AUSTRALIAN Pork™

An Educational Unit for Primary Schools

Enterprising pig farmers

Acknowledgements

This educational resource was produced by Australian Pork Limited (APL).

The resource is designed to introduce young people to pork production in Australia. Whilst not an exhaustive educational resource, it is intended to raise the awareness of school-aged students about the sustainable resource management practices in pork production in Australia and it supports investigations of the past and present and includes investigating a range of futures for intensive livestock industries, like pig farmers.

Where experiments are involved, you are advised to carefully follow all instructions and heed all warnings. Experiments should be conducted only under adult supervision.

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

APL would like to acknowledge and sincerely thank the education program reference group for offering comments on the drafts of materials in this educational resource.

‘EDUCATION IS NOT THE FILLING OF A BUCKET BUT THE LIGHTING OF A FIRE.’

(W.B. Yeats)

CONTENTS

Introduction	3
About the approach	4
Teacher notes	5
Australian curriculum content descriptions	7
Implementing the unit and activities in the classroom	9
Teacher fact sheet: facts and figures about the Australian pork industry	13
Step 1: Engage with the topic	**19**
Step 2: Explore how resources are managed	**23**
Step 3: Explain different practices and their effects	**31**
Step 4: Elaborate on concepts and ideas	**35**
Step 5: Evaluating	**39**
References	40
Resource pages	41
Resource 1.1	41
Resource 1.2	42
Resource 1.3	49

Introduction

Rationale

This unit aims to help teachers and students in primary schools investigate sustainable resource management practices involved on an Australian pig farm. It also introduces and explores some of the concepts of onsite power generation and farming more sustainably as students are given an insight into ways farmers convert manure from their pigs into renewable energy which powers their farm.

The objectives of the educational resources are to:

- Support APL and its members in expanding awareness about the pork 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
- Provide resources which help build leadership skills amongst teachers and students in communicating about pork production and the industry in Australia
- Develop education resources that can be used across Australia that provide encouragement, information and practical teaching advice that will support efforts to teach about pork production and the pork industry sector
- Educate school students on ways pigs are farmed using environmentally sustainable practices
- Demonstrate to students that everyone can consider careers in the pork industry and along the chain of supply of pork products
- Develop engaging learning programs using an inquiry process aligned with the Australian Curriculum
- Develop in school communities, an integrated pork industry education program that emphasises the relationship between the pork industry, individuals, communities, the environment and our economy.

These educational resources are an effort to provide practical support to teachers and students learning about pork production in schools.

About the approach

Several key principles underpin the theoretical and practical application to this unit. In providing an ***integrated framework for inquiry***, complemented by rich explorations of texts that are, in turn, supported by an emphasis on undertaking a challenge or task, the unit requires students to:

- Search for information using both digital and non-digital means
- Use research techniques and strategies
- Use thinking and analysis techniques
- Present findings to a real audience
- Reflect both on the product created and the process undertaken.

Rather than seeing knowledge as something that ***is taught*** the emphasis in this unit is on knowledge and understanding that ***is learned***.

The unit involves students in:

- Working from a basis of their prior knowledge and experience
- Seeing a real task or purpose for their learning
- Being directly involved in gathering information first hand
- Constructing their knowledge in different ways
- Presenting their learning to a real audience
- Reflecting on their learning.

The approach used, is the ***inquiry approach*** through five phases: Engage, Explore, Explain, Elaborate and Evaluate. The phases of the model are based on the 5Es instructional model (Bybee, 1997). These phases are:

- **Engage:** The 'Engage 'phase begins with lessons that mentally engage students with an activity or question. It captures their interest, provides an opportunity for them to express what they know about the concept or skill being developed, and helps them to make connections between what they know and the new ideas.
- **Explore:** The 'Explore' phase includes activities in which they can explore the concept or skill. They grapple with the problem or phenomenon and describe it in their own words. This phase allows students to acquire a common set of experiences that they can use to help each other make sense of the new concept or skill.
- **Explain:** The 'Explain' phase enables students to develop explanations for the phenomenon they have experienced. The significant aspect of this phase is that explanation follows experience.
- **Elaborate:** The 'Elaborate' phase provides opportunities for students to apply what they have learned to new situations and so develop a deeper understanding of the concept or greater use of the skill. It is important for students to discuss and compare their ideas with each other during this phase.
- **Evaluate:** The 'Evaluate' phase provides an opportunity for students to review and reflect on their own learning and new understanding and skills. It is also when students provide evidence for changes to their understanding, beliefs and skills.

Teacher notes

Resource description

This unit aims to help teachers and students in primary schools investigate sustainable resource management practices involved on an Australian pig farm. It also introduces and explores some of the concepts of onsite power generation and farming more sustainably as students are given an insight into ways farmers convert manure from their pigs into renewable energy which powers their farm.

As the unit progresses, the emphasis shifts to investigating how increases in scientific knowledge and developments in technology are changing farming methods and techniques to reduce reliance on non-renewable and non-recyclable resources. Students are encouraged to consider actual sustainable resource management practices used by pig farmers, and be part of the process of understanding, documenting and communicating the industry's opportunities and challenges.

Having explored some of increases in scientific knowledge and developments in technology in the present, students then introduced to the challenges of a changing climate and they investigate potential sustainable resource management practices for the pig industry.

They think about how reducing greenhouse gas emissions and sustainability will demand improvements in current technologies in order to reduce reliance on non-renewable and non-recyclable resources and in turn generate ideas and explore options suggested by others as being needed to produce pigs in the future.

Many of the activities are designed to investigate an action or farm that is making a change in the pig industry. The types of actions that could be undertaken are examined through a video of pig farmers actively involved in producing low emission energy for onsite generation of electricity and through several structured critical thinking and research activities.

Finally, the students are encouraged to communicate solutions for improved sustainability in the pig industry.

Year levels: Year 4, 5 and 6

Curriculum focus

It contains a unit of work in **Technologies, Humanities and Social Sciences** and **Science** with a variety of student activities selected as vehicles to help students:

- Investigate and explore new and existing methods, designs and technologies involved on Australian pig farms to sustainably manage resources
- Assess places where and the ways in which people have grown pigs and produced food and how their actions are influenced by increases in scientific knowledge and developments in technology

- Investigate concepts and ideas relating to how concerns about sustainable resource management practices has influenced the designs
- Investigate concepts and ideas about effluent management, waste management and sustainability and how these influence the designs
- Select ideas and undertake an inquiry
- Reflect and evaluate the success of the action pig farmers are taking for sustainable resource management practices by producing low emission energy and producing quality pigs.

Teachers will find, as they examine this unit and its student activities that there are some learning areas which are more strongly represented than others. This is a consequence of the subject matter with which students are dealing. Sustainability is the dominant cross curriculum priority, and Technologies, Science and Geography learning areas feature strongly in the unit as the topics deal with pigs and their manure, factors that shape the low emission energy system used in this farms production of pigs, characteristics of this system, and other sustainable resource management practices used on the farm. English and the critical and creative thinking, particularly in design and technologies processes are featured strongly throughout the activities.

Deep understanding takes time – achieving it is a gradual process that evolves throughout the unit and is facilitated by reflection. This unit invites students to think beyond the information and data they gather and the texts they read and view – to step back from their investigations and do some big picture thinking for improved sustainable resource management practices and sustainability, for example renewable energy generation and use, improved waste avoidance/resource recovery and options to produce low emission energy on farms. In many activities, it is suggested the teachers 'reflect aloud' and thereby model to students the kinds of questions, language and thinking associated with this task.

