AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

Meat Matters.

We All Have a Steak in this!

A Year 7 & 8 Educational Resource for Schools

Acknowledgements

This online curriculum-linked resource was produced by the Australian Meat Processing Corporation (AMPC).

The curriculum-linked resource is designed to introduce young people to the production and processing of red meat in Australia.

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The materials in this educational resource have been developed by Angela Colliver from Angela Colliver Consulting Services, Pty., Ltd.

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All links to websites were accessed in January 2017. As content of the websites used in this unit is updated or moved, hyperlinks may not always function.

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Introduction

The aim of this online curriculum-linked educational resource is to help teachers and students in secondary schools investigate and understand more about the Australian red meat processing industry.

The objectives of the educational resource are to:

- Support AMPC and its members in expanding awareness about the red meat processing industry in Australia by engaging and informing teachers and students about the role and importance of the industry in the Australian economy, environment and wider community.
- Engage and inform teachers and students regarding state-of-the-art processing facilities and best practice red meat production.
- Provide resources which help build leadership skills amongt teachers and students so they can communicate about red meat production and the industry in Australia.
- Increase knowledge and understanding about the complexity and innovative nature of Australia's red meat processing industry.
- Provide encouragement, information and practical teaching advice that supports teachers to educate their students about red meat production processes and the red meat processing industry.
- Educate school students about innovation and environmentally sustainable practices implemented in the red meat processing industry.
- Expand awareness of the broad range of career pathways available through the red meat processing industry and broader supply chain.
- Develop engaging learning programs using an inquiry process and Project Based Learning (PBL) approach aligned with the Australian Curriculum.

These online curriculum-linked educational resources provide practical support for teachers and students learning about food and fibre production and primary industries in schools.

The Learning Process in this Unit

This educational resource is a unit of work that uses an inquiry-based and integrated approach to learning. It is also student-centred and interactive.

It makes extensive use of the student's existing knowledge, questions and investigations. It uses a teaching and learning model based on the current philosophy that scientific knowledge is a social construction, highlighting how people's ideas and explanations create new knowledge. The teaching and learning model is also based on the idea that learning is a process of personal construction and reconstruction of ideas, rather than the absorption of a hierarchy of taught facts and concepts.

In practical terms, this means that teachers are not seeking to instil in students a selection of understandings, but are teaching and supporting them to experience and use creative ways of thinking to develop understandings of issues around them.

The interactive teaching and learning approach is based on the 21st Century Fluencies created by Crockett et al. (2011), and are outlined extensively in the book ***'Literacy Is Not Enough'*** by Crockett et al. (2011). See **https://globaldigitalcitizen.org/**. It uses the *solution fluency* through six phases: **Define; Discover; Dream; Design; Deliver and Debrief**. The phases of the model are based on based on

The fluencies are:

- **Define:** The 'Define 'phase begins with lessons that intellectually engage students with a challenge, problem, question and task. This phase captures their interest, provides an opportunity for them to express what they know about the topic, share understandings being developed, and helps them to make connections between what they know and the new ideas.
- **Discover:** The 'Discover' phase includes activities in which students can explore, investigate, research, read, discuss, gather, organise and compare knowledge and data. They grapple with the challenge, problem, question or phenomenon and describe it in their own words. This phase provides a context and enables students to acquire a common set of experiences that they can use to help each other make sense of the new knowledge or understandings.
- **Dream:** The 'Dream' phase enables students to imagine and develop possible solutions and explanations for the challenge, problem, question and task they have experienced. The significant aspect of this phase is that the students' explanations follow substantive conversations and higher order thinking experiences.
- **Design:** The 'Design' phase provides opportunities for students to apply what they have learned to new situations, to map production processes and so develop a deeper understanding of the challenge, problem, question or phenomenon. It is important for students to extend explanations and understandings, using and integrating different modes such as diagrammatic images, written language and media.
- **Deliver:** The 'Deliver' phase has two stages – production and publication or presentation. In the production phase, the task comes to life – this is the doing phase. At the end of this phase, the student task should be completed. Next, they present or publish their work sample to an audience.
- **Debrief:** The 'Debrief' phase provides an opportunity for students to revisit, review and reflect on their own learning and new understanding and skills. This is also when students provide evidence for changes to their understanding, beliefs and skills.

Source: Solution Fluency **https://globaldigitalcitizen.org/**

Throughout this educational resource the emphasis is on providing teachers with ideas and activities that enable them to:

- Provide a supportive classroom environment by valuing what students already know; meeting individual and collective needs; providing scaffolding and supporting all students to be successful.
- Be a resource person by collecting resources and materials; and suggesting strategies for investigation.
- Be a fellow investigator by advising on appropriate investigations; modelling ways of learning and identifying learning opportunities.
- Challenge students' ideas and learning strategies by encouraging further inquiry; providing the stimulus for investigating real life situations, alternative viewpoints and empowering students to investigate and respond to a challenge, task or project (commonly called 'Project-Based Learning').
- Co-evaluate what students know, can do and understand; using a range of assessment strategies including self assessment and peer assessment; negotiated assessment tasks, learning logs, observation and conferencing. (Note: The unit of work contains a 'Student Task' which is well suited for assessment, as it is the summation of the work undertaken by the students in the unit of work).

The unit of work has been designed as a sustained sequence of activities, based on the content descriptions of the Australian Curriculum identified in Year 7 and Year 8 in Design and Technologies and in Science.

Note, that in each fluency phase, several activities are suggested from which teachers are encouraged to select the most appropriate for their purposes. Not all activities in each stage of the unit need to be used. Alternatively, teachers may adapt, modify, add to or complement the suggested activities with ideas to suit the needs of the students with whom teachers are working.

Also note, digital tools including YouTube videos and Apps are utilised in the unit, both for the teacher and students' use. The unit also offers options for how the unit can be implemented in high, low, and non-technical environments. Teachers' decisions will need to be based on what technology is readily available in their teaching environment. Students may have many ideas regarding the digital tools they might wish use in their work samples.

Teacher Notes

Resource description

The aim of this unit is to help teachers and students in secondary schools discover sustainable resource management practices used by the Australian red meat processing industry for the use and management of water and energy, and the sustainable management of waste.

Students discover how a selection of Australian meat processing plants are using and managing water, energy and waste, and are tasked with reinvigorating an older processing plant to ensure the plant uses best practice environmental management strategies on-site.

Students are encouraged to consider practices used by the industry, and be part of the process of understanding, documenting and communicating the industry's sustainability practices.

Students are tasked in pairs, with completing an analysis of the systems and technologies used by meat processors with a specific emphasis on how they use best practice environmental management in the processing plants.

Students are then tasked with designing a key that can be applied through a meat processing plant that shows all the on-site sustainability features. In addition to a key, students are required to provide the meat processor with a poster that can be placed near the entrance of the meat processing plant to inform visitors about the best practice environmental management strategies utilised there. Additionally, students are required to design a brochure to provide more details about the identification system, and provide more details about the practical, positive and achievable actions the plant and its staff are making to achieve sustainability.

Finally, students are encouraged to think about how to give the industry an update by communicating new ideas and innovations used in sustainable red meat processing operations in changing times.

Year level: Year 7 & 8

Curriculum objectives

In this unit, students:

- Analyse how red meat is processed and produced in a managed environment;
- Investigate and analyse how meat processing plants can use and manage water, energy and waste more sustainably;
- Explore technologies, tools, equipment, procedures and systems used in the industry to process, produce, package and label different cuts of meat;
- Explore the ways people in design and technology occupations, like environmental engineers, find solutions for the red meat processing industry;
- Use and apply concepts and ideas about how the Australian red meat processing industry can use and manage water, energy and waste more sustainably;
- Design and deliver a presentation to give the industry an update including new ideas and innovations used in sustainable red meat processing operations in changing times; and
- Reflect and evaluate what students know about how red meat is processed and packaged in managed environments and how these processes can become more sustainable.

Based on Australian Curriculum, Assessment and Reporting Authority (ACARA) materials downloaded from the Australian Curriculum website in January 2017. ACARA does not endorse any changes that have been made to the Australian Curriculum.

Australian Curriculum Content Descriptions

Technologies

Design and Technologies knowledge and understanding

Year 7 & 8

Analyse how food and fibre are produced when designing managed environments and how these can become more sustainable **ACTDEK032**

Investigate the ways in which products, services and environments evolve locally, regionally and globally and how competing factors including social, ethical and sustainability considerations are prioritised in the development of technologies and designed solutions for preferred futures **ACTDEK029**

Design and Technologies Processes and Production Skills

Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas **ACTDEP035**

Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques **ACTDEP036**

Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions **ACTDEP037**

Independently develop criteria for success to evaluate design ideas, processes and solutions and their sustainability **ACTDEP038**

Use project management processes when working individually and collaboratively to coordinate production of designed solutions **ACTDEP039**

Science

Science as a human endeavour: Use and influence of science

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations **ACSHE120** **ACSHE135**

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity **ACSHE121** **ACSHE136**

Cross Curriculum Priorities: Sustainability

OI 2: All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival.

OI.3: Sustainable patterns of living rely on the interdependence of healthy social, economic and ecological systems.

OI.7: Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments.

OI.8: Designing action for sustainability requires an evaluation of past practices, the assessment of scientific and technological developments, and balanced judgments based on projected future economic, social and environmental impacts.

General Capabilities

Literacy

This unit's learning experiences enable students to develop literacy capabilities that relate to everyday living contexts that students face throughout their lives. For example:

- Comprehending texts through listening, reading and viewing;
- Composing texts through speaking, writing and creating;
- Developing skills in reading, interpreting and analysing information; and
- Developing oral language skills as students ask questions, seek advice, present viewpoints and discuss their practical tasks.

