



**Australian Government**

**Australian Bureau of Agricultural and  
Resource Economics and Sciences**



# **Energy update 2011**

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# Energy update 2011

## Australian energy production, consumption and trade, 1973–74 to 2009–10

- This update of the Australian Energy Statistics (AES) represents a major step forward in the development of energy statistics in Australia. For the first time, the AES draws on National Greenhouse and Energy Reporting (NGER) data as the primary source of energy consumption data, providing better industry-level coverage of energy use in Australia.
- Partly reflecting stronger economic growth in 2009–10 compared with the previous year, Australia's total primary energy supply, the equivalent of total energy consumption, increased by 1.1 per cent in 2009–10 to 5945 petajoules.
- Total final energy consumption in Australia grew by 1.4 per cent during the year to 3703 petajoules.
- The main drivers of higher final energy consumption during 2009–10 were the manufacturing and transport sectors. Final energy use in the residential sector grew moderately, while energy consumption in the commercial and mining sectors was largely unchanged.
- In energy content terms, renewable energy (excluding biomass) recorded the strongest consumption growth in 2009–10 at 17.1 per cent, followed by gas consumption, which grew by 4.5 per cent. In contrast, coal consumption declined by 1.9 per cent.
- Australia's energy production, in energy content terms, declined by 3 per cent in 2009–10 to 17 282 petajoules, driven largely by a fall in uranium oxide production.
- Total electricity generation declined by 1.2 per cent to 241 566 gigawatt hours in 2009–10, as a fall in generation from combustible fuels (including coal, oil products and bioenergy) more than offset an increase in generation from renewable sources (including wind, hydro and solar).
- In energy content terms, Australia's energy exports declined by 0.7 per cent to 13 710 petajoules in 2009–10, as a fall in uranium oxide exports more than offset strong growth in coal and liquefied natural gas (LNG) exports.

## Methodology and coverage

This year's *Energy update* reflects the addition of 2009–10 estimates, and historical revisions, to ABARES Australian Energy Statistics (AES), which can be found at [www.abares.gov.au/publications\\_remote\\_content/publication\\_series/australian\\_energy\\_statistics](http://www.abares.gov.au/publications_remote_content/publication_series/australian_energy_statistics).

Several major changes were made for this release of the AES.

Firstly, National Greenhouse and Energy Reporting (NGER) data, sourced from the Australian Government Department of Climate Change and Energy Efficiency, have been adopted as the main energy consumption data source for the AES. Previously, the construction of

ABARES historical energy statistics was based on the voluntary Fuel and Electricity Survey (FES), conducted in the second half of each year. With the introduction of NGER, survey year 2008–09 became the final year that the FES was conducted. For survey year 2009–10, NGER data have been used as the primary source of energy consumption data. Revisions were made to 2008–09 AES statistics to incorporate NGER data where appropriate.

Secondly, total final energy consumption (TFEC) estimates have been presented in this publication for the first time. The two most recent years (2008–09 and 2009–10) of TFEC estimates have been prepared for this update; however, backward extensions to this time series will be developed on an ongoing basis.

The move to replace the FES with NGER data is expected to result in a more accurate representation of energy consumption in Australia through the AES. Mandatory NGER reporting for entities consuming over a defined threshold of energy is likely to improve the estimates of energy use for many industries that the FES was unable to adequately survey. However, as with the FES, aggregate NGER data represent only a subset of total Australian energy use, as the majority of Australian businesses are small or medium consumers of energy.

In undertaking the AES, NGER data were supplemented with information from other Australian Government agencies, state-based agencies and industry associations. As in the past, in sectors with low or no NGER coverage (commercial and services, agriculture and residential), energy consumption was estimated using the energy balance process and other estimation techniques.

Thirdly, the 2006 Australian and New Zealand Standard Industrial Classification (ANZSIC) standards to categorise industry have been incorporated into the AES for the first time. These replace the 1993 ANZSIC classifications that had been used previously, and improve the AES as a resource comparable with other Australian Government industry-specific information.

