# TASMANIAN GREENHOUSE GAS ACCOUNTS

## State Greenhouse Gas Inventory 2015-16

Tasmanian Climate Change Office
Department of Premier and Cabinet
18/49094

Tasmanian Government

*Tasmanian Greenhouse Gas Accounts: State Greenhouse Gas Inventory 2015-16*

Tasmanian Climate Change Office

Published April 2018
ISBN: 978 0 7246 5742 8

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# Minister's Message

I am pleased to report on the latest greenhouse gas accounts for Tasmania. The State's emissions have declined by 100 per cent from 1990 levels. This means that Tasmania achieved zero net emissions for the first time in 2016.

Tasmania is the first jurisdiction in Australia to achieve zero net emissions. This is of international significance and reflects Tasmania's longstanding investment in renewable energy and the carbon sink in our forests.

The latest greenhouse gas accounts confirm Tasmania's status as a very low emitter. However, there is more we can do to further reduce the State's greenhouse gas emissions, and continue to maintain zero net emissions into the future.

The Tasmanian Government has committed to making Tasmania energy self-sufficient by the end of 2022. This will require up to 1,000 gigawatt hours of additional renewable energy generation in Tasmania.

This target will further cement Tasmania's place as the renewable energy battery of the nation, enhance energy security, and reduce Tasmania's greenhouse gas emissions.

Last year, the Tasmanian Government released *Climate Action 21: Tasmania's Climate Change Action Plan 2017-21* (Climate Action 21), which sets the Tasmanian Government's agenda for action on climate change through to 2021. Climate Action 21 has 37 actions based around six priority areas with actions focusing on: climate change research; improving energy efficiency; reducing transport emissions; and supporting business, local government and communities to take action.

This report on the latest greenhouse gas accounts highlights Tasmania's competitive strengths in our natural assets and enviable renewable energy profile. It also reflects the important role that Tasmania can play in the global response to climate change.

Elise Archer MP

**Minister for Environment**

# Introduction

The *Tasmanian Greenhouse Gas Accounts 2015-16* report monitors greenhouse gas emissions by sector and highlights a significant milestone for the State. In 2016, Tasmania became the first jurisdiction in Australia to achieve zero net emissions. While acknowledging this milestone, it is important to recognise that Tasmania's emissions profile is subject to change and that ongoing emissions abatement efforts are required for the State to continue to achieve zero net emissions.

## Measuring Tasmania's emissions

Each year, the Minister publishes Tasmania's baseline and latest emissions figures in the Tasmanian Government Gazette as required under the *Climate Change (Greenhouse Gas Emissions) Regulations 2012* (the Regulations). This report, prepared by the Tasmanian Climate Change Office (TCCO), provides further information on the State's emissions by sector.

The Regulations set out the method for measuring Tasmania's 1989-90 baseline greenhouse gas emissions, and changes to the State's emissions over time. The method outlined in the Regulations is consistent with national and international emissions reporting requirements.

The 1989-90 baseline is the total carbon-dioxide equivalent ($CO_2$-e) emissions for Tasmania for the financial year ending on 30 June 1990, as set out in the most recently published State and Territory Greenhouse Gas Inventories report.

This *Tasmanian Greenhouse Gas Accounts 2015-16* report was compiled using data from the Australian Government's *State and Territory Greenhouse Gas Inventories 2016*[1], produced by the Australian Government's Department of the Environment and Energy, to meet annual reporting commitments under Article 12 of the United Nations Framework Convention on Climate Change (UNFCCC) and Article 7 of the Kyoto Protocol.

According to the Regulations, emissions reductions for the baseline and most recently published years are to be included for the following sectors:

- energy;
- industrial processes and product use;
- agriculture;

[1] http://www.environment.gov.au/climate-change/climate-science-data/greenhouse-gas-measurement/publications/state-and-territory-greenhouse-gas-inventories-2016.

- waste;
- land use, land use change and forestry (LULUCF); and
- any other sector set out in the State and Territory Greenhouse Gas Inventories report.

The Australian Government released the latest data on Tasmania's greenhouse gas emissions accounts on 28 February 2018.

Due to the complexity of the data and calculations, there is a two-year lag in reporting. The latest greenhouse gas emissions accounts relate to 2015-16.

## International reporting rules

The *State and Territory Greenhouse Gas Inventories 2016*[2] is the fourth prepared under the second Kyoto Agreement reporting period. In accordance with international guidelines[3] agreed to by the UNFCCC Conference of Parties in Warsaw in 2013, emissions are estimated using methods described by the Intergovernmental Panel on Climate Change (IPCC) *2006 IPCC Guidelines for National Greenhouse Gas Inventories* and the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. These methods ensure that the estimates of emissions are accurate, consistent and comparable with inventories in other countries.

In 2015, the Australian Government, as part of its obligations under the UNFCCC Paris Agreement, committed to an economy-wide target to reduce greenhouse gas emissions by 26 to 28 per cent below 2005 levels by 2030. In its submission to the UNFCCC[4], the Australian Government agreed to report progress towards this target by estimating emissions and removals (sinks) according to UNFCCC classifications. The change in reporting from the Kyoto Protocol to the UNFCCC affects the calculation of emissions and sinks from the LULUCF sector.

Each year, the emissions estimates are calculated for all sectors from the baseline year of 1989-90 through to the current year. To incorporate changes to the reporting rules over time, and to maintain usefulness and accuracy in reporting and comparing estimates, all emissions are recalculated yearly across all sectors, from the baseline year through to the current year. This means the emissions estimates included in this report cannot be directly compared with those released in previous year's greenhouse gas accounts.

[2] The year 2016 refers to the Australian fiscal year from 1 July 2015 to 30 June 2016.
[3] Decision 24/CP.19: *Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention.*
[4] http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Australia/1/Australias%20Intended%20Nationally%20Determined%20Contribution%20to%20a%20new%20Climate%20Change%20Agreement%20-%20August%202015.pdf.

# Baseline and emissions profile for 2015-16

Tasmania's total greenhouse gas emissions in 2016 were -0.01 mega-tonnes (Mt) of carbon dioxide equivalent ($CO_2$-e), which is a 100 per cent reduction from the 1989-90 baseline.

Tasmania's total baseline greenhouse gas emissions in the year of 1989-90 were 18.9 Mt $CO_2$-e. The State's total emissions for 2015-16 were -0.01 Mt $CO_2$-e, which is a 100 per cent reduction from the baseline. This means Tasmania achieved zero net emissions for the first time in 2016.

## Emissions profile for 2015-16

The most significant reduction in emissions can be attributed to the LULUCF sector, which changed from a major source of emissions at 10.83 Mt $CO_2$-e in 1989-90, to become a carbon sink of -8.05 Mt $CO_2$-e in 2015-16, effectively offsetting a large portion of emissions from other sectors.

As with the previous year, the transport sub-sector continues to be the largest contributing sub-sector to the State's emissions at 1.71 Mt $CO_2$-e in 2015-16.

The reduction in Tasmanian's greenhouse gas emissions is significant, given Tasmania's population has grown by 12 per cent, and its Gross State Product has grown by 72 per cent. This demonstrates that Tasmania has decoupled the historic link between economic activity and emissions growth.

Emissions from the LULUCF sector have had a major influence on Tasmania's total annual emissions, as shown in Figure 1.

