

Analyzing Changes Induced by the Shale Revolution

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This report's title is taken from the subtitle for the "Asia/World Energy Outlook 2013" (hereinafter referred to as the "Outlook") that the Institute of Energy Economics, Japan, published on October 21. As indicated by the subtitle, the Outlook's focuses include an analysis on how differences in degrees of progress in developing shale gas/oil and other unconventional energy resources would impact the global energy system and the world economy. As did the past Outlook reports, this latest one also analyzed the Reference Scenario in which existing global energy supply and demand trends will continue and the Advance Technology Scenario in which advanced energy technologies to promote energy security and environmental protection will be diffused and used to the maximum on both the supply and demand sides. By comparing the two scenarios, the Outlook looked into details of energy conservation effects and carbon dioxide emission reduction induced by the promotion of advanced technology deployment. But the most important point of the Outlook is that the report provides the Enhanced Unconventional Resource Development (EURD) Scenario, in which unconventional energy resources development will make substantial progress in the United States as well as in the rest of the world, and analyzes the impacts or implications of the progress. (For details, see http://eneken.ieej.or.jp/whatsnew_op/131021teireiken.html)

I here do not detail the EURD Scenario. Instead, I would like to analyze changes induced by the shale revolution, as indicated in the title. In the EURD Scenario, technological, economic, institutional and all other conditions for promoting unconventional energy resources development are assumed to be met to substantially expand unconventional oil and gas production. For example, production in 2040 will substantially increase from 7.4 million barrels per day in the Reference Scenario to 26 million b/d in the EURD Scenario for unconventional oil and from 1.4 trillion cubic meters (CM) to 2.2 trillion CM for unconventional natural gas. The substantial production expansion will ease the supply-demand balance in oil and gas markets, leading crude oil and natural gas prices to decline from the Reference Scenario to the EURD Scenario. How should we interpret the changes induced by the shale revolution? Answers may be divided into three points -- (1) impacts on competition between primary energy sources, (2) impacts on international energy trade patterns and (3) macroeconomic impacts on major countries.

Under the first impacts, gas will become a "winner" in a competition between energy sources in the EURD Scenario. Gas will increase its competitiveness through a price reduction,

allowing gas demand to expand in various areas. Among them, the power generation sector will post a remarkable increase in gas demand. Coal will be most affected among energy sources in the EURD Scenario. Coal demand will slacken. Nuclear and renewable energy development will also be affected by gas's expansion by some degree. Growth in nuclear and renewable energy consumption may slightly decelerate. In this way, the substantial expansion of unconventional gas production and the gas price decline will affect the global energy portfolio. Meanwhile, the substantial expansion of unconventional oil will help reduce crude oil prices. But oil demand's comparatively low elasticity to prices and the transport sector's switch from oil to gas amid gas price reduction will lead oil demand to decline somewhat instead of increasing. Nevertheless, the substantial expansion of unconventional oil production in the absence of any demand increase will affect international trade structurally.

The second impacts will greatly change the net oil and gas import positions of major regions. In the EURD Scenario, North America will substantially expand net oil and gas exports. As far as oil alone is concerned, North America will move from a net import position in the Reference Scenario to a net export position in the EURD Scenario in 2040. Latin America and Oceania will also substantially expand net oil and gas exports and be positioned as major exporters under the EURD Scenario. Given the abovementioned supply and demand changes, present major exporters including the Middle East and the Former Soviet Union will see reduced net exports in the EURD Scenario than in the Reference Scenario. Particularly, the Middle East's net oil exports in the EURD Scenario in 2040 will be 8 million barrels per day less than in the Reference Scenario. Given the easier supply-demand relationship to lower prices, as well as the lower net exports, the enhanced development of unconventional oil and gas resources will have a great impact on oil and gas export revenues in the Middle East and the Former Soviet Union.

The third impacts in major regions will be patchy, depending on the degrees of unconventional resources development. U.S. GDP in the EURD Scenario in 2040 will be 1.4% more than in the Reference Scenario. Even in the Reference Scenario, the United States will have developed unconventional gas and oil resources ahead of other countries. The shale revolution's cumulative effects including those taken into account in the Reference Scenario will push up U.S. GDP by 4% in 2040. Effects of global economic growth, including the U.S. expansion, and unconventional energy resources development will raise Chinese GDP by 1.9% from the Reference Scenario to the EURD Scenario. The positive effects of global economic growth and oil and gas price drops will increase Japanese GDP by 1.1%. But price declines and lower net exports will reduce GDP in 2040 by 4.1% from the Reference Scenario to the EURD Scenario for the Middle East and by 2.3% for the Former Soviet Union. In this way, the enhancement of unconventional resources development will widely impact energy supply and demand and macroeconomic profiles, inducing various changes in relative relations between economic power and national power, in international relations and in international orders.

This analysis only dealt with differences between and effects of multiple scenarios based on bold assumptions regarding the degree of unconventional resources development. In fact, we

must acknowledge that the future course of unconventional resources development is very uncertain. Although the latest Outlook compared the Reference Scenario with the EURD Scenario where unconventional resources development will make substantial progress, we cannot deny a possible stalemate in the development. How such stalemate would affect the global energy system and economy would also be a matter of great interest to us. We must consider future strategies and policies while remembering that uncertainties exist not only with regard to the future course of unconventional resources development but also concerning other key matters that can greatly impact the global energy situation.

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