Finally, in this *Energy update*, new information has been presented on electricity generation in Australia. While previously only aggregate electricity generation, by state, had been reported, the AES now additionally presents a series of national electricity generation by the type of fuel used.

More information on these changes can be found in appendix A.

The ABARES energy database provides detailed energy consumption and production statistics, by state and by fuel, at an industry-specific level. The most detailed sub-sectoral coverage is provided in the energy-intensive manufacturing sectors and for Australia as a whole. In some cases, particularly at the state level, specific industry detail is not able to be released for confidentiality reasons. The overview tables include industry-specific detail, but at an adequate level of aggregation that allows publication.

The general methodology used in the AES is the process of balancing energy consumption with production and trade, where much of the production and trade data is sourced independently. The check for internal consistency is an important component of the AES and ensures that the estimates of energy consumption at an aggregate level are as accurate as possible.

## Energy consumption by fuel

Australia's total primary energy supply is estimated to have increased by 1.1 per cent to 5945 petajoules in 2009–10. Total primary energy supply can be seen as a proxy for the total amount of energy consumed in the Australian economy.

In 2009–10, black and brown coal remained the dominant fuel sources in the Australian energy mix at around 37 per cent. The share of gas rose by 1 percentage point to 23 per cent, while the share of coal fell by 1 percentage point to 38 per cent, mainly reflecting some substitution between these fuels within the electricity generation sector in 2009–10. Oil consumption increased by 2.5 per cent, associated with higher use in the transport sector, the non-ferrous metals industry within the manufacturing sector, and the mining sector. The share of renewable energy consumed remained steady at 5 per cent of the total energy mix in 2009–10 (table 1, figure 1).

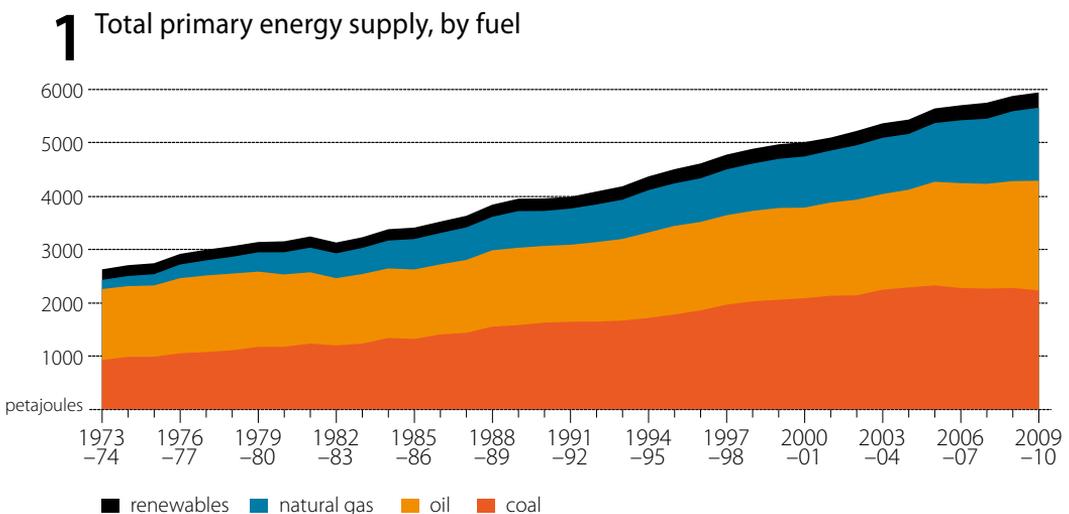
### Box 1 Defining energy consumption

In this update, three different definitions of energy consumption are used—total primary energy supply (TPES), total final energy consumption (TFEC) and total net energy consumption.

TPES is a measure of the total energy supplied within the economy. It is equal to indigenous production plus imports minus exports, plus stock changes and statistical discrepancies. TPES includes the supply of both primary and secondary fuels.

