



Waste minimisation in glass processing



Waste minimisation in glass processing Practical worksheets for industry

Waste Worksheets

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The business reasons

Waste costs UK industry at least £15 billion/year - about 4.5% of total turnover. This cost could be reduced by 1% in most companies by a simple waste minimisation programme. This series is designed to help reduce your waste costs by introducing the tools and techniques of waste minimisation. Effective waste management cuts costs and raises profits.

A 'Waste Minimisation Programme' can improve profits by at least 1% from no cost and low cost measures

The five important reasons for starting to minimise waste are:

1. Waste is lost profit

Waste is costing real money that is lost profit. The box below gives initial estimates of the basic and total cost of waste. At a gross margin of 7%, a reduction in waste costs by 1% is the equivalent of increasing turnover by over 14%. Internal effort spent in waste minimisation produces the same benefits as substantially increasing sales.

2. The hidden costs

There is a large difference between the 'visible' and the 'true cost of waste'.

Direct waste costs are visible and include waste collection and disposal costs but the largest waste costs are indirect and hidden. They include:

- Raw material costs
- Energy consumption
- Water consumption
- Effluent generation
- Packaging
- Factory & office consumables
- Wasted time and effort

These costs are hidden and not shown in the accounts, but exist even for efficient companies. They arise whether you like it or not, and are significant whether you realise it or not. Companies have found waste costs over 20 times the initial estimate, under-estimating the cost of waste is very common.

3. Good returns

Cost-effective waste minimisation is a valuable *investment* that pays dividends. Small capital spends can generate large savings and money spent on waste minimisation is a sound investment. Minimising waste has the potential to save a significant amounts of money.

4. Your reputation

Environmental performance is becoming increasingly important and waste minimisation shows effective and efficient control of operations in this area.

Customers are asking for proof of good environmental performance. Waste minimisation shows this and is a key part of any environmental management system.

Employees know that materials and resources are being wasted and can see that cost benefits make the company more competitive and safeguard their future.

Investors want the best return on capital and dividend growth and banks want to see efficient use of any borrowed capital. Waste minimisation can help to deliver both of these requirements.

5. Legal requirements

Companies - and key directors and managers - face stiff penalties for failing to comply with legislation. Effective waste minimisation helps to prove conformance with the law and save future expensive changes.

The way ahead

The benefits of minimising waste only come from action. To reap the benefits start to work on your own action plan based on the following:

- Establish a Board Level commitment to minimising waste.
- Contact the free Environment and Energy Helpline (0800 585 794) for further information and to get a free copy of GG263 - 'Waste minimisation in the glass and glazing industry'.
- Appoint a part-time waste minimisation 'Champion' to establish the true cost of waste and to motivate the workforce.
- Produce regular financial one line reports on the cost of waste collection and disposal and on the total cost of waste
- Follow this series for further essential information on waste minimisation in glass processing.

The potential benefits

Calculate your potential savings based on raw materials losses:

Amount of main raw material used last year, e.g. tonnes	A
Amount of product produced last year, e.g. parts	B
Amount of main raw material/unit of product, e.g. polymer/part	C
Quantity of main raw material in parts last year = (B x C)	D
Wasted main raw material = (A - D)	E
Purchase cost of main raw material	F
Cost of wasted raw material = (E x F)	G

The calculations above only show the visible purchase cost of wasted raw material. The true and total cost will also include wasted production costs, labour, storage etc. Consideration of all areas of waste will give a much higher figure.

1% of turnover	£
Profit margin as % of turnover	%
Turnover last year	£
Potential saving = turnover ÷ 100	£

Waste minimisation in glass processing

The walk-around

Waste is all around us. Some companies put up signs urging staff to 'STOP WASTE', most people would stop waste if only they knew where to find it. The signs should really read 'FIND WASTE' - only after finding the hidden waste can you really start to stop it. The first step in waste minimisation is to start to find the inevitable waste in the business and the best tool for this is the 'waste walk-around'. A 'walk-around' is designed to gain an overview of the processes and to identify some rapid no-cost or low-cost improvements to save money. The survey should be carried out as soon as possible - waste is happening now and it is costing money now. Take an unannounced walk around the site at mid-shift. If there is no night shift, it can also be profitable to take a walk around the factory when there is no production being carried out. Always look in the skips as a first step - it is an excellent starter for locating waste!

