Case Study

Company name	Van Dyck Floors					
Size of company (Based on energy bill)	**SMME** (R250k –R750k)		**Medium** (R750k –R24mil)		**Large** (Above 24mil)	
Sector	Clothing and Textile					
Location	Durban					
Company Contact	Name: Dr Mehran Zarrebini			Position: CEO		
	Email: Mehran@zarrebini.com			Telephone: 0873536581		
Year joined Project	2014					
Date of Implementation	2015/16	**Duration**		4 months		
Utility Intervention	Compressed air leaks					
Case Study Author	Devon Fisher					
Project Manager	**Milisha Pillay**					

1. BACKGROUND

1.1 Company profile

Van Dyck Carpets(Pty) Ltd which now operates as Van Dyck Floors, is one of the leading carpet manufacturing companies in South Africa(based in Durban) and the only manufacturer that offers all types of soft floor coverings being tufted, needle punch and woven carpets that are available for both the residential and commercial market. In recent years, sustainability and the global thinking shift towards a reduction in harmful environmental emissions have become a key focus area for the company.

Van Dyck Floors is ISO 9001:2008 (quality management) and ISO 14001 (environmental management) approved by the SABS, and the only flooring manufacturer who has an ISO 14064-1 Green House Gas verification report. As part of their drive to become more "green" in their production processes, they became the first company in South Africa to achieve the ISO14064 Carbon Trust Standard certification. This certification means that the organisation proactively monitors, record and take actions to reduce emissions arising from their operations.

Over the years, Van Dyck has invested in upstream capital expenditure such as a state-of-the-art fibre extrusion line and also in the upgrading and modernization of the tufting, and needle punch looms enabling the company to enhance its product offering.

1.2 Plant profile

Situated in Reunion, which is in the South of Durban, Van Dyck Flooring employs approximately 225 people. The manufacturing plant is made up of various different energy using processes such as tile converting, finishing line, space dye, rubber line and drying. The site uses a number of energy sources such as paraffin, steam, the largest contributor of which is coal-generated electricity. Due to the extensive product range, compressed air is a vital utility that is required for automated production processes.

Van Dyck has 11 compressors located on site. The number of compressors that run at any given time is dependent on demand for compressed air. There are 2 sections on the user side that require different pressure bands, the low-pressure band (recorded from 4.8bar - 6.2bar) and the high-pressure band (recorded from 7.2bar to 10.1bar). Compressed air supply to the main plant is by means of the Broomwade 6075N and the SSR-12L compressors. The Broomwade compressor is used during the day while the IR12L compressor is used at night. These are switched on and run 4 days a week on a 24-hour shift pattern (unless weekend work is scheduled due to production requirements). The compressors are then switched off on the weekend and over public holidays to reduce the energy usage. The higher pressure band is only being used for critical pieces of equipment that are prone to pressure drops and production stoppages if the minimum pressure is not maintained. Compressed air is primarily used for pneumatic control and process applications in the factory.

1.3 Nature of the challenges

Van Dyck Flooring competes in a global market where cost leadership is a key competitive advantage. With the unpredictable increases in the cost of electricity in South Africa, the company's energy-related costs became a concern which led them to become involved in the IEE Project. Having previously undertaken a resource efficiency assessment, the company had gained some insight into the high cost area of compressed air and the potential for optimisation.

The company then signed up as a demonstration plant with the IEE Project which allowed them to access specialist support in the area of compressed air with respect to the strategic issue of energy efficiency. A compressed air system optimisation assessment was conducted in October 2015, under the auspices of UNIDO and the Industrial Energy Efficiency (IEE) Project. The purpose of the assessment was to highlight gaps between Van Dyck's compressed air system practices and industry best practice and in so doing identify and quantify potential energy improvement opportunities.

1.4 IEE capacity building programme

Being an organisation that places significant focus on sustainability, the plant engineer attended several of the IEE Projects Energy System Optimization courses. A half day awareness raising session on Compressed Air was conducted after the assessment close-out meeting, and this was attended by many of Van Dyck's maintenance and operational staff. The keen interest from those involved showed a change in mindset toward energy efficiency, particularly toward the compressed air system. The plant engineer and the safety, health and environment officer also went on to undertake the 2-day end user and expert level training in Energy Management Systems. Various energy savings projects stemming from the EnMS implementation are underway as the organisation continues to work towards attaining their ISO 50001 Certification.