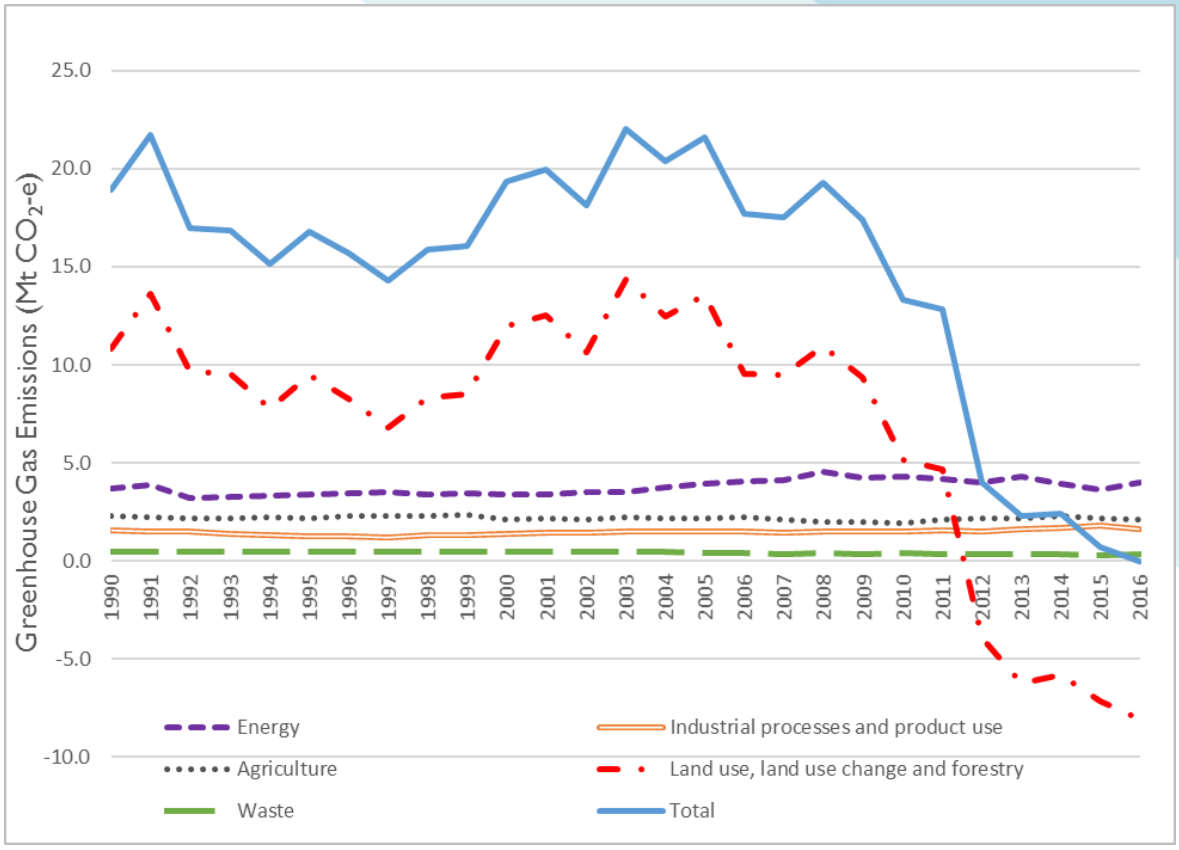


*Figure 1: Tasmania's greenhouse gas emissions from 1989-90 to 2015-16, by sector*

Figure 2 shows the contributions to total Tasmanian greenhouse gas emissions by sector in 2015-16. Further discussion relating to the impact of sub-sectors on the greenhouse gas emissions for each sector is contained in the *Emissions by sector* section of this report.

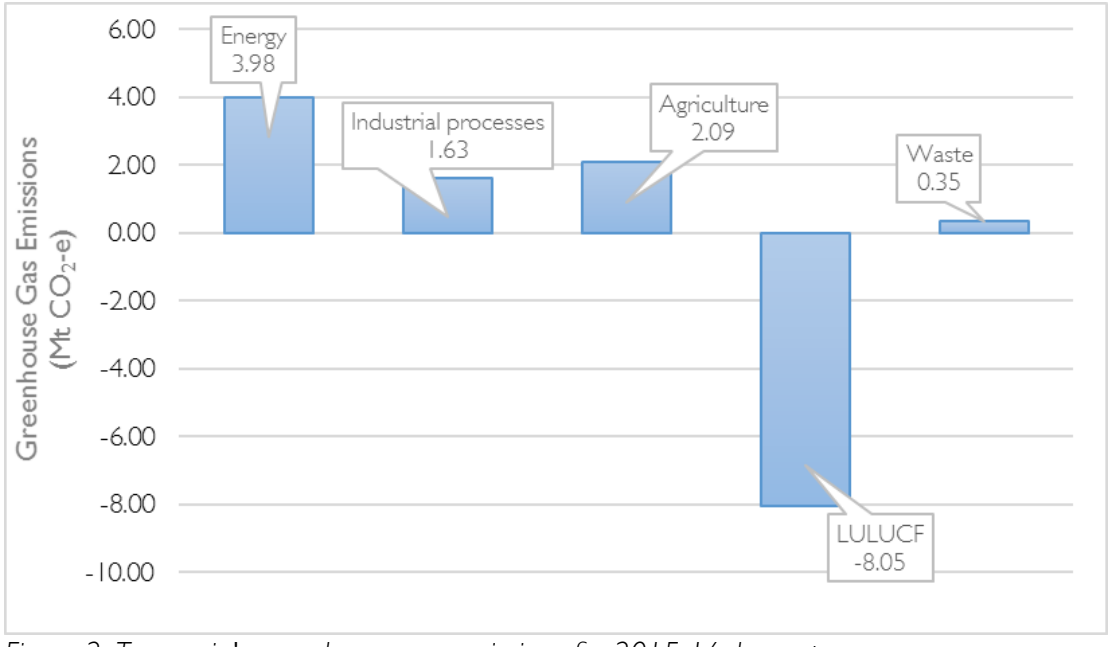


*Figure 2: Tasmania's greenhouse gas emissions for 2015-16, by sector*

Table 1 shows the change in both total and sectoral greenhouse gas emissions between the baseline year and 2015-16, which have increased for the energy and industrial processes sectors and decreased for the other three sectors over this period.

| Sector | Emissions (Mt $CO_2$-e) | | Change (%) * |
|---|---|---|---|
| | 1990 | 2016 | |
| Energy | 3.72 | 3.98 | 7.0 |
| Industrial processes and product use | 1.56 | 1.63 | 5.1 |
| Agriculture | 2.32 | 2.09 | -9.8 |
| Land use, land use change and forestry | 10.83 | -8.05 | -174.3 |
| Waste | 0.48 | 0.35 | -27.6 |

* Note the percentage change calculations may not agree due to rounding.

*Table 1: Change in Tasmania's 1989-90 baselines and 2015-16 greenhouse gas emissions, by sector*

Table 2 shows the differences in Tasmania's 2015-16 emissions by sector from the preceding year and indicates that emissions from the energy and waste sectors increased over the last year while the other sectors decreased.

| Sector | Emissions (Mt $CO_2$-e) | | Change (%) * |
|---|---|---|---|
| | 2015 | 2016 | |
| Energy | 3.63 | 3.98 | 9.6 |
| Industrial processes and product use | 1.79 | 1.63 | -8.9 |
| Agriculture | 2.16 | 2.09 | -3.4 |
| Land use, land use change and forestry | -7.16 | -8.05 | -12.4 |
| Waste | 0.31 | 0.35 | 11.4 |

* Note the percentage change calculations may not agree due to rounding.

*Table 2: Change in Tasmania's greenhouse gas emissions levels in the year to 2015-16, by sector*

# Emissions by sector

This section provides a sectoral analysis, from a Tasmanian perspective, of the greenhouse gas emissions for the five reporting sectors.

## Energy

The energy sector includes the following sub-sectors:

- *Energy industries*: includes emissions that result from the generation of electricity as well as combustion emissions from petroleum refining, oil and gas extraction and processing, coal mining and solid fuel manufacturing.
- *Manufacturing industries and construction*: includes emissions from on-site combustion of fossil fuels by the manufacturing, non-energy mining and construction sectors.
- *Transport*: includes emissions from the direct combustion of fuels in transportation by road, rail, domestic aviation and domestic shipping.
- *Other sectors*: includes emissions from the direct combustion of fuels used by the commercial, institutional and residential sectors, as well as fuel used by agricultural, fishery and forestry equipment.
- *Other*: includes all remaining fuel combustion emissions such as those from engine lubricants and greases.
- *Fugitive emissions from fuels*: includes emissions associated with the extraction and distribution of fossil fuels such as coal, oil and natural gas.
- *$CO_2$ transport and storage*: includes emissions related to carbon capture and storage (CCS). Tasmania does not currently have any CCS projects operating.

