

Report of Castellucci's Seminar

Debating about nuclear energy is challenging and tricky since nuclear energy involves many aspects and personal values. However, it is necessary to have an unbiased view of the question in order to be conscious of the pros and cons of such an energy source. Comprehending some technical features of nuclear power plants is necessary in order to better understand the economic consequences of nuclear energy. In fact, being conscious of the type of nuclear reactor is essential so as to compare costs.

Usually, the most common arguments in favour of nuclear energy are (a) low marginal cost, (b) security of supply, (c) country independence, (d) the lower volatility of price and (e) "clean" energy. However, these are generally half-truths. As regards low marginal cost of nuclear energy, it could be true but nuclear power plants have high construction costs.

Regarding the security of supply, nowadays Western countries are facing a lower demand of energy compared to 2008 and the growth rate is decreasing. As a consequence, improving the capacity of energy production is not necessary. Other states such as China, India and other developing countries have a growing rate of demand of energy that can justify the construction of new nuclear plants, but this is not for OECD countries.

Concerning country independence, importing the fuel (uranium) is necessary to produce energy and, for example, France has to rely on uranium suppliers. Moreover, before putting the combustible into the reactor it is required a process of enrichment which necessitates capabilities and infrastructures. It is a problem of deciding where the independence starts: does it start off with the mining of uranium or the process of enrichment of it?

As regards the lower volatility of uranium price compared to oil and gas and the "clean energy" argument, the former is true whereas the latter is false.

Taking into account the Italian case, a strong argument in favour of nuclear energy in Italy is the lowering of kWh production costs and hence tariffs. According to Enel, with a new nuclear program Italy could lower the cost of production of one kWh by 20% respect to the actual costs. According to another estimation made by Clò (2010), the reduction could vary from 2% to 5%. However, the focus is on costs, not on tariffs. Transferring the reduction from costs to tariffs is another story. Taking into account the market structure is necessary in order to understand whether this switch can happen or not.

Nevertheless, there are other costs which are hard to evaluate and quantify: external costs. The European Commission has developed a common methodology to assess such costs which is called ExternE (External Costs of Energy). It has been used by the European Environmental Agency and it describes all stages in the energy chain, provides information on material, energy flows and environmental burdens, it allows estimation of health and environmental impacts and it provides a mechanism for estimating the costs of the impacts. Through the ExternE methodology, the European Environmental Agency (EEA) has produced and estimated average of external costs for electricity generation in the European Union divided by technologies. Nuclear power plants produce less externalities than other power plants in term of GHG emissions. However, in order to properly evaluate the cost of externalities, it is necessary to understand all the externalities that a specific energy source may produce. Hence, taking into account the externalities of a nuclear incident is mandatory but quite difficult. In fact, without the evaluation of such external costs, the comparison between two different technologies could be incomplete and unconvincing. Nevertheless, evaluating such a kind of externalities is not straightforward and there exist different approaches to the problem.

Another key aspect is the construction cost. Costs differ according to which source is taken. As stated by Enel, an EPR nuclear power plant of 1700 MW of power generation may cost between 3 and 3.5 billion of Euro. Other companies such as Moody's, E.On and Florida Power&Light give different figures, arguing that costs may be from two to three times higher than budgeted 3

billion. Another lesson comes from Olkiluoto. In 2001 the Finnish Parliament approved the construction of a 1600MW EPR nuclear power plant with a forecast of service equal to 60 years. In 2005 the construction began with a projected cost of 4 billion. Nowadays, the total costs have grown to 5 billion and a delay of three years and half is expected.

Moreover, also Areva argues that the cost of a new reactor is today between six and eight billion of Euro. That demonstrates that construction costs are rising and budgeted costs are not sure and certain.

Another lesson comes from the USA where there exists a liberalised energy market. In the last 30 years no completely new nuclear plants have been built in the USA. That could be due to the liberalised market where private capital flows only in profitable projects. As stated also by MIT in 2003, nuclear power is much more costly than coal and gas even with a high gas price scenario. Moreover, the uncertainty about construction and operating costs and the regulation affects the investors' decisions. In 2009, Du-Parsons updated the 2003 MIT study, founding that costs of construction doubled. As a consequence, a long service life determines a low unit cost of production but requires a huge investment with a long-term perspective which discourages capital inflow. Furthermore, the high capital intensity and the difficulties in predicting both costs and time of construction entail a lot of delays and costs increases which prevent investments to flow in. As a result, the structure of the energy market is affected.

In fact, a competitive market does not attract investments in nuclear power plant since huge investments and delayed returns make the sector very sensitive to the interest rate. Thus, as stated by OECD in Nuclear Energy Today (2011), a supportive public policy framework and appropriate financing models are necessary to build new nuclear plants. The governmental support to such power plants takes the risk of investment away from producers and put it on the taxpayer, entailing a less competitive market.

In conclusion, it can be said that marginal costs are low only once the power plant has been constructed and put into operation. The price of nuclear energy is not sensitive to the variation of uranium price but that cannot guarantee the supply security (e.g. Fukushima accident). Moreover, nuclear energy is not a clean technology since it is GHG emissions free but its impacts on land, water, human and animal health are high. The main differences between nuclear energy and other combustible fuel plants are in the amount of investments needed and in the price of fuels. So, the low price of uranium is not pivotal since it covers about 16% of total costs only whereas investments cover 59% and operational and maintenance activities 25%.

As regards Italy, the demand for energy is lower compared to 2008 due to the economic crisis but also to more efficient ways of using energy. Projections for 2020 sketch a 370TWh of demand and a production from renewables up to 99TW. Probably, in 2020 Italy will have excess of power plants, entailing a capacity underutilisation, i.e. higher and increasing unit costs. Thus, it seems that more and new investments in power plants are not necessary since other kinds of investment are needed by the Italian infrastructure, i.e. smart grids, which could let Italy increase its renewable sources and lower electrical leakages.

In order to proceed with the liberalisation of the Italian energy market, it is necessary to avoid the renaissance of nuclear energy which would reduce the still limited competition. Indeed, there are three ways of governmental support to producers that could affect the competition. The decree law 31 provides firms investing in nuclear power with financial and insurance protection against the risks of delay in the construction and operation of plant. Nuclear producers would have the priority in dispatching their energy to the grid and would have certainty about selling prices that would provide a protection against changes in the demand for electricity.

Finally, to the above-mentioned costs, other costs should be added: the risk of nuclear accidents and the cost of final storage of wastes. No country has yet resolved the problem of finding a proper location for the final disposal of nuclear wastes.

Given similar circumstances, in case of a renaissance of nuclear energy in Italy the energy market will be less competitive, entailing an unlikely reduction of costs and, hence, tariffs. Secondly, there will be no advantages in reverting to nuclear energy, implying no improvement for consumers.