2. KEY ACHIEVEMENTS

Key findings table

Implementation Period (yyyy-yyyy)	November 2015 - March 2016
Total Number of project	1
Monetary savings in ZAR	R72 388 per annum
Energy savings in GJ	70 969kWh per annum
Total investment made ZAR	R50 000-00
Overall % of total consumption saved	70 969/11293958= 0.63%
Total Savings from no cost interventions	Zero
Payback time period in years	0.69 years
GHG Emission Reduction (ton CO2)[1]	73.98
Number of females employed prior to implementation	No change

[1] kWh to CO2 Conversion Factor set at 1.0425 as per the GEF IEE Project; March 2017.

Number of females employed after implementation	No change

There was a total number of 214 leaks identified during the assessment, and it was the decision of the company to prioritise the repair of these leaks before any other intervention. 152 of the leaks were repaired during the annual shutdown period, resulting in an annual saving of 70 969kWh.

3. IMPLEMENTATION CHALLENGES

Some of the challenges that were met during and post- assessment included:

- Fixing the identified compressed air leaks required the use of ultrasonic leak detection equipment when fixing these leaks. Many of the leaks were not rectified for this reason. Some of the leaks recommended for fixing to require isolation and depressurization of the lines. A shut down of the production facility must be scheduled accordingly
- Plant personnel did not seem to understand the costs involved with compressed air usage. This led to some members of staff using unregulated compressed air to clean their clothing and work areas. This challenge is a difficult one to overcome as it requires a mindset shift in a varied group of individuals.
- One of the largest challenges when dealing with energy and cost reduction in compressed air systems is the widely accepted misconception that compressed air is free. If something has no cost, then there is no incentive to make any cost reduction on related systems.

4. HIGHLIGHTS OF OPERATIONAL/ESO INTERVENTIONS

4.1 Summary of all interventions

There was a total number of 214 leaks identified during the assessment, and it was the decision of the company to prioritise the repair of these leaks before any other intervention.

Energy uses/users	Energy sources	Intervention	Utility saving Period	Investment (ZAR)	Savings (ZAR/year)	Payback (Yrs)	Utility saving (Units) GJ	GHG Emission Reduction (tonnes CO2/year)
Compressed Air	Electricity	Leak repair	November 2015-March 2016	R50 000	R72 388	0.69	70 969 kWh	73.98
TOTAL				**R50 000**	**R72 388**	**0.69**	**70 969 kWh**	**73.98**

4.2 Details of highlights

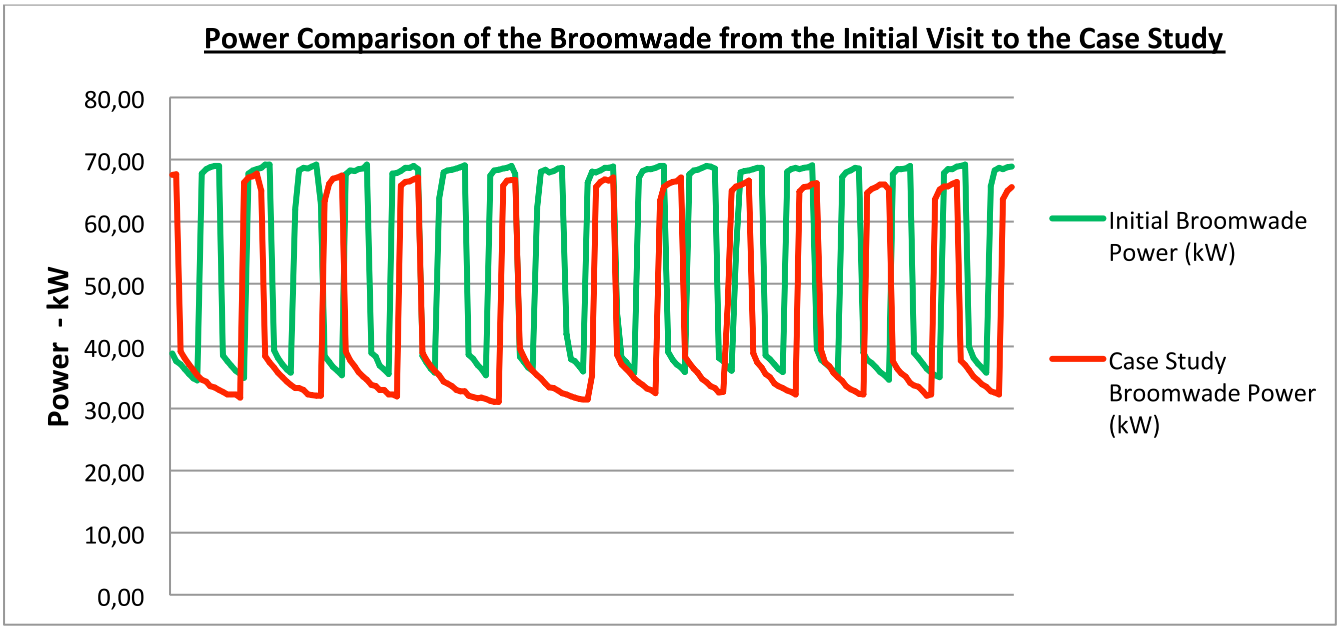
Compressed Air Leak Reduction:

Opportunity identified: The initial report had an in-depth leak detection survey completed on site. The survey identified a total of 214 compressed air leaks on site, and this was estimated to be wasting approximately ±57kWh.

