



France and Italy: is nuclear power the way for energy independence?

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This is a guest post by Eugenio Saraceno, member of ASPO-Italy and consultant for energy sources management.



France's nuclear power plants produce almost 80% of the nation's electricity. In contrast, nearby Italy has no nuclear plant in operation.

One of the main arguments of the present debate on energy is whether a nuclear energy program should be restarted or not. We can use the cases of Italy and France as a way for evaluating whether it is a good idea for a non nuclear country to get nuclear plants.

Italy is probably the only country in the world that has dismantled by law the existing nuclear plants. It was the result of a referendum against nuclear power that was held twenty years ago and that led to the stopping of all nuclear energy activities in the country. The only nuclear plant that was under construction at the time, Montalto di Castro on the Tyrrhenian coast, was converted to natural gas. In the following years, the Italian government shut down the remaining nuclear plants even though it this was not required by the results of the referendum, probably

So, nuclear power was completely abandoned in Italy in the 1980s and the country focused on hydrocarbons for the generation of electricity. Years of low oil prices helped this trend but, after 2000, with rising oil prices the debate on nuclear power restarted. Nuclear supporters say now that stopping the Italian nuclear program was a mistake and that new nuclear plants will have to be built because of the very low price per kWh produced. The debate is ongoing in the Italian TV and in the press and, recently, the leading candidate for the right wing party for the coming April elections, Mr. Berlusconi, has stated that, if elected, his government will restart the Italian nuclear program.

In contrast to the case of Italy, France is engaged in the most ambitious nuclear program in the whole world, achieving the maximum ratio of nuclear energy to total electric power production, near 80%. France has 63 GWe of installed nuclear power, 58 reactors over 19 sites.

For a comparison, first of all let's see some data about the energy consumption in both countries.

All data in the table are for the year 2005. Look at the yellow boxes for a quick assessment of the relevant differences and similarities between the two systems. Coal consumption is nearly the same for France and Italy, while oil consumption is larger for France, especially for the transport and household sectors. However, natural gas consumption is lower in France by nearly 30 Mtep. Italians have to burn about 26 Mtep of natural gas in order to generate electric power. This is the relevant advantage of nuclear power: without nuclear, the French would have needed 75 Mtep extra of natural gas.

However, it is also clear that nuclear energy cannot satisfy all energy needs of a country. So, even though France has nuclear power, the country still has to import coal and hydrocarbons (natural gas and oil derived fuels) whose prices are not influenced by the presence of atomic power. So in 2005 the energy imports bill for France and Italy was nearly the same, 37,5 G€ for France and 38,5 for Italy.

We can also compare energy prices in France and Italy. Here are the relevant data.

Energy source price / country	FRANCE	ITALY	EU 15
Medium Electricity price industrial use €/MWh	54,1	98,3	80,3
Medium Electricity price domestic use €/MWh	92,1	165,8	120,5
Medium gas price industrial use €/MWh	27,1	30,5	31,4
Medium gas price domestic use €/MWh	41,1	42,4	43,8

Medium Energy prices 2007 (without tax). Source Eurostat

Electrical Energy GWh	FRANCE	ITALY
Total production	575365	303699
Net import/export	-60296	49155
Available for domestic use	515069	352654
Nuclear power plants	451529	0
Hydro power plants	56938	42927
Biomass power plants	5081	5985
Waste to energy	3260	2620
Wind power plants	959	2338
Geothermal power plants	0	5022

Comparative electricity generation for Fr and It
 Source: Eurostat year: 2005

Electrical Energy GWh	FRANCE	ITALY
Distribution losses	31825	20626
industry	133894	144763
transport	12211	9414
Household/services	276418	146199
Electricity generation sector	25979	13064
Pumped storage plants	6640	9319
Refineries, other energy uses	28051	8947
TOTAL	515018	352332

Comparative electricity consumption for Fr/It

Note how oil products have nearly the same price in both countries. Natural gas prices for both France and Italy are very similar and lower than the EU-15 mean. The real advantage for France

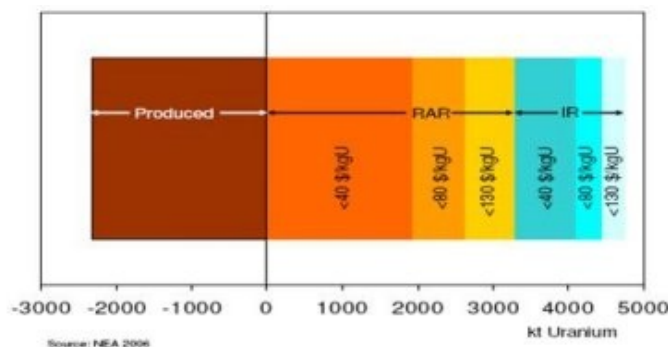
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 is the low cost of electricity, lower than the EU-15 average and much lower than in Italy. Again, we see that nuclear energy has an effect on the prices of electricity, but not on other energy sectors.