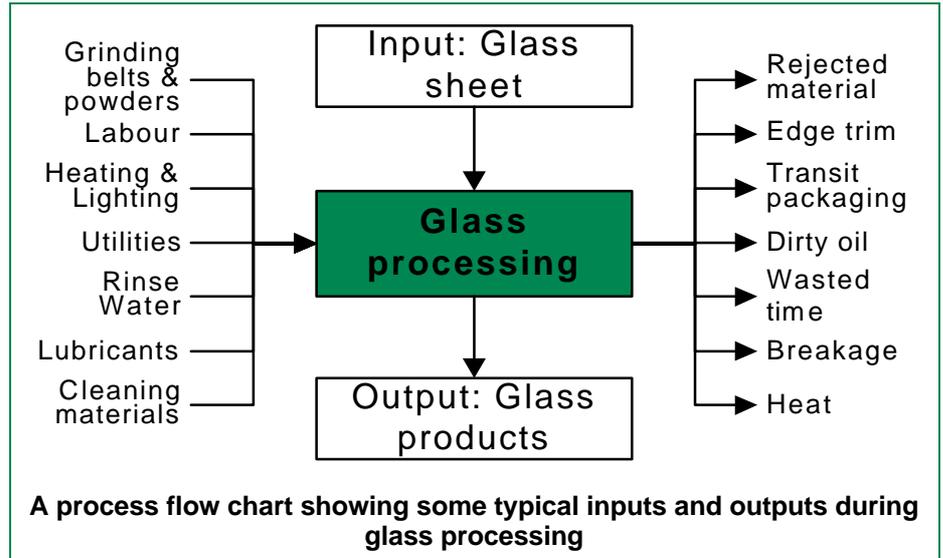
Cut waste, and you will boost profit. Money saved from waste goes straight to the bottom line.

Simple no-cost and low-cost ideas

Eliminate, reduce, re-use, recycle

The waste 'hierarchy' is vital to save the most money: first eliminate the source of waste, then reduce the amount of waste, then re-use any waste that does arise, then recycle the waste and only when these have been eliminated should we dispose of the waste.

- Identify the various waste streams produced on-site. The process flow chart gives an outline of the typical



inputs and outputs during glass processing.

- Optimise waste segregation and recycling to minimise the amount of waste requiring disposal. Skip disposal costs real money.
- Estimate the true cost of waste. The cost of waste glass is not just the disposal cost, it is the cost of the glass and the embodied processing costs to the stage at which it was wasted.

Materials management

- Avoid breakages by improving storage and handling techniques (especially after value has been added by processing).
- Record glass utilisation wherever possible. Track, locate and reduce any variations.
- Plan production to minimise changeover losses.
- Establish the total material losses for the process. Compare these losses with utilisation rates to find the relative importance of process and materials handling losses.

Packaging

- Re-use any packaging for your products, where appropriate.
- Find ways of minimising packaging with both suppliers and customers. Packaging is paid for twice - once to buy it and again to dispose of it.

Water

- Make everyone aware of water costs - especially the difference between purchase and effluent disposal costs. Check the bills to make sure that you are paying only for what you are disposing of; consider metering discharges if there are large evaporative losses.
- Turn off the water supply to processes that are not operating.

- Check for leaks in the water system and repair dripping taps as soon as possible.
- Check that hot water controls are set to stop heating one hour before the end of daily work.
- Fit flush controls to urinal systems in all men's toilets.
- Fit trigger controls to hosepipes.

Utilities

- Implement no-cost and low-cost methods to improve energy efficiency and reduce costs.
- Compressed air is a major energy user. Typically, 40% of generated compressed air is wasted in feeding leaks. A 3 mm hole leaks about 11 litres/sec and costs £1,000 per year.
- Get a free copy of 'Focus' from the Helpline to provide ideas for reducing energy costs.

Other measures

- Train employees to understand the effects of their actions.

The action plan

- Once you are looking for waste, a walk-around will identify obvious areas for improvement. Make some 'fast starts' to reduce waste.
- Start to monitor utility and packaging usage.
- Find out where and why waste glass is being created.
- Record the starting position and publicise improvements to motivate employees and maintain commitment from senior management.
- Contact the Helpline (0800 585 794) for free resources to identify more opportunities for waste minimisation and profit improvement. If your company has fewer than 250 employees, ask the Helpline for a free Fast Track visit to help you get started.

