CHAPTER 10

CANDU REACTORS

In the following pages we list some tabular data and show some graphs and figures pertaining to CANDU reactors. Most of this materials is self-explanatory and, hence, the descriptive captions have been kept to a minimum.
<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>Pickering (nuclear)</th>
<th>Lambton (coal)</th>
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<tbody>
<tr>
<td>Capacity</td>
<td>4 x 514 MW</td>
<td>4 x 495 MW</td>
</tr>
<tr>
<td>Life</td>
<td>30 years</td>
<td>30 years</td>
</tr>
<tr>
<td>Interest rate</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Capital cost</td>
<td>$746 M</td>
<td>$264 M</td>
</tr>
<tr>
<td>Station capacity factor</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>UNIT ENERGY COST</td>
<td>m/kWhr</td>
<td>m/kWhr</td>
</tr>
<tr>
<td>Capital</td>
<td>4.6</td>
<td>1.69</td>
</tr>
<tr>
<td>Operation and maintenance</td>
<td>.54</td>
<td>.53</td>
</tr>
<tr>
<td>Heavy water upkeep</td>
<td>.20</td>
<td>--</td>
</tr>
<tr>
<td>Fuel</td>
<td>.88</td>
<td>4.82</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6.22</td>
<td>7.04</td>
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TABLE 10.2: Estimated comparison between nuclear and coal fired plant (1972 data).
CANDU Power Stations

NPD CANDU-PHW - 22 MWe (net) 1962

Douglas Point CANDU-PHW - 200 MWe (net) 1966

Gentilly CANDU-BLW - 250 MWe (net) 1971
Rajasthan Atomic Power Project CANDU-PHW —
2 x 200 MWe (net)
(scheduled 1972, 1974)

KANUPP CANDU-PHW
– 125 MWe (net) 1971

Pickering CANDU-PHW —
4 x 500 MWe (net)
Units 1, 2 1971, Units 3 and 4 scheduled for 1972, 1973

Fig. 10.2 CANDU Power Stations (2)
Fig. 10.3: Pickering Generating Station
Fig. 10.4: Bruce Generating Station - Looking South
Fig. 10.5: Pickering Reactor Building - General Arrangement
Fig. 10.6: Pickering Calandria Vault

1. Calandria
2. Dump Tank
3. Calandria Support Rods
4. Helium Balance and Blow Off Lines
5. Calandria Vertical Adjustment
6. Calandria Vault Reactivity Mechanism Plug
7. Calandria Vault Reactivity Mechanism Plug
8. Cooling Piping
9. Reactivity Control Mechanism Penetrations
10. Calandria Vault Hatches
11. Calandria Vault Roof Biological Shield Cooling
12. Heavy Concrete Block Wall
13. Calandria Valve Chamber
14. Calandria Vault Piping
15. Calandria Vault Floor
16. Calandria Vault Floor Biological Shield Cooling
17. Spent Fuel Transfer Duct
18. East Wall Biological Shield Cooling
19. Pipe Chases
20. Fueling Machine Vault Cooling
21. Calandria Vault Boiler Room Inter Space
Fig. 10.7: Pickering Reactor Arrangement
Fig. 10.8: Gentilly Reactor Assembly

1. HELIUM PIPE PENETRATION SHIELD
2. HELIUM VENT LINES
3. BELLOWS
4. VACUUM RuptURE DISC
5. OUTWARD BURSTING RuptURE DISC
6. HELIUM BALANCE LINES
7. BOOSTER DRIVE SUPPORT FRAME
8. BOOSTER MECHANISM
9. BOOSTER DRIVE
10. MODERATOR INLET, BOOSTER COOLING
11. BOOSTER FLOW TUBE
12. GRATING FLOOR ELEVATION 5' 6"
13. MODERATOR DUMP LINES
14. CALANDRIA VESSEL SHELL
15. THERMAL SHIELD VESSEL SHELL
16. RADIAL SHIELDS
17. UPPER AXIAL SHIELD SLAGS
18. HEAT EXCHANGE COOLING PIPING
19. CALANDRIA UPPER TUBE SHEET
20. CALANDRIA TUBES
21. CALANDRIA LOWER TUBE SHEET
22. REFLECTOR BOUNDARY SHELL
23. ANNUAL DUMP POST
24. LOWER AXIAL SHIELDS
25. CALANDRIA SUPPORT FRAME
26. LOWER END FITTING
27. HEAT TRANSFER SYSTEM INLET FEEDER
28. HEAT TRANSFER SYSTEM INLET HEADER
29. BIOLOGICAL SHIELD
30. EMBEDDED BEARING STOOL
31. MAIN ANCHOR BOLTS
32. CANTILEVER BEAM
33. ANNUAL SHIELD SLAB
34. COOLANT SEAL PLATES
35. CONTROL ASSOCIATED ASSEMBLY
36. FLUX MONITOR
37. UPPER END FITTING
38. UPPER AXIAL TUBE SHEET
39. OUTLET FEEDER
40. HELIUM PURGE LINES
Fig. 10.9: Pickering G.S. Reactor Building - Elevation
Fig. 10.10: Bruce G.S. Reactor Building, Plans and Elevations
<table>
<thead>
<tr>
<th>Name or Location</th>
<th>Power MW(e)</th>
<th>Utility</th>
<th>Date of First Power</th>
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<tr>
<td>NPD</td>
<td>22</td>
<td>Ontario Hydro</td>
<td>1962</td>
</tr>
<tr>
<td>Douglas Point</td>
<td>208</td>
<td>Ontario Hydro</td>
<td>1967</td>
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<tr>
<td>KANUPP</td>
<td>125</td>
<td>Karachi Electric Supply Corp., W. Pakistan</td>
<td>1971</td>
</tr>
<tr>
<td>RAPP 1 &amp; 2</td>
<td>203</td>
<td>DAE, India</td>
<td>1972-1974</td>
</tr>
<tr>
<td>Gentilly 1</td>
<td>250</td>
<td>Hydro-Quebec</td>
<td>1971</td>
</tr>
<tr>
<td>Pickering (4 units)</td>
<td>4 x 508</td>
<td>Ontario Hydro</td>
<td>1971-1973</td>
</tr>
<tr>
<td>Bruce (4 units)</td>
<td>4 x 732</td>
<td>Ontario Hydro</td>
<td>1975-1978</td>
</tr>
<tr>
<td>Gentilly 2</td>
<td>600</td>
<td>Hydro-Quebec</td>
<td>1979</td>
</tr>
<tr>
<td>Rio Tercero</td>
<td>600</td>
<td>Comision Nacional de Energia, Atomica, Argentina</td>
<td>1979</td>
</tr>
<tr>
<td>Pickering B (4 units)</td>
<td>4 x 500</td>
<td>Ontario Hydro</td>
<td>1980-1982</td>
</tr>
<tr>
<td>Bruce B (4 units)</td>
<td>4 x 750</td>
<td>Ontario Hydro</td>
<td>1980-1983</td>
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<tr>
<td>Darlington</td>
<td>4 x 750</td>
<td>Ontario Hydro</td>
<td>1982-1984</td>
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**TABLE 10.1:** CANDU power reactors in operation, under construction, or committed as of July 1974.