# Contributing to a sustainable planet

## A case study

**Australian Pork Limited**

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September 2023

This case study was prepared by ACIL Allen for Australian Pork Limited as part of the project:

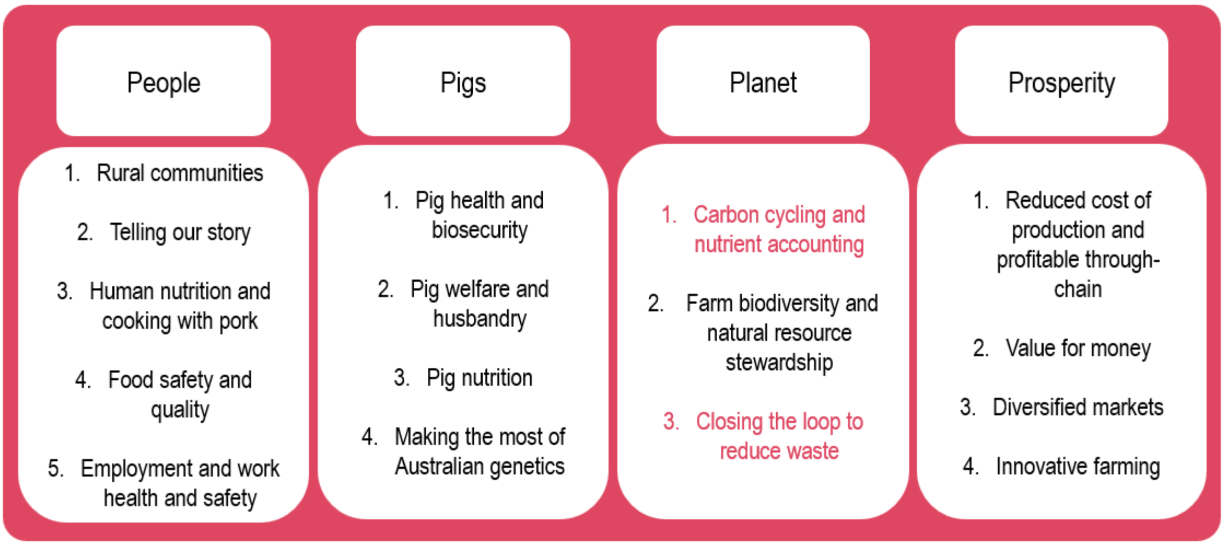
ACIL Allen (2024), 2021-22 Economic Contribution of the Australian Pork Industry, Prepared for Australian Pork Limited (APL). January 2024.

ACIL Allen is a leading independent economics, policy and strategy advisory firm, dedicated to helping clients solve complex issues.

# 1. Overview

The Australian pork industry, through the support of Australian Pork Limited (APL), are working to improve the industry's sustainability through focus on people, pigs, planet, and prosperity. Refer Figure 1.

### FIGURE 1 Australian Pork Sustainability Framework snapshot




Of the major issues facing the industry the 'planet' is key and the agricultural sector, and pork specifically, has a role to play in reducing emissions and waste. Contributing to a sustainable planet is critical for the development and sustainability of the Australian pork industry. Below outlines the key take-home messages from this case study.

### TABLE 1 Case study key points

- **APL is actively working on projects with producers to reduce emissions.**
- **There are opportunities for governments to work with industry to facilitate better uptake and business investment in emissions reduction.**
- **APL recommends several measures to overcome barriers and disincentives.**

