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## THE CANADIAN INITIATIVE TO BRING THE INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR TO CANADA

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### **Introduction**

The International Thermonuclear Experimental Reactor (ITER) is the next step in fusion research. It is expected to be the last major experimental facility, before the construction of a prototype commercial reactor.

The Engineering Design Activities (EDA) of ITER are being funded by the USA, Japan, the Russian Federation, and the European Union, with each of the major parties contributing about 25% of the cost. Canada participates as part of the European coalition. The EDA is due to be completed in 1998, and the major funding partners are preparing for the decision on the siting and construction of ITER.

The Canadian Fusion Fuels Technology Project (CFFTP) formed a Canadian ITER Siting Task Group to study siting ITER in Canada. The study indicated that hosting ITER would provide significant benefits, both technological and economic, to Canada. We have also confirmed that there would be substantial benefits to the ITER Project. CFFTP then formed a Canadian ITER Siting Board, with representation from a broad range of stakeholders, to champion, '*Canada as Host*'.

This paper briefly outlines the ITER Project, and the benefits to both Canada and the Project of a Canadian site. With this as background, the paper discusses the international scene and assesses Canada's prospects of being chosen to host ITER.

### **The ITER Project**

ITER is designed to demonstrate that an ignited, self-sustaining fusion reaction can be produced in a magnetic-confinement tokamak machine. The reactor will be of essentially commercial size, producing fusion power of 1500 MW. However, the machine will operate in a pulsed mode, at low capacity factors, so it will be uneconomic to include a steam turbine and generator. The heat produced will be discharged to the lake.

The Engineering Design Phase is due for completion in 1998. Ordering long lead-time components and site preparation could start as soon as 1998, with actual construction following by about 2000. Construction should be complete by 2008, and ITER will have a twenty year operating life. Construction cost is estimated at \$10 billion, and operating costs over 20 years a further \$10 billion.

### **Incentive to Host ITER**

The Canadian Fusion Fuels Technology Project (CFFTP) is funded by the Federal Government and Ontario Hydro, to seek opportunities in the fusion business for Canadian companies. The ITER Siting

Task Group, formed by CFFTP, undertook an intensive study of both Canada's capability to act as host to ITER, and of the benefits and obligations that would arise.

The major conclusions of our study are as follows:

- The Ontario Hydro owned nuclear sites at Bruce and Darlington are uniquely suited as sites for ITER.
- 87,000 Canadian jobs would be created, of which 78,600 would be in Ontario.
- \$8 billion of foreign spending would occur in Canada (mostly in Ontario), over 30 years.
- There would be an \$11.8 billion increase in GDP, of which over \$10 billion would be in Ontario.
- Government expenditures would be exceeded by incremental tax revenues, arising from foreign spending in Canada.
- Canada's investment would be risk-free due to the fact that the economic benefits are independent of the outcome of the research activities.
- ITER would require all available tritium from Ontario Hydro, as well as significant amounts of power. Hydro's revenues would be in the order of \$2 billion, helping to maintain competitive electricity rates.

### **Canada Offers Low-Cost Sites**

Canada is a very attractive option for ITER countries. Canada's CANDU reactors are currently the only source of tritium fuel needed by ITER. Although both the American and Russian weapons programs have produced tritium in the past, aging production facilities in both countries are currently being shut down, and each country has indicated that it will not have tritium for ITER. Canada's unique experience in the design, construction, and operation of tritium systems is a distinct advantage.

Because of favourable seismic conditions, the low cost of power, the strength of the grid, and other economic factors, Canada can provide the lowest cost site for ITER. Because of extensive existing infrastructure, the costs to Canada of making the offer are relatively low, while the value to ITER is high, at an estimated 15% of the total project cost.

### **The Canadian Initiative**

The ITER Siting Board comprises representatives of Ontario Hydro, major industrial firms, universities, labour organizations, industrial associations, and regional and provincial governments. All these major stakeholders have expressed strong support for a concerted effort to have ITER sited in Canada.

In the summer of 1995, the ITER Siting Board forwarded a proposal to the Federal Government, documenting the fact that favourable locations exist in Ontario, specifically at the Bruce and Darlington nuclear generating sites. The proposal indicated Ontario Hydro's willingness to make these sites available, and the economic and other benefits which would accrue to Canada should it be successful in seeking to host ITER. The proposal resulted in the Federal Government informing the other funding parties of Canada's interest in hosting ITER. This resulted in the Canadian ITER Siting Board making a presentation at the last ITER Council meeting, in Germany, in December 1995.

