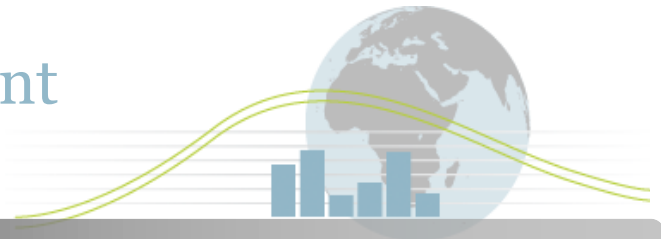


4E

Mapping Document



| | |
|---------------|--------------------|
| Country: | Australia |
| Technology: | Domestic Lighting |
| Sub Category: | All domestic lamps |

Introduction

[NOTE: This analysis updates a mapping report first published in June 2011¹. Data from years 1999-2001 has been updated since that publication - see notes for details.]

The first stage in the Mapping and Benchmarking process is the definition of the products, i.e. clearly setting the boundaries that define the products for use in data collection and analysis. The definition ensures that comparisons between the participating countries are performed against a specific and consistent set of products/criteria.

The summary definition for this product is:

“Lighting products that perform the vast majority of illumination applications within the domestic (household) sector²”

Hence data was sought (where possible) for the following lighting product types (subdivided by wattage buckets):

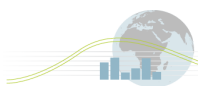
- Mains Voltage Incandescent
- Mains Voltage Halogens (Single and Double Ended)
- Low Voltage (12V) Halogen
- Pin Based and Self Ballasted CFLs
- Linear Tubes (T12, T8 and T5)³
- Retrofit LEDs
- Dedicated LEDs

A full product definition is provided at the annex website².

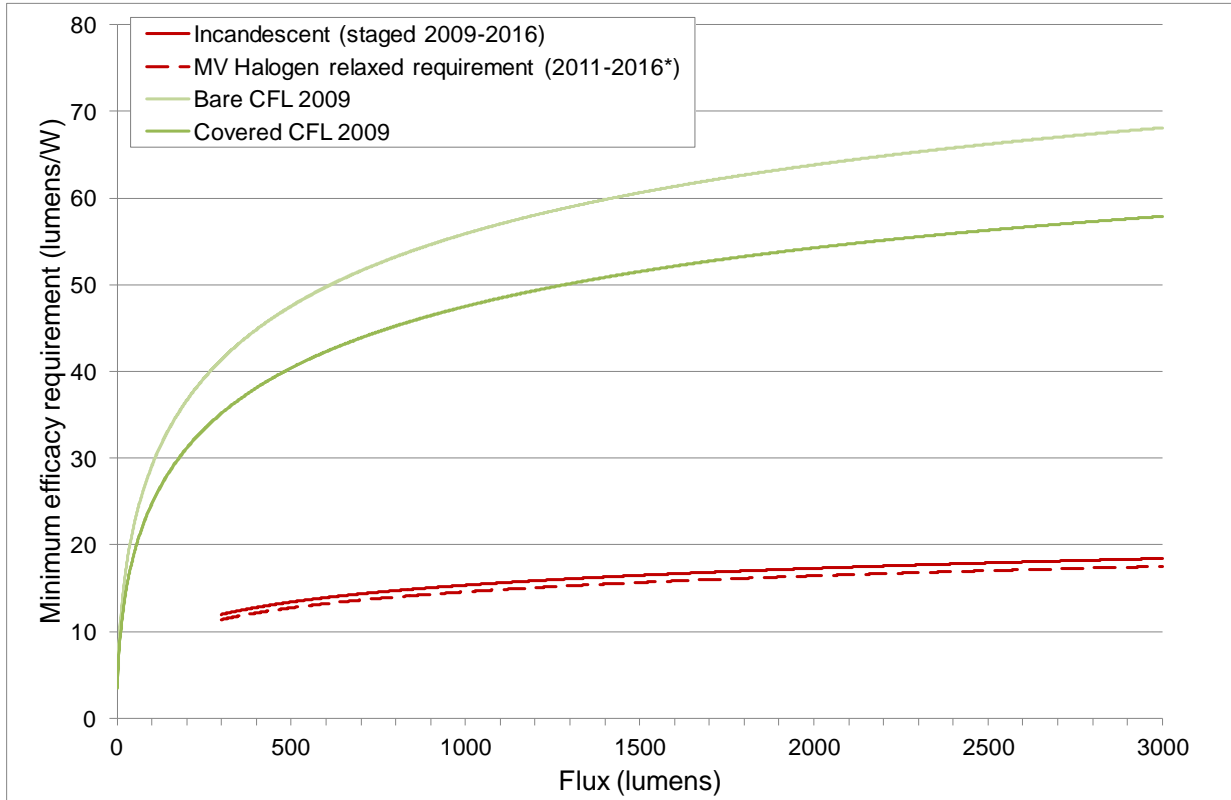
¹ see <http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=5>

² Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

³ The subsequent analysis in the associated benchmarking report³ excludes linear fluorescent tubes as, for those countries submitting data, these lamps constituted a small proportion of use in the domestic sector.



Phase out regulations for domestic lamps - Australia



Key notes on Graph (see notes section 1)

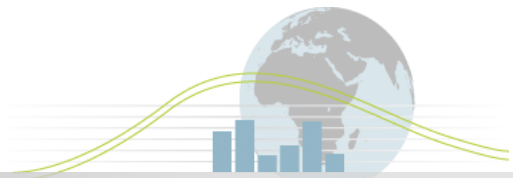
- The summary timeline for phased implementation is as follows:

| Lamp Types | Sales Restriction From |
|---|-----------------------------|
| • Fluorescent Tubes ⁴ | October 2004 |
| • Tungsten incandescent GLS lamps • ELV halogen non reflector • CFLs with integrated ballasts | November 2009 |
| • >40W Candle, fancy round and decorative lamps • Mains voltage halogen non-reflector (note a 5% relaxed requirement for these lamps 2010-16 with a review in 2016) • ELV halogen reflector | October 2010 – January 2011 |
| • >25W Candle fancy round and decorative lamps | October 2012 |
| • Mains voltage reflector lamps including halogen (PAR, ER, R, etc) | October 2016* |
| • Pilot lamps 25W and below | To be determined |

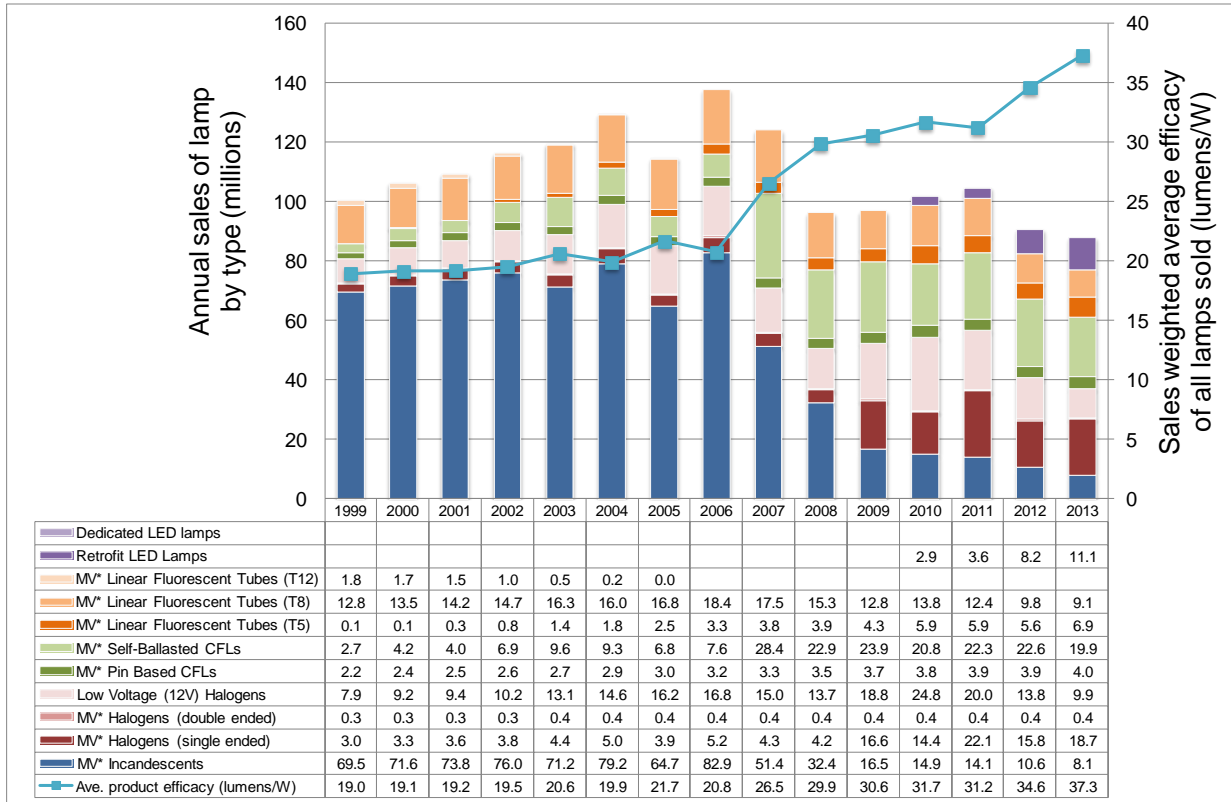
* date to be reviewed and determined dependent on availability of efficient replacement product

- Import of non-compliant tungsten filament GLS banned February 2009, with sale prohibited from 1 November 2009
- Additional performance criteria are required for all lamps (eg lifetime and lumen maintenance). CFLs with integrated ballasts are also subject to a range of further quality requirements

⁴ Note that the graphic refers to incandescent, halogen and CFLs with integral ballast only, *not* fluorescent tubes.



