Journal of The Gujarat Research Society

ISSN: 0374-8588
Volume 21 Issue 1, January 2019

History, Future, and Potential of Oil and Nuclear Power

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ABSTRACT: ***Over the last 50 years, the connection between oil and nuclear energy in the global energy landscape has been examined. The previous product rivalry between nuclear and oil in power production and other end-use sectors has been discovered to have evolved into a complimentary relationship. Price volatility, supply security, geopolitical sensitivity, depletion alarms, and environmental pollution issues for oil, economic performance, operational safety, proliferation, terrorism, radioactive waste disposal, and the resulting public acceptance for nuclear are examined as determinants of their future roles in the world energy balance. To assist future economic and energy policy studies, a century-scale evaluation of the long-term prospects for oil and nuclear energy is provided. It is the first comprehensive assessment of global energy forecasts based on a comparison of long-term socioeconomic scenarios and their coordinated quantifications by a set of integrated energy–economic models.***

KEYWORDS: ***Coal, Oil, Long-Term Scenarios, Nuclear Energy, Renewable.***

1. INTRODUCTION

Oil and nuclear energy's perceived significance and real involvement in the global energy landscape have shifted many times over the last 50 years owing to a variety of reasons. Some notable instances are the oil price shocks of the 1970s and 1980s, as well as the disasters at Three Mile Island and Chernobyl. Currently, there are a number of worries about both energy sources and the technology that support them. Supply security, geopolitical sensitivity, price volatility, water pollution from off-shore installations and tanker accidents, soil contamination in processing plants, emissions of substances that contribute to acid deposition (SOx and NOx) and global climate change (CO2), and the threat of depletion are all on the list when it comes to oil. Economic performance, the spread of hazardous materials, the threat of terrorism, operation safety, radioactive waste disposal, and, as a consequence of all of these, and public acceptability are among the concerns about nuclear energy [1].

The resolution of these issues will be a complicated societal process including both relatively straightforward scientific, technological, and economic elements as well as highly divisive social and political decisions. The result of this process will decide the long-term roles of oil and nuclear energy in the global energy balance.

This paper examines the long-term patterns and major turning moments that have influenced the actual use of oil and nuclear energy in the past, as well as the policies that have responded to those occurrences .Following that, a succinct evaluation of the current status and the major issues regarding these energy sources in the early twenty-first century is presented. Long-term scenarios of the global economy, energy consumption, and environmental issues produced by the Intergovernmental Panel on Climate Change (IPCC, 2000) are used to assess existing assumptions about their future roles under various social, economic, and technical development patterns. This is the first comprehensive, in-depth assessment of IPCC predictions at the century scale from the viewpoint of the oil–nuclear connection. The study adds to our understanding of

ISSN: 0374-8588
Volume 21 Issue 1, January 2019

the variations in relative and absolute significance of these two energy sources across IPCC scenarios and model-based quantifications [2].

Studies of the history of the global energy system at a century scale reveal a fairly consistent pattern of the rise and fall of several main energy sources. logistic substitution model captures the complex web of interactions among the driving forces (resource availability, technologies, delivery systems, and costs determining supply on the one hand, lifestyles, tastes, preferences, and income levels influencing demand on the other) that shape the energy sector in a simple but insightful scheme. The developing patterns of long-term dynamics indicate that oil's share of global primary energy supply peaked in the third quarter of the twentieth century, about when, but not only because of, nuclear energy joined the picture, Oil's steady rise through the first half of the twentieth century was aided in the 1950s and 1960s by post-World War II reconstruction and sustained economic growth in OECD countries, as well as the rapid expansion of automotive transportation, the petrochemical industry, residential and commercial space heating, and power generation.

Oil has maintained its overwhelming dominance in road and air transportation, as well as a feedstock in a variety of industries, but has been seriously challenged by natural gas in the residential and industrial process heat markets, and at least partially by nuclear in power generation, in recent decades. As a result of this, many oil producers now see nuclear power as a serious rival to oil. A quick historical review shows whether or not this impression is correct, and if nuclear power has ever represented a threat to oil export markets [3].

To examine a nuclear–oil product competition, one must first comprehend the marketplaces in which such rivalry could occur. Nuclear power and oil products may face competition on two levels. The first is the power producing market, where direct rivalry exists between these fuels and, of course, other generating choices. The second dimension is indirect competition, which includes the different end-use sectors where electricity competes for market share against oil, natural gas, and heat, among other things [4].

The present connection between nuclear power and oil is quite different from what it was only a few decades ago. Nuclear and oil for electricity production are targeting distinct energy market sectors at the start of the twenty-first century, with minimal overlap in the long term. In most developed nations, oil for power production serves primarily as a means of disposing of leftover oil that has no other use. Peak supply, backup fuel, and scattered non-grid production are some of the other applications for oil products. These markets have been very oil-dependent in the past, but with the introduction of fuel cells, that may alter in the future. Because nuclear power has no role to play in these captive markets, a nuclear presence in the electricity producing sector has no impact on oil's growth prospects.