# 2. Background

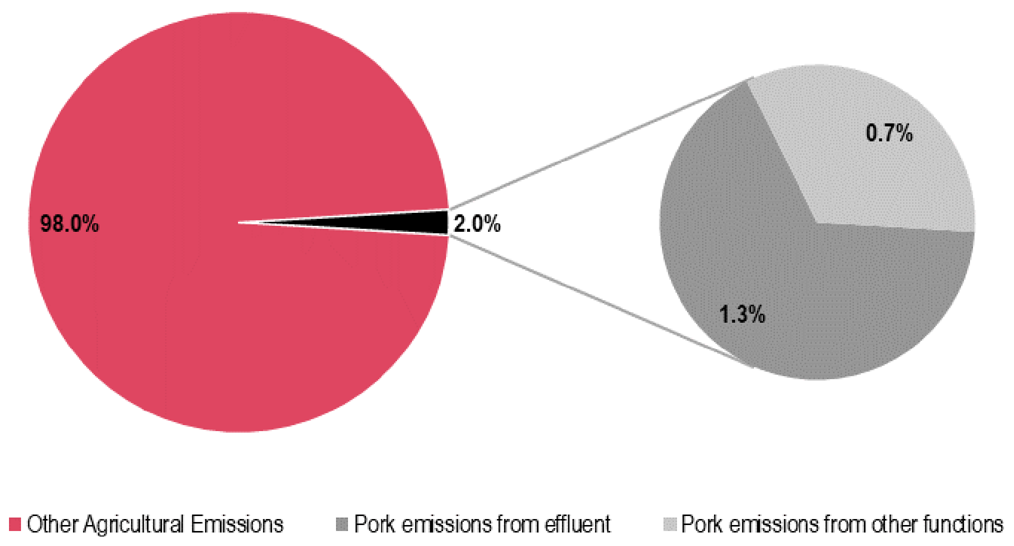
Although pork has worked to decrease its emissions over time (a 69% decline since 1980)[1] and is a low emissions protein relative to other sources (emitting just 3.3kg of greenhouse gases per kilo of liveweight) and accounting for just 2% of total agricultural emissions, there is further work that can be done.

A significant proportion (as high as 66%)[2] of emissions come from pig effluent (a waste mixture containing faeces, water, wasted feed). Refer Figure 2.

One solution to emissions from effluent is biogas.

Biogas systems are strongly tied to APL's sustainability focus areas 'Carbon cycling and nutrient accounting' and 'Closing the loop to reduce waste' (Figure 1) and contribute to APL's target of "60% of production utilising waste recycling and renewable energy technology".[3]

**FIGURE 1 Pork industry emissions as a percentage of total agriculture emissions, and the percentages of effluent and non-effluent emissions in the pork industry**




Source: ACIL Allen

[1] APL (2018b) Trends in environmental impacts from the pork industry. Accessed September 2023: https://australianpork.com.au/reduction-environmental-impact-pork-industry-between-1980-and-2020

[2] APL (2010) Environmental Assessment of Two Pork Supply Chains Using Life Cycle Assessment. Accessed September 2023: https://agrifutures.com.au/wp-content/uploads/publications/09-176.pdf

[3] APL (2021) Low Carbon Emission Roadmap for the Australian Pork Industry. Accessed September 2023: https://australianpork.com.au/sites/default/files/2021-12/Pig%20Industry%20Low%20Emission%20Roadmap%20-%20Final.pdf

# 3. Biogas - reducing waste and providing a source of renewable energy

Effluent that would otherwise be emitting methane can be processed into biogas. APL research projects show that biogas systems for piggeries can lead to a reduction in overall greenhouse gas emissions of 53% under CAP-CHP (Covered Anaerobic Pond – Combined Heat and Power) system[4].

It was estimated that about 16% of producers had biogas systems in place in 2021[5]. Of these, the vast majority were large-scale operations (1,000 sows). Refer Table 2. There is significant potential for expansion, especially considering increasing evidence for feasibility of biogas in smaller-scale piggeries[6].

**TABLE 2 The benefits of biogas - an example of a small-scale Victorian pig operation**

An APL study published in 2020 examines the technical and economic aspects of a (535 sow) Victorian piggery in their implementation and operation of a biogas system.

The results of the case study established a strong foundation of economic and technical feasibility in smaller scale piggeries. This was particularly innovative because previously, it was thought to be the case that only larger piggeries (1000+ sows) could feasibly operate a biogas system.

The report highlights key insights into feasibility, including:

- Up to 8 years to achieve a break-even point
- $55,170 estimated electricity savings per annum
- $50,000 estimated liquid petroleum gas (LPG) savings per annum.