Australian curriculum content descriptions

Technologies

Design and Technologies Knowledge and Understanding
Investigate how and why food and fibre are produced in managed environments and prepared to enable people to grow and be healthy ACTDEK021

Humanities and Social Sciences

Geographical Knowledge and Understanding
The use and management of natural resources and waste and the different views on how to do this sustainably ACHASS090

Geographical Knowledge and Understanding
The environmental and human influences on the location and characteristics of a place and the management of spaces within them ACHASS113

Science

Science as a Human Endeavour: Use and influence of science
Scientific knowledge is used to solve problems and inform personal and community decisions ACSHE083

Science Understanding: Biological science
The growth and survival of living things are affected by the physical conditions of their environment ACSSU094

Science as a Human Endeavour: Use and influence of science
Scientific knowledge is used to solve problems and inform personal and community decisions ACSHE100

General capabilities

Literacy, ICT capability, Critical and creative thinking, Personal and social capability

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

NSW Syllabus Outcomes

Science and Technologies Stage 3

Knowledge and understandings

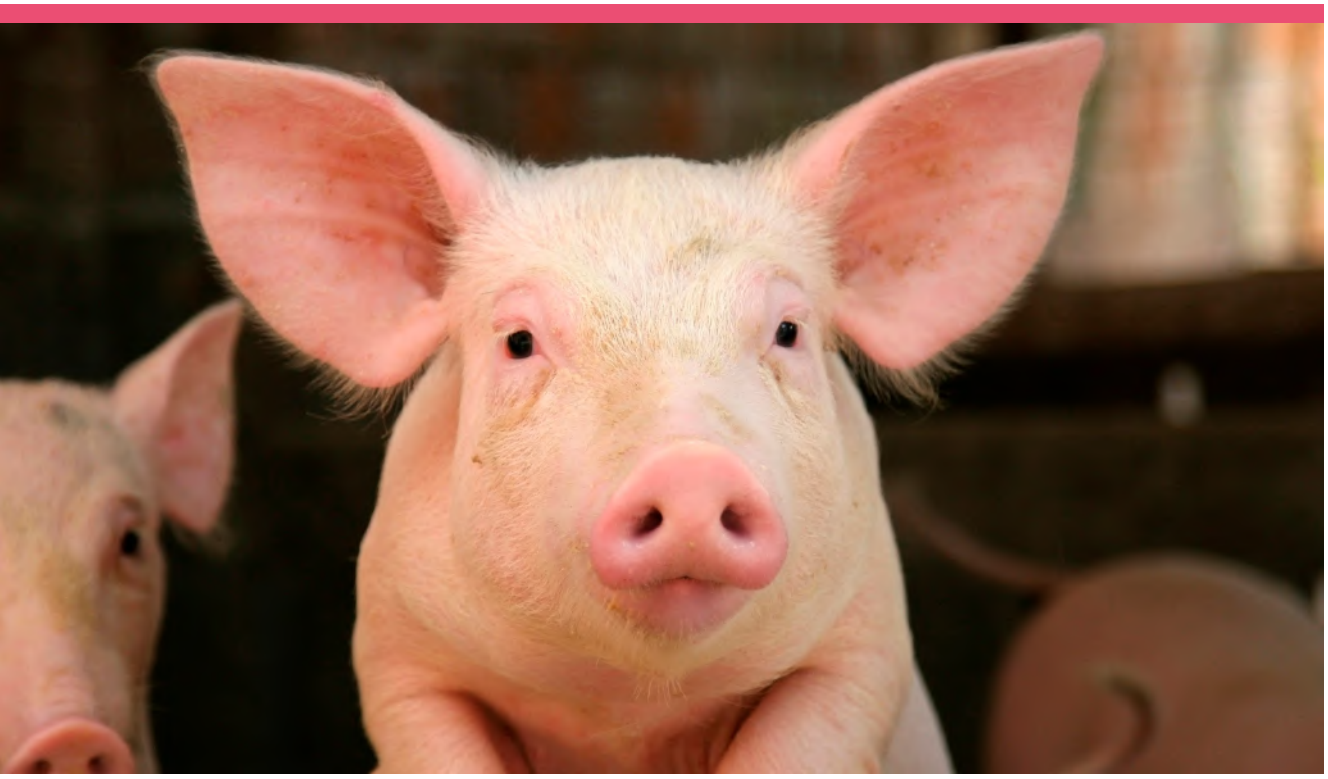
ST3-5LW-T explains how food and fibre are produced sustainably in managed environments for health and nutrition

Skills

ST3-1WS-S plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions

ST3-2DP-T plans and uses materials, tools and equipment to develop solutions for a need or opportunity

ST3-3DP-T defines problems, and designs, modifies and follows algorithms to develop solutions



Implementing the unit and activities in the classroom

Using the unit

The unit can be used in a number of ways. It will be of most benefit to teachers who wish to implement a sustained sequence of activities following the inquiry stages identified on pages 5 and 6 in Year 5/6 in Design and Technologies and in Science, and in Year 4/5 in the Humanities and Social Sciences in Geography as stated in the Australian Curriculum. In NSW schools it will benefit teachers who wish to implement a food and fibre focus in the NSW Syllabus for the Australian Curriculum Science and Technologies K-6.

Selecting activities

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

It is suggested that teachers create a hyperlinked unit. Organise the digital resources for your class's use on a website or wiki or provide them on your interactive whiteboard.

Resourcing the unit

The resources suggested are on the whole, general rather than specific. Schools and the contexts in which they exist vary widely as does the availability of some resources – particularly in remote areas. There is a strong emphasis in the unit on gathering information and data, and research and observations feature strongly as these methods develop important skills and ensure that the exploration of the topics, are grounded in a relevant context.

Online videos in addition to Internet based resources are suggested in the unit. You will need to investigate what is available in your school.

Adapting the unit

The unit is targeted at Year 4, 5 and 6 students. This is a suggested age range only and teachers are encouraged to modify activities to suit the needs of their students with whom they are working.

The unit's topics are based on content descriptions of the Australian Curriculum, on the key perspective of education for sustainability and embrace content that we believe is of relevance and significance to all students. We encourage you to explore ways in which the content can be adjusted to the context in which you are working.

Many of the activities contain the following icons offering a suggestion on how many students should be involved:

Suggested for individuals

Suggested for pairs or small groups

Suggested for larger groups or entire classes

Resource sheets are provided for some activities. Most are for photocopying and distribution to students.

They are identified within units by the following icon: **Resource 1.2.**

The resource sheets are designed to assist teachers to facilitate learning without necessarily having access to many other resources.

What about assessment?

Rather than being a task carried out at the end of the unit, assessment is viewed as integral to the entire unit sequence. Each activity should be regarded as a context for assessment of student learning.

When planning and implementing the unit of work make clear decisions on what you will focus on in assessing learning. The unit provides an opportunity for a range of ***skills*** and ***understandings*** to be observed. We encourage you to devise an assessment plan or assessment rubric that features areas to be assessed over subsequent lessons.

In planning for assessment, student learning in the following areas can be considered:

- Understandings about the topic
- Development of skills
- Exploration and clarification of values
- Use of language in relation to content
- Ability to use and critically analyse a range of texts
- Ability to analyse and solve problems
- Ability to interpret information, perceive its meaning and significance and use it to complete real-world tasks
- Ability to work cooperatively with others
- Approach to learning (independence, confidence, participation and enthusiasm).