Sales and average efficacy of all domestic lamps - Australia



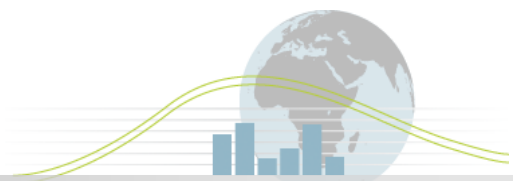
* Mains Voltage

Key notes on Graph (See notes section 2)

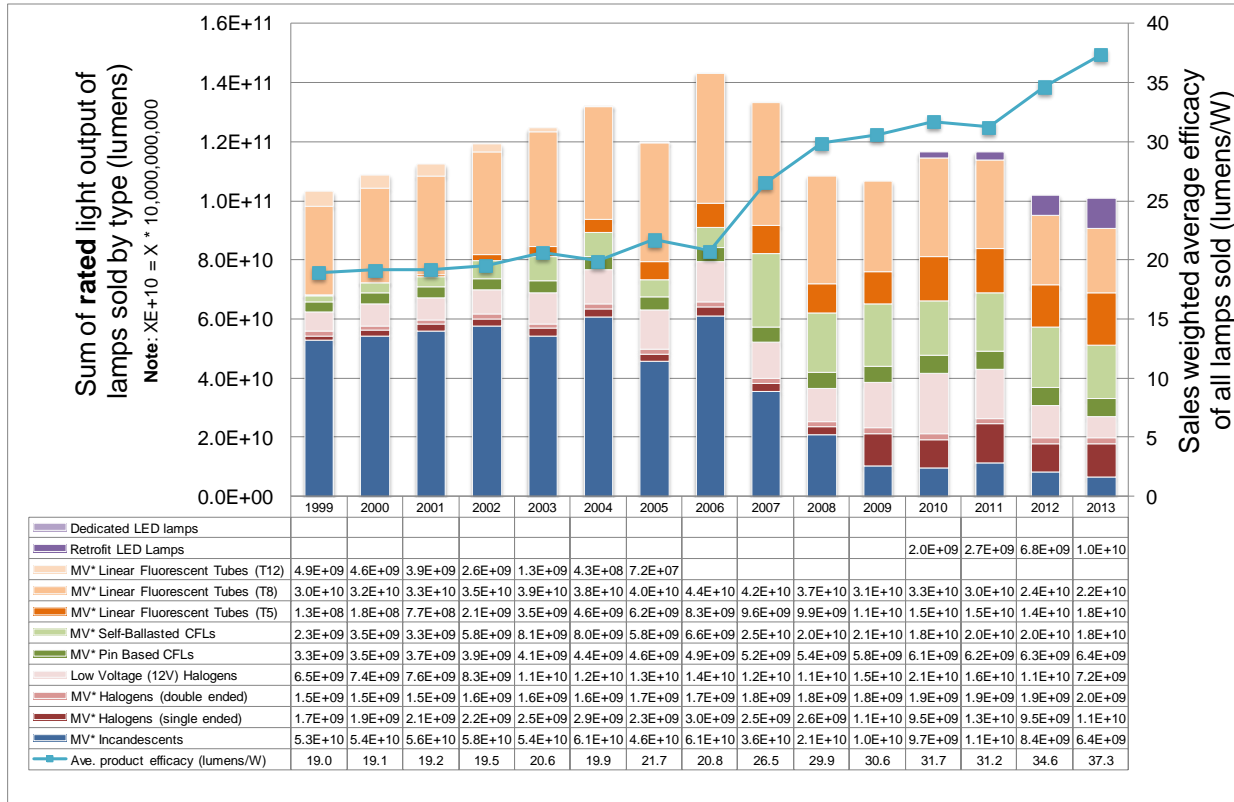
- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling⁵. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps⁶
- Data provided for LEDs is only illustrative as import data is not available. It is estimated assuming that 75% of the reduction in MR16 halogen lamp imports is due to sales of LEDs replacing halogens. Furthermore, no data was available for dedicated LED lamp sales although this is likely to be very low in the residential sector.
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps.

⁵ Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

⁶ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.



Total instantaneous light output of all annual domestic lamps sales - Australia



* Mains Voltage

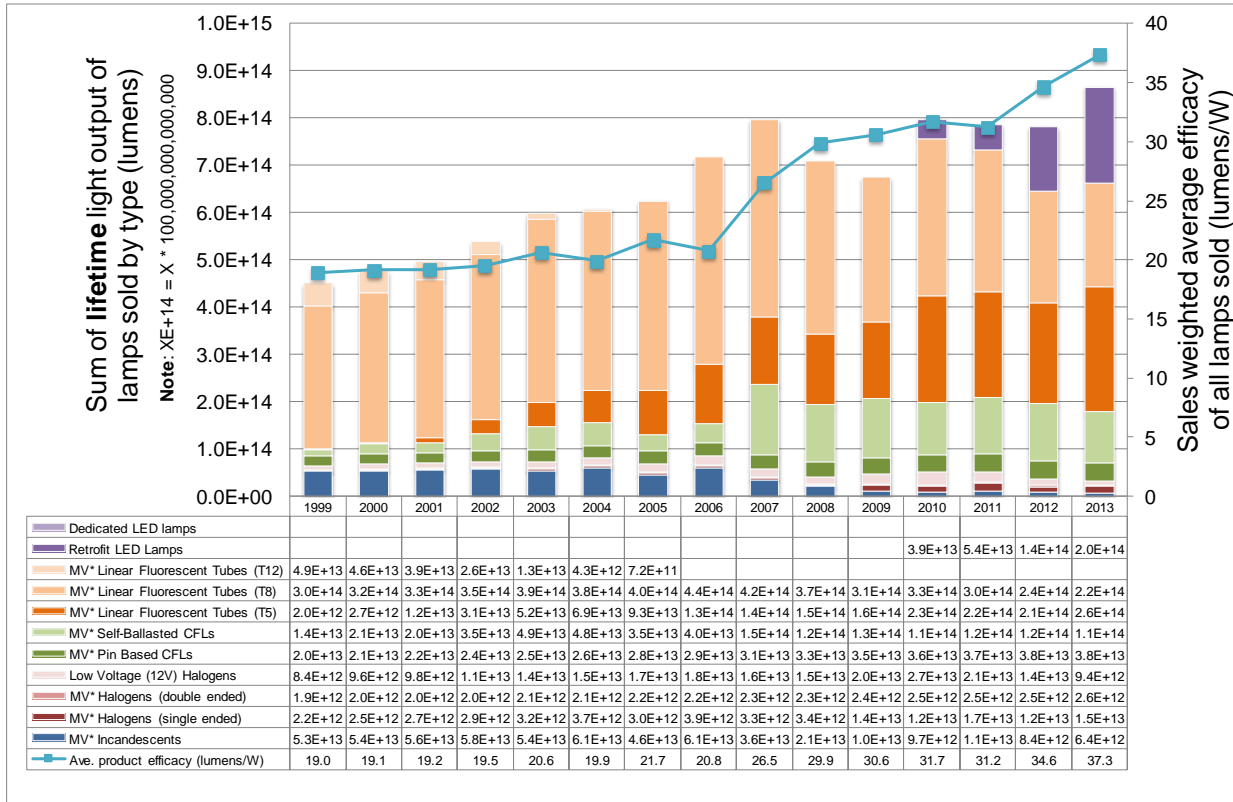
Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling⁷. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps⁸
- Data provided for LEDs is only illustrative as import data not available. It is estimated assuming that 75% of the reduction in MR16 halogen lamp imports is due to sales of LEDs replacing halogens. Furthermore, no data was available for dedicated LED lamp sales although this is likely to be very low in the residential sector.
- Instantaneous light output calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps
- Instantaneous light output is for lamps sold in each year only, *not* all installed stock

⁷ Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

⁸ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Total lifetime light output of all annual domestic lamps sales - Australia



* Mains Voltage

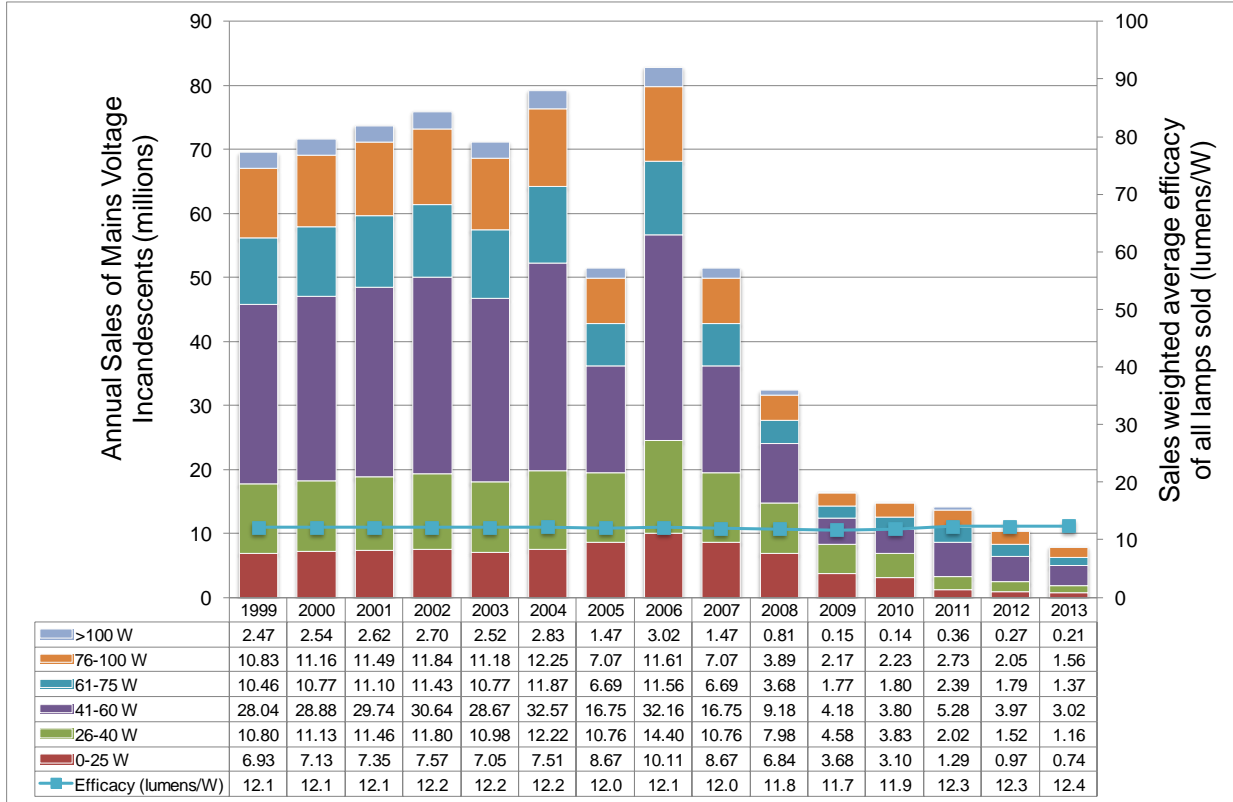
Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling⁹. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps¹⁰
- Data provided for LEDs is only illustrative as import data not available. It is estimated assuming that 75% of the reduction in MR16 halogen lamp imports is due to sales of LEDs replacing halogens. Furthermore, no data was available for dedicated LED lamp sales although this is likely to be very low in the residential sector.
- Lifetime light output calculated on a sales weighted basis using estimated average global efficacies and lifetimes for each lamp type and associated wattage range for 240V lamps
- Lifetime light output is for lamps sold in each year only, not all installed stock