The contribution of these sub-sectors to Tasmania's energy sector greenhouse gas emissions is shown in Table 3 and Figure 3.

The emissions associated with electricity generated in Victoria and imported into Tasmania via Basslink are not included in Tasmania's inventory; but rather are included in the emissions estimates for Victoria.

In 2015-16, the transport sub-sector continued to be the largest contributor to emissions from the energy sector, increasing by 8 per cent since 1989-90. However, emissions have declined by almost 18 per cent from a peak in 2008, despite an additional 80,039 vehicle registrations over this period,[5] indicating an increase in the fuel efficiency of vehicles.

[5] From 505,151 vehicles registered in 2008 to 585,190 in June 2016; Department of State Growth, Historical Registration & Licensing Statistics.

| Energy Sub-sector * | Greenhouse Gas Emissions (Mt $CO_2$-e) | | Change (%) |
|---|---|---|---|
| | 1990 | 2016 | |
| Energy industries | 0.57 | 0.48 | -15.3 |
| Manufacturing industries and construction | 1.00 | 1.25 | 25.4 |
| Transport | 1.58 | 1.71 | 8.5 |
| **Total** | **3.72** | **3.98** | **7.0** |

* Note the emissions from the 'other sectors' and 'fugitive emissions from fuels' sub-sectors are not available for reporting by sub-sector. However, emissions from those sub-sectors are included in the totals set out in Table 3, which are accordingly different from the sum of figures available for publication.

*Table 3: Change in Tasmania's energy sector greenhouse gas emissions between the 1989-90 baselines year and 2015-16, by sub-sector*

Table 3 shows that the energy sector produced 3.98 Mt $CO_2$-e of emissions in 2015-16 and was the State's highest emitting sector, with the various sub-sectors showing significant fluctuations in recent times. Emissions from the manufacturing industries and construction sub-sector increased by 25 per cent since the baseline year of 1989-90 to 1.25 Mt $CO_2$-e.

Despite the increase in emissions for the transport and manufacturing industries and construction sub-sectors, Tasmania's emissions from the energy sector overall are relatively low compared with other Australian jurisdictions, given the State's high levels of renewable hydro-electric and wind generation.

There was a notable increase in emissions for the energy industries sub-sector in 2015-16 compared to the previous year, despite a decrease in this sub-sector in recent years due largely to reduced operation of the Tamar Valley Power Station (shown in Figure 3). During the electricity supply challenges in 2015-16, including the Basslink outage, Hydro Tasmania imported a number of portable diesel generators and recommissioned the Tamar Valley Power Station to meet Tasmania's electricity demand. The diesel generators produced approximately 55 gigawatt hours of electricity into the Tasmanian grid and were decommissioned by 30 June 2016.[6]

[6] Office of the Tasmanian Economic Regulator, Energy in Tasmania – Performance Report 2015-16 (December 2016), page 4.

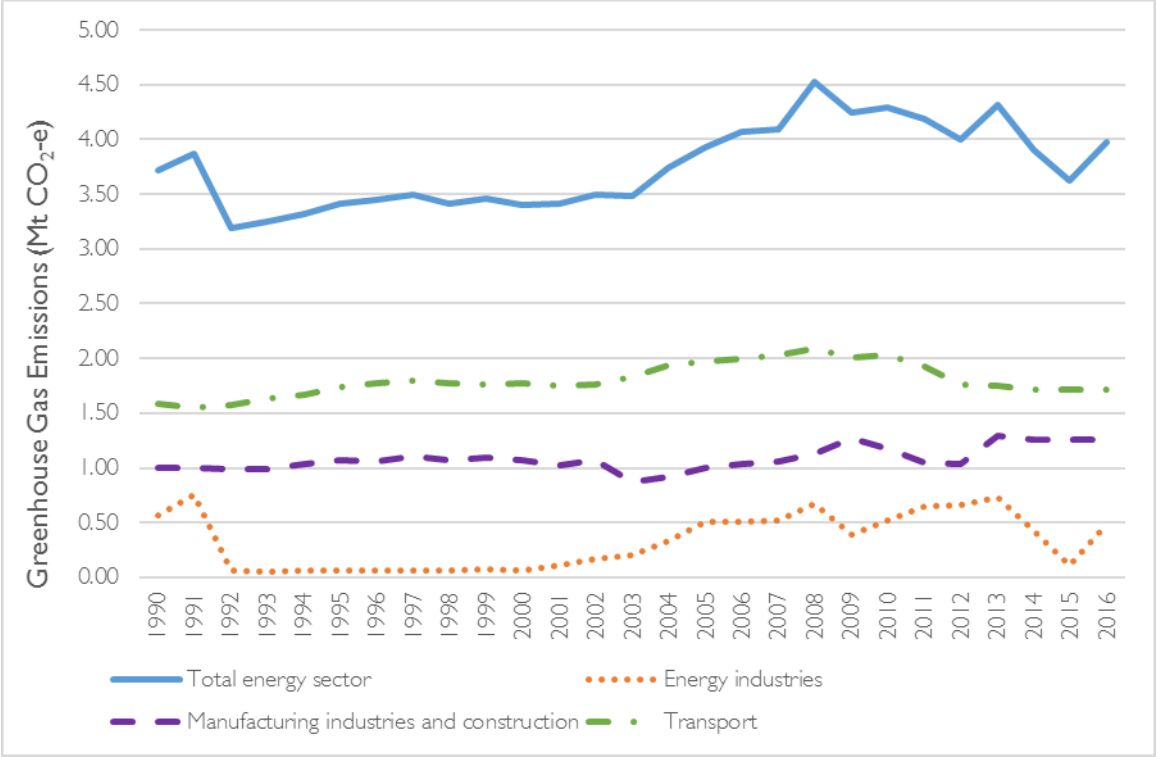


*Figure 3: Tasmania's energy sector greenhouse gas emissions from the 1989-90 baseline year to 2015-16, by sub-sector*

## Industrial processes and product use

The industrial processes and product use sector includes the following subsectors:

- *Mineral industry*: includes emissions that result from mineral processing industries, such as cement, lime, glass and limestone production and road paving with asphalt.
- *Chemical industry*: includes emissions from chemical production industries, such as soda ash and ammonia.
- *Metal industry*: includes emissions from the metal processing industries, such as aluminium, steel, iron and zinc production.
- *Non-energy products from fuels and solvents use*: includes emissions from production of lubricants, greases and solvents.
- *Electronics industry*: includes emissions from manufacture of integrated circuitry, semiconductors and photovoltaics.
- *Product uses as substitutes for ozone depleting substances (ODS):* includes emissions from synthetic halocarbons used in refrigeration, air-conditioning, foam blowing, fire protection and aerosols.
- *Other product manufacture and use*: includes emissions associated with the manufacture of other electrical equipment and compounds such as nitrous oxide, sulphur hexafluoride and perfluorocarbons.

- *Other*: includes emissions related to food and beverage industries, including the processing of meat, milk products and salmon, and the manufacture of beer, wine and alcoholic spirits. [7]

The contribution of these sub-sectors to Tasmania's industrial processes and product use sector greenhouse gas emissions is shown in Table 4 and Figure 4.

Despite an increase from the baseline year by almost 16 per cent in 2014-15, greenhouse gas emissions from the industrial processes and product use sector have shown a correction in 2015-16 and have only increased by around 4 per cent since 1989-90 as shown in Table 4.

| Industrial Processes & Product Use Sub-sector * | Greenhouse Gas Emissions (Mt $CO_2$-e) | | Change (%) |
|---|---|---|---|
| | 1990 | 2016 | |
| Mineral industry | 0.58 | 0.67 | 16.5 |
| Non-energy products from fuels and solvents use | 0.01 | 0.00 | -66.3 |
| Product uses as substitutes for ozone depleting substances | - | 0.28 | - |
| Other product manufacture and use | 0.01 | 0.00 | -39.0 |
| Other (food and beverage) | 0.97 | 0.68 | -30.1 |
| **Total** | **1.57** | **1.63** | **4.1** |

* Note the emissions from the chemical industry, metal industry and electronics industry sub-sectors are not available for reporting by individual sub-sector. However, emissions from those sub-sectors are included in the totals set out in Table 4. Note also that some total emissions and percentage change calculations may not agree due to rounding.

