1. The start up charges may include the following:
   1] Oil consumption
   2] Demineralised water consumption
   3] Auxiliary power consumption
   4] Chemicals used in the system
   5] Extra manpower input
   6] Fatigue on the equipment due to shut down or start up
   7] Unforeseen problems if any

2. A start up period of 12 hours (right from the start of the first equipment up to full load reaching) is adopted.

BREAK - UP

1. Cost of Oil Consumed

Quantity of oil from first burner cut in up to last burner cut out = 125KL
Cost of fuel oil (LSHS) = Rs 7662.61
Cost of oil (125 * 7662.61) = Rs.9,57,826.25
2. Demineralised (DM) Water Requirement

Quantity of DM water required for start up = 1085 m³
Cost of 1 m³ of water (Working sheet enclosed) = Rs. 7
Cost of DM water consumption for start up (1085 * 7) = Rs. 7595

3. Auxiliary Power Consumption

Power generation in 1 hr. per 210 MW unit = 0.210 MU
Auxiliary power consumption at 10 % = 0.021 MU
60 % of full load requirement may be taken as needed during start up (0.021*0.6*12) = 0.1512MU
Selling cost of stage II power/KWhr = Rs. 0.8065
Cost of auxiliary power (0.1512*1000000*0.8065) = Rs.1, 21,942.80
Cost of auxiliary power = Rs.1, 21,943.00

4. Chemicals

Requirement of trisodium phosphate = 2.6 kg
Requirement of hydrazine hydrate = 52.5 kg
Applied cost of the above chemicals = Rs. 4250
Additional overhead at 50 % towards over head = Rs. 2125
Total cost of chemicals = Rs. 6375
Cost of all the above (1+2+3+4) = Rs. 10, 93,739
Additional 20 % towards extra manpower
Input, unforeseen problems etc. = Rs. 2, 18,748
Total = Rs. 13, 12,487
5. There will be loss of profit from the time of getting the go ahead for bringing the unit up to the time of reaching full – load on the unit. A time period of 10 Hrs may be assumed for the same.

Total time from the start of first equipment up to full load reaching = 12 hrs.
4 Hrs for reaching full – load from synchronization and half the time taken as the period for loss of full generation = 2 hrs.

Loss of profit for 10 hrs

\[
\text{Loss of profit for 10 hrs} = 0.21 \times 10 \times \text{GP ratio} \times \text{selling price} = 0.21 \times 10 \times 0.5 \times 0.8065 \times 100000 = \text{Rs. 8,46,825}
\]

**CHARGES DURING SHUT DOWN OF A UNIT**

The extra expenditure during the shut down of a unit on receipt of instruction from *Southern Region Load Dispatch Center And Southern Region Electric Boards* is as below. The planned shut down duration is taken as 2 hrs.

1) Oil consumption

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption of oil</td>
<td>5 KL</td>
</tr>
<tr>
<td>Cost of fuel oil</td>
<td>Rs. 7662.21</td>
</tr>
<tr>
<td>Total cost of oil consumed</td>
<td>Rs. 38,313</td>
</tr>
</tbody>
</table>
2) **Higher auxiliary power consumption during shut down**

The higher auxiliary power consumption during shut down may be adopted as 2% over & above the normal.

Extra power consumption for 12 Hrs \((0.21*10^6*.1*.2*2)\) = 8400KWhr

Extra cost incurred towards the above \((8400 * 0.8065)\) = Rs. 6774.6

3) **Loss Of Profit For Generation At 50 % Only For 2 Hrs**

It is taken that the average load demand during the planned shut down period of 2 Hrs will be 50% of full load at the need of receiving the instruction to shut down.

Loss of profit for 50% load for 2 Hrs = \(0.21/2 * 2* \text{GP ratio} \times \text{Selling Price}\)

\[
= 0.21/2 * 0.5 * 0.8065 * 1000000
= \text{Rs. 84,682.5}
\]

Total charges during shut down \((38,313+6,774.6+84,682.5)\) = Rs.1,29,770.1

**THE START UP CHARGES WILL VARY WITH THE CHANGES IN THE COST OF THE FOLLOWING**

1] Oil (due to changes in oil price)

2] Auxiliary power due to changes in selling price of power

3] Chemicals (for regeneration in demineralised plant as well as for internal treatment).
IN FINE, THE CHARGES PER START UP/UNIT ARE

1] Charges during start up = Rs. 13,12,487
2] Loss of profit during start up = Rs. 8, 46,825
3] Charges during shut down (incl. Loss of profit) = Rs1, 29,770.1
   Total = Rs. 22, 89,083
4] Cost of auxiliary power/hr. for keeping the auxiliary equipment in service beyond 24 hrs. = Rs. 3387
5] 10 % of the total start up charges as compensation of shortening of overhaul period.

METHODOICAL COST CALCULATION OF DEMINERALISED WATER

Method I

Complete cost of stage II DM plant = Rs.266.19 Lakhs
Recovery/year = Rs.33.27 Lakhs
Add 10 % towards overhaul and maintenance and cost of chemicals
   Total = Rs.36.597 Lakhs
Annual DM of water production = 6, 00,000 m³
Cost of 1m³ of DM water (36,59,700/6, 00,000) = Rs. 6.10.
Method II

Cost of raw water (367/1000m$^3$) = Rs. 0.367 per m$^3$
Assume it to be = Rs. 1 per m$^3$
Cost of (6,00,000 * 1.1) m$^3$ of raw water = Rs. 6,60,000.