Finding hidden costs

The total cost of waste is generally around 20 times the first estimate that a company makes. Most of these costs are hidden and companies simply do not consider them when looking at the cost of waste. A first step in assessing performance is finding the true cost of waste. The 'true cost' of waste is not only the cost of the raw materials but is also a function of how much added value has been put into the product before it is lost from the production process.

For example, if a product is broken in the goods-out department, causing it to be lost as waste, the true cost of that waste will be:

True cost of waste = Cost of wasted raw materials + lost time + cost of utilities used + waste treatment + disposal costs.

To find out the current costs and performance, use the table at right. The information needed should be easy to obtain:

“If you don’t measure it then you can’t manage it.”

- Use existing accounts records for raw material purchases.
- Use production records to find out how much glass is used, rather than how much is ordered and delivered. If more than one type of glass is used then use additional lines in the table.
- For the main glass process wastes, include edge trimmings, off-cuts and damaged finished product.
- Use waste transfer notes (a legal requirement) to find out how much solid waste has left the site and invoices for waste disposal costs.
- Companies or suppliers covered by the packaging waste regulations will already have data on packaging use.
- Use utilities bills to assess and record energy and water usage.
- Tip** - always check that the correct tariffs have been applied and that any Power Factor correction equipment fitted has been switched on!
- If you do not have all the data to fill in the table then the accounts department can provide details of materials and services bought, product sold and waste disposal costs. If in doubt, estimate the appropriate number - it is

Calculating the true cost of waste				
Process waste	Raw material cost (£)	Treatment and disposal costs (£)	Lost production time and processing cost ⁽¹⁾ (£)	Total 'true' cost of waste (£)
Glass (4 mm)				
Glass (6 mm)				
Solid waste, e.g. packaging				
Water input				
Effluent costs				
Energy used				
TOTAL	£	£	£	£

⁽¹⁾ This should account for the lost costs of processing until the waste happens. For example, breaking a finished unit will also cost the time and resources spent in making it to that stage.

better to have an informed estimate than no estimate at all. The 'true total cost of waste' will probably be between 5 to 20 % of turnover and will come as a shock to many people. The cost of waste is often a deciding factor between not only profit and loss but also between success and failure. A formal waste minimisation programme can save up to 1% of turnover from effective and low cost waste minimisation efforts. These are substantial gains.

Benchmarking

Production performance in the glass fabrication and processing industry is often measured by overall output and 'due date'. Using performance measurements directly related to process efficiency and waste minimisation will improve overall control and help to develop good practice.

Examples of performance benchmarks include:

- cutting yield.
 - glass waste/tonne of saleable product.
- These types of performance benchmarks should be used to monitor internal improvements from the waste minimisation programme.

Next steps

- Calculate the true cost of waste on a

regular basis as part of Board level reporting - it is done for labour costs, why not do it for the much larger 'true cost of waste'?

- Contact the Helpline (0800 585 794) for free publications and improvement ideas. If your company has fewer than 250 employees, ask the Helpline for a free Fast Track visit to help you get started.
- Get a copy of GG263 'Waste minimisation in the glass and glazing industry'.
- Get a copy of ET30 'Finding hidden profit - 200 practical tips for reducing waste'.

The process

Improving performance to reduce waste in any company means changing 'the way we do things around here' and the best process is to use some 'fast starts' to convince people that it is worth the effort.

Improving performance is not a 'quick technology fix'. It is a continuous process of attention to detail and holding the gains.

A typical 5 step process is:

1. Gather the information.

Information is needed to find the 'fast starts' in the business. Gather the information available in the company (see last month's article) before starting to prioritise the 'fast starts'.

•**Tip** - Take photographs of waste and where it is being produced. These will show where waste is, and help in future comparisons.

2. Identify the priorities

Using the information, find some major sources of waste and identify the priority areas. These may be the largest quantities or the highest net costs. It is best to focus on areas with the largest financial savings and where there are practical ideas for making changes.

In one day you should be able to identify potential actions to make 'fast start' savings and to put them in order of priority.

3. Make the first savings

Make a 'fast start' action plan. The plan should involve the 'front line' staff because they have first hand knowledge of the processes and know the ways to make them better. The action plan should include some simple measuring systems to quantify the results.