⁹ Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

¹⁰ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Sales of Mains Voltage Incandescent lamps by wattage range - Australia

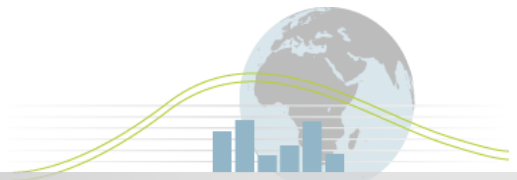


Key notes on Graph (See notes section 2)

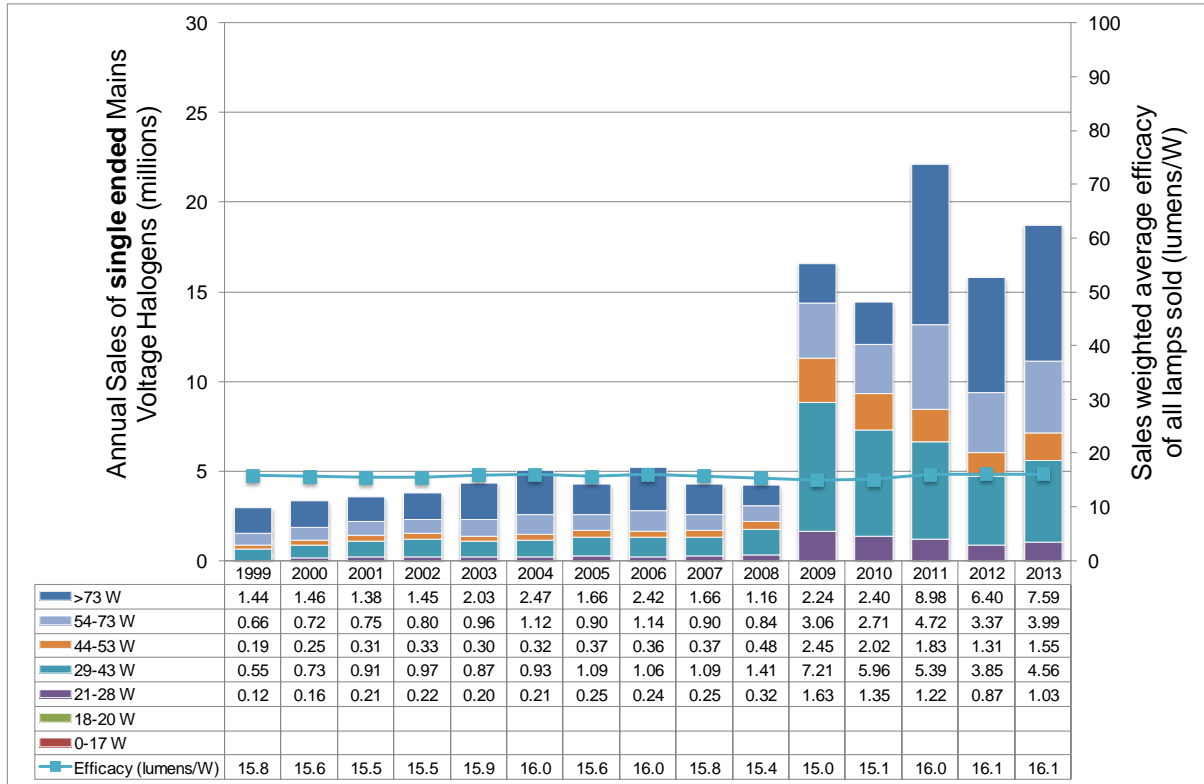
- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling¹¹. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps¹²
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

¹¹ Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

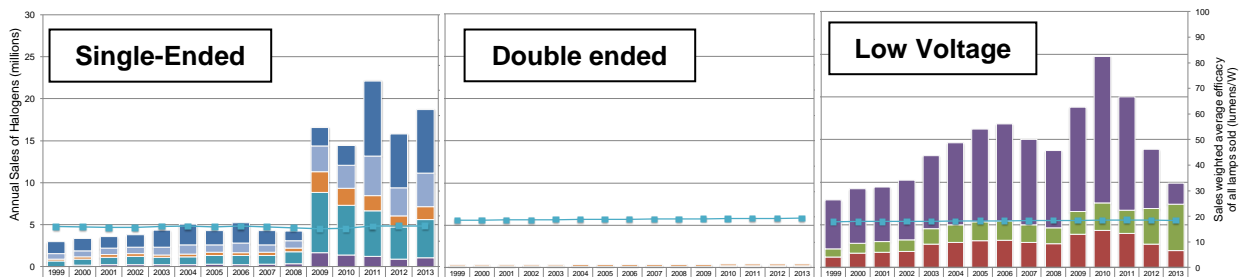
¹² Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.



Sales of Single Ended Mains Voltage Halogen lamps by wattage range - Australia



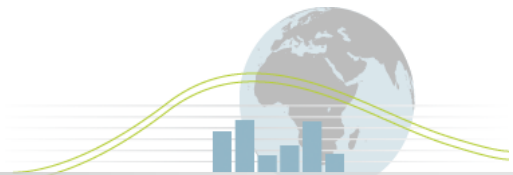
The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.



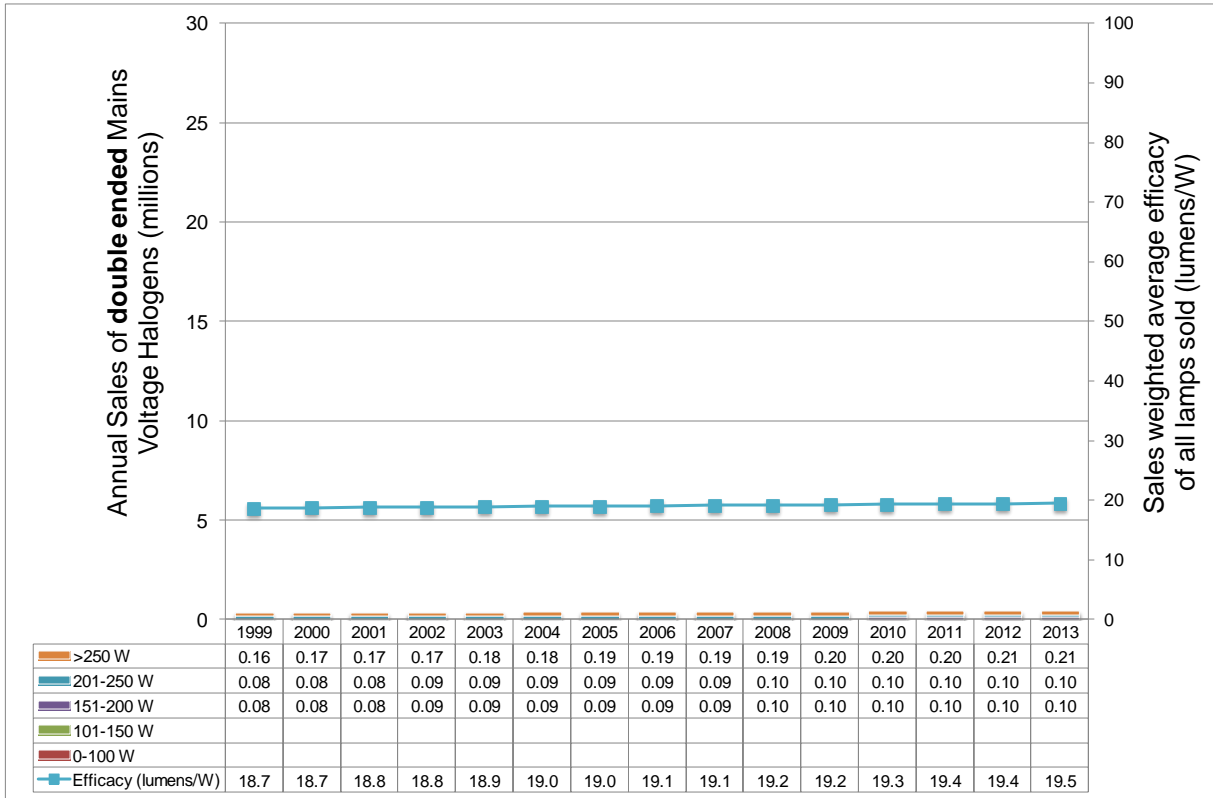
Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps¹³
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

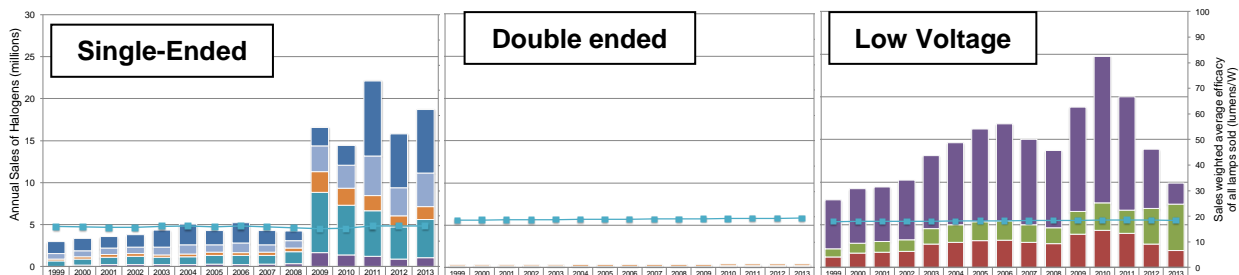
¹³ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.