Diesel production is often the only reliable energy supply route in distant, non-grid linked regions, making nuclear power (at least with current nuclear technology) out of reach. Remote markets in developed nations, on the other hand, are often linked with pristine natural settings, where the current trend is to install renewable energy sources. Grid-connected electrification has already achieved more than 95 percent area coverage in the OECD nations, thus remote energy markets are unlikely to expand.

ISSN: 0374-8588
Volume 21 Issue 1, January 2019

This is definitely not the situation in underdeveloped nations, where over two billion people, the majority of whom live in rural regions, do not have access to power. This may be attributed to two factors: a lack of power production, transmission, and distribution infrastructure, as well as a lack of affordability. Furthermore, grids are often tiny and weak, making nuclear power unsuitable for use. As a result, oil continues to be an excellent fuel for dispersed power production.

Whether or whether oil can be challenged by renewable in these markets not by nuclear power depends on economics (fuel costs), dependability, and convenience. They discover that, depending on the solar photovoltaic system's performance, it offers the cheapest alternative up to 15 kW h daily energy need in bad economic conditions, but that this threshold rises to 68 kW h/day requirements in good conditions.

2. DISCUSSION

Nuclear energy against oil goods at the end-use level is the second dimension of the oil–nuclear rivalry. Economic considerations, productivity, convenience, regulation, availability, product quality, and societal preferences all have a role. In the residential, commercial, industrial, feedstock, and transportation sectors, these considerations restrict competition between electricity and oil products (and vice versa).

Fuel qualities and related conversion technologies may be advantageous or disadvantageous in fulfilling a specific energy service need in this case. Are almost entirely dominated by electricity, with oil products mostly absent. Electricity is a zero-emission end-use energy source that is extremely efficient, flexible, and easy to utilize. It's no surprise that it's the world's fastest-growing end-use energy transporter. Oil consumption outside of the transportation and chemical sectors (feedstock) as well as non-energy consumption has decreased in the OECD nations' residential, commercial, and industrial sectors, owing to increasing usage of electricity and natural gas [5].

Another type of indirect linking that is linked to nuclear is the replacement of alternative energy sources for power production, which may subsequently be used to replace oil in other market sectors. Nuclear power, in particular, may replace natural gas in power production, freeing up natural gas for use in transportation or the heating market.

In order to better understand the indirect rivalry between nuclear electricity and oil products, it's helpful to look at the market share of electricity in total final energy as a function of nuclear power production in various nations. Nuclear power accounts for 78 percent of electricity generation in France, whereas electricity accounts for 20% of total energy. Germany has a 29 percent 18 percent indicator pair, the United States has a 20 percent 19 percent indicator pair, and Japan has a 27 percent 24 percent indicator pair. In comparison, Australia has a 23 percent electricity share, Austria has a 19 percent electricity share, and Italy and Denmark each have 18 percent electricity. To summarize, there is no evidence, at first sight, that the degree of nuclear presence in electricity production has a major impact on the electricity market share in final energy, and therefore a large indirect rivalry between nuclear power and oil [6].

In summary, nuclear power has increased its market share in electricity production mostly at the expense of oil since 1973. Oil sales to power generation, on the other hand, did not fall in absolute terms—in fact, they rose somewhat. Nuclear power has nothing to do with the decrease

ISSN: 0374-8588
Volume 21 Issue 1, January 2019

in oil product usage in non-transport end-use industries. There are certain outliers and exceptional situations, such as in Sweden, where nuclear-generated power has mostly replaced oil in household and district heating. However, several reasons have led to the relative decrease in oil consumption in the OECD area, the most significant of which being OPEC geopolitics and price [7].

The Intergovernmental Panel on Climate Change (IPCC, 2000) offers a series of hundred-year global futures with the primary goal of presenting a collection of greenhouse gas emission pathways in its Special Report on Emissions Scenarios (SRES). These emission pathways derive from vastly divergent but realistic socioeconomic growth scenarios into the twenty-first century. The IPCC scenarios provide a helpful foundation for looking at long-term energy prospects and information about the anticipated role of oil and nuclear energy, even if greenhouse gas emissions are not the focus of this paper [8].

The scenarios are based on in-depth studies of possible socioeconomic growth pathways, with a focus on demographic, economic, and technological trends. A set of global models are used to trace the consequences of these patterns for energy demand, supply systems, and the resultant resource usage and pollutant emissions.

