



PROJECTED COSTS OF GENERATING ELECTRICITY

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Source : NEA/OECD (1997 Report)

1. Introduction

Every three to four years, the NEA undertakes a study on projected costs of generating electricity in OECD countries. This started in 1983 and the last study (1997) has just been completed. All together five studies were performed, the first three dealing with nuclear and coal options, while the 1992 and 1997 included also the gas option.

The 1989, 1992 and the present study have been jointly undertaken by the NEA and the IEA in association with the IAEA and UNIPEDE. It must also be stressed that some non-OECD countries took part in the study, i.e. : Brazil, China, Hungary, India, Romania and Russia.

The goal of the study is to compare, country by country, generating costs of nuclear, coal-fired and gas-fired power plants that could be commissioned in the respondent countries by 2005-2010.

2. Methodology and common assumptions

- As previously, the constant-money levelised lifetime cost method was used for calculating generation costs, since it is adequate for an economic comparison of different types of power plants to be commissioned at a given date in the same country. It also gives an harmonised framework for all countries.
- All costs are expressed in US dollars of mid 1996. One must recognized that this implies to convert in US dollars all costs given by each country and expressed in national currency units. Such choice is mainly motivated by convenience for presenting summary tables on a common monetary basis. This way of doing is however dangerous, especially for non-adverted readers, since it may easily lead to some cross-countries comparison which would be meaningless.

This is due to the fact that exchange rates do not necessarily reflect purchasing power parities. Moreover fluctuations of exchange rates over time may easily reverse the result of a cross-countries comparison within a short period of time and in fact, some classifications that could have been made at the time the 1997 study was performed are no longer true one year later.

- The other common assumptions are :
 - Plant commissioning date : 2000/2005
 - Assumed service life : 40 years
 - Load factor : 75 % at equilibrium
 - Discount rate : 5 and 10 %

3. Country specific assumptions

3.1. Investment cost and schedule

The overnight construction cost figures vary from one country to another. Some countries gave an average figure for a type of plant while others gave several figures related to specific plants; The herebelow table summarizes the cost ranges, being understood that for each type fo plant one single figure has been selected for a given country (hence averaging values for countries having given several figures).

| | | |
|---------|---|----------------------------|
| Nuclear | : | \$ 1 277/kW to \$ 2 566/kW |
| Coal | : | \$ 772/kW to \$ 2 678/kW |
| Gas | : | \$ 402/kW to \$ 1 514/kW |

The ranges of values are very wide and may be explained by :

- design changes to match specific regulatory and siting requirements
- plant size
- single or multi-unit site
- series effect
- exchange rate volatility

Total Capital Investment Costs includes overnight costs, contingencies, interest during construciton (IDC) and decommissioning costs.

Their values are shown in the following table :

| | 5 % discount rate \$/kW | 10 % dicount rate \$/kW |
|---------|----------------------------|----------------------------|
| Nuclear | 1 718 to 2 828 | 2 098 to 3 057 |
| Coal | 966 to 2 819 | 1 039 to 2 964 |
| Gas | 440 to 1 558 | 468 to 1 603 |

3.2. Operating and maintenance (O & M) costs

Projected O & M costs in 2005 are as follows :

| | | |
|---------|---|-----------------------|
| Nuclear | : | \$ 29/kW to \$ 115/kW |
| Coal | : | \$ 18/kW to \$ 83/kW |
| Gas | : | \$ 6/kW to \$ 50/kW |

3.3. Fuel costs

The given figures relate to present costs as well as to projected costs up to year 2045.

For Natural Uranium the costs range from \$ 42/kg to \$ 117/kg in 1996 and from \$ 42/kg to \$ 165/kg in 2045.

4. Results and comments

4.1. Generation costs. Absolute figures

Not surprisingly, generation cost figures show extreme values among countries but exchange rate fluctuations relativize absolute figures :

| | 5 % discount rate US mills/kW | 10 % discount rate US mills/kW |
|---------|----------------------------------|-----------------------------------|
| Nuclear | 27/57 | 43/76 |
| Coal | 24/55 | 34/74 |
| Gas | 24/76 | 25/78 |

4.2. Generation costs. Percentage spreads

with 5 % discount rate

| | Nuclear (LWR) % | Coal % | Gas % |
|------------|--------------------|-----------|----------|
| Investment | 44/71 | 25/49 | 13/33 |
| O & M | 16/35 | 8/27 | 5/30 |
| Fuel | 13/27 | 34/62 | 53/81 |

With 10 % discount rate

| | Nuclear (LWR) % | Coal % | Gas % |
|------------|--------------------|-----------|----------|
| Investment | 61/81 | 40/64 | 21/44 |
| O & M | 9/23 | 6/22 | 3/26 |
| Fuel | 8/18 | 24/51 | 46/75 |

This shows how large is the investment share in the generation cost of nuclear origin. Hence efforts to reduce the investment costs of nuclear power plants are very important.