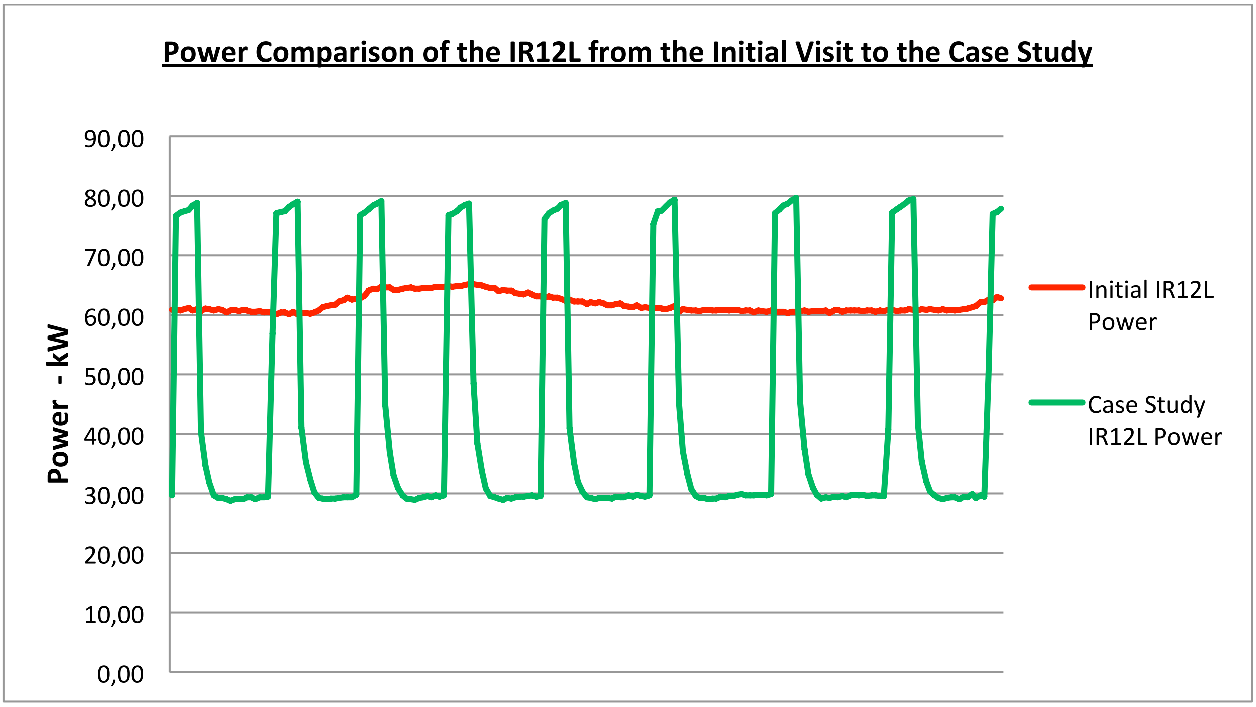
Changes made: During the December shutdown period, 152 leaks were repaired at an approximate cost of R50 000.

Results of Changes: The improvement was evident in the energy savings by reducing the amount of run-time on the compressors as well as a more stable and higher system pressure. However, due to not having ultrasonic leak detection equipment on site, some of the leaks that were presumed to be fixed were still leaking.

A simple low / no cost solution when rectifying leaks without the use of ultrasonic leak detection equipment is to use a soapy solution of Sunlight Liquid and water with a paint brush. Due to the pressure differences from the compressed air system to atmosphere, painting over the repaired area with some of the soapy solutions will then assist in identifying whether the item is completely fixed or not. If there is still a leak, bubbles will be observed. If there are no bubbles, then the leak is adequately repaired fixed.