Start the plan and regularly review progress against the aims.

4. Measure the savings

Use the measuring systems to demonstrate quantified savings and record the measurements for reference.

5. Achieve more savings

Carry out progress reviews to provide evidence that waste reduction is worth the commitment and effort. Use the evidence to extend the operations.

•**Tip** - Take photographs to record the changes.

The 'fast start' areas

Benchmarks

•Set performance benchmarks that are directly related to production efficiency.

Quality

•Carry out quality checks at critical stages to prevent further processing of rejects.

•Monitor the cost of processing defects.

Delivery and storage

•Use 'Just-In-Time' delivery to minimise storage time and damage.

•Develop delivery quality checks to improve the quality of glass used and reduce defects/breakages.

•Measure all breakage in deliveries and charge back to the supplier.

•Increase the stillage size to reduce space and number of glass lifts.

•Maintain stillages at an angle of 5° or 6°.

•Use battens to optimise storage conditions and avoid glass damage.

•Keep storage areas free of water leaks and dust to reduce staining.

Cutting

•Set aggressive improvement targets for glass utilisation that are relevant to your business.

•Fully optimise cutting to minimise waste - do not stop optimising at the first 'acceptable' result.

•Check for any surface and edge defects before cutting.

•Check the accuracy of the 'squareness' of cutting equipment.

•Box in cutting tables so that cullet does not fall underneath them.

Contaminated cullet decreases in value and is often disposed of rather than recycled.

•Catalogue and store significant off-cuts for future use.

Glass handling and processing

•Use tracking systems to identify glass by batch. If a batch causes preventable process waste, this will allow the batch to be quarantined and prevent further wastage.

•Stack glass correctly to avoid problems with de-stacking.

•Ensure that the correct lifts and equipment are used for lifting and manoeuvring glass from delivery vehicles to factory storage areas.

•Maintain racks with unworn felt/rubber padding and set at the correct angle, i. e. 3°.

Glass recycling

•Collect waste flat, float and clean glass separately from other glass types and contaminants (e.g. wood and metals) for recycling.

•Collect coated, coloured and laminated glasses separately for recycling.

Packaging waste

•Increase the size of the glass blocks to reduce the amount of timber end-cap.

Washing and finishing

•Ensure that the water supply to washing and finishing machines is turned on only when needed.

•Use reverse flow cleaning-in-place for glass washing. This allows demineralised water to be recycled and reduces water usage and effluent generation.

•Install conductivity monitors to check water quality and maximise recycling.

Maintenance

•Ensure that all machinery is well-maintained and clean to reduce mistakes, accidents and breakage.

•Assign machines to operators to increase operator ownership.

•Train staff to handle glass and end-products correctly to avoid bruising, scratching and damage.

Site layout

•Lay out production areas to optimise material flow logistics. This reduces both the potential for breakage and the time taken to move the product.

Waste minimisation tools

The key waste minimisation tools are 'waste tracking' and the 'cause and effect diagram'. These both help to find 'fast starts' and to develop the systematic approach for long-term savings.

Waste tracking

To manage waste effectively and pinpoint savings opportunities, the different wastes produced by a company (and the step at which they are produced) needs to be identified. The tools used for this are the 'process flow chart' and the 'waste tracking sheet'.

Process flow chart

Consider the production process as a series of steps. Each step has its own inputs, outputs and waste. Each step adds value to the product but also adds a cost from the labour, materials and utilities used in the process step.