Numeracy

This unit's learning experiences enable students to develop numeracy capabilities that relate to everyday living contexts as they make recipes. For example:

- Calculating and estimating; and
- Using a range of measurement techniques when producing designs.

ICT Capability

This unit's learning experiences enable students to develop the capacity to both manage and use information technology safely and responsibly, including the capacity to evaluate sources and their reliability, accuracy and validity of information and use digital technologies in academic, practical, collaborative and creative pursuits. For example:

- Applying social and ethical protocols and practices when using ICT;
- Investigating with ICT;
- Creating with ICT;
- Communicating with ICT;
- Managing and operating ICT; and
- Developing skills to undertake effective searches online and locate appropriate information in a timely manner.

Critical and Creative Thinking

This unit's learning experiences enable students to develop the capacity to solve problems, think critically and creatively, or generate new ideas. Students will also identify alternative explanations, see links and find new ways to apply ideas in the context of everyday living as they engage in analysing and designing systems to manage water, energy and waste productively and in a way that reduces impacts on the environment. For example:

- Inquiring – identifying, exploring and clarifying information;
- Generating innovative ideas and possibilities;
- Reflecting on thinking, actions and processes;
- Analysing, synthesising and evaluating information; and
- Developing creative solutions when they apply divergent thinking to resolving design challenges—for example, designing and creating a poster and brochure to guide visitors through the identification system, and provide more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.

Personal and Social Capability

This unit's learning experiences enable students to develop the capacity to take responsibility for their own work and learning, manage their learning, monitor, reflect on and evaluate learning. They also identify personal characteristics that contribute to or limit effectiveness, plan and undertake work independently, take responsibility for their behaviour and performance, and learn from successes and failures. For example:

- Managing their own and others' safety when working in an online environment.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA), downloaded from the Australian Curriculum website in January 2017.

Additional Teacher Notes

Selecting activities

At each stage of the learning sequence, several activities are suggested from which teachers are encouraged to select the most appropriate for their purposes. Not all activities in each stage of the unit need to be used. Alternatively, teachers may add to or complement the suggested activities with ideas of their own.

Adapting the unit

The unit is targeted at junior secondary students. This is a suggested age range only and teachers are encouraged to modify activities to suit the needs of the students with whom they are working.

At each stage of the unit, a number of activities are listed. Teachers are not expected to do them all. Instead, the units are designed such that a selection of activities can be made at each stage. Teachers should select the activities according to the needs and interests of their students and the time, relevance to the existing school curriculum and resources available to them.

Suggestions from review teachers

Teachers who trialled and reviewed these materials encouraged others to 'put your own spin on it and be sure it is suited to your class'. Here are some of their ideas about how they did this:

- Start by finding out what students' attitudes and knowledge is of the supply chain.
- Condense the unit to suit your needs
- Take time to really explore the resources for yourselves, keeping in mind the perspective of your students and their learning needs and style. Immerse yourself in the programs first to appreciate the material that is contained in them.
- Watch all the videos first if you have no background in livestock production or no knowledge of red meat processing. Download the videos if you are in a poor download speed area (also saves school funds if downloaded once!!)
- A visit to a processing plant or a butcher would be an advantage- gives the students a better understanding of all the processes involved. Or have a guest speaker. Maybe show one of the Dr Temple Grandin videos (watch first to select the suitable parts for your own class)
- Be open-minded and you'll be surprised. Try them. Give it a go, Jump in.

Time allocation

This will, of course, depend on particular circumstances but generally, four to six weeks is suggested.

Moodles, Wikis and e-Learning Systems

It is suggested that the 'Student Resources' at the rear of this unit be made available to students on the school's e-learning system or other e-platforms such that students can access the materials and drive their own learning.

Differing tastes and eating preferences

Encouraging children to eat healthy food is a global issue. People can have different views about eating red meat and it is suggested that where students are vegetarian, pescatarian or vegan, they can choose to investigate how different fruits and vegetables are processed and packaged in managed environments. These students can give an older food processing plant of their choice, a new look to ensure the plant is using best practice environmental management strategies.

Assessment

The assessment methodology is based on using two rubrics, one specifically for the task set in this unit, and the other based on the learning process. The **assessment rubrics** are the summation of the student's learning tasks. The rubrics provide:

- A common language for discussing student achievement in relation to the tasks undertaken, and
- A means of engaging with, and communicating student achievement, to the student and his/her parents or caregivers.

The rubric columns: levels

Each of the rubrics is divided into four levels.

Level 1: Basic

Level 2: Sound

Level 3: High

Level 4: Outstanding

The rubric rows: aspects of the task

Each of the rubrics is divided into rows, with each row representing critical aspects of the student task.

The task in this learning sequence involves students:

Learning about and analysing how red meat is processed and packaged in managed environments and how these can become more sustainable. The students, in pairs, are required to give an older meat processing plant a brand new look, in order to ensure the plant is using best environmental management practices on-site.

Students are tasked with investigating how red meats are processed, and how water and energy use can be minimised on site, whether water and wastes can be reused, recycled and used sustainably, and they then design systems to manage water, energy and waste productively and in a way that reduces impacts on the environment.

Students are tasked in pairs, with completing an analysis of the systems and technologies used by meat processors with a specific emphasis on how these processors use best practice environmental management in the processing plants.

The student pairs are then tasked with designing a key that can be applied through a meat processing plant that shows all the on-site sustainability features. In addition to the key, students are required to provide the meat processor with a poster that can be placed near the entrance of the meat processing plant to inform visitors about the best practice environmental management strategies utilised there. Additionally, students are required to design a brochure to provide more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.

In addition, each student pair is also required to make a five minute presentation of their processing plant redesign, poster, and brochure to an audience in which they explain how red meat is processed in Australia using six or more 'best' environmental management practices.

Overall project rubric

This rubric is designed to specifically evaluate what has been asked of the students from the scenario presented to the class.

Syllabus	Level 4	Level 3	Level 2	Level 1
ACTDEK032 Weighting 25%	A design of a meat processing plant with a key identifying all the on-site sustainability features has been created. It is informed by an analysis of a selection of existing Australian meat processing plants that show how water and energy use can be minimised on site, and whether water and wastes can be reused, recycled and used sustainably. The design includes six or more systems to manage water, energy and waste productively and in a way that reduces impacts on the environment, and that shows evidence of extensive research of the subject matter.	A design of a meat processing plant with a key identifying all the on-site sustainability features has been created. It is informed by an analysis of a selection of existing Australian meat processing plants that show how water and energy use can be minimised on site, and whether water and wastes can be reused, recycled and used sustainably. The design includes four-five systems to manage water, energy and waste productively and in a way that reduces impacts on the environment, and that shows solid evidence of research of the subject matter.	A design of a meat processing plant with a key identifying all the on-site sustainability features has been created. It is informed by an analysis of a selection of existing Australian meat processing plants that show how water and energy use can be minimised on site, and whether water and wastes can be reused, recycled and used sustainably. The design includes three systems to manage water, energy and waste productively and in a way that reduces impacts on the environment, and that shows evidence of some research on the subject matter.	A design of a meat processing plant with a key identifying all the on-site sustainability features has been created. It is informed by an analysis of a selection of existing Australian meat processing plants that show how water and energy use can be minimised on site, and whether water and wastes can be reused, recycled and used sustainably. The design includes two systems to manage water, energy and waste productively and in a way that reduces impacts on the environment, and that shows evidence of little research of the subject matter.
ACTDEK029 Weighting 25%	The content of the poster and brochure showed clear evidence of solid research and understanding of the identification system, and provided more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.	The content of the poster and brochure showed some evidence of research and understanding of the identification system, and provided more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.	The content of the poster and brochure showed limited evidence of research and understanding of the identification system, and provided more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.	The content of the poster and brochure showed little research and understanding of the identification system, and provided more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability..
Literacy 10% Critical & creative thinking Weighting 10%	The design and layout of the poster and brochure makes it very easy to understand and interpret the information provided.	The design and layout of the poster and brochure makes it easy to understand and interpret the information provided.	The design and layout of the poster and brochure makes it possible to understand and interpret the information provided.	The design and layout of the poster and brochure makes it difficult to understand and interpret the information provided.

Syllabus	Level 4	Level 3	Level 2	Level 1
Critical & creative thinking Weighting 10% ICTs Weighting 10%	The presentation of the processing plant redesign, poster, and brochure to an audience which explains how red meat is processed in Australia using six or more best environmental management practices was communicated with a logical flow and without pauses.	The presentation of the processing plant redesign, poster, and brochure to an audience which explains how red meat is processed in Australia using four-five best environmental management practices was communicated with a logical flow and with few pauses.	The presentation of the processing plant redesign, poster, and brochure to an audience which explains how red meat is processed in Australia using three environmental management practices was communicated with a mostly logical flow and with some pauses.	The presentation of the processing plant redesign, poster, and brochure to an audience which explains how red meat is processed in Australia using two best environmental management practices was communicated with a little logic and many pauses.
Literacy Weighting 10%	The student answered all questions clearly and accurately.	The student answered most questions clearly and accurately.	The student answered some questions clearly and accurately.	The student answered a few questions clearly and accurately.

Student work examples from unit trials held in 2016.

Learning process rubric

Each of the learning progressions in the learning sequence has a prerequisite for progression – a list of what the student needs to accomplish in order to proceed to the next step in the process. The text from those areas is duplicated in this rubric and can be used with students to guide their progress with feedback, in a mini-debrief, helping them to refine their process and product at critical points throughout the learning sequence.