*Table 4: Change in Tasmania's industrial processes and product use sector greenhouse gas emissions between the 1989-90 baseline and 2015-16, by sub-sector*

Figure 4 shows that emissions from the mineral industry sub-sector have remained relatively steady since 1989-90, despite a peak of 0.71 Mt $CO_2$-e in 2014-15, while the emissions from product uses as substitutes for ozone depleting substances have increased steadily since the mid-1990s and the introduction of the Montreal Protocol.

[7] AgriGrowth Tasmania notes developments in the food and beverage industries through its annual Agri-Food ScoreCard.

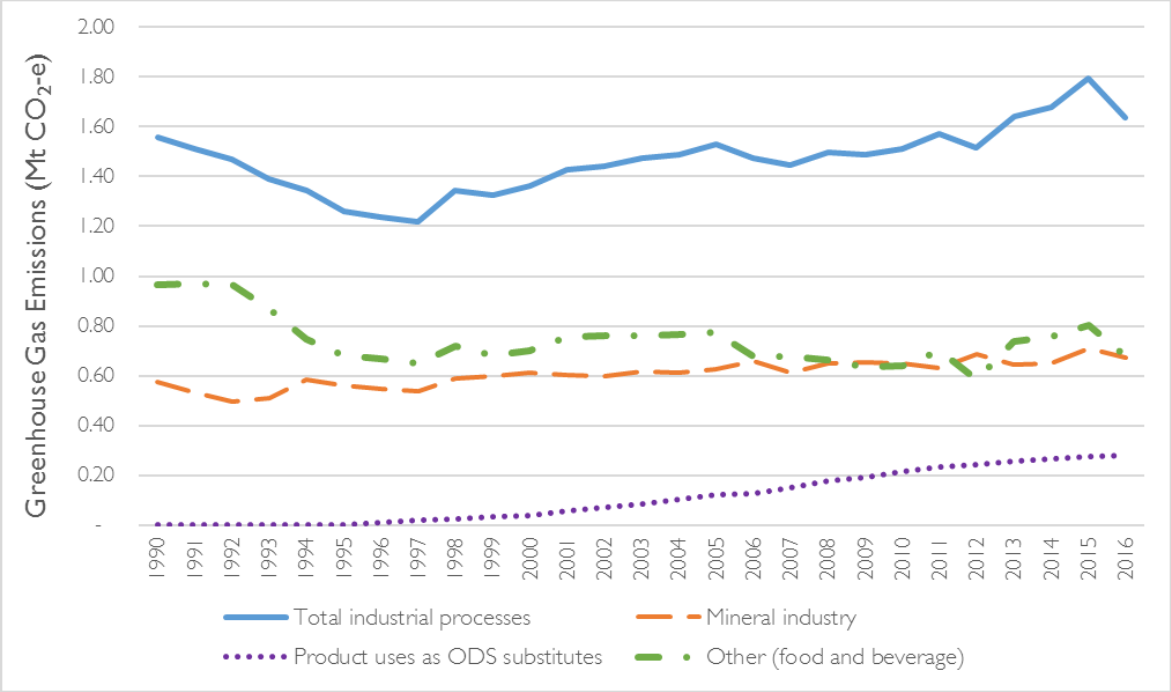


*Figure 4: Tasmania's industrial processes and product use sector greenhouse gas emissions from the 1989-90 baseline year to 2015-16, by sub-sector*

## Agriculture

The agriculture sector includes the following subsectors:

- *Enteric fermentation*: includes emissions from the digestive processes of ruminant animals such as cows, sheep, pigs and goats.
- *Manure management*: includes emissions from the decomposition of organic matter in manure under anaerobic conditions.
- *Rice cultivation:* includes emissions during rice growing from the decomposition of plant residues and other organic carbon material in the soil.
- *Agricultural soils*: includes emissions from microbial and chemical transformations that produce and consume nitrous oxide in the soil.
- *Liming*: includes carbon dioxide emissions from the addition of limestone and dolomite to the soil to improve soil quality and plant growth.
- *Urea application*: includes the loss of carbon dioxide from the addition of urea-based fertilisers to the soil.
- *Other carbon containing fertilisers*: includes the loss of carbon dioxide from the addition of other carbon-based fertilisers to the soil.
- *Other*: includes emissions from other sources of agricultural practices.

The agriculture sector includes emissions of methane and nitrous oxide only (that is, non-carbon dioxide gases) from livestock, crops, and agricultural and forest soils, and the emissions of carbon dioxide from the application of carbon-containing soil additives.

Tasmania's emissions from the various agriculture sub-sectors for the baseline year 1989-90 and 2015-16 are shown in Table 5.

| Agriculture Sub-sector | Greenhouse Gas Emissions (Mt $CO_2$-e) | | Change (%) |
|---|---|---|---|
| | 1990 | 2016 | |
| Enteric fermentation | 1.88 | 1.54 | -17.9 |
| Manure management | 0.05 | 0.09 | 81.9 |
| Agricultural soils | 0.36 | 0.40 | 10.3 |
| Liming | 0.02 | 0.03 | 46.8 |
| Urea application | 0.01 | 0.04 | 245.7 |
| **Total** | **2.32** | **2.09** | **-9.8** |

Note that some total emissions and percentage change calculations may not agree due to rounding.

*Table 5: Change in Tasmania's agriculture sector greenhouse gas emissions between the 1989-90 baseline year and 2015-16, by sub-sector*

Emissions from Tasmania's agricultural sector have declined by around 10 per cent since 1989-90. In 2016, the majority of emissions from the agriculture sector can be attributed to enteric fermentation, which takes place in the digestive system of cattle, sheep, pigs and goats. The impact that the enteric fermentation sub-sector has on total emissions from the agriculture sector is demonstrated in Figure 5.

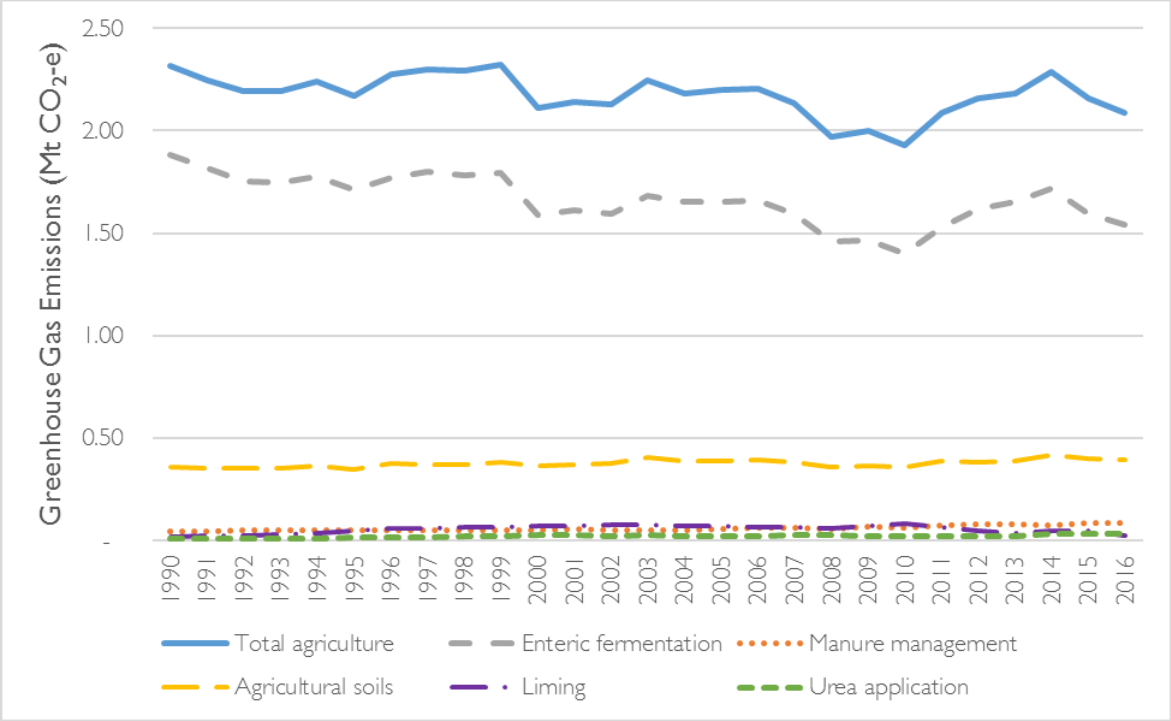


*Figure 5: Tasmania's agriculture sector greenhouse gas emissions from the 1989-90 baseline year to 2014-16, by sub-sector*