4.3. Nuclear /coal and Nuclear/gas ratios by country

Tables 1 and 2 show such ratios. It is clear that countries having a nuclear program combining the advantages of series effect, site effect, productivity effect have a much better chance to benefit of a competitive nuclear option.

It remains that over the past 15 years the trends of generation costs are not favorable to nuclear in a nuclear/coal or a nuclear/gas comparison (see Table 3). Although the generation cost of nuclear power have not increased (as an average) the generation costs of coal or gas fired units have considerably decreased due to the combined effects of decreasing fuel prices, decreasing investment costs and increasing efficiency. As a world-wide average, and at 5 % discount rate, all options are more or less economically equivalent. At 10 % and again as a world-wide average the nuclear option would not be competitive.

This shows how important it is for the nuclear industry to reduce its costs and for the countries that want to include nuclear in their energy mix to develop the conditions (i.e. programme of standardized units) that allows the nuclear option to be competitive.

TABLE 1 - Nuclear/coal generation cost ratios with common assumptions
(on average value by country)

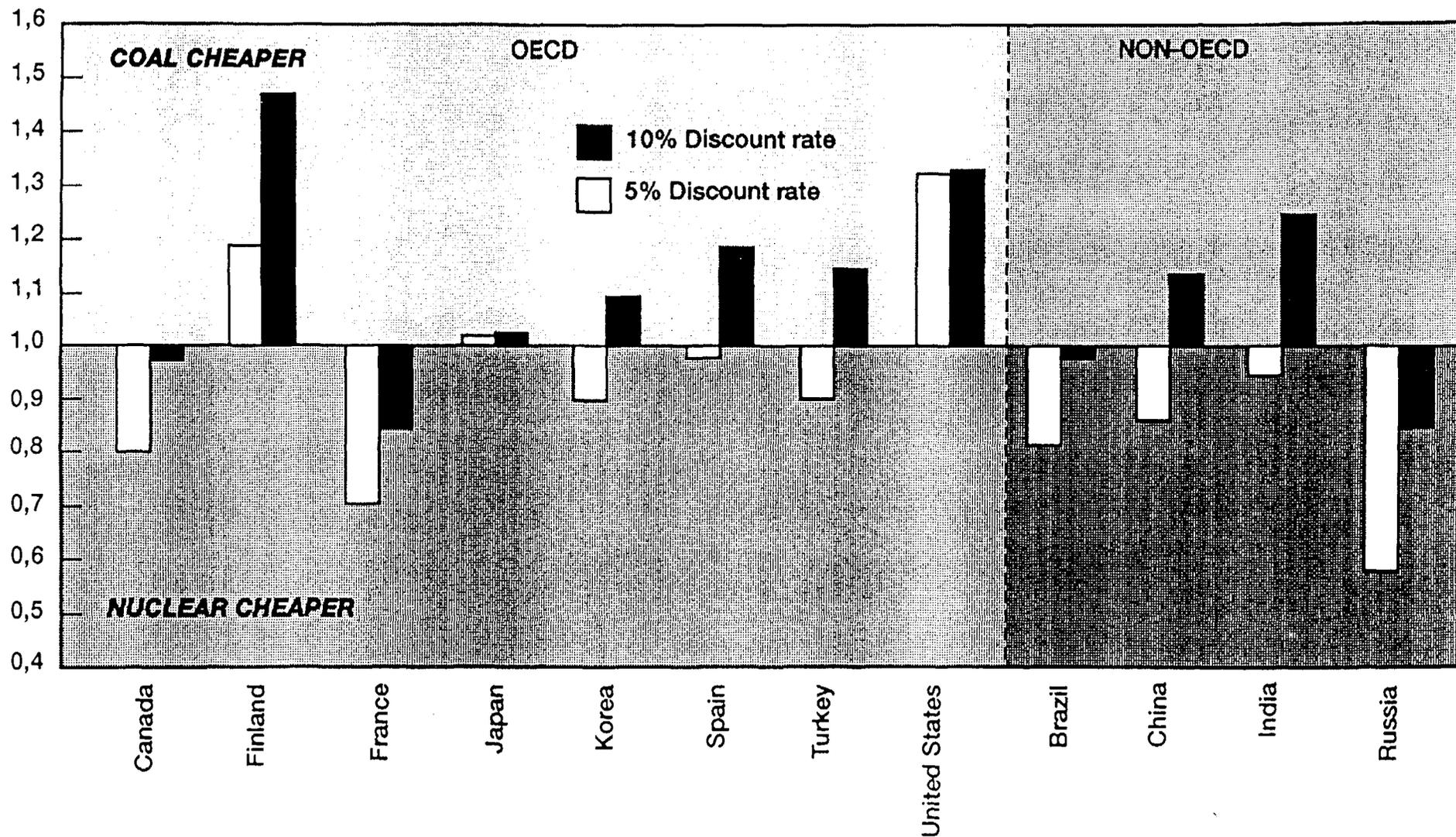


TABLE 2

Nuclear/gas generation cost ratios with common assumptions (on average value by country)

