CHAPTER 6

TARGET COSTING AND RE-ENGINEERING APPROACH FOR PERFORMANCE IMPROVEMENT

Target costing (TC) is a structured approach to determine the cost at which a proposed product, meeting the quality and functionality requirements, must be produced in order to generate the desired profits (Gopalakrishnan et al 2004). Target costing approach is used to fix the targeted cost reduction in the final cost of compressed air and using various tools / methods, the system is designed/ modified to achieve the targeted cost reduction. Reengineering (RE) is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed (Michael and James 1993).

A combined approach involving both the Target Costing and Reengineering is proposed and such an approach is applied for textile spinning mill (producing yarns). The present chapter provides the details of the approach and its results.

6.1 TARGET COSTING APPROACH

Target costing is mostly focusing on the cost reduction of products existing or newly developed and reengineering is applied to the renovation of the organizational working nature. Applying the concept of target costing in fixing the production cost of compressed air and working for energy
conservation in compressed air supply system definitely requires a rigorous study on the existing utilization systems, distribution methods, consumption patterns and compressor operating parameters. The study at times requires several changes in the existing systems and pattern of the operation of the compressors which in general lead to reengineering. Thus, combining the concept of target costing and reengineering for this purpose involves two major activities (i) fixing a target cost for the compressed air based on the specific energy consumption of an industry and (ii) applying the reengineering concept for achieving the target cost.

6.1.1 Fixing the target cost for compressed air

The target costing process for compressed air involves the study of the present cost of the compressed air based on a measurable parameter related to the industry or based on the total specific energy consumption of the compressor. Though the compressed air usage, its pattern and application usually vary with the nature of the industry, which results in the variation in the method adopted by individual industry, the following are used as guidelines for fixing the target cost:

(i) If the consumption of air does not vary with the nature and variety of the products, the target cost is fixed on the basis of cost of compressed air per unit of production.

(ii) If the consumption of air depends on the nature and variety of the products, the target cost is fixed on the basis of the cost of compressed air per total cost of production of components during a time period.
The total money spent for the energy consumed by the compressors is calculated for a period of one month and the total measurable quantity of products produced are used for this purpose irrespective of the method of target cost fixing. The detailed process used for fixing the target costing is given in Figure 6.1. Internationally or nationally available benchmark value in terms of cost of compressed air, that is relevant to that industry can also be fixed as the target cost. In the case of non-availability of such benchmark value, the target cost is fixed on the basis of internal cost estimation procedures of the organization and the expected savings.

Figure 6.1 Target cost fixing process for compressed air
6.2 REENGINEERING APPROACH

Though several strategies are available for energy conservation in the compressed air supply system as listed earlier, an in-depth analysis of the present system of supply and usage of compressed air is required before applying reengineering concept. The radical redesigning of the process starting with such analysis helps to overcome the deficiencies faced when those recommendations implemented separately. This involves the following activities:

i. Estimating the average quantity of air consumed and maximum quantity of air consumed at any point of time. In most of the cases, normal usage of air is much less than the maximum demand as all the utilization points does not consume air at the same time, though in general compressed air supply systems are designed for the maximum demand.

ii. Identification of actual quantity of air that is required essentially for the system or processes and that is consumed in unwanted places becomes important. It is common practice in industries to use compressed air for several miscellaneous applications such as cleaning, cooling, etc., which does not require compressed air at all. This creates an artificial demand of compressed air which costs energy as well as creates heavy fluctuation in the consumption level and surging demands.

iii. Checking whether the operating pressure of the compressor is close to the maximum pressure required in the plant and its bandwidth is narrow. To face the artificial demands and high fluctuation, the operating pressure of the compressor is kept at much higher level than the maximum pressure required in the plant and the bandwidth is kept wider.
iv. Estimation of leakage in compressed air which is unnoticed or ignored in most of the industries. While carrying out the case study reported in this chapter, it has been noticed that compressed air leakage to the extent of 48.89% of total compressed air production went unnoticed by the plant authorities. Aged fittings, tubing and worn out sealing etc., contribute more for the leakage besides pipe joints.

v. Studying the temperature of air at different locations such as entry of compressor and after intercooler when entering into high pressure stages. Blockage of intercooler is frequently unnoticed and the air at high temperature enters into the high pressure stage which demands much higher energy for compression.

vi. Analysing the possibility of decentralizing the compressors, in case of the pressure requirement is different at various applications. Compressed air utilization systems can be classified on the basis of pressure requirement and can be made into different clusters.

vii. Studying the possibility of using alternative control system or drive system. For more load fluctuating units, variable speed drives can be used effectively. The control mode and regulation mode also play a major role in the energy consumption for multiple compressor systems.