Reported emissions from Tasmania's agricultural sector is subject to fluctuation and is affected by a combination of factors including: the number of dairy and beef cattle, sheep and pigs; and the number of lot-fed and pasture-fed animals. Figure 6 shows that the recent decline in sheep and cattle numbers have been the most likely driver of decreasing emissions from the sector.

Seasonal variability also affects emissions in the agricultural sector by impacting farming practices and the quantity and quality of feed for livestock. 2015-16 was a challenging year for our farmers, as Tasmania experienced a number of extreme weather events including: a prolonged dry period with record low rainfall early in the year; the worst statewide flooding in 40 years occurred late in the year; and snowfall to low elevations in some areas.

The agricultural soils sub-sector produces the second highest emissions in Tasmania and includes emissions of nitrous oxide ($N_2O$) from soils, which are added to the soil through processes including the application of nitrogen fertilisers, crop residues or animal wastes and sewage sludge to pastures, and mineralisation due to cultivation of organic soils or loss of soil carbon.

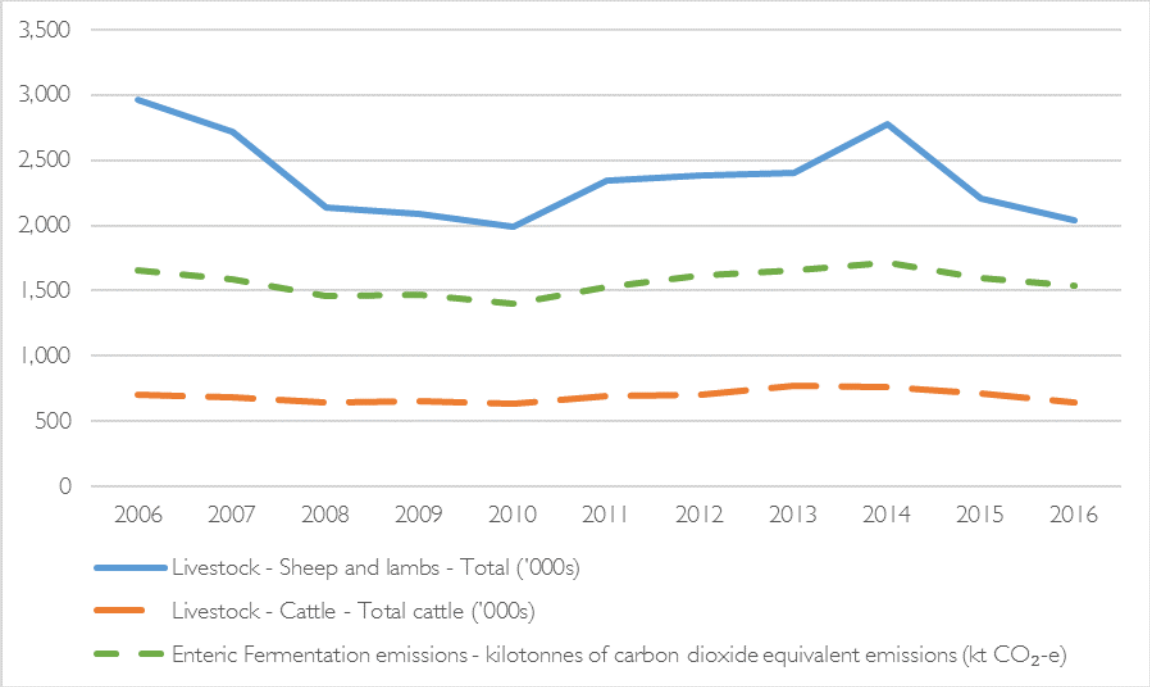


*Figure 6: Comparison of agriculture (enteric fermentation) emissions and livestock numbers ('000s)*[8]

## Land use, land use change and forestry

The Land Use, Land Use Change and Forestry (LULUCF) sector includes the following sub-sectors:

- *Forest land*: includes emissions and sinks from plantations, harvested native forests and other native forests. Emissions from fuelwood consumption, controlled burning and wildfire in forests are also included, as are sinks associated with post-fire recovery.
- *Cropland*: includes emissions and sinks from the cultivation of crops such as orchards and vineyards, and practices such as crop rotations, stubble management, tillage techniques and application of fertilisers, manures and irrigation.
- *Grassland*: includes emissions and sinks from changes in land management practices, including changes in shrub or sparse woody vegetation and disturbances such as a fire.
- *Wetlands*: includes emissions and sinks from human-induced changes in areas of sparse woody vegetation, loss of seagrass beds due to capital dredging and $N_2O$ emissions from aquaculture operations.

[8] Livestock numbers have been sourced from the Australian Bureau of Statistics, 7121.0 - Agricultural Commodities, Australia series.

- *Settlements:* includes emissions and sinks from the conversion of forest land to residential, commercial and transport infrastructure. It also includes emissions from the conversion of wetlands (tidal marsh) to settlements.
- *Harvested wood products:* includes emissions from the harvesting and manufacture of wood products and by the use and disposal of wood.

Tasmania's emissions from the LULUCF sector between 1989-90 and 2015-16 are shown in Table 6 and Figure 7.

| LULUCF Sub-sector | Greenhouse Gas Emissions (Mt $CO_2$-e) | | Change (%) |
|---|---|---|---|
| | 1990 | 2016 | |
| Forest Land | 6.20 | -9.96 | -260.7 |
| Cropland | 0.11 | 0.07 | -37.8 |
| Grassland | 4.75 | 2.06 | -56.7 |
| Wetland | 0.33 | 0.03 | -91.5 |
| Settlements | 0.07 | 0.02 | -70.7 |
| Harvested wood products | -0.63 | -0.26 | -58.1 |
| **Total** | **10.83** | **-8.05** | **-174.3** |

Note that some total emissions and percentage change calculations may not agree due to rounding.

*Table 6: Change in Tasmania's LULUCF sector greenhouse gas emissions between the 1989-90 baseline year and 2015-16, by sub-sector*

Tasmania's forest land sub-sector changed from a major source of greenhouse gas emissions at 6.2 Mt $CO_2$-e in the baseline year to become a carbon sink of -9.96 Mt $CO_2$-e in 2015-16.

The LULUCF sector has been affected by the structural change experienced by the forestry industry over the past decade. This change has resulted in annual volumes of softwood and hardwood timber harvested from both native forests and plantations declining from a peak of 7.0 million cubic metres ($m^3$) in 2007-08 to 2.4 million $m^3$ in 2012-13.[9] However, this has since increased to 4.3 million $m^3$ in 2015-16.

The emissions from harvested native forests and plantations are captured under the forest land sub-sector, shown in Figure 7 as declining from a peak in 2002-03. This decline in emissions is largely due to the regrowth and increased carbon sequestration of previously harvested forests, and offsets an increase in the volume of harvested hardwood from plantations in 2015-16, which was up 57 per cent from the previous year to around 2.0 million $m^3$.[10]

[9] Australian Bureau of Agricultural and Resource Economics (ABARES), Australian Forest and Wood Products Statistics and Sciences and Summary - Tabular data of Australian forest and wood products statistics: September and December quarters 2016 summary statistics.
[10] ABARES, Australian forest and wood products statistics September and December quarters 2016, overview report.