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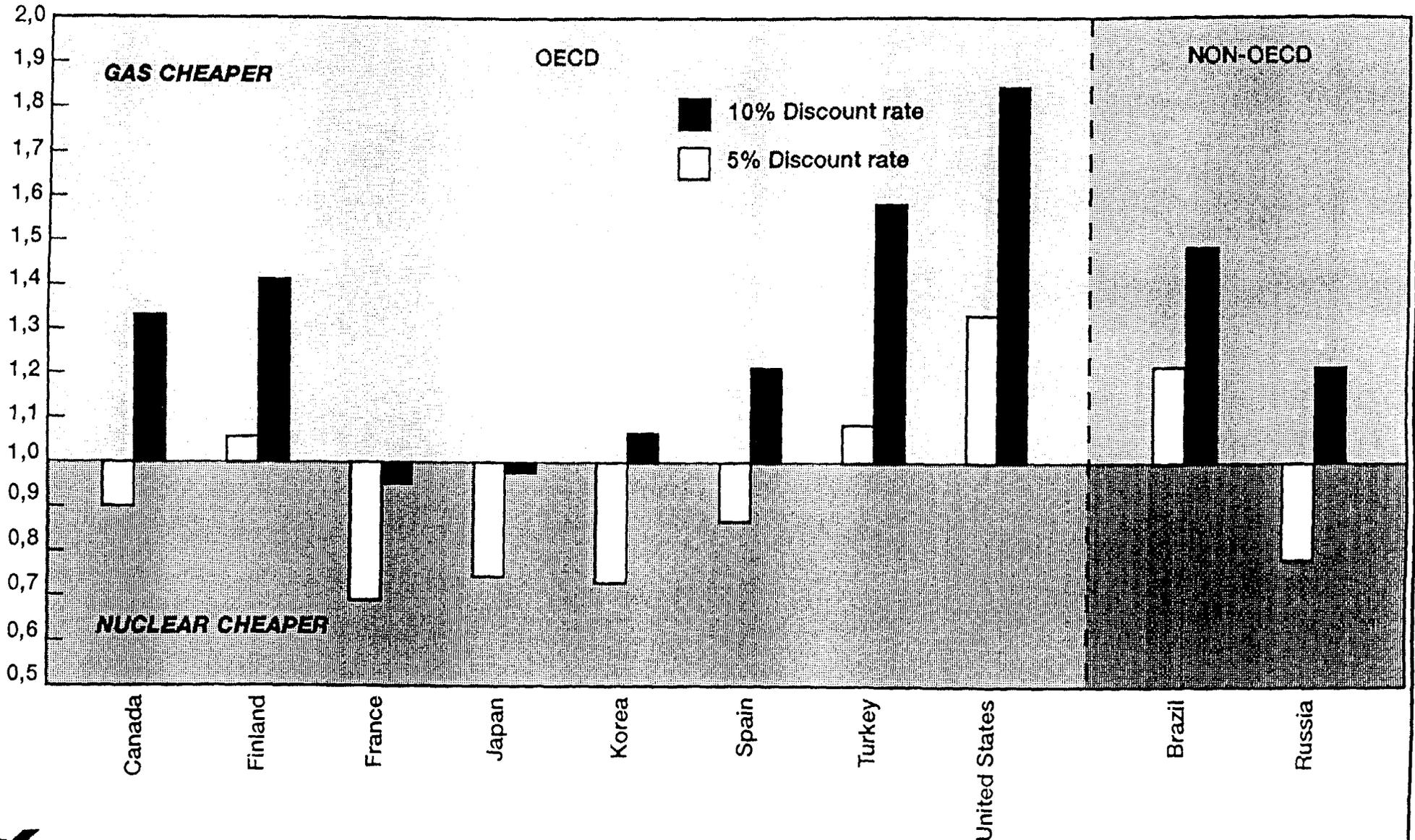


TABLE 3

TRENDS OF GENERATION COSTS (at 5% discount rate)