Sales of Double Ended Mains Voltage Halogen lamps by wattage range - Australia



The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.

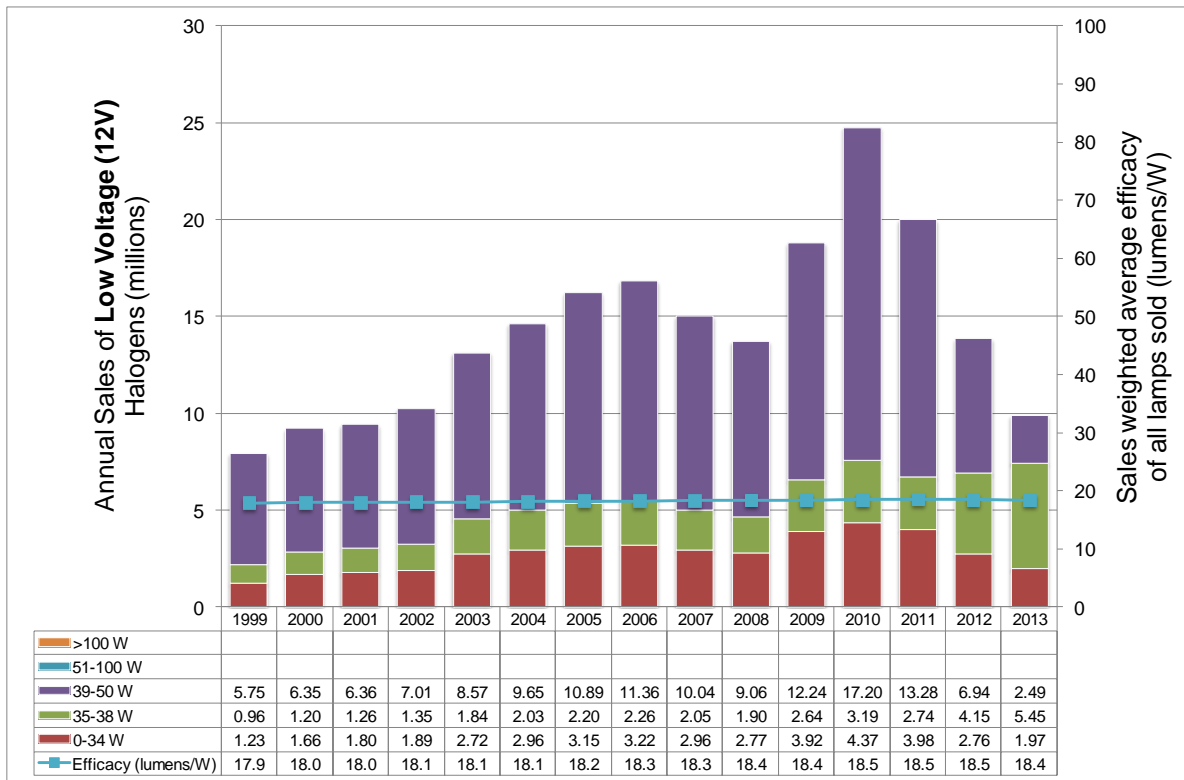


Key notes on Graph (See notes section 2)

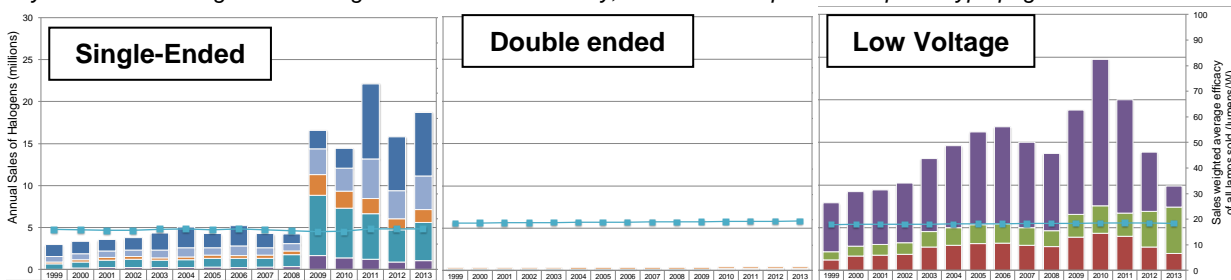
- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps¹⁴
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

¹⁴ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Sales of Low Voltage (12V) by wattage range Australia



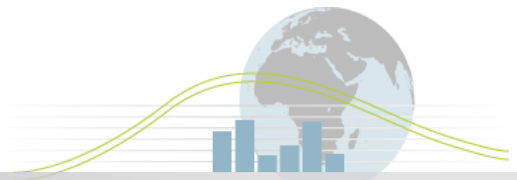
The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.



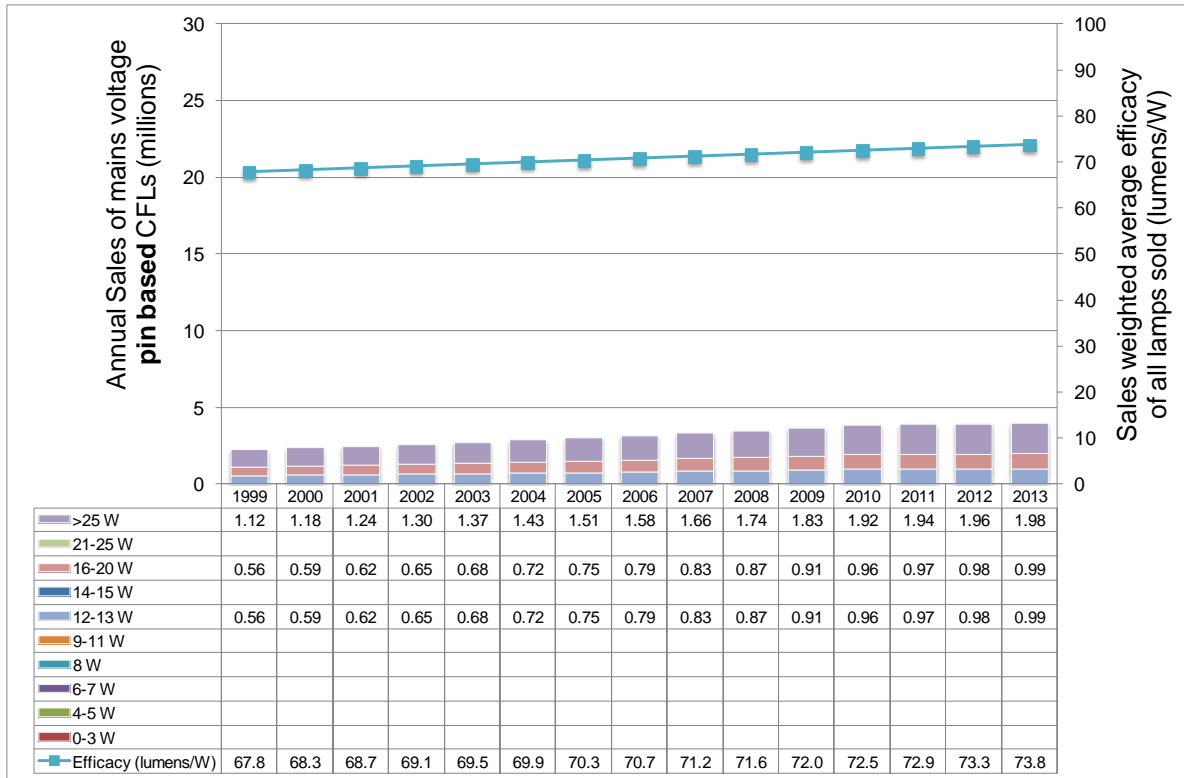
Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps¹⁵
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

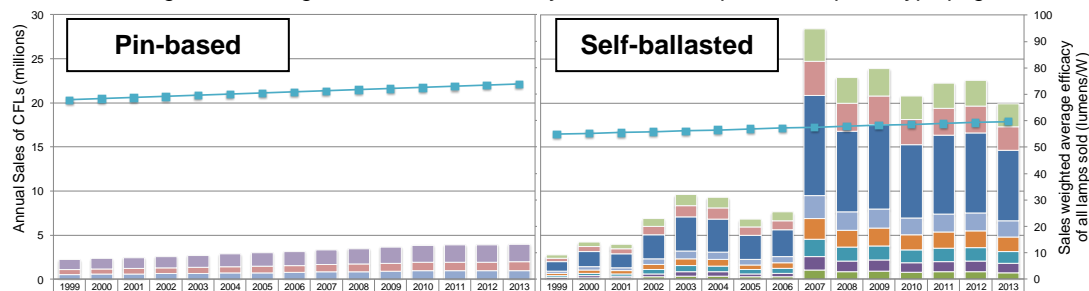
¹⁵ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.



Sales of Pin Based CFL lamps by wattage range Australia



The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.