Level 4	Level 3	Level 2	Level 1
A clear definition of the task was provided.	A somewhat clear definition of the task was provided.	An average definition of the task was provided.	A definition of the task could not be provided.
Research and analysis was completed with no prompting.	Research and analysis was completed with minimal prompting.	Research and analysis was completed with some prompting.	Research and analysis was completed with significant prompting.
Needs and opportunities for the meat processing industry identified with no prompting.	Needs and opportunities for the meat processing industry identified with minimal prompting.	Needs and opportunities for the meat processing industry identified with some prompting.	Needs and opportunities for the meat processing industry identified with significant prompting.
A clear visualisation of the three designs was provided.	A mostly clear visualisation of the three designs was provided.	A reasonably clear visualisation of the three designs was provided.	No clear visualisation of the three designs was provided.
An extremely clear plan of what the three designs will contain was provided.	A very clear plan of what the three designs will contain was provided.	A clear plan of what the three designs will contain was provided.	A somewhat unclear plan of what the three designs will contain was provided.
An extremely clear plan of the accompanying narrative was provided.	A very clear plan of the accompanying narrative was provided.	A mostly clear plan of the accompanying narrative was provided.	A somewhat unclear plan of the accompanying narrative was provided.
Three designs have been created and presented to an audience with a logical presentation about how they educate consumers and explain how red meat is processed in Australia using environmental management practices.	Three designs have been created and presented to an audience with a mostly logical presentation about how they educate consumers and explain how red meat is processed in Australia using environmental management practices.	Three designs have been created and presented to an audience with a somewhat logical presentation about how they educate consumers and explain how red meat is processed in Australia using environmental management practices.	Three designs have been created and presented to an audience with little logic about how they educate consumers and explain how red meat is processed in Australia using environmental management practices.

Meat Matters:

Facts and Figures about the Australian Red Meat Processing Industry

The following basic information may be helpful when teachers interact with their school students.

The Meat and Livestock Industry

- There are approximately 29 million head of cattle, 70 million sheep and millions of bush goats in Australia.
- Australia is one of the world's most efficient producers of cattle and the world's third largest exporter of beef.
- Australia is also one of the world's leading producers of lamb and mutton, the world's largest exporter of mutton and the second largest exporter of lamb.
- Australia is a relatively small producer of goat meat yet, is the world's largest exporter of goat meat.

Source: Meat and Livestock Australia **http://mla.com.au**

Looking after our cattle, sheep and goats

Good animal welfare is not only vital from a moral and ethical perspective, but also for farmers and processors' productivity, profitability and sustainability. To continually improve the well-being of Australia's cattle, sheep and goats, the industry invests in research and development to provide tools and knowledge for farmers, transporters and processors.

Animal welfare research is undertaken on farms, at feedlots and at the processing sites of beef, lamb and goat meat.

The Red Meat Industry

Around 200,000 people are employed in the Australian red meat industry, including on-farm production, transporters, processing and retail activities.

Australian cattle, sheep and goat farmers, livestock transporters and processors value highly the health and wellbeing of their stock.

Farmers have an attachment to their cattle, sheep and goats, as they have often raised animals from birth and they know that healthy and well cared for stock also produce better quality, beef, lamb, mutton and goat meat. It is widely acknowledged that consumers want their red meat produced humanely and ethically. As such, Australian cattle, sheep and goat producers are recognised around the world for their animal husbandry and farm management techniques.

The Australian Meat Processing Sector

Australian Meat Processors and Butchers are passionate about delivering top quality, safe and nutritious products to market.

The Australian Meat Processing Sector is a world leader in processing beef, lamb and goat meat and processing plants employ the latest technologies to ensure superior levels of meat product.

Australia has approximately 300 abattoirs (including boning rooms) with a workforce of around 34,000 people. The red meat processing industry is estimated to contribute just under $23 billion of value added to the Australian economy including flow-on impacts, equivalent to 1.5 percent of Australia's Gross industry value added. It generates 134,000 jobs equivalent to 1.4 percent of full-time equivalent (FTE) employment when flow-on effects are taken into account.

Source: Heilbron, S.G. 2016. Evaluating the Socio-economic benefit of the red meat processing industry in regional Australia, pages 14 and 20. (Unpublished)

Red Meat Processors trim and prepare the beef, sheep and goat carcases to specific standards. They grade the carcasses for colour, tenderness, fat, age, sex and bruising according to AUS-MEAT standards and weigh and brand each carcase. The weight is used to calculate how much farmers are paid.

Meat Processors who work in abattoirs include Trimmers, Boners, Graders and Packers.

A 'Trimmer' skins, cleans, trims, dresses, hangs and prepares the beef, lamb or goat carcasses to specific standards.

Each carcass is cut in half and carefully chilled in the chiller room. The chiller room keeps the meat at the correct temperature to ensure the red meat is tender and fresh.

After chilling, meat 'Graders', grade the beef, lamb and goat meat for colour, tenderness, fat, age, sex and any bruising on the meat. Each carcass is tagged by the 'Graders' to show the classification, the date of processing and the brand of meat, as well as the plant in which it was processed.

After chilling for at least 24 hours the 'Boners' cut the beef, lamb and goat meat into different cuts of meat or prepare the carcasses to be sent to a butcher who will prepare the smaller cuts of meat.

Meat 'Packers' pack the varying cuts of beef, lamb and goat meat ready for sale and delivery to local, regional, interstate and overseas customers.

Red meat products are transported from the processing plant to butchers, wholesalers, restaurants and supermarkets, in refrigerated trucks. There are Australian Standards that must be followed during transportation to make sure that the red meat is kept hygienic for people to eat.

Red meat for export markets is packed into large refrigerated containers and delivered to ports and airports for transport overseas.

Stringent food safety standards are applied by Quality Assurance teams to ensure the meat is hygienic to eat by consumers in Australia and overseas.

Meat Processing and the Environment

The Australian meat processing industry is serious about environmental stewardship. The industry believes it has a duty to ensure that Australian red meat is produced, processed and distributed responsibly, while also remaining competitive and sustainable. The Australian meat processing industry has taken proactive steps to help ensure it carefully manages the nation's precious environment and resources. In efforts to reduce the industry's environmental footprint, ongoing industry research and development is focused on the continuous improvement of overall productivity, waste minimisation, pollution prevention and beneficial reuse of wastes.

Environmental issues pose both a challenge and opportunity for the Australian meat processing industry. The industry has tackled this challenge head-on and is making important progress in addressing these issues—especially in acknowledging and addressing water, energy and waste management and greenhouse gas (GHG) emissions.

Most of the industry's GHG relate to emissions from effluent ponds. This provides meat processors with opportunities for emissions capture, destruction or use. Industry research is developing new and innovative technologies and management systems to mitigate and utilise GHG emissions.

As well as GHG emissions, the industry is also addressing many other environmental issues proactively such as nutrient management, by-product reuse, alternative waste management and soil health.

Food Safety

Product integrity continues to be one of the most important aspects of Australian meat production and processing. The industry has quickly responded to growing consumer demand for top quality produce that is safe to eat. The National Livestock Identification System (NLIS) is a quality assurance program that allows producers and processors to demonstrate good practice using the principles of Hazard Analysis and managing Critical Control Points for management, food safety, animal welfare, bio-security and traceability.

Australia's meat processing industry is also leading the world in ensuring its meat products are fully traceable from paddock to plate.

These systems help to ensure the integrity of the Australian meat supply chain which makes the Australian meat industry leaders in their field.

Source: MLA **http://www.mla.com.au/meat-safety-and-traceability/red-meat-integrity-system/about-the-national-livestock-identification-system/**

Step 1: The essential question and scenario

Objective: Define the main question and share the scenario that is the focus of the unit.

Ask students to brainstorm ideas about what they know about how beef, lamb or goat meat might be processed in Australian meat processing plants. Display these for future reference.

Talk with students about how Australia has approximately 300 meat processing plants, some of which are small local plants and others which are much larger processors who supply beef, lamb and goat meats for both national and international markets.

Set the task and explain to the class that in this unit, their task is to learn about and analyse how red meat is processed and packaged in managed environments and how these practices can become more sustainable. The students, in pairs, are required to give an older meat processing plant a brand new look, in order to ensure the plant is using best environmental management practices on-site.

Students are tasked with investigating how red meats are processed, how water and energy use can be minimised on site, and whether water and wastes can be reused, recycled and used sustainably. They then design systems for a processing plant to manage water, energy and waste productively and in a way that reduces impacts on the environment.

Students in pairs are tasked with completing an analysis of the systems and technologies used by meat processors with a specific emphasis on how they use best practice environmental management in the processing plants.

The student pairs are then tasked with designing a key that can be applied through a meat processing plant that shows all the on-site sustainability features. In addition to the key, students are required to design a poster that can be placed near the entrance of the meat processing plant to inform visitors about the best practice environmental management strategies utilised on-site. Additionally, students are required to design a brochure for visitors to provide more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.

Each pair of students is also required to give a five minute presentation of their processing plant redesign, poster and brochure, to an audience in which you explain how red meat is processed in Australia using six or more best environmental management practices.

Share the following question and scenario with the class. See **Resource 1.1**.

The essential question:

What benefits are achieved when we understand all the things Australian red meat processors do to bring us juicy, tender cuts of beef, lamb and goat meat, while using and managing water, energy and waste sustainably?

Step 1: The scenario

The Australian Meat Processor Corporation (AMPC) is searching for schools to discover how Australian meat processors might produce an array of different beef, lamb and goat meat cuts for local, national and international markets, while using and managing water, energy and wastes sustainably.

Become an environmental designer and use your ingenuity and creative thinking to give an older meat processing plant a brand new look, and design sustainable water, energy and waste solutions that can benefit the environment, and meat processors.