For this unit, the following understandings are provided to assist teachers in planning for assessment.

By the end of this unit, students should understand:

- How and why pigs as a food are produced in managed environments ACTDEK021
- How pig farmers use and manage natural resources and waste ACHASSK090
- How environmental and human influences in a location (like pig farms) affect the management of spaces within them ACHASSK113
- How scientific knowledge is used to solve problems and inform personal and community decisions on pig farms ACSHE083 and ACSHE100
- How the growth and survival of living things are affected by the physical conditions of their environment ACSSU094

Assessment strategies

Each stage in the inquiry sequence provides information about student learning. There are, however, two stages in the unit that are central to assessment: the **engage** stage and the **evaluate** stage. Work that is undertaken in these stages can assist teachers to monitor growth and see concrete examples of the way student ideas have been refined or changed through the unit sequence. Work samples should be retained for this purpose.

Some questions and possible answers

Should I do all the activities?

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

While you are encouraged to follow the suggested inquiry sequence for each unit, it is quite possible to pick and choose from the range of activity ideas throughout the unit. It may also be used in conjunction with other programs you use.

How do these units fit into my weekly program?

Although the unit integrates a range of key subject areas, it is not designed to be a total program. It is assumed that regular routines that operate in your classroom will continue to run alongside your unit of work. For example, you may have regular times for use of the library, for maths, physical education etc. These things don't change – although student's writing topics or choice of topics to research in the library or in ICT classes may be may be influenced by this unit.

How long should the unit run?

This will of course depend on your particular circumstances but generally, a few weeks to a term is suggested.

I don't know much about pork production or renewable energy myself – will I be able to teach it effectively?

Yes! The unit is designed in such a way that you, as the teacher are a co-learner and you are provided with teacher notes, plus the resources are mainly web-based and are readily available. Most importantly, you will find that you learn with the students and make discoveries with them.

Teacher fact sheet: facts and figures about the Australian pork industry

This page gives some basic pork production information that may be helpful when you interact with the school students.

Pigs and the environment

The Australian pork industry is serious about environmental stewardship. The industry believes it has a duty to ensure that Australian pork is produced and distributed responsibly, while also remaining competitive and sustainable. The Australian pork industry has taken proactive steps to help ensure its producers carefully manage 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 pork industry. The industry has tackled this challenge head-on and is making important progress in addressing these issues—especially in acknowledging and addressing greenhouse gas (GHG) emissions. The industry has become the first in Australia to have developed and approved a methodology for the government's Carbon Farming Initiative (CFI).

GHG emissions produced by the pork industry are significantly lower than other agricultural sectors, such as beef cattle, dairy cattle and sheep. Currently, the industry's emissions and potential mitigation options puts us in the position to have a low, if not the lowest, global warming potential for pork production worldwide. But we, as an industry, are striving to reduce this even further by setting an industry goal of ***1kg CO2 equ per kg of pork produced***. Fortunately, most of the industry's GHG relate to emissions from effluent ponds. This provides us with a fantastic opportunity for emissions capture, destruction or use. Progressive industry research is developing innovative new technologies and management systems to mitigate and utilise these GHG emissions. Current research shows that a 500-sow piggery has the potential to produce enough energy to power 3.1 million 100 watt globes for one hour, or produce electricity to run 62 houses for one year. And if combusted and destroyed, it would eliminate the equivalent of the fossil fuel GHG emissions from 458 Toyota Corollas travelling 20,000km/per year burning 7L/100km.

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

Pigs and food safety

The health of the Australian pig herd is free from many serious diseases afflicting other pork producing countries. This is why product integrity continues to be one of the most important aspects of Australian pork production. The industry has quickly responded to growing consumer demand for top quality produce that is safe to eat. The Australian Pork Industry Quality Assurance Program (APIQ✓®) is an on-farm quality assurance program that allows producers to demonstrate good farming practice using the principles of Hazard Analysis and managing Critical Control Points for management, food safety, animal welfare, biosecurity and traceability. Rapid uptake of APIQ✓® by producers throughout Australia has reached 86% of the national herd, and is increasing.

Australia's pork industry is also leading the world to ensure its pork products are fully traced from paddock to plate. This has been realised through traceability systems (PigPass National Vendor Declaration—NVD). The PigPass NVD provides key information that can be used to trace pigs or pork back to the property of origin in the event of an emergency, such as an animal disease outbreak or a food safety incident.

Looking after our pigs – we're leading the world

Australian pig producers have the same concerns you do when it comes to taking care of their pigs. To demonstrate that they are listening to consumer sentiment, in November 2010 the industry announced the voluntary phase-out of sow stalls by 2017. Australia's pork farmers are the first in the world to make such a voluntary commitment.

Producers understand more than anyone that providing excellent care results in a contented animal that provides a high quality product—pig producers' livelihoods depend on it. The industry invests millions of dollars each year to research new technologies and practices to improve pig welfare, and provide valuable education and training to stock people throughout Australia.

The *Model Code of Practice for Welfare of Animals (Pigs)*—(the Model Code)—is a guide that has been developed in consultation with all levels of industry, regulators, RSPCA and scientists to detail the acceptable practice for the management of pigs. It outlines all responsibilities involved in caring for pigs—including their housing, food, water and special needs. Standards in the Model Code have been incorporated into APIQ✓® and are independently audited each year to ensure producers comply.

How pigs are farmed

All pigs grown for pig meat are housed in different sized groups depending on their age and weight.

A sow raised for breeding will have her first litter when she's about one-year-old. The gestation period (the time from conception to birth) for a sow is between 15 and 17 weeks. She can have up to two litters each year and usually has between 9–10 piglets weaned per litter. The piglets feed from their mother for three to four weeks before being weaned and grouped with other pigs the same age in a weaner or grower facility.

Pigs are handfed on mostly grains and continue to grow until they reach between 24–55 kg and are sold as 'porkers'. Pigs that grow larger than 55 kg are sold as 'baconers'/'finishers'.

There are three main types of pig farming methods used in Australia—indoor housing, deep litter housing and outdoor bred/free range systems.

Indoor housing systems are for pigs from birth to weaning and for lactating and weaned sows. This system allows pigs of similar ages to be kept together. Group pens and individual pens are often used indoors.

Deep litter housing systems are usually large open-sided sheds or hoop–like structures with deep litter flooring (rice hulls, straw, sawdust). These systems are used extensively for growing pigs and for group housing of dry sows.

Outdoor bred/free range systems consist of outdoor paddocks, including rooting areas, wallows and shelter huts. The weaners, grower pigs and sows have access to paddocks at all times throughout their lives.

Gestation stalls: In November 2010, the industry overwhelmingly agreed that Australia would be the first nation in the world to voluntarily phase-out the use of sow stalls by 2017. This means sows and gilts must be kept in loose housing from five days after mating until one week before farrowing.

The reason producers have used sow stalls in the past is because pigs can be extremely aggressive animals, especially during the early stage of pregnancy. The best and safest way to ensure sows get enough food and aren't bullied, bitten and injured has been to protect them in individual stalls. Australian producers are now transitioning to a sow stall free status.