Canada's presentation seemed to be the catalyst for a flurry of international activity.

### **The International Scene**

The ITER Council established a Special Working Group (SWG) to recommend a process for reaching a decision on siting and construction of ITER. The SWG is expected to report back to the ITER Council in July, 1996. The process is likely to require the parties to engage in "*Explorations*" from July, 1996 to July, 1997. During this period, potential host countries will be required to formally declare their interest in hosting ITER. By mid-1997, the choice of sites will be reduced to just the two leading contenders. "*Negotiations*" will then take place between the ITER parties and one, or perhaps both, of the two countries remaining in contention. A siting decision could be made by mid-1998.

Russia lacks some of the essential infrastructure and the financial resources to mount a bid to host ITER. Russian officials have indicated that they will not offer a site, and have informally offered support to Canada. The Russian contribution to ITER is unlikely to be more than ten per cent.

The US fusion program has gone through a significant budget cut. There is now competition for limited funds between the US national program and US participation in ITER. Consequently, the US is only expected to be able to contribute about ten per cent to ITER's construction cost, and will not be offering a site.

European support for ITER remains high, although its position on siting is not yet clear. There have been initiatives to host ITER in at least four countries: France, Germany, Sweden and Switzerland. At the time of writing (May, 1996), only the French bid looks as if it may proceed, and even that is not certain. The European organization requires a formal declaration of interest, from the government of any European country that wishes to remain in contention. It anticipates choosing one or more sites by the end of 1996, to champion in the final site selection process. It would appear to be in their interest to have at least one serious competitor to the Japanese offer, so they may put forward either the French or Canadian sites, or possibly both. If Canada is not selected as a European nominee, it does not preclude an independent Canadian bid.

Japan is extremely committed to ITER going ahead, and that it be built in Japan. Japan is likely to suggest each of the major parties contribute an equal share of the fusion core and, in order to secure a Japanese site, Japan will pay all other construction costs. This amounts to Japan paying some 70% of the total construction cost. At first sight, this seems an overwhelming position. However, construction and operation costs in Japan will far exceed those in any other country. Labour rates and living costs are substantially higher than in Canada, and the cost of electricity (a significant operating cost) is three and a half times the Ontario Hydro rate. It is not yet clear what offer Japan will make with respect to operating costs but, based on current knowledge, we continue to believe the other partners would all minimize their total (construction plus operating) costs, by choosing a Canadian site.

In addition to straight economics, the partners will be concerned about a number of socio-political factors. Perhaps the most significant is the fact that, by choosing Canada, the parties would prevent any one of the major players assuming a leading role in the project, and subsequently assuming dominance in fusion technology.

In short, we expect Canada to be a serious contender, when the formal bids are on the table.

## **The Next Steps**

The Canadian ITER Siting Board and Task Group are busy preparing a Framework Agreement to be the basis of a Canadian bid. This Framework Agreement will be presented to the three potential Canadian contributors, namely Ontario Hydro, the Ontario government, and the Canadian government. We shall keep abreast of international developments, and closely follow the deliberations of ITER's Special Working Group, on the siting process. The timing of our bid will depend on the SWG's findings, and subsequent decisions by the ITER Council. The ITER Council, although clearly an influential body, does not have the mandate to reach binding agreements on siting and construction. That will require treaties, signed on behalf of governments. The next year or two will be a busy, but exciting time.

## **How Can I Help?**

Canadian industry and, in particular, members of the Canadian Nuclear Association are significant stakeholders in the Canadian ITER Initiative. The economic and technological spin-offs are many and wide ranging. By now I hope you will be asking yourselves, '*What can I do to help bring ITER to Canada?*'. The answer is that the federal government has been supportive in a low key, somewhat non-committal way. This is not the way to win big international prizes like ITER. Canada has the capability to make sure ITER is a scientific success, and a showpiece of international cooperation. We need to demonstrate our capability and will to the international community, and that can only be done if our government shows leadership. Make sure our government knows we will fight for ITER, and we expect no less from our elected representatives.