The *State and Territory Greenhouse Gas Inventories 2016* also reports greenhouse gas emissions from human-induced disturbances such as forest harvesting, and natural events (bushfire or drought). This is captured in the forest converted to other land uses sub-sector.

In January 2016, North and North-West Tasmania experienced multiple fires caused by dry lightning strikes, which affected approximately 20,125 hectares of the Tasmanian Wilderness World Heritage Area.[11] The impact of naturally occurring bushfires is monitored for a period of time to determine if any land use changes occur after the bushfire. Emissions from bushfires are smoothed over this monitoring period until a permanent land use is identified.

A number of factors makes it difficult to forecast the potential impact on the emissions profile of Tasmania's LULUCF sector. These include: the complexity of the methodologies and models used to estimate levels of carbon sequestration and emissions for Tasmania's public and private native forests and plantations; changing local and global markets for Tasmanian grown timber products; and impacts associated with a changing climate such as increased bushfire risk, pathogens and reduced growth from heat stress.

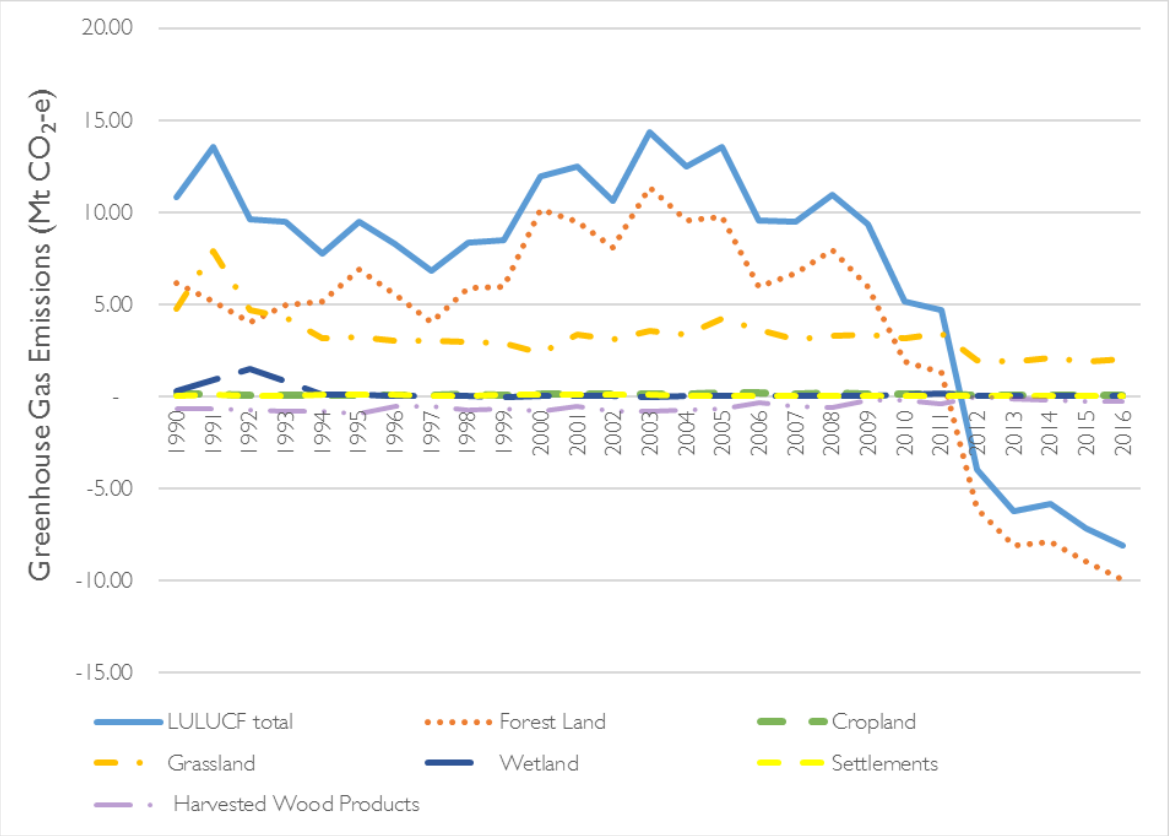


*Figure 7: Tasmania's LULUCF sector greenhouse gas emissions from the 1989-90 baseline year to 2015-16, by sub-sector*

[11] Australasian Fire and Emergency Service Authorities Council Limited, A review of the management of the Tasmanian fires of January 2016 (April 2016).

## Waste

The waste sector includes the following subsectors:

- *Solid waste disposal:* includes the emissions from the anaerobic decomposition of organic matter in landfill.
- *Biological treatment of solid waste:* includes the emissions from processes such as windrow composting and enclosed anaerobic digestion.
- *Incineration and open burning of waste:* includes the emissions from the incineration of solvents and municipal and clinical waste.
- *Wastewater treatment and discharge:* includes the emissions from the anaerobic decomposition of organic matter in wastewater and the chemical processes of nitrification and denitrification in wastewater treatment plants.

The waste sector is a minor contributor to Tasmania's total greenhouse gas emissions. In 2015-16, emissions from this sector totalled 0.35 Mt $CO_2$-e, which is a reduction of over 27 per cent since 1989-90 as shown in Table 7.

| Waste Sub-sector | Greenhouse Gas Emissions (Mt $CO_2$-e) | | Change (%) |
|---|---|---|---|
| | 1990 | 2016 | |
| Solid waste disposal | 0.31 | 0.25 | -19.5 |
| Biological treatment of solid waste | 0.00 | 0.01 | - |
| Incineration and open burning of waste | - | - | - |
| Wastewater treatment and discharge | 0.17 | 0.09 | -46.1 |
| **Total** | **0.48** | **0.35** | **-27.6** |

Note that some total emissions and percentage change calculations may not agree due to rounding.

*Table 7: Change in Tasmania's waste sector greenhouse gas emissions between the 1989-90 baseline year and 2015-16, by sub-sector*

In Tasmania, there was an increase in waste ending up in landfill from 415,443 t in 2014-15 to 427,358 t in 2015-16, of which 233,520 t was recovered through recycling and composting.[12]

Nationally, there has been a decrease in emissions from solid waste disposal, mainly due to methane recovery. Furthermore, as rates of recycling have increased, paper disposal has declined as a share of total waste disposed. In Tasmania a number of landfill sites have installed methane capture and recovery equipment for electricity production or gas flaring,

[12] Environment Protection Authority, Annual Report 2015-16, page 27.

which has contributed to the almost 20 per cent reduction in emissions from the solid waste disposal sub-sector.

In recent years, state and territory waste management policies have driven the viability of alternative waste treatment options. Changes in estimates for wastewater treatment and discharge emissions are largely driven by changes in industry production, population loads on centralised treatment systems and the amount of methane recovered for combustion or flaring.