Such activities in different areas depend on the nature of the industry and its existing system capabilities. Some industries may additionally have further options for cost reduction such as waste heat recovery, using different prime mover, etc. While carrying out the above activities, a strong inclination towards redesigning of the processes and existing systems has
been realized to achieve the targeted cost of compressed air. Redesigning is supported by the answers for the following questions:

a) Whether the existing method of working of compressed air supply and utilisation systems is mandatory for the effective operation of the plant? What are the alternative methods possible?

b) What will happen if the existing method is modified to an energy saving option?

c) Is the existing system can be replaced by a newer technology?

d) What will be the savings in application of newer technology? What will be the pay-back period?

e) What type of hurdles to be overcome for implanting the reengineering process?

6.3 PROPOSED TARGET COSTING AND REENGINEERING COMBINED APPROACH

Figure 6.2 shows the flowchart of the combined approach where both target costing and reengineering concepts are applied for the energy conservation in air compressors. Based on the fixed target cost and various possible avenues for reengineering to achieve the targeted reduction has been identified and prioritized on the basis of the saving potential. Reengineering opportunities identified are prioritised based on the saving potential and the opportunity that can yield maximum possible savings is attempted first. After implementing each reengineering activity, the cost saving achieved has been estimated.
**Step 1:** Studying the present compressed air supply system

**Step 2:** Fixing the target cost reduction for compressed air

**Step 3:** Identification of performance enhancing possibilities

**Step 4:** Estimating the cost saving in each identified possibility

**Step 5:** Prioritising the possibilities based on the savings

**Step 6:** Implementing them based on the priority

- Expected savings achieved?
  - Yes: Implement the opportunities based on the priority
  - No: Is all saving opportunities implemented?
    - Yes: Verify the estimate
      - Correct?
        - Yes: Re-work the implementation strategy
        - No: Re-estimate
    - No: Is expected target cost achieved?
      - Yes: Stop
      - No: Expected savings achieved?

*Figure 6.2  Steps of combined target costing and reengineering based approach*
6.4 APPLICATION OF PROPOSED METHODOLOGY TO THE COMPRESSED AIR SUPPLY SYSTEM OF THE TEXTILE SPINNING UNIT

The proposed methodology has been implemented in a textile spinning unit, involved in manufacturing yarns. The spinning unit is ten years old and involves in the activity of producing different varieties of cotton yarns from raw cotton. The industry consumes electricity from the State Electricity Board at the cost of INR 4.0 per kWh. The machines in various sections of the plant need compressed air at different volume and pressure for their operation.

Apart from production, the plant uses compressed air for handling of raw cotton. Every section and its machinery of the plant is cleaned every day for a fixed duration and compressed air is used to blow off the cotton dust particles settled on machine parts and intricate locations.

The plant has separate compressor room which houses four compressors of different output capacities. Three of them are of reciprocating type and one is screw type compressor. Each reciprocating compressor has its own air receiver of 0.3 cubic meter and the output of the compressor is connected to that receiver. Output from these receivers and the output of screw compressor are connected to a common receiver having a size of one cubic meter. The layout of compressors is given in Figure 6.3 and the details about them are presented in Table 6.1.

![Compressed air supply system layout](image)

**Figure 6.3** Compressed air supply system layout
Table 6.1 Compressor details

<table>
<thead>
<tr>
<th>Compressor identification</th>
<th>Type of the compressor</th>
<th>Free air delivery (SCMM)</th>
<th>Control regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Reciprocating – Two stage</td>
<td>0.833</td>
<td>Continuous running</td>
</tr>
<tr>
<td>C2</td>
<td>Reciprocating – Two stage</td>
<td>0.833</td>
<td>Continuous running</td>
</tr>
<tr>
<td>C3</td>
<td>Reciprocating – Two stage</td>
<td>1.535</td>
<td>Continuous running</td>
</tr>
<tr>
<td>C4</td>
<td>Screw</td>
<td>2.152</td>
<td>On / off regulation</td>
</tr>
</tbody>
</table>

The total free air delivery from compressors when all the four compressors run simultaneously is 5.353 SCMM. The compressors have been operating in the pressure bandwidth of 8 bar to 10 bar. The plant runs 24 hours a day and works for 360 days a year. Apart from the machines and equipments as mentioned above, high pressure air is used for cleaning of machines at regular intervals. At any point of time, two of the reciprocating compressors are run continuously along with the screw compressor in on /off regulation.