Farrowing stalls: The average sow weighs between 120–200 kg (equivalent to three standard fridges), and after farrowing, her new piglets are at serious risk of being crushed to death. A farrowing stall allows a sow to stand up, lie down and stretch out, while keeping her piglets safe in a separate section. The temporary use of a farrowing stall during the piglets' most vulnerable weeks plays a vital role in their protection. It's estimated that the use of farrowing stalls saves over a million piglets each year.

How to make sure you're buying Australian pork

All fresh pork sold in Australia is 100% Australian grown. However, 65% of processed pork (ham, bacon and smallgoods products) is made from frozen boneless pork imported from places like Denmark, Canada and the United States.

When buying Australian pork, look for one of three things:

- the packet label states 'Product of Australia'
- the bright pink Australian PorkMark logo
- the green Australian Grown kangaroo logo.

Or visit the Australian pork consumer website: www.pork.com.au and look for a butcher near you that sells Australian grown pork to make ham, bacon and smallgoods products.

Nutrients

Nutrition Information: Trimmed Lean Pork *	Quantity per 200g serving size	% Daily Intake per serving **
Energy (kJ)	930	11%
Protein (g)	46.6	93%
Total fat (g)	3.70	5%
		% Recommended Dietary Intake (Aust/NZ) per serving
Thiamine (mg)	1.95	178%
Niacin (mg)	18.5	185%
Vitamin B6 (mg)	1.01	63%
Vitamin B12 (µg)	0.69	35%
Zn Zinc (mg)	3.69	31%
Fe Iron (mg)	1.44	12%
Se Selenium (µg)	42.4	61%

DATA SOURCED FROM:

H. Greenfield, J. Arcot, J.A. Barnes, J. Cunningham, P. Adorno, T. Stobaus, R.K. Tume, S.L. Beilken, W.J. Muller. 2009. Nutrient composition of Australian retail pork cuts 2005/2006. Food Chemistry 117, 721–730.

A.J. Sinclair, S. Barone, T. Stobaus, R. Tume, S. Beilken, W. Müller, J. Cunningham, J.A. Barnes, H. Greenfield. 2010. Lipid composition of Australian pork cuts 2005/2006. Food Chemistry 121, 672–681.

* Trimmed Lean Pork is calculated using the numerical average of raw trimmed lean pork cuts (Loin Steak, Fillet, Rump Steak, Round Steak, Topside Steak, Silverside Steak, Diced Pork, Pork Strips, Loin Roast, Round Mini Roast and Loin Chop)

** Percentage Daily Intakes are based on an average adult diet of 8700 kJ. Your daily intakes may be higher or lower depending on your energy needs.

Bringing home the bacon

Did you know that pork is the most widely consumed meat in the world?

- Australia produces around 344,000 tonnes of pig meat every year. A little over 10% is exported to countries like Singapore, New Zealand and Hong Kong, and 25% is sold through restaurants and other food service outlets in Australia.
- Each year Australians consume around 23.5 kg of pork per person—this is made up of 8.5 kg of fresh pork and 15 kg of processed ham products such as bacon and smallgoods.
- During 2010–11, pork products accounted for around 10% of Australia's total fresh meat retail consumption and had a gross value of production (GVP) of more than $882 million. (Source: Australian Bureau of Agriculture and Resource Economics, ABARE 2012)
- Australian farmers produce around 4.75 million pigs (forecast number of pigs produced to the end of June 2012) from a sow herd of around 261,000.
- The APL PigPass NVD Traceability database in March 2012 had over 2,200 pig producer registrants. However just over 1,500 producers could claim they derive an income from growing pigs.
- The main source of food for Australian pigs is grains such as wheat, barley and sorghum, resulting in a white fat around the outside of the meat. In contrast, corn or maize fed pigs grown in the northern hemisphere will produce a yellow coloured fat around the outside of the meat.

Crackling facts!

- Australia is the first nation in the world to introduce the voluntary phase-out of gestation stalls.
- Pork accounts for approximately 0.4% of the national greenhouse gas emissions – significantly lower than other agricultural sectors, including beef at 11.2%, sheep at 3.4%, and cattle at 2.7%. (Source: Garnaut, R. 2008, The Garnaut climate change review— final report, available at: www.garnautreview.org.au/index.htm)
- Whether housed indoors or outdoors, a pig spends more time resting than any other domestic animal.
- Most pig producers use the manure and effluent on their farms as an organic fertiliser to improve crops and pasture, or to capture methane gases to convert to energy.
- Australia's pig herd health is one of the cleanest in the world, free from many detrimental diseases found in most other pig producing countries.
- The feed component (mainly grains such as wheat, barley and sorghum) makes up about 60% of the total cost of producing pork.
- Pigs have a very wide angle of vision (310 degrees) and are therefore easily distracted.
- On average, a sow will produce 10–12 piglets per litter.
- The average growth rate of Australian pigs is around 600–650 g a day from birth to sale.
- Pigs have colour vision but they can't focus both eyes on the same spot.
- Pigs are considered to be smarter than dogs and are easy to train. This characteristic helps producers develop safe handling routines.
- Grower pigs eat the equivalent of about 3% of their body weight and drink about 10% of their body weight, daily.
- Pigs are unable to perspire and they lose heat through their mouths. Their ideal growing temperature is 20–22°C.
- A pig which has nursed a litter is called a sow; a pig which has not nursed a litter is called a gilt.

Step 1: Engage with the topic

Getting started

Purpose

To provide students with opportunities to:

- Gather information about student's prior knowledge about pig farming
- Understand the difference between renewable and non-renewable resources
- Understand practices used on farms
- Pool ideas and share with others
- Assist students to organise the ideas they have about pig farming
- Develop skills in making connections between ideas
- Help set directions for an investigation
- Provide data for assessment purposes.

Pig farming and production

Pig farming and production occurs in approximately 2800 farms spread across all states of Australia.

Brainstorm what is known about pig farming and production. Consider questions like:

- 'What do we understand about pig farming and production?'
- 'What have we heard about pig farming in the media or from scientists, friends or family members?'

Display brainstorm lists around the classroom. If questions emerge from this activity, record these and display them for reference throughout the unit.

Talk about where students think pig farms are located in Australia.

Using **Resource 1.1** at the rear of the unit find places where pigs are farmed.

Story of pork

It's easy to take for granted the short journey of a piece of pork from the piglet on a farm, to the butcher or supermarket shelf, fridge or freezer. But there is far more to the story of food that we rarely consider.

Explain that they are to write a narrative or a flow chart of how they'd imagine a pork product's journey from the time a piglet is born to the moment it is placed as a pork product into a person's freezer or refrigerator. This narrative should include an estimation of how long the process would take, e.g. 'From the farm to the processing plant, the trip would take days by road'.

Point out that the students should consider what happens on the pig farm, for example:

- Where the pig is grown
- What inputs might be needed to grow the pig
- How the pig is raised
- Where the pig is housed
- How the pig is fed and watered
- How the pig is kept in good health
- How the pig's manure is handled.

Mention that they also need to consider what happens after the pig is fully grown and ready to be processed as a product for consumers, for example:

- How the products are transported and stored
- How the products might be processed
- How the products are packaged
- How the products are displayed (e.g. on a shelf or in a fridge/freezer)
- How the packaging is handled after purchase.

Share stories or flow charts.

Practices used on farms

Discuss with the students that this unit of work will be investigating the types of sustainable resource management practices farmers use on pig farms.

Talk about 'resources' we use to satisfy our needs and wants and those that pig farmers might use to grow and raise pigs.