AMPC invites you to design systems to manage water, energy and waste and help meat processors reduce impacts on the environment. The water and waste needs to be handled carefully so that it cannot pollute rivers, streams and underground water supplies, or affect animals, plants and humans. The energy used at the plant also needs to be sourced and used sustainably.

In pairs, you are tasked with completing an analysis of the systems and technologies used by meat processors with a specific emphasis on how they use best practice environmental management in the processing plants.

You are then tasked with designing a key that can be applied in a meat processing plant that shows all the on-site sustainability features. In addition to the key, you are required to provide the meat processor with a

poster that can be placed near the entrance of the meat processing plant to inform visitors about the best practice environmental management strategies utilised on-site. Additionally, you are required to design a brochure to provide more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.

You are also required to give a five minute presentation of your processing plant redesign, poster and brochure, to an audience in which you explain how red meat is processed in Australia using six or more best environmental management practices.

- What investigations can assist you to research how Australian meat processors use water and energy?
- What investigations can assist you to research how they handle and manage waste in their plants?
- Will you investigate how Australian meat processors currently manage wastewater?
- Will you investigate how Australian meat processors use water for hand washing, cleaning and disinfecting tools and equipment, washing carcasses, and in high pressure hoses to wash down areas of the processing plant?
- Will you investigate whether any Australian meat processors currently use manures or biomass to create electricity?
- Will you investigate how some Australian meat processors wash out their sheds and recycle the solid waste and wastewater to irrigate surrounding pastures?
- Will you investigate how some Australian meat processors recycle solid waste that is then processed into products like 'Blood and Bone' fertilisers?

AMPC and other meat processors can help out with lots of information, images and videos on their websites. **http://www.ampc.com.au/education-training/school-resources/meat-matters**

Your challenge is to use the websites and a range of activities and videos to help understand how Australian meat processors can use and manage water, energy and waste more sustainably in their processing plants.

- How will you give an older plant a new sustainable look in this project?
- How will your systems work, and how will it help Australian meat processors reduce impacts on the environment? How might you present your design to others?

Step 2: Define understandings

Objective: Have students illustrate their understanding of the challenges set out in the scenario by providing an oral definition of the task.

Capture students' interest and brainstorm ways their families might use and manage water, energy and waste sustainably at home.

Ask questions about whether their family:

- Captures and uses rainwater;
- Have low flow taps, showerheads and/or dishwashers;
- Fixes leaking taps and leaks quickly;
- Has a dual flush toilet;
- Water gardens only when its necessary;
- Have replaced or supplemented their energy supply with renewable energy sources (such as Green Power, solar hot water, solar photovoltaics, ground source heat pumps, micro- hydro power or wind power);
- Installed any skylights;
- Use energy efficient globes and appliances;
- Use long life, low energy LED lights;
- Installed blinds and insulation;
- Installed ceiling fans to provide air circulation and enhance heating and cooling;
- Have planted deciduous trees to shade east-and west-orientated windows;
- Turn off appliances overnight, on weekends and during holidays;
- Use occupancy detectors, clockwork time delays, or natural lighting;
- Recycles paper, glass, cans and green waste;
- Composts vegetable scraps and green waste; and/or
- Has a worm farm to help compost green waste.

Talk about organic fertilisers like 'manure' and their value in adding nutrients to the soil.

Discuss composting as a great waste solution. Talk about how it can convert kitchen and garden waste into a dark coloured soil conditioner in just a matter of a few weeks or months. (Wherever possible, have a sample of compost for students to examine).

Talk about worm farms and how worms can be bred for their role in creating fertiliser. Talk about their 'castings' (worm poo) that is rich in essential plant nutrients.

Talk about products like 'Blood and Bone' and its ingredients. Ask questions about where the ingredients might come from.

In pairs, ask students to consider the way the school and local community might use and manage water, energy and waste more sustainably.

Ask students to describe how someone they know might use and manage water and energy sustainably, and reuse or recycle food scraps, leaf litter, grass clippings, and/or animal wastes. Discuss these ideas.

Talk with students about the words 'conserve', 'control', 'manage', 'reuse' and 'recycle'. What do the words mean?

Discuss what the students think they know about how Australian meat processors currently use and manage water and energy and reuse and recycle wastes produced by meat processing practices in their plants.

Talk about systems that recycle and reuse water. For example systems that filter and treat waste water at water treatment plants.

Discuss systems that reuse and recycle waste. For example composting systems that recycle green waste; recycling systems that separate cans, glass, paper and plastics.

Brainstorm how using water and energy sustainably, and reusing and recycling waste might help Australian meat processors reduce impacts on the environment.

Invite students to recall the focus of the task that AMPC has invited them to undertake and record their understanding of their tasks in **Resource 1.2**.

Ask students what they might need to know more about, in order to undertake the task set by AMPC.

- Might they need to know something about the types of resources that are available to assist their research into how Australian meat processors might use and manage water and energy; and reuse and recycle waste products produced during meat processing?
- Might they need to know where to find and research information about how Australian meat processors might use and manage water and energy, and reuse and recycle waste products?
- What might they have to do to make this possible?
- What tools, equipment and procedures might be needed?
- How might each pair of students design systems to manage water, energy and waste and help meat processors reduce impacts on the environment?
- How might the systems help Australian meat processors reduce impacts on the environment?

Prerequisite for progression:

Ask students to articulate their understanding of the task/challenge through oral conversation and if appropriate a written (scribed) statement.

Note: The Prerequisite for Progression are the checkpoints that occur at the end of each stage of the learning sequence. This is the time when formative feedback is given to the students about what they have accomplished in that stage. It describes what the students must complete before they move onto the next phase of the unit. (Crockett, et, al)

Step 3: Discover

Objective: Have students research, read, view, listen to, discuss, gather, organise ideas about how Australian meat processors use and manage water, energy and waste and reduce impacts on the environment.

Ask students to consider the questions

- What is involved in meat processing?
- How might water and energy be used, in the processes of cleaning the animals before and during skinning, trimming, boning, hanging, chilling and preparing beef, lamb and goat carcasses?
- Might hot or cold water be used for hand-washing, cleaning tools and equipment or washing down areas? and
- What waste might be produced when animals arrive after transportation, or when trimmers skin, clean, trim, hang and prepare beef, lamb and goat carcasses?

Brainstorm and collate ideas.

Invite local processors or butchers, wherever possible, to visit the class and talk about how they use and manage water, energy and waste and reduce their impact on the environment.

Talk about the 'slaughter floor' where livestock are slaughtered using the most humane techniques available. Support students in appreciating that livestock are stunned using a special electrical device to make them unconscious, and while unconscious they are slaughtered and die instantly, as approved by current animal welfare standards.

View an image of an electronic ear tag and introduce the 'electronic ear tag' worn by cattle and explain how information from the electronic ear tag, once scanned by the process workers is entered into a company computer, so that each carcass can be traced back to the property from, which it came. **http://www.ampc.com.au/uploads/images/Meat-Matters/Aust-Meat-Processing-Images/Traceability-(Afflicks%20NSW).jpg**

Discuss how all sheep and goats born in Victoria from January 2017 will be fitted with a mandatory electronic ear e-tag to allow their location, movements and origins to be tracked and traced.

Introduce 'trimming', the process where process workers trim any bruising or excess fat from the carcass, according to set standards. View the processes used by staff at 'Afflicks', a domestic meat processor in Moruya in NSW, whereby whole carcasses are trimmed before being cut in half by large, mechanical saws. **https://youtu.be/y2mPEqIuLVY**

Talk about the 'boning room' in meat processing plants and the role 'boners' play in cutting carcasses of beef, lamb or goat into smaller pieces known as primal or retail cuts.

View a video that features one of the local Bungendore farmers who produces his own livestock, has it processed in Moruya NSW and then sells it in his own butcher shop in the Canberra and Southern NSW region. **https://youtu.be/KctHQcH_0hs**

View the video about Afflicks in Moruya **https://youtu.be/y2mPEqIuLVY** and:

Ask students to think about:

- How water and energy might be used, in the processes of keeping hygiene, safety standards and quality controls; and how these resources might be used in the slaughtering, trimming, grading, chilling, and boning processes?;
- What waste might be produced when processors slaughter livestock, trim carcasses and when boners cut and prepare beef, lamb and goat carcases for sale?; and
- Are any wastes likely to be reused or recycled?

Introduce **Resource 1.3** for students to record information in the unit.

Talk about the word 'sustainability.' As a class, consider the differences between 'environmental sustainability', 'economic sustainability' and 'social sustainability'. For example: When a meat processor thinks of being economically sustainable, they might ask themselves a question like 'Are we sustainably profitable?' or 'What do we need to do to make sure that the processing plant provides a living for our family into the future?'.

When a meat processor thinks of being socially sustainable, they might ask themselves a question like 'Are we behaving in a way that the community supports us into the future?' or 'How should we be involved in our community, to support the community and to support us into the future?'

When a meat processor thinks of being environmentally sustainable, they might ask themselves a question like 'Are we maintaining our processing plants and their assets for future generations?' or 'How can we utilise the plant's natural surroundings so that future meat processors can operate successfully in that environment?'

Expand the topic and talk about the sustainable practices that can be used in meat processing operations. Consider how the hides from beef are reused for leather products, and how fats, bones and off-cuts are re-used and processed to make tallow and blood and bone products.

Delve deeper and think about how waste management, water re-use, wastewater treatment, resource recovery, and on-site power generation from biogas, the sun or wind, happen in meat processing plants. Ask students to visualise what a sustainable meat processing plant might look, sound and feel like?

Think about issues such as the meat processing plant's environmental footprint, sustainable management systems to manage air quality, limit chemical usage, improve water use efficiency, reduce and re-use waste, recycle effluent and minimise energy usage.