The major paths of possible socioeconomic growth are grouped into four scenario families as a consequence of two axes being combined. The first axis divides potential futures into two groups based on whether civilizations prioritize economic or environmental assets. The second axis distinguishes future developments by determining whether the trend of growing globalization will continue or if more heterogeneity and regional isolation will emerge. Low population growth and rapid economic growth are elements of the A1 storyline's future, which is fueled in part by rapid technical progress and the rapid introduction of new and more efficient technologies. Because of the growing interconnectivity of the global economy, there is a convergence of per capita incomes across areas, partially due to capacity development and increased social and cultural connections [9]. There is a greater focus on preserving local identities and economic self-sufficiency. Because fertility rates in certain areas decrease slowly, the pace of population increase stays quite high.

In the narrative, the globalization trend continues, but with a growing significance of the service and information sectors of the economy, which leads to rapid material intensity reductions and the rapid development and spread of clean and resource-efficient technologies. This greening of the global economy occurs in the wider framework of the transition to sustainability, or global solutions to economic, social, and environmental problems, even if no climate protection measures are implemented. The narrative depicts a future in which local efforts and solutions are used to achieve sustainability. Despite a slowing of population growth, the geographically varied and on average slower technical progress allows for only moderate economic growth. At the regional or municipal level, environmental and social elements of sustainability are also addressed. Additional variables in terms of energy sources, technology, and emissions are overlaid on these stories to show potential variations within the same global future [10].

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unsuitable for use. As a result, oil continues to be an excellent fuel for dispersed power production.

Whether or whether oil can be challenged by renewable in these markets not by nuclear power depends on economics (fuel costs), use a life-cycle cost calculation to examine the economic feasibility of stand-alone solar photovoltaic systems against diesel production under Indian circumstances. They discover that, depending on the solar photovoltaic system's performance, it offers the cheapest alternative up to 15 kW h daily energy need in bad economic conditions, but that this threshold rises to 68 kW h/day requirements in good conditions.

For decades, issues such as energy consumption, supply, technology, resource base, security, and pricing, as well as their consequences for economic growth, have been high on the social agenda. However, in recent years, we've seen a new wave of debate about the best sources of energy, the socially optimal level and forms of energy sector deregulation and liberalization, with the added dilemmas of privatization in developing countries and economies in transition, about the energy sector's appropriate responses to environmental problems like acid rain and climate change, and about the dilemmas of getting prices to reflect the full social cost of energy.

The most recent aspects of this complicated discussion that is most relevant to the present problems surrounding oil and nuclear energy, as well as potential solutions with long-term consequences. Oil has definitely played a large role in the nonrenewable resource depletion issue. Regardless of the insights given by natural resource and energy economics, as well as the dynamics of technological development, some experts have hinted at the possibility of the final oil well running dry. The work of the Association for the Study of Peak Oil and Gas is a recent example (ASPO). Global oil production is expected to peak around 2008, according to the organization, and it recommends an international agreement to avoid significant economic and supply disruptions during the transition to a post-oil world.

3. CONCLUSION

Based on a large number of worldwide scenarios, the study presents the first in-depth comparison analysis of the anticipated role of oil and nuclear energy in the twenty-first century. It reveals some robust trends that seem to persist across a broad range of socioeconomic scenarios and a diverse set of global energy–economy models: steady growth and regional convergence (albeit at different rates) of incomes, enduring improvement of energy efficiency, and persistent increase in primary energy use. However, geographical specifics and the dynamics of energy sources in the global energy balance vary significantly across global models. It's essential to remember that all of these IPCC scenarios are completely non-intervention scenarios, meaning that no further climate policy interventions are anticipated beyond what existed in 2000. Oil and nuclear power share are expected to vary under climate policy scenarios that seek broad mitigation choices or particular cost-effective CO2 reductions, but the predicted causes and timing of such changes should be the topic of a separate study.

Nuclear power outperforms coal and, depending on the level of environmental regulation, gas in an ecologically aware future. Policies aimed at reducing global warming will undoubtedly have an impact on oil production and consumption, but mainly in end-use markets and, depending on the future techno-economic performance of renewable, even in non-grid power markets. Some oil usage in the residential, commercial, and industrial sectors may be indirectly challenged by

ISSN: 0374-8588
Volume 21 Issue 1, January 2019

nuclear-generated power. However, due of its inherent characteristics to enhance productivity, cleanliness, and convenience, electricity–regardless of how it is generated–is projected to grow in market share. Internalization of externalities connected with the production and consumption of energy services will enhance the competitiveness of clean technologies like nuclear power in the long run. The main issues in the context of global warming are how quickly the world society chooses to decrease CO2 emissions, how expensive alternative mitigation measures will be, and how public acceptability of nuclear energy will change in certain nations. Depending on how these issues and the above-mentioned worries are resolved, nuclear energy may get a fresh push, or it may signal the beginning of the end for this energy source.

Nonetheless, the evolution of nuclear tendencies will have only a minor impact on oil's role in global energy supply in this century. It will be determined by how today's oil-related problems are addressed, as well as how emerging oil rivals perform in terms of cost, ease, safety, cleanness, and reliability in the eyes of future energy consumers.

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