The piggery was estimated to abate 1,613 t CO2-e/annum-1, which is equivalent to 1,613 Australian Carbon Credit Units (ACCUs). In 2020, this was equal to $20,969 per annum.

At the time of the study, however, the costs of reporting and auditing that the piggery would incur were too great to make applying to the Emissions Reduction Fund a financially sound decision. The costs to comply with reporting requirements were estimated at $10,000-$15,000 per annum.

Source: APL (2020c). Clarifying biomethane and small-scale biogas options for Australian piggeries. Accessed: https://australianpork.com.au/sites/default/files/2021-06/2018-0032.pdf

Expansion of and continued support for biogas programs can assist in further reducing the Australian pork industry's already relatively small emissions profile, and bring benefits for pig businesses, regional communities, and the environment.

[4] APL (2021) Low Carbon Emission Roadmap for the Australian Pork Industry. Accessed September 2023: https://australianpork.com.au/sites/default/files/2021-12/Pig%20Industry%20Low%20Emission%20Roadmap%20-%20Final.pdf

[5] APL (2020c) Clarifying biomethane and small-scale biogas options for Australian piggeries. Accessed September 2023: https://australianpork.com.au/sites/default/files/2021-06/2018-0032.pdf

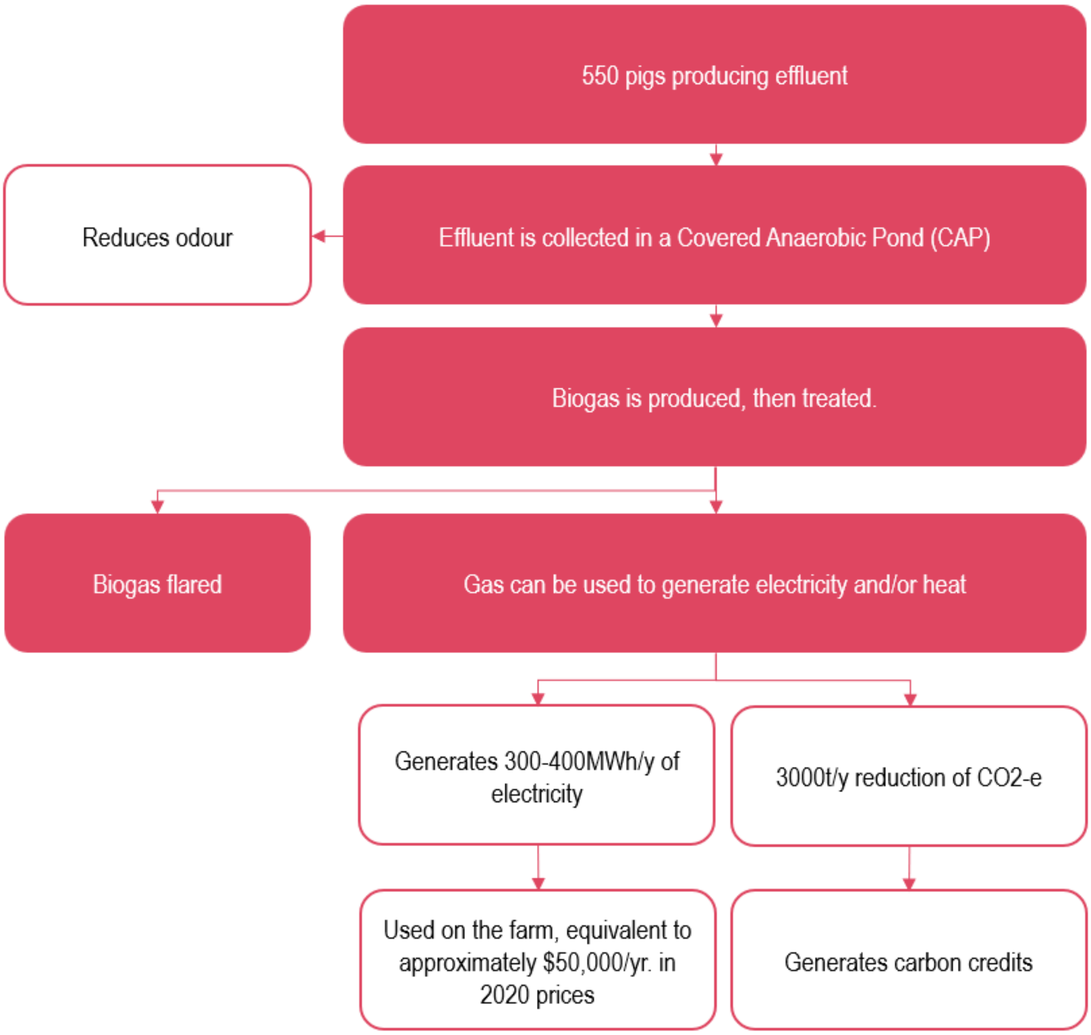
[6] APL (2020c) Clarifying biomethane and small-scale biogas options for Australian piggeries. Accessed September 2023: https://australianpork.com.au/sites/default/files/2021-06/2018-0032.pdf