TFEC is the energy used by the final or 'end-use' sectors, and can be seen as a subset of total energy supplied. TFEC includes all energy consumed, except for the consumption of energy that is used to convert or transform primary energy into different forms of energy. For example, refinery feedstock that is used to produce petroleum products and fuels consumed in the generation of electricity are both excluded from TFEC.

Total net energy consumption is equal to the consumption of all fuels minus the derived fuels produced within the economy. For this update, this term is most useful when describing total energy consumed at an industry or regional level.



## 1 Total primary energy supply, by fuel

	2009–10		growth		share %
	PJ	2009–10 %	2009–10 %	5-year average annual growth %	
Coal	2 229	-1.9		-0.5	37.5
Oil	2 058	2.5		2.3	34.6
Gas	1 372	4.5		5.6	23.1
Renewables	286	-0.3		1.1	4.8
Total	5 945	1.1		1.8	100.0

PJ = petajoules.

In energy content terms, renewable energy (excluding biomass) recorded consumption growth in 2009–10 of 17.1 per cent. Of the renewable energy sources, solar energy and wind energy grew strongly, each by around 26 per cent, although from a relatively low base (table 2). Hydroelectricity

## 2 Total primary energy supply, by renewable energy source

	2009–10		growth	
	PJ	2009–10 %	2009–10 %	2009–10 %
Biogas/biofuels	21		14.0	
Hydro	45		13.3	
Wind	17		26.0	
Solar	11		26.2	
Biomass	192		-7.1	
Total	286		-0.3	

PJ = petajoules.

increased by 13.3 per cent, reflecting higher rainfall in south-eastern Australia than in 2008–09. However, a decline of 7.1 per cent in biomass consumption offset these increases, causing total renewable energy consumption to remain largely unchanged at 286 petajoules in 2009–10. This decline in biomass consumption resulted from a fall in the use of bagasse for electricity generation by sugar manufacturers in Queensland and New South Wales.

## Energy consumption by sector

Australia's total final energy consumption is estimated to have increased by 1.4 per cent to 3703 petajoules in 2009–10 (table 3). The manufacturing sector contributed most to this growth, where consumption grew by 2.9 per cent to 1036 petajoules. Within this sector, following a sharp downturn in steelmaking in 2008–09 that reflected weak global demand, production in the energy-intensive iron and steel industry grew by 25 per cent in 2009–10. Final energy consumption also grew in the chemicals industry (up 8 per cent to 228 petajoules) and the wood, paper and printing industry (up 5 per cent to 77 petajoules).

In the transport sector, total final energy consumption increased in 2009–10 by 0.9 per cent to 1416 petajoules, largely reflecting an increase in the fuels used in the air transport sector. Total final energy consumption also increased in the residential sector by 1.2 per cent to 440 petajoules.

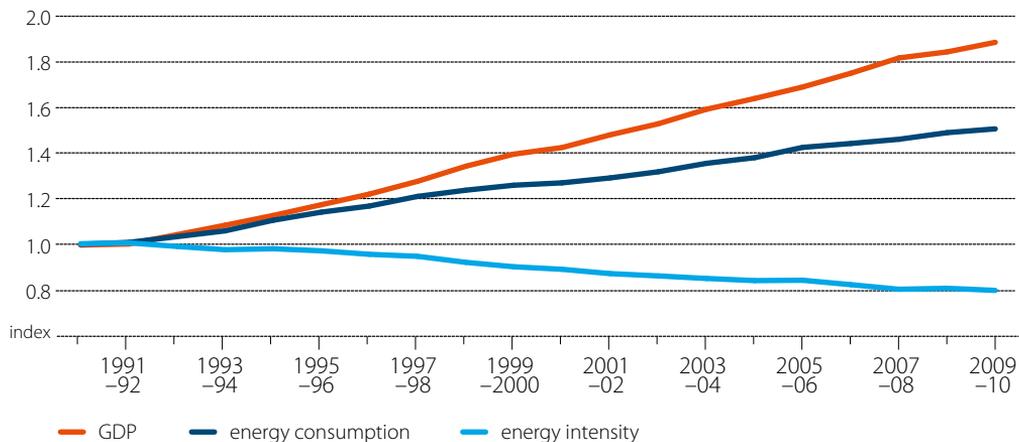
### 3 Australia's total final energy consumption, by sector