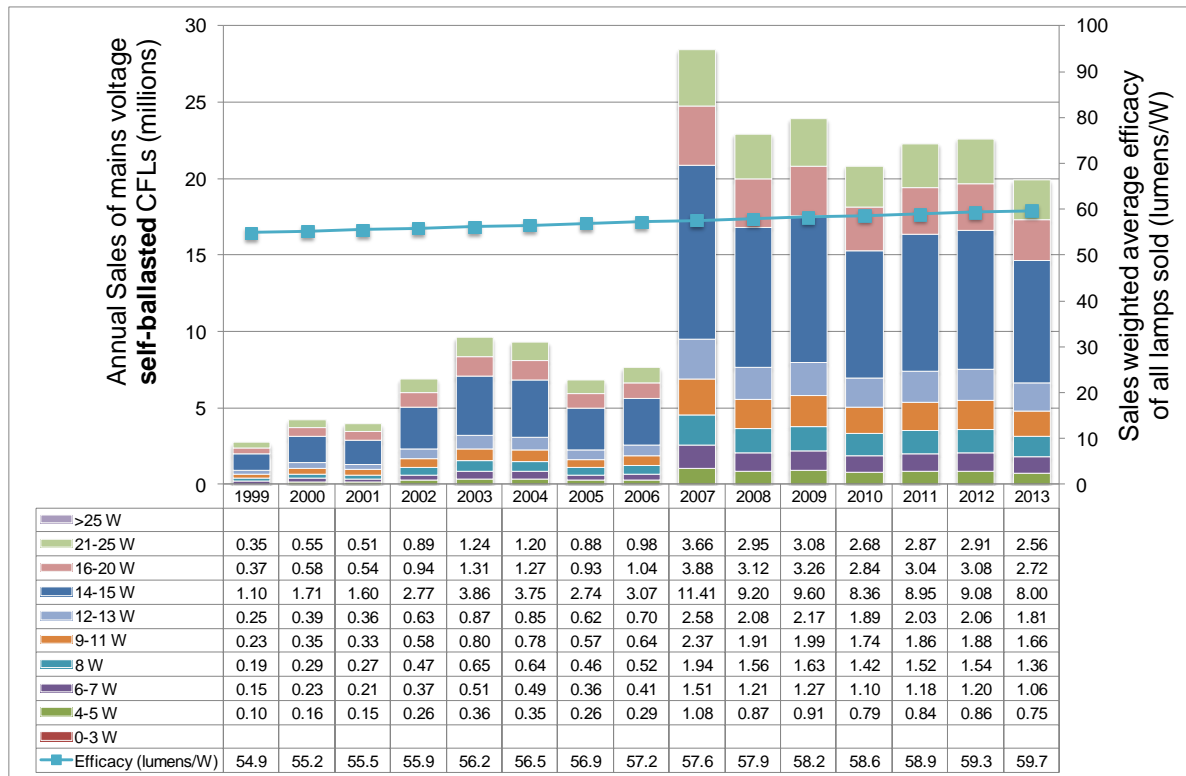


Key notes on Graph (See notes section 2)

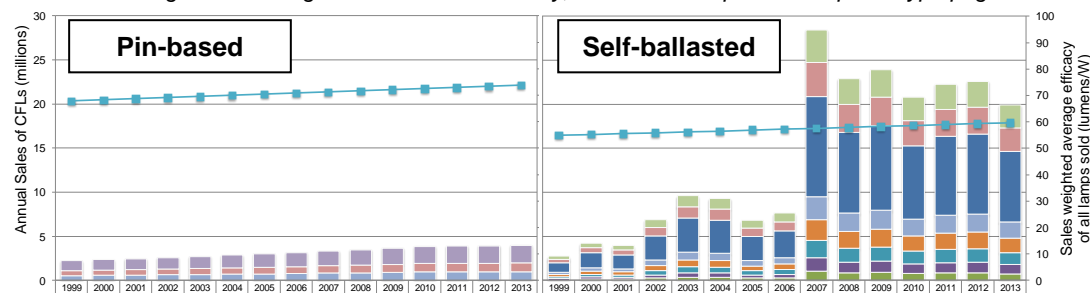
- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling. Data supplier views the sales values as approximations only for this lamp type within the market for all domestic (household) sector lamps¹⁶
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

¹⁶ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Sales of Self-Ballasted CFL lamps by wattage range Australia



The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.

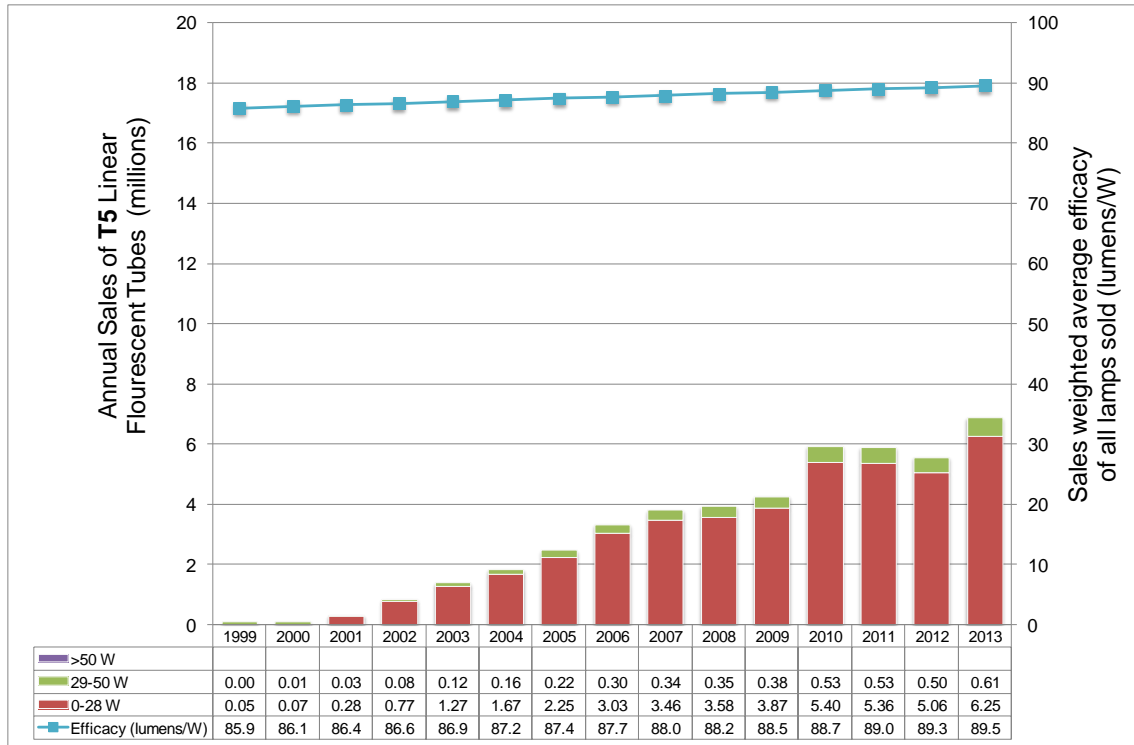


Key notes on Graph (See notes section 2)

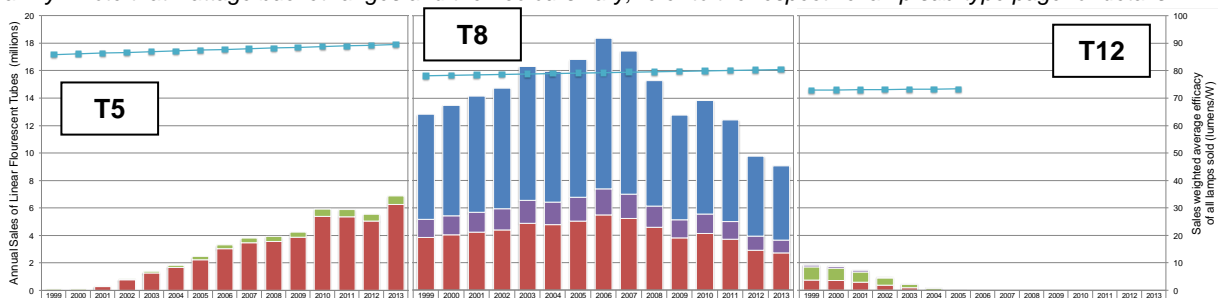
- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling. Data supplier views the sales values as approximations only for this lamp type within the market for all domestic (household) sector lamps¹⁷
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

¹⁷ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Sales of T5 Linear Fluorescent Tubes by wattage range Australia



The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.



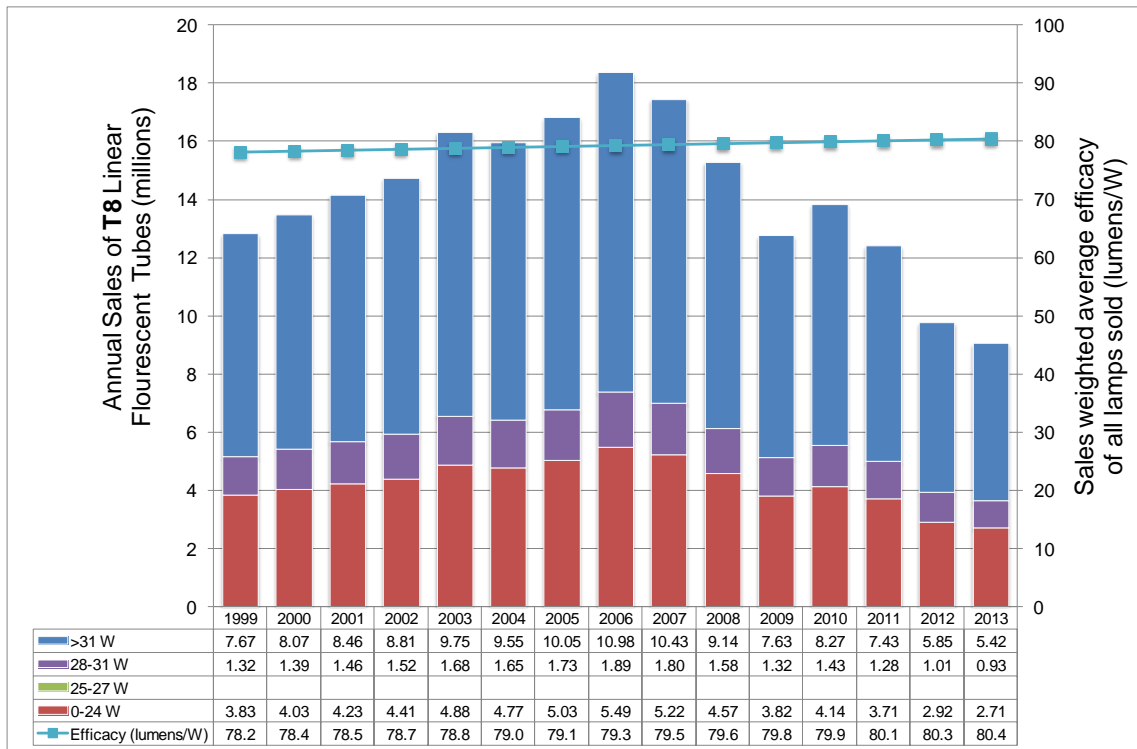
Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling¹⁸. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps¹⁹
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