## 3.1. How a typical biogas system works

Biogas is created in a process called anaerobic digestion, that takes place when organic material in pig effluent (a waste mixture containing faeces, water, wasted feed) is broken down by bacteria, creating a biogas. First the pig effluent is directed into a Covered Anaerobic Pond (CAP), which is a large airtight cover over a body of effluent - the most common system in Australian piggeries. This allows the gases from the effluent to be collected, rather than going into the atmosphere[7]. Furthermore, a covered pond also serves to reduce odour emitted from the effluent[8].

The gases that are collected in the CAP are then treated (such as removing hydrogen sulphide) depending on its application, which can be called scrubbing or conditioning[9]. The biogas can then be flared (combusted to dispose) or used for heat or to generate electricity. Refer Figure 3.

**FIGURE 2 Biogas process in a piggery**




Source: ACIL Allen adapted from APL

[7] APL (2015) Code of Practice for On-farm Biogas Production and Use (Piggeries). Accessed September 2023: https://australianpork.com.au/sites/default/files/2021-06/2011_1013-423-CoP-Final-April15.pdf
[8] APL (2021) Op cit.
[9] APL (2015) Op cit.

# 4. What is APL doing in this space?

APL are currently working to support industry adoption, with the aim to increase anaerobic digestion, deliver significant emissions reductions and reduce energy costs for the pork industry. Refer Table 3.

**TABLE 3 APL assists industry with funding feasibility studies**

| |
|---|
| APL are currently working with member producers across Australia to investigate the feasibility of adopting sustainable technology and practices with an environmental focus. The big focus is on biogas - anaerobic digestion of piggery manure either through digestion in covered anaerobic lagoons or in manufactured digester tanks. |
| APL has been supporting producers to explore biogas by sourcing and funding a biogas consultant to assess the viability (both economically and technically) of each potential biogas facility. This reduces risk and feasibility costs and allows producers to take the first step in deciding whether and how biogas can be used on their site. |
| 55 eligible member producers (> 500 sows) were identified. This number was then reduced based on producer interest and those not producing raw effluent (e.g., those with eco sheds or spent litter). |
| To date there have been feasibility studies developed for 11 producers across 14 sites, with an extra 2-3 due to be finalised in the next few months. The feasibility studies have identified technical and economic barriers for some producers. For example, operations that are close to the coast have saline water which means the amount of biogas that can be produced is not enough to power a generator or the amount of effluent is not sufficient for a return on investment over 7-8 years. |

Source: Personal communication with APL

# 5. Barriers and opportunities

There are several current and potential barriers preventing the pork industry from adopting and maximising the benefits of this technology including **costs** and **regulatory disincentives**.

Numerous studies (6 between 2009-2020) have been funded by APL and others (e.g., Pork CRC) to develop and explore the potential solutions.

## 5.1. Barriers

As with any sophisticated technology, capital costs for biogas systems can be a considerable investment for producers, both initially and at maintenance intervals.