As per stage II,
Annual cost of Hcl = Rs. 3.25 Lakhs
NaOH = Rs. 15.51 Lakhs
Sum = Rs. 18.67 Lakhs
Add 100% of escalation = Rs. 18.77 Lakhs
Total = Rs. 37.52 Lakhs
Total cost (Rs. 6.6L + Rs. 37.52L) = Rs. 44.12 Lakhs
Cost per m$^3$ (44,12,000 / 6,00,000) = Rs. 7.35
Average of methods I and II (6.10 + 7.35 / 2) = Rs. 6.725
say = Rs. 7.00 per m$^3$

START UP CHARGES FOR UNIT I OF STAGE II (SECOND 4 UNITS)

1. The start up charges may include the following
   1) Oil consumption
   2) Demineralised water consumption
   3) Auxiliary power consumption
   4) Chemicals used in the system
   5) Extra man power input
   6) Fatigue on the equipment due to shut down or start up
   7) Unforeseen problems if any
2. A start up period of 12 hours (right from the start of the first equipment up to full load reaching) is adopted.

**BREAK-UP**

1. **Cost Of Oil Consumed**

   Quantity of oil from first burner cut in up to last burner cut out = 125KL  
   Average Cost of fuel oil (LDO & LSHS) = Rs 8767  
   Cost of oil \((125 \times 8767)\) = Rs. 10,95,875  

2. **Demineralised (DM) Water Requirement**

   Quantity of DM water required for start up = 1085 m³  
   Cost of 1 m³ of water = Rs. 7  
   (Working sheet enclosed)  
   Cost of DM water consumption for start up \((1085 \times 7)\) = Rs. 7595  

3. **Auxiliary Power Consumption**

   Power generation in 1 hr. per 210 MW unit = 0.21 MU  
   Auxiliary power consumption at 10 % = 0.021 MU  
   60 % of full load requirement may be taken as needed during start up \((0.021 \times 0.6 \times 12)\) = 0.1512MU  
   Selling cost of stage II power / KWhr = Rs. 1.3367
Cost of auxiliary power = Rs. 2,02,109
(0.1512*1000000*1.3367)

4. Chemicals

<table>
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<tr>
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<td>Rs. 4250</td>
</tr>
<tr>
<td>Additional overhead at 50% towards overhead</td>
<td></td>
<td>Rs. 2125</td>
</tr>
<tr>
<td>Total cost of chemicals</td>
<td></td>
<td>Rs. 6375</td>
</tr>
<tr>
<td>Cost of above (1+2+3+4)</td>
<td></td>
<td>Rs. 1311954</td>
</tr>
<tr>
<td>Additional 20% towards extra manpower input, unforeseen problems etc.</td>
<td></td>
<td>Rs. 262391</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>Rs. 1574345</td>
</tr>
</tbody>
</table>

5. There will be loss of profit from the time of getting the go ahead for bringing the unit up to the time of reaching full-load on the unit. A time period of 10 Hrs may be assumed for the same.

Total time from the start of first equipment up to full-load reaching = 12 hrs.
4 Hrs for reaching full-load from synchronization and half the time taken as the period for loss of full generation = 2 hrs.

Loss of profit for 10 hrs = 0.21 * 10 * GP ratio * selling price
= 0.21 * 10 * 0.5 * 1.3367 * 100000
= Rs.14,03,535
CHARGES DURING SHUT DOWN OF A UNIT

The extra expenditure during the shut down of a unit on receipt of instruction from Southern Region Load Dispatch Center And Southern Region Electric Boards is as below. The planned shut down duration is taken as 2 hrs.

1) Oil consumption

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<td>= Rs. 38,313</td>
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</tbody>
</table>

2) Higher auxiliary power consumption during shut down

The higher auxiliary power consumption during shut down may be adopted as 2% over & above the normal.

Extra power consumption for 12 hrs. \((0.21*10^6*1*.2*2MU) = 8400 \text{ KW-hr}\)

Extra cost incurred towards the above \((8400 * 1.3367) = \text{Rs. 11228}\)

3) Loss of profit for generation at 50% only for 2 hrs

It is taken that the average load demand during the planned shut down period of 2 hrs. will be 50% of full load at the need of receiving the instruction to shut down.
Loss of profit for 50 % load for 2 hrs. = $0.21/2 \times 2 \times \text{GP ratio} \times \text{S.P} = Rs. 0.21/2 \times 0.5 \times 1.3367 \times 1000000 = Rs. 1,40,354$

Total charges during shut down = Rs. 1,89,895

THE START UP CHARGES WILL VARY WITH THE CHANGES IN
THE COST OF THE FOLLOWING

1] Oil (due to changes in oil price)
2] Auxiliary power due to changes in selling price of power
3] Chemicals (for regeneration in demineralised plant as well as for internal treatment).

IN FINE, THE CHARGES PER START UP/UNIT ARE

1] Charges during start up = Rs. 15,74,345
2] Loss of profit during start up = Rs. 14,03,535
3] Charges during shut down (incl. Loss of profit) = Rs. 1,89,895
   Total = Rs. 31,67,775
4] Cost of auxiliary power/hr. for keeping the auxiliary equipment in service beyond 24 hrs. = Rs. 5614
5] 10 % of the total start up charges as compensation of shortening of overhaul period.