The above graph highlights the reduced frequency between the Loaded / Unloaded cycles of the Broomwade compressor. Due to many leaks having been repaired, there was an increase in the available compressed air to accomplish the same amount of required work. This has reduced the number of loaded cycles so as to produce the require compressed air. After the 152 leaks had been rectified, there was a 10% improvement in the compressor runtimes by reducing the loaded times. This ±10% improvement due to leak reduction equates to an energy saving of 4.81kWh saving on the Broomwade compressor. During the time of the assessment, Van Dyck had a higher production level than that during the initial assessment, having additional longer run times on the Entanglers and operating additional equipment. This would explain why there is no noticeable reduction of kWh on the utility bill.



The above graph highlights the change in operation and amps consumed for the Ingersoll Rand SSR-12H Compressor. Initially, the compressor was unable to maintain the system pressure, constantly running without being able to cycle between a Loaded / Unloaded state. After having repaired the 152 compressed air leaks, the flow demand has decreased allowing this compressor to be able to reach the setpoint system pressure and cycle. After the 152 leaks had been rectified, there was a 33% improvement in the compressor runtimes. This ±33% improvement due to leak reduction equates to an energy saving of 18.92kWh saving on the IR12L compressor.

5. BENEFITS AND LESSONS LEARNED

5.1 Benefits

- Leak repairs on compressed air system forms part of energy efficiency savings which has resulted in monetary savings. In addition improved energy efficiency and more effective energy management have contributed significantly to Van Dyck Flooring attaining several environmental accreditations which is a requirement for entering certain export markets.

- Employee engagement with regards to energy efficiency is closer as employees feel more empowered when they better understand their roles with regards to energy usage.
- Staff awareness around compressed air systems has led to individuals taking accountability for significant energy users such as compressed air. The staff have learned how to link the cost of a pinhole leak to something tangible.

5.2 Lessons

- Lessons learned by the company through the process
  - After working with various teams and explaining the true costs of compressed air, cooperation increased dramatically. By focusing on low and no cost projects first and demonstrating the cost savings it was easier to obtain the necessary buy-in, in order to secure funds needed for the more capital intensive improvement opportunities identified.
  - Compressed air Optimisation requires constant monitoring and maintenance.
  - Leak detection also needs to be accompanied by an adequate understanding of the compressed air system and compressor control so as to reduce artificial demand to optimise the energy saving potential systematically. Understanding the complete compressed air system will assist in making the required changes to optimise and maintain the system. An understanding of the relationships between flow demand, pressure profiles, artificial demand and compressor control and leak management will provide a larger energy saving potential.
  - Additional training and awareness need to be provided to the operational staff on site to assist all in understanding the true costs involved in compressed air generation and inappropriate uses of compressed air. In this training, highlight how all can report compressed air leak so as to ensure these savings can be maintained.
  - There are no instruments installed online to provide data for baselining and improving the compressed air system. Installing flow and pressure sensors will assist the onsite personnel to correlate the data received with the various production levels.
- How has the IEE project impacted on the company competitiveness and business culture?
  Energy efficiency savings have resulted in becoming more sustainable in their practices and processes. Energy efficiency is starting to filter into all levels of the organization.

- Is there any specific quote/message that you would like to share and that has guided/supported you throughout this optimisation process? **“Compressed air is not free”**

6. FUTURE PLANS

Other compressed air energy improvement opportunities that are underway or will be implemented in the future are:

- Establishing a compressed air leak management system and improving the system pressure profile across the plant. Leaks will be tagged by dedicated personnel on a weekly basis, and subsequently repaired as soon as possible. Leak management requires constant attention if savings are to be maintained.
- Upgrading of the current compressed air reticulation system to increase piping area, ring-mains and provide additional storage capacity throughout the plant. This will reduce the compressors run-time and subsequent energy usage. Increasing the piping diameter will assist in reducing the internal pressure drops.
- Improve the condensate drainage by installing zero-loss auto drains or adjusting the timing of the time-based solenoid drains to optimise the system's efficiency and compressed air quality.
- Reduce the system pressure as recommended to reduce artificial demand. Another 25 leaks also developed in the past few months that were also tagged and added to the submitted report. There is still a total of ±87 compressed air leaks on site. Without reducing the system pressure, a large portion of compressed air savings is still being wasted through artificial demand. Leak rectification needs to be coupled with pressure reduction for improved savings potential.
- Consider replacement of the IR SSR-12H compressor with a 75kW VSD compressor. This will provide a stable system pressure while speeding up or slowing down according to demand requirements while not wasting any energy while in an unloaded state. For example, an Atlas Copco GA75kW VSD can provide between 2.2 - 15m^3/min at 7bar. The varying flow requires less input power while having the ability to maintain a stable system pressure. This would be dependent on repairing all the leaks found on the site and striving to reduce the existing leaks still on site.

By systematically implementing and maintaining the above recommendations proposed in the above points will yield a large energy saving potential and a much more stable compressed air system.