Ask students to develop criteria describing the standards they feel best describe 'sustainable' meat processing. Share these as a class and display ideas for future reference.

As a class, build understanding by sharing ideas and record issues that the class would like to know more about how an Australian meat processor might address sustainable processes and systems in their business.

Encourage students to find examples of what actual Australian meat processors are doing to address sustainable practices and bring their findings back to class. Share these examples to build a bigger picture of what is happening in the industry. For example students might research using the AMPC website **http://www.ampc.com.au/**

In pairs, using a digital device, ask students to research ways Australian meat processors might use and manage water and energy, and reuse and recycle waste products produced during beef, lamb or goat meat processing.

View the ABC Landline episode featuring R Radford and Son at **http://www.abc.net.au/landline/content/2012/s3615247.htm** and focus on the sustainability considerations in which the meat processing company has invested.

Ask students, in their pairs, to discuss the plant upgrades that have included temperature controlled chilling to enhance eating quality, and the investment in water and energy recovery projects to increase plant sustainability.

Discuss how this processing plant uses 100,000 litres of water a day. Brainstorm and list all the processes that might use water at the plant and consider ways that any processor might be able to undertake to conserve or re-use water.

Talk about this processing plant's water recycling system.

Draw a flow chart that describes the four-stage process that produces top-quality water.

Hear from an Australian meat processor, listen to and view his story and view photos about how this processing plant uses and manages water and energy, and reuses and recycles waste products produced there in a state-of-the-art Rendering Plant that can be operated and monitored from his mobile phone. **https://youtu.be/y2mPEqIuLVY**

Replay the video taken at the Afflicks processing plant, and record where water and energy are used, and where any wastes might be seen. **https://youtu.be/y2mPEqIuLVY**

Find and record any clean energy technologies that can be identified on site.

Hear more from Mr. Jeff Afflick, about the use of lagoons and settling ponds that treat the wastewater created by the plant and discover how it is re-used on site.

Introduce the 'Rendering Plant' located on the Afflick's property and investigate the way all solid waste and

blood is recovered and re-used to make tallow for cosmetics and blood and bone products that are on-sold to other companies.

Focus on the way the Rendering Plant also recovers steam and converts it into hot water used within the plant, in basins, sterilisers, hosing down areas and even for the truck wash.

Listen and find out how vapours and smells are also captured and disposed of within the Rendering Plant.

Sketch out all the sustainability practices that are incorporated into the Afflick's meat processing plant.

Explore how Oakey Beef, in Queensland generate their own energy from their wastewater resources **http://www.ampc.com.au/2016/07/The-Big-Grey-Bubble-Oakey-Beef**.

Research how Gundagai Meats in NSW takes a 'whole-of-lamb' approach to processing, and minimise waste in their operations **http://www.target100.com.au/Farmer-stories/Gundagai-Meat-Processors**

View the video and discover how the processor demonstrates environmental responsibility and stewardship by using wastewater and bacteria to create electricity.

Delve deeper and discover how a Tasmanian meat processor Greenhams, is using a renewable source of briquette as a bio-fuel in its boilers **https://www.youtube.com/watch?v=cOrBAd7-Pfo&feature=youtu.be**

View and listen to the AMPC video showcasing the views of various stakeholders regarding the sustainability issues affecting Australia's red meat manufacturing industry.

Introduction	**https://youtu.be/45BK76YnkBw**
Competition	**https://youtu.be/UeCwJBiNUak**
Regulatory environment	**https://youtu.be/gFykGnPLO-U**
Changing consumption patterns	**https://youtu.be/vOUB6QP0FJY**
Value chain integration	**https://youtu.be/wfp3CwBAdJM**
Social licence to operate	**https://youtu.be/C1mby711Msc**
Climate change	**https://youtu.be/9H5bRf2mkYk**

Ask students to record further findings about how these Australian meat processors use and manage water and energy, and reuse and recycle waste products produced by the plants.

Read about what a scientist suggests can be recycled and reused from meat processing plants **http://www.awmc.uq.edu.au/dr-paul-jensen**

Ask students to record ideas that are suggested by the scientist about resources that can be recovered in meat processing operations.

Discuss ideas about how different types of resource recovery, water management techniques and clean energy technologies could lessen impacts on the environment.

Draw a concept map to demonstrate the students' ideas.

Use a Positive, Minus, Interesting (PMI) chart to revisit and analyse the associated advantages and disadvantages and interesting sustainability features or considerations being used in Australian meat processing plants. When using a PMI consider:

Pluses – focussing on the perceived positive outcomes,

Minuses – focussing on the perceived negative outcomes, and

Interesting to see – being the issues and questions that arise from that idea.

Record ideas using **Resource 1.3.1**

Introduce the compass rose in **Resource 1.3.2** as a simple tool that enables thinking about complex issues according to different contexts. As a class, talk about each axis and what each compass point represents. Discuss the diagonal 'in between' points and types of questions these imply.

Talk about the environmental, social, economic and political factors that might influence the various ways that red meats are, or can be processed sustainably. See **Resource 1.3.2**

After using the 'Compass Rose', discuss current production systems used by meat processors in Australia; and how the production methods, processes and the technologies they use may impact the environment, society, economy and decision-making at local and national levels.

Introduce Edward de Bono's "Six Thinking Hats" in **Resource 1.3.3**

Explore sustainability related issues and ideas raised by the students using the Edward de Bono "Six Thinking Hates" technique **Resource 1.3.3**. Students, in five groups, each with a different hat, discuss and document the ideas and issues according to their given perspectives and come together at the end to share their ideas.

Using Resource 1.4 ask students to consider a range of systems and technologies that could help an older meat processing plant introduce a range of sustainability features, use and manage water and energy more sustainably, and reuse and recycle any wastes produced on site.

Ask students to assess the site featured on **Resource 1.4**, determine where north is, and indicate with arrows and labels:

- Main features of the site;
- Sun angles for summer and winter;
- Flow of any water run-off from hard surface areas; and
- The sustainability solutions you would like to feature on your design.

Form pairs to discuss the different types of systems that could be integrated into their design to demonstrate how water and energy can be used and managed sustainably, and how waste products might be reused and recycled and help Australian meat processors reduce impacts on the environment.

Ask pairs to share these understandings with others.

Ask each student to share what their research has told them and what they still have to accomplish within the task with their peers, the teacher and family.

Prerequisite for progression:

Students have worked as a class, individually and in pairs and collected research on how Australian meat processors might use and manage water, energy and waste and reduce impacts on the environment.

Websites, videos, images and stories are used to contextualise understanding. Students will share their ideas with peers, the teacher and family.

Step 4: Dream

Objective: Ask students to imagine how they are going to give an older plant an upgrade and design systems to manage water, energy and waste productively, in a way that reduces impacts on the environment. Ask students to visualise their environmental systems, poster and brochure.

Ask students in their pairs, to create a vision for their sustainable meat processing plant.

Ask questions like:

- On which aspects of sustainability do you want to focus (e.g. energy, waste, water, transport, air quality etc?)
- How might you integrate these sustainability considerations in the meat processing plant?
- How do you want visitors and staff to feel when they read the poster and brochure at the site office of the meat processing plant?
- How do you want the site's staff members to feel when they read and view the poster and brochure that identifies the sustainability considerations featured in the plant?

Ask students to visualise their systems that can manage water, energy and waste productively at a meat processing plant and in a way that reduces impacts on the environment. Ask questions like:

- Where is water used on site and how is it managed, treated or re-used?
- Is waste water controlled on site? How?
- What types of waste are actually produced? How are they re-used?
- Where is energy used? Might free energy from the sun or wind be appropriate to consider on-site?
- What might they have to do to make their design idea possible?
- What might it include?
- What might be focussed on?
- How might it be created?
- What are the different ways it could be created?

Develop possible solutions by brainstorming all possible solutions.

Invite each pair of students, to visualise their creative direction for their environmental systems, poster and brochure.

Ask students to imagine the steps involved in designing their environmental systems, poster and brochure.

Check out some poster designs on Pinterest at **https://au.pinterest.com/pin/466896686351085393/**

Challenge students to think about the materials, tools, and equipment they will need to design their individual work samples. Will they use digital or non-digital equipment and tools?

Ask students how they might communicate the ways their systems help meat processors reduce impacts on the environment.

Progressions for Learning:

The class have brainstormed ideas to begin designing systems that manage water, energy and waste productively and in a way that reduces impacts on the environment. They have visualised their environmental systems, poster and brochure, and have answered the questions posed in the dream phase.

Step 5: Design

Objective: Ask students to explain, prepare and action how they are going to give an older meat processing plant a brand new look, design systems to manage water, energy and waste productively in a way that reduces impacts on the environment, and also design a poster and brochure that can provide more detail about the sustainable management practices used on-site.

Ask students to decide on the systems they are going to design to manage water, energy and waste productively and in a way that reduces impacts on the environment.

Invite students to think about how they might take into account where meat processing plants typically use water and energy; locations in the processing plants where any wastes, including wastewater is generally generated and deposited; how these wastes might be collected and stored; and the systems and equipment needed to manage these resources.

Talk about the importance of a clear layout and design that makes it easy for an audience to understand and interpret the information given.

Discuss the importance of including information in the design about how the systems manage water, energy and waste productively, make money or save money, and help meat processors reduce impacts on the environment.

Talk about the importance of sourcing graphics, photos and information correctly.

Review rules on personal safety, group safety, and classroom and furniture safety with the students.

Ask students to establish a work station and to gather the materials and tools they require.

Talk about safely storing their design and keeping a record of the processes they use to create it.

Ask students to draft the steps involved in making their chosen digital or non-digital design.

Ask students to gather the materials, tools, and equipment needed and then plan each step involved in creating the digital or non-digital design.