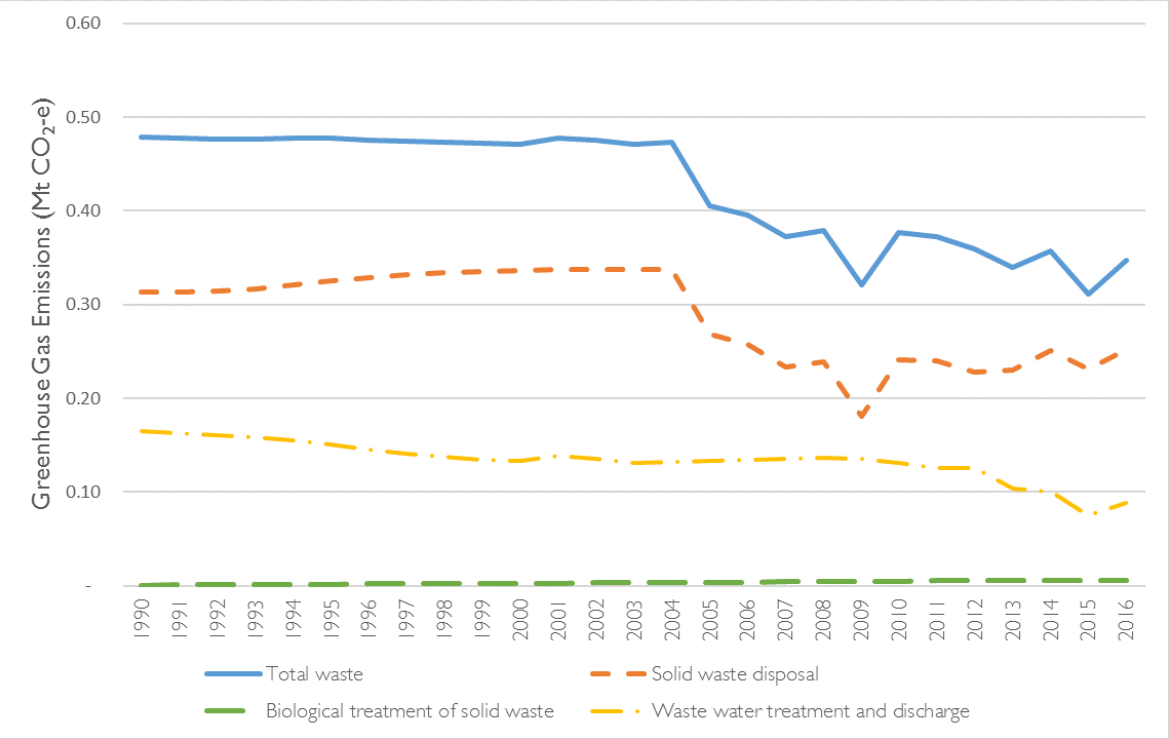


*Figure 8: Tasmania's waste sector greenhouse gas emissions from the 1989-90 baseline year to 2015-16, by sub-sector*

# Other performance measures

This section provides an overview of Tasmania's emissions against other key performance measures, including greenhouse gas emissions per capita and emissions per dollar of Gross State Product (GSP).

## Emissions per capita

Greenhouse gas emissions per capita provide a measure of average emissions, taking into account changes in population. Tasmania's per capita greenhouse gas emissions, which have fallen from a peak of 46.5 t $CO_2$-e per person in 1990-91 to -0.02 t $CO_2$-e per person in 2015-16, are shown in Figure 9.

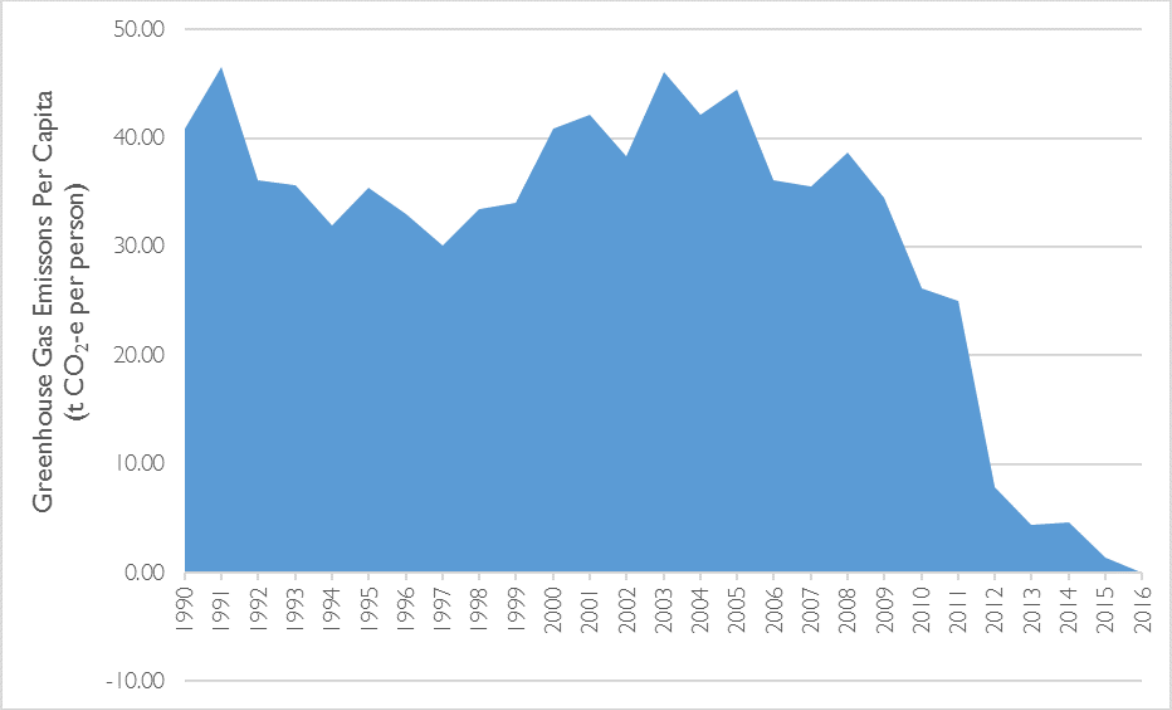


*Figure 9: Tasmania's greenhouse gas emissions per capita (t $CO_2$-e per person) from 1989-90 to 2015-16*

In 2015-16, Tasmania's greenhouse gas emissions per capita figure was the lowest of all Australian states and territories, as shown in Figure 10. The jurisdiction with the second lowest emissions per capita is the Australian Capital Territory, however, this is only a partial inventory as most of its stationary energy is generated in New South Wales and the associated emissions are included in its inventory.

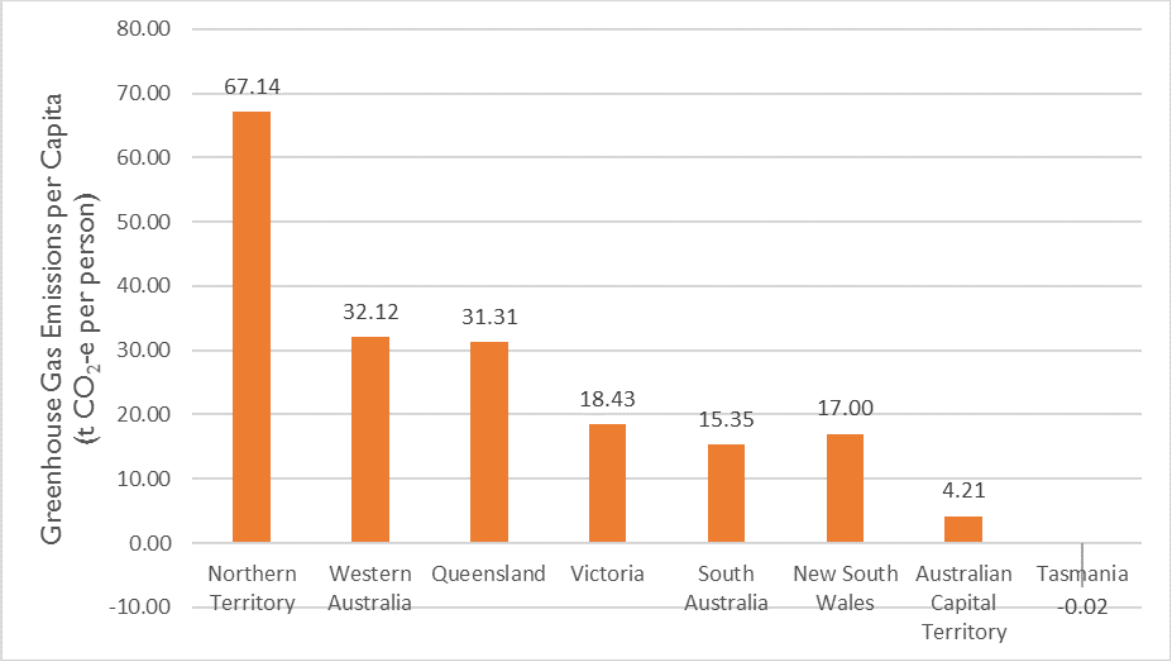


*Figure 10: Comparison of state and territory emissions per capita (t $CO_2$-e per person) in 2015-16*

## Emissions per dollar of GSP

The greenhouse gas emissions per dollar of GSP provides an indicator of the emissions intensity or productivity of the economy, and is calculated by dividing Tasmania's net greenhouse gas emissions by the value of its GSP. Since 1989-90, Tasmania's emissions (excluding LULUCF) per dollar of GSP has declined from 0.49kg $CO_2$-e per dollar of GSP, down to 0.28kg $CO_2$-e per dollar in 2015-16, as shown in Figure 11. This is despite a 72 per cent increase in GSP over the same period.