Key costs are incurred for the following expenses:

- Capital costs including the installation of system and /or the adaptation of previous/interconnected systems[10]

[10] EPA (n.d.) Anaerobic Digestion on Swine Farms. Accessed September 2023: https://www.epa.gov/agstar/anaerobic-digestion-swine-farms

- Upgrade costs for the repair/replacement of CAP lagoon covers can be necessary after 5-10 years
- Daily check of system and regular maintenance, with some components requiring diesel mechanics and other tradespeople.

The costs of sourcing specialised labour in regional areas either for installation or maintenance is high and exacerbated by the current labour shortages in regional areas.

**Capital costs – the most significant barrier to adoption**

Capital is considered the biggest barrier to adoption in piggeries.

Biogas was initially considered as an option for dealing with effluent back in 2010, the technology was well established, and had been tried and tested (in Europe). Overtime the technology has become more expensive, because of the cost of materials (e.g., generators are dependent on steel and the lagoon covers require heavy duty plastics). This has been further exacerbated by supply chain disruptions and inflation following the COVID-19 pandemic. The costs of generators have increased two-fold since the early 2010s.

Uptake in approximately 17 Australian piggeries in 2010-2015 was at a point when the required infrastructure was probably at its cheapest. Some of these early adopters have not continued to re-invest due to the costs of new generators (now more than $200,000). Many of those who have reinvested do so for the cost savings from producing their own energy however, the cost of replacement lagoon covers (with a life of about 10 years) is about to be realised and it is yet to be seen whether the industry is able to bear these costs.

However, as electricity and natural gas prices rise across the board in Australia, producers will have a greater incentive to become less reliant on sources of energy that are volatile and rising in price[11]. Regardless of the direction of movement in the following months and years, volatility has been observed, and producers may place more value on generating their own supply of energy.

**Technical barriers – individual projects can be complex and unique**

There are also key technical and economic restrictions that apply to some producers. Piggeries may have systems that pose technical obstructions to a biogas system. Refer Box 2.3.

Conversely, a system can be technically but not economically viable, for example, a piggery simply not generating enough effluent to generate the energy to power a generator.

Smaller piggeries are more restricted by both technical and economic restrictions as they have less effluent production and fewer financial resources to invest. Furthermore, they may find it more difficult to benefit from carbon credit schemes.

[11] Refer https://www.aer.gov.au/wholesale-markets/wholesale-statistics/gas-market-prices

**Compliance costs – additional time and cost to be deemed compliant**

Beyond capital outlay, maintenance costs and technical barriers, there are significant costs associated with applying for and complying with the Emissions Reduction Fund (ERF) to access Australian Carbon Credit Units (ACCUs).

The complexity of the process typically requires producers to hire an ERF approved consultant for certification and auditing purposes. As compliance costs are fixed regardless of scale, and carbon credit income is proportionate to the size of the piggery, carbon credits are not a viable venture for smaller piggeries – compliance costs are greater than carbon credit income[12].

In addition to considerable associated costs to qualify for ACCUs, biogas producers receive carbon credits for only 7-12 years (depending on the system), whereas carbon sequestration projects receive credits for 25 years[13]. This policy sees producers with established biogas systems deciding to cease use of biogas systems when faced with maintenance costs due to loss of supplementary ERF income.

**Other regulatory barriers – hindering adoption of biogas**

Other considerable regulatory barriers have been observed to slow and obstruct the adoption of biogas systems. These barriers are generally location specific, as regulatory barriers regarding biogas differ throughout Australia. Potential regulatory barriers to maximising biogas adoption are as follows:

- Slow DA processing times
- Conflicting requirements between DAs and ERF methods
  - e.g., Western Australia example where works approval was granted before ERF processed submission so was not deemed 'new' and therefore received no carbon credits
- Difference in state regulations on management of digestate e.g., between Queensland and Victoria
- Differing approaches to GHG emissions assessment and reduction requirements between states
- Complexity of gas regulations when applied to a farm environment

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[12] Since 2020, the ACCU spot prices (https://www.cleanenergyregulator.gov.au/Infohub/Markets/Pages/qcmr/march-quarter-2023/Australian-Carbon-Credit-Units.aspx) have risen to $61,294/annum-1 by end of Q1 2023. This increase in price will encourage producers that are already reducing emissions to apply for carbon credits with ERF and add incentive to producers who have not implemented a biogas system.

