



Australian Government

Department of Education, Employment and Workplace Relations

MSS017002A Determine process loss through mass or energy balancing

Release: 1

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Modification History

Not applicable.

Unit Descriptor

This unit of competency covers the analysis of a process to determine loss of resources by the application of the first law of thermodynamics (more commonly known as mass and energy balancing). It includes the selection of mass or energy balancing or both as appropriate to the type of processes being examined and may be applied to an entire process, part of a large process, or part/all of a value chain.

Application of the Unit

This unit is a Vocational Graduate Certificate unit and follows the AQF guidelines for such units in that it assumes an entry qualification, such as:

- an Advanced Diploma or Diploma in sustainability or relevant technical field
- a Bachelor Degree in a relevant technical field
- other relevant higher education qualifications, often with relevant vocational practice
- relevant extensive vocational practice, without formal qualifications but which result in appropriate entry level skills.

This unit covers the analysis of a mass (material) and energy (usually heat or motive force) flows through a process to determine overall mass and energy efficiency, losses which occur through the process and how much loss occurs in each part of the process. This is achieved by the application of the techniques of mass balancing, energy balancing and combined mass and energy balancing. The application of this unit is especially suitable where high volumes of materials or large amounts of energy are used in a production process. The unit may also apply to other large energy or materials use processes in the value chain, such as logistics and transport.

This unit will lead to the identification of parts of the process which have the greatest resource loss/lowest resource use efficiency and so provides the basis for eliminating or reducing this loss and improving this efficiency. It does not include the implementation of that response (see MSS017004A Lead sustainable strategy deployment).

This unit would typically be undertaken by a manager or senior technologist who has significant responsibility for sustainability in their work role.

Skills covered by this unit may be applied individually or in a team context.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

Not applicable.

Elements and Performance Criteria Pre-Content

Not applicable.

Elements and Performance Criteria

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| 1 | Acquire required data | 1.1 | Identify system to be analysed |
| | | 1.2 | Define appropriate boundaries for this system |
| | | 1.3 | Identify relevant data which is available for the system and its subsystems |
| | | 1.4 | Identify required data which is not currently available |
| | | 1.5 | Negotiate with relevant stakeholders to obtain data which is not currently available |
| | | 1.6 | Acquire necessary and appropriate data |
| 2 | Calculate resource efficiency/loss | 2.1 | Undertake mass/energy balance over system |
| | | 2.2 | Identify subsystems making greatest contributions to loss by mass/energy balances over selected subsystems |
| | | 2.3 | Calculate sustainability impact of identified losses |
| | | 2.4 | Calculate mass/energy efficiencies of system and analysed sub-systems |
| 3 | Prepare recommendations | 3.1 | Investigate sub-systems responsible for significant loss |
| | | 3.2 | Determine currently available responses |

- 3.3 Determine required longer term responses
 - 3.4 Draft recommended responses in appropriate form
- 4 Communicate with relevant stakeholders
 - 4.1 Identify relevant stakeholders
 - 4.2 Determine stakeholder information needs and wants
 - 4.3 Analyse data which may be appropriate to communicate with stakeholders
 - 4.4 Prepare and disseminate information to stakeholders, as appropriate
 - 4.5 Negotiate solutions with stakeholders, as required
- 5 Communicate required responses as appropriate
 - 5.1 Identify what communications are required and to whom
 - 5.2 Prepare appropriate reports and recommendations
 - 5.3 Pitch reports and recommendations as appropriate
 - 5.4 Brief appropriate persons as required by determined responses
 - 5.5 Finalise appropriate recording

Required Skills and Knowledge

Required skills

Required skills include:

- interpreting specifications, operating procedures, manuals, regulations and other complex documents
- consulting and negotiating with internal and external stakeholders
- analysing and problem solving, including determination of root cause
- data acquisition
- interpreting and manipulating data, including the solving of simultaneous equations, the use of tie elements and the conversion of one form of energy into another
- drafting formal reports

Required knowledge

Required knowledge includes:

- process and changes which occur at each step in selected value chain
- principles of sustainability
- root cause analysis
- relevant legislation, regulation and protocols, government incentives and other initiatives
- first law of thermodynamics
- defining boundaries for systems subject to mass/energy balancing
- required data, sources of data from process, and use of data proxies, where necessary
- mass balancing techniques
- energy balancing techniques, including the use of tables of thermodynamic properties (steam tables), and the use of specific heat capacity and specific latent heat
- combined mass/energy balancing techniques, including the use of heats or reaction/dissolution
- methods of reducing resource losses for process and equipment

Evidence Guide

Overview of assessment

A person who demonstrates competency in this unit must be able to analyse processes or part or all of a value chain using mass and/or energy balancing as appropriate.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include: • undertaking a mass and an energy balance (which may be on different systems) or a combined mass/energy balance • identifying appropriate responses • communicating the above as appropriate
Context of and specific resources for assessment	• This unit of competency is to be assessed in the workplace or a simulated workplace environment. • Assessment should emphasise a workplace context and procedures found in the candidate's workplace. • This unit of competency may be assessed with other relevant units addressing sustainability at the enterprise level or other units requiring the exercise of the skills and knowledge covered by this unit. • The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.
Method of assessment	• In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work-like environment.
Guidance information for assessment	

Range Statement

Sustainability	Sustainability incorporates the three aspects of: • survival of the ecology/physical environment (to manage the impact of the business to ensure the survival of the physical environment)
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	• economic viability (efficiency, cost and waste reduction and competitiveness to support survival of the business) • social sustainability (to manage the impact of the business to ensure its continued survival within the community and the survival of the community)
System	A system is that process, or part of a process, which has been selected for analysis. It includes all the steps in the process which fall within the defined boundary. These steps have been referred to as 'sub-systems' above. The system may be any part of the value chain or the entire value chain
Sub-system	A sub-system is part of the system which may be chosen for separate analysis or study
Portion of the value chain	Value chain is the sequence of activities that a firm undertakes to create value/product (good or service). Portion of the value chain includes: • sections internal or external to the organisation
Mass/energy balancing	• Mass balancing is an analysis technique which allows for the calculation of mass flows and consumption through a process and losses of mass from the system/product • Energy balancing is an analysis technique which allows for the calculation of energy flows and consumption through a process and the losses of energy from the system/product • Mass and energy balancing may be undertaken as separate activities or in some circumstances as a combined mass/energy balance
Appropriate response	Appropriate response includes: • application of the hierarchy of hazard control to sustainability hazards • when the impact cannot be prevented application of mitigation and amelioration techniques, such as: • capture and storage (e.g. scrubbing) and similar 'end of pipe' solutions • dilution/dispersion and similar techniques which reduce concentration but not amount • other approaches which meet the sustainability requirements

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Unit Sector(s)

Sustainability

Custom Content Section

Not applicable.