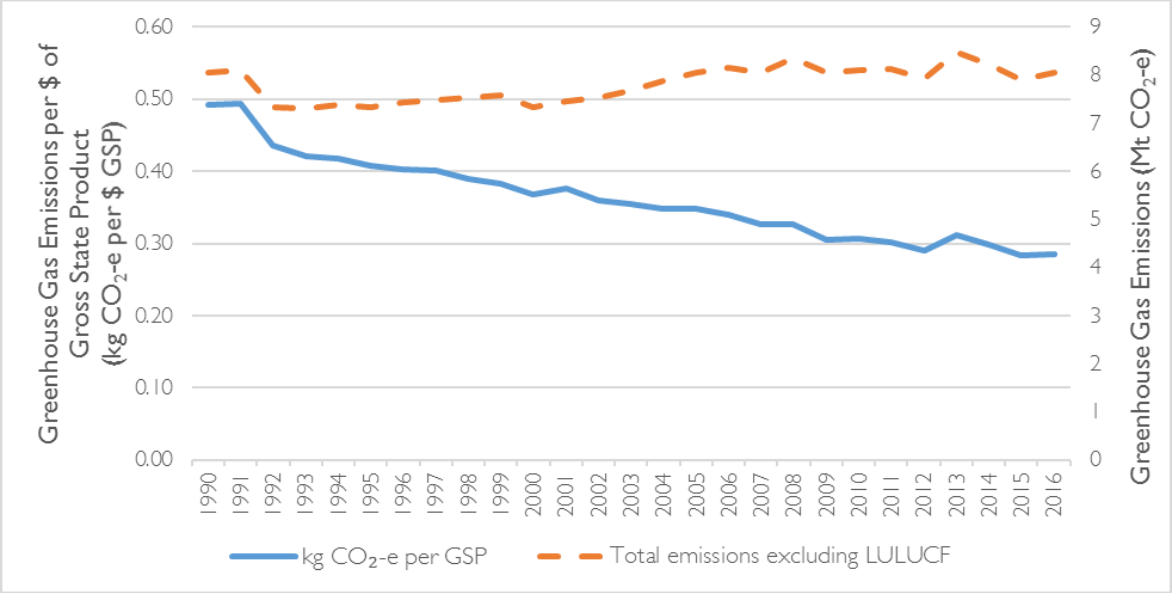


*Figure 11: Greenhouse gas emissions (excluding LULUCF) per dollar of Gross State Product (kg $CO_2$-e per $)*

# National context

This section provides a summary of contemporary national and international policy development that may affect Tasmania's greenhouse gas emissions over the coming years.

## The Paris Agreement

The Australian Government, as a party to the UNFCCC, joined almost 200 other countries in reaching a global climate agreement at the 21st Conference of the Parties in Paris in December 2015 (the Paris Agreement). The Paris Agreement, which was ratified by Australia on 9 November 2016, sets a goal to hold the average global temperature increase to well below 2 degrees Celsius.

The Paris Agreement highlights the importance of the contribution of all levels of government, including state governments, in achieving its goals. Under the Paris Agreement, the Australian Government has committed to a national emissions reduction target of 26 to 28 per cent of 2005 levels by 2030.

The *State and Territory Greenhouse Gas Inventories 2016* notes that Australia's total greenhouse gas emissions were 525.0 Mt of $CO_2$-e in 2016, or 13.7 per cent below 2005 levels. The reported estimate for Australia's total greenhouse gas emissions in 2016, excluding the LULUCF sector, is 549.2 Mt $CO_2$-e, or 5.1 per cent above 2005 levels.[13]

## National Electricity Market

Chief Scientist, Dr Alan Finkel AO, presented the Final Report of the Independent Review into the Future Security of the National Electricity Market to the Council of Australian Governments (COAG) Leaders' meeting on 9 June 2017. At the subsequent COAG Energy Council meeting of 25 August 2017, Energy Ministers agreed on the implementation of 49 of the 50 recommendations in the Finkel Review, including the establishment of the Energy Security Board.

On 17 October 2017, the Australian Government announced it would not establish a Clean Energy Target, as recommended by the Finkel Review. On the advice of the Energy Security Board, the Australian Government announced a new National Energy Guarantee (NEG) to set a reliability guarantee to deliver the appropriate level of dispatchable energy in each state and an emissions guarantee to contribute to Australia's international commitments. The reliability provisions of the NEG, currently in development, are unlikely to disadvantage Tasmania's early adoption of renewable energy.

The Tasmanian Government is a strong supporter of further renewable energy development, and has committed to make Tasmania energy self-sufficient by the end of 2022. Hydro

[13] Department of the Environment and Energy, State and Territory Greenhouse Gas Inventories 2016, pages 26-29

Tasmania, with support from the Australian Renewable Energy Agency, is working to enhance Tasmania's hydroelectric and renewable energy supply to become the *Battery of the Nation*. This includes a proposal for pumped hydro energy storage (pumped hydro) to provide reliable energy production during periods of low wind and solar generation. Furthermore, Infrastructure Australia has announced that it will add a proposal for a second Bass Strait interconnector to its priority initiative list.

## Tasmania's emissions abatement opportunities

Tasmania is benefiting from the implementation of the COAG Energy Council's energy efficiency and energy productivity programs to increase energy efficiency and ultimately reduce emissions across all sectors.

Under the Australian Government's Emissions Reduction Fund (ERF), a budget of up to $2.55 billion has been allocated to fund emissions reduction activities. Nine Tasmanian-based projects have been awarded carbon abatement contracts from six ERF auctions to date. Five of these projects reduce landfill gas emissions, and additional projects protect forests on private land; sequester carbon in long rotation plantation forests; use bio-energy to supply industrial boilers; and recover heat from industrial processes.

The ERF Safeguard Mechanism, which commenced on 1 July 2016, impacts six Tasmanian facilities. These are large emitters that are now required to keep their emissions at, or below, their reported baselines set by the Clean Energy Regulator.

The Tasmanian Climate Change Office (TCCO) is assisting with the delivery of two national energy efficiency programs that report to the COAG Energy Council; the National Energy Productivity Plan and the Energy Efficiency Advisory Team. These programs aim to improve the energy efficiency and productivity of buildings, vehicles and appliances to assist in meeting Australia's emissions reduction targets and save money for consumers.

In addition, the Tasmanian Government's *Climate Action 21: Tasmania's Climate Change Action Plan 2017-2021* (Climate Action 21), which was released in 2017, sets the agenda for action on climate change through to 2021. Climate Action 21 includes practical actions to reduce emissions from Tasmania's transport and agriculture sectors and articulates how Tasmania will play its role in the global response to climate change.

A key priority under Climate Action 21 is to reduce Tasmania's transport emissions and operating costs by supporting the uptake of electric vehicles, including the rollout of a statewide electric vehicle charging network, and improving fleet efficiency through the Smarter Fleets Program.

At the national level, the Ministerial Forum on Vehicle Emissions coordinates a whole-of-government approach to address vehicle emissions, examining issues such as vehicle emissions standards, fuel quality, fuel efficiency standards, and emissions testing for vehicles in accordance with international guidelines.

To reduce emissions in the agriculture sector, TCCO is providing support to DairyTas to deliver the Fert$mart Program to Tasmanian dairy farms. The Program assists farmers to improve the efficiency of their fertiliser and irrigation practices.[14]

[14] Further information on Climate Action 21 can be found on the Tasmanian Climate Change Office website: www.climatechange.tas.gov.au

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