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Future generations and nuclear power—A pluralistic economic appraisal

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ABSTRACT

Nuclear power is a growth industry despite the unresolved problem of waste management. This paper considers the case of Turkey which has a fast growing economy, and where the government has given permission to a Russian company to build a large plant in Mersin, Southern Turkey. Nuclear projects have unique features such as expensive set-up costs, long and expensive decommissioning processes (much longer than construction periods) and the issue of safe disposal of large quantities of highly radioactive wastes, some of which will remain active for many thousands of years, that may create environmental problems especially for future generations. The main focus in this paper is on the role of discounting in economic appraisal of nuclear projects in Turkey and elsewhere. Here we use three discounting methods in economic appraisal of the Turkish plant; standard discounting, the UK government's method of declining discount rate and the intergenerational discounting method. The first two tend to yield somewhat favourable results under the assumption of no interruption in supply due to technical reasons or a major accident. The intergenerational discounting method, on the other hand, which treats all generational cohorts involved equitably, does not yield results as favourable as the other criteria.

1. Introduction

According to the estimate by the International Atomic Energy Association, IAEA (2012), there are 435 nuclear reactors operating in the world, run by thirty three countries. During the last ten years as some existing plants are being closed down, the construction of 62 new units has started which would amount to 59,197 megawatts of new capacity. 2010 was the most buoyant year in the reversal of fortune for the nuclear sector when construction of 16 new reactors began. China appears to be the most ambitious nation, with 42 new reactors planned for construction as of 1 January 2012. Another keen nation is India which plans to construct a substantial number of reactors despite safety problems in existing and proposed ones, Ramana and Rao (2010).

Clearly the nuclear industry is enjoying a comeback even though there seems to be no commonly agreed solution to the growing nuclear waste problem. Up until now Turkey has stayed outside the 'nuclear club', but this is now changing.

In 2012 the Turkish economy was the 16th largest in the world amounting to $1.3 trillion on the basis of purchasing power parity criterion and also one of the fastest growing. In 2010 and 2011 it grew by 9.3% and 8.4% respectively. Demand for energy has been growing faster than the economy. For example, in the two decades to 2012 demand for energy has grown on

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average by 5.2% p.a. whereas the Turkish economy grew by 3.8% annually, International Energy Agency (2013) and Turkish Statistical Office (2013).

Turkish governments have been toying with the idea of going nuclear since 1955 when a bilateral agreement was signed with the United States for the peaceful development of nuclear power. In 1970 there was a feasibility study for the construction of a 300 megawatt plant which was to be the first in the country, but this did not materialise due to technical and economic problems. In 1996 another project was considered at Mersin, in southern Turkey, which was a 2000 megawatt unit involving companies such as AECL and Framatome, Siemens, Westinghouse and Mitsubishi. This too was abandoned largely due to lack of funds.

In 2007 the Turkish Prime Minister argued that the country was too timid in embracing nuclear power which, he argued, was safe, clean and economically viable. On 9th November 2007 an act was passed in the Turkish Parliament which gave the Turkish Atomic Energy Authority consent to establish criteria for building and operating nuclear power plants in Turkey. Turkish Electricity Trade and Contract Cooperation would then buy all the generated nuclear power from producers, whoever they may turn out to be, under 15-year contracts.

In March 2008 tenders were invited to build the first 4800 megawatt nuclear power station in Mersin, which attracted the interest of 14 companies; in the event only one offer was received from the Russians. The government found the Russian company technically competent but the offer could not have been accepted largely due to lack of competition in the process. However, the Turkish government was determined to go ahead with its nuclear programme and to this effect in May 2010 signed an agreement with a Russian company, Rosatom, who will build, own and operate four 1200 megawatt units at the Akkuyu district of Mersin. The government also made it clear that this would be the first of many nuclear projects. In May 2013 another deal was signed with a Japanese company, Mitsubishi Heavy Industries, to build a similar size plant to that of Mersin unit in a northern city of Sinop which will start production under the management of a French company, Areva, in 2023.

Over the years a number of feasibility studies have been conducted on Turkish nuclear power, some including elementary economic analysis, Erdogdu (2009),Edam (2011) and Dokay (2011). The main purpose of this paper is to explore the role of discounting in the economic analysis of nuclear power globally in general, and Turkey in particular.

2. Methods of discounting

In a communal analysis of an investment decision, whether it is a nuclear power plant or a road construction project, discounting is one of the most decisive variables. For example, a project may pass the net present value test at a 3.5% rate but may fail decisively at a 4% figure. There are a number of important aspects of discounting such as distinction between private and social rates, distinction between social opportunity cost and social time preference rates, identification of the correct magnitude and discounting on behalf of present and future generations. All these issues have been attracting the attention of theoretical and applied economists as well as policy makers throughout the world for decades.

The choice between private and social rate appeared to be the earliest controversy when some economists suggested that in cost benefit analysis we should use the private rate which would make a public project as productive as a comparable one in the private sector, Fisher (1930) and Hicks (1965). Furthermore, others argued that the main task of the government should be the removal of imperfections in the economy because in a perfect competition a single interest rate would rule making the divergence between private and social rate redundant, Feldstein (1964) and Mishan (1971). Economists such as Eckstein (1961) and Baumol (1968, 1969) contend that the gap between private and social rates is unavoidable due to institutional and natural barriers such as tax laws and risk, and thus we need a social rate for social analysis.

As for the second issue, a school of thought contends that the proper discount rate must be the social opportunity cost rate which is defined as the one that measures the value to society of the next best alternative investment project in which public funds could be employed. Generally, these next best alternatives are sought in the private sector and the objective behind the use of the social opportunity cost rate is to avoid displacing much better investments in the private sector. If, for example, new investment projects in the private sector are earning a real rate of return of, say, 6% then public sector projects should return comparable rates to the community. On the other hand, another school of thought suggests the use of a different rate, the social time preference rate. The reason behind putting money in investment projects is to enhance the future consumption capacity of the investors, private or public. In other words, an investment project involves a trade-off between present and future consumption and thus what we need to do is to ascertain the net consumption stream of, say, a nuclear power unit, and then use the social time preference rate as a deflator, Arrow and Kurz (1970), Feldstein (1974) and Kay (1972). Others have pointed out that in determining a social interest rate both concepts, the social opportunity cost rate and the social time preference rate, should play a joint role, Marglin (1963).

The United Kingdom was one of the earliest countries to go nuclear and also one of the first to designate policies on discounting. In 1967 the British government advised that nationalised industries should use an 8% test rate of discount in their new investment projects, Cmnd 3437 (1967). Two years later the figure was increased to 10%, in 1972 it was reviewed again but not changed. The government also specified that these figures were based on the social opportunity cost concept as they were consistent with the minimum low risk rate of return which would be regarded as acceptable on new investment projects by large private firms. Critics pointed out that the government had chosen a lopsided figure by ignoring, completely, the social time preference concept, Hampson (1972) and Helliwell (1975). In 1978 the government reduced the figure to 7% striking a balance between the two concepts. However, the data in later years showed that profitability in the private sector was falling and in 1978 the British official rate fell to 5%, Cmnd 7131 (1978).