	2008–09	2009–10	growth 2009–10	share 2009–10
	PJ	PJ	%	%
Mining	341	340	-0.4	9.2
Manufacturing and construction	1 007	1 036	2.9	28.0
Transport	1 404	1 416	0.9	38.2
Commercial	310	309	-0.2	8.3
Residential	435	440	1.2	11.9
Other	157	162	3.2	4.4
<b>Total</b>	<b>3 653</b>	<b>3 703</b>	<b>1.4</b>	<b>100.0</b>

PJ = petajoules.

Since the early 1990s, growth in energy consumption has generally remained below the rate of economic growth. This indicates a longer-term decline in the ratio of energy use to activity in the Australian economy (energy intensity), which can be attributed to two main factors: improvements in energy efficiency associated with technological advancement; and a shift in industry structure toward less energy-intensive sectors such as commercial and services. In 2009–10, energy intensity as defined as the ratio of total primary energy supply to gross domestic product (GDP) declined by around 1.1 per cent (figure 2).

### 2 Intensity of Australian energy consumption



### Energy consumption by region

Energy consumption across Australia's states and territories largely reflects the industry structure of each jurisdiction. Shifts in the composition of Australian industry from energy-intensive manufacturing to less energy-intensive services over several decades, combined with the energy requirements associated with the more recent mining boom, have led to changing trends in regional energy consumption growth.

Total net energy consumption in 2009–10 increased by 3.4 per cent in New South Wales. This increase largely reflected greater energy use in the iron and steel industry, the petroleum refining sector, the aviation industry, and the non-ferrous metal sector.

## 4 Australia's total net energy consumption, by region

	2008–09		2009–10	
	PJ	growth %	PJ	share %
New South Wales	1 648	3.4	1 714	27.7
Victoria	1 406	-0.6	1 400	23.6
Queensland	1 301	-1.1	1 288	21.9
South Australia	348	0.0	348	5.9
Western Australia	1 026	3.1	1 068	17.3
Tasmania	110	0.3	111	1.8
Northern Territory	107	3.6	112	1.8
<b>Total</b>	<b>5 945</b>	<b>1.1</b>	<b>6 052</b>	<b>100.0</b>

PJ = petajoules.

Total net energy consumption increased in Western Australia and the Northern Territory by 3.1 per cent and 3.6 per cent, respectively. The main driver of these increases was higher consumption of natural gas in LNG processing.

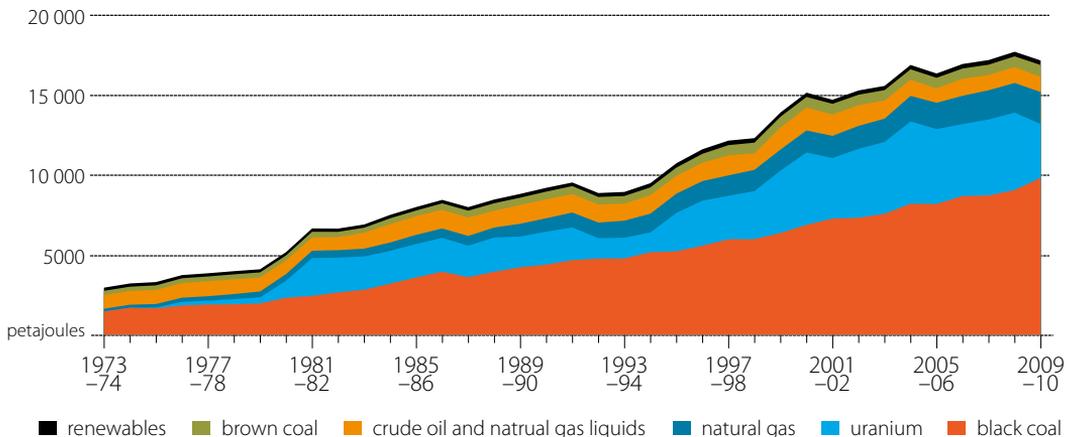
Total net energy consumption in Queensland fell by around 1 per cent to 1301 petajoules as energy consumption fell in the petroleum refining and electricity supply industries (table 4).