6.5 MEASUREMENT OF AVERAGE COMPRESSED AIR USAGE OVER A DAY

Several studies have been conducted in the plant to ascertain the existing operating conditions in the industry and to establish various possibilities for energy saving. Tests have been conducted to identify the present efficiency of the compressors; leak test was conducted to identify the quantum of air leak; study was conducted on the quantum of air used
everyday for cleaning and the operating pressure bandwidth of the compressors. The volume of air required in standard cubic meters per minute (SCMM) and pressure required for various applications are different and the details are provided in Table 6.2. Total air consumption when all the machines and equipments consume air simultaneously is estimated as 1.5959 SCMM.

Table 6.2 Compressed air usage in the plant taken for study

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Department</th>
<th>Air required (SCMM)</th>
<th>No. of machines</th>
<th>Total air required (SCMM)</th>
<th>Pressure required (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blow room section</td>
<td>0.0067</td>
<td>10</td>
<td>0.0670</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Carding section</td>
<td>0.0117</td>
<td>7</td>
<td>0.0819</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Silver lap machine</td>
<td>0.0170</td>
<td>1</td>
<td>0.0170</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Rippon lap machine</td>
<td>0.0330</td>
<td>1</td>
<td>0.0330</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Comber section</td>
<td>0.0033</td>
<td>6</td>
<td>0.0198</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>DRG D0/6 machine</td>
<td>0.0170</td>
<td>1</td>
<td>0.0170</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>SMX 1400 machine</td>
<td>0.0170</td>
<td>2</td>
<td>0.0340</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>LR 6/3 frame</td>
<td>0.0210</td>
<td>5</td>
<td>0.1050</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>LC 300A CDG</td>
<td>0.0150</td>
<td>5</td>
<td>0.0750</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>DRG TD 302 machine</td>
<td>0.0033</td>
<td>4</td>
<td>0.0132</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>Splicer/C/W</td>
<td>0.0500</td>
<td>9</td>
<td>0.4500</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>Autoconer section</td>
<td>0.6830</td>
<td>1</td>
<td>0.6830</td>
<td>6</td>
</tr>
</tbody>
</table>
6.6 STUDY OF COMPRESSOR PERFORMANCE

Compressor efficiency studies were conducted for all the four compressors in the entire pressure range of the compressor operation. Theoretical power required to operate the compressor is estimated using the Equation (3.2). The actual power consumed by the compressors was measured with the help of Power Quality analyzer. Table 6.3 shows the performance details of the compressors.

Table 6.3 Compressor performance

<table>
<thead>
<tr>
<th>Compressor</th>
<th>Theoretical discharge (SCMM)</th>
<th>Actual discharge (SCMM)</th>
<th>Volumetric efficiency (%)</th>
<th>Theoretical power (kW)</th>
<th>Actual power (kW)</th>
<th>Overall Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.8328</td>
<td>0.630</td>
<td>75.6</td>
<td>4.82</td>
<td>6.64</td>
<td>72.59</td>
</tr>
<tr>
<td>C2</td>
<td>0.8328</td>
<td>0.720</td>
<td>86.4</td>
<td>4.82</td>
<td>6.40</td>
<td>75.31</td>
</tr>
<tr>
<td>C3</td>
<td>1.5348</td>
<td>1.032</td>
<td>67.2</td>
<td>5.98</td>
<td>10.80</td>
<td>55.40</td>
</tr>
<tr>
<td>C4</td>
<td>2.1526</td>
<td>2.067</td>
<td>96.0</td>
<td>12.46</td>
<td>17.00</td>
<td>73.29</td>
</tr>
</tbody>
</table>

Compressor C3 found to have the lowest efficiency and the screw compressor gives the maximum volumetric efficiency.