France is a large net exporter of electric power while Italy is the largest net importer in Europe, mostly from France, directly or via Switzerland. France produces electrical power mainly by nuclear energy and hydropower. Italy mainly burns gas in combined cycles or oil and coal in steam turbine plants. Italy has also a good quota of hydropower and the best geothermal production in Europe. The electricity use table shows consumption in various sectors. This time the yellow boxes are all for France. First, look at the distribution losses and plant services consumption (electricity generation sector). These data describe the efficiency of electricity generation and distribution services processes; this ratio is 11,2% for France and 9,5% for Italy. The scarce attention for efficiency in France is probably due to the abundant and cheap electricity available. Considering final uses, the interesting point is the huge French household and service consumption sectors, nearly twice as large as in Italy.

Surely electricity is cheap in France, but what is the real cost of the nuclear kWh? As a first approximation let's consider the whole French production as if it was all nuclear. Then consider that electricity consumption of France is partitioned into two nearly equal parts, industrial (at an average price of 54,1 €/MWh) and domestic (at an average price of 92,1 €/MWh), so the average income for producers is 73 €/MWh. This cost is the maximum possible cost for nuclear energy; otherwise operators couldn't make a profit. The value fits well with IEA World Energy Outlook 2005 that estimates costs between 60-70 €/MWh for nuclear electricity. This value is very far from values of 20-30 €/MWh reported from some optimistic sources. These values could be justified only by means of unrealistic assumptions, such as plant lifespan over 35 years, medium plant availability over 7500 hours per year, interest rate under 5%, building time less than 5 years, building cost less than 2000 €/kW and others.

It appears that electricity prices in France remain low thanks to the huge past investments in nuclear power. French Families and small firms pay for electricity very low rates, nearly half than what Italians have to pay. On the other hand, they enjoy so much these good rates that household and services consumption of electric power is double than in Italy. So, in the end, French and Italian people spend the same in terms of their electricity bill. Evidently, Jevons's paradox is valid also for nuclear power: if you have something cheap, you tend to waste it.

As a last relevant point, let us consider the problem of nuclear fuel availability in the coming years. See below some data in the figure



Produceable uranium at various extraction costs (reasonably assured resources and inferred resource)

Produceable uranium at various extraction costs (reasonably assured resources and inferred resource)

EDF (Electricité de France), the Franch nuclear utility, estimates that there exist economically exploitable uranium reserves for 60 years of present consumption (67 kT/year). This fits well

with the on uranium by energy watch group (EWG). And then? And what if many countries step up their nuclear energy production? A research effort is ongoing on new nuclear technologies such as fast neutron reactors and more efficient uranium mining methods, even from seawater. But concrete results on these issues seem to be very far, Commercial fast neutron reactors are expected to be on the market in 2040; perhaps too late to have an effect on the scarcity of mineral uranium. Uranium from seawater was experimentally obtained in small quantities, of the order of kilograms. We do not see a program for commercial exploitation of the industrial quantities that would be needed, of the order of ktons. Moving to mineral uranium very low concentrations (<0,1%) is possible, but there is a minimum value of the concentration that can be exploited because the energy required for mining it would exceed electric energy that could be obtained from it. The EWG reports that this limit is 0,01%, others report lower values but it is clear that today we have a strong uncertainty on the availability of mineral uranium and, as a consequence, on the role of nuclear energy in the future. This could be the real reasons for the modest growth of the nuclear sector in the last few years.

In the end, we see that complete independence in energy production with nuclear power was not reached by France, nor Italy could hope to reach it by revamping its old nuclear program at this point. To reach the French level of nuclear energy production, Italy would have to build almost 20 GWe of nuclear power, spend over 40 G€ and this would take some 10-20 years. Doing so, Italy couldn't hope to become independent from hydrocarbon imports since we see that France couldn't do that, either, despite all her nuclear reactors.

Energy independence for countries that have (or plan to build) nuclear energy could be obtained increasing the cost of electricity costs in order to avoid wasting power and using the extra incomes for financing energy efficiency and substituting hydrocarbons using plug-in hybrid or all electric vehicles in urban areas and heat pumps for household and services. Obviously, this has not been done in France: in no country of the world politicians become popular by raising prices of utilities. So, France has not attained energy independence, despite the huge effort made on nuclear power. Whether the return to nuclear energy planned by Italy and other countries can do that, is all to be seen.

References

Several resources have been utilized for the preparation of this paper. Statistics on the energy use in France and Italy have been derived from the Eurostat site

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Specific data about Italy have been obtained from

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Data about uranium production and costs have been obtained from

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The study by the energy watch group cited in the text can be found at
www.energywatchgroup.org/fileadmin/global/pdf/EWG_Uraniumreport_12-2006.pdf

A general discussion on the cost of nuclear energy (in italian) can be found at
<http://www.aspoitalia.net/images/stories/coiante/coiantecostonucleare.pdf>
<http://www.aspoitalia.net/images/stories/coiante/coiantenucleare2.pdf>



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