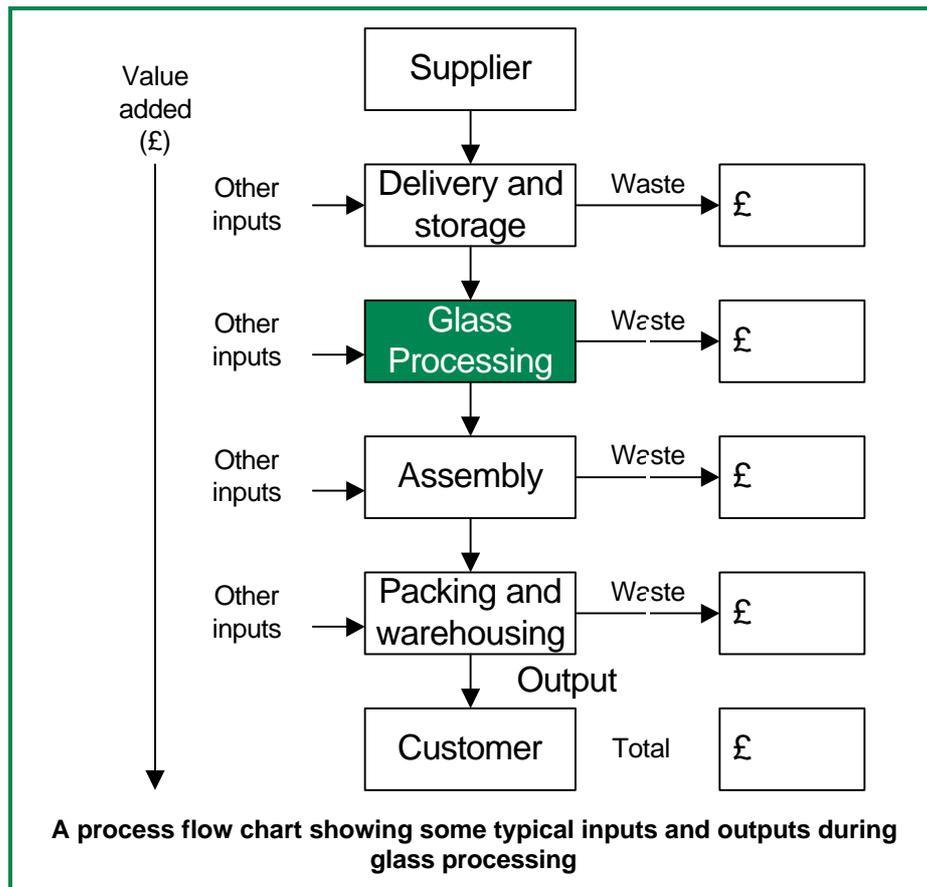
•**Tip** - The true waste cost includes the cost of wasted resources and rejects at each step in the process. The cost of rejects includes the value added to the material by the time it is rejected and this increases through the process. A general 'process flow chart' for glass processing is shown at right.

Waste tracking sheet

From the process flow chart it is possible to create a waste tracking sheet for each individual step. The waste tracking sheet measures and lists the amounts and costs of the waste for the step considered and provides a detailed 'opportunity list' for each step. The waste tracking sheet also provides an accurate picture of the 'cost of waste' for the step. Combining the details for the individual steps gives the overall cost of waste to the company. The results can also be used to see if there are any discrepancies in overall values, i.e. between identified and total actual water use, and raw material and energy consumption. Dig deeper if there are major discrepancies. They can be a major cost and a major savings opportunity!

The 'cause and effect' diagram

'Cause and effect' diagrams (also known as 'Fishbone' diagrams) are a standard tool for quality improvement and will be familiar to many people. They are used to identify potential opportunities for eliminating waste in each process step and are used to identify possible causes of a problem in a structured manner. For each effect there are likely to be several possible



causes. In manufacturing, the major groups of causes are:

- people
- methods
- materials
- machinery.

It is important to look for improvements to solve the root cause (or causes) of the problem and not simply to restate the symptoms.

•**Tip** - Ask the people who work on the process to suggest reasons (without blame) for the problem.

•**Tip** - List their suggestions against each cause (they know the process better than you!)

•**Tip** - Involve everyone in the development of solutions.

•**Tip** - Implement no-cost measures as soon as possible.

People

People are at the heart of waste minimisation. Talk to the staff involved in the process producing the waste to understand why it is produced. Is it because no-one had seriously considered there was a problem or because it is an established practice may no longer be relevant? Using 'waste reduction teams' and 'waste champions' will produce major savings.

The future

This short series has only touched the

Process description: Glass processing		
Supplier/input:		
Resource/ Material/Utility	Quantity Wasted	Monthly Cost (include purchase and disposal)
Rejected material		
Dirty oil		
Wasted time		
Transit packaging		
Edge trim		
Breakage		
Heat		
Total		
Customer: or next process		
Waste tracking sheet for specific process step.		

surface of waste minimisation. The implementation of these powerful techniques can save real money as well as making the company more environmentally friendly. For further free details, information and assistance contact the Helpline (0800 585 794)