## Production and trade

In 2009–10, Australia produced 17 282 petajoules of primary energy, three times more than was consumed domestically.

Energy production fell by 3.0 per cent in 2009–10, mainly as a result of a 30.6 per cent fall in uranium oxide production. This fall largely resulted from the suspension of BHP Billiton's

## 3 Australian energy production



Olympic Dam operation following the closure of the main haulage shaft in late 2009 resulting in lower production over three quarters.

The energy associated with the combined production of Australian crude oil, condensate and liquefied petroleum gas (LPG) also fell by 4.2 per cent during 2009–10. The decline in energy produced partly reflects lower output from the Woollybutt and Stybarrow oilfields associated with scheduled maintenance and extensive flooding in the Cooper Basin.

Partly offsetting these falls was increased energy production from coal (up 8.6 per cent to 10 571 petajoules) and gas (up 8.2 per cent to 2005 petajoules). The increase in energy from coal largely came from increased coal production as a result of the completion of several coal mines, including New Hope Coal's New Acland and Whitehaven's Rocglen. The growth in energy from gas was supported by the start-up of the Blacktip and Henry fields and increased output of coal seam gas in south-east Queensland (figure 3, table 5).

## 5 Australian energy production, by fuel

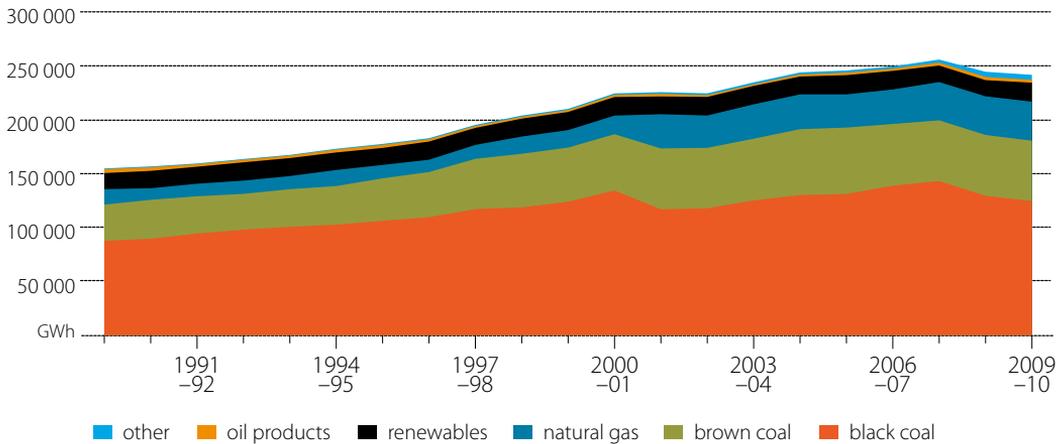
	2009–10	2009–10	growth	share
	PJ	%	5-year average annual growth	%
			%	
Black coal	9 827	8.4	3.7	56.9
Brown coal	744	11.2	2.5	4.3
Renewables	286	-0.3	1.0	1.7
Crude oil and natural gas liquids	1 057	-4.2	-1.4	6.1
Gas	2 005	8.2	4.7	11.6
Uranium	3 363	-30.6	-8.2	19.5
Total	17 282	-3.0	0.3	100.0

PJ = petajoules.

