



NATIONAL PAPER COMPANY

Compressed Air Leak Survey and Leak Repair

SUMMARY OF THE OPTION

The National Paper Factory, located in Valaichenai in the Eastern province of Sri Lanka, is a government-owned company of the National Paper Company (NPC) and produces paper and paper board from waste paper. The compressed air system was investigated, which is one of the main electricity users at the factory and consists of two compressors of 75 kW each. Leak tests showed that about 54% of compressed air escaped through leaks in 2003, and this had increased to 70% when tests were repeated early 2004!

Results from a first round of leak repairs are US\$ 100 costs for materials and labour, US\$ 620 annual electricity cost savings and a payback period of 2 months. Electricity reductions were 8.7 MW, equating to 1.8 tons of CO₂ emission reductions. These results made the company realize the potential for easy financial savings through a leak detection and repair campaign throughout the plant.

KEY WORDS

Pulp and Paper, Sri Lanka, Compressors and Compressed Air System, Leaks

OBSERVATIONS

The *Technical Training Workshop* as part of the GERIAP project that was given to company staff by SMED (organisation implementing the GERIAP project in Sri Lanka) included a module on compressed air systems that emphasized the potential for large financial savings of a compressed air leak survey. This led to the GERIAP Team comprising staff from NPC and SMED and a UNEP consultant focused on the compressed air system. They made the following observations:

- **Usage:** The study of the process flow (which is an important step in the *Company Energy Efficiency Methodology*) found that compressed air is an important input for the paper and board making machines, which have a large number of pneumatically operated equipment and control valves.
- **The compressor data:** The two compressor stations, with two-stage reciprocating air compressors of approximately 30 years old, have the following specifications:

• Motor power (rated)	75 kW
• Maximum pressure	8.8 bar
• RPM	970
• Low pressure cylinder diameter	310 mm
• High pressure cylinder diameter	185 mm
• Stroke	100 mm
• Free air delivery	260 cubic feet / min (cfm)
• Cooling water requirement	0.6 m ³ /hr
• Normal working pressure	7 bar



- **Leak tests:** Leak tests were carried out to calculate the percentage of compressed air that leaks from the system by measuring the compressor loading time (T) and compressor unloading time (t) when all compressed air usage points were shut down and with cut off pressure at 6.5 bar and starting pressure of 5.75 bar.
- A leak test was carried out during the first plant visit in 2003, with the following results:

	Loading time (seconds)	Unloading time (seconds)
	123	101
	121	101
	116	105
	120	103
Average (seconds)	120	102
Average (minutes)	2.0	1.7

- A second leak test was carried out in 2004 and test results are as follows:

	Loading time (minutes)	Unloading time (minutes)
	6.5	2.5
	6.0	2.0
	8.5	3.5
Average (minutes)	7.0	3.0

- The percentage leakage was calculated using the following formula:

$$\text{Leakage \%} = \frac{T}{T + t} \times 100$$

$$\text{Leakage \% in 2003} = \frac{2}{2 + 1.7} \times 100 = 54\%$$

$$\text{Leakage \% in 2004 before arresting leaks} = \frac{7}{7 + 3} \times 100 = 70\%$$

Lesson learnt: *Losses could have been minimized, if the company acted immediately when the leaks were first detected!*

- **Causes of leaks:** The compressed air leaks could be due to faulty joints, tiny holes, leakages in the cylinders of the reciprocating compressors, and in accessories such as flanges used in the distribution lines. As a result a large quantity of electricity is wasted.

OPTIONS

The company decided to arrest leaks in the compressed air system to minimize electrical energy loss. Repairing leaks are often low cost options, such as tightening of joints to close gaps, replacement of pipelines, and replacing connection valves and rubber seats that were bought locally. Following the leak repair, a third test was carried out, with the following results:



	Loading time (minutes)	Unloading time (minutes)
	15	8.5
	16	9.0
	17	9.5
Average (minutes)	16	9.0

$$\begin{array}{rcl} \text{Leakage \% at end of 2004} & = & 16 \\ \text{after arresting leaks} & \frac{\text{-----}}{16 + 9} \times 100 & = 64\% \end{array}$$

RESULTS

The financial, environmental and other results are given below. It is noted that these are only the results of repair of part of the leaks. The company has noticed the benefits and the potential for further financial savings through a leak detection and repair campaign throughout the plant. In-house training to factory staff has taught them how to tracked and repaired on a continuous basis.

Financial benefits

- Investment: US\$ 100
 - Connectors, rubber parts and valves: US\$ 60
 - Labour costs for installation: US\$ 40
- Annual operating costs: leak repair costs are to be covered by regular maintenance budgets
- Annual cost savings from electricity: US\$ 620 (Rs. 7.10/kWh X 26 kWh X 28 days X 12 X 0.001 US\$/Rs)
- Payback period: 2 months

Environmental benefits

- Annual electricity savings: 8,736 kWh, calculated as follows
 - 6% reduction achieved (70% leakage in early 2004 minus 64% leakage after leak repair at end of 2004)
 - Based on the loading time for each day 6% leak reduction equals to 26 kWh electricity savings per day
 - 26 kWh X 28 days X 12 months = 8,736 kWh
- Annual GHG emission reduction: 1.8 tons CO₂ (8.736 MW X 0.205 tCO₂/MW)

FOR MORE INFORMATION

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