Brainstorm known 'natural resources'. (For example sunlight, soil, rocks, minerals, water, air, vegetation/plants and animals).

Discuss the meaning of renewable and non-renewable resources. Discuss which resources farmers use to grow and raise pigs are renewable and those that are non-renewable. Using a chocolate chip cookie ask students to mine or extract the chocolate chips from the cookie and relate what non-renewable might mean back to the others in the class.

Further investigate energy resources by talking about 'renewable sources'. Brainstorm types of renewable sources. (For example: solar, wind, wave, tidal, geothermal, biomass).

An overview of some facts and myths

Ask students to develop a concept map describing what they know about pigs, pig farming and production, the ways Australian pig farmers manage their resources sustainably. Share with students some facts about pig farming as is currently understood.

Refer to reference books and websites for support material.

See: https://aussiepigfarmers.com.au

Also refer to the facts on pages 12–17 of this resource.

Use the Web Map at www.globaleducation.edu.au/verve/_resources/webmap.pdf to develop a concept map describing what you know about pig farming, what it is, what it comprises, what it affects, its potential impacts on the pigs, on environments and their natural resources.

Assessment note

Concept maps are useful for assessment purposes. Students could complete one at the beginning of the unit and then reconstruct it during and at the end of the unit to demonstrate their changed understandings.

Setting the task

Explain to the class that they will be using a range of activities and a website containing a video about a pig farm to develop an understanding of:

- Sustainable resource management practices used to produce pigs
- How Australian pig farmers are converting manure into renewable energy
- Some ways Australian pig farmers are minimising their impact on global change by using processes designed to use decomposing animal and plant matter and separating the methane it produces to produce electricity
- How the renewable energy can then used for direct heating and providing warmth to baby piglets
- How food waste and packaging can be recycled and resources can be recovered from waste to feed pigs
- How greenhouse gas emissions can be cut through the adoption of sustainable resource management practices.

Explain to the class that their task is to work in pairs to record and collect information about the pig farms; their use of technologies and science knowledge and their farm management practices that manage resources sustainably.

Student groups

Introduce students to a range of roles they can consider undertaking for their task.

Groups can include:

- An Investigator – this role requires asking questions, finding information, solving problems. It involves looking into the video's story, learning about pig farmers and ways they are preserving the environment.
- A Recorder – this role requires noting lots of information, recording ideas, recording sources used and keeping lots of records about the investigation.
- An Artist – this role requires creative thinkers who can communicate their findings using art, photography, music or role play.
- A Story Teller – this role requires telling stories and writing them down.
- A Designer – this role requires collecting information, sorting and explaining ideas, and researching, modelling and testing ideas. It involves refining ideas, presenting ideas and communicating them.
- A Builder – this role designing and constructing things. Builders use lots of tools and materials to make things. They often also write explanations of what they have designed and its components.

Invite students to explore the Task Sheet for their use **Resource 1.2** to record information.

Step 2: Explore how resources are managed

Explore a pig farm

Purpose

To provide students with opportunities to develop their understanding of:

- How Australian pig famers use new and existing methods, designs and technologies to sustainably manage resources
- How manures are being used to create electricity
- Different energy sources
- How gases can be captured, transported and used
- A focus for the forthcoming experiences in the 'Explain' stage of the inquiry.

Introduce students to the concepts about ways Australian use sustainable resource management practices on pig farms.

Research Task:
Part 1 – Investigate the methodology

Re-state to the class that they will be using a range of activities and a website containing a video about a pig farm to develop an understanding of:

- Sustainable resource management practices used to produce pigs
- How Australian pig farmers are converting manure into renewable energy
- Some ways Australian pig farmers are minimising their impact on global change by using processes designed to use decomposing animal and plant matter and separating the methane it produces to produce electricity
- How the renewable energy can then used for direct heating and providing warmth to baby piglets
- How food waste and packaging can be recycled and resources can be recovered from waste to feed pigs
- How greenhouse gas emissions can be cut through the adoption of sustainable resource management practices.

Explain to the class that their task is to work in pairs to record and collect information about the pig farm; its use of technologies and science knowledge and their farm management practices that manage resources sustainably.

View a video

Explain to the students that their task is to start researching. Invite students in pairs to initiate their research and view a video explaining how pig farmers convert manure into renewable energy and then use the energy to keep their pigs warm, recover resources from waste products and then use the resources to feed their pigs, and reduce greenhouse gas emissions and save money.

Ask pairs to view the following video and record information for their research about the sustainable management practices used.

Video Title: Environmental Stewardship

Abstract: This is a video explaining how one Australian pork farmer is demonstrating their environmental responsibility and stewardship by using pig manure or biomass to create electricity. It includes sections on how the decomposing manure creates methane; how the methane is captured, transported and used to generate electricity at the farm to provide thermal comfort and appropriate conditions for baby piglets. It also highlights how food and packaging waste from other sources is recycled and reused as food for the pigs.

See: www.youtube.com/watch?time_continue=2&v=KLvSGvw279k

Renewable energy

Research teams all over the world are working on developing renewable energy to help decrease greenhouse gas emissions.

Brainstorm the types of technologies known that use energy from a variety of renewable sources that can generate electricity. For example wind turbines, solar photovoltaic modules, tidal turbines, biomass generators etc.

Questions, questions...

Provoke thinking by focussing on pertinent, challenging and topical aspects about the use of renewable energy sources to generate electricity.

Use the following 'Question Grid' to encourage students to devise additional angles to their questions.

What is?	Where/ when is?	Which is?	Who is?	Why is?	How is?
What did?	Where/ when did?	Which did?	Who did?	Why did?	How did?
What can?	Where/ when can?	Which can?	Who Can?	Why can?	How can?
What would?	Where/ when could?	Which could?	Who would?	Why would?	How would?
What will?	Where/ when will?	Which will?	Who will?	Why will?	How will?
What might?	Where/ when might?	Which might?	Who might?	Why might?	How might?

For example:

- What do I know about energy from a variety of sources that can be used to generate electricity?
- Why is knowing about the conversion of manure into renewable energy on pig farms important?
- How do the pig farmers convert manure into electricity?

At the end of the activities make a class list of students' comments and questions using a table like the one below:

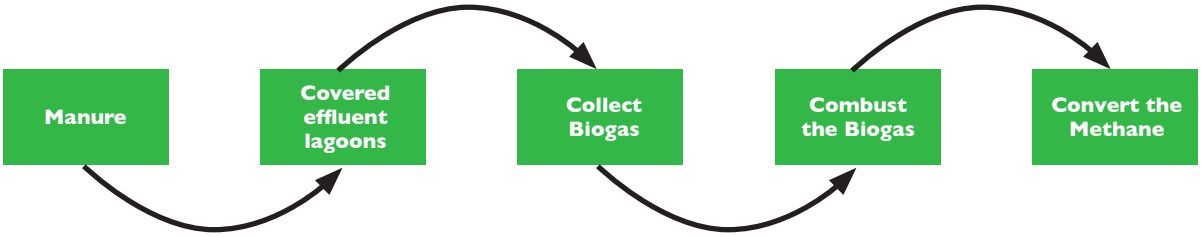
What we know	**What we're not sure about**	**What we want to know**

Learn more about the process

View the video Aussie Pig Farming – Environmental Stewardship www.youtube.com/watch?time_continue=2&v=KLvSGvw279k and explore the methods this pig farmer uses to convert manure into electricity.

Ask students to draw a flow chart to describe the processes used.