6.6.1 Studies with lower operating pressure bandwidth

Air compressor working is studied for its loading time, unloading time and power taken during loading and unloading at various pressure bandwidths. The study is carried out continuously observing the above parameters during the normal working conditions. The power consumed by the compressors reduce considerably and the power consumed by the compressors C1, C2, C3 and C4 in the pressure bandwidth of 7 bar to 8 bar has been measured as 5.9 kW, 5.7kW, 10.2kW and 16 kW respectively.
6.7 ESTIMATION OF COMPRESSED AIR LEAK

While conducting leak test, the compressor C4 was made to run continuously and the other compressors were stopped. All the machines in the plant were stopped and the air was allowed to go up to the machines. Compressor was run for several loading / unloading cycles and the time of loading and unloading for each cycle and total time of loading and unloading were noted. As the machines were not running, the air coming out of the receiver was going as leakage air. The estimated air leakage is 1.476 SCMM, which is about 71.4% of the actual output of the compressor C4.

6.8 ESTIMATION OF THE COMPRESSED AIR USED FOR MISCELLANEOUS APPLICATIONS

For cleaning the machines and equipments, air has been used with the jet nozzle diameter of 4 mm at the operating pressure of the plant. The cleaning has been carried out at various sections of the plant at various times and the duration of cleaning depends on the requirement of the section. The time required and frequency of cleaning at various sections are presented in Table 6.4.

Table 6.4 Air usage for cleaning

<table>
<thead>
<tr>
<th>Section</th>
<th>Time and frequency per day</th>
<th>Total time (hour per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autoconer</td>
<td>0.5 hour x twice a day</td>
<td>1.0</td>
</tr>
<tr>
<td>Old carding</td>
<td>1 hour / shift × 3 shift</td>
<td>3.0</td>
</tr>
<tr>
<td>Simplex</td>
<td>0.5 hour / shift × 3 shift</td>
<td>1.5</td>
</tr>
<tr>
<td>Drawing</td>
<td>0.5 hour / shift × 3 shift</td>
<td>1.5</td>
</tr>
<tr>
<td>Blow room</td>
<td>1 hour per shift</td>
<td>3.0</td>
</tr>
<tr>
<td>New carding</td>
<td>1 hour per shift</td>
<td>1.0</td>
</tr>
<tr>
<td>Comber</td>
<td>1 hour per day</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td>Total cleaning time per day</td>
<td>12.0</td>
</tr>
</tbody>
</table>
6.9 IMPLEMENTATION OF TARGET COSTING AND REENGINEERING APPROACH

The TC-RE approach is applied to the system as discussed below:

i. Step-1 Studying the present compressed air supply system:
The details of the study conducted on the present system are explained earlier in sections 6.5, 6.6, 6.7 and 6.8. With the data collected, the TC-RE approach as discussed in Figure 6.2 is applied.

ii. Step-2 Fixing the target cost reduction for compressed air:
Based on the studies made and using the methodology presented in section 6.1.1, the target cost reduction for the compressed air supply system is fixed. As the benchmark value is not available for this type of process, various possibilities for cost reduction are considered and a target value of reduction is fixed as INR 7,00,000/- per annum.

iii. Step-3 Identification of performance enhancing possibilities:
The study revealed the following performance enhancing possibilities which can reduce the energy consumption by the compressor so that the targeted cost reduction is achieved
a) Bringing the operating pressure bandwidth nearer to the maximum pressure required in the plant
b) Eliminating or reducing air leakage and
c) Eliminating or reducing the air consumed for miscellaneous applications
iv. Step-4 Estimating the cost savings in each identified possibility: The cost savings possible in each identified opportunity is estimated as explained below

a) Cost reduction by bringing the operating pressure bandwidth nearer to the maximum pressure required in the plant:

Data on loading time, unloading time and power consumed by each compressor during loading were recorded for several cycles. The loading time and unloading time were studied by keeping all the four compressors running. While C1, C2 and C3 were running continuously, the percentage of ‘on’ time of screw compressor was 30.8 % and the percentage of ‘off’ time was 69.2 %. Therefore,