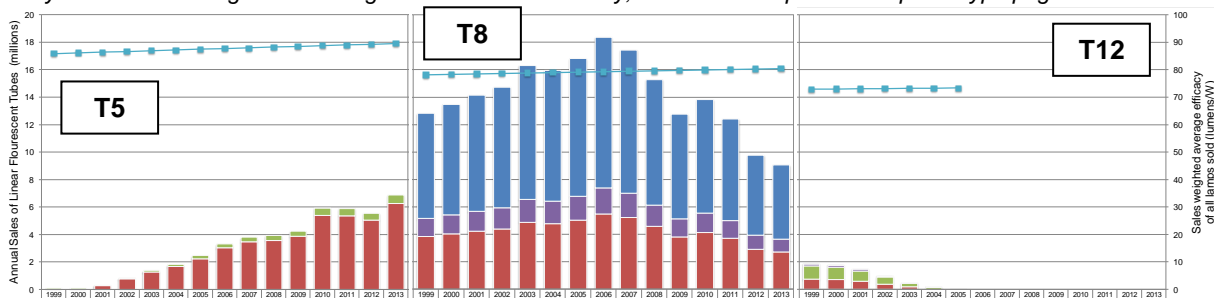
¹⁸ Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

¹⁹ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Sales of T8 Linear Fluorescent Tubes by wattage range Australia



The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.



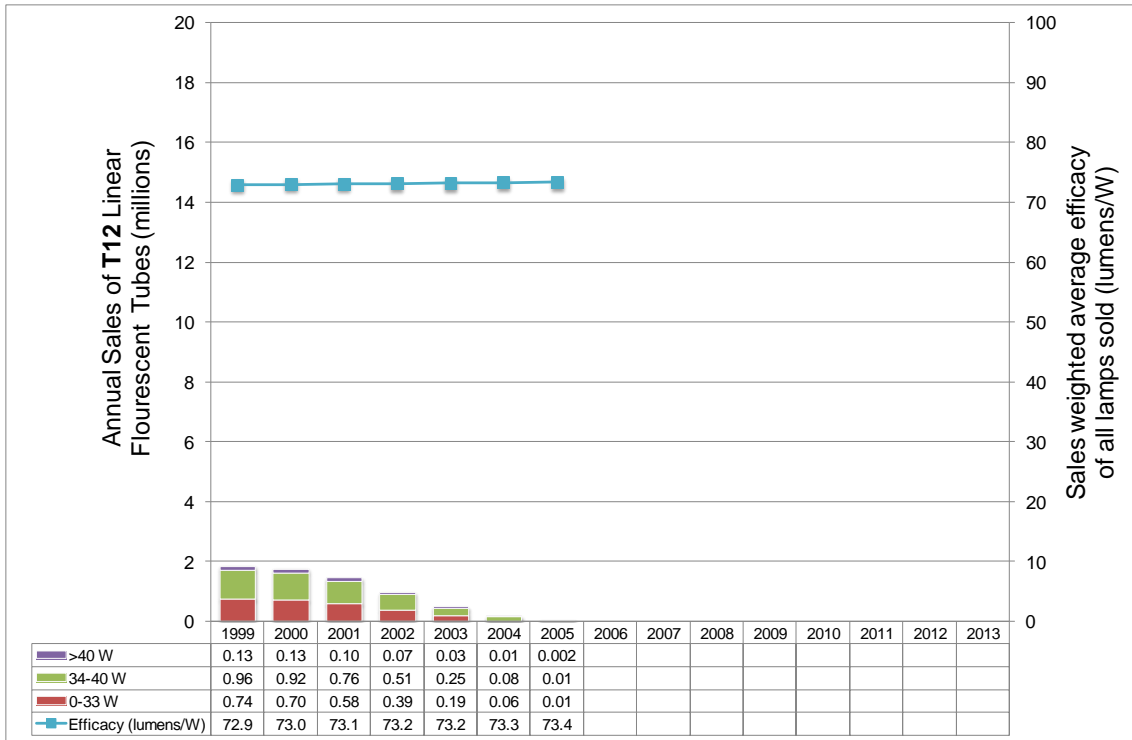
Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling²⁰. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps²¹
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

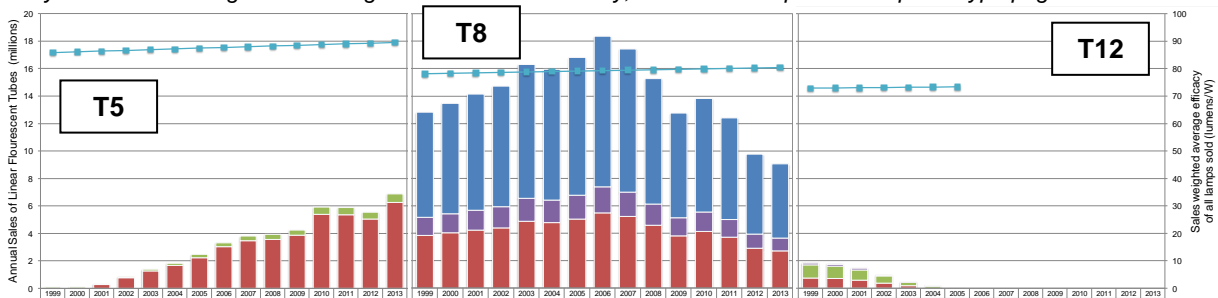
²⁰ Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

²¹ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Sales of T12 Linear Fluorescent Tubes by wattage range Australia



The graphs below are shown only for context; they show the share of sales of each lamp sub-type within the overall lamp family. Note that wattage bucket ranges and their colours vary; refer to the respective lamp sub-type page for details.



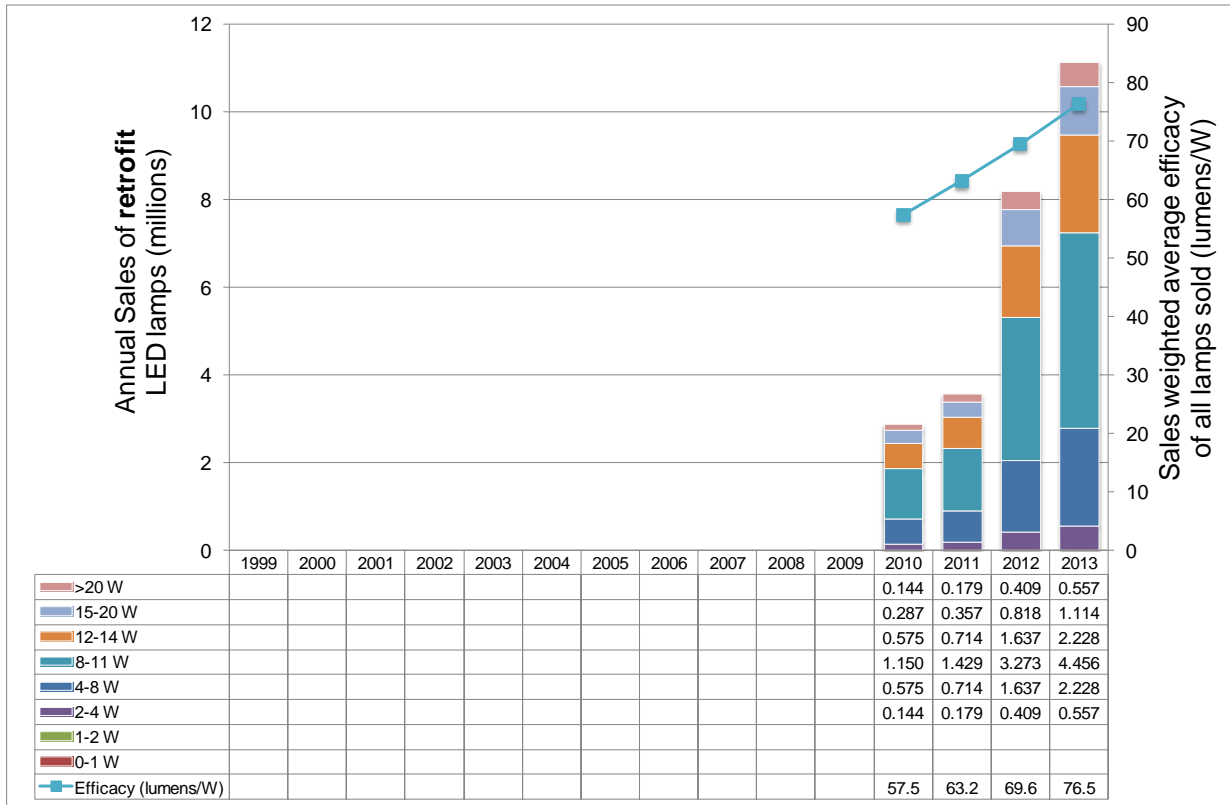
Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling²². Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps²³
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps
- A very small number of special-purpose tri-phosphorous T12 lamps (~0.3% of fluorescent sales), which are outside of MEPS requirements, are still sold into the market but are not shown here.

²² Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

²³ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

Sales of retrofit LED lamps by wattage range Australia



* Mains Voltage

Key notes on Graph (See notes section 2)

- Total annual sales values by lamp type are based on import data, breakdown of total sales by wattage ranges as estimated by industry, and limited extrapolation through modelling²⁴. Data supplier views the sales values provided as a robust representation of the market for all domestic (household) sector lamps²⁵ except for LEDs, for which the data provided is only illustrative. It is estimated assuming that 75% of the reduction in MR16 halogen lamp imports is due to sales of LEDs replacing halogens. Furthermore, no data was available for dedicated LED lamp sales although this is likely to be very low in the residential sector.
- Annual market average efficacies calculated on a sales weighted basis using estimated average global efficacies for each lamp type and associated wattage range for 240V lamps

²⁴ Since the publication of the first mapping report for domestic lighting, these assumptions have been updated for the years 1999-2001 - see notes sections for details.

²⁵ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

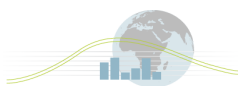
Major Policy Interventions (See notes Section 3)

Policies for lighting fall primarily fall into 3 categories in Australia:

- 1) **Mandatory MEPS²⁶**: as summarised above and described in notes section 1. MEPS for linear fluorescent lamps, ballasts, incandescent lamps and CFLs are currently under review. Options for LED lighting are also under consideration.
- 2) **Building codes/standards requirements²⁷**: A number of building codes within Australia specify minimum lighting levels (for new commercial buildings), and in a number of cases, maximum power allowances (new residential and commercial buildings and major renovations). In 2011, large commercial spaces will require their lighting energy performance to be disclosed at the point of sale or lease. Mercury vapour lamps are also being phased out from road lighting installations under the voluntary street lighting standard AS/NZS 1158.
- 3) **Actions driven by carbon credits**: In a number of states, the energy regulatory authorities have given mandatory efficiency targets to electricity suppliers. In a number of cases, these suppliers have initiated CFL give away schemes (often through third parties) with the CFLs intended to replace incandescent lamps. These schemes were particularly active in the mid 2000's with millions of lamps being distributed. However, following revisions to the "savings" that could be allocated to such schemes, and the announcement of the incandescent phase-out regime, while CFL 'give-aways' continue and LED give-aways have been introduced, these are at a much reduced volume .

²⁶ See: <http://www.energyrating.gov.au/>

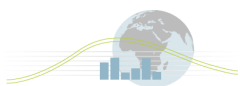
²⁷ See: <http://www.abcb.gov.au/>



Cultural Issues (See Notes Section 4)

The only major cultural issues specific to Australia are:

- 1) **Low Voltage Halogen Reflector Lamps:** Australia has a very high usage of low voltage (12V) halogen reflector lamps for general illumination in households, and until recently this has been increasing. At present there appears to be no like for like replacements that are not encountering compatibility problems with existing transformers and dimming controls. In the last three years import data shows a decline in the import of these lamps which may indicate a transition to retrofit LED lighting.
- 2) **Dimming:** For historical reasons, Australia has a predominance of “two wire” dimming systems that require a continual trickle bypass current to operate the dimmer circuitry. This makes them unsuitable for many CFLs and some LED lamps, therefore halogen replacements may be more common than elsewhere.



Notes on data

Section 1: Notes on Phase out regulations

1.1 Overview²⁸

The Australian Announcement of the “phase-out of inefficient lighting” was made on 20th February 2007 (fluorescent tubes and ballasts have been regulated since 2004)

From 1 February 2009 there has been an import restriction for general lighting service (GLS) tungsten filament incandescent lamps implemented through National (Commonwealth) Regulation²⁹.

Commencing 1 November 2009, certain general purpose incandescent lamps (tungsten filament and tungsten halogen) were required to comply with Minimum Energy Performance Standards (MEPS) that are set out in AS/ 4934.2-2011³⁰. Test procedures for incandescent lamps are set out in AS/NZS 4934.1-2008. The timeline for lamps being subject to MEPS is as follows:

| Lamp Types | Sales Restriction From |
|--|-----------------------------|
| <ul style="list-style-type: none"> Fluorescent Tubes³¹ | October 2004 |
| <ul style="list-style-type: none"> Tungsten incandescent GLS lamps ELV halogen non reflector CFLs with integrated ballasts | November 2009 |
| <ul style="list-style-type: none"> >40W Candle, fancy round and decorative lamps Mains voltage halogen non-reflector (note a 5% relaxed requirement for these lamps 2010-16 with a review in 2016) ELV halogen reflector | October 2010 – January 2011 |
| <ul style="list-style-type: none"> >25W Candle fancy round and decorative lamps | October 2012 |
| <ul style="list-style-type: none"> Mains voltage reflector lamps including halogen (PAR, ER, R, etc) | October 2016* |
| <ul style="list-style-type: none"> Pilot lamps 25W and below | To be determined |

* date to be reviewed and determined dependent on availability of efficient replacement product

The definitions of Lamp Types in the above table can be found in the summary of Part 2 of the Australian Standard³². These include tungsten filament and tungsten halogen lamps with varying voltages, wattages, shapes and lamp caps, used for general purpose lighting. MEPS are also applied to self-ballasted Compact Fluorescent Lamps (CFLs).

²⁸ For info on incandescent MEPS: http://www.energyrating.gov.au/products-themes/lighting/incandescent-lamps/meps_req/ or for more general lighting: <http://www.energyrating.gov.au/products-themes/lighting/>

²⁹ <http://www.customs.gov.au/site/page4369.asp>

³⁰ At the time of publication, a final version of this has now been published as AS/NZS 4934.1 2014 but had yet to be referred to under regulation.

³¹ Note that the graphic refers to incandescent, halogen and CFLs with integral ballast only, *not* fluorescent tubes.

³² http://www.energyrating.gov.au/products-themes/lighting/incandescent-lamps/meps_req/

There are also requirements for Lumen Maintenance (minimum of 80% measured at 75% of rated lamp life) and Minimum Lamp Life (median lamp life of at least 2000 hours).

Note that MEPS also includes a requirement that MR16 12V halogen lamps have power of no more than 37W this has removed previously commonly used 50W LV halogen lamps from the market on the basis that 35W IRC LV lamps now provide equivalent lumen output.

The methods for measurement of efficacy, lumen maintenance and lamp life are set out in AS/NZS 4934.1.

1.2 Summary of Relevant Standards for Incandescent Lamps³³

Test procedures and regulatory standards for tungsten filament and tungsten halogen lamps are published by Standards Australia. The following parts are relevant:

- AS/NZS 4934.1 Incandescent lamps for general lighting service - Test methods - Energy performance.
- AS 4934.2 Incandescent lamps for general lighting services - MEPS requirements.

1.2.1 AS/NZS 4934.1 Incandescent lamps for general lighting service - Test methods - Energy performance

The test methods used to determine lamp efficacy, lumen maintenance and lifetime are generally based on CIE and IEC methods.

Scope: AS/NZS 4934.1 specifies test methods for the energy performance of tungsten filament and tungsten halogen lamps used in general lighting services. It applies to both non-reflector and reflector lamps of all voltages.

1.2.2 AS 4934.2 Incandescent lamps for general lighting services - MEPS requirements.

Scope: this standard specifies requirements for Minimum Energy Performance Standards (MEPS) and other requirements for incandescent lamps both tungsten filament and tungsten halogen. The scope is as follows:

- GLS (general lamp service):
 - (a) Shapes: A50-A65, PS50-PS65, M50-M65, T50-T65 (as generally outlined in IEC 60630) or E50-E65.
 - (b) Caps: E14, E26, E27, B15 or B22d.
 - (c) Nominal voltage ≥ 220 V.
 - (d) Nominal wattage < 150 W.
 - (e) Not including coloured lamps, reflector lamps or crown-reflector lamps or lamps with a halogen gas fill..
- ELV (extra low voltage) halogen non-reflector:
 - (a) Tungsten halogen lamp burner.
 - (b) Shapes: single-ended capsule, non-reflector.
 - (c) Caps: bi-pin.
 - (d) Nominal voltage: 5-14 V inclusive.
 - (e) Not including coloured lamps, reflector lamps or crown-reflector lamps.
- Candle:
 - (a) Shapes: candle or B (as generally outlined in IEC 60630) including twisted and bent tip candle.

³³ http://www.energyrating.gov.au/products-themes/lighting/incandescent-lamps/meps_req/

- (b) Caps: E14, E26, E27, B15 or B22d.
- (c) Nominal voltage >220 V.
- (d) Not including coloured lamps, reflector lamps or crown-reflector lamps.
- **Fancy round:**
 - (a) Shapes: round, P (as generally outlined in IEC 60630), G or globe.
 - (b) Caps: E14, E26, E27, B15 or B22d.
 - (c) Nominal voltage >220 V.
 - (d) Not including coloured lamps, reflector lamps or crown-reflector lamps.
- **Decorative lamps:**
 - (a) Shapes: decorative shapes.
 - (b) Caps: E14, E26, E27, B15 or B22d.
 - (c) Nominal voltage >220 V.
 - (d) Not including coloured lamps, reflector lamps or crown-reflector lamps..
- **Mains voltage halogen non-reflector:**
 - (a) Tungsten halogen lamp burner, non-reflector.
 - (b) Shapes: single-ended.
 - (c) Caps: E14, E26, E27, B15 or B22d.
 - (d) Nominal voltage >220 V.
 - (e) Not including coloured lamps, reflector lamps or crown-reflector lamps.
- **ELV halogen reflector:**
 - (a) Shapes: MR 11-16.
 - (b) Caps: Bi-pin.
 - (c) Nominal voltage: 5-24 V (inclusive).
 - (d) Not including coloured lamps
- **Mains voltage reflector (including halogen):**
 - (a) Tungsten filament or tungsten halogen lamp burner, with reflector.
 - (b) Shapes: PAR, ER, R, RE, XR, YR, ZR or MR 11-16.
 - (c) Caps: E14, E26, E27, B15, B22d or GU10.
 - (d) Nominal voltage >220 V.
 - (e) Not including coloured lamps.