[13] Dept. of Climate Change, Energy, the Environment and Water (2021) Biomethane method package: proposed new method activity under the Emissions Reduction Fund, submission by APL. Accessed September 2023: https://consult.dcceew.gov.au/biomethane-method-package/have-your-say/view/14

## 5.2. Opportunities

There are opportunities in the system that can be harnessed to assist the industry and potentially overcome some of the barriers. As capital costs are a considerable barrier to navigate as a producer, opportunities for increasing biogas uptake lies in approaches to reduce the initial financial burden.

- The possibility of **third-party partnerships** to assist with investment risk and upfront costs (see Table 4).

**TABLE 4 Viability of third-party partnership for biomethane conversion**

| |
|---|
| Biogas can be converted into biomethane and bio-CO2 via three main methods:<br>1. Membrane-based<br>2. Pressure swing adoption (PSA)<br>3. Cryogenic treatment<br>This study examined a NSW producer and estimated their costs and break-even point if they were to partner with a third-party to produce biomethane and bio-CO2 using a membrane-based conversion system. The piggery stated they would rather enter a third-party agreement for biomethane and bio-CO2 conversion for the following reasons:<br>• Decreased responsibility for specialised technology and processes, unrelated to their core business<br>• Reduces overall project risk as third-party suppliers already have an established customer base<br>• Third party suppliers can more readily address the complex regulatory requirements associated with a biomethane and bio-$CO_2$ system.<br>In terms of viability, this example yielded a hypothetical payback period of between 4.5-5.2 years depending on financing.<br>The paper provides evidence that large piggeries with excess biogas can consider upgrading to biomethane and bio-CO2 in partnership with third party commercial gas companies. While this approach adds complexity, it significantly reduces the risk for piggeries by reducing the costs incurred. |

Source: APL (2020c) Op cit.

- Producers can consider utilising **byproducts** of biogas such as to create fertilisers.

  *Where technically feasible, creating other products such as concentrated nutrient fertilizers add to revenues or directly reduces costs of nutrient management*

  EPA[14]

- **Co-digestion** e.g., piggeries can consider additional sources of nutrients to increase methane production[15]

[14] EPA (n.d.) Op cit.
[15] APL (2020c) Op cit.

*Food waste or other organics may be co-digested with swine manure to increase biogas production rates, which can increase revenue from energy sales. Charging a tipping fee for the disposal of other parties' wastes is another source of income.*

EPA[16]

- Increased **grant funding** programs to support small scale producers
- **Reforming** the ERF compliance process and extending the payback of ACCUs credits
- Harnessing **changing market sentiment** and consumer willingness to pay for sustainable products
- **Harmonising** state and local government regulation

## 5.3. The impact of barriers and scope for reform

Barriers disincentivise entry into biogas, continued operation of biogas facilities, or both. The most significant capital costs, installation, and maintenance have increased markedly throughout and following the COVID-19 pandemic due to increases in costs of resources. Regulations have not responded to this change in the investment prospect for piggeries, however, making the choice for producers to begin or continue operating a biogas system more difficult.

Regulatory requirements need to be considered in the broader landscape, as regulation of activity can become an investment hurdle. For example, mandating the covering of ponds are often investments of more than $1 million. Some of the cost can be offset by carbon credits offered by the Emissions Reduction Scheme, however if it is state-mandated, the offset option is removed.

[16] EPA (n.d.) Op cit.