For example:



Improve understandings

Improve understandings about obtaining methane via biogas generated by the fermentation of organic matter and trapping the gas.

Invite students to simulate this process using a small bottle of soda water and a balloon. Challenge students to show how a balloon and bottle of soda water might be used to demonstrate how a gas can be captured, just like the methane is under a cover.

Invite students to try this simulation another way. Use:

- A small snap lock glad bag
- A tablespoon of bicarbonate of soda
- A spoon
- 1/2 a cup of vinegar.

Using a third option students can use:

- An empty 1.25 litre plastic soft drink bottle
- 1/2 a cup of vinegar
- 1 tablespoon of bicarbonate of soda
- A balloon
- A small funnel
- A spoon.

Remind students that the objective is to capture the gas.

If instructions are required, ask students to:

1. Fill the bottle 1/3 full with vinegar.
2. Using the funnel, 2/3 fill the balloon with bicarbonate of soda. Break up any lumps of bicarbonate soda first so it doesn't get stuck. Shake or flick the funnel to help the bicarbonate soda through.
3. Carefully stretch the balloon over the mouth of the bottle, being careful not to spill bicarbonate soda into the bottle or tear the balloon (careful of fingernails).
4. Hold the balloon upright and shake the bicarbonate soda into the bottle – the balloon should start blowing up quickly.
5. Liquid may bubble up into the balloon and if so hold it upright to drain into the bottle.

Invite students to discuss their observations of what is happening. Talk about the gas being captured rather than being released into the air.

Delve deeper

Once the methane is captured, the next step required is transportation to a generator.

Invite students to explore how a gas can be transported under pressure.

Provide students (where possible) with:

- 4 or more metres of garden hose or similar
- A foot pump (as used for airbeds)
- Balloons
- Duct tape
- Rubber bands.

Invite students to imagine the balloon represents the generator where pig farmers transport the methane to. Encourage them to think about how they might use these resources to transport a gas under pressure.

If instructions are required, ask students to:

- Attach the tube to the pump and seal with lots of electrical or duct tape so you have an airtight seal
- Attach the balloon to the other end of the tube, securing with the rubber band
- Simulate the pumping and observe what happens.

Going further

Focus on how the methane is collected and turned into energy on the piggery.

Review the video again and ask students to share ideas about where the methane is collected and what happens with it next (i.e. it is turned into energy).

Invite students to suggest how this might be simulated using the full balloon that is attached to the small plastic bottle that has been used in the earlier activity. (Note: this is the third option in the activity titled 'Improve understandings').

To repeat this activity use:

- An empty 1.25 litre plastic soft drink bottle
- 1/2 a cup of vinegar
- 1 tablespoon of bicarbonate of soda
- A balloon
- A small funnel
- A spoon.

To capture the gas, ask students to:

- Fill the bottle 1/3 full with vinegar
- Using the funnel, 2/3 fill the balloon with bicarbonate of soda. Break up any lumps of bicarbonate soda first so it doesn't get stuck. Shake or flick the funnel to help the bicarbonate soda through
- Carefully stretch the balloon over the mouth of the bottle, being careful not to spill bicarbonate soda into the bottle or tear the balloon (careful of fingernails)
- Hold the balloon upright and shake the bicarbonate soda into the bottle – the balloon should start blowing up quickly
- Liquid may bubble up into the balloon and if so hold it upright to drain into the bottle.

After capturing the gas, talk about how some energy can be simulated. Test ideas!

Invite students to try this simulation using:

- The fully blown balloon still attached to the plastic bottle
- A pair of scissors
- A jug of water
- A shallow tray.

Ask students to:

1. Fill a shallow tray with water.
2. Place the fully blown balloon attached to the plastic bottle in the shallow tray.
3. Fill the tray with water.
4. Snip the balloon using the scissors....and allow the gas top escape and create energy (the bottle should race across the water's surface).

Experiment with creating energy in other ways too.

Try briskly rubbing a blown up balloon on a jumper, then place the balloon against a wall and experience the invisible force that pulls it to the wall. Alternatively, make your hair stand on end by rubbing a balloon on your head and pulling it away. Observe the invisible force that attracts the hair to the balloon.

Summarise

Talk with students about how greenhouse gas emissions can be reduced through the adoption of cleaner energy technologies such as the processes used on the Australian pig farm. Review the video and focus on how food waste and packaging are being recycled and resources are being recovered from the waste to feed pigs.

Ask students whether they think this is an example of sustainable resource management or whether it is not.

Discuss similar processes where families, schools and communities are recycling and recovering resources from waste.

Consider composting, worm farming, sharing unwanted items, and recycled art and fashions.

Sustainable designs

Each day we behave in particular ways, we use particular technologies and manage our living spaces to keep warm or stay cool.

The Australian pig farm at www.youtube.com/watch?time_continue=2&v=KLvSGvw279k has used designs to manage their resources sustainably and provided living spaces to keep their piglets warm while reducing energy consumption.

Review the video again and focus on how the renewable energy is then used for direct heating and providing warmth to baby piglets.

Re-state the research task

Remind students to record and collect information about the pig farm; its use of technologies and science knowledge and their farm management practices that manage resources sustainably.

Encourage students to think creatively. They might draw a design demonstrating the sustainable principles that are at work on the pig farm; re-enact the processes and practices in a role play, podcast or video; communicate the practices using an interview format.

If designing, try Google SketchUp http://google-sketchup.en.softonic.com to create a 3D design.

If creating a video try VoiceThread at http://voicethread.com

If creating a podcast try using Audacity at http://audacity.sourceforge.net

Alternatively, mash up various media, tying together video, audio, still images and text and create a Glog at www.glogster.com

Step 3: Explain different practices and their effects

Purpose

To provide students with opportunities to:

- Describe existing processes and practices involved on Australian pig farms to manage resources sustainably
- Explore the consequences of decisions and choices pig famers make relating to the management of resources
- Develop the skills of discussion, negotiation, critical thinking and analysis of multimedia material
- Create a number of consequence wheels
- Think about their presentation
- Think about changing conditions that are changing farming practices.

Approaches to managing resources

Invite students to develop a 'consequence wheel' to explore the consequences of practices and processes the pig farmers featured in the video made relating to the management of the farm's resources.

The issue is written in the centre of a sheet of paper and a series of concentric circles are then drawn lightly around it. The first question asked is "What are the immediate consequences?" See **Resource 1.3** for an example.

Ask pairs or small groups to discuss what the repercussions might be and briefly write them around the first circle. Ask pairs or small groups to link each statement to the central point by a single line. Next, students discuss what consequences may follow on from the first ones. Following on, third and fourth order consequences can be explored and marked in a similar way.

Share consequence wheels and explore the difference between intended and unintended consequences for a range of issues.