Invite students to start creating the design of the meat processing plant with a key that identifies ways it manages water, energy and waste productively and in a way that it reduces impacts on the environment.

Remind students about the need to also design a poster and a brochure that can provide more detail about the sustainable management practices used on-site.

Talk with students about how they might share and present their designs to an audience?

Ask students to explain how they plan to finalise and create their designs with another peer in the class and seek feedback on their ideas.

Progressions for Learning:

Students are able to document in oral or written/digital forms how this project is to occur. The understanding is demonstrated by the students explaining their thinking to a peer in the class.

Step 6: Deliver- produce

Objective: Have students deliver their design of an older meat processing plant with a key that identifies ways it manages water, energy and waste productively and in a way that it reduces impacts on the environment. They also design a poster and a brochure that can provide more detail about the sustainable management practices used on-site.

The Delivery phase has two stages – production and publication. In the production stage the project comes to life – this is the doing phase. At the end of this phase, the publication/presentation of the design of an older meat processing plant with a key that identifies ways it manages water, energy and waste productively and in a way that it reduces impacts on the environment should be completed. Similarly, the design of the poster and a brochure that can provide more detail about the sustainable management practices used on-site, should also be completed.

Ask students to design and create their individual work samples required in this unit, including their:

- design of an older meat processing plant with a key that identifies ways it manages water, energy and waste productively and in a way that reduces impacts on the environment; and
- poster and brochure that provides more detail about the sustainable management practices used on-site.

In the Publish phase, students get to showcase all of their thinking and planning. This is the time when students present their designs to each other or an audience. This is a good time for peer or self-assessment.

Ask students to share their designs with others.

Video student presentations and enjoy a day of learning about how Australian meat processors use and manage water, energy and waste sustainably.

Progression for learning:

Each pair of students has produced designs featuring an older meat processing plant with a key that identifies ways it manages water, energy and waste productively and in a way that it reduces impacts on the environment. The students have also designed a poster and brochure that provides more detail about the sustainable management practices used on-site. Each pair of students has also presented their designs to an audience.

Step 7: Debrief

Objective: Assess the results of the designs of an older meat processing plant with a key that identifies ways it manages water, energy and waste productively and in a way that it reduces impacts on the environment. Assess the designs of a poster and a brochure that provide more detail about the sustainable management practices used on-site.

Ask students to reflect on their learning. See **Resource 1.8** and ask students to:

Re-tell their findings about the ways Australian meat processors use and manage water, energy and waste whille processing red meat for consumers to eat.

Describe the processes they used in their designs of the older meat processing plant and their designs of the communication products that included the poster and brochure.

Evaluate their designs and write four sentences about whether each design:

- matched the definition of the task
- used a clear layout and design
- was feasible, and
- included sources of the ideas and information each design piece used.

Write about the quality of their planning, their finished design and whether they enjoyed the task.

Reflect on the learning.

Invite students to complete a self-assessment activity.

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IDEAS

The essential question:

What benefits are achieved when we understand all the things Australian red meat processors do to bring us juicy, tender cuts of beef, lamb and goat meat, while using and managing water, energy and waste sustainably?

Step 1: The scenario

The Australian Meat Processor Corporation (AMPC) is searching for schools to discover how Australian meat processors might produce an array of different beef, lamb and goat meat cuts for local, national and international markets, while using and managing water, energy and wastes sustainably.

Become an environmental designer and use your ingenuity and creative thinking to give an older meat processing plant a brand new look, and design sustainable water, energy and waste solutions that can benefit the environment, and meat processors.

AMPC invites you to design systems to manage water, energy and waste and help meat processors reduce impacts on the environment. The water and waste needs to be handled carefully so that it cannot pollute rivers, streams and underground water supplies, or affect animals, plants and humans. The energy used at the plant also needs to be sourced and used sustainably.

In pairs, you are tasked with completing an analysis of the systems and technologies used by meat processors with a specific emphasis on how they use best practice environmental management in the processing plants.

You are then tasked with designing a key that can be applied in a meat processing plant that shows all the on-site sustainability features. In addition to a key, you are required to provide the meat processor with a poster that can be placed near the entrance of the meat processing plant to inform visitors about the best practice environmental management strategies utilised on-site. Additionally, you are required to design a brochure to provide more details about the practical, positive and achievable actions the plant and its staff are making on their journey towards sustainability.

You are also required to give a five minute presentation of your processing plant redesign, poster and brochure, to an audience in which you explain how red meat is processed in Australia using six or more best environmental management practices.

What investigations can assist you to research how Australian meat processors use water and energy? What investigations can assist you to research how they handle and manage waste in their plants? Will you investigate how Australian meat processors currently manage wastewater? Will you investigate how Australian meat processors use water for hand washing, cleaning and disinfecting tools and equipment, washing carcasses, and in high pressure hoses to wash down areas of the processing plant? Will you investigate whether any Australian meat processors currently use manures or biomass to create electricity? Will you investigate how some Australian meat processors wash out their sheds and recycle the solid waste and wastewater to irrigate surrounding pastures? Will you investigate how some Australian meat processors recycle solid waste that is then processed into products like 'Blood and Bone' fertilisers?

AMPC and other meat processors can help out with lots of information, images and videos on their websites. **http://www.ampc.com.au/education-training/school-resources/meat-matters**

Your challenge is to use the websites and a range of activities and videos to help understand how Australian meat processors can use and manage water, energy and waste more sustainably in their processing plants. How will you give an older plant a new sustainable look in this project? How will your systems work, and how will it help Australian meat processors reduce impacts on the environment? How might you present your design to others?

Are you up for the challenge?

High, low and no tech options are available.

High Tech: You can design and produce your new look processing plant digitally using an app or software to create original graphics. You can also design your identification system, poster and brochure digitally using software to create original graphics.

Low Tech: You can design and produce your new look processing plant using a standard computer, graphics provided and editing software. You can also design your identification system, poster and brochure digitally using a standard computer.

No Tech: You can design and produce your new look processing plant using art materials, poster board and hand written information and drawings. You can also design your identification system, poster and brochure digitally using art materials, poster board and hand written information and drawings.

What kind of researcher and environmental designer will you be?

How will you give an older meat processing plant a brand new look, with sustainable water, energy and waste solutions that can benefit the environment, and meat processors?

Define

Submit a written definition of the challenges you are to undertake.

Discover

Begin your research.

Collect and record information about:

- What red meat processing actually involves;
- What red meat processors and butchers might actually do;
- How meat processors and butchers convert beef, lamb and goat meat into a product;
- How and where water is used and managed in the processing plant;
- How and where waste water is generated in the processing plant and how it is treated;
- How and where any effluent is generated in the processing plant and whether any biogas is captured and re-used to generate on-site power;
- How and where energy is used and managed in the processing plant;
- Whether any free sources of energy can be created from the sun or from wind sources; and
- Whether any wastes are generated in the processing plant, and how they might be reused or recycled.

Discover more about: R Radford and Son at **http://www.abc.net.au/landline/content/2012/s3615247.htm** and focus on the sustainability considerations in which the meat processing company has invested.

Consider the plant upgrades that have included temperature controlled chilling to enhance eating quality, and the investment in water and energy recovery projects to increase plant sustainability.

Discover how this processing plant uses 100,000 litres of water a day. Brainstorm and list all the processes that might use water at the plant and consider ways that any processor might be able to undertake to conserve or re-use water.

Investigate a domestic meat processor in Moruya in NSW **https://youtu.be/y2mPEqIuLVY** and find out how this processing plant uses and manages water and energy, and reuses and recycles waste products it produces.

Replay the video taken at the Afflicks processing plant, and investigate where water and energy are used, and where any wastes might be seen.

Find and record any clean energy technologies that can be identified on site.

Look at the use of lagoons and settling ponds that treat the wastewater created by the plant and discover how it is re-used on-site.

Explore the 'Rendering Plant' located on the Afflick's property and investigate the way all solid wastes is recovered and re-used to make tallow for cosmetics and blood and bone products that are on sold.

Focus on the way the Rendering Plant also recovers stream from the Boiler and converts hot water used within the plant to create potable water for use in the processing plant.

Explore how Oakey Beef, in Queensland generate their own energy from their wastewater resources **http://www.ampc.com.au/2016/07/The-Big-Grey-Bubble-Oakey-Beef**.

View the video and discover how the processor demonstrates environmental responsibility and stewardship by using wastewater and bacteria to create electricity.

Delve deeper and discover how a Tasmanian meat processor 'Greenhams' is using a renewable source of briquette as a bio-fuel in its Boilers **https://www.youtube.com/watch?v=cOrBAd7-Pfo&feature=youtu.be**

View and listen to the AMPC video showcasing the views of various stakeholders around the sustainability issues affecting Australia's red meat manufacturing industry **https://youtu.be/L51CoN4P3ZQ**.

Read about what a scientist suggests can be recycled and reused from meat processing plants **http://www.awmc.uq.edu.au/dr-paul-jensen**

Record any ideas that are suggested by the scientist, about resources that can be recovered in meat processing operations.

My notes:

References and Sources:

Plus, Minus, Interesting

What do you think is really important about the way Australian meat processors use and manage resources in the videos you have viewed?

Use the Pluses, Minuses and Interesting (PMI) chart to evaluate any of their claims. In the Pluses column enter all the advantages of the water, energy or waste systems portrayed in the video, in the Minuses column enter all the problems associated with the water, energy or waste systems and in the third column enter the what you thought was most interesting or any other questions you would like to have answered.

Pluses – or advantages	Minuses – or negatives	Interesting – what you think is interesting

Discover a Compass Rose

The compass rose is a framework that encourages a range of questions to be asked about issues in any place or situation. It can be used to help enquiry about any locality, its issues and their relationship to environment, social, economic and political issues.