Total power consumed per hour of running in 8-10 bar bandwidth =

Power consumed by (C1 + C2 + C3 + % of ‘on’ time × power consumed by C4)

\[ = 6.64 + 6.4 + 10.8 + 0.308 \times 17.0 \]

\[ = 29.076 \text{ kW} \]

Energy consumed per hour of operation = 29.076 kWh / hour of operation

If the operating pressure is reduced to the range of 7 – 8 bar, then

Power consumed = 5.9 + 5.7 + 10.2 + 0.308 x 16

\[ = 26.73 \text{ kW} \]

Energy consumed per hour of operation = 26.73 kWh / hour of operation
Expected savings:

Savings per hour of operation
\[= 29.076 - 26.73\]
\[= 2.346 \text{ kWh/hour}\]

Savings per day
\[= 2.346 \times 24\]
\[= 56.304 \text{ kWh/day}\]

Savings in Rupees @ INR 4.0/kW-h
\[= 56.304 \times 4\]
\[= \text{INR 225.20/- per day}\]

Savings for 360 working days
\[= 225.2 \times 360\]
\[= \text{INR 81,072/- per year}\]

(b) Cost reduction by eliminating air leakage

In normal running condition, considering the operating compressors and loading unloading time, total production of compressed air has been at an average rate of 3.0186 SCMM, out of which 1.476 SCMM goes as leakage. The plant consumes only 1.5426 SCMM of air on an average. To supply the required compressed air to the plant, running of compressor C4 is sufficient and compressors C1, C2, C3 can be stopped. When the compressor C4 alone is running, the total FAD will be 2.067 SCMM, which is more than the present requirement of the plant. Hence it is sufficient, that the compressor C4 runs for 75 % of time only to meet the compressed air requirement.

Energy required per day to operate the plant will be
\[0.75 \times 16 \text{ kW} = 12.0 \text{ kWh/hour}\]

Savings from present level of running
\[= 29.076 - 12.0\]
\[= 17.076 \text{ kWh/hour}\]
Savings per year = 17.076 \times 24 \times 360 \\
= 1,47,536 \text{ kWh / year}

Savings in Rupees @ INR4.0/kWh= 1,47,536 \times 4 \\
= INR. 5,90,144/- per year.

(c) Cost reduction by Eliminating or reducing the air consumed for miscellaneous applications:
Cleaning has been carried out using compressed air, as an average, for 12 hours every day. Air flow through 4 mm jet nozzle is calculated using theoretical formula. The actual measurement during the data collection also confirmed the same value of about 0.72 SCMM of compressed air has been used during cleaning. Energy used at the present efficiency, for supplying the 0.72 m$^3$/min air is estimated as 5.48 kWh per hour of cleaning. If compressed air usage for cleaning is eliminated completely, the savings will be 5.48 kWh per hour of cleaning and for a year it would amount to INR. 94,694/- per year.

v. Step-5 Prioritise the opportunities based on savings: Based on the savings, as estimated in the previous section, the first activity to be carried out is eliminating the leakage in the compressed air supply system. Elimination of compressed air usage for miscellaneous purposes is considered next followed by the pressure reduction activity.

vi. Implementation of possible opportunities based on the priority: The identified performance enhancement opportunities while implementing require certain reengineering actions. Such reengineering actions suggested are explained in the following section
6.10 SUGGESTED REENGINEERING ACTIVITIES

i. During the study it is noticed that, with the present condition, reducing the pressure below 7 bar at the compressor is not supplying sufficient pressure at blow room section due to sudden consumption of air at high volume which is not supplied by the pipeline. Autoconer section only needs air at 7 bar for joining of cut threads and the consumption pattern is random, intermittent and individual consumption duration is short. Other sections require only a maximum of 6 bar pressure. Previously, the compressor was made to run at 8 bar pressure minimum to supply air at 7 bar pressure in autoconer section to compensate for losses due to leakage and friction.