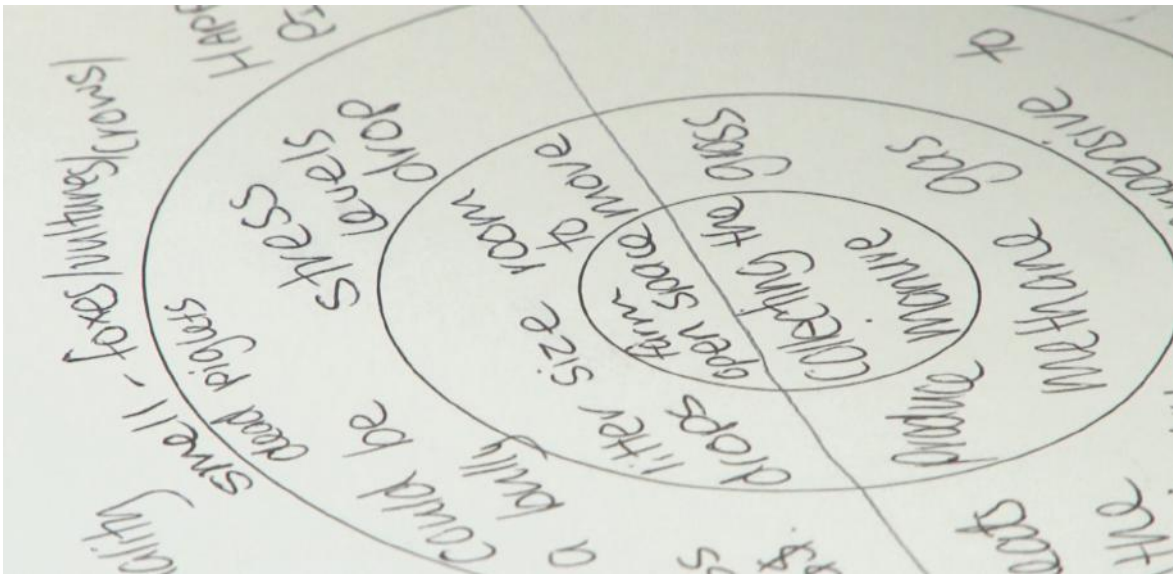
Encourage the students to ask critical questions of one another's work. For example:

- What do you feel, hope and fear in relation to this particular issue?
- Do you think everybody agrees?
- Why might other people think and feel differently?
- How did the issue come about?

- Who do you think influenced your opinions?
- Who gains and who loses?
- Who has power in this situation and how do they use it?
- Is it used to the advantage of some and the disadvantage of others?
- How do you feel students in schools should respond to such issues?
- What values can we use to guide our choices in the way the pigs are farmed, housed, used, managed and produced?
- What are the possible courses of action open to pig farmers?
- What are others already doing?
- How might the pig industry work together?
- Whose help might they need?
- How do we measure their success?

(Adapted from "Education For The Future – a practical classroom guide, D.Hicks, WWF, 1994, p.10).

Create a consequence wheel using **Resource 1.3** to help students consider the various impacts of resource management practices and then discuss the opportunities and challenges available.



Decide on what to present and how to do so

Re-state the purposes of the investigation and ask students to consider how they are going to bring their information together and present it so that the main points come across clearly.

Farm factors

Discuss with students what they have discovered about farm practices that are changing in response to sustainable resource management practices and the reduction of greenhouse gas emissions in the unit. Draw a table on the board with two headings:

Changing farming practices	Predicted influence

Ask them to suggest ways each farm practice is a response to becoming more sustainable and reducing greenhouse gas emissions, with an explanation of their reasoning. For example, drip-irrigation is being used in some parts of the world rather than overhead sprinklers to water pastures, which can cause a large amount of water to evaporate before the plants absorb it. In drought conditions, this farming practice can conserve water. Ask students to document their ideas.

Step 4: Elaborate on concepts and ideas

Presentation planning

Purpose

To provide students with opportunities to:

- Learn more about the latest clean energy science and the scientists involved
- Apply what they have learned and communicate the design principles of resource management practices in the pig industry
- Plan their presentation
- Critically and creatively think about ways the pig industry can reduce greenhouse gas emissions
- Share investigation findings.

CSIROpods

Below is a selection of CSIRO podcasts on the subject of alternative energy sources, in particular a system that combusts waste products to generate electricity. These are audio recordings made by CSIRO scientists designed to keep everyone informed on the latest science research in Australia. Listen to the scientists discuss their work with the following downloadable mp3 files.

Podcasts are audio (or video) files that can be downloaded and played on a computer or transferred to a portable music device.

See:

- **Being cool with waste**
  https://csiropedia.csiro.au/being-cool-with-waste
- **Printing solar like money**
  https://csiropedia.csiro.au/printing-solar-power-like-money

Revisit research

Engage students to reflect on the research and hands-on activities undertaken. Ask students how they are going to bring their information together and present it so that the main processes involved can be communicated to an audience at the school, within the local community or via social media outlets like YouTube.

Ask students to list the main processes involved in sustainable resource management that will feature in their presentation and the main messages to be given about these topics and decide on ways to share this information.

Ask students to create a final plan for completing the presentation. Students may need to create an image bank and collate references and acknowledgements for their work sample. Invite them to summarise these and the learning achieved in a journal log or reflection.

Review and submit

Invite students to revise and fine-tune their presentation of the sustainable resource management practices, the science knowledge and technologies involved.

De Bono's six hat thinking

Students explore issues raised using de Bono's "Six Thinking Hats" technique to explore energy sources that can be used to generate electricity in more depth. Students, in five groups, each with a different hat, discuss and document the issues according to their given perspectives and come together at the end to share their ideas.

Red Hat	White Hat
Feelings *What are the emotions and feelings associated with ways electricity can be generated? How do you feel?*	**Information** *List the facts that you know about ways electricity can be generated and how it affects the environment.*
Blue Hat	**Green Hat**
What thinking is needed *What has happened so far?* *What should happen next?* *What questions should we consider?*	**New ideas** *How could the problems related to greenhouse gases produced in electricity generation be solved?* *What needs to be done?*
Black Hat	**Yellow Hat**
Weaknesses *What are some of the negative aspects and outcomes of seeking new technologies and new behaviours?*	**Strengths** *What are some of the positive aspects and outcomes of seeking new technologies and new behaviours?*

Share investigations

Talk with students about how they can make others in their community aware of their research while receiving feedback on the community's level of awareness about sustainable resource management practices in the pig industry and/or other food production areas, and of energy sources that can be used to generate electricity and reduce greenhouse gas emissions.

Students could:

- Present their presentation to other classes at the school, parents or via a social media tool
- Contribute to a class article for the school newsletter
- Encourage the broader community to shift towards reducing greenhouse gas emissions and more sustainable practices
- Prepare letters to family and friends reporting their findings on sustainable resource management practices
- Create an e-calendar illustrated with the various ways we can reduce greenhouse gas emissions and live more sustainably.

Step 5: Evaluating

Think back and evaluate

Purpose

To provide students with opportunities to:

- Reflect on their own learning
- Provide a source of data for assessment.

To provide teachers with:

- Insights into students' understandings and attitudes, as well as their perceptions of their own strengths and weaknesses.

Reflective writing

Begin by modelling reflective writing through a whole class learning log. Alternatively, you could model your own entry 'thinking aloud' as you write.

Provide students with a set of focus questions for their writing:

- Write about something new you learnt in this unit about ways pig farmers are managing resources sustainably and reducing their impact on the environment
- What is one thing I have learned about my own values when it comes to sustainable resource management?
- How might I help others know more about how the pig industry is managing their resources for the benefit of their pigs and the environment?
- What have I learned about renewable energy and sustainable technologies?
- What have I learned about the increases in scientific knowledge and developments in technology in ways resources are being managed sustainably?
- What would still like to find out about pig farming?
- How well did I/we participate in any group/team learning activities?
- What questions do you have about the topic at the moment?
- What piece of work am I most satisfied with?

References

Australian Academy of Science. (2005) Primary Connections, Canberra, ACT.

