Brazil and the United States and production from oil sands in Canada.

With regard to natural gas, Newell points to growth in consumption of 44% between 2007 and 2035. To meet this demand, the production of natural gas should increase 46% in the same period. The increased production should be greater in the Middle East, Africa and Russia. As in the case of liquid fuels, gas production from unconventional sources such as, for example, tight gas, shale and coal bed methane should grow, especially in the United States, Canada and China.

Coal production and consumption should increase given the lack of a global agreement to limit emissions of greenhouse gases. According to the projections, coal consumption should grow by an average of 1.6% per year. Most of this growth should occur in non-OECD Asia, which must correspond to 95% of the demand for coal between 2007 and 2035.

Finally, the closing plenary session tackled the following question: *Energy and Environment: What Will Come After Kyoto?* It was stressed that the Climate Conference held in late 2009 in Copenhagen was a failure in political terms and did not progress to the adoption of concrete measures. Considering forecasted growth in emissions of greenhouse gases, technological advances alone will not solve the problem of climate change, requiring the adoption of policy instruments, besides increasing the role of best practice models.

Nebojsa Nakicenovic (Vienna University of Technology) articulated his talk around the concept of decarbonization, which should be viewed as a long-term energy strategy, as an evolving trend for energy. According to Nakicenovic, radical changes are needed in order to mitigate the effects of climate change. The decarbonization is a prerequisite to meet the challenges related to climate changes.

We are experiencing a confluence of crises: financial, unsustainable consumption, climate change, access to food and electricity, among other global issues. Integrated solutions must be present in the Rio+20 conference discussions, to be held in 2012 (20 years after the Rio conference in 1992).

A difficult question surrounding the policy formulation to tackle climate change is the fact that measures must be adopted immediately, but the results/benefits are only observed in the very long term. Nakicenovic has also raised the question of what mechanisms to use, “carrots or sticks?” Nakicenovic argued it is necessary to use a combination of both.

Perry Sioshansi (Menlo Energy Economics) pointed that the most relevant factors to the mitigation of climate change are technology and policies. He also mentioned the pessimism toward Cancun, given the failure of Copenhagen. He stressed that power consumption can be reduced significantly by the adoption of energy conservation measures. Some individual efforts to reduce emissions, such as California and Canada, demonstrate that there are important opportunities to reduce energy demand without radical technological changes.

Thus, a large number of key issues were discussed at the 33rd IAEE International Conference, strengthening the exchange of experience and energy among economists from different parts of the world and promoting a greater interaction between academia, energy companies and government institutions.