In 2009–10, total electricity generated in Australia declined by 1.2 per cent to 241 566 gigawatt hours (870 petajoules). The main drivers of this decline were falls in generation from combustible fuels, including coal (down 2.9 per cent), oil products (down 11.6 per cent) and bioenergy (down 9.1 per cent). An unusually warm period during the September quarter of 2009–10 temporarily reduced demand for electricity, resulting in lower electricity output for the year as a whole.

While comprising a small share of overall electricity generation, increasing generation from renewable sources such as wind, hydro and solar energy partially offset the decline in generation from combustible fuels. Estimated electricity generation from wind and solar energy increased significantly in 2009–10, by 26.0 per cent and 78.2 per cent, respectively (figure 4, table 6). The strong growth from solar energy was largely a result of government policies encouraging increased uptake of solar photovoltaics in the residential sector.

## 4 Australian electricity production, by fuel



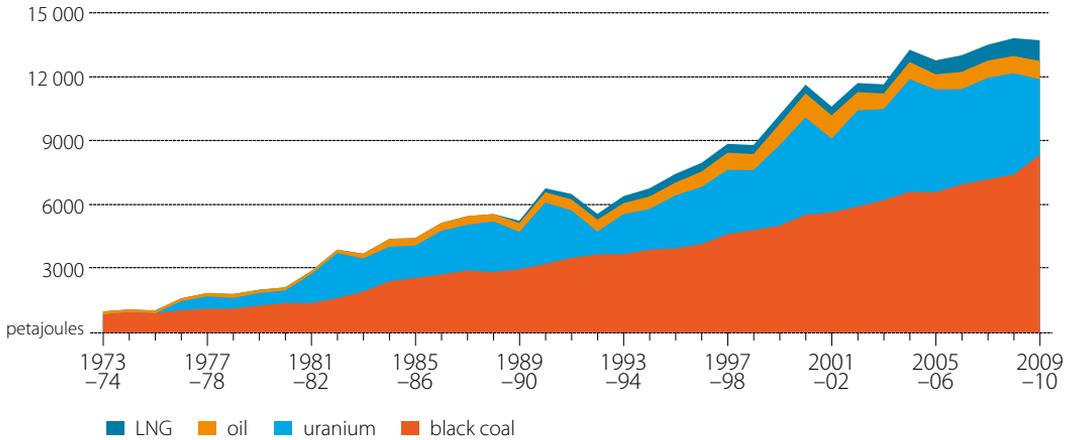
## 6 Australian electricity production, by fuel

	2009–10 GWh	2009–10 %	growth		share %
			5-year average annual growth %		
<b>Fossil fuels</b>					
Black coal	124 478	-3.7	-0.9		51.5
Brown coal	55 968	-0.9	-1.8		23.2
Gas	36 223	1.0	2.3		15.0
Oil	2 691	-11.6	6.8		1.1
Other	2 496	4.2	na		1.0
<b>Renewable energy</b>					
Bioenergy	2 113	-9.1	2.4		0.9
Wind	4 798	26.0	40.2		2.0
Hydro	12 522	13.3	-4.3		5.2
Solar PV	278	78.2	25.2		0.1
<b>Total</b>	<b>241 566</b>	<b>-1.2</b>	<b>-0.2</b>		<b>100.0</b>

GWh = gigawatt hours.

In energy content terms, Australia's energy exports declined by 0.7 per cent to 13 710 petajoules in 2009–10, largely reflecting lower exports of uranium oxide associated with lower production as a result of the outage at Olympic Dam. Largely offsetting this, LNG and coal exports grew strongly, by 15.9 per cent and 12.4 per cent, respectively. In energy content terms, coal exports accounted for 61 per cent of Australia's energy exports in 2009–10 (8327 petajoules), while uranium accounted for around one-quarter (3551 petajoules). Higher exports of coal and LNG were supported by increased demand from Asia, particularly China and India, where economic growth was relatively strong during the year (figure 5, table 7).

