Cleaner Production Case Study

Cleaner production involves reducing the consumption of raw materials (including water and energy) and reducing the volume and toxicity of waste and other emissions.

Virtual manufacturing: big saving opportunities for tooling industry

Austool Ltd undertook a project to test the benefits of product development collaboration in conjunction with the use of a range of new 'virtual manufacturing' technologies integrated into existing tool fabrication processes. The results produced significantly reduced waste material and energy consumption and dramatically improved production times to deliver an overall improvement in tooling and product production performance.

Industry:

Machine tool making

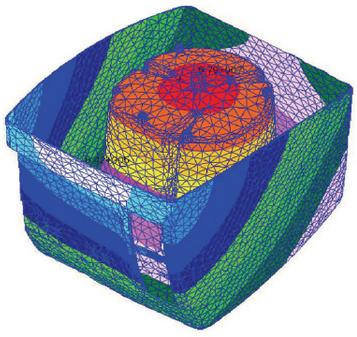
Austool Ltd

Austool represents the machine tool makers of NSW and is dedicated to advancing the development of the Australian tool making industry.

The tooling industry underpins the manufacturing sector by providing the dies, moulds, press tools and special machines used by manufacturers to produce end consumable products. For example a 'tool' would be required for production of computer monitors, telephone handsets or light fittings—almost anything manufactured in a prefabricated form.

Company characteristics

Austool Ltd is a not-for-profit public company which was established in 1998. It is based in Ingleburn and has two staff members. Its annual turnover is approximately $1 million.



Environmental successes

This is one of a series of case studies featuring companies that participated in the Department of Environment and Conservation (NSW) $5 million 'Profiting from Cleaner Production' – Industry Partnership Program.

Virtual manufacturing systems can predict problems in a tool design before tool manufacture, thereby eliminating the very costly traditional trial and error design method and reducing the time taken to design, develop and produce a tool.

The Australian tooling industry is largely composed of small and medium-sized enterprises (SMEs) operating on low profit margins, and with little vertical integration. Firms have limited funds for investing in new developments, they face strong competitive pressures and few are active exporters. Demand fluctuates significantly and there is a relatively low take-up of the latest technology. While the current workforce has excellent skill sets and can produce quality tools equal to or better than anywhere else in the world, in recent times the industry has experienced downturns in world and domestic markets because of increased foreign competition that is producing cheaper products.

Overcoming these shortcomings is essential if Australia is to achieve world competitive status in tool making and if the industry is to achieve its full potential. This can only be done on an industry-wide basis and through the adoption of fundamental changes in the tool design and development process.

What did they do?

Austool set out to determine if a combination of concurrent engineering and computer simulation could reduce the number of design iterations experienced when producing a selected manufactured product.

Bell Plastics of Milperra, NSW, agreed to participate in the project. It provided detailed information to the project team about its experience of manufacturing and trialing a medical device casing, which required intricate design specifications, high tolerances and a quality finish.

To begin, the consultant URS Australia conducted a detailed benchmarking study of the original process undertaken by Bell Plastics to produce the medical device casing. Once this was completed, Austool engaged the expertise of MSC Software, the designers of a number of virtual manufacturing software packages, to work with the product designer, tool designer and toolmaker/moulder to simulate the tool design, to identify production flaws and to recommend design improvements.

The results delivered savings in cost, resource and time inputs to the product build process and these were assessed to quantify and compare variations and potential savings between conventional manufacturing techniques and the new computer-simulated product build process.

Why did they do it?

When designing a tool such as a mould or die to the exact tolerances required to mass-produce manufactured parts, problems will occur in the plastic moulding or sheet metal pressing if the mould or die is not absolutely correct. The resulting part or product is 'imperfect' and may exhibit 'flashing' as a result of plastic leakage, it may have marks or lines on the surface, or the part may not even

mould at all, and this is generally caused by a 'design fault'. To perfect a tool design a mould usually goes through *many* design iterations, which then lead to a number of tooling iterations before the performance quality of the die or mould is eventually good enough to produce the optimum final manufactured product. Every redesign and retooling iteration results in over-consumption of resources, additional costs and, most significantly, delays in getting a new product to market.

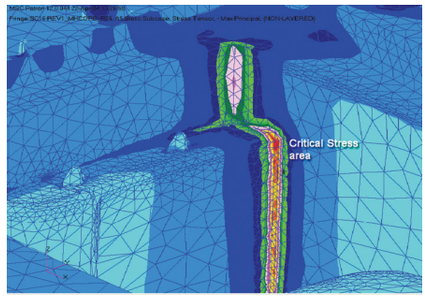
What are the environmental gains?

The study revealed that four out of six tooling iterations which were required in the original tool build could potentially be eliminated when using a collaborative approach in conjunction with virtual manufacturing technologies. This result could potentially lead to considerable reductions—greenhouse emissions by 19%, energy usage by 20% and waste generation by 30%—when compared to a traditional manufacturing process.

What were the costs and savings?

While the virtual manufacturing process required significant initial investment, this was recovered throughout the duration of the tool manufacturing process, in particular, during the tool trial and refinement stages. It was found that the cost of rework incurred from conventional manufacturing was $61,600 (or 22% of total manufacturing costs) whereas the cost of rework likely to be incurred during virtual manufacturing would be $12,600 (or 5% of total manufacturing costs).

It's likely there will be a number of benefits accruing to industry—through adopting a collaborative product build processes and using virtual manufacturing technologies—that were not quantified as part of this project. These include reduced tool manufacturing lead times, higher quality product, greater certainty of product performance and durability. All of these factors will improve the competitiveness of the Australian tooling industry.



"If every tool maker in NSW removed just two re-works (iterations) from each new tool build, 20 million kW.h of electricity, 320 tonnes of CO_2 and more than $3.3 million in tooling costs could be saved each year. Not only would the tool making industry be making a positive contribution to the environment, they would also have the opportunity to improve their own profitability." Bob Lundie Jenkins, CEO, Austool Ltd.

Savings due to collaborative product build/virtual manufacturing

Cost item	*Virtual manufacturing saving*	*% saving*
Total labour	255 hours	10.3
Total labour cost	$15,300	10.3
Total electricity consumed	16 464 kW.h	19.3
Total electricity cost	$1,646	19.3
Waste volume	1,180 kg	29.9
Waste disposal cost	$85	18.9
Waste material cost	$4,161	26.3
Truck rental cost	$3,130	56.8
Mobile crane cost	$3,130	56.8
Moldflow analysis	$9 000	100
Tool design	$12,000	0
Surface model	$5,000	0
MSC simulator	($36,400)	0
Steel used in die	$32,000	0
Savings in lost production	$26,400	76.4
Total production cost variation	$26,452	9.6
Total production waste variation	1,180 kg	29.9
Total production electricity consumption variation	16,464 kW.h	19.3
Total savings in greenhouse gas emissions ($CO_{2\text{-}e}$)	16.67 tonnes	19.3

Where to now?

These promising outcomes will be used by Austool as a basis for extensive awareness-raising activities leading up to a national roll-out of collaborative product development and take-up of virtual manufacturing technologies. Austool is developing a digital factory project, which aims to increase the competitiveness of the Australian tool making industry by helping it move away from its traditional approach to product development.

More information

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