The standard does not cover safety requirements. These are covered separately in the AS/NZS 60432 series of Standards. It does not apply to appliance lamps, special purpose lamps and automotive lamps.

The standard sets out MEPS as minimum Efficacy (in lumens per Watt or lm/W) according to the formula:

$$2.8 \times \ln(L) - 4.0$$

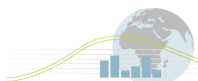
where $\ln(L)$ is the natural logarithm of the measured initial luminous flux (in lumens)

(note that a 5% relaxation on this efficacy requirement for halogen lamps has been given for the years 2010-2016)

1.3 Summary of Relevant Standards for CFLs³⁴

From 1 November 2009, self-ballasted compact fluorescent lamps (CFLs) were required to comply with Minimum Energy Performance Standards (MEPS) which are set out in AS/NZS 4847.2. This standard specifies MEPS requirements and related attributes for self-ballasted CFLs with integrated means for controlling starting and stable operation that are intended for domestic and similar general lighting purposes. It applies to self-ballasted lamps of all voltages and wattages irrespective of the type of lamp cap. Test procedures are set out in AS/NZS 4847.1.

³⁴ <http://www.energyrating.gov.au/products-themes/lighting/compact-fluorescent-lamps/meps/>



The intention of MEPS for CFLs is to improve the performance of CFLs to ensure that they remain a viable alternative for inefficient incandescent lamps.

As part of the overall MEPS requirements, there are performance specifications for the following CFL attributes:

- Starting time
- Run-up time
- Luminous flux, efficacy and lumen maintenance
- Power, power factor and harmonics
- Premature lamp failure rate
- Low temperature starting
- Switching withstand
- Lamp life
- Colour attributes
- Mercury content

1.3.1 Performance Requirements

- In order to conform to MEPS, the standard states that CFLs must comply with one of the following:
- "Local" MEPS set out in regulation and the standard
- Model certification with the Efficient Lighting Initiative (ELI). More information available from www.efficientlighting.net
- Model certification with the Energy Savings Trust (EST) version 5 or version 6. More information available from www.energysavingtrust.org.uk

For full requirements please refer to AS/NZS 4847.2 Self Ballasted Lamps for General Lighting Services – Part 2 MEPS requirements³⁵.

1.4 Summary of Relevant Standards for Fluorescent Tubes³⁶

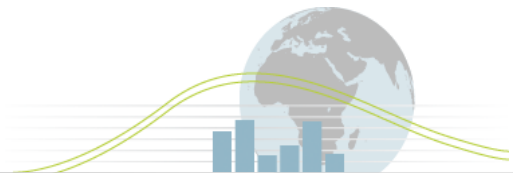
From 1 October 2004, linear fluorescent lamps manufactured in or imported into Australia were required to comply with Minimum Energy Performance (MEPS) requirements which are set out in AS/NZS 4782.2-2004. The scope of linear fluorescent lamps MEPS covers FD and FDH lamps ranging from 550mm to 1500mm in length (inclusive) and having a nominal lamp power of 16 Watts or more. The intention of MEPS is to improve end-use energy efficiency by eliminating lower efficiency fluorescent lamps from the market and to encourage the sale and purchase of higher efficiency fluorescent lamps.

The Minimum Energy Performance Standards (MEPS) for linear fluorescent lamps in AS/NZS 4782.2-2004 are set out as **minimum luminous efficacy in lumens per Watt** for various lamp sizes. There are also requirements for minimum **Colour Rendering Index and Maximum Mercury Content**. The test methods for measurement luminous efficacy are set out in AS/NZS 4782.1 and AS/NZS 4782.3.

Exclusions: MEPS in AS/NZS 4782.2-2004 does not apply to lamps that are clearly not intended for general illumination, specifically:

³⁵ <http://www.energyrating.gov.au/products-themes/lighting/compact-fluorescent-lamps/meps/>

³⁶ <http://www.energyrating.gov.au/products-themes/lighting/compact-fluorescent-lamps/meps/>



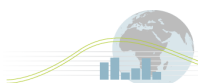
- b. lamps with a dominant colour or with an output that is predominantly outside the visible spectrum;
- c. lamps for colour matching and that have a colour rendering index greater than 90 and a colour appearance approximating to a point on the black body locus;
- d. lamps that are specifically for use in an industrial or agricultural process;
- e. lamps for medical applications; or
- f. lamps that have been given written exemption by the relevant regulatory authority on the grounds that they are for a specific purpose other than general illumination and are clearly distinguishable from lamps for general illumination.

1.4.1 MEPS Levels

When measured in accordance with AS/NZS 4782.1 the initial efficacy (at 100 hours) and the maintained efficacy (at 5000 hours) shall exceed the values specified in the table below. Lamps shall also have a Colour Rendering Index which exceeds the value in the table below.

| Lamp nominal length L (mm) mandatory | $550 \leq L < 700$ | $700 \leq L < 1150$ | $1150 \leq L < 1350$ | $1350 \leq L < 1500$ |
|--|------------------------|------------------------|------------------------|------------------------|
| Lamp typical power (watts) (informative) | 16 - 24 | 17 - 40 | 28 - 50 | 35 - 80 |
| Initial efficacy | $F_{100} \geq 66.0$ | $F_{100} \geq 74.0$ | $F_{100} \geq 80.0$ | $F_{100} \geq 85.0$ |
| Maintained efficacy | and $F_M \geq 57.5$ | and $F_M \geq 61.0$ | and $F_M \geq 70.0$ | and $F_M \geq 70.0$ |
| Minimum CRI | 79 | 79 | 79 | 79 |

The maximum quantity of mercury present in fluorescent lamps shall not exceed 15 mg. The quantity of mercury present is determined in accordance with the relevant Clauses of AS/NZS 4782.3.



Section 2: Notes on Sales and efficacy of all lamps, total light output and sales by product type

2.1 Data Source

Data supplied by Beletich Associates on behalf of the Australian Government's Department of Climate Change. Annual sales values based on:

- import data from Australian Customs,
- a range of assumptions sought from industry including the share of sales for each of the wattage ranges used in the analysis, and
- extrapolation through modelling.

The data supplier considers the sales values provided as a robust representation of the market for all domestic (household) sector lamps³⁷ with the following exceptions; sales values for double ended halogen lamps, Pin-based CFLs and LEDs. These values have limited empirical support and are based on manufacturers estimations and modelling. However, sales of these lamp types are low and consequently have limited impact on the overall market.

Other notes on the data supplied:

- Data is for ALL SECTORS - residential, commercial, industrial.
- This data contains uncertainty in some areas, due to a lack of robust data being available. Estimates and assumptions were applied where required.
- Most data for 2002-2010 are from previous M&B data collection (2010).
- Incandescent and fluorescent lamp sales for 1999-2001 have been revised.
- Incandescent, halogen and fluorescent lamp sales based primarily on import statistics (no manufacturing in Australia from 2002 onwards).
- Effect of CFL giveaway programs (CFLs not installed) has been modelled, based on data provided by program operators.
- Breakdown of lamp wattage ranges based on supplier and author estimates.
- Poor data for LEDs. Data provided are estimates for MR16 LEDs, which is by far the most significant LED type. These estimates are based on a downturn in MR16 halogen lamp imports - it was assumed that 75% of the downturn is due to sales of LEDs replacing halogens. Note this data is for all sectors.
- No data on was available for dedicated LED lamps (dedicated LED fittings?). In the residential sector, this is likely to be very low, but is significant in the commercial sector (LED troffers).
- Lamp T5 vs T8 share are estimates from industry.
- Ballast electronic vs magnetic share are estimates from industry.

³⁷ Most 'domestic lighting' products are also used in other areas (e.g. hotels, shops, offices, etc). However, given the functionality of these products is virtually the same in all installations, and in almost all participating countries it will be impossible to separate sales to the domestic sector from sales elsewhere, all products shown will be considered as "domestic lighting" irrespective of final installation point.

2.2 Manipulations of Data Supplied

Sales data used as supplied.

Average efficacies calculated on a sales weighted basis by:

$$\frac{\text{Sum (sales of lamp type a sales * efficacy of lamp type a)} + \dots + \text{Sum (sales of lamp type x sales * efficacy of lamp type x)}}{\text{Sum (all lamp sales)}}$$

Instantaneous light output calculated as sales weighted basis by:

$$\frac{\text{Sum (sales of lamp type a sales * efficacy of lamp type a * wattage of lamp type a)} + \dots + \text{Sum (sales of lamp type x sales * efficacy of lamp type x * wattage of lamp type n)}}{\text{Sum (all lamp sales)}}$$

Lifetime light output calculated as sales weighted basis by:

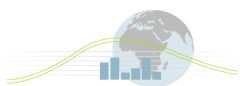
$$\frac{\text{Sum (sales of lamp type a sales * efficacy of lamp type a * wattage of lamp type a * lifetime of lamp type a)} + \dots + \text{Sum (sales of lamp type x sales * efficacy of lamp type x * wattage of lamp type n * lifetime of lamp type n)}}{\text{Sum (all lamp sales)}}$$

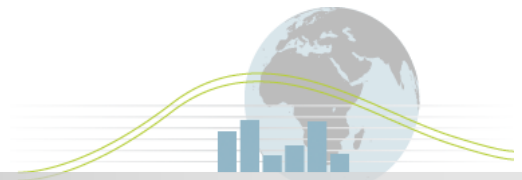
2.2.1 Key assumptions:

Efficacies used for all calculations based on estimated average global efficacies for each lamp type and associated wattage range for 230V lamps.

Lifetimes used for all calculations based on estimated average global lamp life for each lamp type and associated wattage range for 230V lamps.

Tables for efficacy and assumed lifetimes of each lamp type/wattage range for the years 1996-2013 can be viewed in the product definition which is in the supporting documents section of the Domestic Lighting area of the Mapping and Benchmarking website – see <http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=5>



**Section 3: Notes on Policy Interventions**

No Additional Notes

Section 4: Notes on Cultural Issues

No additional Notes

