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What Are the Driving Forces for Global Energy Transition?

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Energy transition or global energy transition has become a keyword for energy stakeholders in the world. If global energy transition is defined as long-term structural changes in global energy supply and demand, markets and industries, it should be very significant for energy stakeholders including energy policy planners, energy industry people, energy technology developers, energy sector finance experts and those benefitting from energy consumption or use.

Nearly 20 years have passed since the 21st century started. The 20th century was called “the century of oil,” as described below. Oil is still a key energy source that accounts for the largest share of global energy consumption. However, the oil share has steadily been decreasing. What would the representative energy source be for the 21st century? Energy stakeholders now widely recognize that the world is in a transition to a new age.

There may be numerous factors that exert influence on the global energy transition towards a new era. Given the essential significance of energy, however, it will remain important to provide energy in a stable, environmentally friendly and affordable manner. A key matter attracting attention in regard to the environment is how far the world could implement low-carbonization or decarbonization. This is because low-carbonization or decarbonization is a new challenge that has never been seen in past energy transitions. In a bid to get useful implications for considering how the global energy transition would make progress and how the world would address the new challenge, I would like to analyze factors or driving forces for the past energy transitions.

Energy has remained an essential material or good that holds the key to survival for human beings. Over a very long term in human and social history, human beings have depended on natural energy sources. Human labor, livestock labor, traditional biomass (such as firewood), windmills, waterwheels and other natural energy sources remained main energy sources even in the late modern period. A fundamental change came on the industrial revolution. Industrialization since the 19th century has required far more energy consumption than ever before. Coal was selected on the supply side to meet the giant change on the demand side. Since then, human society has forged ahead with massive energy consumption. Therefore, what energy sources to select and how to meet such energy demand have become central challenges for the global energy transition.

The transition to oil from coal as a central energy source for the industrial revolution made rapid progress. Various factors were behind the rapid transition to oil. However, a simple conclusion is that oil took advantage of its competitiveness, abundance and convenience to replace coal as the largest energy source. Nominally, it is no exaggeration that the dramatic expansion of oil as transportation fuel under the rapid diffusion of automobiles ushered in the century of oil. The discovery and development of enormous oil resources mainly in the Middle East have played a key role in paving

the way for the century of oil. So have the development and diffusion of large tankers in a technological innovation that has supported the massive oil transportation to large scale consuming areas in the world.

The oil crises in the 1970s brought about an inflection point in the century of oil. Those crises came as the world increased dependence on oil as the most competitive energy source, leading the world to understand the importance of energy security as an externality. Since then, member countries of the Organization for Economic Cooperation and Development have powerfully developed policies to lower their dependence on oil and diversify energy sources. As a result, OECD oil demand has stopped expanding, with oil's energy mix share falling. Nevertheless, global oil consumption has continued expanding because non-OECD oil demand has robustly increased due to sustained economic growth and progress in motorization. In anticipating future oil demand, therefore, we must pay attention to what would bring about an inflection point in non-OECD oil demand.

In this way, factors behind the past global energy transitions included great changes in energy consumption or use, dramatic changes in the availability of energy sources, the emergence and diffusion of advanced or innovative energy technologies and the development of powerful energy policies for specific purposes. Particularly, we must take note of the point that some external events triggered or accelerated changes.

While having continued to reduce its share of global primary energy consumption since the beginning of the 21st century, oil has remained the largest energy source, accounting for 34% of global energy consumption as of 2017. Fossil fuels, including coal as the second largest energy source and natural gas as the third largest in addition to oil, have a combined share of 85%, indicating that the world depends heavily on fossil fuels. While stable energy supply and energy security remain important challenges due to the structural dependence of energy supply, demand and markets on fossil fuels, however, switching to non-fossil fuels is attracting global attention because of the importance of addressing fossil fuel consumption's environmental load including air pollution and climate change.

In this respect, the substantial expansion of renewable energy including solar photovoltaics and wind power generation has recently attracted global attention due to a rapid decline in solar PV and wind power generation costs. The advancement and diffusion of important electricity storage technologies for addressing the intermittency of renewable energy are also given priority. In the automobile field that exerted great influence on the century of oil, vehicle electrification and changes in mobility are seen as key factors to innovate the energy field. Various other technologies leading to energy transition are also blossoming, including innovative information technologies like artificial intelligence and the Internet of Things, hydrogen and other innovative energy technologies, and new nuclear power generation technologies.

However, what technologies or energy sources would lead the global energy transition is still uncertain at present. In the face of enormous uncertainties, all energy stakeholders will be required to closely, coolly and objectively watch and analyze what policies, events, social need changes and technologies would drive innovations and shape a new energy world.

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