Installing a receiver of suitable size in autoconer section and providing separate pipeline from the receiver in compressor room will ensure providing sufficient quantity of air at 7 bar pressure even if the supply pressure is reduced to 7 bar at compressor. Additionally, the supply to other sections can also be regulated with a pressure reducing valve so that only required pressure is supplied. The reduction in the operating pressure bandwidth requires installation of 0.1m³ size air receivers at blow room section and splicer area to minimise sudden pressure drop during the time of momentary consumption of bulk quantity of air.

ii. Elimination of the leakage in the plant requires replacing of most of the connecting elements and tubing. Leakages are noticed to some extend in the pipe joints and those joints need welding to eliminate leakage permanently. Study also reveals
that the leakage is more in one of the sections and that is given more priority to prevent the leakage. Elimination of leakage requires a paradigm shift in the maintenance activities. The use of new generation fittings and tubing can help in leakage elimination.

iii. Instead of air blow method for cleaning, vacuum cleaning is recommended for most of the places and in places where vacuum cleaning is not possible, small hand held blower is recommended which consumes very less power.

6.11 RESULTS AND DISCUSSION

The proposed methodology of applying the combined target costing and reengineering based approach for energy conservation results in a significant savings. The success of the method and the quantum of savings achieved depends on the nature of the plant operations, understanding of the present conditions of the compressed air supply system, the target cost fixed and the extend of implementation of reengineering efforts. In the case study presented, the reengineering is carried out only to the operating parameters of the compressor and elimination of wastages in the form of leakage and miscellaneous usage. These actions if applied individually may not yield the same quantum of result since the actions taken are interrelated to each other and the combined action creates additional benefits. Reduction of leakage helps in reducing the pressure loss in the line and reducing the pressure bandwidth helps in reducing the quantum of leakage which is pressure dependant. The effect of the individual reengineering efforts in the energy savings is shown in the Figure 6.4.
Cost saved due to the reduction of pressure bandwidth is INR. 81,072/- per year, that due to leakage is INR. 5,90,144/- per year and that due to elimination of cleaning air INR. 94,694/- per year. The quantum of saving in individual energy saving opportunity is industry dependent. While the leak elimination and cleaning elimination require some amount of money, reduction of pressure bandwidth does not require any investment other than investment on two small air receivers. Investments required for individual reengineering activity are estimated and their pay-back periods are presented in Table 6.5. Fixing of target costing needs to be done judicially and based on the conditions of the industry. In the case study, detailed study is conducted and based on the observations, the target cost reduction of INR.7,00,000/- is finalised. But, for most of the cases the target cost for the compressed air can be adopted from the available international benchmarks which may further improve the saving potential.
Table 6.5 Investment and pay-back period

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Proposed reengineering activity</th>
<th>Estimated investment (INR.)</th>
<th>Estimated Savings (INR.)</th>
<th>Approximate simple pay-back period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reduction of maximum operating pressure and pressure bandwidth</td>
<td>25,000/-</td>
<td>81,072/-</td>
<td>4 months</td>
</tr>
<tr>
<td>2</td>
<td>Elimination of air leakage</td>
<td>40,000/-</td>
<td>5,90,144/-</td>
<td>1 month</td>
</tr>
<tr>
<td>3</td>
<td>Elimination of air usage for cleaning</td>
<td>30,000/-</td>
<td>94,694/-</td>
<td>4 months</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>95,000/-</td>
<td>7,65,910/-</td>
<td></td>
</tr>
</tbody>
</table>

6.12 CONCLUDING REMARKS

From the present study, the combined usage of target costing and reengineering for the energy conservation in the compressed air supply system yields considerable reduction in the cost required for producing the compressed air. The major conclusions are:

i. Target value can be fixed for the cost of compressed air or its cost reduction.
ii. Targeted cost or cost reduction can be achieved by applying reengineering strategies suitable to the organisation.
iii. The savings achieved in the present case study is INR.7,65,910/- per year which is more than 76% of the actual cost of production of the compressed air.
iv. The pay-back periods for the investment required are very less.
While working towards the target cost, few predominant reengineering activities may achieve the targeted cost and in such case, the target cost to be revised upward and all the possible reengineering activities need to be implemented. However, reengineering activities incorporated in this study requires change in the operational methods of maintenance activities, plant cleaning methods and operating parameters of the air compressor. Reduction of pressure bandwidth and fixing the limits very closely to the plant requirements need to be carried out carefully. Because, during sudden surge in consumption at high pressure requiring section, sufficient volume of air could not be supplied which may affect the performance of the plant. Studies on the usage of separate pipeline for the sections requiring different operating pressures and connecting them to dedicated small compressors operating at the required pressures to be conducted further.