**TABLE 5 Regulatory barriers and the point at which they disincentivise producers' biogas system uptake/maintenance**

| Regulatory barrier | Impact | Disincentivises entry | Disincentivises continued operation | Response to incentivise biogas systems |
|---|---|---|---|---|
| Producers must undergo ongoing audits | Increases costs for producers | ● | ● | Regulation to address the costs posed by compliance |
| Producers must hire an ERF approved biogas consultant / complex ERF application | Increases costs for producers | ● | | APL provides an independent biogas consultant to producers for initial assessment stages |
| Producers do not know how biogas would work at their piggery | Producers discouraged from considering biogas | ● | | APL provides an independent biogas consultant to producers for initial assessment stages |
| Maintenance requires specific certifications that significantly limit supply | Increases costs for producers | | ● | Policy that considers where certifications may or may not be required for maintenance |
| Crediting period ends after 7 years for biogas operations generating electricity/heat, and 12 years for flaring only | Producers may not choose to extend their biogas operation when their crediting period ends | | ● | APL has advocated to Emissions Reduction Assurance Committee recommending an extension of crediting period |

*Source: ACIL Allen*

# 6. Benefits to industry and the community in fostering greater biogas uptake

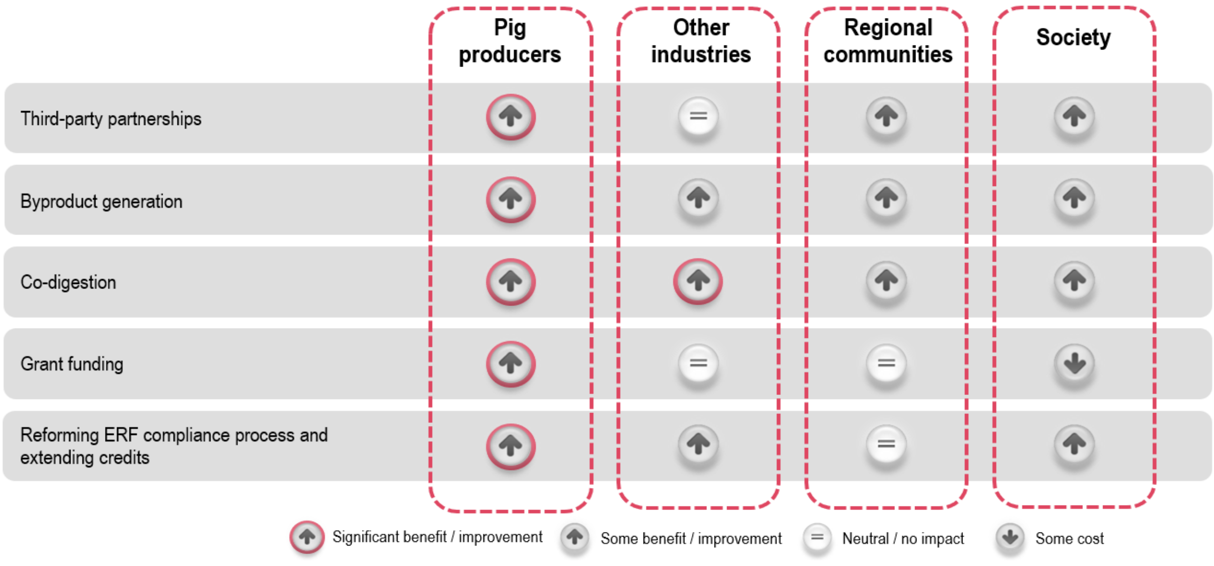
The Australian pork industry is likely to see benefits from biogas including:

- Reduction of greenhouse gas emissions by up to 53%
- Reduction in waste
- Reduction in odour
- Cost savings from electricity generation
- Cost savings from LPG
- Improved environmental sustainability

There will also be broader beneficiaries such as regional communities, which may benefit from skilled job creation (specialised plumbers, diesel mechanics, construction of new facilities etc.), bringing new residents and businesses into regional communities. Broader society and consumer benefits from reduced greenhouse gas emissions, reduced waste and odour are also substantial.

Reducing barriers and realising the potential of biogas within the pork industry, will enhance these benefits. Figure 4 presents the potential distributional impacts of reform.

**FIGURE 3 Potential distributional impacts by stakeholder**




Source: ACIL Allen

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