## 5 Australian energy exports



## 7 Australian energy exports, by fuel

	2009–10 PJ	2009–10 %	growth		share %
			5-year average annual growth %		
Coal	8 327	12.4	4.8		60.7
Oil <sup>a</sup>	860	6.5	1.3		6.3
LNG	972	15.9	11.0		7.1
Uranium	3 551	-25.3	-7.7		25.9
Total	13 710	-0.7	1.3		100.0

<sup>a</sup> includes crude oil, natural gas liquids and petroleum products. PJ = petajoules.

Australia is a net importer of liquid hydrocarbons, including crude oil, and most petroleum products. In 2009–10, Australia exported around 860 petajoules of liquid fuels (excluding LNG but including international bunkers) and imported around 1800 petajoules. Net imports rose by 7.9 per cent in 2009–10 as the increase in imports of liquid fuels more than offset the increase in exports.

# A Changes to the Australian Energy Statistics methodology and structure

The 2011 edition of the *Energy update* reflects several changes made to the methodology and structure used in the Australian Energy Statistics (AES) database. The changes were made to incorporate three main developments:

1. new primary source data
2. new energy statistics definitions
3. new industry classifications.

This appendix provides an explanation of these changes and the effect of the changes on the AES.

## 1. New primary source data

Historically, the construction of ABARES historical statistics was based on the voluntary Fuel and Electricity Survey (FES), conducted in the second half of the year. With the establishment of a mandatory system of National Greenhouse and Energy Reporting (NGER), the FES ceased, with the final collection covering the 2008–09 reporting year. From the 2009–10 reporting year onwards, the NGER will be used as the primary source of data underlying the AES.

Under the *National Greenhouse and Energy Reporting Act 2007*, businesses that consume and/or produce above a minimum level of energy are subject to mandatory reporting requirements. These thresholds, summarised in table A1, are designed to include all large energy consuming entities in the Australian economy to cover most of Australia's energy consumption and production. Small and medium businesses with energy consumption or production less than these thresholds will therefore be excluded from the NGER. Nevertheless, it is well understood that a relatively small proportion of the total number of Australian businesses account for the great proportion of Australia's total energy use and that these large, energy-intensive businesses will be captured by the NGER data.

The shift to the NGER as the primary energy data source has raised concerns about AES data continuity and the need to ensure that current levels of coverage and quality are maintained (and potentially improved). The mandatory nature of the NGER, compared with the voluntary FES, has resulted in good quality data being obtained from large and medium sized energy users and producers.

# A1 NGER reporting thresholds

year	emissions	energy
<b>Controlling corporations a</b>		
2008–09	125 000 tonnes carbon dioxide equivalent	500 terajoules consumption/production
2009–10	87 500 tonnes carbon dioxide equivalent	350 terajoules consumption/production
2010–11 on	50 000 tonnes carbon dioxide equivalent	200 terajoules consumption/production
<b>Facilities b</b>		
All years	25 000 tonnes carbon dioxide equivalent	100 terajoules consumption/production

**a** If a business breaks the controlling corporation threshold, it must report its energy consumption, production and/or emissions data for each facility under its control. **b** If a business does not break the controlling corporation threshold, but one of the facilities under its control breaks the facility threshold, that business is required to report for that facility only.

Source: Department of Climate Change and Energy Efficiency

When constructing the AES, in some sectors—for example, mining and non-ferrous metals—where NGER coverage is almost complete, it was possible to use the NGER as the predominate source of information for the AES. For most industry sectors, while coverage is greatly improved from that obtained using the FES, substantial estimation continues to be required to determine state-based and national industry energy consumption aggregates. In other sectors, including agriculture, commercial and services, and residential, it was necessary to continue to rely mainly on other estimation techniques, including regression analysis.

## 2. New energy statistics definitions

The 2011 edition of the AES incorporates several new definitions, which have been introduced to better align the AES with the framework used by the International Energy Agency (IEA). The energy statistics definitions that are now used in the AES are detailed below.

### *Definitions now used in the AES*

**Primary fuels:** The forms of energy obtained directly from nature, involving only the extraction or collection of the energy source. They include non-renewable fuels such as coal, ethane and methane, crude oil and condensate, naturally occurring liquefied petroleum gas (LPG) and uranium; and renewable fuels such as wood, bagasse, landfill gas, hydroelectricity, wind energy and solar energy.