Cecil, N. (1995) The Art of Inquiry: questioning strategies for K-6 classrooms, Peguis, Canada.

Gardner, H. (1985) Frames of Mind: the theory of multiple intelligences, Basic Books, New York.

Hamston, J. and Murdock, K. (1996) Integrating Socially: units of work for social education, Eleanor Curtain, Melbourne.

De Bono, E. (1992) Six Thinking Hats for Schools, Books 1 & 2, Hawker Brownlow Educational.

Hicks, D. (1996) Educating for the Future – a practical classroom guide, WWF.

Hill, S. And Hill, T. (1990) The Collaborative Classroom, Eleanor Curtin, Melbourne.

Stokes, C. & Howden, M. (2010) Adapting Agriculture to Climate Change. CSIRO Publishing, Victoria.

Wilks, S. (1992) Critical and Creative Thinking: strategies for classroom enquiry, Eleanor Curtin, Melbourne.

Websites (viewed June 2018)

Audacity
http://audacity.sourceforge.net

Aussie Pig Farmers
www.youtube.com/watch?time_continue=2&v=KLvSGvw279k

Australian Pork
www.pork.com.au
www.australianpork.com.au

Commonwealth of Australia Global Education Website
www.globaleducation.edu.au/verve/_resources/webmap.pdf

CSIRO
www.csiro.au/en/Portals/Multimedia/CSIROpod/Being-cool-with-waste.aspx
www.csiro.au/Portals/Multimedia/CSIROpod/Printing-solar-power-like-money.aspx

The Garnaut Climate Change Review
www.garnautreview.org.au/index.htm

Glogster
www.glogster.com

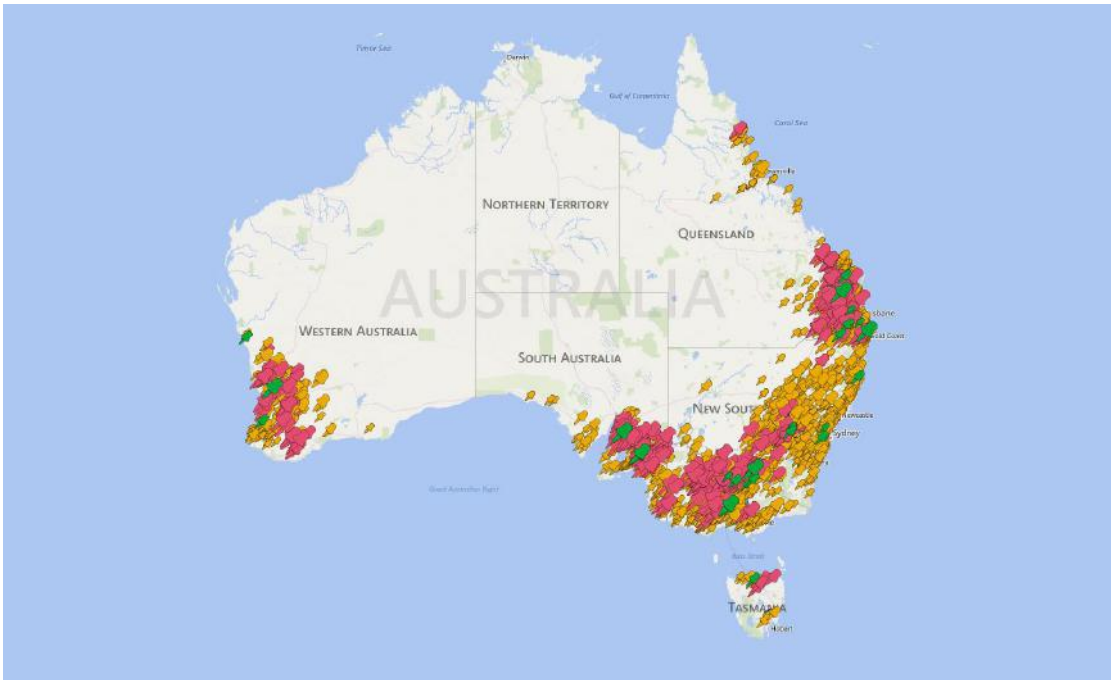
Google
http://google-sketchup.en.softonic.com

VoiceThread
http://voicethread.com

Resource pages

Resource 1.1

Pig production



Note: The bigger the pin on the map, the bigger the piggery! The pink pins are APIQ✓® accredited piggeries, the yellow pins are non APIQ✓® accredited piggeries and the green pins are abattoirs.

Notes

Resource 1.2

Task sheet

Evert project task needs some record keeping. Using the table below keep a record of your role(s) in the task, your sources, ideas and information collected.

Your name: .....

The task

Your task is to work in pairs to investigate the types of sustainable resource management practices farmers use on a pig farm; record and collect information about the pig farm; the use of technologies and science knowledge and their farm management practices that manage resources sustainably.

Overview

Using the website at www.youtube.com/watch?time_continue=2&v=KLvSGvw279k as a basis of your study, record and collect information about the pig farm, report on the types of sustainable resource management practices farmers use; the use of technologies and science knowledge and their farm management practices that manage resources sustainably.

Explore the way the pig farmer pig farmers are converts manure into renewable energy.

Describe the processes designed to use decomposing animal and plant matter and separating the methane it produces to produce electricity.

Describe how the renewable energy can then used for direct heating and providing warmth to baby piglets.

Find and describe possible ways of recycling food matter and packaging to feed pigs.

Find and describe how greenhouse gases can be reduced through the adoption of such practices.

Write or draw, or record and video, or design and make a model of the pig farm showing all of the sustainable resource management practices used there.

My tasks and role(s)

My first task	My role
My next task	**My role**
My next task	**My role**
My next task	**My role**

Notes:

List of resources used

Author's name
The name of the video
The year it was filmed
The name of the publisher
The sections I found most useful

Information I think is important

What I know

Keep a record of what you know about each of the following:

Describe how the pig farmer pig farmers are converts manure into renewable energy
Describe the processes designed to use decomposing animal and plant matter and separating the methane it produces to produce electricity
Describe how the renewable energy is then used for direct heating and providing warmth to baby piglets

Find and describe possible ways of recycling food matter and packaging to feed pigs
Find and describe how greenhouse gases can be reduced through the adoption of such practices
Other notes:

My draft

Write or draw, or record and video, or design and make a model of the pig farm showing all of the sustainable resource management practices used there.

Resource 1.3

Consequence wheel

Consequence wheels are used to explore wide ranging consequences that can follow from actions, issues or trends in the present. Look at the example below.

Decide on an issue that is part of understanding sustainable resource management practices. Place the focus in the centre of the consequence wheel. Then, explore the focus by asking the question "What are the immediate consequences?"

Write the immediate consequences in the inner ring around the main idea. Link each consequence to the main idea with a single line. This indicates that they are first order consequences. Continue exploring second, third and forth order consequences using the outer circles.

Use the four concentric circles below to explore the consequences of an action, issue or trend relevant to the sustainable management of resources.

Notes

AUSTRALIAN Pork™

Primary Industries Education Foundation

AUSTRALIAN PORK LIMITED
ABN 83 092 783 728

Level 2, 2 Brisbane Avenue Barton ACT 2600
PO Box 4746 Kingston ACT 2604 Australia

P: 02 6285 2200 **F:** 02 6285 2288
E: apl@australianpork.com.au

www.australianpork.com.au