The four main compass points represent:

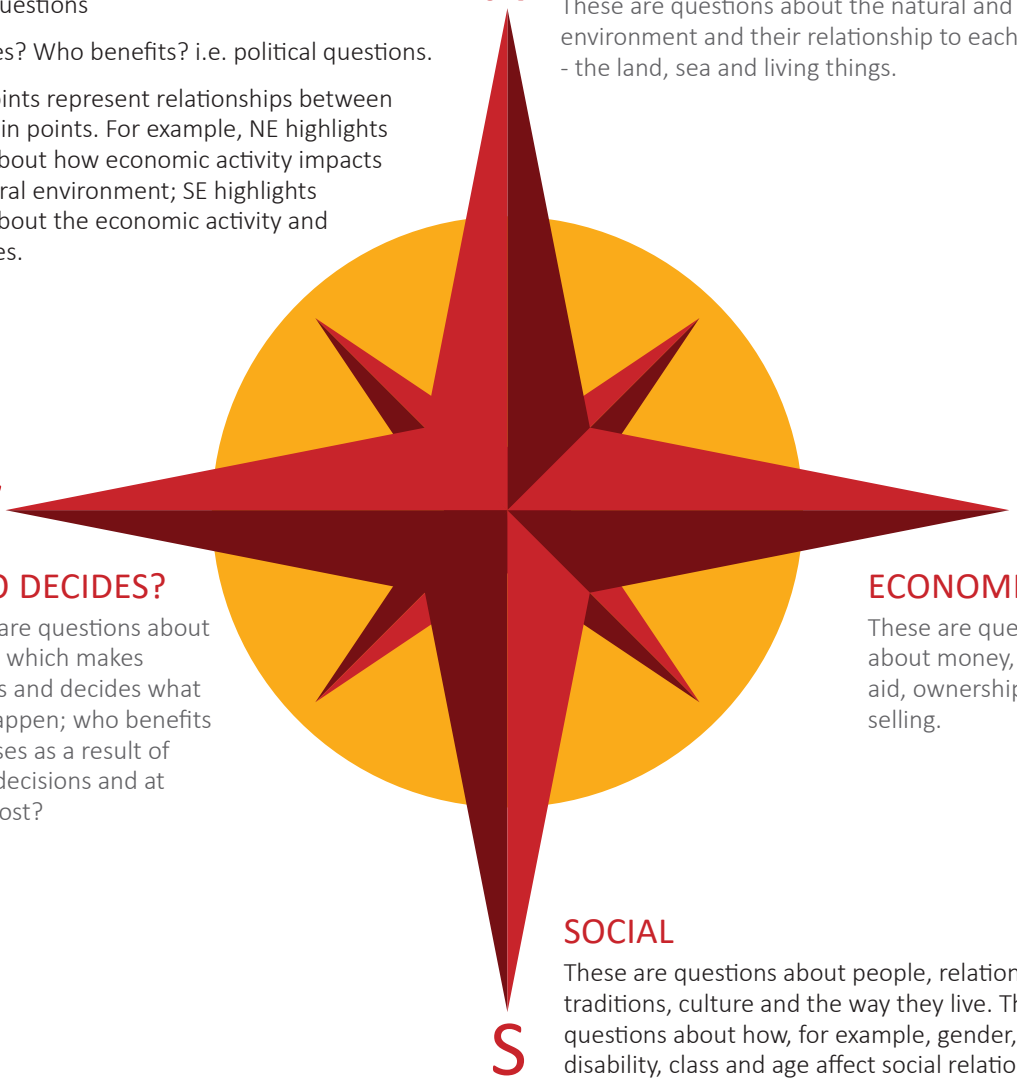
Natural and ecological questions

Social and cultural questions

Economic questions

Who decides? Who benefits? i.e. political questions.

Diagonal points represent relationships between the four main points. For example, NE highlights questions about how economic activity impacts on the natural environment; SE highlights questions about the economic activity and people's lives.



N

NATURAL

These are questions about the natural and built environment and their relationship to each other - the land, sea and living things.

W

WHO DECIDES?

These are questions about power, which makes choices and decides what is to happen; who benefits and loses as a result of these decisions and at what cost?

E

ECONOMIC

These are questions about money, trading, aid, ownership, buying & selling.

S

SOCIAL

These are questions about people, relationship, their traditions, culture and the way they live. They include questions about how, for example, gender, race, disability, class and age affect social relationships.

Use the 'Compass Rose' and the questions it can pose to discover and research more about how the Australian meat processors are processing red meat sustainably. Research how their processes that use and manage water, waste, and energy may inform, influence or impact the environment, society, economy and decision-making at local and national levels.

Record new understandings you now have about how Australian meat processors use and manage water, waste and energy sustainably.

Start thinking about how you will incorporate these into your designs!

Source: Development Education Centre, UK: (ISBN 0 948 838 280)

Edward de Bono's Six Thinking Hats

Explore the issues you uncovered about the sustainable systems used by meat processors. Use the Six Thinking Hats below to think through the issues according to each coloured hat and the question asked.

RED HAT

Feelings

What are the emotions and feelings associated with meat processing systems?

How do you feel?

BLUE HAT

What thinking is needed?

What has happened so far?
What should happen next?
What questions should we consider?

BLACK HAT

Weaknesses

What are some of the negative aspects and outcomes of meat processing systems?

WHITE HAT

Information

List the facts that you know about meat processing systems and how they affect the environment.

GREEN HAT

New ideas

How could the problems related to meat processing systems be solved?

What needs to be done?

YELLOW HAT

Strengths

What are some of the positive aspects and outcomes of meat processing systems?

An Australian Meat Processing Plant

Most of Australia's meat processing plants were built before minimum environmental standards were introduced. Therefore how might you introduce sustainability features without demolishing and starting over?

Assess the plant featured on the graphic below, determine and indicate with arrows and labels:

- Main features of the site;
- Sun angles for summer and winter;
- Prevailing wind direction for summer and winter;
- Flow of any water run-off from hard surface areas; and
- The technological and/or sustainability considerations and solutions you would like to feature on your design.

Consider technological and sustainability considerations

Locate a section of the meat processing plant and think about the practical, positive and achievable technological and sustainability considerations you might integrate into the meat processing plant or its site.

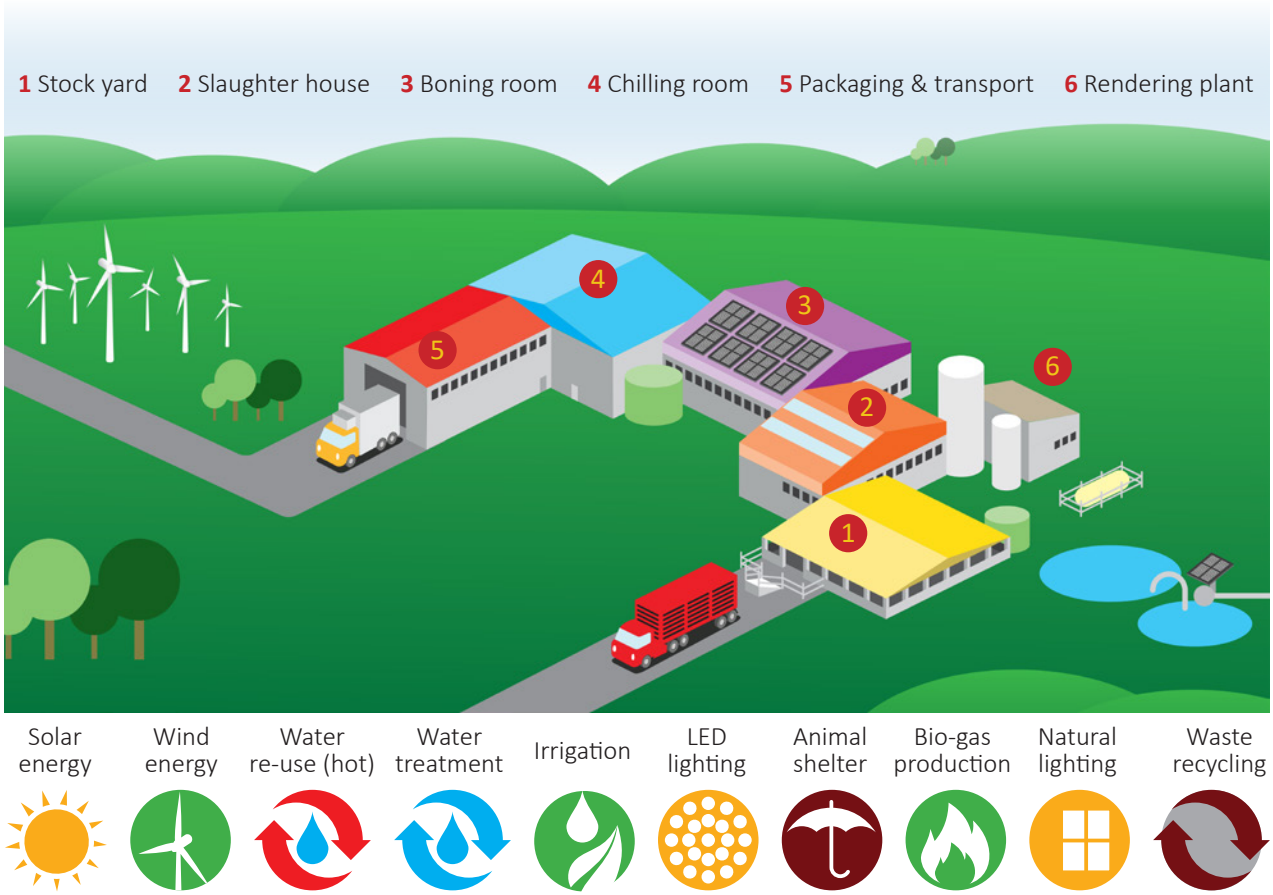
Ergonomic considerations

Show how you think things might work and function.