**Secondary fuels:** The forms of energy that result from transforming primary fuels. They include electricity, petroleum products, LPG produced in refineries and liquid biofuels produced through the transformation of agricultural or waste feedstocks.

**Total primary energy supply (TPES):** A measure of the total energy supplied within the economy. It is equal to indigenous production plus imports minus exports, plus stock changes and statistical discrepancies. TPES includes both primary and secondary fuels (figure A1).

## A1 Total primary energy supply



**Total net energy consumption:** A measure of the total energy used within the economy. At an aggregate level, total net energy consumption is equivalent to total primary energy supply.

It is equal to consumption of all fuels minus the derived fuels produced within the economy, which is equivalent to the total consumption of primary fuels in both the conversion and end-use sectors plus net imports of transformed fuels.

This term is most useful when describing total energy use at an industry or regional level, as TPES is not applicable in these circumstances.

It includes fuel inputs in conversion activities—notably the consumption of fuels used to produce petroleum products and electricity—and own use and losses in the conversion sector. It also includes the consumption of transformed fuels, such as refined petroleum products, that are not produced domestically. It does not include secondary fuels that are produced domestically, such as coke, coal by-products and petroleum products, as the energy embodied in these fuels is already accounted for in the primary fuels that they are produced from (figure A2).

## A2 Total net energy consumption



**Total final energy consumption (TFEC):** The total energy consumed in the final or end-use sectors. It is equal to TPES less energy consumed or lost in conversion, transmission and distribution.

### *Changes made to incorporate new definitions in the AES*

In the past, statistics for energy use at the end-use stage, or final energy consumption, have included some conversion activities in the sector in which they occur. For example, electricity generated in the mining sector has historically been included in the mining sector, resulting in some overestimation of final energy consumption. In the energy balances, this was referred to as 'gross final energy disposal' to reflect the inclusion of some conversion activities.

As explained above, the AES has changed its definition for the use of energy at the end-use stage to be in line with the IEA definition for TFEC. The IEA framework requires that conversion activities that occur within industry sectors be moved to the conversion sector in the energy statistics. In the new energy balances, all conversion activities have been transferred to the conversion sector, so it is possible to present TFEC instead of the previous 'gross final energy disposal'. Conversion activities that have been transferred to the conversion sector include electricity generation (previously included in the sector in which it occurred), LNG manufacturing (previously included in the mining end-use sector) and some chemicals manufacturing (for example, petroleum refining, which occurs in the chemicals sector).

## 3. Updated industry classifications

The Australian and New Zealand Standard Industrial Classification (ANZSIC) codes provide the industry sectors and subsectors used for both the AES and NGER datasets. Historically, in order to better represent energy flows throughout the economy, the AES has used a modified form of the ANZSIC classifications introduced in 1993. This modified classification structure contained additional classes in some industries and assumed aggregated energy use in others where appropriate.

This year's AES incorporates the ANZSIC codes introduced in 2006 in line with the NGER dataset. Where the 1993 ANZSIC codes did not directly correspond with the 2006 codes, either the AES or NGER industry structure was adjusted by aggregating industries or existing data was transferred between codes to maintain comparability between datasets. Most changes reflected by the 2006 ANZSIC codes take place within the aggregated commercial and services sector, which do not materially affect the AES. As in the past, a modified ANZSIC classification structure has been used, to best reflect the nature of energy flows and maintain consistency with international energy statistics conventions.

A comparison between the 1993 and 2006 ANZSIC codes can be found at [www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1292.02006%20\(Revision%201.0\)?OpenDocument](http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1292.02006%20(Revision%201.0)?OpenDocument).

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Australian Government Department of Innovation, Industry, Science and Research	Grape & Wine Research & Development Corporation
Australian Government Department of Climate Change and Energy Efficiency	Horticulture Australia Limited
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