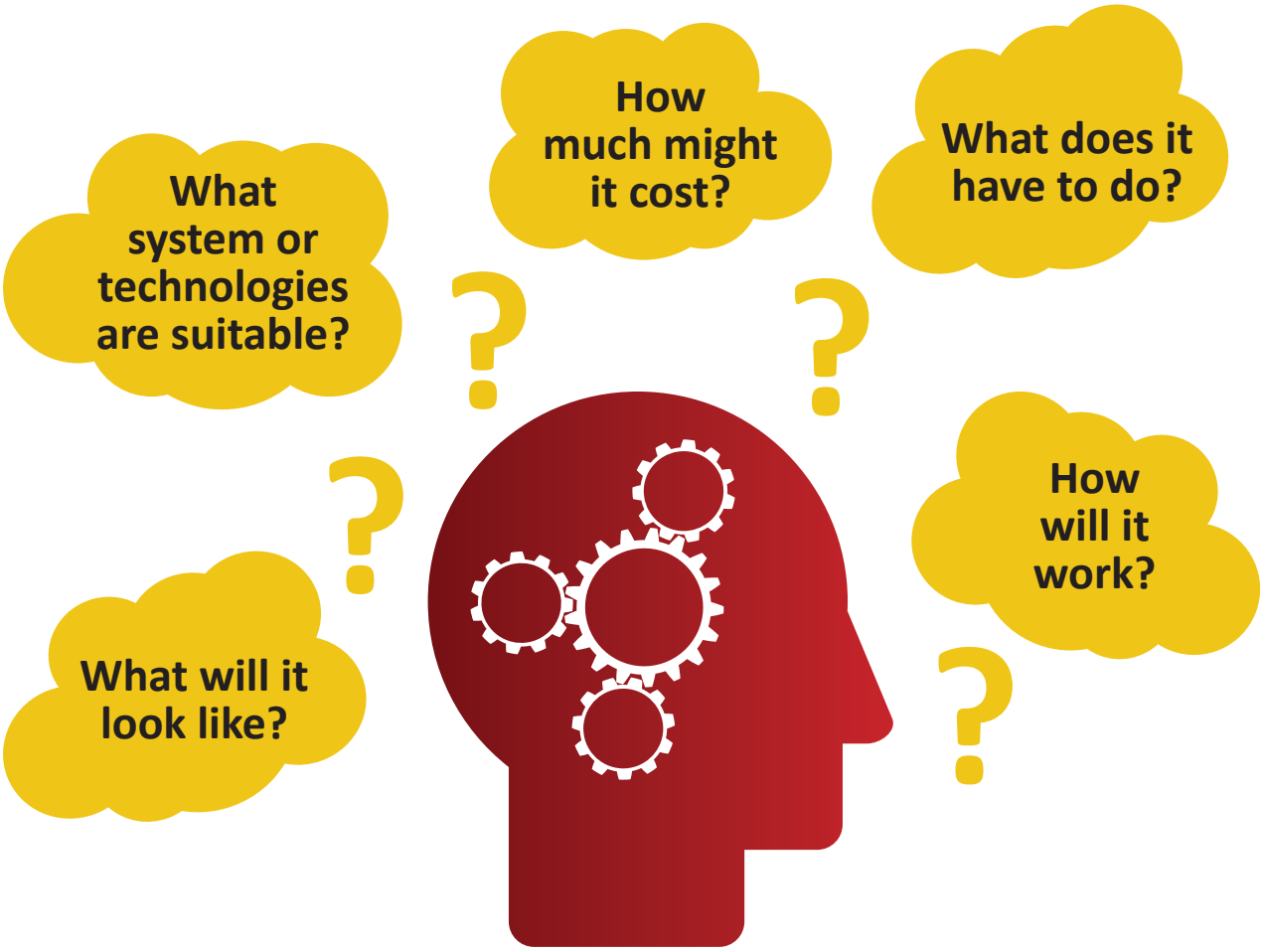
Include your thoughts about how these considerations and solutions might be used by people at the meat processing plant.

Economic considerations

Think about what finances might be available to owners of meat processing plants for sustainability projects and what might limit or constrain the considerations and solutions being proposed.



Refine your ideas



All of these areas of thought will spark off a whole range of questions to answer, which should be recorded.

You will see there are many different things to think about when designing, which is why it is important to record all of your thoughts. This might involve making up many design sheets.

Dream

This is where you use the knowledge you've gathered to visualize a creative and appropriate solution.

This is an holistic process where we imagine what the solution will appear like as it would in the future. Instead of asking "why" we ask "why not?" The question of "what's the worst that could happen" becomes "what's the best that could happen?"

Consider the many possible ways you can design a sustainable meat processing plant.

Which aspects of sustainability do you want to focus on (e.g. energy, waste, water, transport, air quality, etc?)

How might you integrate these sustainability considerations in the meat processing plant?

Are some solutions or considerations more sustainable than others? Why?

How do you want visitors and staff to feel when they read the poster and brochure at the site office of the meat processing plant?

How do you want on-site staff members to feel when they read the poster and brochure that identifies the sustainability considerations featured in the plant?

Visualise your systems that can manage water, energy and waste productively at a meat processing plant and in a way that reduces impacts on the environment. Where is water used on site and how is it managed, treated or re-used? What types of waste are actually produced? How are they re-used? Where is energy used? Might free energy from the sun or wind be appropriate to consider on-site?

Develop possible solutions and brainstorm all possible solutions.

Visualise your creative direction for your identification system, poster and brochure.

Imagine the steps involved in designing your systems, your identification system, poster and brochure.

Check out poster design on Pinterest.

What types of materials, tools, and equipment will you need to design your work samples? Will you use digital or non-digital equipment and tools?

How will you communicate the ways your systems help meat processors reduce impacts on the environment?

Think about the questions posed above and record your 'draft' solutions.

What might you have to do to make your design ideas possible?

What might the design be focussed on?

How might the design be created?

What are the different ways the design could be created?

This is your chance to design a sustainable meat processing plant and educate others about how their red meat is processed in Australia using best environmental practices.

Design

Commence by establishing your desired outcome; then visualise the various steps necessary to achieve the visualized solution in measurable, achievable steps.

Prepare a project plan to outline information that needs to be gathered, who is responsible, where you will seek information from, and how it will be gathered. Try and work out the order in which you are going to do things when researching and designing. Knowing what you have to complete, and in which order will help you organise your time better during the project. Write it down as a suggested order of work.

What do I need to do?	How will I gather the information? How will I create my designs?	When will I do this?	How can my products and processes be improved?

Or, consider another type of Project Plan. Consider a plan with the following headings.

What	How	When	Who and what's needed	How will we know if it worked

You may like to sequence an order of work

Step 1	
Step 2	
Step 3	
Step 4	
Step 5	
Step 6	
Step 7	
Step 8	
Step 9	
Step 10	
Step 11	
Step 12	
Step 13	
Step 14	
Step 15	

Deliver

This stage is the process by which the dream becomes a reality. It's where you actually implement the designs you have created to complete the solution to the problem in two separate steps:

Produce (a design for an older meat processing plant with a key that shows all the on-site sustainability features; a poster and brochure that can inform visitors about the best environmental management practices used on site), and publish (presenting the finished designs in your effort to educate others about how red meat is processed in Australia using best environmental practices).

Use the following prompts to write your presentation explaining your designs and educate others about how red meat is processed in Australia using best environmental practices.

Write the introduction:

Write the body:

Write the conclusion:

Debrief

Self-Assessment – Things to improve

You need to be able to judge and measure the success of your designs in addressing the original tasks and achieving your goals.

Refer back to the earlier tasks set by AMPC whether you achieved your goals of creating a design for an older meat processing plant with a key that shows all the on-site sustainability features; a poster and brochure that can inform visitors about the best environmental management practices used on site. Did you present the finished designs and educate others about how red meat is processed in Australia using best environmental practices?

- Review your work samples and see whether you/ your partner achieved the goals.
- Reflect on the strengths and any weaknesses in the designs.
- Brainstorm any things that could have been done differently to get a better result.
- Discuss ways you/your team might communicate its success and engage others to try the ideas that worked.
- Write an account of the processes undertaken in the project or develop a flowchart identifying various strengths and weaknesses, opportunities and threats of the strategies used in the final designs.

Reflect on the learning

Complete the self-assessment activity on the following pages.

Self-evaluation Meat Matters. We all have a steak in this!

Student name:

1. What was the most surprising thing you learned about sustainability in red meat processing?	
2. What did you enjoy the most while doing this project?	
3. How well did your group work as a team	POOR ——— EXCELLENT
4. Make a suggestion on how your team could have done things better to improve your own learning.	
5. How well did your team undertake the research tasks?	POOR ——— EXCELLENT
6. How well did you work as an individual within your team?	POOR ——— EXCELLENT

Source: Margy Wright, Unity College, South Australia.

7. Make a comment on how you could have contrivuted better to your team outcome	
8. How well did your team plan the design for the processing plant?	POOR EXCELLENT
9. How well did your team work together while creating the design?	POOR EXCELLENT
10. Do you think your design represents the research you did?	POOR EXCELLENT
11. What could your team have done differently to improve your final outcome?	
12. How well do you think your team used lesson time for the whole topic?	POOR EXCELLENT
13. What do you think you could do better to use your time more effectively?	
14. Suggest some improvements for studen learning in this whole project (for the developers of the resource).	

AMPC

AUSTRALIAN MEAT PROCESSOR CORPORATION